

# Supporting environmental modelling with Taverna workflows, web services and desktop grid technology

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15-19 June 2014 – San Diego, CA, USA

# BioVeL

## Biodiversity Virtual e-Laboratory, 2011-2014

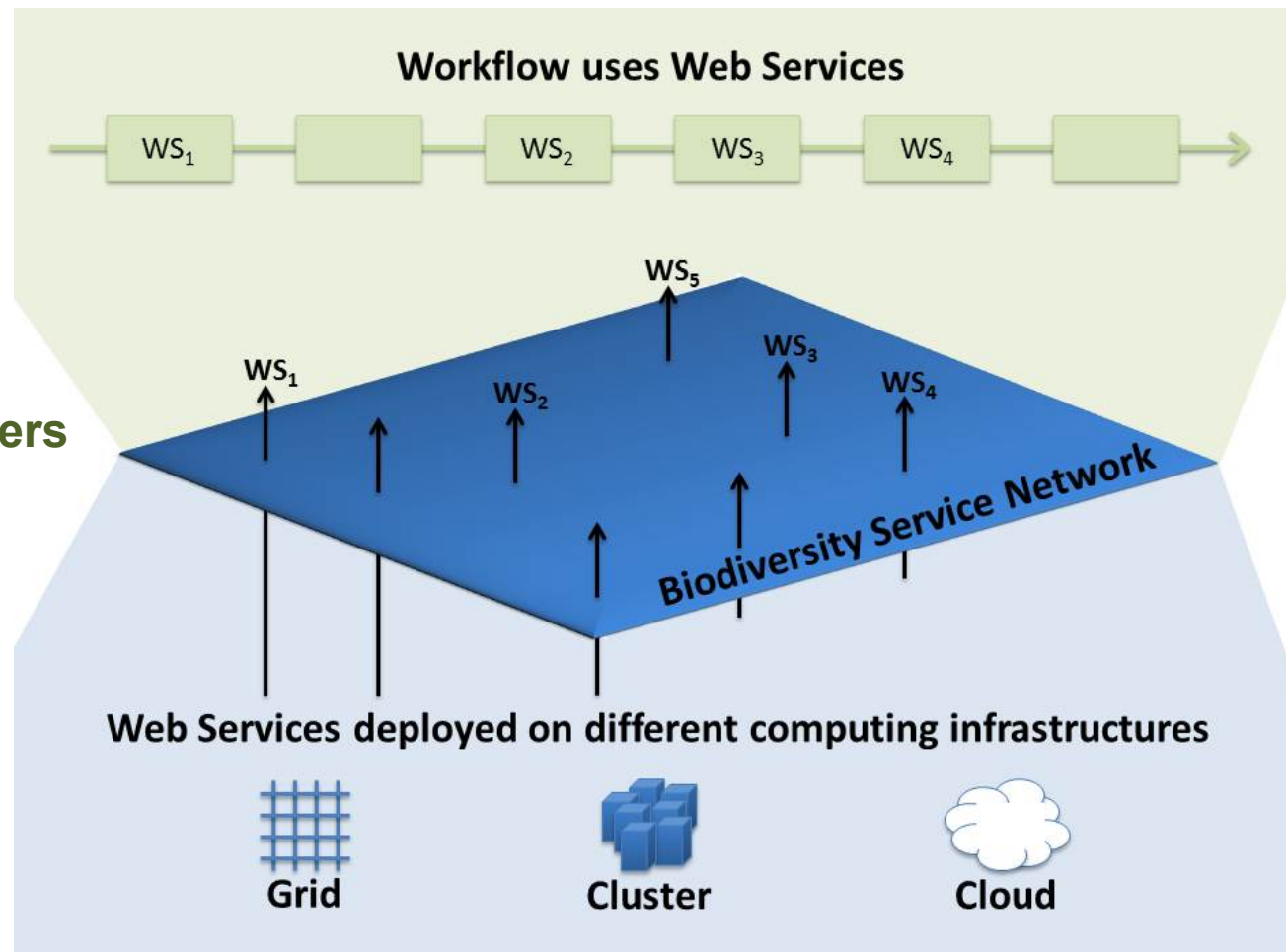
- **supports research on biodiversity & ecology**
  - **by offering computerized tools**
  - **to process large amounts of data**
  - **from cross-disciplinary sources**
- **is developing workflows built from web services**
- **cooperation of IT & science partners**

## Building a network of Web Services

**Users' workflows and applications**

**Service and Data Providers**  
(BioVeL, GBIF, CoL, EBI, BGBM, CRIA, etc.)

**Resource Providers**  
(EGI.eu, EDGeS@Home, commercial cloud, etc.)



## User requirements

- Web services (existing & new) need to be secure, scalable, reliable, and well-documented
- Web services need to be discoverable
- Workflows need to be storable and discoverable
- Users need to be able to build their own workflows with minimal training and assistance
- Users need to be able to re-use and execute shared workflows effectively

[www.biodiversitycatalogue.org](http://www.biodiversitycatalogue.org)

**BiodiversityCatalogue**  
"The Biodiversity Sciences Web Services Registry"

Getting Started | About Us | Contact Us | API Docs

Sign up | Sign in

Search:  **Go!** | [Home](#) | [Services](#) | [Register a Service](#) | [Service Providers](#) | [Search by Data](#) | [Latest](#) |

[Home](#) »

**The BiodiversityCatalogue: providing a curated catalogue of Biodiversity Web Services**

**Helpful Links**  
[Getting started with the Catalogue](#)  
[General info on Web services](#)  
[Best practice guide for developing Web services](#)  
[SSIs top tips on creating Web services](#)  
[Executing Web services](#)  
[Turn your command line application\(s\) into Web services](#)

BiodiversityCatalogue currently has **47 services**, **37 service providers** and **86 members**

*"Web Services are hard to find"*

**DISCOVER**

- Find the right Web Service
- Powerful search and filtering
- Information from providers and community

*"My Web Services are not visible"*

**REGISTER**

- Easily register Web Services
- Instantly available to everyone
- Providers can advertise, describe and monitor their Services

*"Web Services are poorly described"*

**ANNOTATE**

- Anyone can describe and annotate
- Ongoing expert curation
- Social curation by the community

*"Web Services are volatile"*

**MONITOR**

- Services change and get outdated
- BiodiversityCatalogue monitors Services
- Monitors availability and reliability

**Site Announcements**   
**New Feature - Markdown Annotations**  
By [niall beard](#) (1 day ago)  
**Scheduled Maintenance**  
By [niall beard](#) (about 1 month ago)  
**BiodiversityCatalogue Upgrade to Rails 3**  
By [Aleksandra Nenadic](#) (5 months ago)  
[More](#)

... curated catalogue of Web Services

[www.biodiversitycatalogue.org](http://www.biodiversitycatalogue.org)



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Search:  **Go!** [Home](#) [Services](#) [Register a Service](#) [Service Providers](#) [Search by Data](#) [Latest](#)

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**Top 20 tags on BiodiversityCatalogue** ( more ) [See All Tags](#)

method | BioVeLSupported | phylogenetic inference | Biome-BGC | biodiversity | biovel | taxonomy | accepted name | class | classification | common name | ecology | family | genus | kingdom | occurrence | order | phylum | species | synonym

The services index has been filtered [Subscribe to these results](#)

**Filtering**

Current Filters Applied

Service Categories

Biogeochemical Modelling

Clear all filters

Select filters from below...

Enable tag filters

Service Types (2)

Search within results:  **Go!**

Displaying all 4 services

Include archived? ☐  
Sort by: Newest  
Per page: 21  
View: Grid

**FORESEE** REST

BioVeL Biogeochemical Modelling Geospatial Data Retrieval

**Biome-BGC on Grid** REST

BioVeL Biogeochemical Modelling Biomass Productivity

**Biome-BGC Carbon** REST

BioVeL Biogeochemical Modelling Terrestrial Carbon Sequestration Biomass Productivity

... curated catalogue of Web Services

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The screenshot shows the BioVeL group page on the myExperiment platform. The header includes the BioVeL logo (a green leaf on a grid) and the text "Biodiversity Virtual e-Laboratory on myexperiment". Navigation tabs for "Home", "BioVeL", "Workflows", "Files", and "Packs" are present. A search bar and a "New Group" dropdown are also visible. The main content area shows the group name "Group: BioVeL" and links for "Members (3)", "News", "Shared Items", "Creditations (7)", and "Tags (3)". The "Overview" tab is selected, displaying a description of the group's purpose for sharing workflows. On the right, a sidebar shows the group owner, Alan Williams, and statistics: "3 members" and "78 shared items".

**Biodiversity Virtual e-Laboratory**  
on myexperiment

Log in | Register

Home BioVeL Workflows Files Packs

New Group GO [ ] All Search

Home > Groups > BioVeL

View Group Content

**Group: BioVeL**

| Members (3) | News | Shared Items | Creditations (7) | Tags (3) |

Overview Members (3) Creditations (7)

This group is for sharing workflows relating to BioVeL - Biodiversity Virtual e-Laboratory - FP7-283359 BioVeL

The BioVeL group is curated. If you previously had membership or if you wish to share content with the group, please contact [f.quevedo.fernandez@cs.cardiff.ac.uk](mailto:f.quevedo.fernandez@cs.cardiff.ac.uk).

Please feel free to explore. You can find [documentation](#) on the BioVeL wiki. If you need assistance, you can get it by emailing to [support@biovel.eu](mailto:support@biovel.eu) or by posting a question in our online [forum](#).

For more information about the overall BioVeL project, please visit <http://www.biovel.eu/>.

**Owner**

  
Alan Williams

**3 members**

**78 shared items**

... repository for sharing workflows ... for groups



[biovel.myexperiment.org](http://biovel.myexperiment.org)



**Biodiversity Virtual e-Laboratory**  
on myexperiment

Home BioVeL **Workflows** Files Packs

New Workflow GO Workflows Search

Home > Groups > BioVeL > Workflows

### BioVeL Workflows

Search filter terms: « Previous 1 2 3 4 5 Next » Sort by: Rank Results per page: 10

Showing 42 results. Use the filters on the left and the search box below to refine the results.

**Filter by type**

- ☒ Taverna 2 42

**Filter by tag**

- ☐ component 14
- ☐ demography 9
- ☐ matrix populat... 9
- ☐ stage matrix 9
- ☐ package 'pop...' 8
- ☐ biovel 7
- ☐ biome-bgc 4
- ☐ ecosystem fu... 4
- ☐ eigen analysis 4
- ☐ phylogenetics 4

**Taverna 2** **Ecological niche modelling workflow (22)**

**Original Uploader**

Renato De Giovanni

**Project**

**Created:** 07/01/13 @ 18:29:13 | **Last updated:** 26/03/14 @ 13:03:45

**Credits:** Renato De Giovanni Alan Williams Robert Kulawik

**Attributions:** ENM native and 2050 workflow with interaction

**License:** Creative Commons Attribution-Share Alike 3.0 Unported License

View Download (v22)

This workflow takes as input a file containing species occurrence points to create a model with the openModeller Web Service. Algorithm, environmental layers and mask are selected during the workflow. The model is tested (internal test and optional cross validation external test) and then projected one or more times. All points from the input file are used to create a single model, even if there are differences

... repository for sharing workflows ... for groups

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<http://www.taverna.org.uk>



# Taverna



Google™ Custom Search

[Introduction](#) [Documentation](#) [Download](#) [Developers](#) [Cite](#) [Collaborations](#) [News](#) [About](#)

## Taverna Workflow Management System

Powerful, scalable, open source & domain independent tools for designing and executing workflows. Access to 3500+ resources.

### RECENT NEWS

- Taverna powers the BioVeL demo at EGI Community Forum
- Taverna Player plugin for Ruby on Rails
- Calling Taverna Workflows from iPython Notebook
- Digital preservation framework Islandora

Workbench

Server

Player

Command Line

Taverna Online

**TO RUN**

**TO DESIGN, ...**

- Taverna for astronomy, bioinformatics, biodiversity, digital preservation
- Workflow components
- Taverna 3 OSGi
- Taverna Online
- Next generation sequencing on Amazon cloud
- Taverna-Galaxy

**Taverna** is an open source and domain-independent **Workflow Management System** – a suite of tools used to design and execute scientific workflows and aid *in silico* experimentation.

Taverna has been created by the **myGrid team** and is currently funded through FP7 projects **BioVeL**, **SCAPE** and **Wf4Ever**.

See Taverna in action



[portal.biovel.eu](http://portal.biovel.eu)



BioVeL

Home Workflows Runs Contact Ferenc Horváth Log out

Photo by María Paula Balcázar Vargas

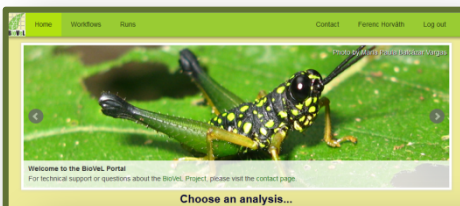
Welcome to the BioVeL Portal  
For technical support or questions about the BioVeL Project, please visit the contact page.

Choose an analysis...


Taxonomic Refinement Ecological Niche Modelling Metagenomics Phylogenetics Population Modelling Ecosystem Modelling My BioVeL

... executable „workflows“

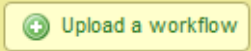




eu

[Home](#)[Workflows](#)[Runs](#)[Contact](#)[Ferenc Horváth](#)[Log out](#)

## Workflows




### Currently showing

- In category **Ecosystem Modelling** (clear)

Clear all filters


### Filter by category

- Taxonomic Refinement
- Ecological Niche Modelling
- Metagenomics
- Phylogenetics
- Population Modelling
- Ecosystem Modelling**



### Biome-BGC CARBON 1.1

Ecosystem Modelling

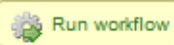



Biome-BGC is a process-based biogeochemical model that can be used to simulate carbon, nitrogen and water fluxes of different terrestrial ecosystems. The BBGC CARBON executes a single simulation run, which consists of a so called spinup and normal simulation phases pipelined.

The simulations require

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Uploaded 12 Feb 2014 03:17:05 UTC





### Biome-BGC ESI ALL version 1.2.2

Ecosystem Modelling



Biome-BGC is a process-based biogeochemical model that can be used to simulate carbon, nitrogen and water pools and fluxes of different terrestrial ecosystems. The

... for ECOSYSTEM MODELLING

## Biome-BGC family

- Biome-BGC 4.2 (2014)  
Numerical Terradynamic Simulation Group, Montana
- **Biome-BGC 4.1.1 MPI** (Max Planck Inst., Trusilova 2009)
- Agro-BGC – C4 photosynthesis (Di Vittorio et al. 2010)
- ANTHRO-BGC – agri-management (Ma et al. 2011)
- **Biome-BGC MuSo** – Multi-layered Soil, management, improved phenology, drought effects, ground water ...  
(Hidy, Barcza et al. 2012, ... in preparation)

# Biome-BGC

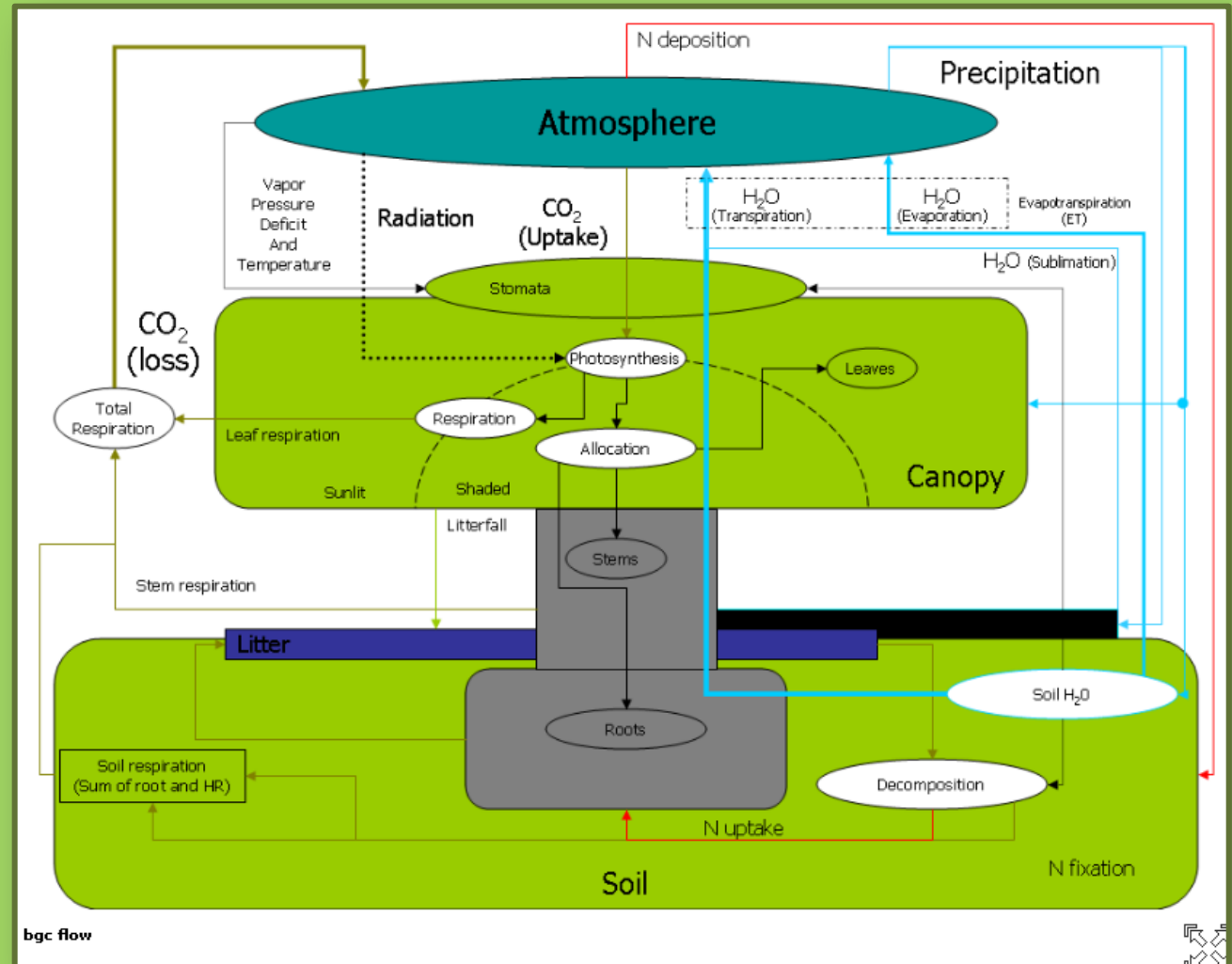
typical  
biogeochemical  
model

(pools+fluxes)

meteorology  
driven

daily time step

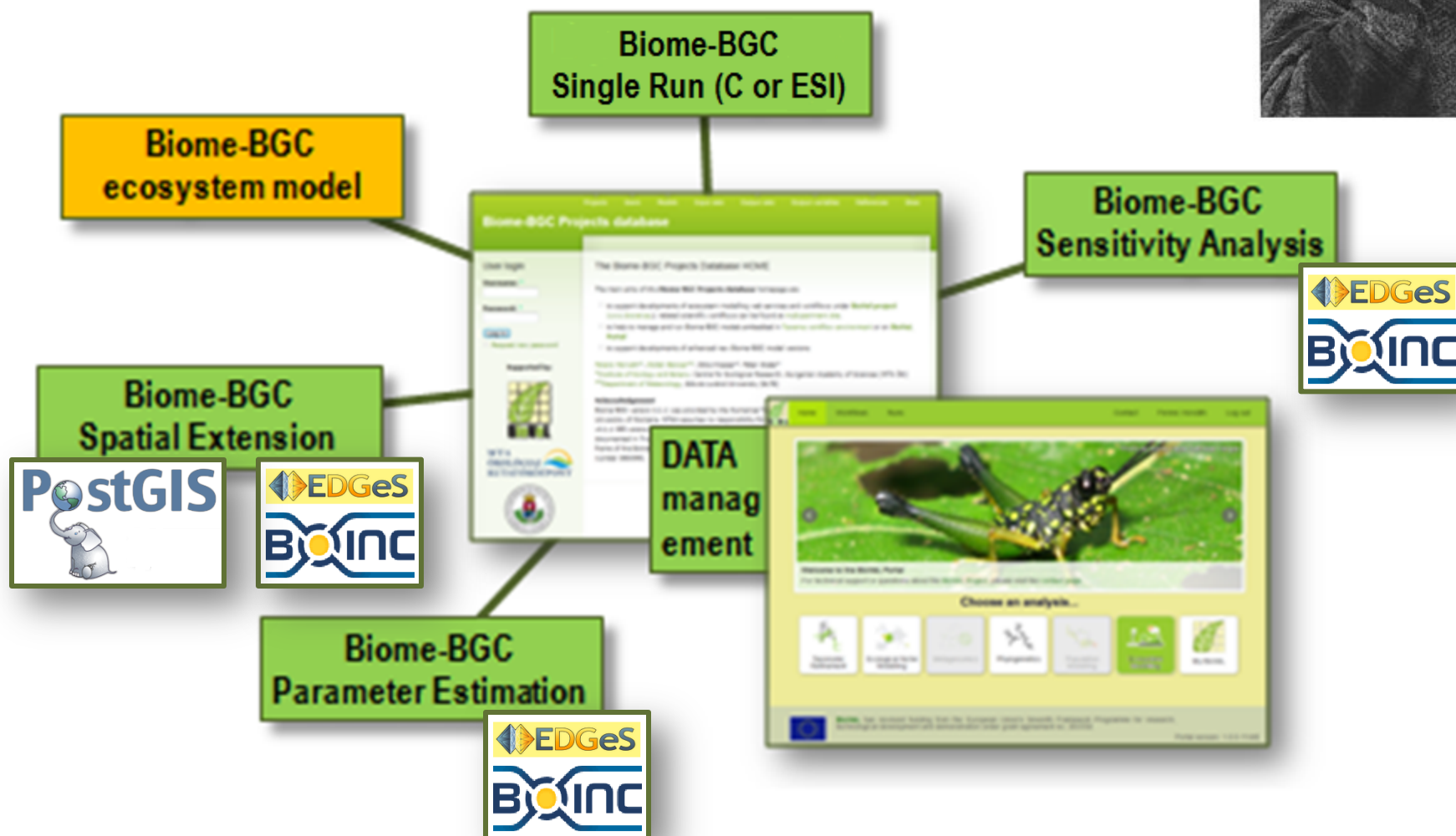
carbon, water  
+ nitrogen



*„Essentially, all models are wrong,  
but some are  
useful“*



# MODEL – DATA – FUSION FRAMEWORK





## BioVeL Portal



A browser-based interface that contains everything necessary

to run workflows without you having to install anything on your own computer.

<http://portal.biovel.eu/>

## Taverna Workflows



Biodiversity  
and  
ES modeling

workflows can be found on myExperiment, BioVeL group.

<http://www.myexperiment.org/groups/643/workflows>

## ECOS Web Services

Registered in Biodiversity Catalogue

<https://www.biodiversitycatalogue.org/>

## Biome-BGC Projects DB

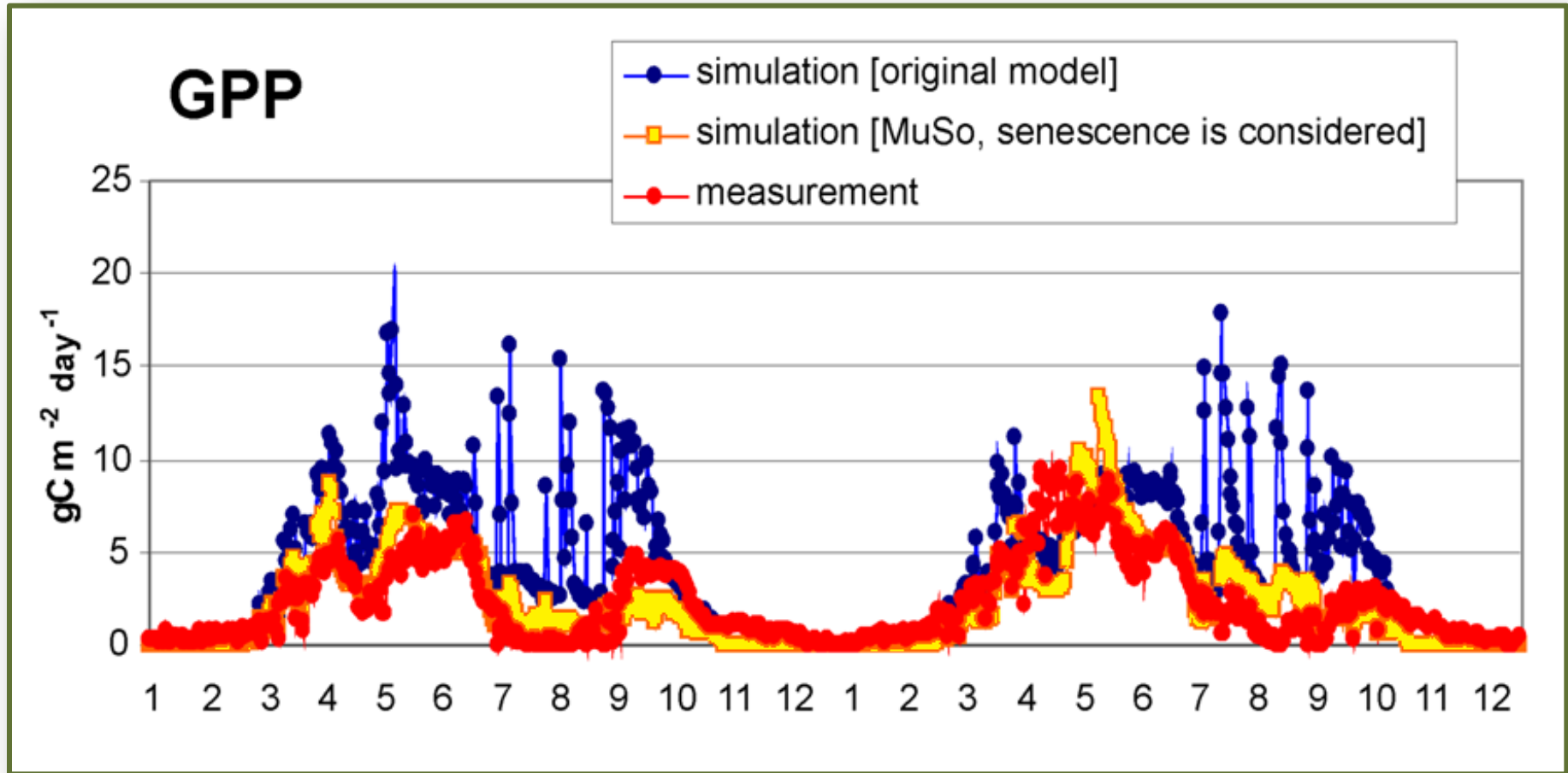
Support ecosystem modeling

<http://ecos.okologia.mta.hu/bbgcdb/>

**Biome-BGC**

Powered by 

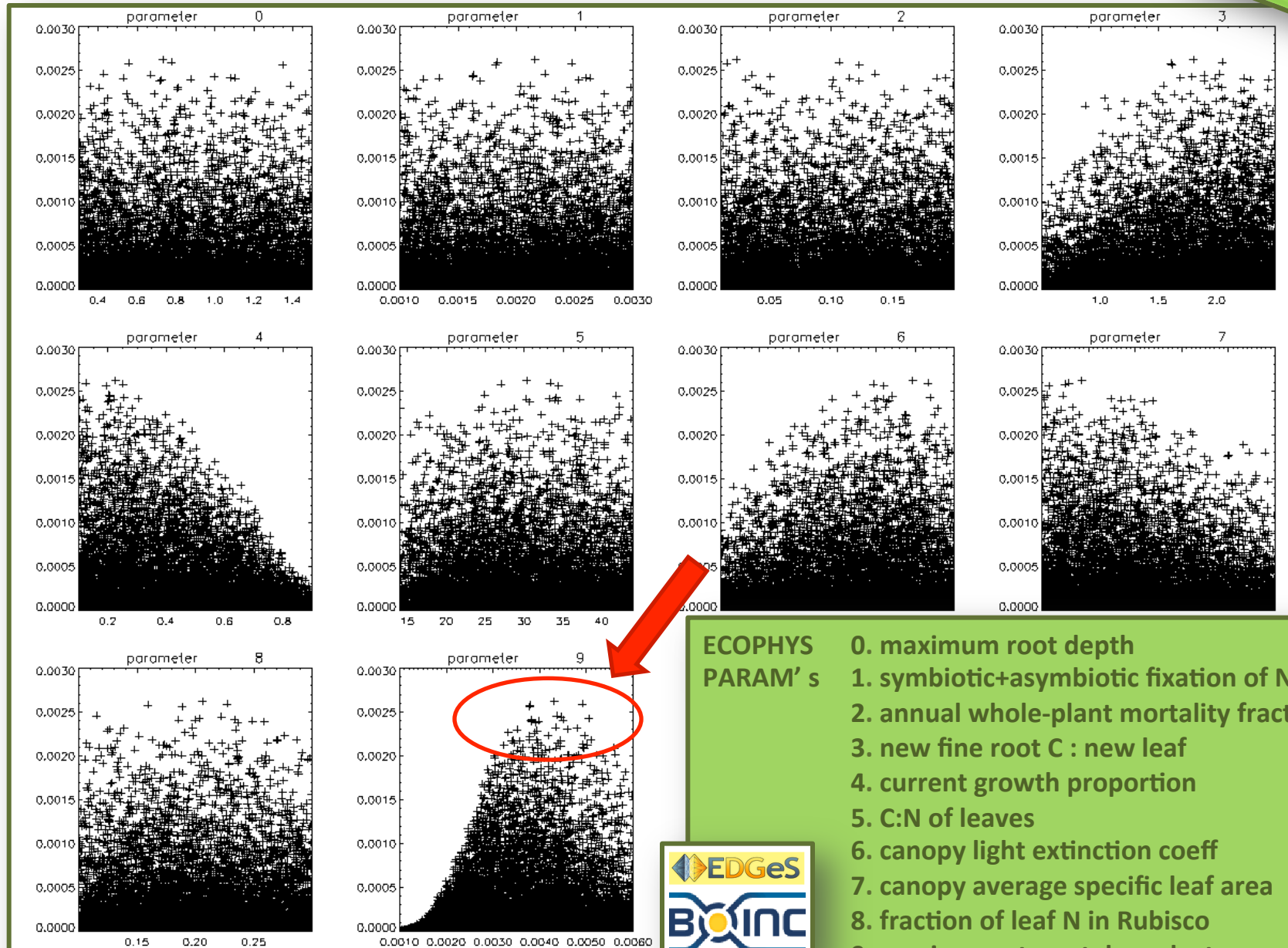
# Biome-BGC MuSo [■] versus 4.1.1 MPI [●] improved drought effect to Gross Primary Production



dry grassland at Bugac

# Global Likelihood Uncertainty Estimation (GLUE)

Biome-BGC  
Parameter Estimation



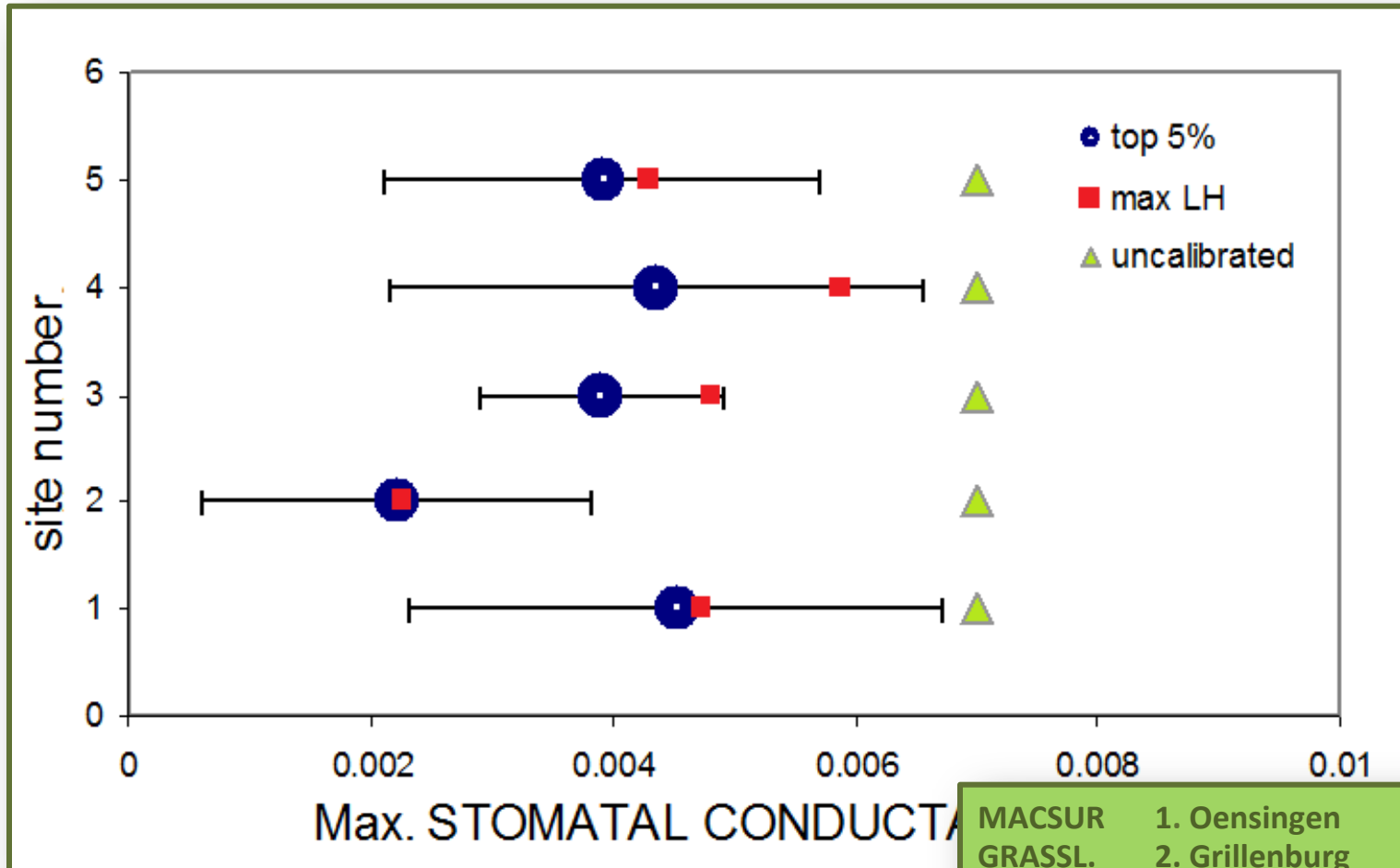
ECOPHYS  
PARAM' s

0. maximum root depth
1. symbiotic+asymbiotic fixation of N
2. annual whole-plant mortality fraction
3. new fine root C : new leaf
4. current growth proportion
5. C:N of leaves
6. canopy light extinction coeff
7. canopy average specific leaf area
8. fraction of leaf N in Rubisco
9. maximum stomatal conductance



# GLUE Parameter Estimation

*a priori* [ ▲ ] versus *a posteriori* [ ● ]



MACSUR  
GRASSL.  
SITES

1. Oensingen
2. Grillenburg
3. Laqu – extensive mgmt
4. Laqu – intensive mgmt
5. Monte Bodone

## Conclusion & remark

- **The e-Virtual Lab IT framework:**  
workflows – web services – grid – GIS – legacy software integration, Biodiversity Catalogue, myExperiment, BioVeL portal ... are powerful & easy to use
- **Further developments & deployments are in progress**
  - on data retrieval services
  - on spatial extension
  - on post processing evaluation services

[www.biovel.eu](http://www.biovel.eu)