

BioVeL – Biodiversity Virtual e-Laboratory

Workflow Documentation

Calculate variance matrix Workflow for local execution

Augustus 2014

Capacities Programme of Framework 7: EC e-Infrastructure Programme – e-Science Environments - INFRA-2011-1.2.1

Grant Agreement No: Project Co-ordinator: Project Homepage: Duration of Project: 283359 Mr Alex Hardisty <u>http://www.biovel.eu</u> 36 months





1 Description

This workflow estimates the variance matrix from a list of matrices.

2 General

2.1 Name of the workflow in myExperiment.

Name: Calculate variance matrix workflow

Download: The workflow pack can be downloaded at myExperiment under the following address:http://www.myexperiment.org/packs/663.htmloronlytheworkflow:http://www.myexperiment.org/workflows/4443.htmloronlytheworkflow:

2.2 Date, version and licensing

Last updated: 28 Augustus 2014

Version: 1

Licensing: CC-BY-SA

2.3 How to cite this workflow

To report work that has made use of this workflow, please add the following credit acknowledgement to your research publication:

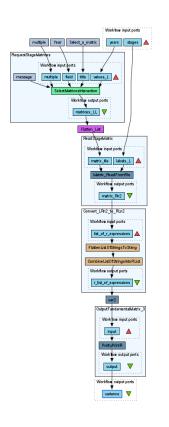
The input data and results reported in this publication (tutorial) come from data (Dr. Gerard Oostermeijer unpublished results and publication: Oostermeijer, J.G.B. M.L. Brugman, E.R. de Boer; H.C.M. Den Nijs. 1996. Temporal and Spatial Variation in the Demography of *Gentiana pneumonanthe*, a Rare Perennial Herb. *The Journal of Ecology*, 84: 153-166.) using BioVeL workflows and services (www.biovel.eu). Calculate variance matrix workflow was run on *<date of the workflow run>*. BioVeL is funded by the EU's Seventh Framework Program, grant no. 283359.

3. Scientific specifications

3.1 Keywords

BioVeL, demography, *Gentiana pneumonanthe*, matrix, matrix population models, package '*popbio*' in r, stage matrix, variance matrix.

3.2 Scientific workflow description



The aim of this workflow is to provide a connected environment to calculate the variance matrix. The workflow accepts input data (matrices) in a .txt format (decimal numbers indicated by dots e.g.: 0.578). The output is provided as a set of R results.

Figure 1. A) Graph of the variance matrix Workflow in Taverna workbench.

For more detailed description of the functions, please visit the Tutorial section.

4 Technical specifications

4.1 Execution environment and installation requirements

The Workflow requires a Taverna Engine including the Interaction Service plugin. The simplest way to install a Taverna Engine is to install Taverna Workbench, and then install the Interaction Service plugin.

The workflow also requires an Rserve installation with the *popbio* package installed. It is possible to setup the workflow to use a remote Rserve. However, instructions for installing a local Rserve are provided below.

4.2 Taverna installation, including updates and plugins

4.2.1 Taverna installations

• Taverna Workbench: Version 2.4 or 2.5. For installation files and instructions, please go to http://www.taverna.org.uk/download/workbench

4.2.2 Taverna Plug-ins

• Please install the <u>Interaction</u> plugin: version 1.0.2+

4.2.3 Taverna Dependencies

- Install R software in your computer. See: <u>http://www.r-project.org/</u>
- Start R, and install package Rserve:
 - o install.packages("Rserve")
- Install package popbio
 - install.packages("popbio")
- Local R Server: (Rserve) running at port 6311. See <u>https://wiki.biovel.eu/x/3ICD</u> for additional information.

4.2.4 How it works

First, open R, once R is opened, type library(Rserve) and press enter; then type Rserve() and press enter again. You will see then the following message: Starting Rserve.
 "C:\PROGRA~1\R\R-30~1.1\library\Rserve\libs\x64\Rserve.exe"

After this operation you can open Taverna and run the workflow.

5 Tutorial

5.1 Introduction

This tutorial requires 6 input files or matrices of 6 consecutive years (from 87-88 to 92-93) of the same place (Terschelling, The Netherlands, Oostermeijer *et al.*, 1996).

5.2 Input data.

5.2.1 Data preparation/format

The workflow accepts input data (matrices) in a .txt format, all decimal numbers in each matrix must be indicated by dots e.g.: 0.578. All examples matrices for the tutorial are available in the PACK: http://www.myexperiment.org/packs/663.html or here below. *All the files must be saved in the same directory.*

5.2.2 Input data

The input files are in a .txt format: to download click here in each file:

Terschelling matrices

- MTers87 88.txt
- MTers88_89.txt
- MTers89 90.txt
- MTers90 91.txt
- MTers91 92.txt
- <u>MTers92 93.txt</u>

5.3 Select input data dialogue boxes.

The first step is to fill out the input ports:

5.3.1 INPUTPORTS

1) **Stages:** the names of the stages or categories of the input matrix. The respective name stages must be filled one by one. First press add value (see arrow in Fig 2), fill a stage name and press enter; then press add value and fill once again the next stage name, repeat the action until you have fill all the stages names.

In the following example, the matrix has 5 stages or categories:

The stages of this matrix are called:

1) Seedlings	S
2) Juveniles	J
3) Vegetative	V
 Reproductive individuals 	G
5) Dormant plants	D

e.g. [S, J, V, G, D]

iagram	
	Port description The names of the stages or categories of the input matrix. In the following example, the matrix has 5 stages.
	The names of the stages of categories of the input matrix. In the following example, the matrix has 5 stages.
	The stages of this matrix are called:
	1) Seedlings S 2) Juveniles J
	Example value
	[S, J, V, G, D]
Vorkflow description	
his workflow estimates the variance matrix	
om a list of matrices.	🗙 Delete 🟘 Add value 📄 Add Inclocation 🎱 Add URL
his workflow has been created by the iodiversity Virtual e-Laboratory (BioVeL tp://www.biovel.eu/) project. BioVeL is funded y the EU's Seventh Framework Program, gran o. 283359.	List selected -abj: S -abj: J -abj: V -abj: G -abj: D
Vorkflow author	
aria Paula Balcazar-Vargas, Mikolaj Krzyzanowski, onathan Giddy, Francisco Quevedo and Gerard ostermijer .	
	Drag to re-arrange, or drag files, URLs, or text to add
	Store an angle of each of

Figure 2. Inputs stages names to be filled in (example).

2) <u>Years</u>: each year represents a matrix and therefore characterizes a period of transition (Fig. 12). The respective years must be filled one by one. First press add value (see arrow in Fig 12), fill a year (e.g. 1987) and press enter; then press add value and fill once again the next year (1988), repeat the action until you have fill all the years, the year must be filled out in a consecutive order.

In this tutorial, we have 6 matrices (see **5.2.2 Input data**) that represent 6 years **1987** =data interval between 1987 and 1988; **1988**= data interval between 1988 and 1989 etc.

e.g. [1987, 1988, 1989, 1990, 1991, 1992]

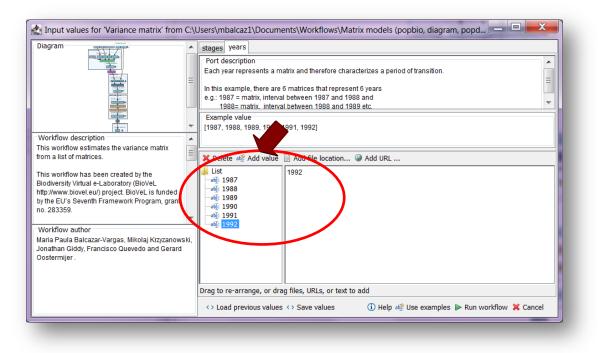


Figure 3. Inputs years to be filled in (example).

After the user has filled out the input ports, click *Run Workflow* button, a dialogue pages appear in the user's internet browser.

5.3.2 INTERACTION

1) <u>Select a matrix for each year</u>: all the matrices must be in the same folder. The interaction page will show the submitted years. When the dialogue appears (Fig 4), click Browse for the first year (e.g. 1987). A file dialog appears. Select the file (one matrix that belong to that year) and clicks Open (Fig 5). Then the selected matrix appears in the browser (Fig 6). Repeat the procedure for each year (Fig 7). Once all the matrices are submitted, click the Confirm button (Fig 7). After clicking Confirm, the confirmation "Returned Results" appears (Fig 8). The workflow controls whether each location have submitted 1 matrix.

In the following example, there are 6 years:

1) 1987	3) 1989	5) 1991
2) 1988	4) 1990	6) 1992

localhost8080/interaction/li	teraction6a14eb9ee2564	\$3e82a95c7372179961.html		🐨 😋 🛛 🔀 = Google	P 4	- 👧 -	÷	☆ 自	a ≡
Most Visited 📫 🕨 Researcher Tr	nining 💶 COMO HAC	ER UNA P 📷 Home 🔝 Labo	ratorio de Genéti 🛄 Tavema interaction 🛄 Tavema interaction	Tavema interaction 🗢 Index of /~gross/eeb5.	🗢 Lou Gross - Home Pa	Disp	ersal Ec	ology and	,
elect a matrix	ch year, then cl	ick the Confirm butt	on.						
Year			Files	Matrices					
987	Browse_	No file selected.							
88	Browse	No file selected.							
189	Browse_	No file selected.							
90	Browse	No file selected.							
91	Browse_	No file selected.							
92	Browse	No file selected.							
			The interaction service was developed in the BioVeL	nation -					

Figure 4. Select a matrix for each year dialogue appears.

Most Yuited P > Researcher Tairing COUCHACER URAP. How Was How With About to de Genetit. Takena interaction Takena interaction Takena interaction About the Conformation of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods - Home Rg. On Dependent of the set of /-group was a loss Goods a loss of the set of /-group was a loss Goods a loss of the set of /-group was a loss Goods a loss of the set of /-group was a loss of t	Files	Select a matrix			on 👁 Index of /-gross/eeb5 👁 Lou Gross - Home Pag 💈	Dispersal Ecology and
elect a matrix for each year, then click the Confirm button. Year Files 987 Browse No file selected. 988 Browse No file selected. 990 Browse No file selected. 991 Browse No file selected. 992 Browse No file selected. 994 Browse No file selected. 996 Browse No file selected. 996 Browse No file selected. 997	Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files	5 X3X Ø	r, then click the Confirm button.			
elect a matrix for each year, then click the Confirm button. Year Files 987 Browse No file selected. 988 Browse No file selected. 990 Browse No file selected. 991 Browse No file selected. 992 Browse No file selected. 994 Browse No file selected. 996 Browse No file selected. 996 Browse No file selected. 997	Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files Files F	5 X3X Ø	r, then click the Confirm button.			
Year Files 987 Browse, No file selected. 988 Browse, No file selected. 989 Browse, No file selected. 990 Browse, No file selected. 991 Browse, No file selected. 992 Browse, No file selected. 993 Browse, No file selected. 994 Browse, No file selected. 995 Browse, No file selected. 996 Browse, No file selected. 997 Browse, No file selected. 998 Browse, No file selected. 990 Browse, No file selected. 991 Mater modeling workforw 22 992 Browse, No file selected. 993 Browse, No file selected. 994 Browse, No file selected. 995 Browse, No file selected. 996 Browse, No file selected. 997 Browse, No file selected. <	Files Vertices * Matrix models (popples, diagram, popplemo) * WE22-Clouder variance matrix * + + Search WE22-Clouder Granter - New folder Vertices * New folder Documents library WE22-Clouder variance matrix WE22-Clo	elect a matrix for each yea	, then click the Confirm button.			
Year Files 987 Browse, No file selected. 988 Browse, No file selected. 989 Browse, No file selected. 990 Browse, No file selected. 991 Browse, No file selected. 992 Browse, No file selected. 993 Browse, No file selected. 994 Browse, No file selected. 995 Browse, No file selected. 996 Browse, No file selected. 997 Browse, No file selected. 998 Browse, No file selected. 990 Browse, No file selected. 991 Match modeling workforw.22 992 Browse, No file selected. 993 Browse, No file selected. 994 Browse, No file selected. 995 Browse, No file selected. 996 Browse, No file selected. 997 Browse, No file selected. <	Files Vertices * Matrix models (popples, diagram, popplemo) * WE22-Clouder variance matrix * + + Search WE22-Clouder Granter - New folder Vertices * New folder Documents library WE22-Clouder variance matrix WE22-Clo	elect a matrix for each yea	, then click the commit button.		the second se	
Year Files 1987 Browse. No file selected. 1988 Browse. No file selected. 1999 Browse. No file selected. 1990 Browse. No file selected. 1991 Browse. No file selected. 1992 Browse. No file selected. 1993 Browse. No file selected. 1994 Browse. No file selected. 1995 Browse. No file selected. 1992 Browse. No file selected. 1993 Match motiling worthous? 1994 Browse. No file selected. 1995 Match motiling worthous? 1996 Browse. No file selected. 1997 Browse. No file selected. 1998 Match motiling worthous? 1999 Browse. No file selected. 1990 Browse. No file selected. 1990 Match mo	Documents Documents library Arrange by: Image: Decision Documents Displace Image: Decision Documents Displace Image: Decision Documents Displace Image: Decision Displace Displace			~~	(pophia diagram popdemo) & WE22 (plotte upinge matrix &	
987 Browse No file selected. 988 Browse No file selected. 989 Browse No file selected. 990 Browse No file selected. 991 Browse No file selected. 992 Browse No file selected. 994 Browse No file selected. 992 Browse No file selected. 994 Browse No file selected. 995 Browse No file selected. 996 Browse No file selected. 997 Browse No file selected. 998 Browse No file selected. 990 Browse No file selected. 991 Matrix moduling worthrows2 992 Browse No file selected. 993 Browse No file selected. 994 Browse No file selected. 995 Browse No file selected. 996 Matrix moduling worthrows2 997 Browse Matrix moduling worthrows2 998 Matrix moduling worthrows2	Favorite: Documents library Armore by: Folder - W22-Calcular variance matrix Name Corrado southore 22 Tarena Metrix coeffing worthore 22 Tarena Corrado southore 23 Tarena Corrado southo	Year	Files		(poppio, diagram, populerito) • wrzz-cakurate variance matrix •	
Browse No file selected. Doutwents library 1983 Browse No file selected. W22-Calcular statutes 1990 Browse No file selected. Enstop 1991 Browse No file selected. Bloanter 1992 Browse No file selected. Market Confirm Browse No file selected. Market	W22 Calculars variance matrix Artiligit style Desptox Name Date Desptox Second sectors 22 313-58 Maix Second sectors 22 313-58 Maix Markin modeling workfow22 313-58 Markin modeling workfow22 313-58 Markin modeling workfow22 313-58 Marking type Marking type Marking type 315-58 Marking type <	987	Browse. No file selected.	Organize • New folder		
983 Browse., No file selected. Dopbar Name 990 Browse., No file selected. Evento Evento 991 Browse., No file selected. Evento Statory 992 Browse., No file selected. Evento Material selected. 992 Browse., No file selected. Material selected. Material selected. 993 Browse., No file selected. Material selected. Material selected. 994 Browse., No file selected. Material selected. Material selected. 6 Material selected. Material selected. Material selected.	Draybox Name Date m © Draybox Immeria 21-87 © Destor Immeria 21-87 © Destor Immeria 21-87 © Destor Immeria 21-87 © Doumenta Immeria 21-87 © Doumenta Immeria 21-87 © Maria Immeria 21-87 Immeria Immeria 21					Arrange by: Folder -
983 Browse No file selected. Recett Races Recet Races	Image: Constraint of the set of the se					
1990 Drowse No file selected. Brokov Rotory 1991 Browse No file selected. Documents Conados wolfdow 22 1992 Browse No file selected. Markin modeling wolfdow 22 Confirm Markin modeling wolfdow 22 Image: Second	Interview INterview <t< td=""><td>1989</td><td>Browse No file selected.</td><td></td><td></td><td></td></t<>	1989	Browse No file selected.			
1991 Browse No file selected. Ill tarries Image: Consider workflow 22 1992 Browse No file selected. Image: Construction workflow 22 Confirm Image: Confirm Image: Confirm Image: Confirm	Image: Comments Image: Com	1990	Browse No file selected.	Desktop		
1992 Browse No file selected. Sections writere matrix Confirm Matrix Matrix Matrix Browse No file selected. Matrix Matrix Sparse Sparse Matrix Matrix Writer Matrix Matrix Matrix Writer Matrix Matrix Matrix Writer Matrix Matrix Matrix Writer Matrix Matrix Matrix Matrix Matrix Matrix Matrix <tr< td=""><td>Image: Comparison Image: Comparison Image: Comparison 22-8-3 Image: Comparison Image: Comparison 33-5-3 Image: Comparison Image: Comparison 35-5-3 Image: Comparison Image: Comparison <</td><td>991</td><td>Browse No file selected.</td><td>MO Libertine</td><td></td><td></td></tr<>	Image: Comparison Image: Comparison Image: Comparison 22-8-3 Image: Comparison Image: Comparison 33-5-3 Image: Comparison Image: Comparison 35-5-3 Image: Comparison Image: Comparison <	991	Browse No file selected.	MO Libertine		
Mail: P Institution Confirm S Potres Mail: moleting work/wor22 Image: Second Sec	Britaries Ministri modelling workfow22 31-5-42 Videon Minest/28 15-6-2 Minest/28 15-6-2 15-6-2 Minest/28 15-6-2 15-6-2 Minest/29 Minest/29 15-6-2 Minest/29 Minest/29 15-6-2 Minest/29 Minest/29 15-6-2					21-8-20
Contirm	Wiews Miess7,38 15-6-2 Wiews Miess8,89 15-6-2 Miess8,89 15-6-2 Miess8,90 15-6-2 Miess9,90 15-6-2 Miess9,91 26-4-3	1992	Browse No file selected.	🕹 Music		
Hindos Minest8,89 Minest89,90	Immegrap	Confirm				
Nonegroup Mitris89.90	Mies89.90 15-4-X Mies89.91 26-4-X			S Videos		
	Mers90,91 26-4-20			A Homeanaun		
	MTerrel 92			Homegroup	MTers90_91	26-4-20
Computer Mitres91,92	Computer 20-4-20			Scomputer	MTers91_92	26-4-20
System (C) MTes92,93				System (C:)		
🧟 workflow 22 Variance				🦅 mbalcaz1 (\\uva.nl\dfs\frwi-home) (I		
Twordhow 22 Variance				🚙 fnwi-public (\\doozy.uva.nl) (P.) 🛫	Workflow 22 Variance	
File name: MTers7 88	Finei-public (Vdpozy (wain)) (P) Vorkflow 22 Variance 31-5-20			File name: MTers87 88		- All 61
	fini-public (\\doccy.uva.ni) (P) e e Workflow 22 Variance II II					Onen Cancel
	Wordfow Z2 Variance					open cance
	fini-public (\\doccy.uva.ni) (P) e e Workflow 22 Variance II II					
	Wondber (Messguant) (P) Wondber 22 Variance Wondber 22 Variance Hessguant					
C System (C)	C System (C)					
The mean and the second s						
					🏃 Workflow 22 Variance	31-5-20
finwi-public (\\docguva.ni) (P) F Workflow 22 Vanance III				🙀 fnwi-public (\\doozy.uva.nl) (P:)	Wonkflow 22 Variance	
	See forwi-nychlic (Vydpozy (wa ni) (P) 😾 Workflow 22 Variance 31-5-2				•	
File name: MTers87.88	See forwi-nychlic (Vydpozy (wa ni) (P) 😾 Workflow 22 Variance 31-5-2			File name: MTers87_88		-
	🙀 finwi-public (\\doccy.uw.m) (P) 🔹 e Tworkflow 22 Variance 31-5-8.					Onen Cancel
	Wondber (Messguant) (P) Wondber 22 Variance Wondber 22 Variance Hessguant					Open Cancel

Figure 5. Select a matrix for each year dialogue browse. Click in browse (1987), and select one file (e.g. MTer87-88.txt) and then click in Open button.

			and the second			
Most Visited	Researcher Training D COMO HACER UNA P	Home 🔢 Laboratorio de Genéti 🗋 Taverna interaction 🗌 Taverna interaction 💭 Taverna interaction 🝩 Index of /-gross/eeb/	S., 🗢 Lou Gross - Home Pag	Dispersal Eco	logy and	79
Select a r	natrix					
		19 19 19 19 19 19 19 19 19 19 19 19 19 1				
Select a ma	trix for each year, then click the Co	onfirm button.				
Year	Files	Matrices				
		0 0 7.6666667 0				
1987	Browse MTers87_88.txt	0.05797101 0.01 0 8.2857143 0 0.46376812 0.83 0.900900901 0.2857143 0.86046512				
		0 0.04 0.009009009 0.6190476 0.11627907 0 0.03 0.018018018 0 0.02325581				
1988	Browse. No file selected.					
1989	Browse No file selected.					
1990	Browse. No file selected.					
1991	Browse No file selected.					
1992	Browse No file selected.					
Confirm						
		The interaction service was developed in the BioVeL project				

Figure 6. Select a matrix for each year dialogue. The selected matrix appears. Repeat the procedure for each year.

 G localhost8 	080/interaction/interaction6a14eb9ee256453e82a95c7	17217996t.html			~ C	Google		P +	S . U	合自	
Most Visited 988	Researcher Training COMO HACEE UNA P Browse MI Ers88_89.txt		/54189944 0.100775	0.81/82946	0.08693632	eraction 🐵 Index of /~(01025	ross/eeb5 🗢 Lou Gross -	Home Pag	Dispersal E	ology and	*
989	Browse., MTers89_90.txt	0.008547009 0 0.051282051 0 0.188034188 0 0 0.0158730 0 0.0211640	0 52380952 1 0.010050								
990	Browse MTers90_91.txt	0.05882353 0.00000000 0.00000000 0.00000000 0.000000	01204819 38554217 00000000	0.00000000 0.00000000 0.68925234 0.01401869 0.02102804	0.3461538 0.3461538 0.6538462 0.2692308 0.0000000	0.000000 0.000000 0.862069 0.000000 0.137931			ľ		
991	Browse MTers91_92.txt	0.0000000 0 0.111111 0 0.0000000 0	0000000 3636364 0000000	0.000000000 0.000000000 0.559782609 0.016304348 0.008152174	0.0000000 0.3846154 0.6153846 0.3076923 0.0000000	0.00000000 0.00000000 0.92857143 0.07142857 0.00000000					
992	Browse MTers92_93.txt	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	00000000 63362069 00000000	0.0 1.90909091 0.63636364 0.27272727 0.09090909	0.0 1.0 0.0 0.0						
Confirm									÷		
		The inte	raction service was	developed in the]	BioVeL project						

Figure 7. Select a matrix for each year dialogue. Once all the matrices are submitted, click in Confirm.

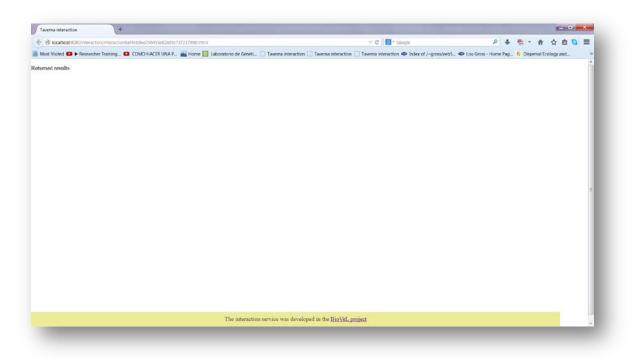


Figure 8. Select a matrix for each year dialogue. After the user clicks Confirm, the confirmation "Returned Results" appears. Refer back to Taverna workbench.

When the analyses are completed, they appear on different windows under results in Taverna, the user have to save each output separately.

5.4 Save data/results

5.4.1 OUTPUTS

First, click in the selected result window e.g. *variance* (Fig 9, red oval). Second, click in the left window on value 1 (Fig 9, blue oval) and you will see the numerical results. Third, on the right window click on save value (Fig 9, green oval). Fourth, name the file and determinate the extension file, e.g. .csv or .txt. Finally, save the file in the chosen map (Fig 10).

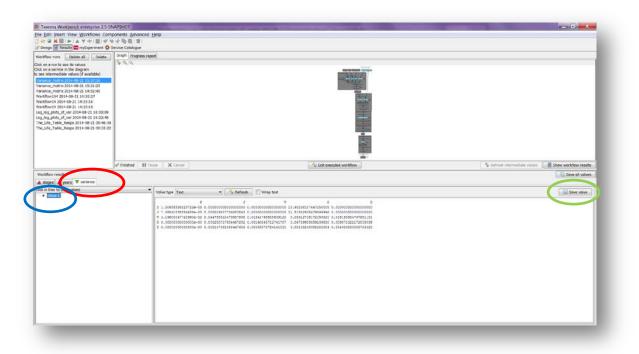


Figure 19. Taverna workbench results. When the analysis is completed, they appear on different windows under results in Taverna.

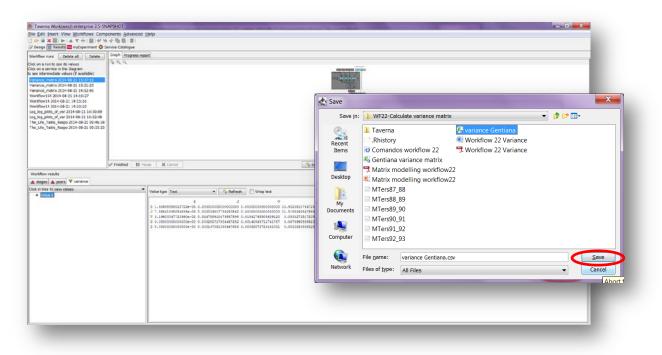


Figure 10. Name the file, click on Save value, name the file and add the extension for the file. For a text file: e.g. .csv or .txt.

1) Variance matrix

The variance matrix of 6 Gentiana matrices (1987-1992). The csv file after apply text to columns (Fig 11).

0	from Web	From I Test	1		Connection 2 Properties - Lift Criss		The State		dito Remov		Comolidate	R? Andra -	No ingrees	\$53 -q	Shew Detail Helt Detail						
	AL		= (n	5	CONNECCEL		101.8.HISF			. UND N	50 S.		0.	EN!	- Ca						
21	A	-		c	D	ε	F	G		н	T.	1	К		1	М	N	0	p	0	8
t	~						D	0								141	14	0		u.	2
	5	-	1,51E-05			10,93258															
						11,51583															
1							0,019194														
	G						0,009071														
	D		0,00E+00	0,000147	0,000636	0,001582	0,004984														
3																					
D																					
1																					
2																					×.
3																					
\$																					
5																					
5																					
7																					
8																					
9																					
D																					
5 6 7 8 9 0 1 2																					
Z																					
3																					
1																					-
()	P Ge	ritiona	variance ma	trix 😰									1.	1				6.)		Lors (=)	+1

Figure 11. Variance matrix numeric results (.csv or text files).

6 Support

For questions with using the workflow, please write support @biovel.eu

For definitions of technical and biological terms, please visit the BioVeL glossary page: <u>https://wiki.biovel.eu/display/BioVeL/Glossary</u>

7 Bibliography

This workflow was created using and based on Package '*popbio*' in R. (Stubben & Milligan 2007; Stubben, Milligan & Nantel 2011).

- **Caswell, H.** 2001. Matrix population models: Construction, analysis and interpretation, 2nd Edition. Sinauer Associates, Sunderland, Massachusetts.
- **Oostermeijer J.G.B., M.L. Brugman; E.R. de Boer; H.C.M. Den Nijs.** 1996. Temporal and Spatial Variation in the Demography of Gentiana pneumonanthe, a Rare Perennial Herb. The Journal of Ecology, Vol. 84(2): 153-166.
- **Stubben, C & B. Milligan.** 2007. Estimating and Analysing Demographic Models Using the popbio Package in R. Journal of Statistical Software 22 (11): 1-23
- **Stubben, C., B. Milligan, P. Nantel.** 2011. Package 'popbio'. Construction and analysis of matrix population models. Version 2.3.1

7.1 Acknowledgements

7.1.1 Authors

- 1) *Maria Paula Balcázar-Vargas* Instituut voor Biodiversiteit en Ecosysteem Dynamica (IBED), Universiteit van Amsterdam.
- 2) *Mikołaj Krzyżanowski* Cardiff School of Computer Science and Informatics, Cardiff University, Cardiff CF24 3AA, United Kingdom.
- 3) *Jonathan Giddy* Cardiff School of Computer Science and Informatics, Cardiff University, Cardiff CF24 3AA, United Kingdom.
- 4) *Francisco Quevedo* Cardiff School of Computer Science and Informatics, Cardiff University, Cardiff CF24 3AA, United Kingdom.
- 5) *J. Gerard B. Oostermeijer* Instituut voor Biodiversiteit en Ecosysteem Dynamica (IBED), Universiteit van Amsterdam.

7.1.2 Project funding

The workflow described in this documentation has been designed and implemented as part of the BioVeL project.

BioVeL is funded by the European Commission 7th Framework Programme (FP7) as part of its e-Infrastructures activity. Under FP7, the e-Infrastructures activity is part of the Research Infrastructures programme, funded under the FP7 'Capacities' Specific Programme. It focuses on the further development and evolution of the high-capacity and high-performance communication network (GÉANT), distributed computing infrastructures (grids and clouds), supercomputer infrastructures, simulation software, scientific data infrastructures, e-Science services as well as on the adoption of e-Infrastructures by user communities.

7.2 Publications