

BioVeL – Biodiversity Virtual e-Laboratory

Workflow Documentation

Life Table Response Experiments (LTRE) Fixed design Effect of years in one place Workflow for local execution

Augustus 2014

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<http://www.biovel.eu>
36 months



LTRE fixed design effect of years in one place Workflow

1 Description

The Life Table Response Experiments Effect of Years in One Place workflow provides an environment to analyse two or more stage matrices from different years in one location. The objective of this workflow is to determine the effects of the research years (2 or more) in one place on λ . This workflow performs a fixed LTRE, one way design (Caswell 2001).

LTRE is a retrospective analysis (Caswell 1989), beginning with data on the vital rates and on λ under two or more sets of environmental conditions (in this case 2 or more years in one location) (Horvitz, Schemske and Caswell 1997). The goal of the analysis is to quantify the contribution of each of the vital rates to the variability in λ . (Caswell 1989, 1996, 2001 in Horvitz, Schemske and Caswell 1997).

Fixed Treatments: Decomposing Years Treatment Effects in one location or place

A fixed-effect analysis treats the matrices as representative of particular conditions, either experimental or natural (*high vs. low nutrients* in a one-way model, for example, or *year and spatial location* in a two-way model). The goal is to determine how much a treatment level (in this case year) on λ is contributed by each of the vital rates. The analysis uses a linear approximation in which the sensitivities appear as slopes. The effect of a treatment on λ depends on its effect on each matrix entry and on the sensitivity of λ to that entry. (Horvitz, Schemske and Caswell 1997).

For more details of the analysis see: Retrospective Analyses: Fixed Treatments (page 262 in Horvitz, Schemske and Caswell 1997) and Chapter 10 Life Table Response Experiments (page 258 in Caswell 2001).

2 General

2.1 Name of the workflow in myExperiment.

Name: Life Table Response Experiments fixed design effect of years in one place workflow

Download: The workflow pack can be downloaded at myExperiment under the following address:
<http://www.myexperiment.org/packs/590.html> or only the workflow:
<http://www.myexperiment.org/workflows/4434.html>

2.2 Date, version and licensing

Last updated: 14th 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:

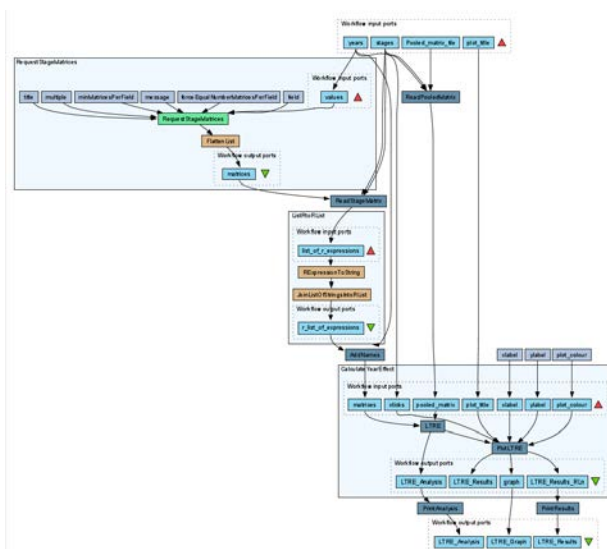
The input data and results reported in this publication (tutorial) come from data (Dr. Gerard Oostermeijer unpublished results and publication: Oostermeijer, J.G.B. M.L. Brugman, E.R. de Boer; H.C.M. Den Nijs. 1996. Temporal and Spatial Variation in the Demography of *Gentiana pneumonanthe*, a Rare Perennial Herb. *The Journal of Ecology*, 84: 153-166.) using BioVeL workflows and services (www.biovel.eu). The Life Table Response Experiments Effect of Years in One Place 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, fixed design, Life Table Response Experiments, effect of years in one place, Matrix Population Models, Retrospective analysis, stage matrix.

3.2 Scientific workflow description



The aim of the LTRE - effect of years in one place workflow is to provide a connected environment to perform LTRE analysis of two or more matrices representing two or more years in one place or location. 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 and graphic plots.

Figure 1. A) Graph of the LTRE – effect of years in one place 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 [Interaction](#) plugin: version 1.0.2+

4.2.3 Taverna Dependencies

- Install R software in your computer. See: <http://www.r-project.org/>
- Start R, and install package Rserve:
 - `install.packages("Rserve")`
- Install package popbio
 - `install.packages("popbio")`
- Local R Server: (Rserve) running at port 6311. See <https://wiki.biodel.eu/x/3ICD> 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:\PROGRAMS~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 7 input files; 6 matrices of consecutive years (87-88, 88-89, 89-90, 90-91, 91-92) of the same place (Terschelling, The Netherlands) and a pooled matrix (or a weighted main matrix).

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/590.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](#)
- [MTers92_93.txt](#)

Pooled matrix

- [MT_pooled data.txt](#)

To understand how to calculate a pooled matrix or a weighted main Matrix, please see: *Choice of a reference matrix* (pag: 253, in Horvitz, Schemske and Caswell 1997). This list of matrices will be used to perform a fixed Life Table Response Experiments effect of years in one place analysis.

5.2 Select input data dialogue boxes.

The first step is to fill out the input ports:

5.3.1 INPUTPORTS

1) **Plot Title:** Descriptive main title for labelling generated outputs (graphs). Click Add Value, enter a title and press Enter.

e.g: LTRE, *Gentiana pneumonanthe* (name of the analysis, species taxonomic name)

2) **Pooled matrix file:** Weighted main Matrix in a .txt file format what *popbio* (R package) calls pooled matrix (to see more details: Horvitz, Schemske and Caswell 1997; Horvitz, and Schemske 1995). Click in Set file location (red arrow in Fig 2), a window dialog appears and the user selects the file (e.g. MT_pooled data.txt) and then clicks the Open button. Then the link to the file will appear on the Taverna window.

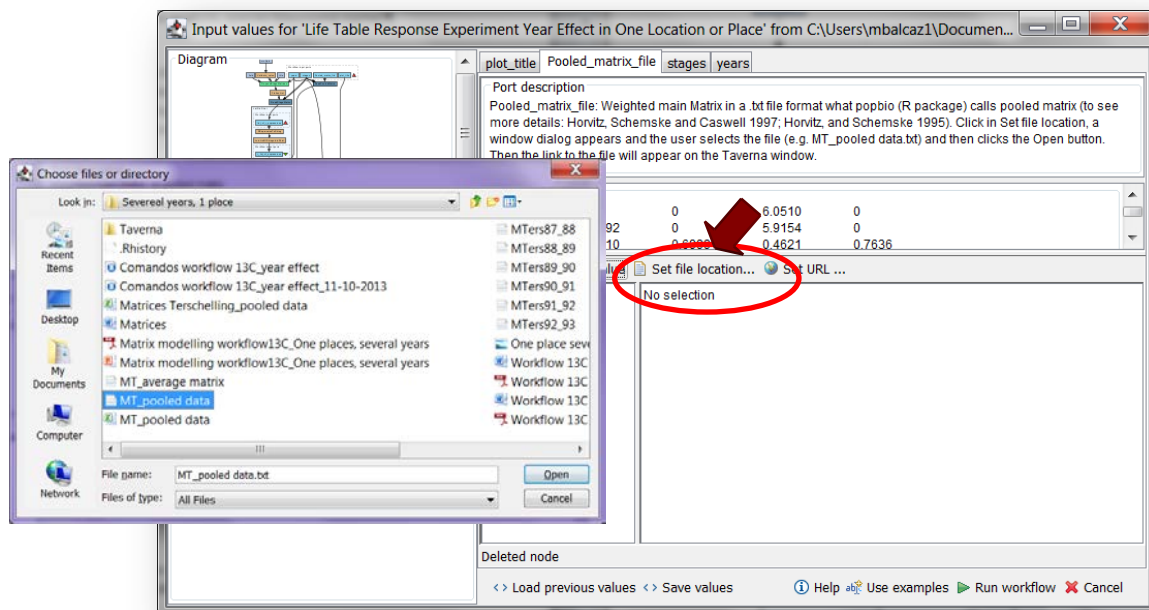


Figure 2. Input Pooled matrix to be filled in. Click in Set file location (red arrow), a window dialog appears and the user selects the file (e.g. MT_pooled data.txt) and then clicks the Open button.

4) **Stages:** the names of the stages or categories of the input matrix. In the following example, the matrix has 5 stages or categories. The respective name stages must be filled one by one. First click Add Value (see arrow in Fig 3), enter a stage name (not longer than 8 characters) and press Enter; then click Add Value and enter the next stage name, repeat the action until you have entered all the stage names.

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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 |
| 4) Reproductive individuals | G |
| 5) Dormant plants | D |

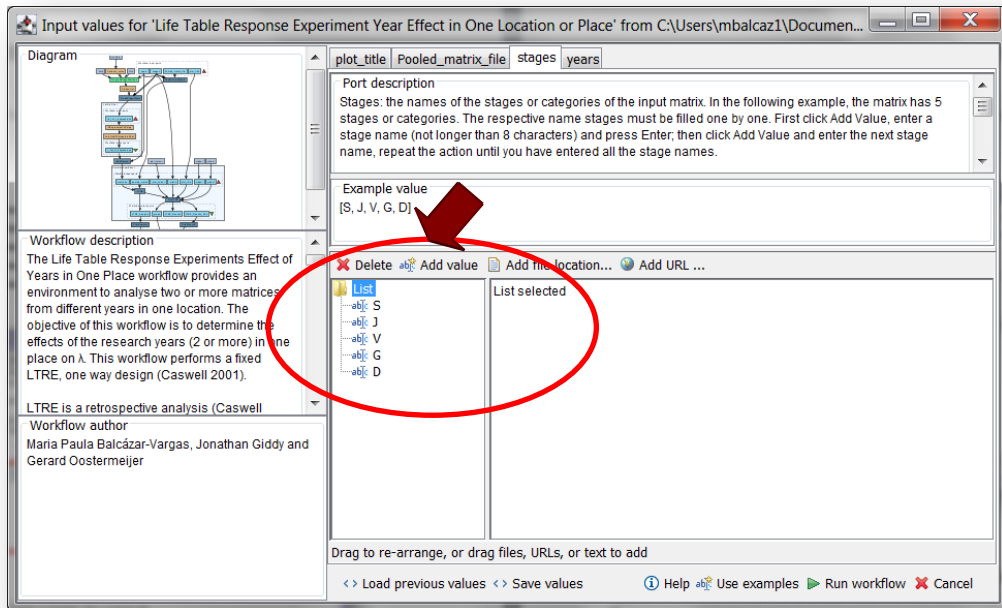


Figure 3. Inputs stages names to be filled in (example).

5) **Years:** All years which start a period of transition. This should indicate two consecutive study periods (Fig. 4). In the following example, we have six years (e.g.: 1988 =data interval between 1988 and 1989 and 1989= data interval between 1989 and 1990):

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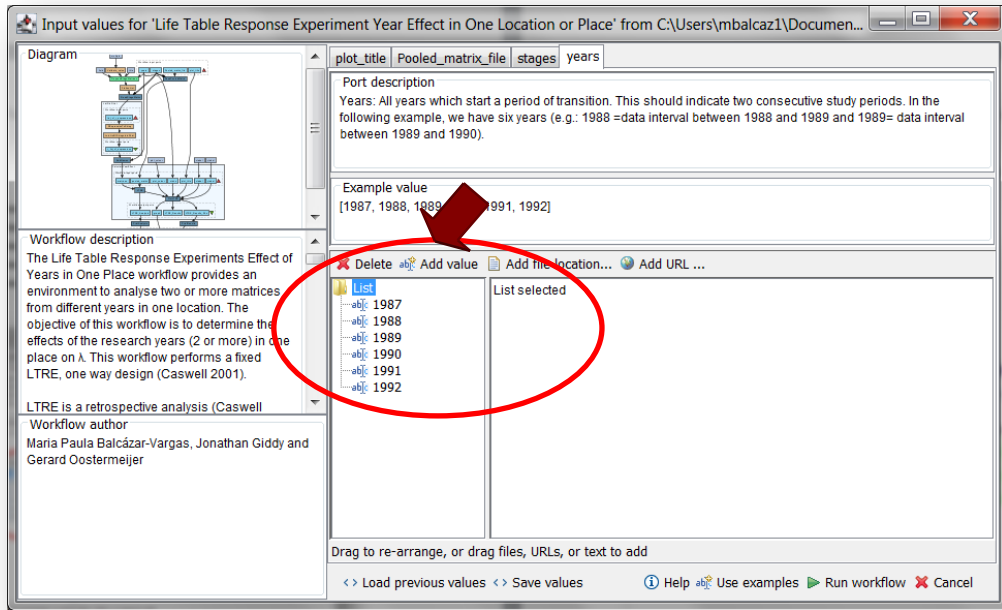


Figure 4. Inputs years to be filled in (example).

After the user has filled out the input ports and has clicked the **Run Workflow button**, a dialogue pages appear in the user's internet browser. See the next section:

5.3.2 INTERACTION

1) **Years:** the interaction page will show the submitted years. When the dialogue appears (Fig 5), click Browse for the first year (1987). A file dialog appears. Select the file (one matrix that belong to that year) and clicks Open (Fig 6). Then the selected matrix appears in the browser. Repeat the procedure for each year (Fig 7). Once all the matrices are submitted, click the Confirm button (Fig 8). After clicking Confirm, the confirmation "Returned Results" appears (Fig 9). The workflow controls whether each location have submitted at least 1 matrix.

In the following example, there are 6 years:

- 1) 1987
- 2) 1988
- 3) 1989
- 4) 1990
- 5) 1991

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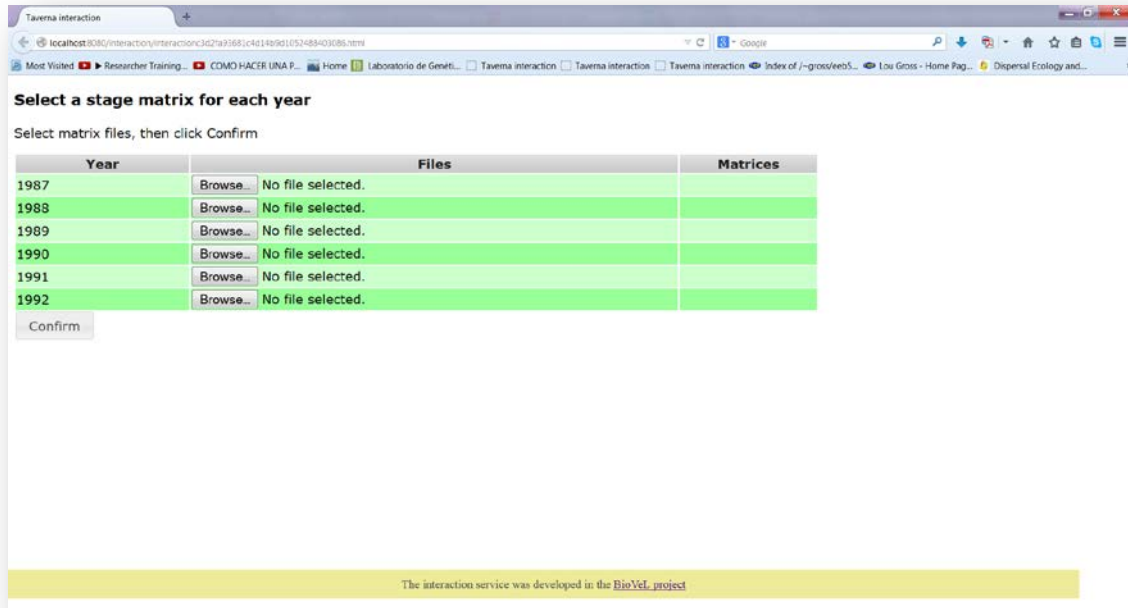


Figure 5. Years dialogue appears.

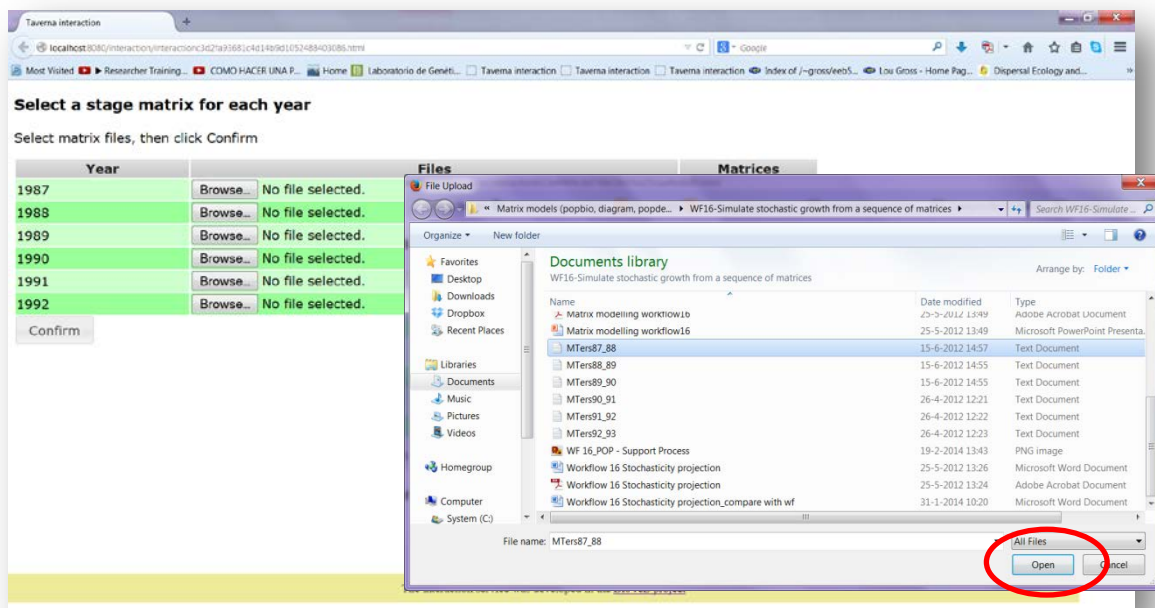


Figure 6. Years dialogue browse. Click in browse (1987), and select the file (one file) and then click in Open button.

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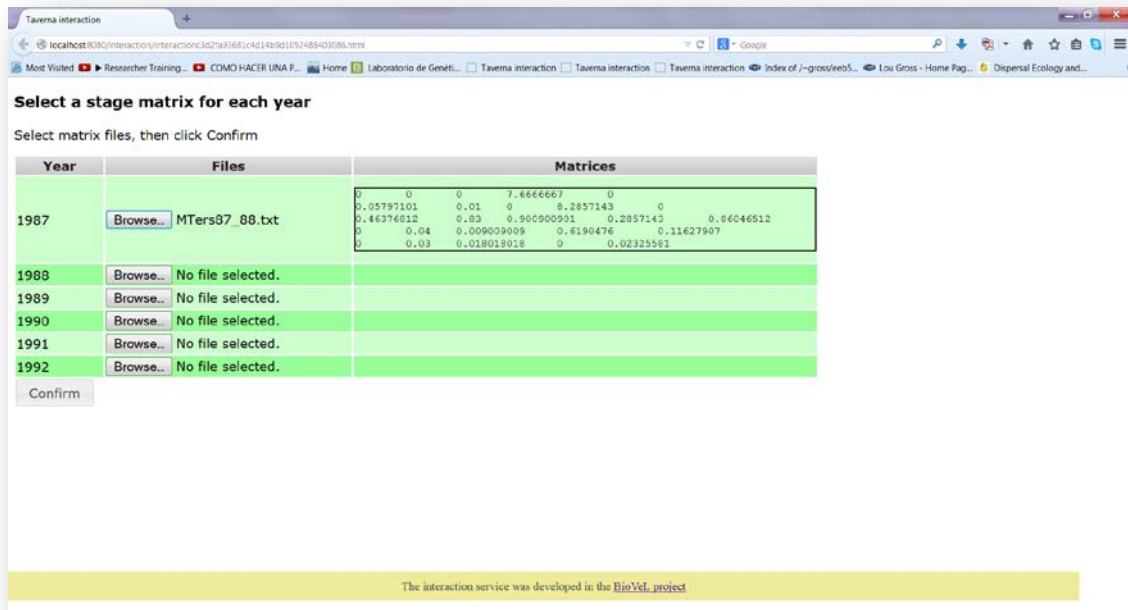


Figure 7. Years dialogue. The selected matrices appear. Repeat the procedure for each year.



Figure 8. Years dialogue. Once all the matrices are submitted, click in Confirm.

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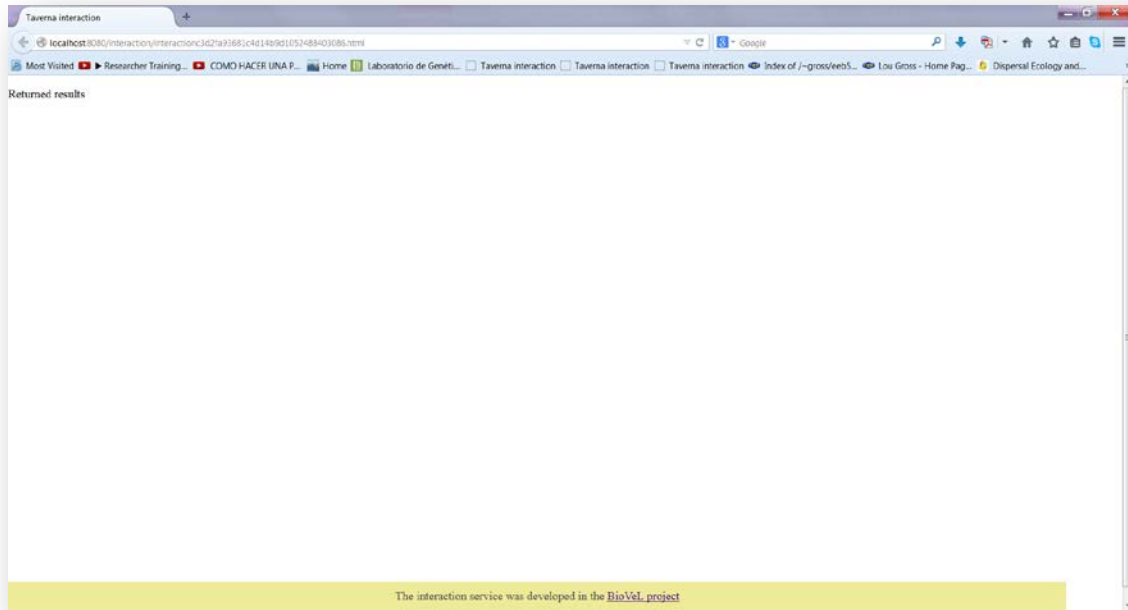


Figure 9. Years dialogue. After the user clicks Confirm, the confirmation “Returned Results” appears. Refer back to Taverna workbench.

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

5.4 Save data/results

5.4.1 OUTPUTS

First, click in the selected result window e.g. **LTRE_Analysis**. Second, click in the left window on value 1 and you will see the **LTRE_Analysis** results in the right window. Third, on the right window click on save value (Fig 11). Fourth, name the file and determinate the extension file. For a text file: e.g. .csv or .txt. For images: .jpg or .png (Fig 11). Finally, save the file in the chosen map (Fig 11).

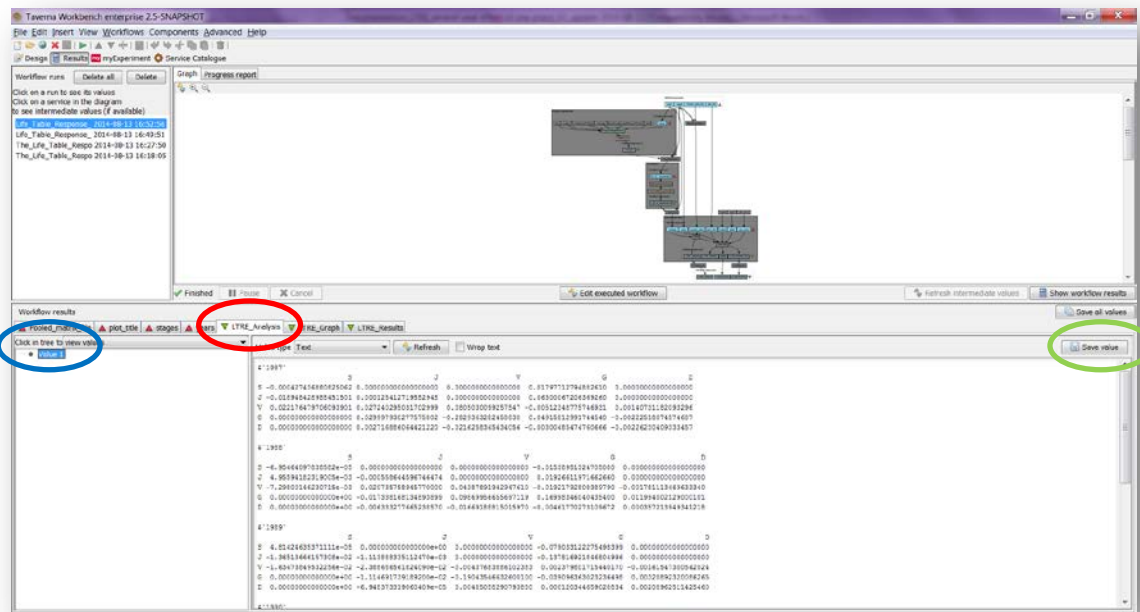


Figure 10. Taverna workbench results. When the analyses are completed, they appear on different windows under results in Taverna. **LTRE_Analysis** window (red circle). Value 1 on the left window of the **LTRE_Analysis** output results (blue circle). Save value on the right window of the **LTRE_Analysis** output results (green circle).

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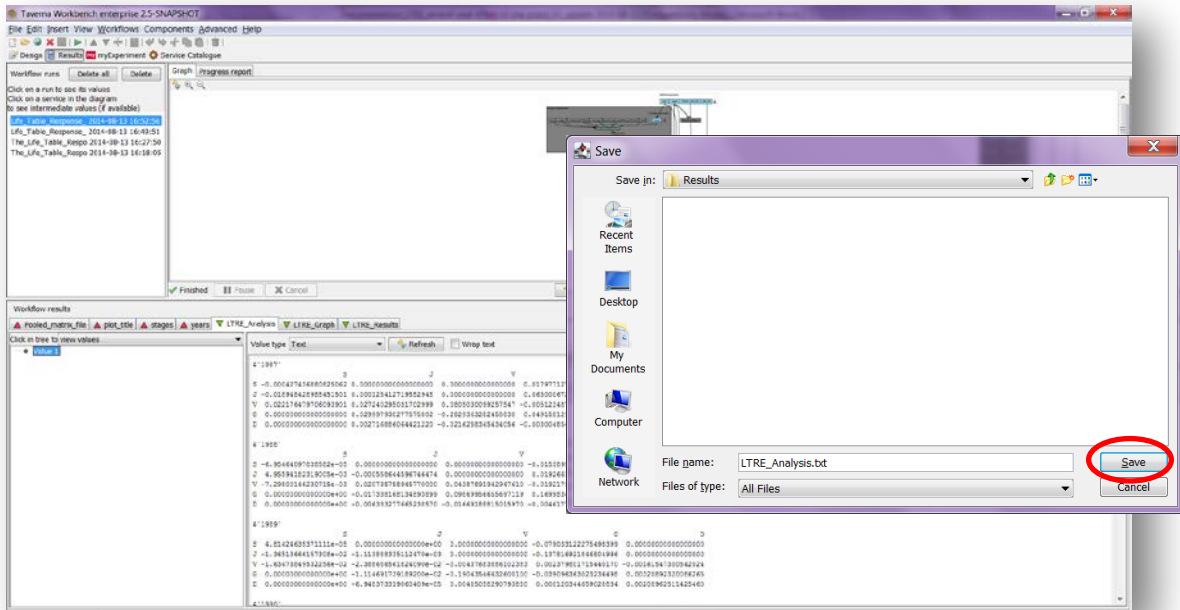


Figure 11. Name the file, adding the extension for the file. For a text file: e.g. .csv or .txt. For images: e.g.: .jpg or .png.

LTRE fixed design year effect for multiple places

1) **LTRE_Analysis:** Intermediary results showing the matrices calculated on the LTRE analysis per year. After this step the workflow sums up all the values per matrix giving us the final result: LTRE_Results. The csv file after apply text to columns (Fig 12).

The screenshot shows a Microsoft Excel spreadsheet titled 'LTRE_Analysis'. The data is organized into a matrix for each year. The columns are labeled S, J, V, G, D. The rows are labeled with the year and the variable (S, J, V, G, D). The values are numerical, representing the results of the LTRE analysis.

Year	S	J	V	G	D
1987	-0.00043	0	0	0.017977	0
1987	-0.01895	0.000125	0	0.063001	0
1987	0.022176	0.02724	0.080503	-0.00512	0.001407
1987	0	0.029988	-0.28294	0.049158	-0.00223
1987	0	0.002717	-0.07163	-0.003	-0.00226
1988	-6.95E-05	0	0	-0.01539	0
1988	4.96E-03	-0.00056	0	0.019256	0
1988	-7.30E-03	0.020736	0.043879	-0.01922	-0.00178
1988	0.00E+00	-0.01734	0.0987	0.169983	0.011994
1988	0.00E+00	-0.00633	-0.01669	-0.00462	0.000957
1989	4.81E-05	0.00E+00	0	-0.07903	0
1989	-1.37E-02	-1.11E-03	0	-0.13782	0
1989	-1.63E-02	-2.39E-02	-0.00438	0.00238	-0.00162
1989	0.00E+00	-1.11E-02	-0.19044	-0.0391	0.003209
1989	0.00E+00	-6.95E-05	0.004851	0.00012	0.00209
1990	-0.00027	0	0	-0.06301	0
1990	-0.01301	0.000304	0	-0.16085	0
1990	-0.04543	-0.04679	-0.005	0.008516	0.002994
1990	0	-0.02428	-0.16925	-0.0542	-0.02022
1990	0	-0.00213	-0.02061	-0.00347	0.001151

Figure 12. LTRE_Analysis output file open in excel (.csv).

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2) **LTRE_Graph**: a histogram to display the **LTRE_Results** (Fig 13). The year effect is shown in the Figure. In this example: The year 1989 had the largest negative effect on λ , and 1988 had a positive effect.

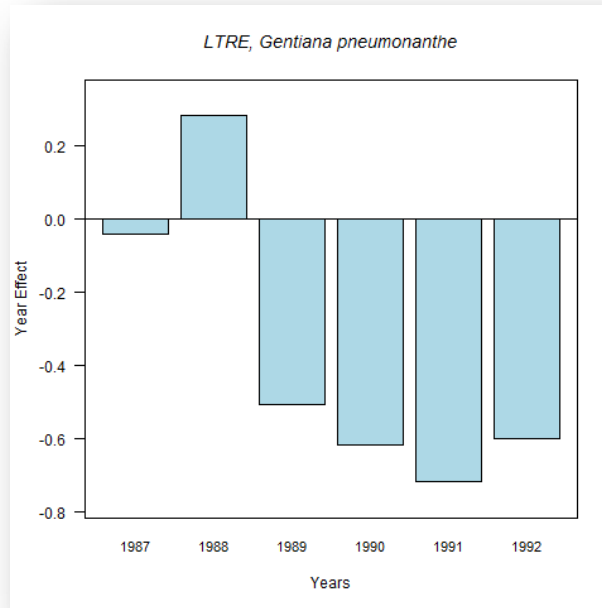


Figure 13. **LTRE_Graph** opens as a coloured graph.

3) **LTRE_Results**: The results of the LTRE per year. These are the generated values of the plotted LTRE graph. The csv file after apply text to columns (Fig 14).

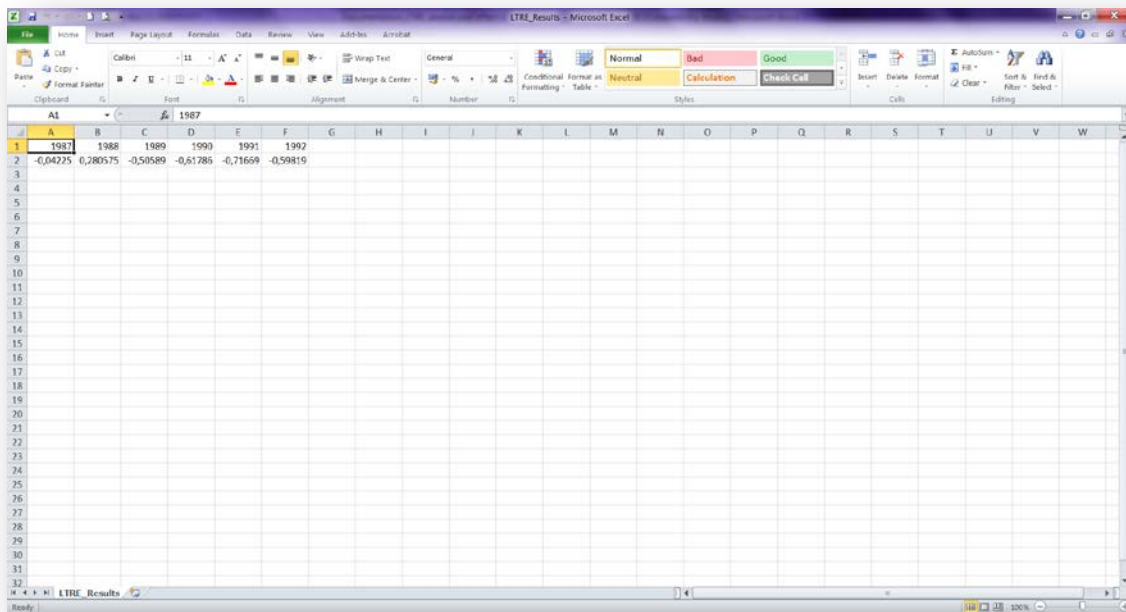


Figure 14. **LTRE_Results** output file open in excel (.csv).

6 Support

For questions with using the workflow, please write [support @biovel.eu](mailto:support@biovel.eu)

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

7 References

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

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7.1 Acknowledgements

7.1.1 Authors

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7.1.2 Project funding

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7.2 Publications