



# JECAMI 2.0 – User Guide

Integrative Alpine wildlife and habitat management for the next generation

**Interreg**  
Alpine Space



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## Content

<b>A</b>	<b>Introduction</b>	<b>3</b>
A.1	Why is ecological connectivity important?.....	3
A.2	Aims of JECAMI 2.0.....	4
A.3	Concepts.....	4
<b>B</b>	<b>Getting started</b>	<b>5</b>
B.1	JECAMI at a glance .....	5
B.2	Tutorial for beginners .....	7
B.3	Tutorial for experts .....	10
<b>C</b>	<b>Reference manual</b>	<b>13</b>
C.1	Ecology beyond borders (explore it!) .....	13
C.2	Ecological connectivity for experts.....	14
<b>D</b>	<b>References</b>	<b>16</b>

## A Introduction

JECAMI, the Joint Ecological Continuum Analysing and Mapping Initiative, is a web-based mapping and analysing application describing ecological connectivity.

In section A, JECAMI begins with a section providing information on ecological connectivity for users not familiar with the topic which may also be used for educational purposes. The expert section provides users with layers and tools for in-depth analysis of important aspects of ecological connectivity within and around the Alps.

Section B allows the user to quickly become familiar with the application. It consists of a short overview (section B.1) and examples to start with - for beginners (section B.2) as well as for experts (section B.3).

For users familiar with the application, a comprehensive reference manual is included in section C.

### A.1 Why is ecological connectivity important?

Functioning ecosystems provide humans with a multitude of services, such as clean drinking water, clean air and pollination of crops. At the same time, nature conservation in Western Europe is enacted almost exclusively in remote areas, where few conflicts exist. It is, therefore, no surprise that biodiversity here is declining considerably.

Biodiversity is also decreasing worldwide (Pimm et al., 2014). In order to decelerate the extinction crisis and simultaneously sustain human livelihood, Noss et al. (2012) and Dinerstein et al. (2017) propose conserving 50% of the earth surface (land and sea) Based on island biogeography (Simberloff and Abele, 1976), areas rich in

biodiversity must be of a certain size in order to maintain their biodiversity, and small disconnected areas that do not allow for movement lose their biodiversity within a short time (Fig. 1). The importance of ecological connectivity increases even more in the face of climatic change, which necessitates movement of species in order to adapt to changing environmental conditions (e.g. Klausmeyer and Shaw, 2009; Mawdsley et al., 2009; Stein et al., 2013; Wessely et al., 2017). Heller and Zavaleta (2009) reviewed 22 years of recommendations for biodiversity management in the face of climatic changes concluding that ecological connectivity is important for adaptation to climatic changes.



Fig. 1: Schematic sketch of the island biogeography theory (Simberloff and Abele, 1976).

Initiatives pursuing an improved ecological connectivity in Europe include the green infrastructure concept of the European Union and the projected creation, within the Alpine Convention, of a ‘network of existing national and transboundary protected areas, of biotopes and other protected elements or those to be protected’.

Ecological connectivity is usually defined as ‘the degree to which the landscape facilitates or impedes movement’ (Taylor et al., 1993). It may be defined by species-specific connectivity of habitats, connectivity of human-defined patterns of landcover or the connectedness of ecological processes (Lindenmayer and Fischer, 2007). Since only around 20 percent of the extant worldwide species richness is known (Kim and Byrne, 2006) , and this subset is limited to frequently observed taxa as well as insects, which represent less well studied taxa. So, it is likely that true diversity and abundance declines are considerably greater than described. With this in mind, it is important to focus on a holistic landscape approach. Within JECAMI we therefore consider landscape as an ecological continuum.

## A.2 Aims of JECAMI 2.0

JECAMI 2.0 was developed with the following audiences and purposes in mind:

### **Beginners:**

- Provide people not familiar with ecological connectivity with basic concepts and allow them to easily become familiar with the subject.
- Raise awareness about the importance of ecological connectivity.

### **Experts:**

- Elaborate homogenized datasets of important aspects of ecological connectivity covering the whole EUSALP perimeter and more detailed datasets in selected project working regions.
- Depict areas that are strategically important for ecological connectivity.
- Provide analysis tools that could be used in various sectors and for a multitude of applications.

## A.3 Concepts

### A.3.1 Continuum suitability indicators (CSI)

One core component of JECAMI is a set of indicators evaluating the landscape with regard to suitability as an ecological continuum. The continuum suitability indicators contain relevant factors for ecological connectivity:

- Land use indicator
- Population pressure indicator
- Environmental protection status indicator
- Topography and altitude indicator
- Fragmentation indicator
- Infrastructure indicator

### A.3.2 Strategic Alpine Connectivity Areas (SACA)

Areas that are integral to ecological connectivity are subdivided into three types of strategically important areas. They are defined as follows:

- **SACA1:** Ecological conservation areas
- **SACA2:** Ecological intervention areas
- **SACA3:** Connectivity restoration areas

The delineation of the different SACA types is based on spatial analyses of the continuum suitability indicators.

## B Getting started

### B.1 JECAMI at a glance

JECAMI 2.0 provides several access possibilities for different user groups (section B.1.1) leading each user to the appropriate and relevant content. The general composition of the mapping application is summarized in section B.1.2.

#### B.1.1 Access possibilities

Users not familiar with the topic choose the section ‘Ecology beyond borders’. It consists of games providing hands-on access to ecological connectivity and generalized data and tools for ecological connectivity. Experienced users choose one of the topics provided in the section ‘Ecological connectivity for experts’ (Fig. 2).

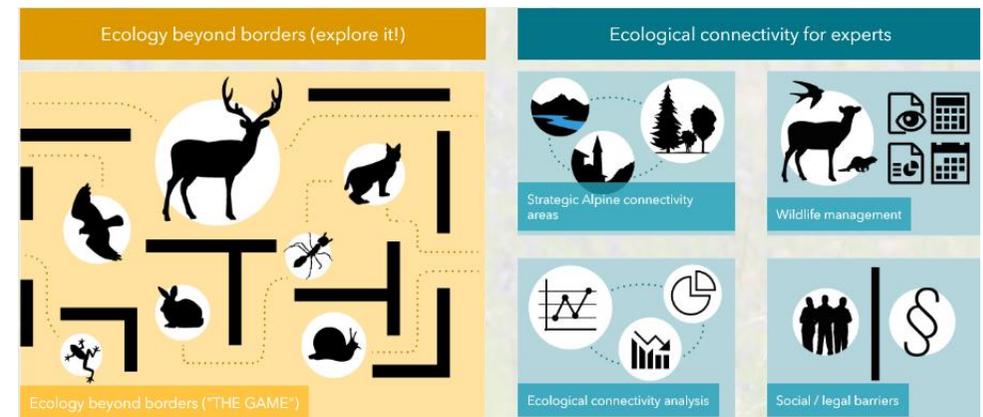


Fig. 2: Access possibilities

B.1.2 Mapping application

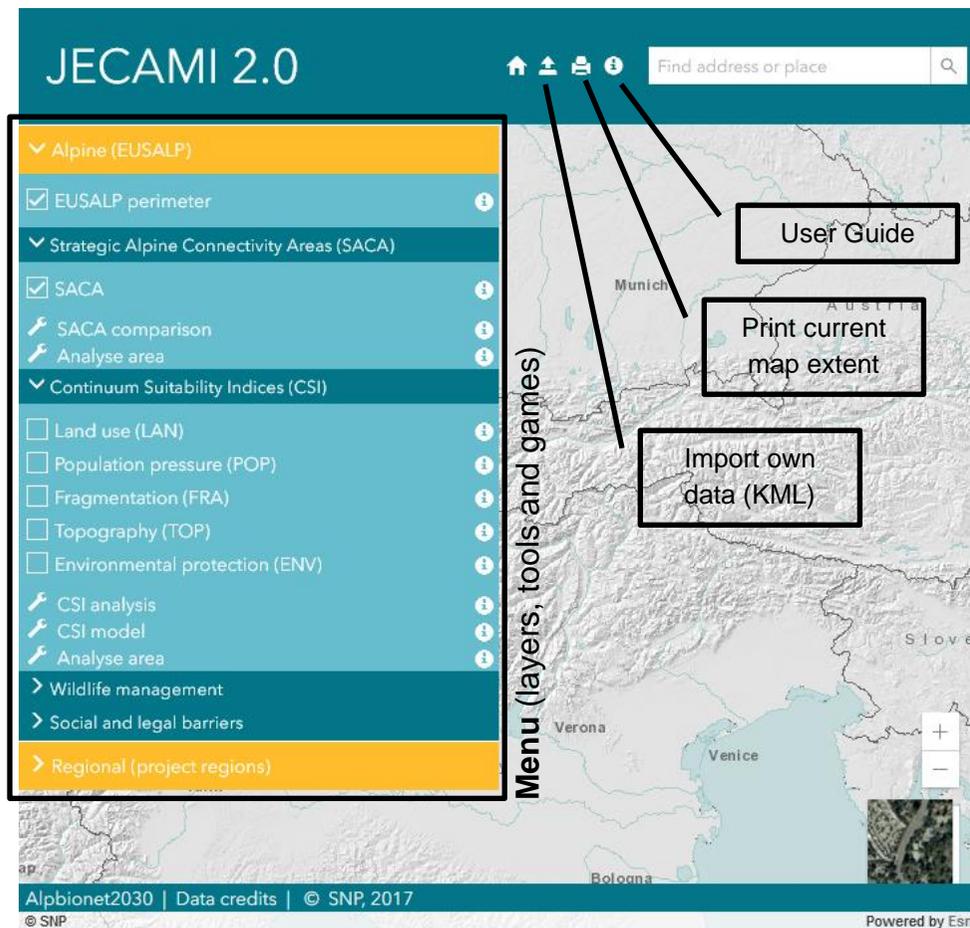


Fig. 3: Mapping and analysing application

Both versions of the mapping and analysing application consist of a header containing basic functions, such as printing the current map extent, accessing the user guide, importing own data and/or selecting the language (Fig. 3). All layers, tools (🔧) and games (🎮) are ordered thematically in the menu and subdivided into an Alpine

(EUSALP perimeter) and a regional (project working regions) section. The extent of the EUSALP perimeter and the project working regions are shown in Fig. 4. Each element of the menu is described in an info box (i) containing a legend and/or a link to the detailed documentation of the layer / tool.

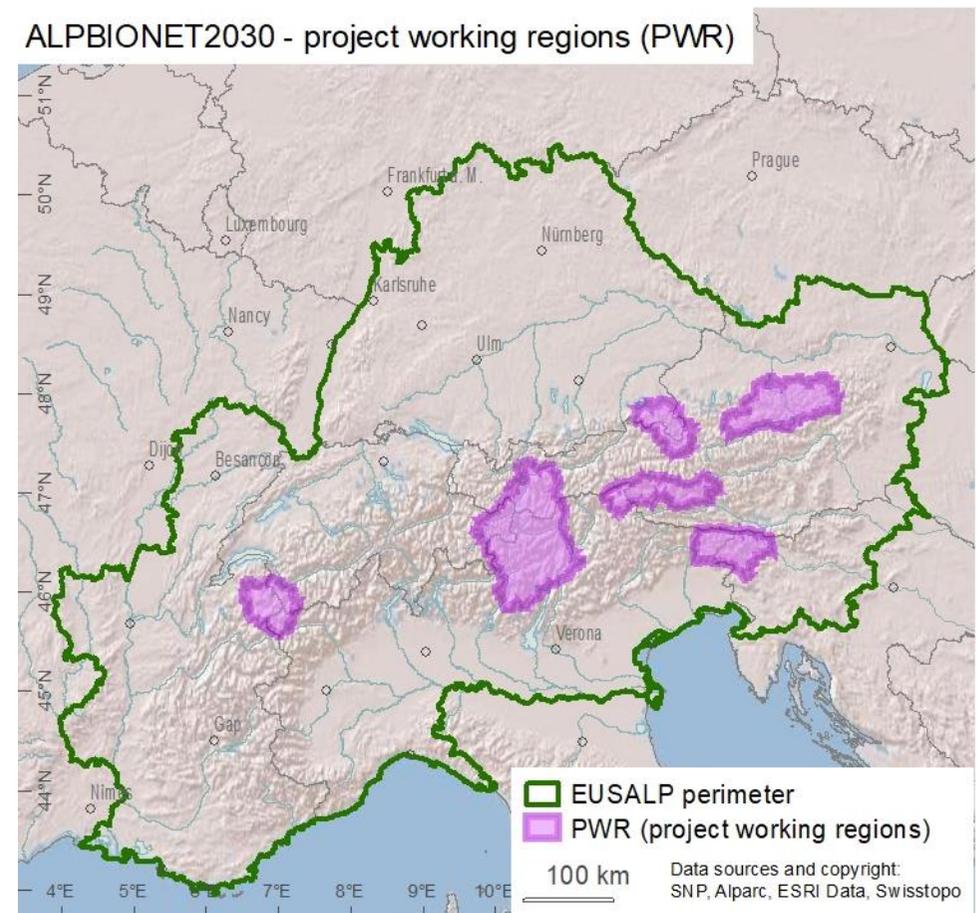


Fig. 4: Perimeters considered for the regional and Alpine analysis.

## B.2 Tutorial for beginners

The tutorial, using a few case examples in the section ‘Ecology beyond borders’ (Fig. 2), shows how the application works and how content is structured. Users looking for a comprehensive composition of all functions, datasets and tools are referred to section C.1.

### B.2.1 Game ‘Site identification’

#### B.2.1.1 Overview

In this example, the user explores the basic functionality of JECAMI 2.0 and is introduced to one out of three games via the ‘Site identification’. It shows various aspects of ecological connectivity based on real world data.

#### B.2.1.2 Step-by-step instructions

1. If you have not already done so, read section B.1 in order to become familiar with the general structure of JECAMI 2.0.



2. Fig. 5: Tutorial of the game ‘Site identification’ step 2 and 3.

2. Select language (Fig. 5). ‘Ecology beyond borders’ is available in English and German (it will be available in additional languages soon).
3. Open the section ‘Explore it (game)’ in the menu (Fig. 5). Start the game ‘site identification’ by clicking on it.

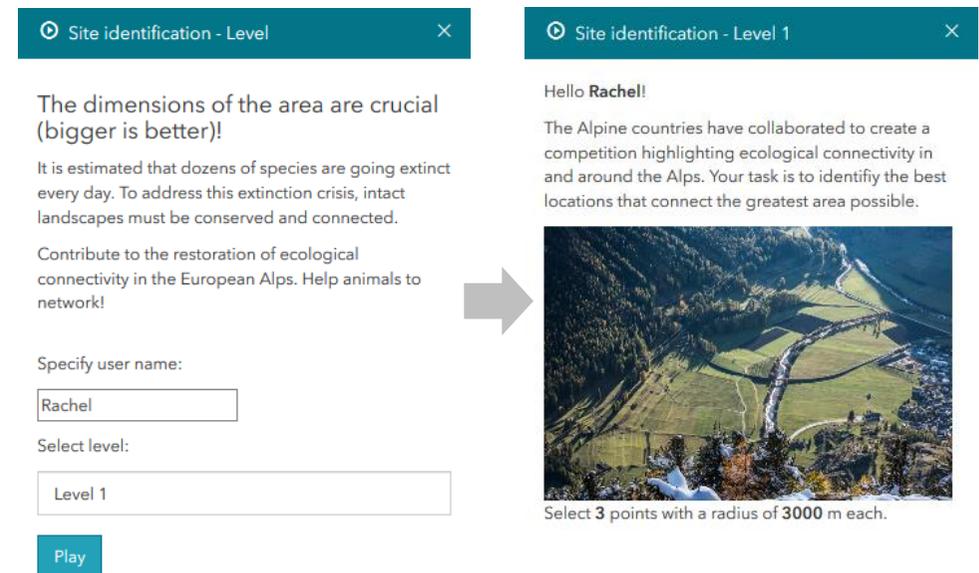


Fig. 6: Tutorial of the game ‘Site identification’ step 4.

4. Clicking ‘site identification’ opens a panel providing you with a short explanation of why ecological connectivity is important. At the bottom of the panel you need to specify a user name, which will be used for the ranking, and you can choose between three levels. Each level is linked to an individual story and is based on different scenarios for ecological connectivity.

5. Your task is to find locations where existing good quality areas could be connected and measures could be taken in order to improve the overall ecological situation. Depending on the level you have chosen, you are allowed to place a predetermined number of points, each with a predefined radius, connecting high quality areas (Fig. 7). As soon as you are satisfied with your locations, press the 'submit' button in order to get your result.

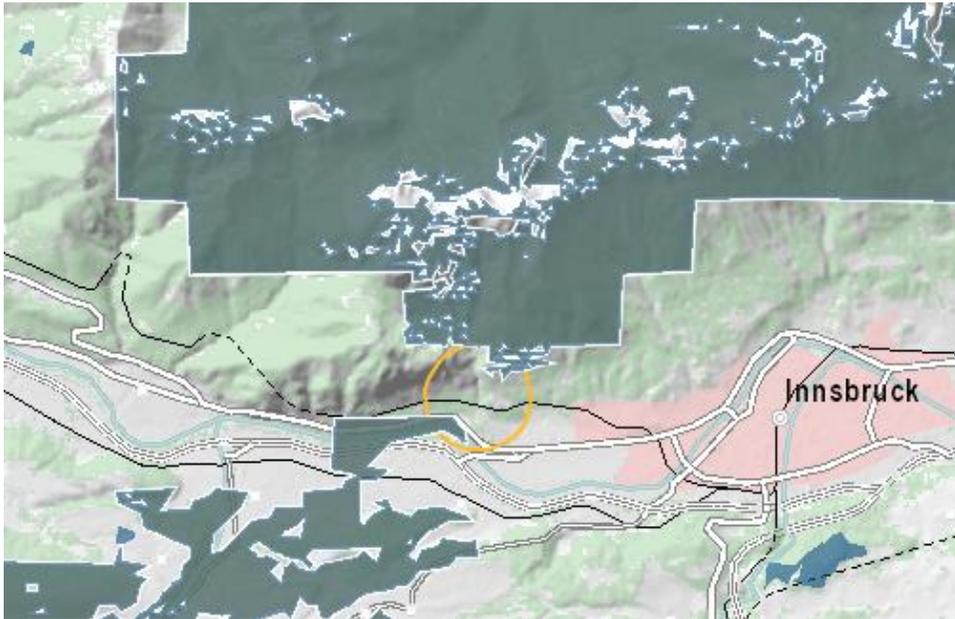


Fig. 7: Find places where high quality areas could be connected.

## B.2.2 Strategic Alpine Connectivity Areas

### B.2.2.1 Overview

In this example, the user becomes acquainted with the basic functionality of JECAMI 2.0 and is introduced to the SACA concept. SACAs are **Strategic Alpine Connectivity Areas**. Three categories of SACAs are identified and defined:

- **SACA1**: Ecological conservation areas  
Areas where ecological connectivity works quite well ( $CSI \geq 8$ )  
Recommendation: conservation of the status quo
- **SACA2**: Ecological intervention areas  
Important links between SACA1s; connectivity is (partly) working  
Recommendation: improvement / restoration measurements
- **SACA3**: Connectivity restoration areas  
Important barriers between SACA1s  
Recommendation: remove barriers

### B.2.2.2 Step-by-step instructions

1. Activate the regional or Alpine strategic connectivity area layer in the menu (Fig. 8). Via the info sign you can access a short description of the layer and the corresponding legend. A link to further information (e.g. pdf-documents) is provided.

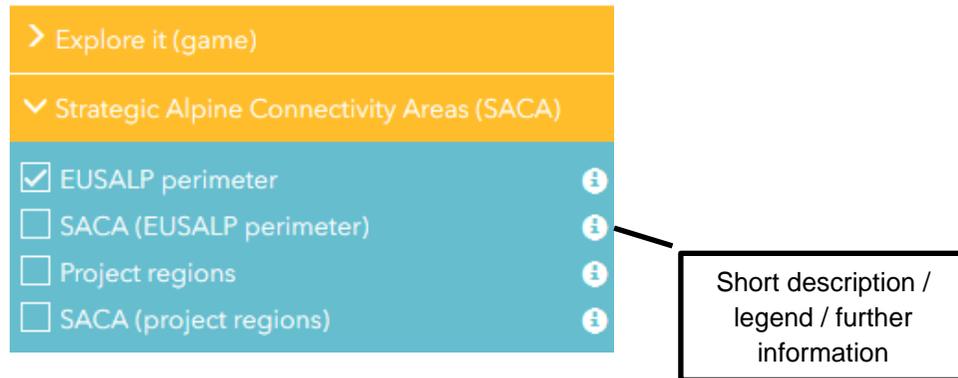


Fig. 8: Menu of the web application.

2. Go to a location you know well (zoom and pan OR search location).
3. Analyse the SACA distribution in the displayed region and compare it to your personal perception of the situation of ecological connectivity.
  - 📌 If you wish to go into more detail, we refer you to the experts' version, where you can explore different aspects of ecological connectivity.
4. Export the current map extent with the displayed layers Fig. 9.

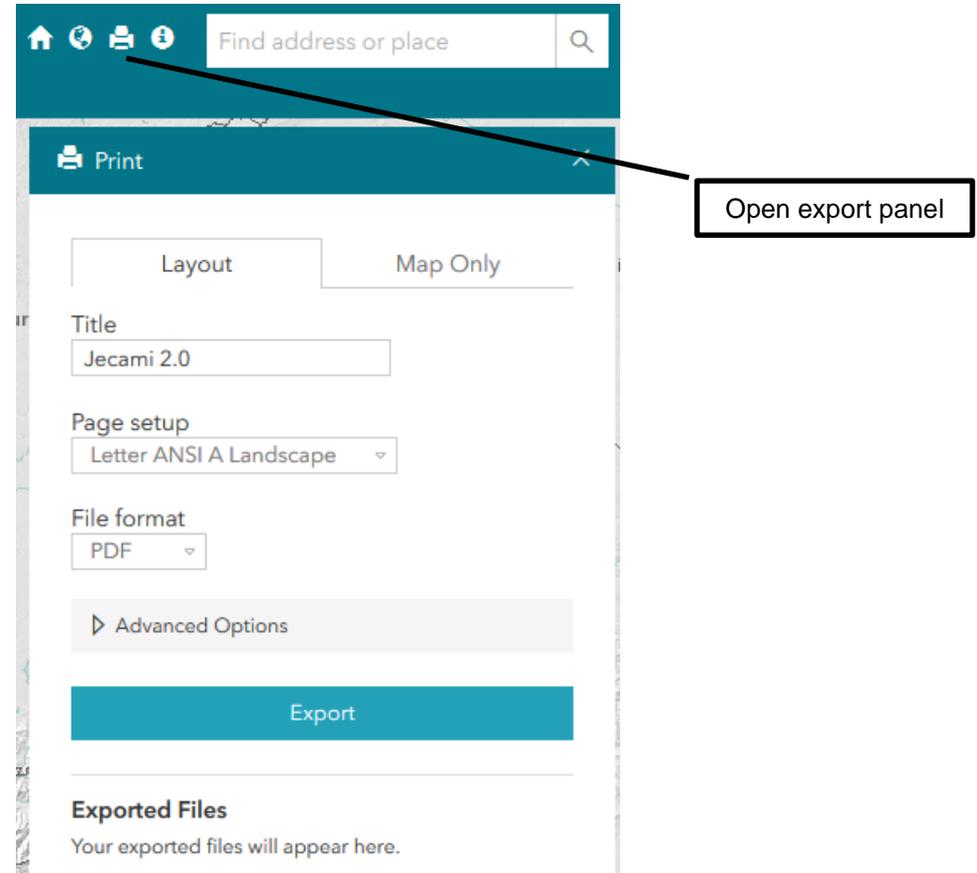


Fig. 9: Export the current map extent.

### B.3 Tutorial for experts

Using a few case examples, the tutorial shows how the application works and how content is structured. Users looking for a comprehensive composition of all functions, datasets and tools are referred to section C.2.

#### B.3.1 CSI analysis

##### B.3.1.1 Overview

In this example, the user is introduced to the basic functionality of JECAMI 2.0 and the ‘CSI analysis’ tool. The continuum suitability indices (CSI) are a set of indicators of factors relevant to ecological connectivity. The landscape is analyzed with regard to the quality of its ecological continuum and classified accordingly. The CSI analysis tool calculates the average of each indicator for a specified area.

##### B.3.1.2 Step-by-step procedure

1. If you have not already done so, read section B.1, in order to familiarize yourself with the general structure of JECAMI 2.0.
2. Open the ‘Continuum Suitability Indices (CSI)’ subsection in the ‘Alpine (EUSALP)’ section. Start the tool ‘CSI analysis’ by clicking on it (Fig. 10).
3. Specify the data extent for the CSI analysis. Click the button ‘Draw extent’ (Fig. 11). It enables you to draw a polygon on the map.
4. Select the ‘Alpine (EUSALP)’ data (Fig. 11).

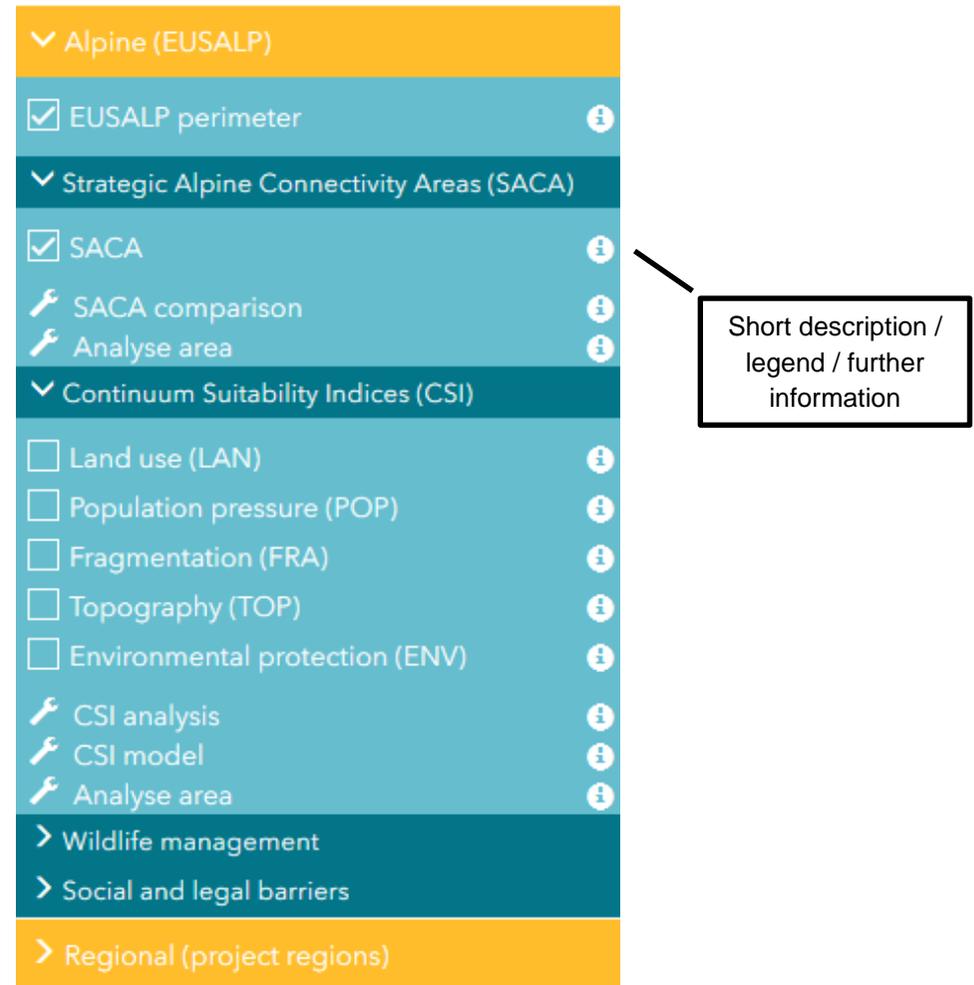


Fig. 10: Menu of the web mapping and analysing application.

5. Start the CSI analysis tool by clicking on the ‘Analyse CSI’ button (Fig. 11). Depending on the area selected this may take some time.

- After completion, a panel showing the CSI analysis result and the current map extent with the area of investigation is displayed. You can export it as a PDF file.

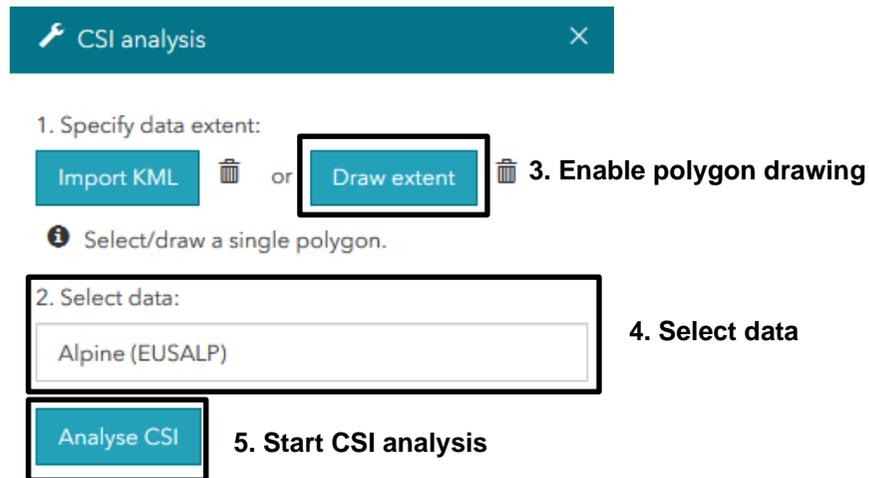


Fig. 11: 'CSI analysis' panel.

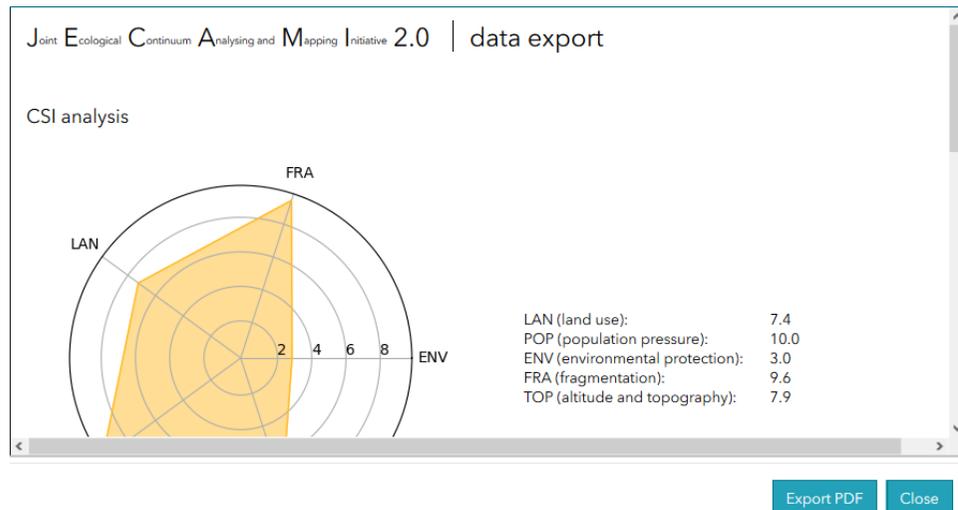


Fig. 12: 'CSI analysis' result.

## B.3.2 CSI model

### B.3.2.1 Overview

In this example, the user is shown functionality of JECAMI 2.0 and is introduced to the 'CSI model' tool. The CSI model tool allows one to calculate the weighted mean of combinations of the different CSI indicators and to display it.

### B.3.2.2 Step-by-step procedure

Upload your own data (optional):

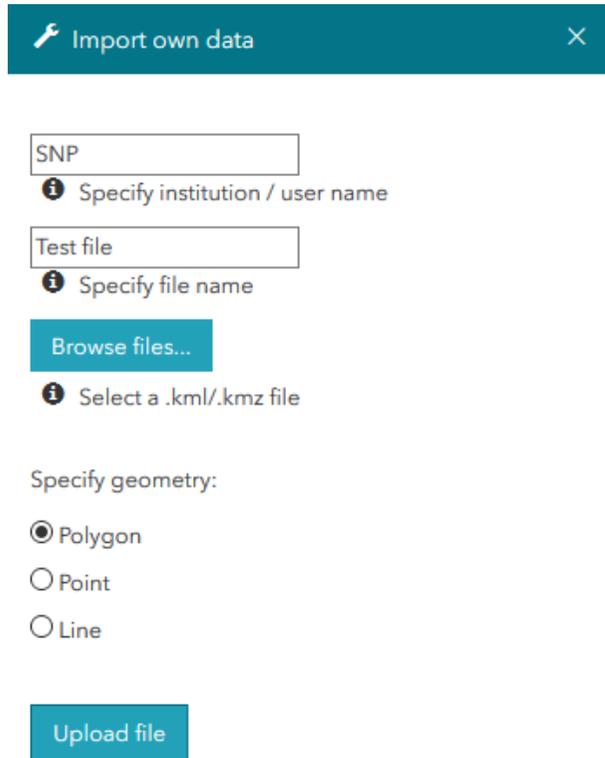
- Convert your data (e.g. hotspots, corridors or species distribution) into a KML file. A maximum file size of 2.5 MB is allowed.
- Start the import panel by clicking on the import button in the header (Fig. 13).



Fig. 13: Header of the web mapping and analysing application. The import button is marked.

- Fill in the required fields in the 'Import own data' panel (Fig. 14), browse files and specify the geometry of the data. If your file contains several geometries, only the selected one will be used. Click the 'Upload file' button. Depending on the file size, this may take some time.
- After completion of the upload, a panel is displayed where you can choose the attribute field to be used for classification (Fig. 15).

5. The data is then displayed on the map (Fig. 16). You can access the attributes of individual features by clicking on them. The layer is also listed in the 'My documents' section of the menu (Fig. 16). You can toggle the visibility of your layer. By clicking on the settings sign (⚙️), you can access the section where you can delete your layer, change its opacity or access the legend.



The 'Import own data' panel is a teal-colored window with a close button (X) in the top right corner. It contains the following elements:

- A text input field containing 'SNP' with an information icon (i) and the text 'Specify institution / user name' below it.
- A text input field containing 'Test file' with an information icon (i) and the text 'Specify file name' below it.
- A teal button labeled 'Browse files...' with an information icon (i) and the text 'Select a .kml/.kmz file' below it.
- A section titled 'Specify geometry:' with three radio button options: 'Polygon' (selected), 'Point', and 'Line'.
- A teal button labeled 'Upload file' at the bottom.

Fig. 14: 'Import own data' panel.



This dialog box is a teal-colored window with a close button (X) in the top right corner. It contains:

- An information icon (i) and the text 'Select field to display'.
- A text input field containing 'OBJECTID'.
- A teal button labeled 'Ok' at the bottom.

Fig. 15: Select attribute field to be used for classification.

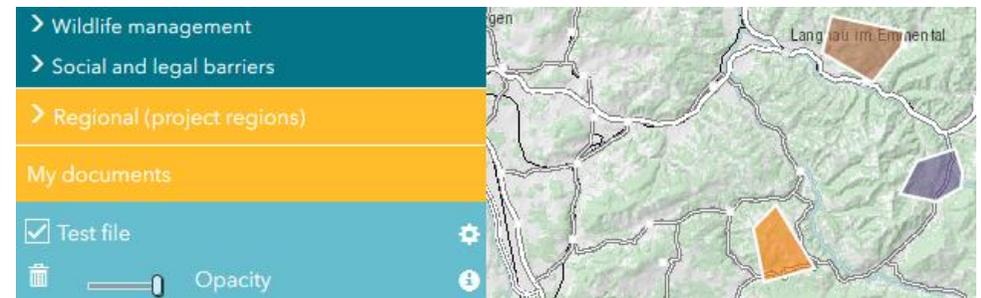


Fig. 16: Example of KML data import.

#### CSI model tool

- Open the 'Continuum Suitability Indices (CSI)' subsection in the 'Alpine (EUSALP)' section. Start the tool 'CSI model' by clicking on it (Fig. 10).
- Choose a combination of indicators you are interested in and then click the 'Calculate CSI' button (Fig. 17). The CSI model will be displayed on the map (Fig. 18).
- You can now export your result. Click on the export button (🖨️) in the header in order to access the print panel. The print function exports the current map in various formats with many options to choose from.

🔧 CSI model
✕

Please select the weight of the different indicators:

0 ——— 1 ——— 2      Land use (LAN)

0 ——— 1 ——— 2      Population pressure (POP)

0 ——— 1      Environmental protection (ENV)

0 ——— 1      Fragmentation (FRA)

0 ——— 1      Altitude and topography (TOP)

Calculate CSI

Fig. 17: 'CSI model' panel.



Fig. 18: Example of a 'CSI model' result. The lines are test layers representing data uploaded by the user.

## C Reference manual

### C.1 Ecology beyond borders (explore it!)

#### C.1.1 Layers

The following layers are included:

- **EUSALP Perimeter:** Perimeter of the macroregional strategy for the Alpine area
- **Project regions:** Perimeter for in-depth analyses and investigations as well as for case-studies.
- **SACA:** Strategic Alpine connectivity areas:
  - **SACA 1:** ecological conservation areas
  - **SACA 2:** ecological intervention areas
  - **SACA 3:** connectivity restoration areas

#### C.1.2 Games

##### C.1.2.1 Love story

The game 'Love story' addresses dispersal difficulties of specific species. Using the examples of roe deer, brown hares and wildcats, you discover various barriers between populations. In the game, you help individual animals to find a partner. Select the game in the menu in order to start and follow the instructions. Good luck!

##### C.1.2.2 Site identification

The game 'Site identification' deals with the fragmentation of suitable landscape. On the basis of three examples, you are asked to find a location where large areas in particular can be connected

ecologically. Select the game in the menu in order to start and follow the instructions. Good luck!

## C.2 Ecological connectivity for experts

### C.2.1 Layers

#### C.2.1.1 Alpine (EUSALP perimeter)

The following layers are included:

- **EUSALP Perimeter:** Perimeter of the macroregional strategy for the Alpine area
- **CSI:** Continuum suitability indices
  - **Environmental protection (ENV):** Measure of ecological integrity. Protected areas are classified based on their legal protection status. The classification ranges from 0 (no protection) to 10 (strict conservation status; no economic use).
  - **Fragmentation (FRA):** Representation of the influence of landscape fragmentation on ecological connectivity. Fragmentation is expressed as the effective mesh density<sup>1</sup>.
  - **Land use (LAN):** Classification of land use categories according to their influence on ecological connectivity and based on principles of sustainability.
  - **Population pressure (POP):** Classification of human pressure on ecological connectivity. It is expressed as

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<sup>1</sup> effective mesh density = effective number of meshes (or unfragmented landscape patches) per 1000 km<sup>2</sup>

- a combination of permanent inhabitants and tourism demand.
- **Topography (TOP):** Representation of ecological networks at lower altitude and the topographic influence on dispersal axes. Altitude and slope are classified from 0 to 10 and combined within the topography indicator.
- **SACA:** Strategic Alpine connectivity areas:
  - **SACA 1:** Ecological conservation areas where ecological connectivity already works quite well (CSI ≥ 8). Ecological connectivity should be conserved in these areas.
  - **SACA 2:** Ecological intervention areas that represent important links between SACA1 areas (ecological conservation areas). Connectivity is currently working to some extent but would benefit from enhancements. In these areas, improvement / restoration measurements are needed.
  - **SACA 3:** Connectivity restoration areas represent important barriers between SACA1 areas (ecological conservation areas).
- **Wildlife management**
  - **No hunting (by hunters):** Areas in the EUSALP perimeter where hunting is either explicitly banned, is under protection related to wildlife management needs, or where hunting is paused/discontinued.

- **Species distribution:** chamois, alpine ibex, red deer, roe deer, wild boar
- **Hunting seasons** data reduced to day of year in the EUSALP perimeter of black grouse, brown hare, capercaillie, chamois, alpine ibex, red deer, roe deer and wild boar.
- **Number of hunting days:** Aggregated hunting seasons data of black grouse, brown hare, capercaillie, chamois, alpine ibex, red deer, roe deer and wild boar.
- **Human-wildlife interactions:** results of student surveys and workshops in project regions.

#### C.2.1.2 Regional (project working regions)

The following layers are included:

- **Infrastructure (INF):** Classification of the influence of infrastructure elements (e.g. wind power stations) on ecological connectivity.

The following layers are included for either the Alpine (EUSALP perimeter) or Regions (project working regions) spaces: ENV, FRA, LAN, POP, TOP, SACA 1, SACA 2 and SACA 3.

### C.2.2 Tools

#### C.2.2.1 Analyse area

The 'Analyse area' tool allows the user to compare up to three administrative units with regard to the following aspects:

- Continuum suitability indices - CSI
- Strategic Alpine connectivity areas - SACA

- Wildlife management

#### C.2.2.2 CSI analysis

The 'CSI analysis' tool calculates the average of the individual continuum suitability indicators within a given area. The Alpine analysis contains the indicators LAN, POP, ENV, TOP and FRA. The regional analysis additionally includes the indicator INF.

Start the tool by selecting it in the menu. A panel opens where you can choose to define the extent either by drawing on the map or by uploading a .KML file. In a second step, you can choose whether the analysis should be conducted with the Alpine or the regional dataset. The results are displayed in a window and can be exported as a .PDF file.

#### C.2.2.3 CSI model

Depending on your inquiry, different combinations of the individual CSI indicators may be needed. The 'CSI model' tool allows you to calculate the weighted mean of several continuum suitability indicators.

Start the tool by selecting it in the menu. A panel opens where you can change the weight of the individual indicators by moving them with the pointer. When you have chosen the desired combination, you can click on the 'Calculate CSI' button in order to get the result.

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