

SEEMLA

Sustainable exploitation of biomass for bioenergy from marginal lands in Europe

SEEMLA Project Grant Agreement no. 691874

Improved web-based application – Final version

11th December 2018

I. About the SEEMLA project

The aim of the Horizon 2020-funded “Sustainable exploitation of biomass for bioenergy from marginal lands in Europe” (SEEMLA) project is the reliable and sustainable exploitation of biomass from marginal lands (MagL), which are used neither for food nor feed production and are not posing an environmental threat. The project will focus on three main objectives: (i) the promotion of re-conversion of MagLs for the production of bioenergy through the direct involvement of farmers and forester, (ii) the strengthening of local small scale supply chains, and (iii) the promotion of plantations of bioenergy plants on MagLs. The expected impacts are: Increasing the production of bioenergy, farmers’ incomes, investments in new technologies and the design of new policy measures. FNR will coordinate the project with its eight partners from Ukraine, Greece, Italy and others from Germany.

Project coordinator

Agency for Renewable Resources

Fachagentur Nachwachsende Rohstoffe e.V.

FNR

Germany

Project partners

Salix Energy Ltd.

SALIX

Ukraine

Institute for Bioenergy Crops & Sugar Beet
of the National Academy of Agricultural Science

IBC&SB

Ukraine

Legambiente

LEGABT

Italy

Democritus University of Thrace

DUTH

Greece

Decentralised Administration of Macedonia and Thrace

DAMT

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BTU CS

Germany

Institut für Energie- und Umweltforschung
Heidelberg GmbH

IFEU

Germany

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II. About this document

This report corresponds to D6.7 Improved web-based application for MagL suitability assessment – Final version. It has been prepared by:

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RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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1.0	2018-11-29	Elias Dimitriadis, Nikolaos Gounaris, Despoina Vlachaki	Request for input from partners	finalised
2.0	2018-12-11	Spyridon Galatsidas, Nikolaos Gounaris	Integration of input - Final version	finalised

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III. Background

The databases and the SEEMLA GIS algorithm have been incorporated into a web-based application, which works as a logical pathway to help possible stakeholders identify marginal lands and assess their suitability for bioenergy production. The results of the GIS application have been transferred to Google Maps®, allowing the presentation of marginal land types across Europe on a familiar interface to the average user. Moreover, the web-based application incorporates an SQR calculator which enables any interested party to make its own informed assessment.

DUTH is leading this task. All partners are asked to review and apply proposals, as well as test the (developed) tools and to give feedback to the WP leader to refine the application in this deliverable (D6.7).

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SEEMLA Web-based application

Available at:

<http://seemla.eu/wa>

The web-based application was developed to support the identification of marginal land by calculating the SQR index for specific points. It allows the user to fill in the value for each indicator necessary for the calculation of the SQR index and receive the corresponding result, with high accuracy.

Moreover, the web application includes a map window which allows the user to refer to the maps produced by the SEEMLA GIS tool to retrieve useful information about the overall allocation of marginal land in Europe. It is noted however that the resolution of the maps is 0.5 sq. km, which does not allow for accurate estimations at a local level. The purpose of the map is to outline the areas in Europe where marginal lands are located, while on the other hand the SQR calculator can provide point specific measurements that allow marginality assessment to take place

The web-based application includes the following sections:

1. Home page

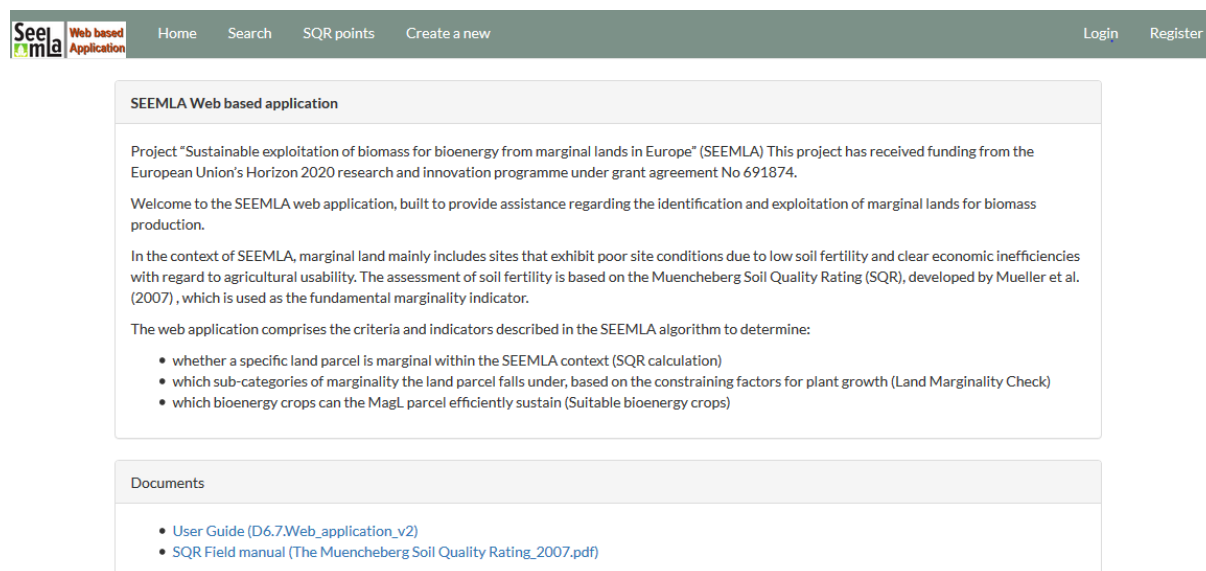
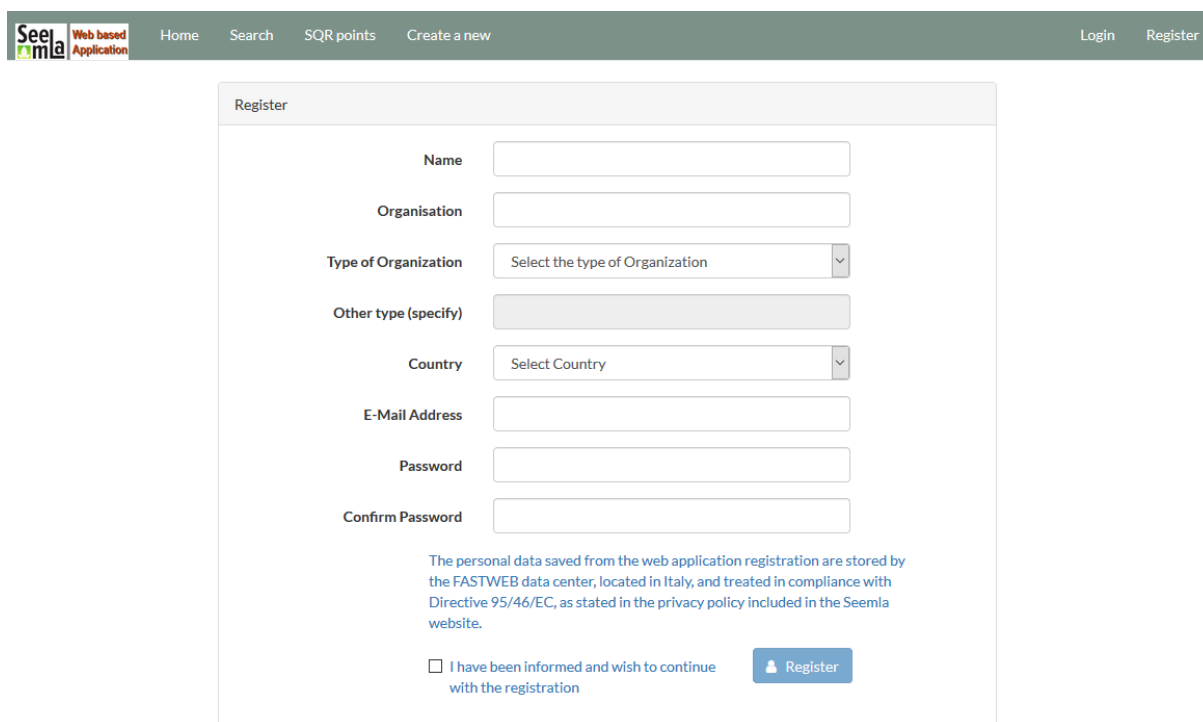


Figure 1. Home page (<http://www.seemla.eu/wa/>)

The home page gives a short presentation of the web-based application of the SEEMLA project. At this point, the user may also download two relevant documents that deal with the present web-based application. These are (a) the present user's guide and (b) a Field Manual on The Muencheberg Soil Quality Rating (SQR) available at http://www.zalf.de/de/forschung_lehre/publikationen/Documents/Publikation_Mueller_L/field_mueller.pdf.

2. Register page

In order to use the web application, a registration is required so that user data history may be created and saved. Registration is only required for first time users. This functionality is available by clicking the top right **Register** button from the Home page (Figure 2). In order to complete the registration, the user must enter his/ her name, email and password and click on the **Register** button. By registering for the web – application the users consent to the storage and handling of their personal data in compliance with Directive 95/46/EC, as stated in the privacy policy included in the Seemla website. This message is displayed on the registration page and is followed by a consent form (checkbox) that the user has to acknowledge in order to proceed with the registration process. The **Register** button is only activated after the check box has been filled in.



The screenshot shows the 'Register' page of the Seemla Web based Application. The page has a navigation bar at the top with links: Home, Search, SQR points, Create a new, Login, and Register. The main content area is titled 'Register' and contains the following fields:

- Name: Text input field
- Organisation: Text input field
- Type of Organization: Dropdown menu with the text 'Select the type of Organization'
- Other type (specify): Text input field
- Country: Dropdown menu with the text 'Select Country'
- E-Mail Address: Text input field
- Password: Text input field
- Confirm Password: Text input field

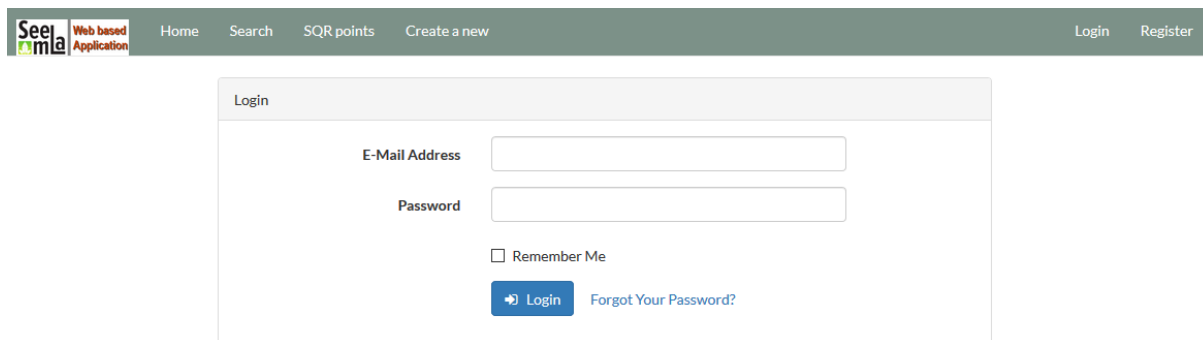
Below the input fields, there is a paragraph of text: 'The personal data saved from the web application registration are stored by the FASTWEB data center, located in Italy, and treated in compliance with Directive 95/46/EC, as stated in the privacy policy included in the Seemla website.'

At the bottom, there is a checkbox labeled 'I have been informed and wish to continue with the registration' and a blue 'Register' button with a user icon.

Figure 2. Register page (<http://www.seemla.eu/wa/register>)

3. Login page

If the user is already registered, he/ she may click on the **Login** button to enter the web application. After that, the login page opens and the e-mail and password that were stated during the registration must be filled before clicking on the **Login** button (Figure 3).

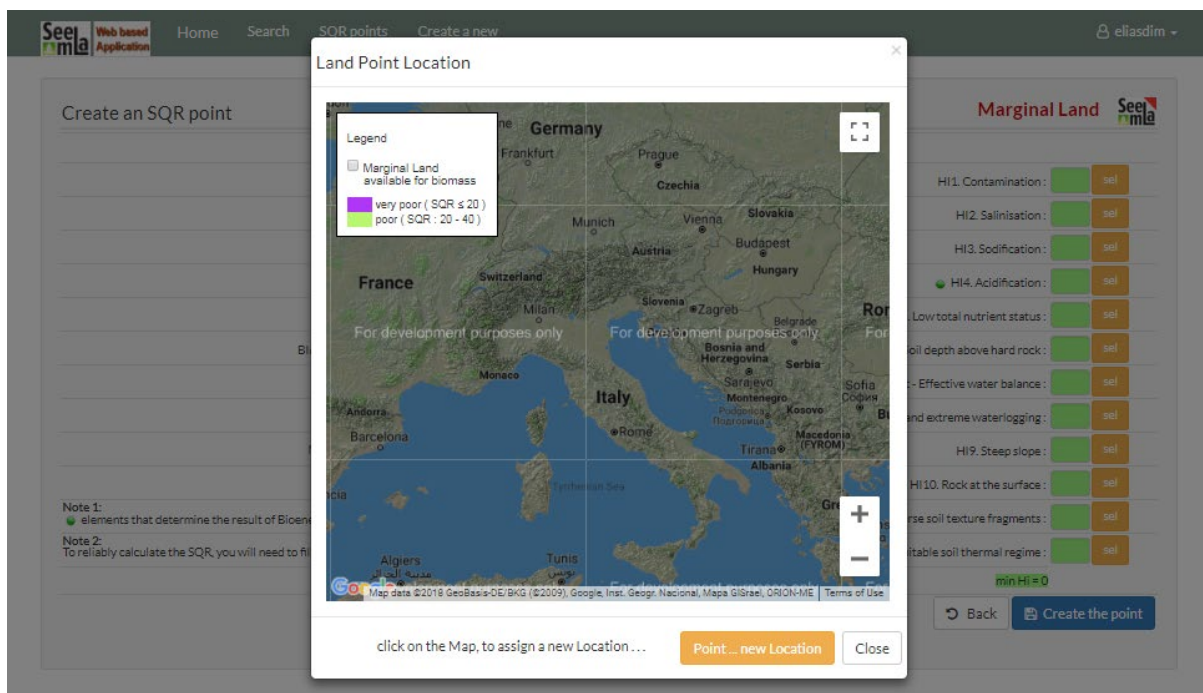


The screenshot shows the login page of the Seemla web application. At the top, there is a navigation bar with the Seemla logo, 'Web based Application', and links for Home, Search, SQR points, Create a new, Login, and Register. The main content area is titled 'Login' and contains a form with two input fields: 'E-Mail Address' and 'Password'. Below these fields is a checkbox labeled 'Remember Me'. At the bottom of the form are two buttons: a blue 'Login' button and a link 'Forgot Your Password?'.

Figure 3. Login page (<http://www.seemla.eu/wa/login>)

4. 'Create a new point' page

The user may create a new point through this page, by clicking the **Create a new** button. This button opens a new page where the user may select (optionally) a point location on the map (Figure 4).



The screenshot shows the 'Create a new point' page in the Seemla web application. The page has a dark grey background. On the left, there is a sidebar with the text 'Create an SQR point' and some notes. The main area features a map of Europe with a legend indicating 'Marginal Land available for biomass' in three categories: 'very poor (SQR ≤ 20)' in purple, 'poor (SQR : 20 - 40)' in green, and 'good (SQR > 40)' in yellow. A modal window titled 'Land Point Location' is open over the map, showing a zoomed-in view of the map with a legend and a 'Point ... new Location' button. On the right side of the page, there is a list of indicators with corresponding 'sel' buttons, including HI1. Contamination, HI2. Salinisation, HI3. Sodification, HI4. Acidification, Low total nutrient status, Soil depth above hard rock, Effective water balance, and Extreme waterlogging. At the bottom right, there are 'Back' and 'Create the point' buttons.

Figure 4. 'Create a new point' page (<http://www.seemla.eu/wa/parcels/create>)

After the creation of a point, the user must provide the values of the basic soil indicators and the respective hazard indicators related to the created point, for which the SQR index will be calculated (Figure 5).

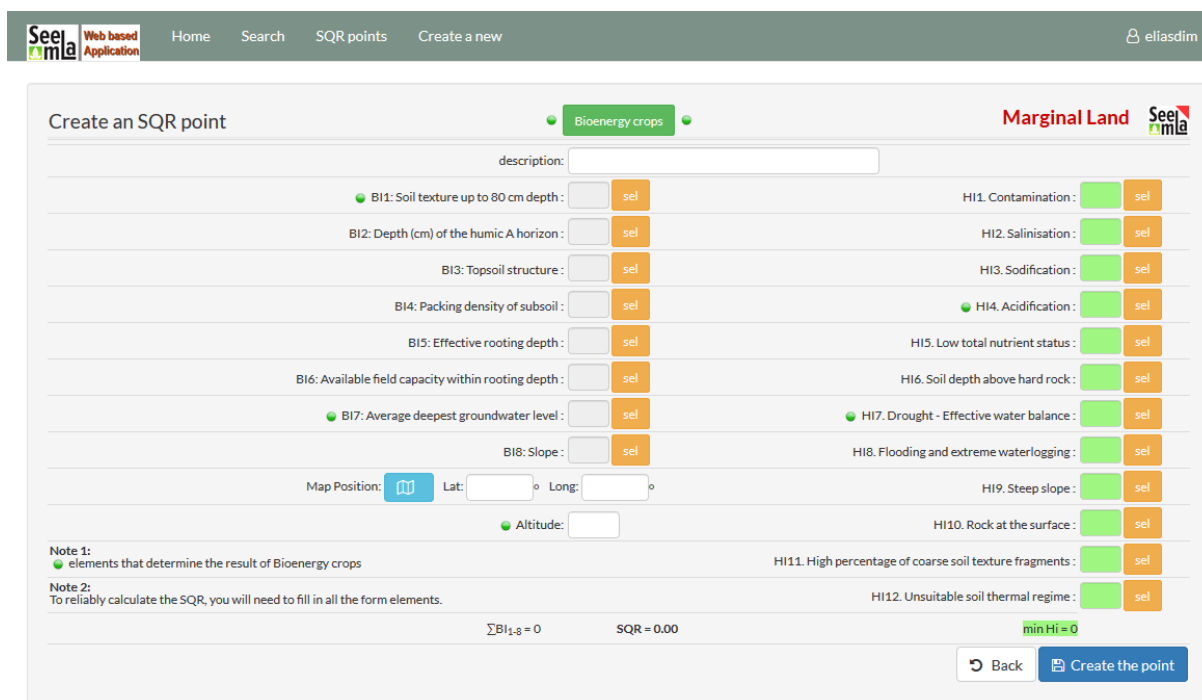

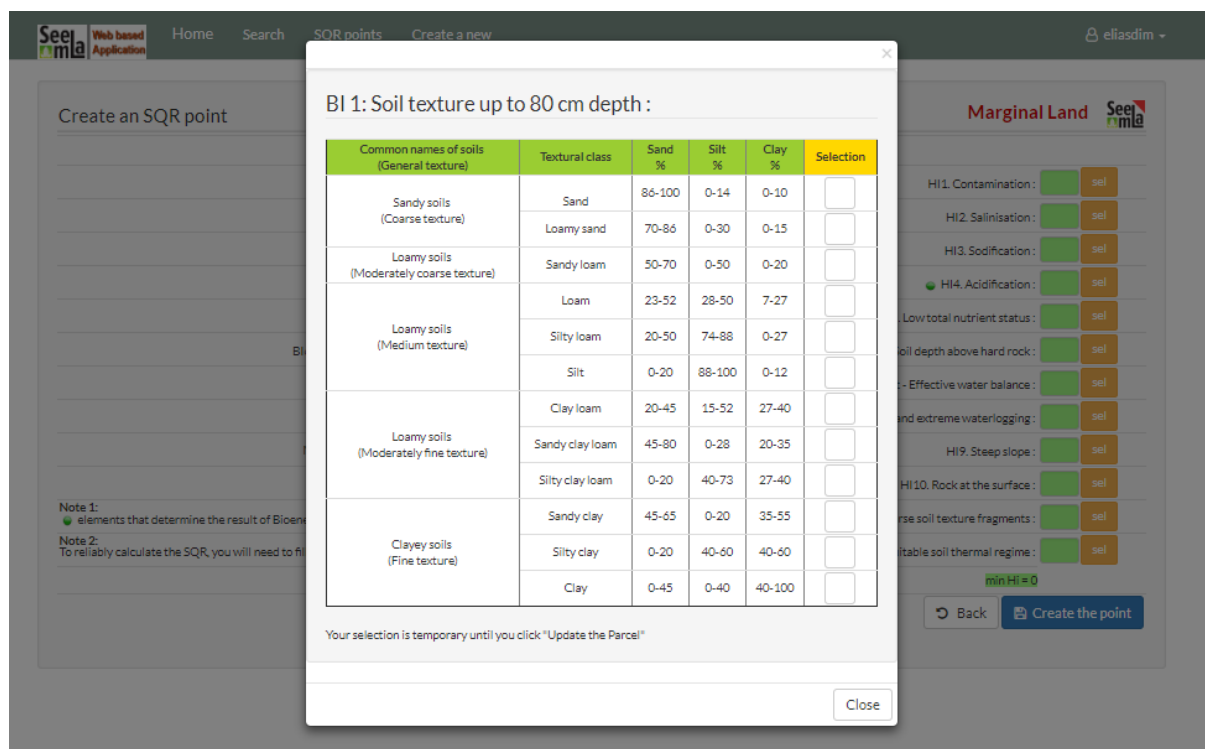


Figure 5. ‘Create a new point’ page (<http://www.seemla.eu/wa/parcels/create>)

The user must fill in the value for each indicator by clicking on the  button (Figure 5), which opens the scoring table (example in Figure 6) according to the Muencheberg Soil Quality Rating (SQR) Field Manual¹. A detailed description on how to calculate the value of each indicator is given in deliverable D6.6, as well as in Mueller et al. 2007.

Each basic indicator can receive values between 0 (very poor) to 2 (excellent). For hazard indicators these values range from 0 (very poor) to 3 (excellent). Therefore, the highest values point to better soil quality. These values are filled in the table shown in Figure 5 only after the user has selected the category the point falls under for each indicator (Figure 6). In order to receive reliable results, values for all indicators must be filled in.



BI 1: Soil texture up to 80 cm depth :

Common names of soils (General texture)	Textural class	Sand %	Silt %	Clay %	Selection
Sandy soils (Coarse texture)	Sand	86-100	0-14	0-10	<input type="checkbox"/>
	Loamy sand	70-86	0-30	0-15	<input type="checkbox"/>
Loamy soils (Moderately coarse texture)	Sandy loam	50-70	0-50	0-20	<input type="checkbox"/>
	Loam	23-52	28-50	7-27	<input type="checkbox"/>
Loamy soils (Medium texture)	Silty loam	20-50	74-88	0-27	<input type="checkbox"/>
	Silt	0-20	88-100	0-12	<input type="checkbox"/>
	Clay loam	20-45	15-52	27-40	<input type="checkbox"/>
Loamy soils (Moderately fine texture)	Sandy clay loam	45-80	0-28	20-35	<input type="checkbox"/>
	Silty clay loam	0-20	40-73	27-40	<input type="checkbox"/>
	Sandy clay	45-65	0-20	35-55	<input type="checkbox"/>
Clayey soils (Fine texture)	Silty clay	0-20	40-60	40-60	<input type="checkbox"/>
	Clay	0-45	0-40	40-100	<input type="checkbox"/>

Your selection is temporary until you click "Update the Parcel"

Close

Figure 6. Scoring table for Basic indicator 1.

The SQR index is then calculated near the middle-bottom of the page, after the data has been updated (button on the bottom right), while on the top right of the page the user may find the label **Marginal Land** or **not Marginal Land**, depending on the result of the calculated SQR index.

Also, the weighted sum of basic indicators (S-Bi) and minimum Hazard Indicator multiplier (minHi) is provided on this page. This information indicates the marginality factors of the land, either very poor soil quality (S-Bi <10) or the effect of a hazard indicator, which is highlighted in green (values below 1). A detailed description on the calculation process is given in deliverable D6.6, as well as in Mueller et al. (2007).

Note also that green bullets (on the left of five indicators) mark the factors used to determine which Bioenergy Crops are suitable for each marginal land. Soil texture (BI1), average deepest groundwater level (BI7), acidification (HI4), drought risk (HI7), as well as altitude, are all taken into account.

The user may also modify the data of the SQR point in this page e.g. edit, save or delete.

5. SQR points page

In this page, the user can view all SQR points one has created, with the calculated SQR and the values of the Basic Indicators (Figure 7). The user can also view maps of marginal lands in Europe that were created by the SEEMLA project through google maps. Marginal lands

were identified according to the Muencheberg Soil Quality Rating (SQR) Field Manual (Mueller et al. 2007). Three datasets are included in the web application, corresponding to the final deliverables of the SEEMLA GIS application:

- marginal lands in two SQR categories: very poor (SQR 0 – 20) & poor (SQR 20 - 40),
- marginal lands available for biomass production in two SQR categories: very poor (SQR 0 – 20) & poor (SQR 20 - 40), and
- minimum values of Hazard Indicators that define land marginality (values < 1).

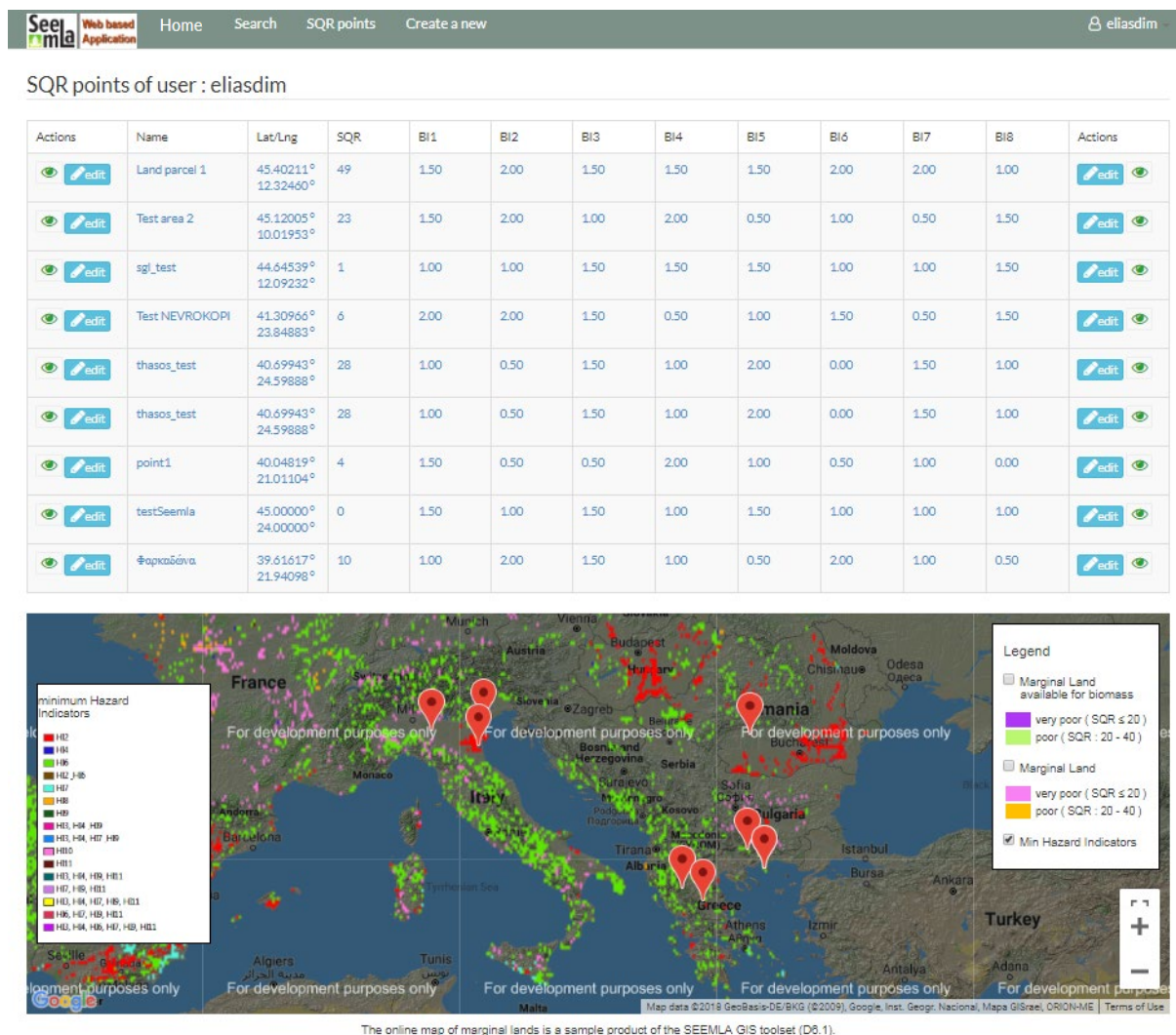
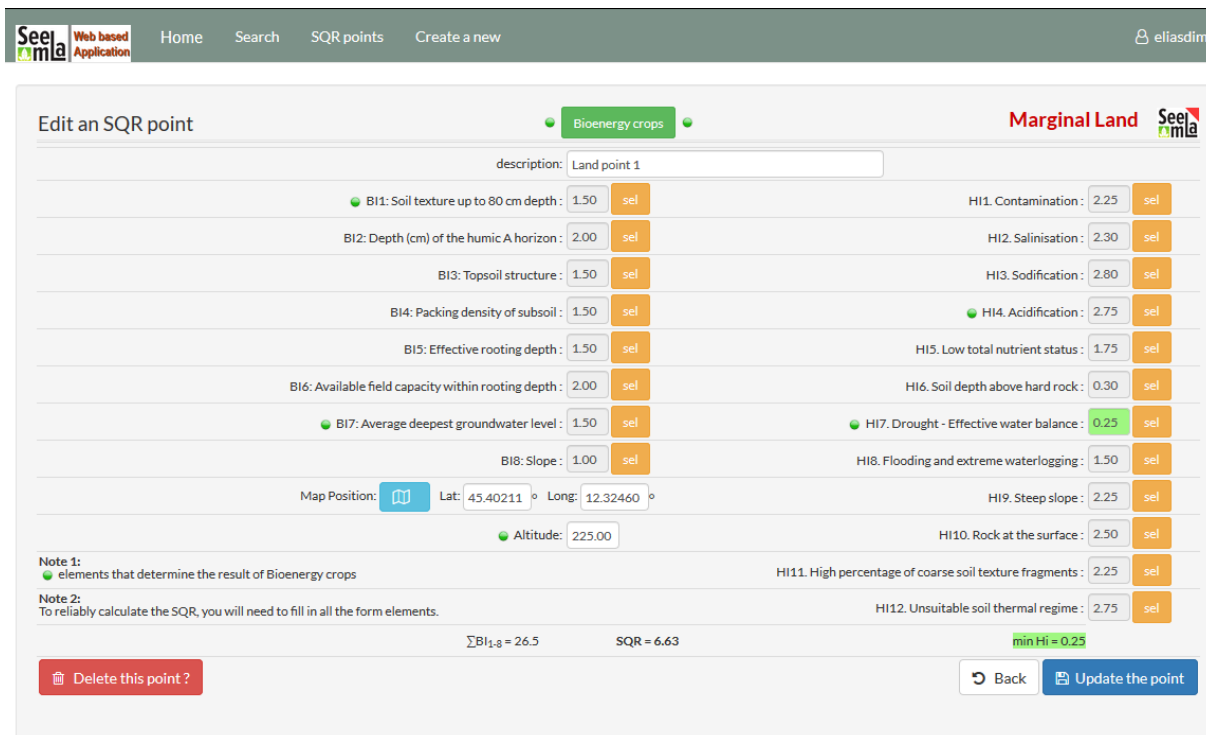


Figure 7. SQR points page (<http://www.seemla.eu/wa/parcels>)

On the SQR page the user also has the option to select an SQR point and edit its data by clicking on the button (Figure 8).



Edit an SQR point

description: Land point 1

Bioenergy crops

Marginal Land

BI1: Soil texture up to 80 cm depth: 1.50 sel

BI2: Depth (cm) of the humic A horizon: 2.00 sel

BI3: Topsoil structure: 1.50 sel

BI4: Packing density of subsoil: 1.50 sel

BI5: Effective rooting depth: 1.50 sel

BI6: Available field capacity within rooting depth: 2.00 sel

BI7: Average deepest groundwater level: 1.50 sel

BI8: Slope: 1.00 sel

HI1: Contamination: 2.25 sel

HI2: Salinisation: 2.30 sel

HI3: Sodification: 2.80 sel

HI4: Acidification: 2.75 sel

HI5: Low total nutrient status: 1.75 sel

HI6: Soil depth above hard rock: 0.30 sel

HI7: Drought - Effective water balance: 0.25 sel

HI8: Flooding and extreme waterlogging: 1.50 sel

HI9: Steep slope: 2.25 sel

HI10: Rock at the surface: 2.50 sel

HI11: High percentage of coarse soil texture fragments: 2.25 sel

HI12: Unsuitable soil thermal regime: 2.75 sel

Map Position: Lat: 45.40211 Long: 12.32460

Altitude: 225.00

Note 1: elements that determine the result of Bioenergy crops

Note 2: To reliably calculate the SQR, you will need to fill in all the form elements.

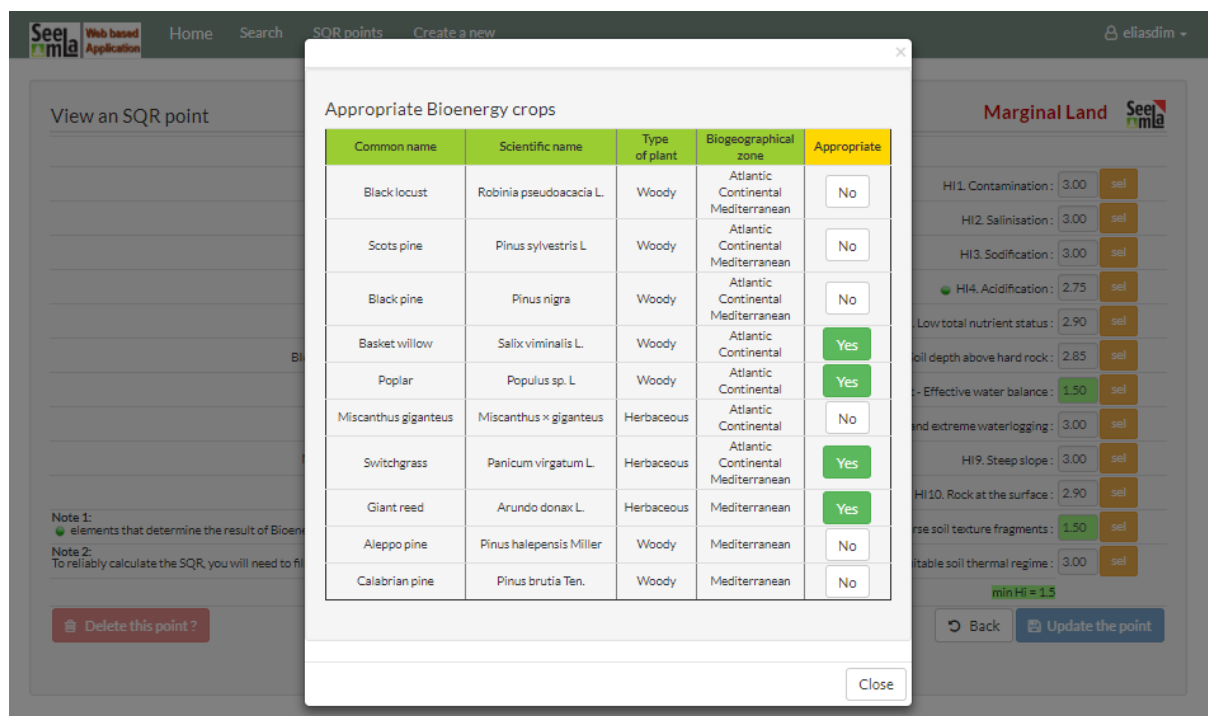
$\sum BI_{1-8} = 26.5$ SQR = 6.63 min Hi = 0.25

Delete this point? Back Update the point

Figure 8. SQR edit points page (<http://www.seemla.eu/wa/parcels/1/edit>)

Once the user starts an editing process, the SQR index, the weighted sum of basic indicators ($\sum BI$) and minimum Hazard Indicator multiplier (minHi) will be automatically recalculated (at the bottom of the page), as these are updated with every new data entry or every modification of any data that were already entered in the application.

Furthermore, after the SQR point is identified as MagL, the user may be informed about the suitable crops for this specific SQR point. By clicking on the **Bioenergy crops** button a table opens that presents the appropriate bioenergy crops for the land parcel that is examined (Figure 9).



The screenshot shows the Seemla web application interface. A modal window titled 'Appropriate Bioenergy crops' is open, displaying a table with the following data:

Common name	Scientific name	Type of plant	Biogeographical zone	Appropriate
Black locust	<i>Robinia pseudoacacia</i> L.	Woody	Atlantic Continental Mediterranean	No
Scots pine	<i>Pinus sylvestris</i> L.	Woody	Atlantic Continental Mediterranean	No
Black pine	<i>Pinus nigra</i>	Woody	Atlantic Continental Mediterranean	No
Basket willow	<i>Salix viminalis</i> L.	Woody	Atlantic Continental	Yes
Poplar	<i>Populus</i> sp. L.	Woody	Atlantic Continental	Yes
Miscanthus giganteus	<i>Miscanthus × giganteus</i>	Herbaceous	Atlantic Continental	No
Switchgrass	<i>Panicum virgatum</i> L.	Herbaceous	Atlantic Continental Mediterranean	Yes
Giant reed	<i>Arundo donax</i> L.	Herbaceous	Mediterranean	Yes
Aleppo pine	<i>Pinus halepensis</i> Miller	Woody	Mediterranean	No
Calabrian pine	<i>Pinus brutia</i> Ten.	Woody	Mediterranean	No

The background shows the 'View an SQR point' page with various input fields and a 'Marginal Land' section on the right.

Figure 9. Suitable Bioenergy crop table

6. Search page

On the search page (<http://www.seemla.eu/wa/parcels/search>), the user may search any registered SQR point either by name or by SQR points by clicking then on the **Execute** button (Figure 10).

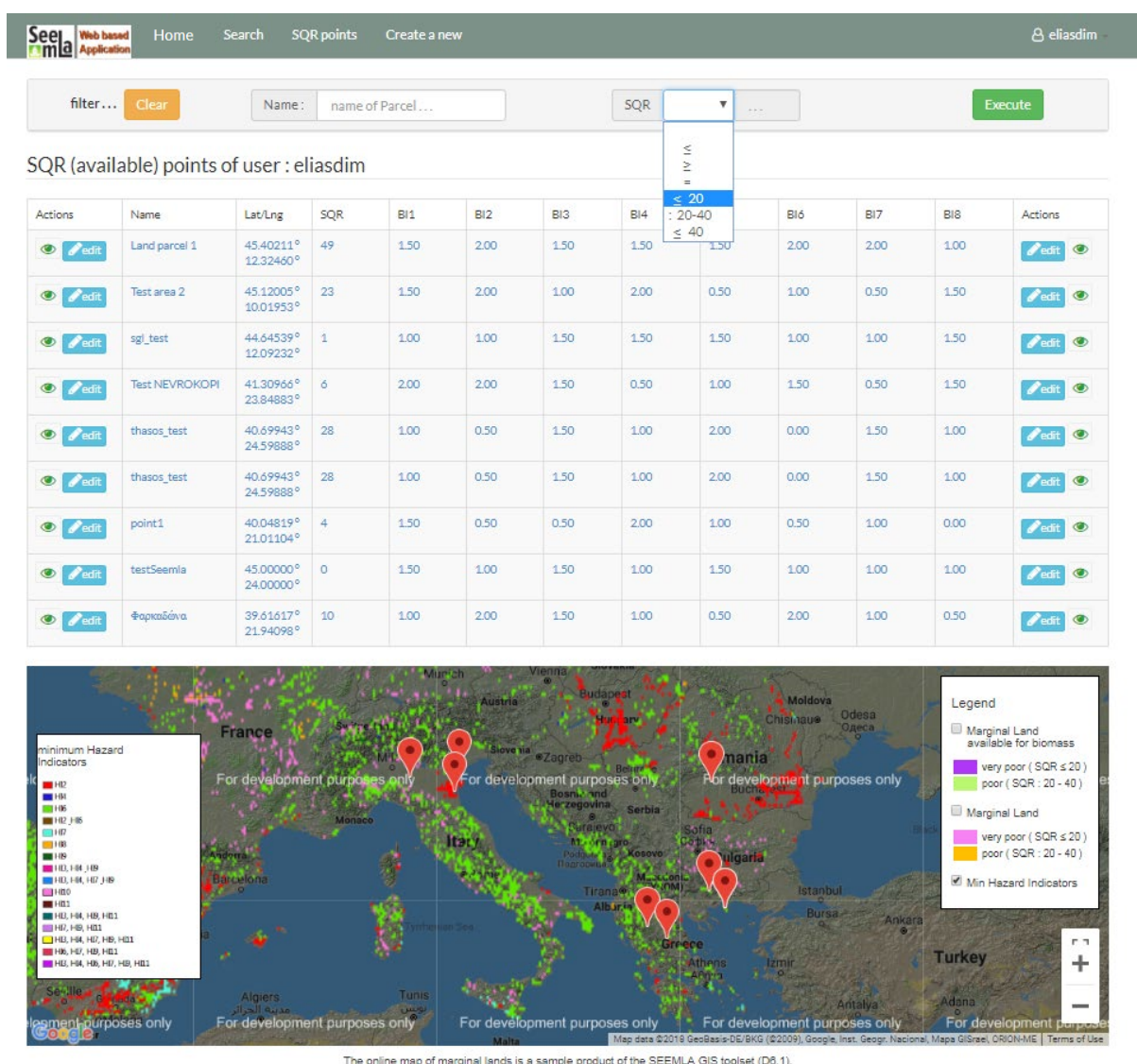


Figure 10. Search page (<http://www.seemla.eu/wa/parcels/search>)

7. Summary/ Outlook

The SEEMLA web application provides a conceptual overview of marginal lands in Europe, featuring the maps developed by the SEEMLA GIS application. The information illustrated includes the spatial allocation of marginal lands, their availability for biomass production as well as the main constraining factors for cropping, expressed through the hazard indicators of the Muencheberg Soil Quality Rating (SQR). Moreover, the web application incorporates an SQR calculator which provides accurate, point specific marginality assessment. Depending on the constraining factors for plant growth specific bioenergy crops are proposed or excluded.

The web application can be further developed in the future by incorporating aspects outside the scope of the SEEMLA project. Information about additional bioenergy crops and potential yield data for different feedstocks are some examples of such advancements. Furthermore, additional maps can be developed and incorporated in the web application, to illustrate data relating to other aspects of marginal lands, e.g. to the potential for biomass production for bioenergy.