RECHARGE.GREEN PROJECT ACTIVITIES IN PILOT AREAS – TESTING AND IMPLEMENTATION

(WP6 lead partner report)

Authors: Jessica Balest, Giorgio Curetti, Giulia Garegnani, Gianluca Grilli, Julie Gros, Valentina D'Alonzo(EURACresearch, Bozen); Alessandro Paletto CRA-MPF, Trento); Marco Ciolli and Francesco Geri (University of Trento); Clemens Geitner, Richard Hastik (University of Innsbruk); Sylvain Leduc (IIASA, Vienna); Simone Bertin, Francesca Miotello, Erica Zangrando (VenetoRegion, Venice); Davide Pettenella, Alessia Portaccio (University of Padua); Alenka Petrinjak (Triglav National Park); Rok Pisek (Slovenia Forest Service), Aleš Poljanec (Slovenia Forest Service and Department for forestry and renewable forest resources at the biotechnical faculty of UL); Tomaž Kralj and Borut Vrščaj (Agricultural Institute of Slovenia)

Document editing: Alenka Petrinjak (TNP)

Project partners: Research Institute of Wildlife Ecology (FIWI) of the University of Veterinary Medicine Vienna, lead partner; Agricultural Institute of Slovenia; Agroscope –Swiss research into agriculture, nutrition and the environment; Bavarian electric power company (BEW); Department for forestry and renewable forest resources, University of Ljubljana; Environment Agency Austria; Institute for Geography, University of Innsbruck; European Academy of Bozen/Bolzano (EURAC); International Commission for the Protection of the Alps; International Institute for Applied Systems Analysis (IIASA); Mountain Institute; Regional Development Vorarlberg; Slovenia Forest Service; Triglav National Park; Agricultural institute of Slovenia (AIS); Veneto Region/Office for Economics and the Development of Mountain Areas

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Content

1. THE AIM OF RECHARGE.GREEN PROJECT ACTIVITY – TESTING AND IMPLEMENTATION

In the recharge.green project the work package (WP) 6 was dedicated to test the instruments and models that were developed during the recharge.green project in differently structured pilot areas and for different renewable energy (RE) sources. Six pilot areas chose different RE according to the availability of the source (Table 1).

Table 1:

PILOT AREA	COUNTRY	RENEWABLE ENREGY SOURCE
Triglav National Park	Slovenia	forest biomass
Piemont (PNAM)	Italy	forest biomass and hydropower
Regione Veneto (Mis and Maè valley)	Italy	forest biomass and hydropower
Bavaria	Germany	hydropower
Vorarlberg	Austria	forest biomass, hydropower, solar, wind
Megève, Valloire, Belledonne later National Park Vercors	France	hydropower

2. ASSESSMENT OF AVAILABLE RENEWABLE ENERY SOURCES AND FUTURE SCENARIOS IN PILOT AREAS

Within recharge.green project researchers made tools for assessing available renewable energy source and tools to produce future scenarios for selected RE in the Alps and in the pilot areas. Scenarios are a valuable tool for researchers and policymakers to come to optimal solutions. In this chapter we present activities and results for the pilot areas.

2.1. Triglav National Park (TNP) pilot area

Triglav National Park (TNP) is the only national park and the largest protected area in Slovenia. It covers an area of almost 84.000 hectares or nearly 4 % of Slovenia. It is divided into three protection zones. The park's landscape is characterized by glacier-shaped valleys, mountain plateaus and steep mountain ridges above the tree line. It is a typical mixture between unspoiled nature areas and cultural landscape.

Almost 60 % of the park is covered by forest. In the first protection zone no commercial use of forests is allowed whereas in the second and third zones sustainable forest activities are possible.

Triglav National Park pilot area (Photo: Aleš Zdešar, TNP archive)

2.1.1. Assessment of available forest biomass and future scenarios for forest biomass use in the Triglav National Park

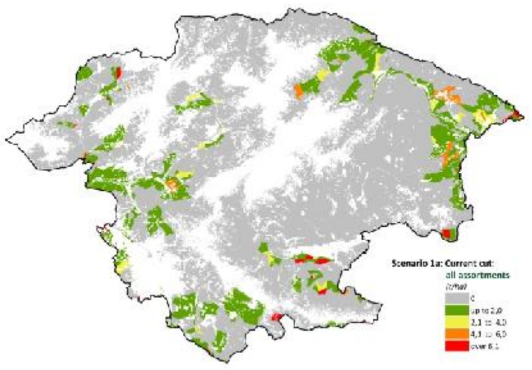
The most important RE source in TNP is forest biomass. Almost 60 % of the park is covered by forest and most of the forests are highly productive. It was used in the past as technical wood and source for the ironworks. Today wood cutting is mostly for technical wood and source of energy for private households. The demands for forest biomass as energy source are growing.

We used WISDOM tool to evaluate possible biomass use in the study area. The WISDOM is a planning tool that allows users to integrate data from various sources and to conduct multiscale spatial analysis (Masera et al., 2006) (see also chapter 5.6). For modelling purposes we build three hypothetical scenarios:

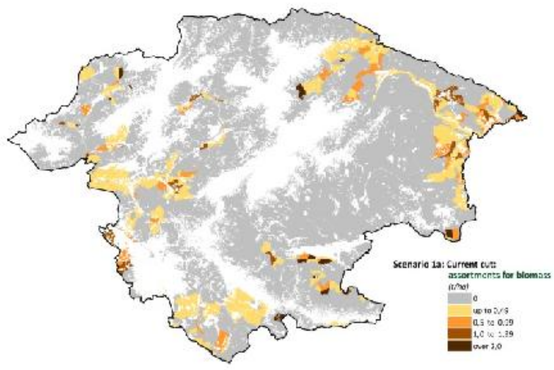
- Scenario S1 (business as usual), where current (S1a) and planned (S1b) cut was considered;
- Scenario S2 (nature protection scenario), where we hypothesized no felling in the core protection zone, felling in the secondary protection zone only where the naturalness of forests is highly changed and felling in the tertiary protection zone only where the forests are changed or highly changed;
- Scenario S3 (biomass production scenario) where we assumed that in tertiary, secondary and core protection zone 100%, 70%, and 30% of increment is cut, respectively.

The energy demands in TNP are relatively small. The Park is low populated with 21 settlements and 2,444 inhabitants (Šolar, 2015) and no bigger energy consumer such us industry. According to three scenarios the results of forest biomass supply modelling show that current demands for woody biomass energy within the Park are relatively small (2.940 t/year) and they could be entirely covered under any of the scenarios. If we consider also demands for energy from bordering towns and cities, which are highly related to land use in the park, the estimated demands are much higher (19,940 t/year), but could still be covered with planed cut in the management plans (S1b; 30,290 t/year) and within increased use of forest (scenario 3; 40,859 t/year). The current cut (S1a; 9,932 t/year) and nature conservation scenario (Scenario 2; 15,365 t/year) covered more than 75 % of energy needs.

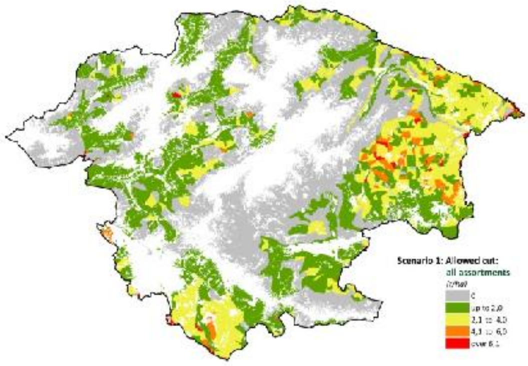
Assessed potential is high (high productive forests, increasing forest stock) and it represents opportunities for income for the forest owners. On the other hand oversized exploitation might represent a threat for biodiversity and sustainable use of forests (Poljanec & Pisek, 2013).



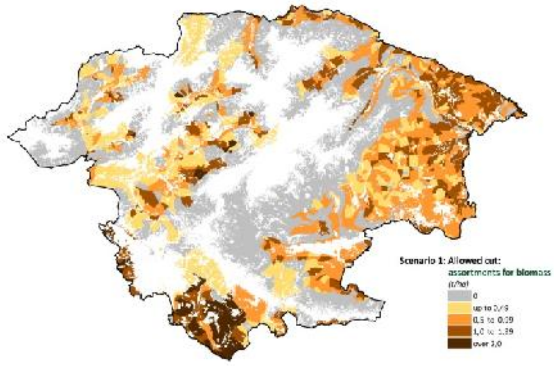
S1a: Current cut – all assortments



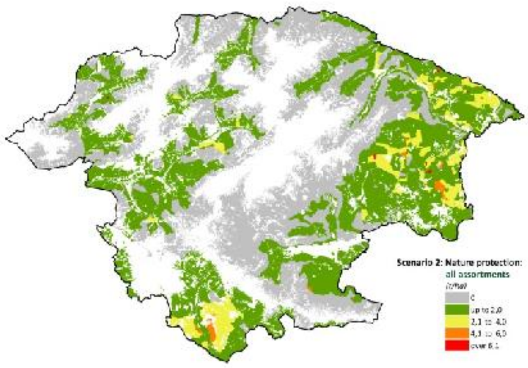
S1a: Current cut – wood for biomass



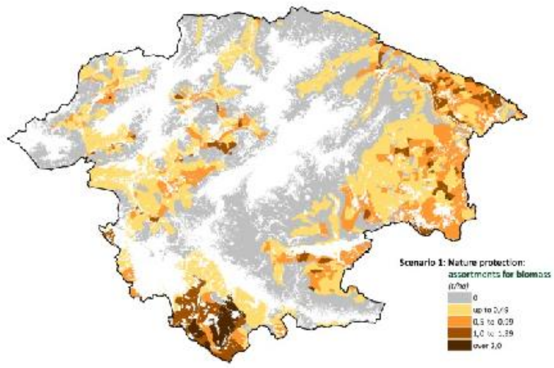
S1b: Allowed cut – all assortments



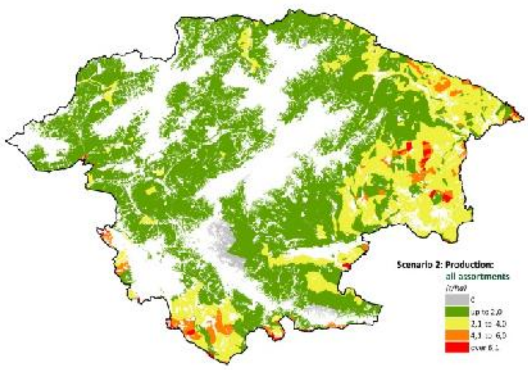
S1b: Allowed cut – wood for biomass



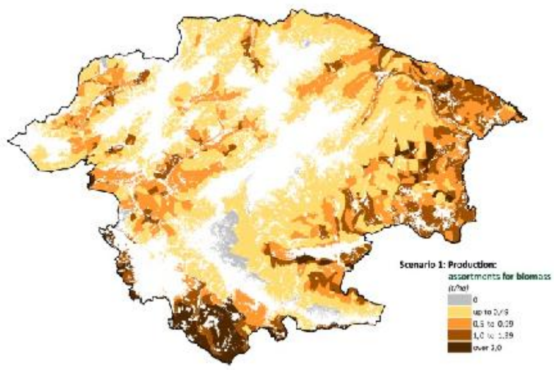
S2: Protection scenario – all assortments



S2: Protection scenario – wood for biomass



S3: Production scenario – all assortments



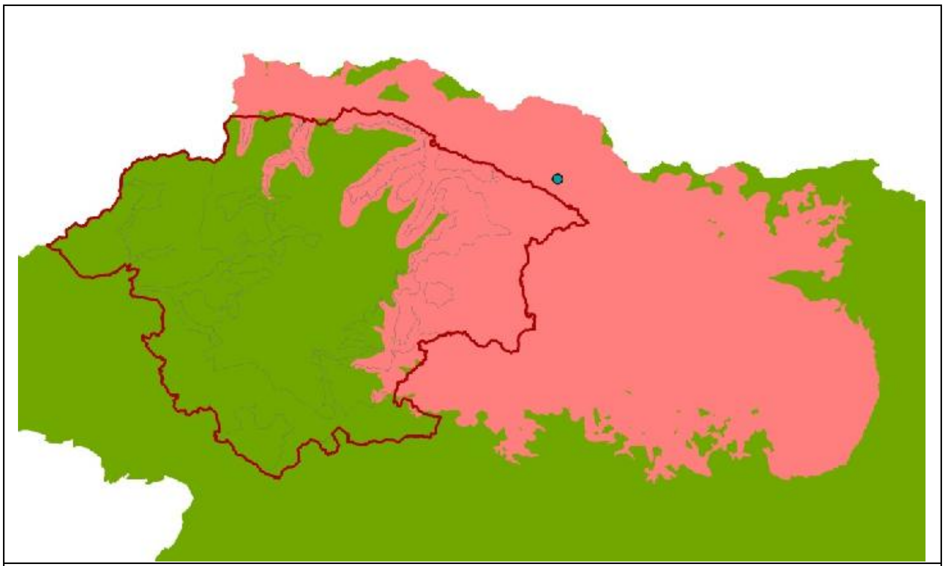
S3: Production scenario – wood for biomass

Figure 1: Scenarios of potential of wood production in TNP (SFS data 2012)

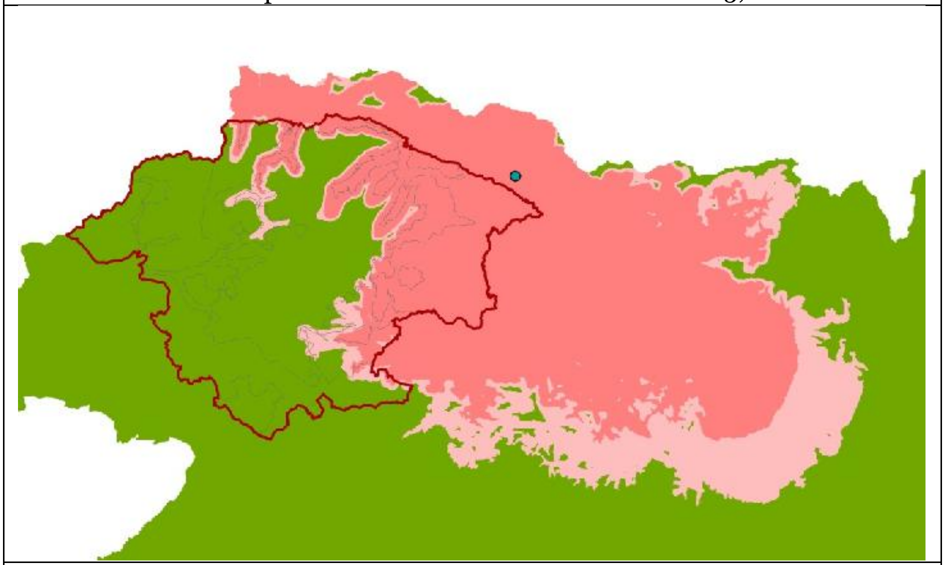
For comparison EURAC used r.green biomassfor tool to produce future scenarios for biomass use in TNP.

2.1.2. Assessment of additional biomass demands at local level in the Triglav National Park

We also make assessment of additional biomass demand at local level (e.g. new biomass plant). The results show that increased demands could be covered by biomass from much broader region (Fig. 2). Alternatively, increased demands for biomass could be covered by increased production in the nearby area, which could cause conflicts with conservation goals of park.



Bilance map 1: Current cut and current demand + 5,000 t



Bilance map 2: Current cut and current demand + 20,000 t

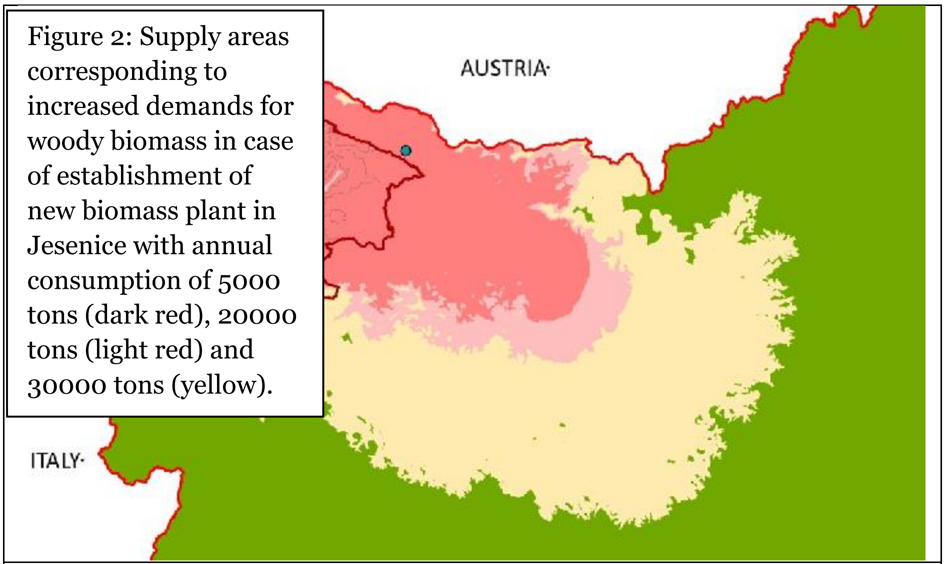


Figure 2: Supply areas corresponding to increased demands for woody biomass in case of establishment of new biomass plant in Jesenice with annual consumption of 5000 tons (dark red), 20000 tons (light red) and 30000 tons (yellow).

Bilance map 3: Current cut and current demand + 30,000 t

Taking into account this analysis we may conclude that fuel wood production, if properly planned and having well-stocked forests, could be in accordance with management objectives of the protected areas. However, significantly increased demands such as for use of residues could have significant negative influence on biodiversity and cause conflict with nature conservation objectives in the park. To reduce risks of biodiversity loss and to avoid contradictory management objectives in the park, careful planning and appropriate forest management system is needed. Close-to nature forestry and cognitive approach with constant monitoring, planning and evaluation of realized measures could be the most appropriate one.

2.1.3. Testing two Decision Support Systems (DSS) for forest biomass in the Triglav National Park

The WISDOM (SFS, UL BF) and r.green biomassfor (EURAC) DSS were compared for forest biomass comparison in Triglav National Park. The study was focused on the comparison between the recent GIS-based DSS model r.green.biomassfor (Zambelli et al. 2012, Sacchelli et al. 2013) and WISDOM approach (Masera et al. 2006). WISDOM technique was chosen due to the extensive application at international level. One main difference between the two approaches regards the possibility offered by r.green.biomassfor to manage the technical exploitation limits and therefore the possibility to exploit area with a different degree of accessibility, as well as the possibility of evaluating such extraction as economically convenient. The results will be presented in scientific paper (Poljanec et al., in preparation).

2.1.4. Assessment of biomass produced on marginal/afforested agricultural areas in the Triglav National Park

Agricultural Institute of Slovenia has been assessing a possibility to produce biomass on agricultural area. The main conclusions are:

- Marginal agricultural areas are economically unattractive for farmers. The most consequence is the overgrowth with forest.
- With transition from agricultural to grew up forest we lost a lot of biodiversity and we got less attractive mountain landscapes. This has crucial influence on tourism attraction and on our perception about landscape and agriculture land.
- With active management of abandoned agricultural areas we can increase income and keep areas in biodiversity rich stage. Active management mean 5-10 years rotation from location to location with bushes cut for biomass supply. Self supply or market.

Key study Gorjuše (TNP):

- From 1954 to 2015 forest increase for 14,8 %. This are potential aeries for - biomass production.

Table 2: Land use change from 1954 to 2015 in Gorjuše region (TNP).

Nr	**Land use**		**Area (ha)**		**Area (%)**	
	ID	name	1954	2015	1954	2015
1	2000	FOREST	413,64	519,8	57,6	72,4
2	1410	OVERGROVING AREAS		4,7		0,7
3	1500	BELTS OF TREES AND BUSHES		8,5		1,2
4	1600	ABANDONED AGRICULTURAL LAND		1,5		0,2
5	1800	MEADOWS WITH TREES		3,4		0,5
		SUM 2-5	63,9	18,1	8,9	2,5
6	1100	FIELDS		2,0		0,3
7	1222	EXTENSIVE ORCHARD		4,0		0,6
8	1300	PERMANENT MEADOW		152,2		21,2
9	3000	URBAN AREA		22,1		3,1
10	6000	BARREN LAND WITH GRASSES		0,1		0,0
11	7000	WATER BODIES		0,1		0,0
		SUM 6-11	240,9	180,5	33,5	25,1

		SUM	718,4	718,4	100,0	100,0

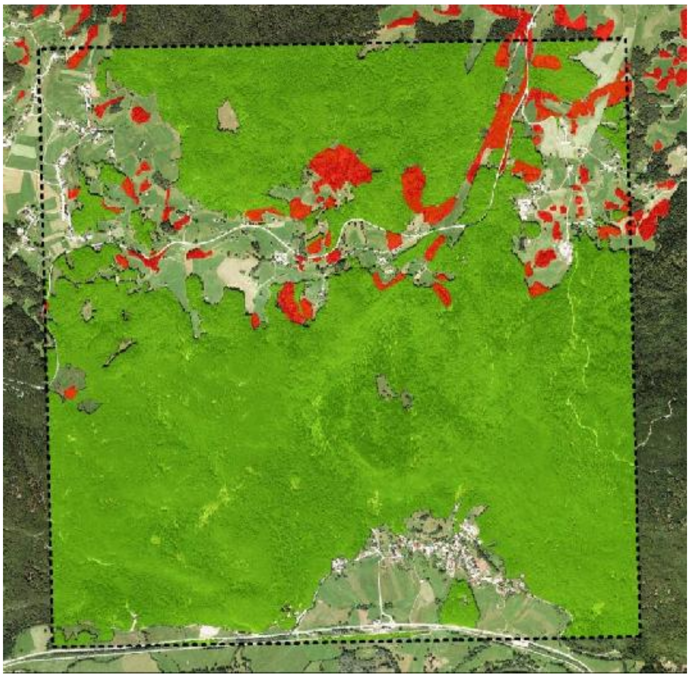


Figure 3: Marginal agricultural areas appropriate for biomass production in Gorjuše (TNP).

2.1.5. Assessment of biodiversity and soil diversity in the Triglav National Park

Using renewable energy source has an effect on the biodiversity and also on soil diversity. Weather the effect is negative or neutral or even positive for a certain species depends on the quantities, time and especially on the way the exploitation of the source is done. A good sustainable long term management plan has to be done to maintain the diversity. But the basis for good management plan are data gathered from the inventarisations. In TNP the data related to biomass exploitation are limited. In the recharge.green project we asked specific group experts to collect data on pedological profiles, macrofungi, coleopteran, chilipoda, woodlice and birds in the managed in nonmanaged forest stands with *Adenostylo glabrae-Piceetum* association. At least seven permanent sample plots in the forest management region Bled were chosen; four of them in the managed forest of the forest management unit Pokljuka (4216, 4406, 4408, 4596), and three nonmanaged plots in the forest management unit Bohinj (3260, 3450, 3640).

ID of permanent sample plots	Location	Altitude (m)
3260	Julian Alps, Lopučnica valley	1435 m
3450	Julian Alps, Pršivec	1600 m
3640	Julian Alps, 400 m SW from pasture Vodični vrh	1450 m
4216	Pokljuka, above pasture Krasca	1450 m
4406	Pokljuka, Rudna dolina	1320 m
4408	Pokljuka, Medvedova konta	1395 m
4596	Pokljuka, Krnica	1265 m

The data are presented in the scientific paper of TNP called *Acta triglavensia* (Menegalija, T., 2015) with abstracts and summaries in English. An important result of this project activity are also common guidelines and recommendations for the management and use of forest biomass in the national park (Pirnat & Piltaver, 2015).
http://issuu.com/tnp-publikacije/docs/acta_3_2015

http://www.tnp.si/images/uploads/Acta_3_2015.pdf

2.2 Piedmont (PNAM) pilot area

The Gesso and Vermenagna valleys are located in the North-West of Italy, in Piedmont Region. The two valleys include seven municipalities (Valdieri, Entracque, Roaschia, Roccavione, Robilante, Vernante and Limone Piemonte). The land surface is approximately 51,500 ha. In 2010 the population was about 10,000 inhabitants with a density of 0.194 inhabitant/ha. Maritime Alps Natural Park and Nature 2000 site Maritime Alps are the most important protected areas of the two valleys. The local economy is based mainly on tourism (about 121,000 tourists per year) and secondarily on agriculture and forestry.

2.2.1. Assessment of available forest biomass and future scenarios for forest biomass use in the Piedmont

The availability of fuelwood was estimated using the module r.green.biomassfor, which works on GRASS GIS (free and open source GIS software). R.green.biomassfor is a holistic model which is able to quantify in MW/year the bio-energy potential exploitable from wood biomass in forest ecosystems. It was developed by EURAC in collaboration with the University of Trento as an evolution of the UNITN Biomassfor.

The results on the forest biomass availability took into account legal, technical and economic constrains. The scenario were discussed during participatory meetings involving experts, local stakeholders and citizens. The round table discussion focused on forest biomass energy, local stakeholders underlined their preferences on the development of small plants working in a forest short-chain (Fig 6). Starting from these considerations, maps highlighting local stakeholders' preferences were created (Fig 4, Fig 5). Maps are useful visual tools used to explain with clarity local situation to stakeholders and citizens. Moreover, maps are very good instruments to support decision-makers. In this case, decisions concerning power production from forest biomass have a good support of data based on energy production potential that can cover local heat consumptions.

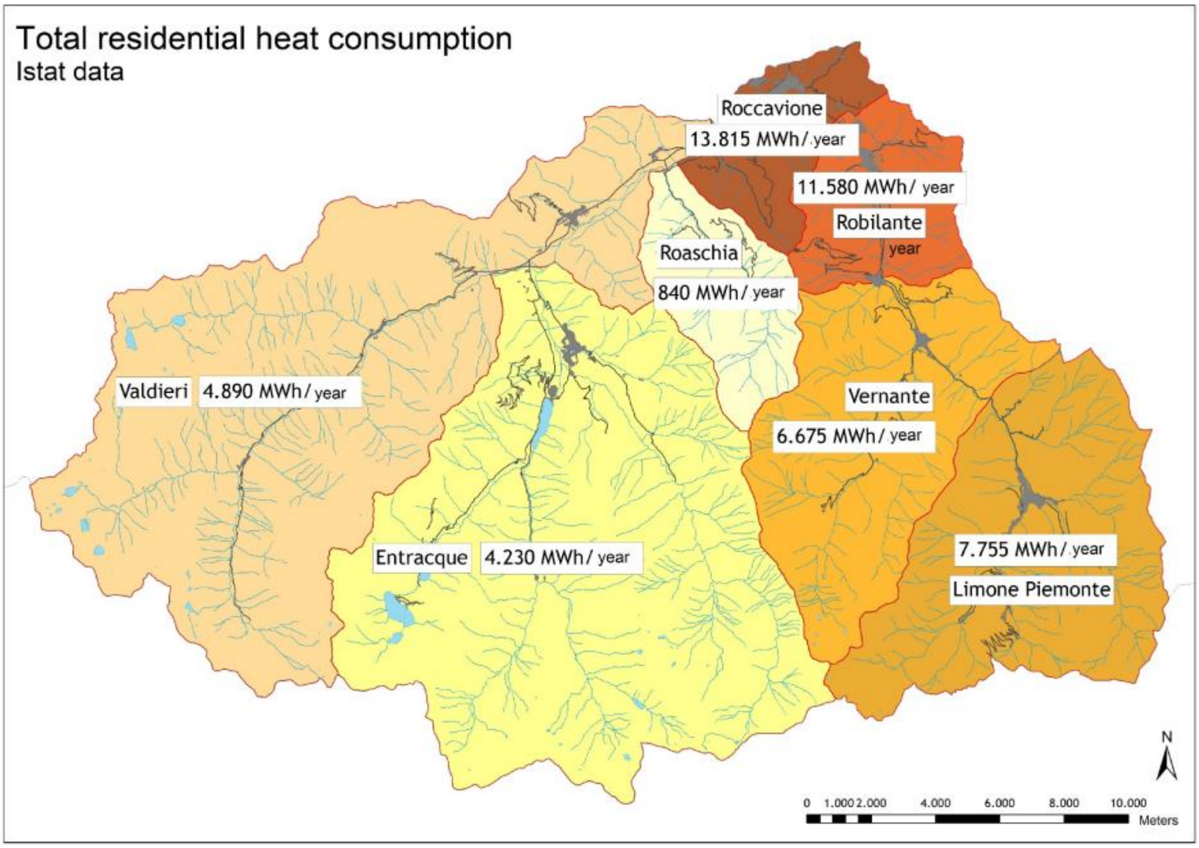


Figure 4: Total residential heat consumption in Gesso and Vermenagna valleys.

As stated before, EURAC created and utilized a Decision Support System (DSS) model and developed future scenarios (with technical, economic and ecological variables). The map below (Fig 5) shows the hypothetic coverage of heat consumption using the biomass available. It corresponds to the economic scenario which is the most complete because it takes into account the theoretical potential adding legal, technical and economic constrains.

In this experimental case the available biomass is used by seven power plants, one for each Municipality. This scenario relates to the availability of biomass and the heat consumption, assuming the construction of seven power plants. The plants' position has been chosen in order to maximize the closeness between the resource (wood biomass) and the energy production site.

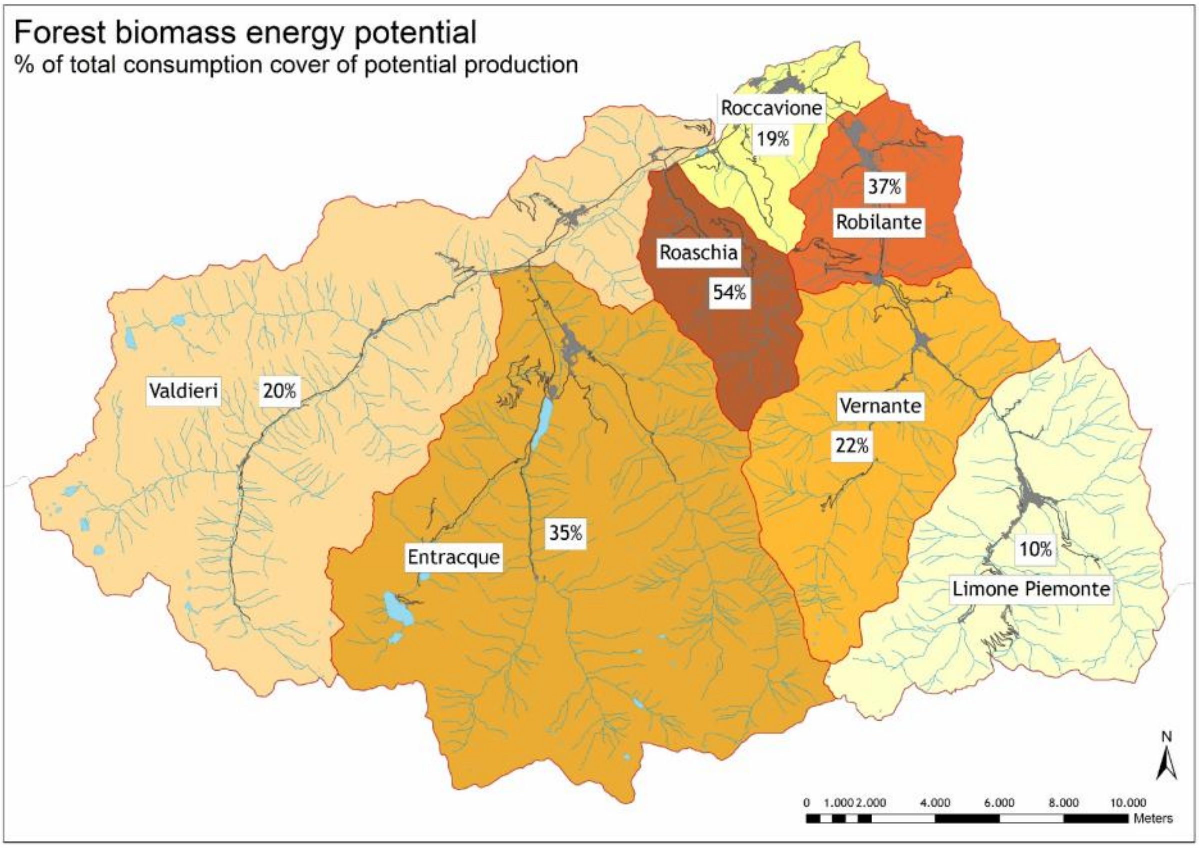


Figure 5: Forest biomass energy potential in Gesso and Vermenagna valleys.

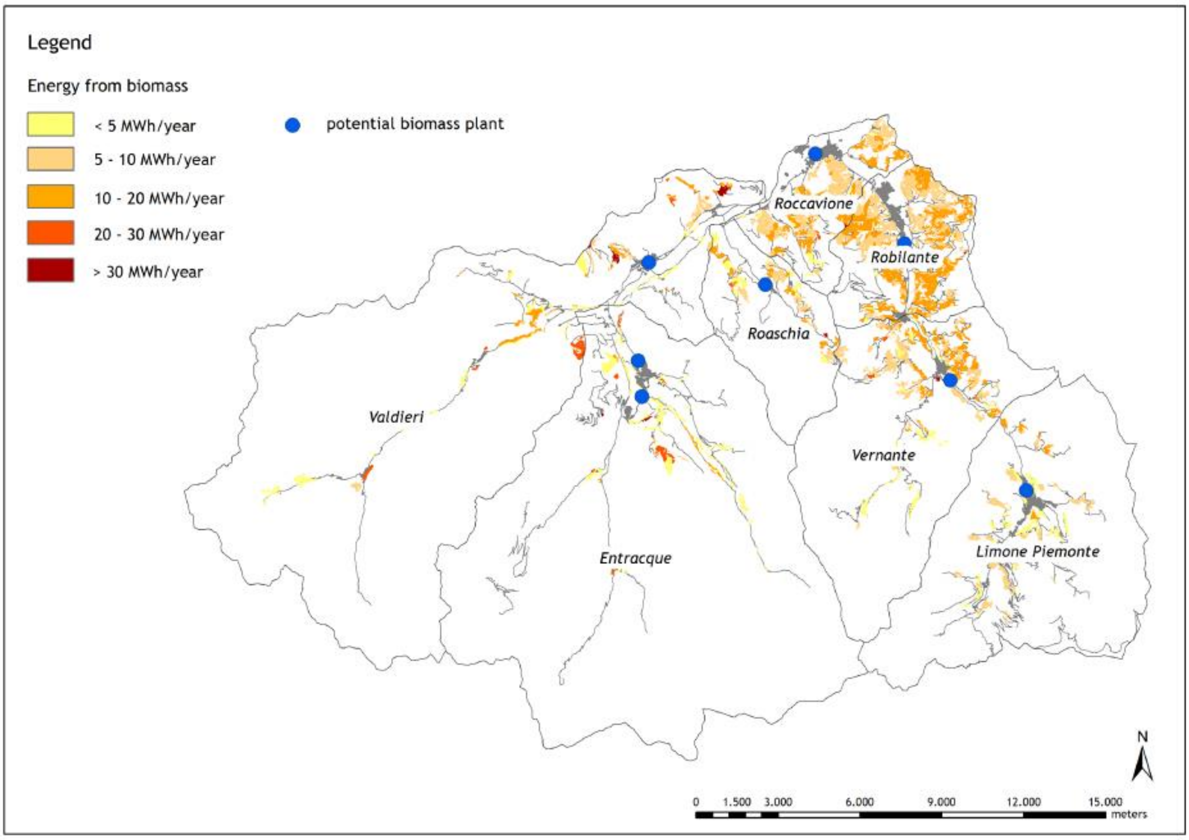


Figure 6: Local stakeholders' preferences about forest biomass energy development in Gesso and Vermenagna valleys.

2.2.2. Assessment of available hydropower and future scenarios for hydropower use in the Piedmont

In Gesso and Vermenagna valleys, hydropower is currently the main used renewable energy. In the area, there are 21 hydropower plants and the total installed power is 1137.37 MW. The most powerful power plants are sited in Entracque (1065 MW) and in Andonno (65 MW) and represent 86 % of the installed power. These big plants were built before the construction of the Natural Park of the Maritime Alps and the Natura 2000 sites.

The power plant in Roccavione (1420 kW) is also significant. Moreover, in Robilante there is an intake that diverts water for a hydroelectric plant sited in Borgo San Dalmazzo, outside the boundaries of the study area. During the project, EURAC calculated the residual theoretical energy potential of the rivers.

Starting from the r.green.hydro.theoretical module, EURAC considered the maximum energy that can be produced in the case of run-off plants. The theoretical potential is quite high in the two valleys, as shown in the following map (Fig 7) (segments' classification from very high potential -in dark brown- to very low potential -in yellow-).

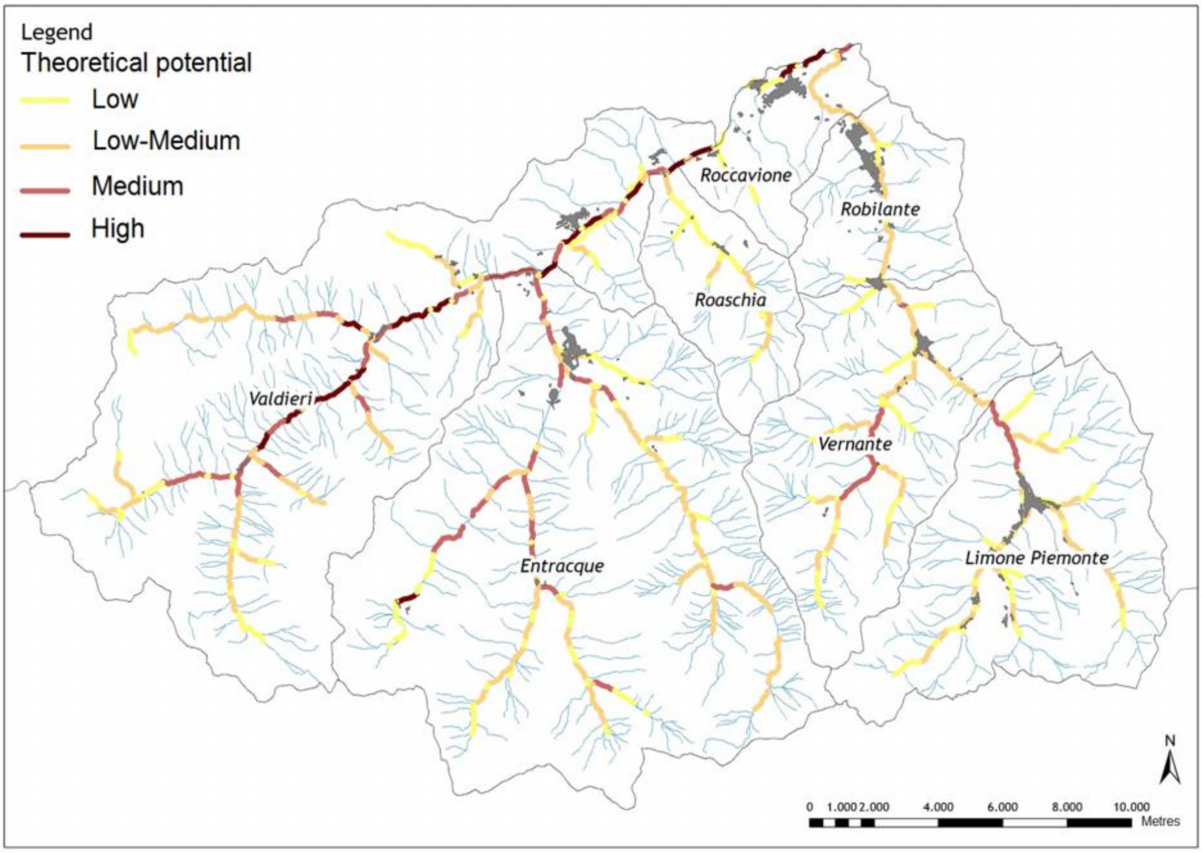


Figure 7: Hydroelectric theoretical potential in Gesso and Vermenagna valleys.

Also for hydropower, EURAC utilized a Decision Support System (DSS) model and developed future scenarios (with technical, economic and ecological variables).

Currently, the hydropower reservoir of Entracque is used to store the water not only for energy purposes but also for irrigation of the agricultural areas; consequently, it changes the water availability downstream the Sant'Anna weir. As showed in the Figure 5, the priority is the use of water for provisioning services, i.e. irrigation instead of other possible hydroelectric uses downstream the weir. This is a clear example of trade-off between energy production and other activities, like agriculture or ecosystem valorisation (biodiversity and habitat preservation, etc.).

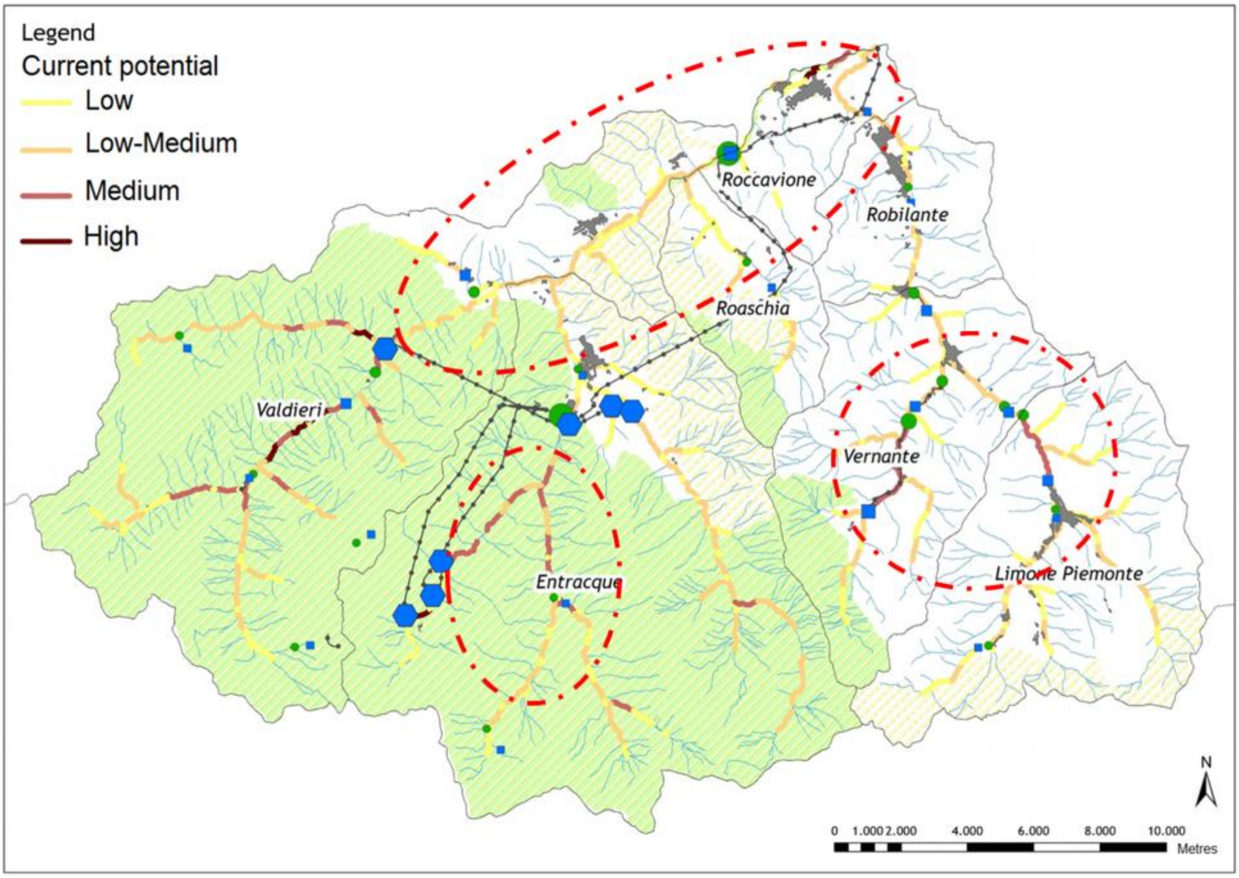


Figure 8: Hydroelectric current potential in Gesso and Vermenagna valleys and trade-offs between water's uses.

2.2.3 Recommendations for the construction of the fish passages on the rivers in Gesso and Vermenagna valleys (Piedmont)

About the recommendations for the construction of fish passages, a priority intervention index was utilized, which is an environmental indicator able to quantify the state of rivers' fragmentation. It can be compared with other streams displaying similar characteristics, in order to choose and plan interventions to restore the continuity. The Figure 6 shows that the highest frequency of interventions are located inside the protected area of the Park.

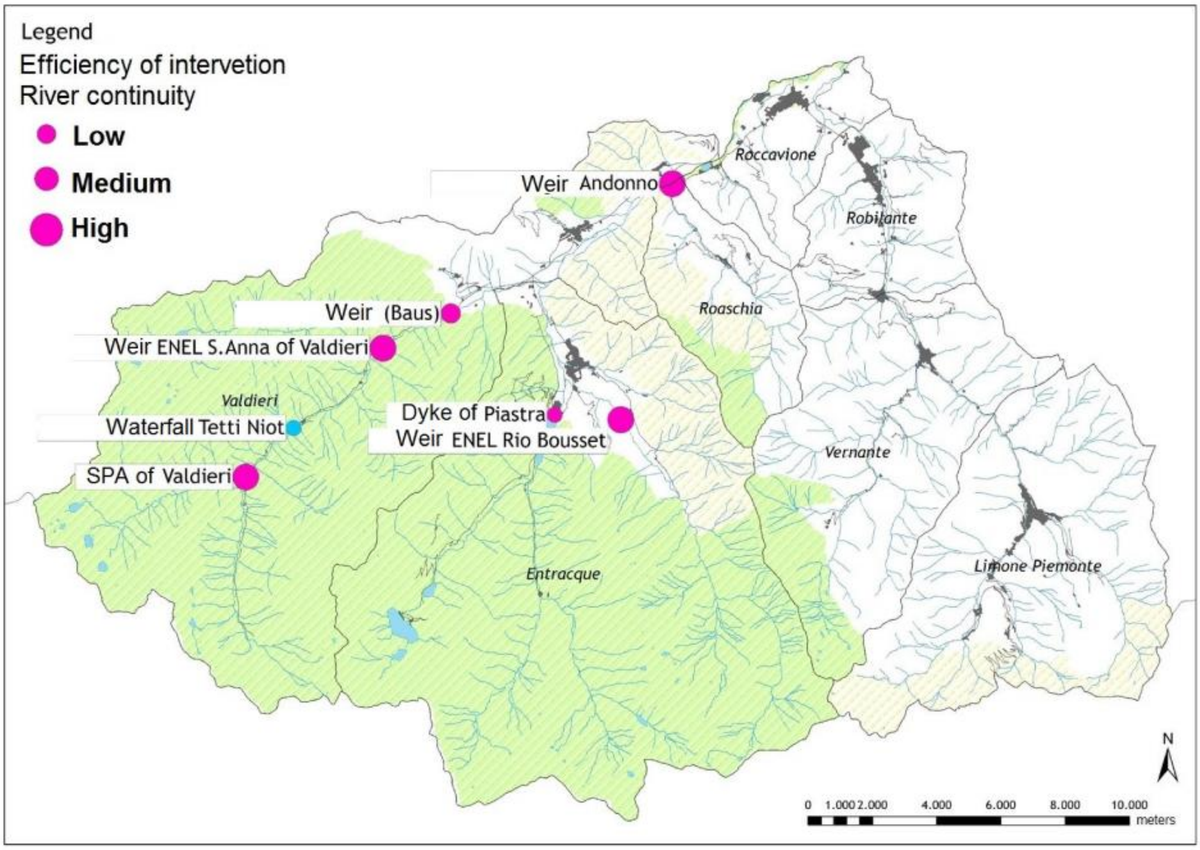


Figure 9: Priority intervention index for fish passages in Gesso and Vermenagna valleys.

The results of the DSS r.green confirm that the tool has the potential to enhance the understanding of planning consideration and increase the objectivity of the trade-offs and conflicts evaluation. In fact, first results were a starting point for the discussion with local stakeholders. By integrating stakeholders' needs and expert knowledge in the r.green GIS tool, a spatial analysis of existing and potential conflicts was possible.

2.3. Mis and Maè Valley pilot area in the province of Belluno (region Veneto)

With its 69 municipalities and a surface area of 3,678 square kilometres, province of Belluno is the largest and at the same time most thinly populated province in the Veneto.

The Province of Belluno has particularly high nature value owing to the numerous animal species and highly diverse flora of national and international significance that is found there. Some 54 % of its surface is a Natura-2000 area, while part of the province lies within the Dolomiti Bellunesi National Park and the Dolomiti d'Ampezzo Regional Park. Thanks to its unique geological and landscape features, the Dolomite "complex" has recently been designated a UNESCO world natural heritage site. Five out of nine of the Dolomites world natural heritage area locations lie within the Province of Belluno.

The main aim in this pilot area is to evaluate the use of hydropower and forest biomass with regard to ecosystem services. This will be organised together with the local population.

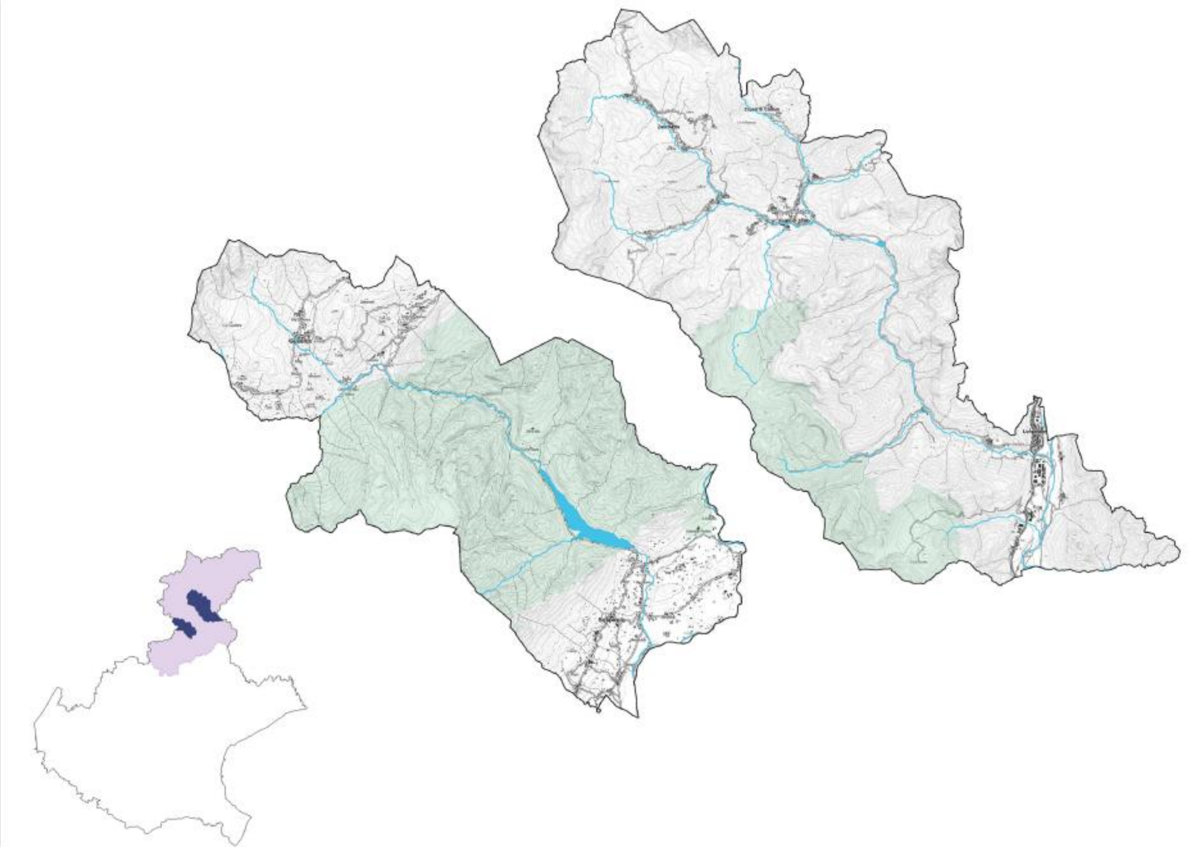


Figure 1: The two pilot areas: Mis and Maè Valley. In green: Park area (source: elaboration by Regione del Veneto, 2015).

2.3.1. Assessment of available forest biomass and future scenarios for forest biomass use in Mis and Mae valley (Veneto)

The evaluation of potential use for forest biomass begins from the dataset of current forest plans, available at municipalities scale level. In Mis valley only one of the two municipalities is covered by Forest Plan of Gosaldo and the part of Natonal Park is not subjected to forest cutting.
Considering the experts inputs some critical aspects are underlined:
- The cutting of recent forest areas that in last decades have covered meadows and pastures, especially close to small villages;
- cutting forest near/ around roads, river beds, electric power lines;
- the cutting of forest is limited by private properties that are small and fragmented.

In case of Maè valley all four municipalities have a forest plan.
The experts consider important:
- to preserve a part of forest production to the wood products at high added value as structural wood and heating wood for local people;
- harvesting is not convenient for some parts of the valley due to high slope and not good viability/forest roads;
- the cutting of forest is limited by private properties that are small and fragmented.

Some data in the following table:

Valley	Total Forest area (Hectares)	Planned forest Area (Hectares)	Annual yield
Mis (Gosaldo and Sospirolo)	8347	2059	1120 m^3/year
Maè (Longarone, Zoppè, Forno di Zoldo, Zoldo Alto)	18928	16047	7150 m^3/year

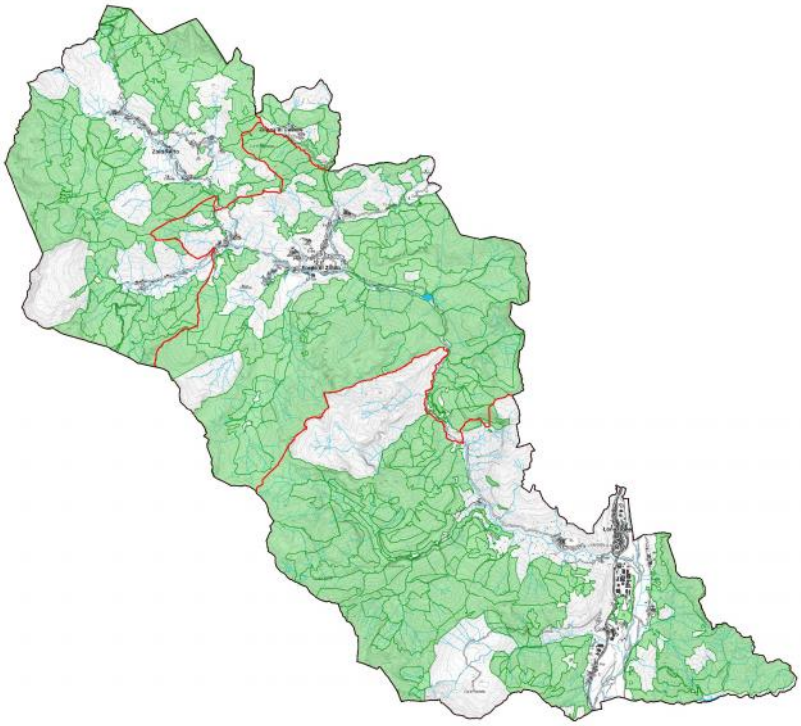


Figure 2: Area subjected to forest planning, Maè Valley (source: elaboration by Regione del Veneto, 2014).

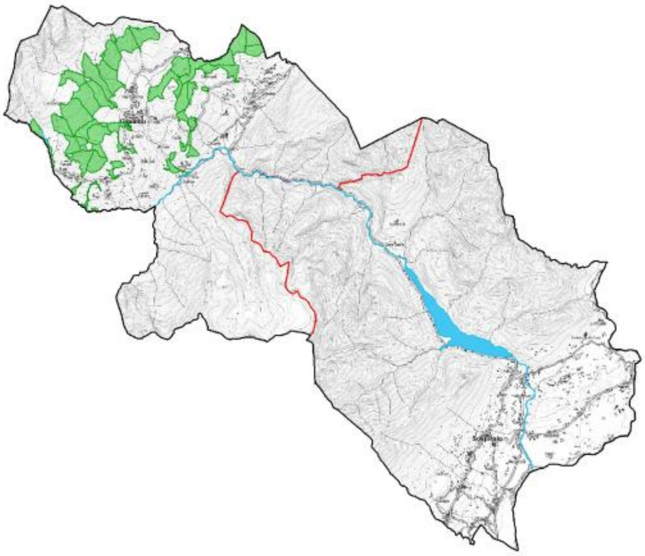


Figure 3: Area subjected to forest planning, Mis Valley (source: elaboration by Regione del Veneto, 2014).

With use of GIS-DSS model **r.green.biomassfor, GRASS module,** different future scenarios for forest biomass use were made. Beginning from dataset of stand, increment, yield for each compartments, it ‘is possible to evaluate the amount of energy wood material for chips in the two valleys.

Using the GIS software r.green.biomassfor, GRASS module, it is possible calculate the potential energy from biomass through following steps

- Theoretical level: the amount of energy that can be produced using all the increment available;
- Legal level: the amount of energy that can be produced from yields and using a part of compartments;
- technical level: the amount of energy that can be produced considering different levels of mechanization;
- Economic level: final evaluation about the economic benefit in relation to different points and directions where the chips products can be used
- Recommended level: it will be implemented after the results from ESS analysis and focus groups inputs.

The scenarios analyzed are determined on the basis both of analysis of power plants in the study areas and suggestions by experts during the initial interview (questionnaire ex ante).

Scenarios for Mis valley:
- the material will be used in an existing stock area in Sospirolo municipality, in valley floor (Scenario A)

- the material will be used partly in Sospirolo and partly in a municipality close to Gosaldo (Scenario B);

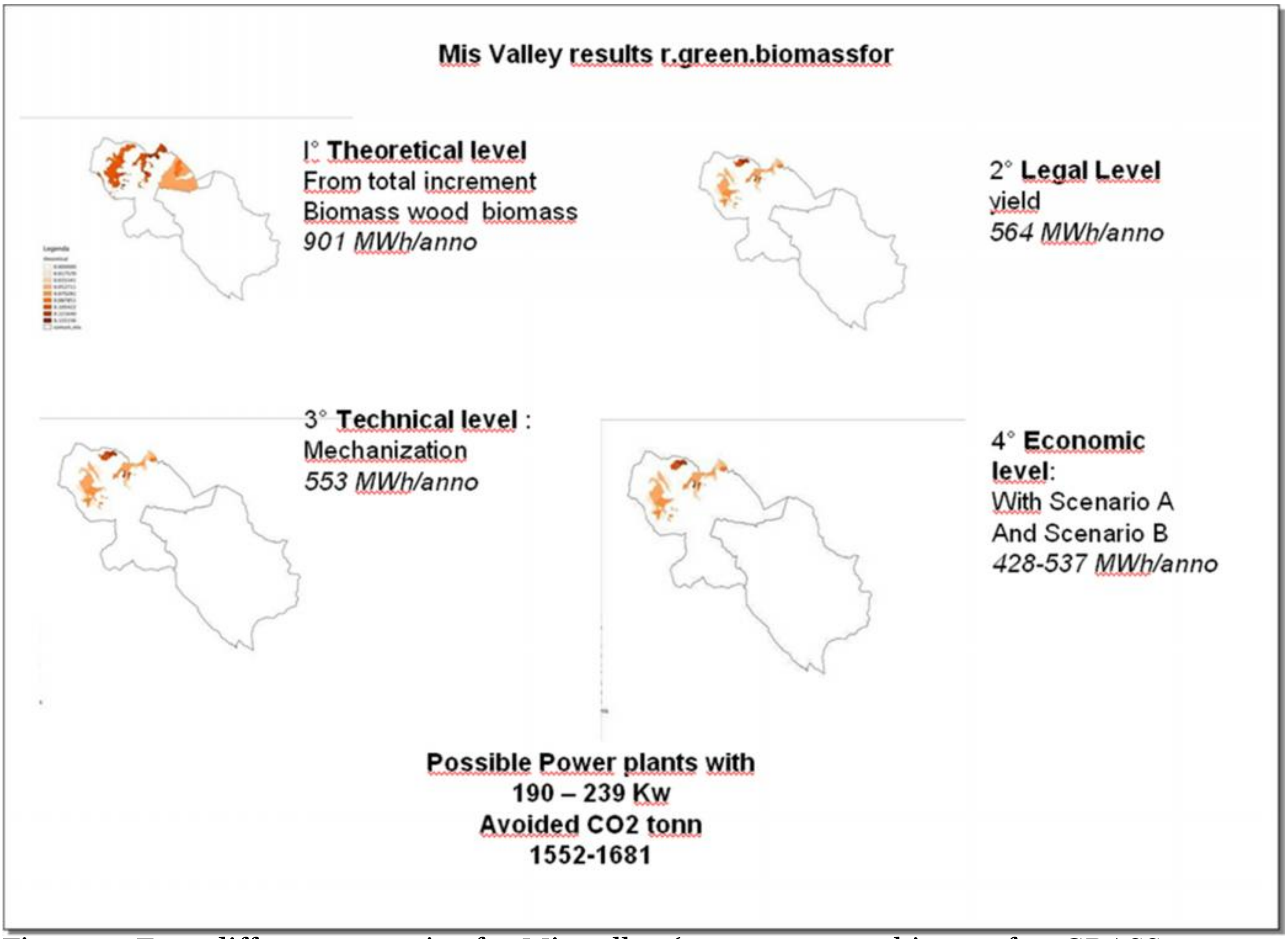


Figure 4: Four different scenarios for Mis valley (source: r.green.biomassfor, GRASS module – EURAC and elaboration by Regione del Veneto)

Scenarios for Maè valley:

- the material will be used in an existing small power plant in Zoppè di Cadore (Scenario A)
- the material will be used in an the power plant in Zoppè di Cadore + in a second power plant that will be built soon (Scenario B);
- the material will be used in (Scenario B) + hypothetic power plant in valley floor for an existing swimming pool (Scenario C);

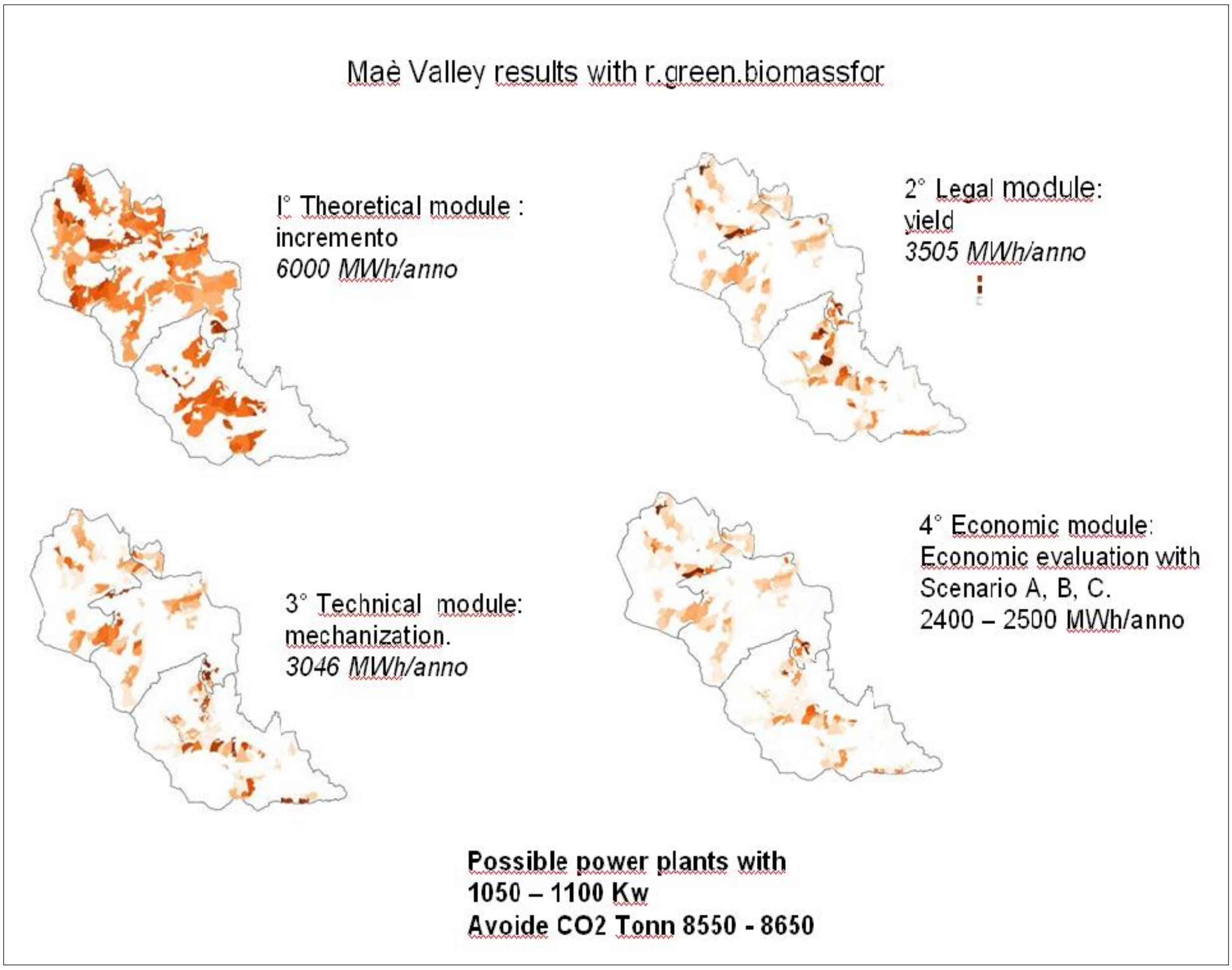


Figure 5: Four different scenarios for Maè valley (source: r.green.biomassfor, GRASS module – EURAC and elaboration by Regione del Veneto)

2.3.2. Assessment of available hydropower and future scenarios for hydropower use in Mis and Mae valley (Veneto)

The following images show the existing power plants respectively in Mis and Maè valley.

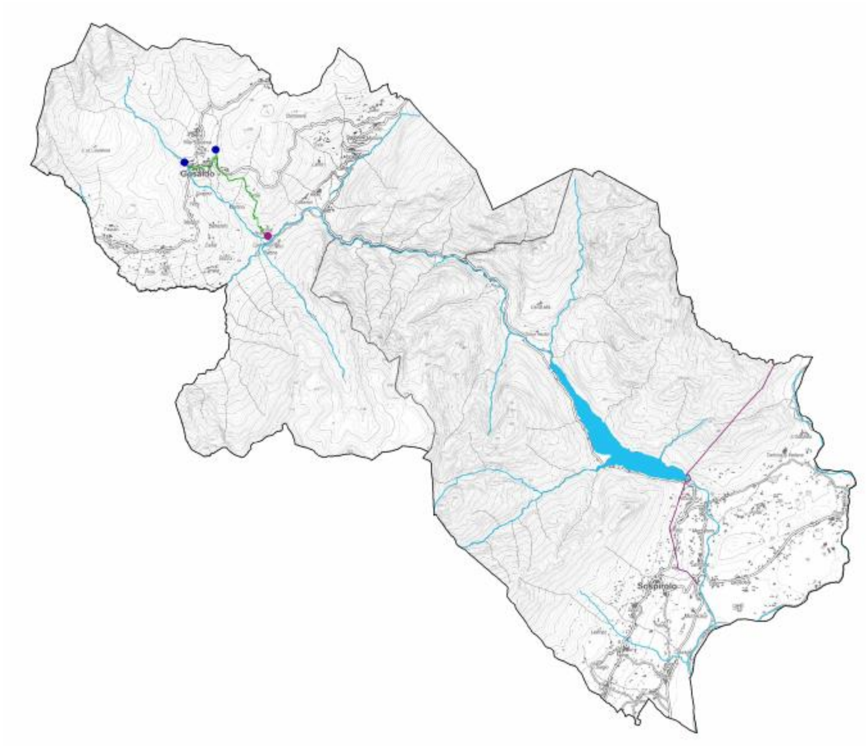


Figure 6: The existing power plants in Mis valley (source: elaboration by Regione del Veneto, 2015)

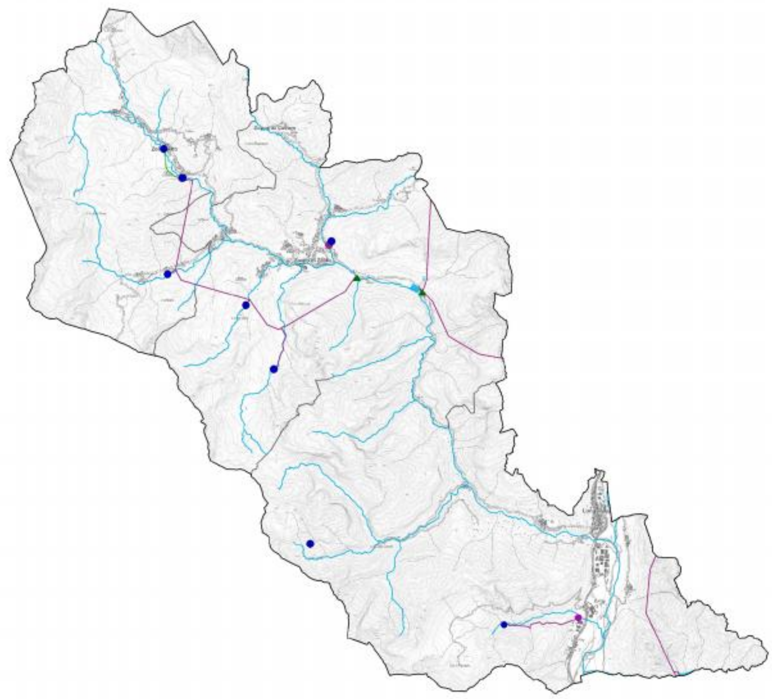


Figure 7: The existing power plants in Maè valley (source: elaboration by Regione del Veneto, 2015)

Considering what is already existing – a big dam for each valley, small hydropower plants and requests for new ones - the left available energy that can be produced from water in Mis and Maè valley is evaluated through the following activities:

- data collection, if possible also geographically, concerning existing hydropower plants, as well as plants whose licensing scheme is in progress. For the geographic level, derivations and restitutions are arranged in a shape file;
- natural discharge in streams is calculated starting from a literature value of specific mean discharge (by the Basin Authority) and the value of the surface of the corresponding sub-basin;
- calculation of Minimum Flow Discharge through the official formula of the Basin Authority.

At the step of activities just explained, some critical aspects are underlined:

- there is not an only one authority responsible of collection and validation of data for small hydropower plants – both existing and under licensing scheme, especially in the geographic format;
- for the two valley, measures of real discharge (continuous data) are not available.

Some suggestions are given by experts:

- length of the derived segment: a certain length (for ex. 100 m) between derivation and restitution for small hydropower;
- a good solution is to use existing check dams and aqueduct networks to install turbines;
- it is necessary to define the MFD in a different way, to take into consideration all the environmental features of the river.

With use of GIS-DSS model **r.green.hydro, GRASS module,** different future scenarios for hydropower use were made. Starting from the geographic information of hydropower plants, both existing and under authorization procedure, the hydropower potential is studied in the valleys, using the DSS r.green.hydro. The procedure is the following:

- theoretical level: potential energy calculated if all the discharge in the streams is used for energy production;
- legal level: introduction of limits, as the respect of the MFD and, for example, the exclusion of protected areas from the analyses;
- technical level: technical limitations as the plant efficiency are introduced;
- recommended level: it introduces some legislative constraints, regarding for example Water Framework Directive, and inputs from stakeholders, as distance between derivation and restitution or buffer from protected areas.

Results show segments of streams that can be used for energy purposes, and the maximum power that can be produced. The following images show the first maps obtained:

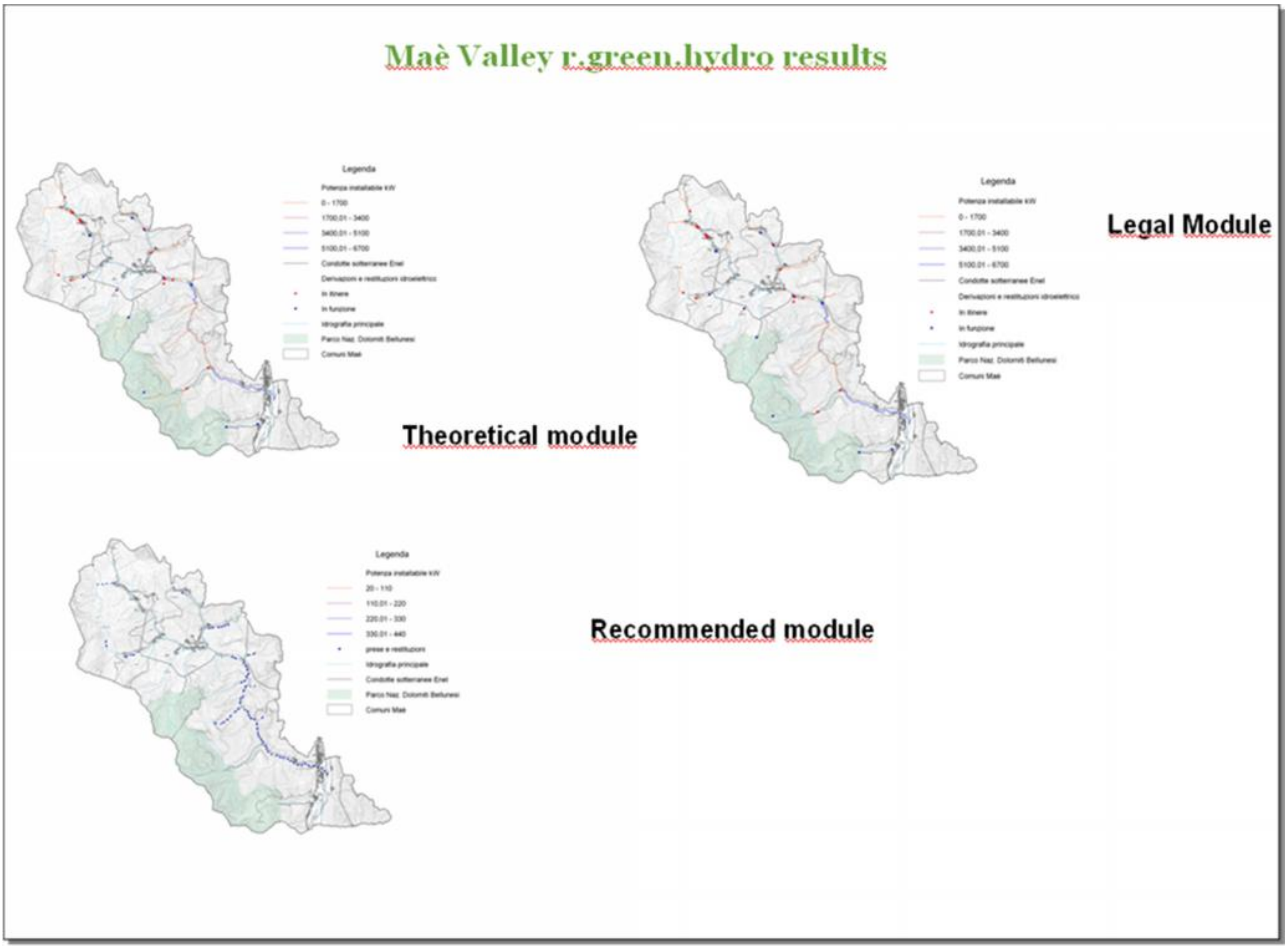


Figure 8: Three different scenarios hydropower use in Maè valley (source: r.green.biomassfor, GRASS module – EURAC and elaboration by Regione del Veneto)

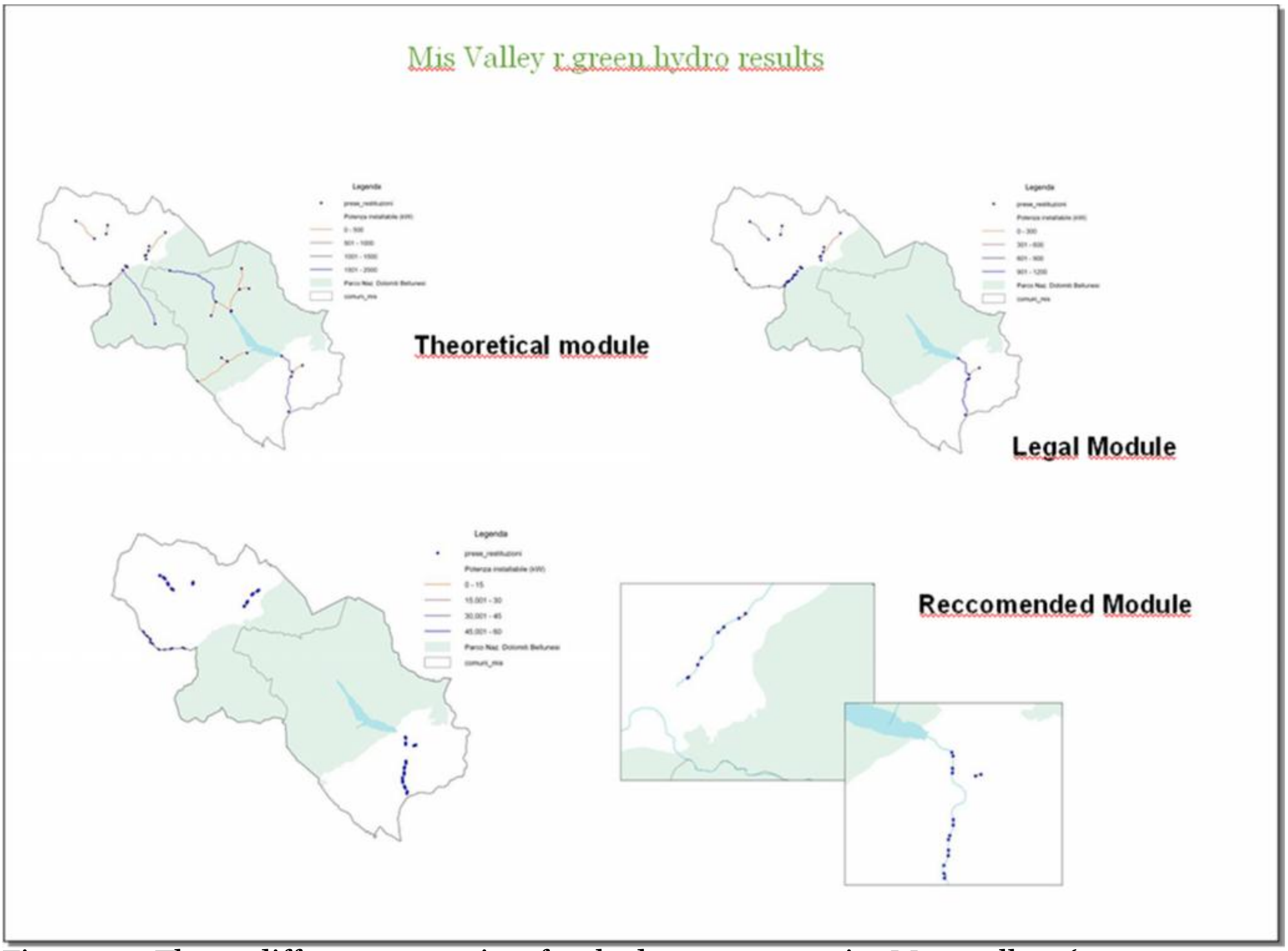


Figure 9: Three different scenarios for hydropower use in Mae valley (source: r.green.biomassfor, GRASS module – EURAC and elaboration by Regione del Veneto)

The results are discussed with stakeholders. The optimization of production is an integration of the DSS technical results, the inputs from local communities and the ESS evaluation.

The Land, Agro & Forestry System Department of the University of Padova together with Regione Veneto analyse the ESS in relation to power generation from water and forest biomass, in Mis and Maè valleys.

In general, the approach of the University of Padova follows the steps:

1. Literature review,
2. ESS identification, analysis and mapping,
3. Identification and implementation of the suitable economic evaluation method.

Mainly through the online research, scientific articles were gathered, ad hoc studies and different types of publications related to the broad theme of the ESS; guidelines and handbooks for the identification and analysis of the ESS were examined and online tools relating to the Evaluation and Payment for Ecosystem Services (PES) were consulted. Where possible, a merchantable value was attributed.

From the list of the ESS edited by the project partners, and using information from to the survey conducted with the local experts, 10 categories of ESS were identified for having a major importance for the pilot areas of the Veneto Region.

- Provisioning services
- Water related services
- Carbon sequestration
- Air quality
- Water quality
- Protection from hazards
- Habitat conservation
- Landscape services
- Recreation services
- Intrinsic value

Each category has been analyzed, in order to find out the relevant ESS for the Mis and Maé areas. For example, in the first category of the "Provisioning" relating to forest biomass we have to consider timberwood, fuelwood production as well as non-wood forest products. Another example can be represented by fishing as a recreational ecosystem service. The basis is the fish map provided by the Province of Belluno, where the streams are classified considering their usability in fishing activities. A numeric value was given to each of these classes, and then translated into a qualitative index from "null" to "very high".

Multhitematic maps were produced, to describe and map the whole service's category; they have been produced through the model elaborated in the C3Alps project (Alpine Space Programme 2007-2013) by the Land, Agro & Forestry System Department itself. The maps represent Landscape-Touristic, Ecologic and Protection ESS, obtained combining together several indicators. For example, some of the indicators for the landscape value are: distance from streets and paths, distances from rivers and lakes, presence of National Parks and Natura 2000 areas, distance and visibility from mountain lodges, *etc.*

Maps were presented to stakeholders during round tables. Discussion help them to focus and identify also areas and places they want to be preserved: these information were used to map the "intrinsic value". This new map is used in the recommended module of r.green, to evaluate the visual impact and exclude areas.

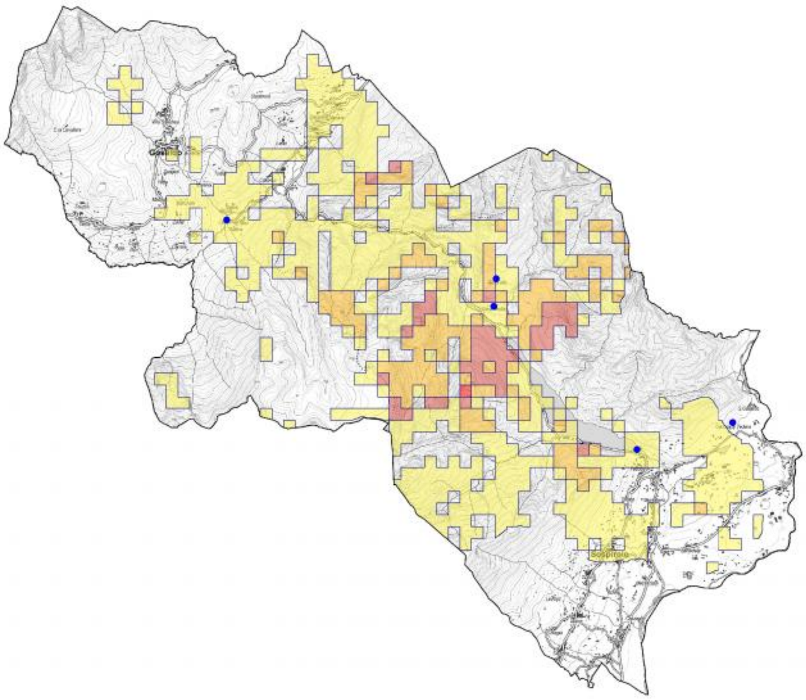


Figure 10: Areas visible from the points (source r.green.hydro.recommended, Grass module and elaboration by Regione del Veneto)

Stakeholders discussed also results from DSS. For example in Mis valley: they stated no hydropower for the valley, except if it is related to small off grid plants. Eurac produced maps for a new scenario, that considers only the possibility to have two small power plants (off grid) in the Park area (see figure 19).

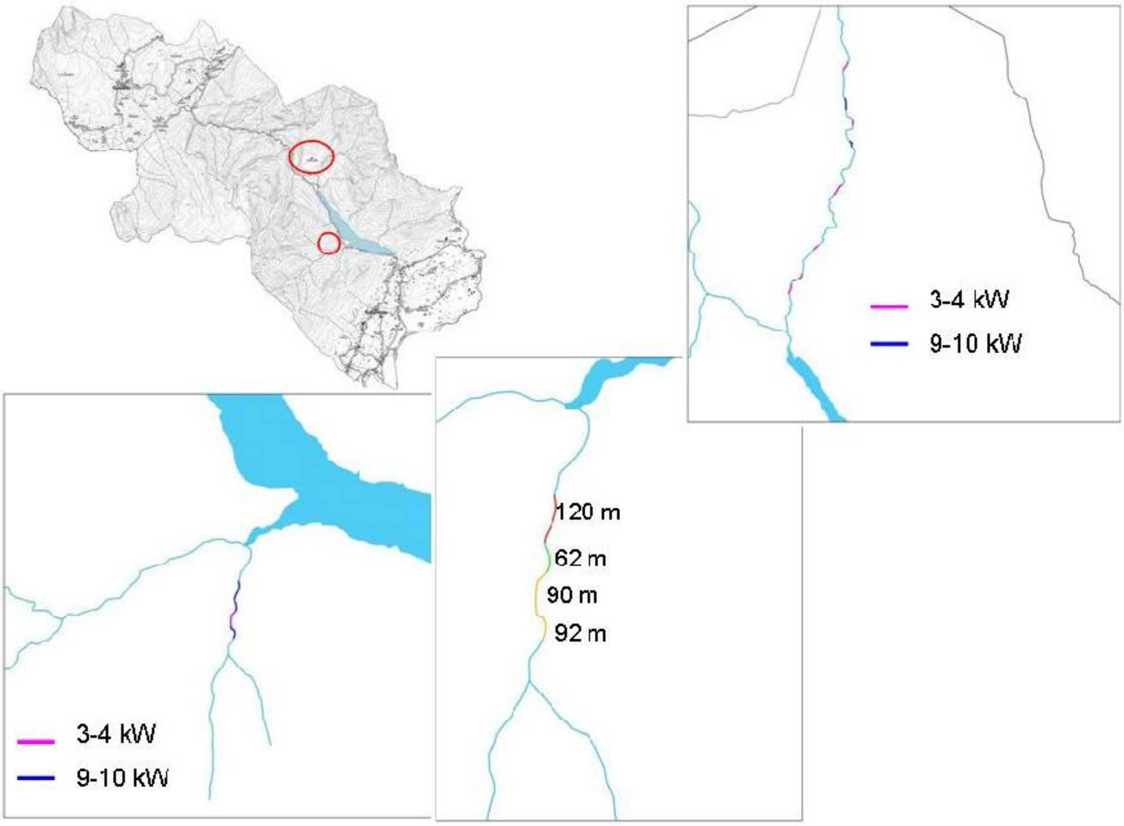


Figure 11: Results after focus groups for Mis Valleys (source: Eurac and elaboration by Regione del Veneto, 2015)

2.4. Bavaria pilot area

The Bavarian electric power company, BEW, maintains and operates 35 hydroelectric power plants on the Lech, Wertach, Iller, Günz and Danube rivers, as well as biomass power plants and distance heating networks. BEW's aim is the ecologically sustainable operation of power plants. The hydropower plant Altusried in the pilot region Bavaria is situated at the river Iller which has a poor ecological status regarding the European Water Framework Directive due to hydropower usage. The most important parameter in this context is the fish population. The main areas of interest are ecological connectivity at water-retaining structures and the protection of the fish population in accordance with the European Water Framework Directive. The objective of the project has been the development of measures to improve fish population in Alpine Rivers in Bavaria (e. g. Iller, Lech, Danube) to alleviate the negative impacts of hydropower plants on river ecosystems.

2.4.1. Implementation studies on hydropower plants with fish passages at the river Iller (Bavaria pilot area)

The idea of the pilot activity is to carry out a special monitoring about fish fauna at hydropower plants and to optimize the construction and operation of existing hydropower plants and fish passages to minimize negative impacts on fish. In the year 2014 ecological observations have been carried out to determine the status quo and the deficits and to get a basis for developing measures to improve the situation.

Summarized deficits:

- Local fish population is dominated by undemanding species (chub, stickleback and stone loach)
- Severe deficits in the abundance of rheophilic index species especially due to ‚a small amount- or, absence of juveniles

Cause: Lack of functional spawning- and rearing habitats. In addition, hydro peaking degrades quality and availability of possible spawning- and rearing habitats

Based on a comparison of the historic with the current situation, a catalogue of measures has been developed.

Package of measures directly referring to reference conditions

- Aim: optimization and creation of riverine habitats, especially rearing- and spawning habitats suitable for rheophilic species.
- Target Area: Head of the reservoir and riverine stretches downstream of the Altusried HEP.

Proposed measures concern:

- gravel spawning grounds
- vitalization of riverine habitats
- connection of tributaries and backwaters

Package of measures not referring to reference conditions

- Aim: optimization and creation of additional functional habitats inside the reservoir area (upstream of the HEP) in order to create retreats during hydro peaking.
- Target area: From the Altusried HEP to the head of the reservoir, area strongly influenced by hydro peaking

Proposed measures concern:

- rearing habitats
- retreat areas during floods
- wintering sites

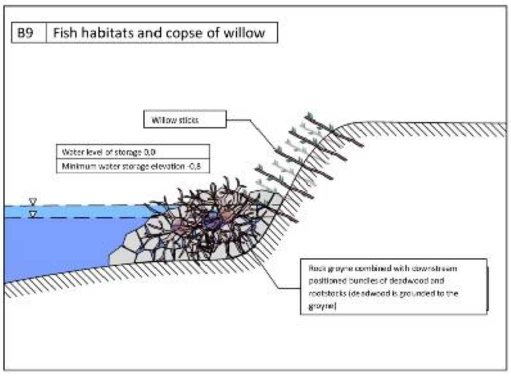
With the proposed measures riverine habitats can be restored and additionally created which do not develop naturally due to the lack of dynamic flow in the river. Since the situation at Altusried can be generally compared to other Alpine rivers the measures are suitable for other rivers as well. By realising and maintaining the proposed measures, the ecological potential of the water body can be significantly and sustainably improved.

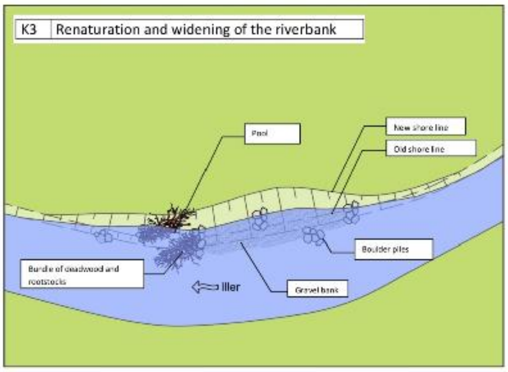
A detailed description of the observations and the developed measures can be found in the report “Verbesserung des ökologischen Potenzials der Iller am Kraftwerk Altusried” (BNGF, June 2015; in German). The most important summarising figures and plans are shown in the enclosed poster presentation of the final conference.

Subsequent to the recharge green project the implementation of the measures took place in the course of two example projects and building activities of the BEW.

2.4.2. Guidelines for improving fish habitats or river Iller (Bavaria pilot area)

In the study done in the Bavaria pilot area concrete measures to minimize negative impacts on fish population due to hydropower plants were described and two of them already implemented in 2015. The measures to improve fish habitat were to develop structures such as gravel banks, shallow slack waters and deadwood structures.





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2. 5. Leiblachtal pilot area in Vorarlberg

The Pilot Area Leiblachtal lies in the most northwestern part of Vorarlberg (Austria) on the border to Germany. With a number of five municipalities (Lochau, Hörbranz, Hohenweiler, Möggers and Eichenberg), approximately 15.000 inhabitants and a size of 50 km2, the Leiblachtal is the smallest Pilot Area scrutinized in this study.

The main land uses are as follows: 48.9% forests (2,497 ha), 39.5% grasslands (2,017), 4.1% agricultural crops (208 ha) and 7.5% urban area (381 ha). About forests, the main forest types are Norway spruce, silver fir and European beech mixed forests (75.3%), followed by pure Norway spruce forests (13.6 %) and the mixed broadleaves coppices (4.5%). Considering the tree species composition, mixed forests cover 1,880 ha, pure conifer forests cover 429 ha, while pure broadleaves forests cover the remaining 188 ha which can be found in the lower valley area.

The Leiblachtal is socioeconomically characterized by moderate tourism, work migration to the nearby urbanized area of Rheintal and forestry and agricultural activities in smaller villages. As in many parts for the Alps, hydropower and biomass are also in Vorarlberg the most important renewable energies. However, in the Region of Leiblachtal only limited hydropower potential is available. Therefore, alternative renewable energy sources such as wind power and forest biomass are under intensive discussion to meet regional energy demands (Seidel et al 2013).

2.5.1. Future scenarios for renewable energy use in Vorarlberg pilot area

Vorarlberg has developed DSS model called "Sample Hectare". This instrument was used for all renewable lines of energy, except nature reserves and hydro.

The individual Sample Hectares regarded as separate entities, does not correspond to the complex spatial reality, because

- its assessment also depends on the neighbourhood relations. A determined equipped area for example, in the vicinity of settlements is to be assessed differently than in further settlement location.
- the ecosystem services of the areas also depend on the neighbourhood relations, especially also of frequencies. The loss of one hectare of forest is low when dominated forest in the area.
- the complex effect "landscape" results only from a mosaic of different areas, especially the changes often makes the special charm of an area.

The neighbourhood relations should be included in the review with, even if it cannot be standardized. You could do this, inter alia, make a "rarity" of hectares or about diversity indices, but this requires a more comprehensive landscape analysis.

Furthermore the different "action at a distance" of energy use should be included that is not represented by the selective view of the Sample Hectares, this is at windmills extremely high; when photovoltaics, hardly present in biomass utilization.

In the present review now the Sample Hectares the multiple use of a surface is not taken into account. Thus, it would sometimes possible to use the surface on which a wind turbine is installed for biomass production and yet to even install solar panels at mid-height, so the acres would be used three times and the energetic or social benefit higher.

Between the different services there are rules-like interactions, as they are sometimes in a conflicting relationship. The simultaneous maximization of all desired effects is difficult in the highly complex system.

Critical of the approach needs to be evaluated when it is linear factors in the use of energy, as occurs with the use of water power in general. Here, the reference surface is given in a comparable manner. A particular challenge is the consideration of the use of ambient heat such as geothermal or ground water heat.

Another issue is how far in the assessment of ecosystem services, the actual demand and the real price to be paid is taken into account. A settlement near forest may be more valuable by increased demand as a more distant, but which is perhaps more attractive. Remains completely open individual economic valuation of ecosystem services.

2.5.2. Assessment of soil diversity and trade-offs

Soil maps were done in WP5 and was integrated to energy concept of Vorarlberg (see Clemens Geitner, Gertraud Sutor, Richard Hastik, 2015: Bodenbewertung für das Leiblachtal Ergebnisse und Interpretation unter dem Gesichtspunkt des Bodenschutzes im Kontext des Energiekonzeptes. Innsbruck, Juni 2015).

2.5.3. Further guidelines for renewable energy use in Vorarlberg

In the participatory processes of assessment should be made between the technical and regional expertise. People who lives in this area or regular stays are very familiar with this can be seen as "experts" because there is a strong identification with the space. Professional expertise can be present without knowledge of the specific area (eg. specialists in the field of agriculture, forestry or conservation) but can also be associated with it.

Working with photo material in the questionnaire must be viewed critically. You can take photos affecting assessment widely, this means, this must be done very carefully and balanced.

Overall, the review of hectares by the population is a highly subjective approach, which should be completed in all cases by other methodological teaching methods such as expert assessment and / or scientifically based assessment with appropriate algorithms and models.

From a practical point of view, the question should be clear who actually can perform sample hectares reviews. Past experience has shown that the willingness technical / regional experts to participate in such projects is small, this is also due to the lack of establishment of the method itself.

In a first step, there is no distinction between the professional expertise of professionals and regional expertise of local residents. With the increasing application and development of a differentiation of feedback is useful.

The narrower range of ecosystem services can be extended to the specificities of different regions or groups of users (guests, locals, users, owners) to cover better. To avoid too much a lump sum, the number of sample areas in a region should not be too low. They should cover the different landscape uses, at least approximately. In the course of work for the Leiblachtal numerous sample hectares and measures scenarios were not considered and recommended for editing within the project team for the Alpine macro-region in a first step.

In addition to the current use of a hectare its potential should not be ignored. A meadow in the plane would have the potential for specialty crops (fruit and vegetable production, settlement area) and would therefore be due to these possible alternative outweighed by a meadow on a slope, although currently the same use is realized. This could go so far that you consider the potential that could have an area for dismantling (demolition and reuse for agriculture).

A comprehensive evaluation of the services - for example, under the criteria of provision, relevance, demand, sensitivity to change is a complex and sometimes lengthy process, especially when it comes to a larger number of ecosystem services. It can be used in evaluating different methods, ranging from the scientific mapping and modeling to social science approaches to the survey. Usually it takes appropriate indicators which track an ecosystem services as well as possible and to quantitatively detected. The result of the vote can be represented in a ranking scale points per ecosystem services. It is also possible to go further and to subject the benefits of a monetary valuation. This approach provides good tangible and transmittable values (in both senses) and makes the negotiation process very concrete. The monetization of nature is fraught with many methodological (different economic approaches) and also ethical problems.

2.6. Rhone-Alps pilot area – National Park Vercors: perceived impacts and comparison with other pilot areas

In recharge.green project, a questionnaire was administered to local experts in all the pilot areas, included French region: Leiblachtal, Mis and Maé valleys, Triglav National Park, Gesso and Vermenagna valleys and Regional Natural Park of Vercors. Local experts were chosen based on three elements, as in the following figure:

Equitable geographical distribution

Expertise and skills on ecosystem services and/or renewable energies

Local knowledge and no stakes

Figure 1: Criterion to choose local experts for administering questionnaires.

The questionnaire was administered face-to-face to 45 local experts (fig 2). It was composed by several parts:

(1) Personal information (e.g. gender, education, age);

(2) Current development of renewable energy production in pilot area;

(3) Future potential of renewable energy in pilot area;

(4) Impacts of REs on environmental

(5) Socio-economic aspects.

Interviewed experts	
Gesso and Vermenagna valleys	8
Mis and Maé valleys	11
Vorarlberg	10
Triglav National Park	13
Park of Vercors	5
TOTAL	47

Figure 2: Local experts from different pilot areas that answered to face-to-face questionnaire.

The experts' questionnaires supply some information about the local current and future development of renewable energy.

Regarding the Park of Vercor, the first useful information is the current situation of renewable energy power in the Park of Vercors. According to interviewed local experts (fig 1), three considered sources are well-developed in the pilot area, while there is not energy production by wind source.

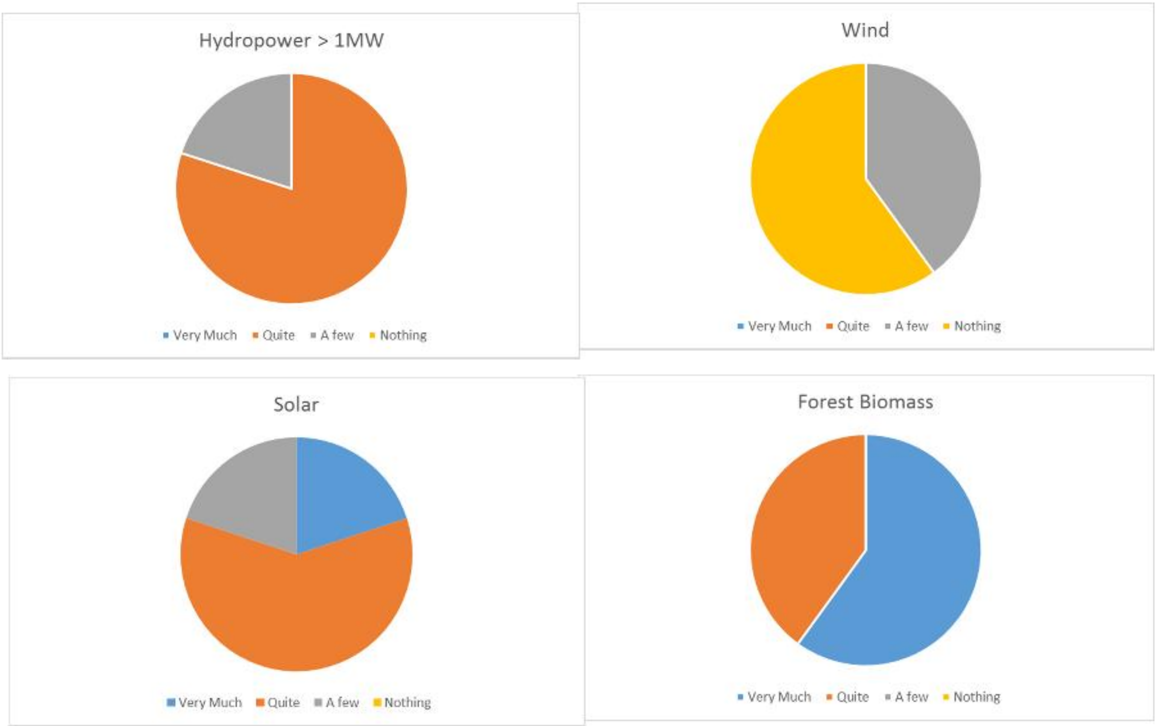

Figure 3: Current development of renewable energy in Park of Vercors, according to local experts.

Local experts agree on the possibility to have a very high potential to develop forest biomass energy's production, according to most part of local experts interviewed in all the pilot areas of recharge.green.

In the questionnaire a focus was made on the impacts of the four renewable sources (forest biomass, hydropower, wind and solar) on ecosystem services and on socio-economic aspects. Concerning forest biomass energy's production, interviewed local experts agree on the very positive impact on local employment. Furthermore, other socio-economic aspects have positive impacts by forest biomass energy's production: diversification of local economy, local enterprises, residents' income, efficient use of local resources and, finally, local participation. The combination of local experts' opinions about future development and impacts on socio-economic aspects of forest biomass power could be the start point of some more detailed analysis and plans.

In all the five pilot areas, local technicians answered to the questionnaire considering forest biomass and hydroelectric power as the most developed renewable sources in their areas (fig 3). The most suitable renewable source for the future production of energy is the forest biomass, according to local technicians.

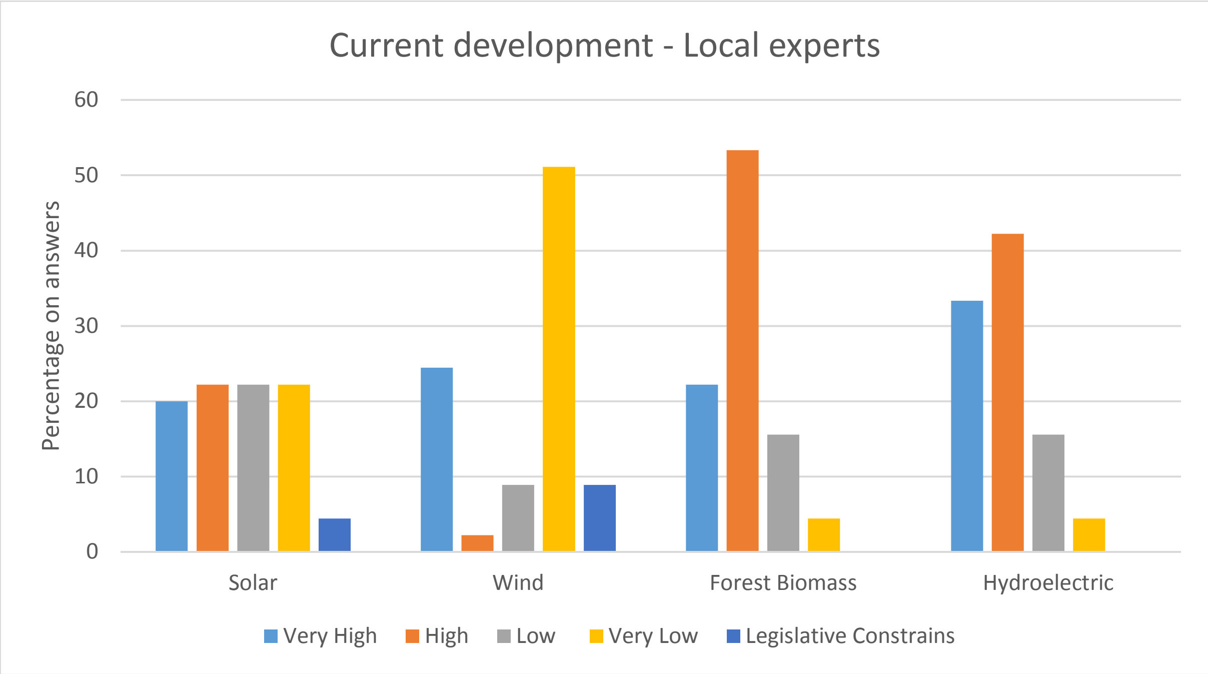

Figure 4: Current development of renewable energy production in all the pilot areas, according to local experts (%). Percentage of answers for each renewable source.

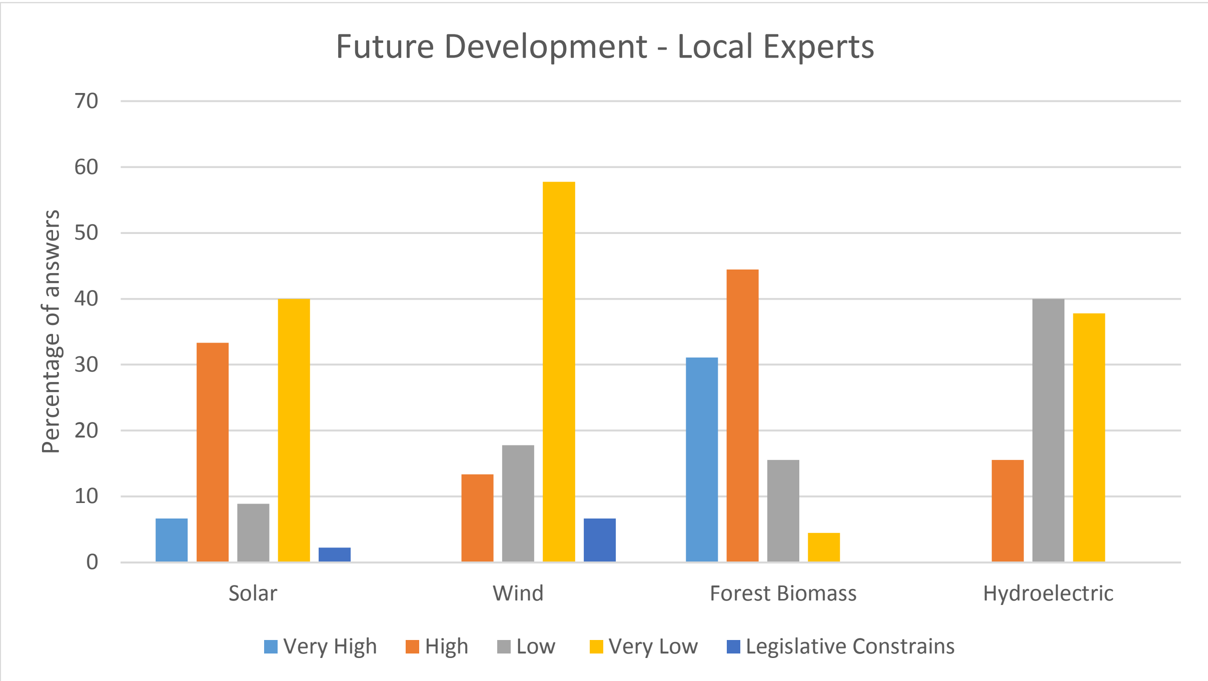

Figure 5: Future development of renewable energy production in all the pilot areas, according to local experts (%). Percentage of answers for each renewable source.

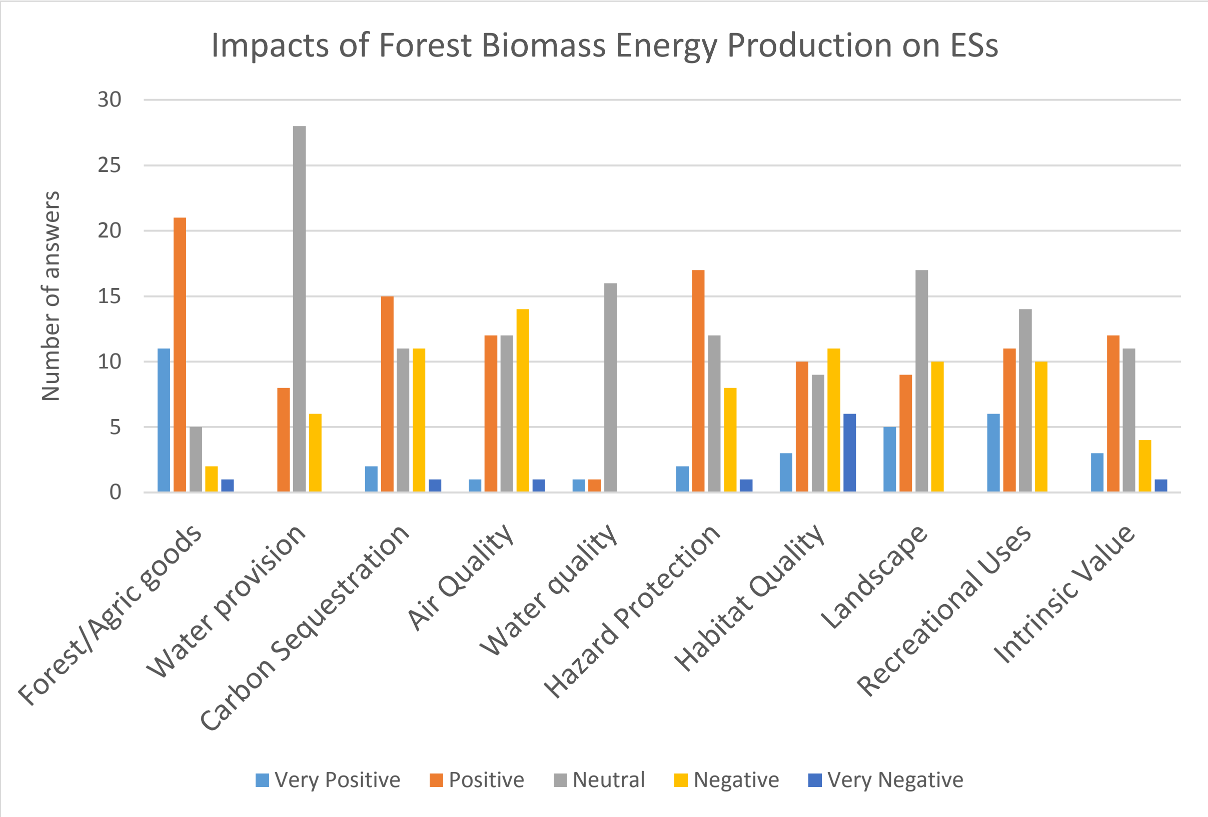

Figure 6: Perceived impacts of forest biomass energy production on ESs, according to local experts.

Some differences between the answers of local experts could be related to:

- different characteristics of local context,
- different background of local experts,
- different past approaches about renewable energy production.

Of course, also other elements should explain the following disagreements between experts in different PA. For example, impacts of solar photovoltaic energy production are perceived in different ways (fig 4): Gesso and Vermenagna valleys, Mis and Maé valleys have negative perception of solar photovoltaic to habitat quality, while Vorarlberg, Triglav and Vercors do not perceive any kind of impacts on habitat quality.

SOLAR on habitat quality (%)					
	Gesso/Vermenagna	Mis/Maé	Vorarlberg	Triglav	Vercors
Very Positive	0.0	0.0	0.0	22.2	0.0
Positive	0.0	0.0	0.0	0.0	0.0
Neutral	25.0	0.0	**57.1**	**77.8**	**100.0**
Negative	**62.5**	**63.6**	14.3	0.0	0.0
Very Negative	12.5	36.4	28.6	0.0	0.0
	100.0	100.0	100.0	100.0	100.0

Figure 7: Perceived impacts of solar photovoltaic on habitat quality, according to local experts in the pilot areas. (Number of local experts: see fig 2 of this chapter)

Another example considers the perception of hydroelectric power plants on the provision of water (fig 8).

HYDRO on water provision					
	Gesso/Vermenagna	Mis/Maé	Vorarlberg	Triglav	Vercors
Very Positive	0.0	0.0	0.0	0.0	No answers
Positive	**37.5**	0.0	14.3	0.0	No answers
Neutral	**37.5**	9.1	**85.7**	**100.0**	No answers
Negative	12.5	**63.6**	0.0	0.0	No answers
Very Negative	12.5	27.3	0.0	0.0	No answers

Figure 8: Perceived impacts of hydroelectric plants on water provision, according to local experts in the pilot areas. (Number of local experts: see fig 2 in this chapter)

In conclusion, planners and decision makers can not avoid to consider in their program the involvement of stakeholders and their different perception as reported in the next chapter.

3. DIALOGUE WITH REGIONAL STAKEHOLDERS – AN EXAMPLE OF BEST PRACTICE

Dialogue with regional stakeholders was an important part of the WP6 project activities. A step by step approach towards balancing renewable energy use and nature has been used. Firstly the local needs, possibilities and limitations for renewable energy use have been identified by experts and local stakeholders. Experts then calculated capacities and prepare different scenarios. On round tables and workshops different stakeholders further discussed scenarios. During the project partners from different pilot areas experienced that by using participatory approach is a best practice example towards a good management plan for renewable energy use. The results of the discussions with the stakeholders will be implemented in regional management plans and programs.

3.1. Dialogue with regional stakeholders in Triglav National Park

Table: List of activities for the stakeholders in the Triglav National PA

Date	Location	Title	No. Participants
August 2012	Slovenia	Questionnaire to the experts	13
17. 12. 2013	Pokljuka	Workshop on local biomass production and multi-objective forest management	66
3.12.2014	Bled	Meeting/workshop of Slovenian PP and external experts for biodiversity	10
17. 9. 2014	Ljubljana	Meeting with authority competent for SEA	4
17. 12. 2014	Bled	Recharge.green summer school final event	100
30. 5. 2015	Bled	Stakeholders workshop – TNP rangers	27
1. 4. 2015	Pokljuka	* training session and workshop at Hotel Pokljuka on 1st and 2nd of April 2015	31
2. 4. 2015	Pokljuka	* training session and workshop at Hotel Pokljuka on 1st and 2nd of April 2015	65
10. 6. 2015	Pokljuka	International workshop on biodiversity maintance in TNP agricultural area	21
12. 6. 2015	Pokljuka	* the transnational workshop on soil, land use and biodiversity	10

(*WP7 activity)

3.2. Dialogue with regional stakeholders in Piedmont

3.2.1. Dialogue with local stakeholders

The focus of the trade-offs and conflicts evaluation started from the involvement of local experts, stakeholders and citizens. Several meetings were organized to collect information and data from the local knowledge that is explicit through different social actors. The participation of experts, stakeholders and citizens confirm the results of the model, sometimes with the correction of used data and procedures. Elaborated maps were useful to present and synthetize the results in a short and clear way.

The first meeting of participatory process was on 20th February 2015 and it was the opportunity to show some results of recharge.green project to 19 local experts. In some topics, local technicians provided feedback on how to improve the quality research with better data and procedures. The local knowledge is an important tool to improve and get realistic results in a research project.

A second meeting was on 31st March 2015. Stakeholders who were previously engaged by experts in an "ad hoc" questionnaire participated in thematic round tables: (1) hydroelectric power and (2) forest biomass power in Gesso and Vermenagna valleys. The work started with simple questions about the possible future of forest biomass in the pilot area and the perceived impacts of hydroelectric plants in the valleys. Two facilitators mediated the relations between participants. The main tools used were maps developed by r.green model.

Different results were elaborated from the content's analysis of round tables:

1) Trade-off between local stakeholders emerged (Fig 5). Water resource can be used for different reasons (agricultural, touristic-recreational, environmental protection). The water uses can be competitive when there is not a good management of the resource (for example, the competition between hydroelectric and recreational uses of the water). Decision-makers can have support for better decisions from the consciousness of local trade-off.

2) At the forest biomass round table, the conversation focused on the stakeholder's goal to develop small plants that work with a forest short-chain (Fig 3). The results of forest biomass round table are published in a guidelines' list ((http://www.recharge-green.eu/wp-content/uploads/2012/12/FOCUS-GROUP-31st-March-2015.pdf) that can be useful for the development of forest biomass power.

The third and final meeting was on 21st April 2015 and involved all citizens and stakeholders affected by recharge.green project and its energy issues. 45 persons participated to the transnational implementation workshop titled "Valle Gesso e Valle Vermenagna: energia rinnovabile tra ambiente e produzione" (Gesso and Vermenagna valleys: renewable energy between environment and production). During the meeting, researchers explained recharge.green results and local entrepreneurs showed some local models of renewable energy management (for the presentation, see http://www.recharge-green.eu/infoservice-2/events/).

3.2.2 Questionnaire to citizens

An additional part in recharge.green project was to develop and administer a questionnaire to citizens. The questionnaire is composed of several parts:

1) general information about knowledge on energy issue;

2) perceptions about some elements concerning Gesso and Vermenagna valleys:

a) current energy production;
b) renewable energy impacts on ecosystem services;
c) future potential development of renewable energy in the pilot area;

3) information about Willingness To Pay (WTP);

4) finally, some general information about the interviewed.

The questionnaires were administered face-to-face involving 83 local citizens. The sample size included people that live in all the municipalities of Gesso and Vermenagna valleys, belonging to different age classes (9 persons less than 30 years old; 21 persons between 31 and 40 years old; 18 interviewed between 41 and 50 years old and 18 interviewed older than 50 years old).

The pilot area has a high level of perceived current development of hydroelectric power (Fig 7), while the forest biomass is the most perceived renewable source for future development (Fig 8). These results confirm participatory process' results. In the case of hydroelectric power, the source can be used only depriving the water source from other uses, coherently with the high level of current development of hydroelectric power. The forest biomass energy is a new sector for the pilot area: stakeholders and citizens agree on its future potential development.

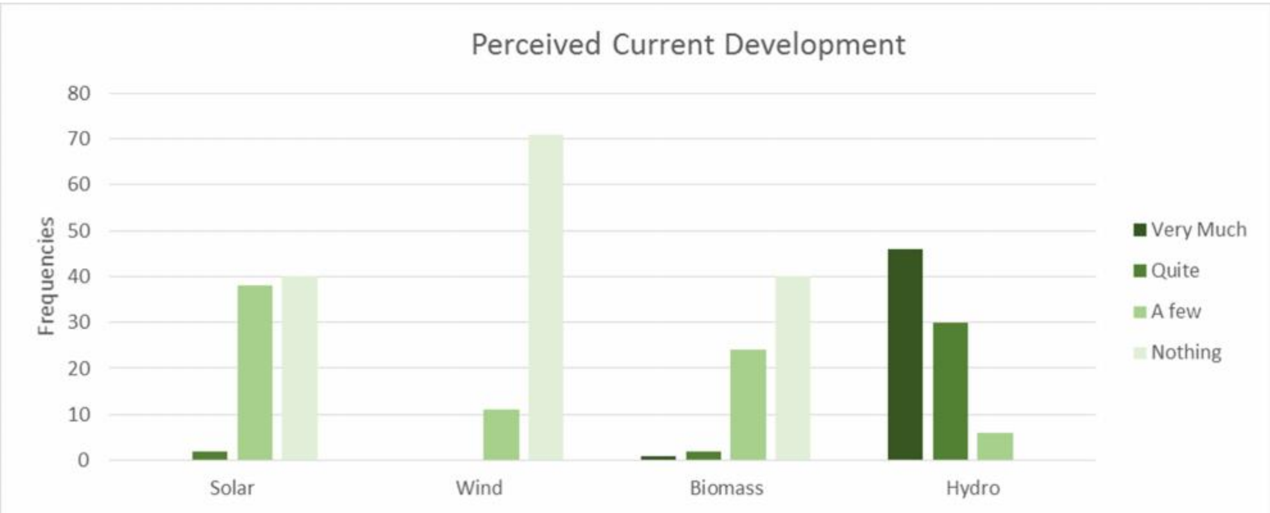

Figure 21: Perceived current development in Gesso and Vermenagna valleys according to citizens' sample.

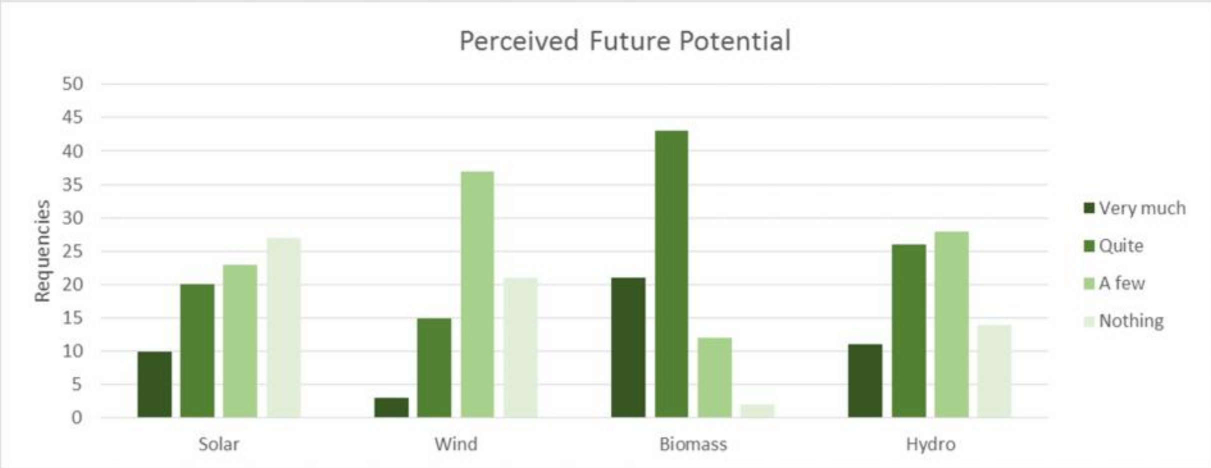

Figure 22: Perceived potential in Gesso and Vermenagna valleys according to citizens' sample.

A comparison between perceptions of citizens and local experts is described in the chapter 4 of recharge.green handbook (WP7). A future participatory process for next phases of decision-making about renewable energy have useful tools to be efficient in Gesso and Vermenagna valleys. Considerations about trade-offs in local area between stakeholders and different perceptions of impacts on ecosystem services between experts and stakeholders are tools for supporting decision-makers.

Table: List of activities for regional stakeholders in Gesso and Vermenagna valleys.

Date	Title	No. Participants
2013	Questionnaire to local experts	8
1st March – 21st April 2015	Questionnaire to citizens	83
20th February 2015	Focus group with local experts	19
31st March 2015	2 Round tables with stakeholders: 1) hydropower and 2) biomass power	23

21st April 2015	Transnational Implementation Workshop *"Valle Gesso e Valle Vermenagna: energia rinnovabile tra ambiente e produzione"*	45

3.3. Dialogue with regional stakeholders in Mis and Mae Valley (Veneto)

A participatory approach in Mis and Maè Valley has been used to discuss RE use and DSS models r.green.hydro and r.green.biomasfor with regional stakeholders (*Table: List of activities for regional stakeholders in Veneto region*). The methodology adopted was "round tables", developed in two steps, to involve local communities and stakeholders. We informed the stakeholders also by informative material (cards and posters) and social media.

Landscape Veneto PA (author: Alessio Flego, Sprinter srl)

They were organized with the support of an external facilitator: this choice helped the discussion, involving people in giving their suggestion on the specific topics.

Stakeholders involved were selected from: a) categories suggested by experts through the ex-ante questionnaire, b) participants to the first informative meetings, and c) interested people "captured" through publicity material as flyers and posters, that was placed on purpose in the information points of the pilot areas. Stakeholders were people of the valleys, that is local administrators, representatives from local associations for environment, tourism, recreational activities, and citizens.

The first round tables were organized at a municipality scale (two for Mis Valley – Gosaldo and Sospirolo – and two for Maè Valley – Zoldo Alto and Forno di Zoldo). This meetings were based on "information phase". During this meeting, participants were presented the structure of the project and in particular the first results from the DSS and concepts about ESS; they were also explained how they would have been involved in the following activities. During the meeting comments and suggestions were collected, regarding the decision support system and the analysis and mapping of ecosystem services. At the end stakeholders were provided of the ecosystem services maps and some "blank" maps, where they could draw their own inputs and suggestions as "homeworks": this could be an help to complete the analysis on the services of their valleys.

The second part of round tables was organized at the valley scale, after a month (one meeting in Sospirolo for Mis Valley and one meeting in Zoldo Alto for Maè Valley). The time between the two parts gave the possibility to people to elaborate information and possibly to have discussion between them, to put their inputs in the "blank" maps or send them directly to a specific mail address. The meetings were focused on "evaluation phase". Stakeholders were asked to fill a questionnaire giving a ranking to a selected number of values of their territory. "Values" corresponded to the previously selected and analysed ecosystem services, and they were: ecological value, social value, economic value, touristic value, historical and cultural value, personal/family value, landscape. They commented also their choices, and they justified them also drawing new information for the categories of ESS on a "blank" map in A0 format.

The final result was a ranking of the ESS in the pilot area that reflected the personal opinion of stakeholders. In Mis Valley, most importance was given to the ecological value and the touristic value, given the presence of a National Park in half of the Valley itself. Also some technical suggestion were collected – in the use of hydropower for off-grid power plants and forest biomass from a buffer around roads and electric networks. They were then analyzed and inserted within the DSS.

Maè valley reflects the situation of several alpine valleys, as connection with the valley floor is not easy and it is subjected to depopulation, so people feel the need to provide connection to infrastructural and technological networks. Social, personal and economic values were considered the most important by stakeholders, who stressed the need to maintain people in the valley and give them the possibility to work and have services, but also to recover the social aggregation now partially lost. Regarding RE use stakeholders underlined the need to maintain the remaining streams, saving their high natural and intrinsic value. Some of the suggestions were focused on the importance of energy saving and efficiency.

Many of the suggestions were finally used to define the intrinsic value of the pilot areas.

Round tables were the opportunity to meet people and have their own opinion on such important and strategic themes, but also to have a clear idea of their perceptions and how to use RE in their territory.

Methodology and results are well described on a specific report for WP6.

Figure 23: First round table in Zoldo Alto. (Author: Simone Bertin, Regione del Veneto)

Figure 24: Summary scheme regarding round tables methodology.

Table: List of activities for regional stakeholders in Veneto region

Date	Title	No. Participants
14th April 2014	Meetings with majors and Presidents of Mountain Communities for Mis and Maè Valleys - Longarone	7
4th June 2014	Informative meeting for Maè Valley - Longarone	30
6th June 2014	Informative meeting for Mis Valley - Agordo	36
18th December 2014	Informative meeting for technicians and officials – Mestre, Venezia	18
29th January 2015	I-Focus group in Mis Valley - Gosaldo	10
30th January 2015	I- Focus group in Mis Valley - Sospirolo	14

5th February 2015	I- Focus group in Maè Valley – Zoldo Alto	15
6th February 2015	I- Focus group in Maè Valley – Forno di Zoldo	12
11th March 2015	II - Focus group in Mis Valley – Sospirolo	6
12th March 2015	II- Focus group in Maè Valley – Zoldo Alto	11

3.4. Dialogue with regional stakeholders in Bavaria

At the beginning of the project the scepticism of nature conservation organisations whether arrangements should be executed at project costs, which would have to be executed by the hydro power plant operator anyway was quite perceptible. On the other hand, the organisations feared that they would not be included with regard to the contents of the project procedure.

The following dialogue process took place:

- First, the intentions and questions of all involved parties as well as the course of cooperation within the project were discussed.
- CIPRA was integrated / included by BEW where the calls for proposals and allocations of fish ecological valuations were concerned.
- At the start of the evaluations and strategies a workshop comprising an excursion in the project area was held and the working program was discussed.
- Before finalising the work, intermediate results were presented at a meeting where interested stakeholders as well as involved authorities were given the opportunity to introduce wishes and suggestions until the completion of the project.
- The result of the project – suggestions of arrangements improving the fish ecological potential of the Iller – were publicly presented at the final conference of recharge.green during an excursion.

Based on the experiences in the project it was found that the mutual understanding of each other's positions and aims was deepened and that the faith in a fair and cooperative intercourse during the dialogue process was promoted. The biggest difficulty in the execution of the project was the tight time schedule. The coordination of the single project steps was noticeably more time consuming than expected. Enough time for a comprehensive and satisfactory exchange of content specific questions should be allowed.

Table: List of activities for regional stakeholders in Bavaria (only WP 6 activities)

Date	Title	No. Participants
24.05.2014	Training session	18
21. 5. 2015	Presentation of the results of the pilot study	20-30
21. 5. 2015	presentation of proposed measures to public at final conference and	80

3.5. Dialogue with regional stakeholders in Vorarlberg

Local experts of the Leiblachtal pilot area, in the Vorarlberg region in Austria, identified 28 stakeholders during the stakeholders analysis. Public administrations are 46% of total stakeholders, while private organizations and NGO-associations represent 25% and 21% of total stakeholders.

3.5.1 Stakeholders perception survey

Stakeholders perception survey was carried out in November 2015. The questionnaire was sent out to the inhabitants of the Leiblachtal. The questions focused on divergences between RE projects plans and perceptions of stakeholders, also in the context of Ecosystem Services impacts. Results were presented at stakeholders meeting (17.3., Presentation) and at final conference in Sonthofen (20.-21.5., Poster).

3.5.2 Long Night of the Research

The Long Night of Research is Austria's biggest research event. The biennial event has become a fixture for the open dialogue of science with society. During this event the gates of universities, colleges, universities, non-university institutions and companies in all over Austria are open to the interested public for free. The goal is to make research accessible and understandable.

The Long Night of Research took place in all nine provinces of Austria, in 37 regions and 1.789 stations 234 projection places, 2014 already for the sixth time. People of all ages took advantage of the varied offerings to meet Austrian research and innovative technologies at close range. Families, school groups, young people and technology fans attended the event and were impressed by the variety of the topics.

In direct contact with scientists and researchers, complex research services are comprehensible and perceptible. The dialogue arouses the interest of research, innovation and technology and represents the diverse research landscape as attractive workplace for new recruits.

In Vorarlberg, there were five exhibition places. One of the 46 stations recorded the Regionalentwicklung Vorarlberg. The opportunity was used to present the project recharge.green and in particular the tool "Sample Hectares".

The government of Vorarlberg, Austria plans energy independence by 2050. Therefore it is necessary to compare the potential of different renewable energy sources for this limited area. "Sample Hectare" assists stakeholders in making decisions about the use of landscape for renewable energies.

"Sample Hectare" reflects the complexity of renewable energies. It considers the energetic potential of renewables per area combined with the existing use of areas, ecosystem services, and socio-economic aspects. The tool reflects the trade-offs between different solutions. The tool "Sample Hectare" has been tested by about 50 laymen, experts and politicians in the course of three events in years 2013 and 2014. The reference region has been the Leiblachtal in the province of Vorarlberg.

The tool which is easy to use provides the testing groups frame of mind within minutes. Further it delivers a contemporary survey of the consulted people estimations. It therefore offers a fruitful contribution to the integration of public interest in spatial planning processes. During the long night of research, visitors had the opportunity to inform themselves in direct talks or posters on recharge.green. The instrument of "Sample Hectares" could be used. Visitors could calculate the own energy consumption measured by the online tool. 1,125 visitors from the neighboring Germany, Switzerland and Vorarlberg could be counted in the house this evening. A part of them visited also the stand of the regional development of Vorarlberg. The visitors were very interested in the topic and in applying the tool “Sample Hectares”.

For the project team the Long Night of Research was an ideal opportunity to test the method "Sample Hectares" with laymen, young and old, male and female. It resulted in several adaptions of the instrument and the communication material.

The Long Night of Research in Vorarlberg was organized by Wirtschafts-Standort Vorarlberg GmbH, Vorarlberg University of applied sciences, the Industrial Association of Vorarlberg and the Wirtschaftskammer Vorarlberg. The province of Vorarlberg, the Hypo Landesbank and the companies Julius Blum, Bachmann electronic, OMICRON electronics and high Q laser support the event in Vorarlberg. The nationwide measures were supported by the Ministry of Research and Economic Affairs and by the Federal Ministry of Education and Women.

Figure 25: Sample Hectares DSS presented at Long Night of Research in Vorarlberg PA

Table: List of activities for the stakeholders in Vorarlberg

Date	Title	No. Participants
04.06.2013	Meeting with PP CIPRA on the poster exhibition	2
25.02.2013	Meeting with local stakeholders and experts	6
10.06.2013	Meeting with local stakeholders and experts	6
18.06.2013	Meeting with local stakeholders and experts	15
03.07.2013	Report Recharge.Green and Sample Hectare	7
06.09.2013	Report Recharge.Green and Sample Hectare. Benefit for villages and regions.	8
18.11.2013	Report Recharge Green and Sample Hectare for State Government	10
04.04.2014	Long Night of Research	500
30.09.2014	Workshop with national officials	17

3.6. Dialogue with regional stakeholders in Park of Vercors

The Park of Vercors is located in the Northern French Alps in the Rhône-Alpes region. The National Natural Reserve of Hauts Plateaux of Vercors is protected since 1985 and constituted by 17000 hectares.

Date	Title	No. of participants	Output	WP
15th May – 30th June 2015	QUESTIONNAIRE to local experts	5	Integration of local experts questionnaires' results	6
29th June 2015	Workshop with local stakeholders	8	Create a local debate about renewable energy	7

Table 1: EURAC's activities in the Park of Vercors, 2015.

In the Park of Vercors, a network among actors interested in renewable energy development already exist. The team of Park of Vercors works on several activities with the goal of protecting and preserving the Park. Renewable energy production is an important issue to ensure a good development of the area, considering the impacts on nature. For this reason, the Park of Vercors is working in a project concerning renewable energy (e.g. the development of solar photovoltaic in communities). With the support of Alparc, local stakeholders were involved in a short debate to introduce recharge.green results in the local area. Including Vercors' pilot area at the end of the project, the main objective was to create knowledge on recharge.green project and its main results.

In further paragraphs of this report, we deepen three main topics on the renewable energy production and environmental protection that were discussed in the recharge.green workshop made in Lans-en-Vercors (FR), with the participation of EURAC Research, Alparc, Parc of Vercors, Communauté de communes Val'Eyrieux and Regional Natural Park of Ardèche Mountains.

1. Energy consumption and potential in the Alps and recharge.green pilot areas

During the years and the eras, society consumptions has grown, in terms of energy used for domestic use, services, industry, agriculture and transports. Fossil fuel energy resources are ending, while there is high availability of renewable energy resources. Consequently, a good planning of renewable energy production is mandatory. The great energy potential in the Alps contributes, on one hand, to mitigate the climate change and, on the other hand, to increase pressure on nature.

There is the need to have a tool that analyses the trade-off between renewable energy exploitation and the ecosystem services. The recharge.green decision support system r.green developed by EURAC is an open-source software and can be applied and adapted to several areas. It considers theoretical, legal, technical and economical potentials (fig 1) of renewable sources and can be downloaded as GRASS GIS add-on https://grass.osgeo.org/download/addons/.

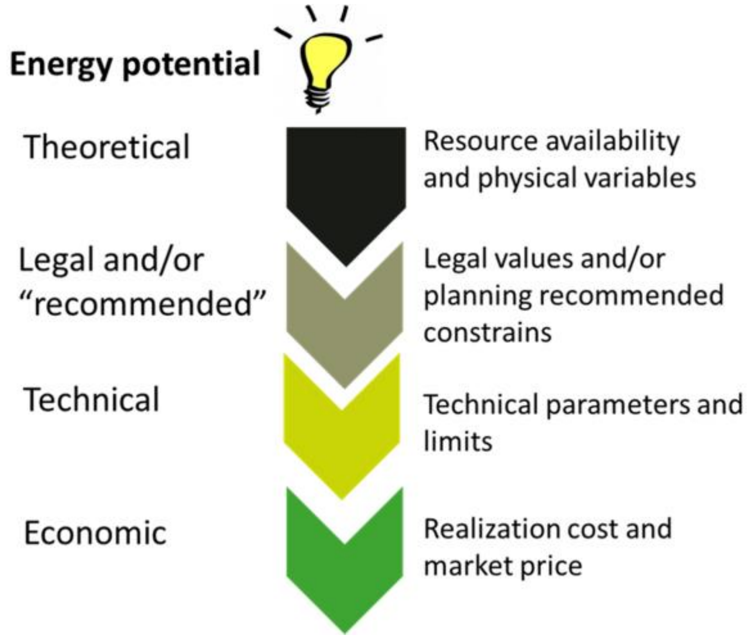

Figure 1: Modules of r.green software

The local participants to the recharge.green workshop (Alparc, Parc of Vercors, Communauté de communes Val'Eyrieux, Regional Natural Park of Ardèche Mountains) were interested in the wind energy potential of the French pilot area. On the base of GIS calculation showed in fig 2, working hours for wind power are greater than 1500h only in correspondence of mountain ridges. Notice that the working hours can be an estimation of the feasibility of a plant. In the case of wind potential, only areas, with working hours greater than 1750, can be economically exploitable. These areas are in the most cases in protected areas.

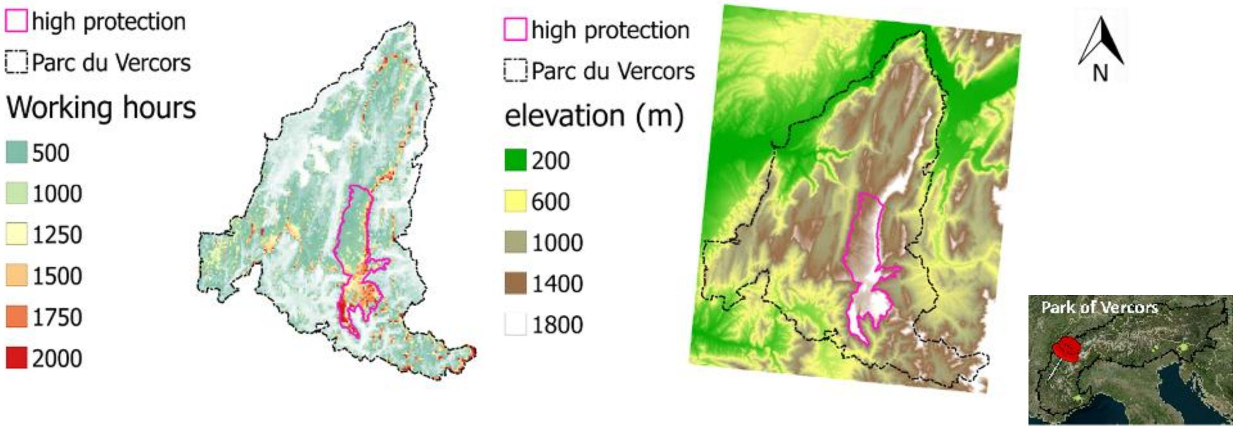

Figure 2: Wind potential in Park of Vercors, considering elevation and working hours, maps obtained with r.green.wind.theorethical module of r.green.

2. Trade-off analysis between renewable energy and environment

The second topic focused on the impacts of renewable energy on the environment, the concept of ecosystem services and the trade-off analysis. Producing renewable energy means reducing greenhouse gases and deplete ecosystems and ecosystem services, creating trade-offs analyzed in the recharge.green project.

Ecosystem services (ESs) are goods and services provided by natural ecosystems, fundamental for human life. ESs are classified in provisioning, regulating, cultural and supporting services.

The exploitation of renewable sources for energy production means positive effects as reduction of greenhouse gases, timber production, river line protection, reduction of fire risk and the increment of energy production, and negative effects, as landscape changes, land consumption, decrease of soil fertility, loss of biodiversity, hydrogeological protection and water quality.

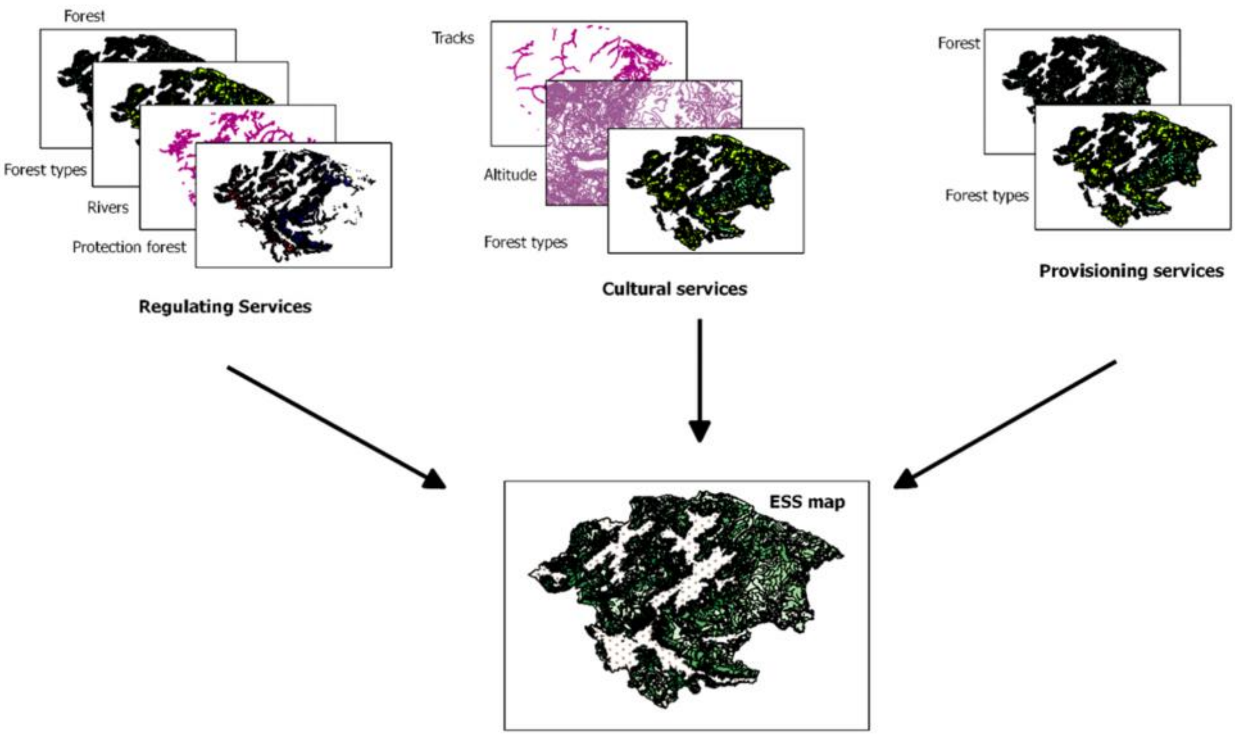

Figure. 3: Mapping impacts of renewable energy production on ecosystem services.

Researchers developed also the module impact in r.green software. It includes the calculation of impacts ES values and their mapping (fig 3).

Wind power has its impacts on ESs, summarizing into the classes of provisioning (land consumption), regulating (loss of biodiversity, especially for birds and baths, considering rotor collisions, noise disturbances, migration barriers, habitat alterations), cultural (impact on landscape and spaces for recreational activities). In general, the main problem is that most of the wind potential in Alpine area is located at higher altitudes, where the impacts may be higher. On one hand, wind power is good for reducing greenhouse gases while, on the other hand, it affects ESs. The interest in the Park of Vercors focused on the ways to calculate change on ESs values and the elements to take into account in the ESs value's analysis. An example of mapping is reported in fig 3.

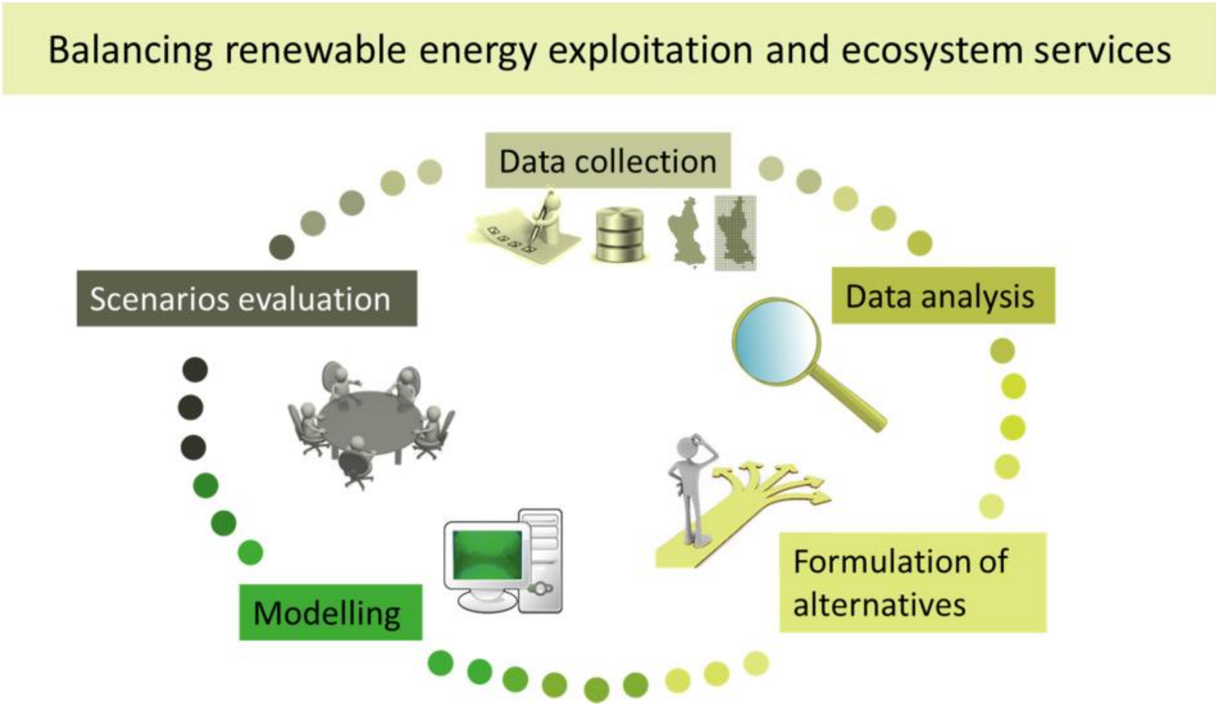

Figure 4: Phases used in recharge.green project for Piedmont pilot area.

3. Conflicts analysis between renewable energy production and ecosystem services.

In order to analyse conflicts, the involvement of local stakeholders is very relevant. The recharge.green project develop a methodology represented in fig 4 that has been applied in Piedmont pilot area in the North West of Italy and discuss with local stakeholders. The first phase is the data collection about current energy exploitation, future development, perceived impacts on ESs, energy consumption and production, road and grid networks, infrastructures and other important information for a wide description of pilot area. The second phase included the data analysis on several aspects: current renewable energy exploitation, existing plants and their mapping (fig 5), current energy consumption, possible future development, perceived impacts on ecosystem services and economic growth, ecosystem services mapping.

The third phase was the formulation of alternatives, considering the perceptions of local technicians and citizens. Besides, the formulation of alternatives is one goal of r.green tool that considers available sources and constrains. Modelling (fourth phase) is the development of scenarios with r.green software that is available as GRASS GIS add-on. An advantage of r.green is the possibility to fill masks with local data and to get the map with renewable energy production potential. Finally, local stakeholders, technicians and citizens were involved (fifth phase) for evaluating scenarios with the aim of confirming or not confirming the feasibility of future possibilities.

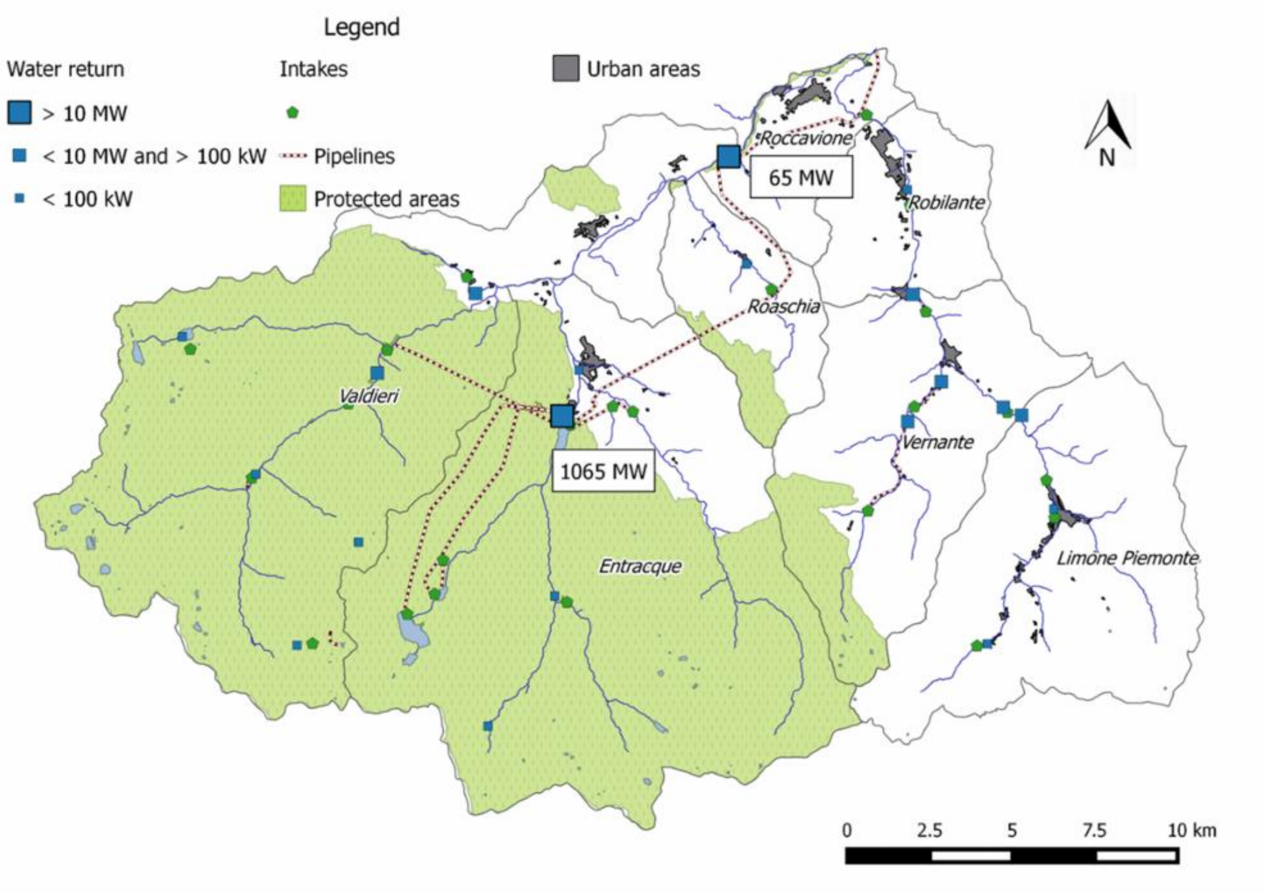

Figure 5: Current exploitation of hydroelectric power in Piedmont pilot area, Gesso and Vermenagna valleys.

4. MANAGEMENT GUIDELINES

Different phases for preparing good management guidelines for RE use were presented in the recharge.green project: stakeholders involvement, collecting basic information (biodiversity, soil and land use inventarisation, RE availability, RE demands), modelling, another stakeholders involvement.

Further reading on management guidelines:

- biomass use and it's possible influence on the biodiversity and soil: *Acta triglavensia* (abstract and summary in English) and in the analytical report from Triglav National Park pilot area (Pirnat in Piltaver, 2015: Evaluacija rezultatov raziskav biote na območju TNP v okviru projekta Recharge green - usklajevanje izrabe obnovljivih virov energije in ohranjanja narave v Alpah, Slovenian only, with English abstract). http://issuu.com/tnp-publikacije/docs/acta_3_2015

Annex 1 (only in Slovenian)

- Soil, land use, biomass and biodiversity trade-offs and ESS approach for biodiversity and soil was closely examined in the article: Renewable Energies and Ecosystem Service impacts, Richard Hastik (UIBK), Stefano Basso (EAWAG), Clemens Geitner (UIBK), Christin Haida (ALPS), Aleš Poljanec (UL/SFS), Alessia Portaccio (TESAF), Borut Vrščaj (AIS), Chris Walzer (FIWI) (under review).

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- maps on soil evaluation and soil protection as an input for recommendations within SEA and to be integrated in energy concept for this region: Clemens Geitner, Gertraud Sutor, Richard Hastik, 2015: Bodenbewertung für das Leiblachtal Ergebnisse und Interpretation unter dem Gesichtspunkt des Bodenschutzes im Kontext des Energiekonzeptes. Innsbruck, Juni 2015

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