PHUSICOS

According to nature

Deliverable D2.3

Overview of submitted and approved NBSs for implementation during months 15-24

Work Package 2 – Case study sites**:** large scale demonstrator sites and supporting concept cases

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NGI

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Summary

This report summarizes the NBSs proposed by the agencies responsible for the three large scale demonstrator sites and the two smaller concept case sites during Month 15 to 24 of the PHUSICOS project. In addition, the report also provides short summarizes of the development after month 14 of the NBS projects which were reported in deliverable D2.2 (i.e. submitted and approved during months 1-14). The present report also focuses on challenges encountered and lessons learned from these.

During M15-M24, three new proposals have been submitted from the Serchio River Basin demonstrator case site and one from the Isar River concept case. The proposals from the Serchio River Basin comprise another intervention of vegetated buffer strips in an area of different soils from the first one, and a sedimentation basin, through which water from the two areas of buffer strips will flow. Hence these NBS measures together form a system for reducing soil loss from erosion and avoiding transfer of pollutants to the canals and eventually to Lake Massaciuccoli. The proposal from the Isar River concept case concerns an NBS summer school aimed at young professionals and students, to be held over a 10 days period in September 2020. The summer school is planned as a combination of classroom and field activities to be performed both in Munich and in the Pyrenees. The proposal is a joint effort between project partners TUM, CTP and BRGM. However, this event will most likely be postponed due to the current Covid-19 pandemic situation.

The previously approved NBS projects have all had activities during the reporting period but have also faced challenges. These are related to the tendering processes for procuring goods and services, local politics and bureaucracy, opposing land owners, and last but not least, the current Covid-19 virus situation, which has put a halt on a number of activities. Combined, these challenges lead to delayed implementation of the measures, which brought the PHUSICOS consortium to apply for a one year extension of the project.

WP2 is closely linked to WP3, WP4, and WP5, and emphasis is also given to the stakeholder involvement through the Living Lab processes, and to the data collection for the WP4 assessment framework. For the latter, collecting data for establishing baseline conditions, before measures are implemented, is particularly important, and WP2 follows this up with the site owners. In addition, many of the challenges faced at the sites are related to governance issues and therefore of interest to WP5.

Contents

1 Introduction

PHUSICOS will demonstrate the viability and up-scalability of nature-inspired solutions for reducing the risk of extreme weather events in rural mountain landscapes through implementation of such solutions in case study sites in Europe. The case study sites comprise three large-scale demonstrator sites and two supporting concept cases. Together, they represented a broad range of stages with regard to the implementation of NBSs at the start of the project in May 2018. Since the case studies form the backbone of PHUSICOS, over 45% of the PHUSICOS budget is dedicated to the implementation of NBSs at the case study sites. Work Package 2 (WP2) is responsible for the process and procedures for selecting the NBSs to be implemented, as well as for the implementation of the measures themselves.

This report, deliverable D2.3 is, as for D2.2, linked to all WP2 tasks; Task 2.1 (Selection of NBSs to be implemented) and Task 2.2 (Implementation of demonstration sites) and Task 2.3 (Implementation of NBS at concept sites) as described in the DoA – part A. This deliverable provides an overview of the NBSs approved for implementation during months 15-24 of the project. However, included in the report are also further information on the development of some of the proposals submitted before month 14, and assessment of challenges met regarding implementation of the proposed NBSs.

2 Summary of NBSs proposed and approved during months 1-14

By the end of June 2019 (month 14), seven NBS proposals were submitted from the Demonstrator case sites and two from the Concept case sites. Of these, three proposals from the Demonstrator case sites and both from the Concept case sites were approved (Table 2.1). Four proposals from the Pyrenees demonstrator case site were being processed by WP2 and the PHUSICOS Steering Committee (SC) and were awaiting approval.

The proposals from demonstrator case sites Gudbrandsdalen, Norway, and Serchio River Basin, Italy, as well as the two from the concept case sites, were all processed following the original procedures, described in deliverable D2.1 (PHUSICOS, 2018a). This procedure was revised after discussions in the consortium meeting in Vienna in the spring of 2019, and the proposals from the Pyrenees were all handled according to the revised procedure, which includes one more step between WP2 and the SC, in addition to a joint on-line meeting within the SC to discuss the proposals. This delays the final decision on the proposals, but it ensures that the final decision on approval or disapproval is better anchored in the project. The approval process, described in D2.1 (PHUSICOS, 2018a) and with the revision described in D2.2 (PHUSICOS, 2019a) could have been developed to a more quantitative and perhaps also more objective process, and elements which have been discussed include:

- Applying the WP4 assessment framework and MCA analysis to select the best proposals, thereby implementing a more quantitative assessment for selection.

- Using one or more external reviewers in addition to the project's Steering Committee.

The use of the WP4 framework, even a limited version of it, would most likely have delayed the process, as demonstrated by the current slow progress in establishing the baseline assessment. Although it might have given a better base for selection, project progress was favoured. Regarding potential use of external reviewers, this was decided not to pursue, as the total partnership represents a broad spectrum of sciences and practitioners and would be able to provide balanced feedback to the proposals.

Furthermore, a simple scoring scheme has been made for the evaluation of the proposals (PHUSICOS, 2018a), but it has been up to each partner to apply it or not. Hence, most of the assessments have been done qualitatively, without using the scoring scheme. Still, however, several rounds of commenting, with revisions and response from the proponents, serve to greatly improve the proposals and ensure that the most important aspects of NBSs are safeguarded.

Whereas the site owners are working towards implementation of the approved measures, there have been several challenges resulting in changes and delays for the demonstrator case sites in Norway and in the Pyrenees. The challenges are related to topics like the tendering process, bureaucratic routines, local politics and private land owners, and are all described and discussed below. The proposals from the concept case sites, the Kaunertal Valley and the Isar River, have not faced such challenges and are proceeding more or less according to the original plans.

Table 2.1 Status of PHUSICOS NBS proposals by M14 (PHUSICOS, 2019a)

Site	Proposal	Submitted	Revised	Approved	Budget (kEuro) Total/PHUSICOS	Status
DS-Gudbrandsdalen, Norway	Receded green flood barrier	19.12.2018	14.01.2019	20.02.2019	1250,00 / 732,00	Out for public procurement
DS-Serchio River Basin, Italy	Buffer strips along canals in a portion of the area of Lake Massaciuccoli	11.03.2019	27.03.2019	08.06.2019	1282,90 / 657,70	Approved, but working on improving the measure after comments from the Steering Committee
DS-Pyrenees, Spain	Landslides, Santa Elena (Spain)	30.04.2019	No revision	05.07.2019	571,25 / 342,75	In process within the SC
DS-Pyrenees, France	Snow avalanches, Baréges (France)	30.04.2019	To come	To come	328,00 / 196,80	Approval process to start
DS-Pyrenees, France	Torrents, Bastan River (France)	30.04.2019	To come	To come	520,00 / 312,00	Approval process to start
DS-Pyrenees, France	Rock fall, Artouste (France)	30.04.2019	To come	To come	445,50 / 267,30	Approval process to start
DS-Pyrenees, France	Torrents, Socques (France)	30.04.2019	To come	To come	522,00 / 313,20	Approval process to start
CCS-Isar River, Germany	Look and learn' visit; workshop and excursions	19.12.2018	No revision	22.01.2019	8,90 / 5,40	Visit and workshop 20.03-22.03.2019
CCS.Kaunertal, Austria	Altitude adapted and microbe assisted seed mixture to reduce erosion in high mountain environments	22.02.2019	06.03.2019	22.05.2019	854,00 / 35,00	Most work to be covered by UNIVIE and PLUS. Only small amount (35 kEuro) set off for subcontracting

The proposed measures (Table 2.1) were described in detail in deliverable D2.2, and only brief summaries are provided here, as background for description of the subsequent development of these NBSs and for the new ones proposed, as well as the ones that will be proposed also after month 24. The descriptions provided in D2.2 (PHUSICOS, 2019a) also comprise short reports on the stakeholder involvement/Living Lab processes at the various case sites.

Demonstrator case site Gudbrandsdalen, Norway

The Gudbrandsdalen valley in central south Norway, regularly experiences severe floods as well as landslides, and a 'Masterplan' for the valley has been established, comprising several measures, thus defining a good background for proposing NBSs to PHUSICOS. The proposal that was submitted and approved consisted of constructing a receded, green flood barrier up to 200-300 m away from the river Gausa, a large tributary river to the main river Gudbrandsdalslågen, flowing through the valley. The measure will provide more controlled space for the river, allowing the control and confinement of flooded areas during extreme events, both maintaining the riparian vegetation on the floodplain and reducing flood velocity. Thus, it will reduce the erosional power and transport capacity of the river which, during flooding events, cause significant detriments in the confluence area between the two rivers.

Demonstrator case site Serchio River Basin, Italy

The proposals from the Serchio River Basin, Italy, are mostly designed to reduce runoff from the farmland to a system of canals next to Lake Massaciuccoli close to the Tuscan coast. The lake is highly polluted by agricultural activity and has a salinity comparable with that of sea water. There is a requirement to improve the quality of the lake in order to fulfil the EU Water Framework Directive. This can be done by a combination of measures in the surrounding farmland and measures to avoid significant lowering of the lake water level during droughts, to prevent sea water from penetrating into the lake through the main canal between the lake and the sea. The latter will be mitigated by bringing in water from the Serchio River through a diversion pipeline, whereas measures in the farmland are proposed to PHUSICOS. The proposal submitted to PHUSICOS during the first phase of the project was to construct a set of vegetated buffer strips between the farmed fields and the canals in an area south-east of Lake Massaciuccoli. Runoff from the farmland into the canals eventually end up in the lake, and the measure should be intended as a first step of a system of buffer strips and retention basins, aimed at mitigating both the propagation of pollutants and the erosion and sediment transfer to the main canals, and eventually to the lake.

Demonstrator case site the Pyrenees

Five NBS proposals were submitted from the Pyrenees but were not yet approved by the Steering Committee at the time of writing of deliverable D2.2 (PHUSICOS, 2019a). The proposals comprised measures at three sites along highway A-136 / RD-934 (named differently on the Spanish and French side, respectively), an important road between France and Spain. At *Santa Elena, Spain,* the main issue is related to erosion of a road cut through a large block-rich till ridge. This results in frequent rockfall on to the road

at a location where the visibility for drivers is limited through a curve and the speed is often high. The proposed measure is a combination of slope terracing and revegetating with species suited to minimize the erosion. At *Socques, France,* along the same road, the main issue is related to torrents, which threaten the road and have damaged it repeatedly. The proposed measure was a set of check dams constructed of wood, combined with erosion protection along the banks, upstream of the road. The third location along road RD-934 is at *Artouste, France*, where rockfall from ledges in a very steep slope hits the road, and also has led to a fatal accident in recent years. The proposed measure consists of wood structures close to the ledges to prevent release of blocks, combined with wooden barriers shortly downslope of the ledges to stop blocks from travelling further, combined with forest maintenance to preserve a protective forest in the slope.

Two other NBS proposals on the French side are located in the *Bastan Valley*. One measure is afforestation in the upper parts of the *Capet forest* area, where snow avalanches often are released and follow well-known avalanche paths. These threaten the *village of Baréges* and have also hit the village, often causing serious damage. Through planting of well selected tree species, protected by wooden tripods, release of avalanches along the most dangerous avalanche path will be prevented, together with velocity reduction of released snow avalanches. The last proposed NBS consisted of two individual measures to mitigate against flooding and erosion in the *Bastan and Gavernie rivers*. The first is to construct a set of steps and pools along a 1 km stretch of the Bastan river using local rock material and to combine this with redesign of the river cross section, aimed at providing both erosion protection and greater flowing capacity during floods. Whereas this measure is planned a few km upstream from the river mouth, the second part of the measure is planned at the confluence zone where the Bastan River meets the larger Gavernie River. The proposed measure aims at removing a concrete construction which causes a hydraulic obstacle, combining it with both a small receded barrier and erosion control in the confluence area.

Concept case site Isar river, Germany

The Isar concept case is a 'retrospective case'. Measures to reduce flood risk and improve the ecological state of the river and its immediate surroundings were taken several years back in time and the previous Isar restoration project ended in 2011. This represents a very high learning potential for the PHUSICOS project, regarding the assessment of both the implemented measures and the participative process of stakeholders' involvement. The proposed and approved action was a 'look and learn visit' to the Isar in March 2019. This comprised field excursions along the river in the vicinity of Munich and to the upper reaches of the Isar, in addition to a workshop with key actors of the project, including representatives from relevant stakeholder groups. Moreover, a visit to the hydraulic test facility, where model experiments had been carried out prior to the implementation of the measures, was also included.

Concept case site Kaunertal, Austria

The Kaunertal concept case is an innovative small-scale research project with the aim of revegetating barren slopes in high alpine areas, such as those left by retreating glaciers, devoted to reducing erosion from these slopes. The proponents of the measures in the Kaunertal Valley will a) test the potential of high alpine plant species in reducing erosion and b) identify microbes with the ability to assist the plants in establishing in areas prone to soil loss. Thereafter the aim is to use the local microbes to enhance plant growth, exclusively applying autochthonous species without introducing external species and microbes into the area. The work consists of a combination of laboratory and field experiments using several plots in the slopes of the Kaunertal Valley. The measures have a large upscaling potential, and the methods may also be of interest for other PHUSICOS sites, such as some of the sites in the Pyrenees (above).

3 Update on activities of the NBSs proposed and approved during months 1-14

3.1 Demonstrator site Serchio River Basin, Italy

The initial proposal submitted from the Serchio River Basin case site, for constructing a set of buffer strips between the farmland and canals south-east of Lake Massaciuccoli (PHUSICOS, 2019a) (Table 2.1) and work is currently being carried out for the implementation of the measure. Implementation activities cannot take place at any time but have to be carried out in accordance with the farming seasons.

Founded in Italian regulations, the construction work can be carried out by the farmers who own the land, using their employees and machineries, providing a work esteem lower than a threshold set by the EU. Due to significant support from the local administration, as well as from the farmers, the buffer strips will be implemented without the need of expropriation.

The area devoted to the buffer strips has been currently 're-profiled' to define the necessary slope for water flow, through the buffer strips, into the canals. As a second step, the strips, as well as the rest of the farmland, will be sowed. This has been delayed due to the restrictions set by the Covid-19 emergency, but as these are currently being lifted, the buffer strips are expected to be eventually implemented during spring or summer season of 2020.

Finally, ADBS is currently preparing for monitoring of the effects of the measures on both soil and water. They have requested quotes from 5 companies, from which they will choose one deliverer, based on the best combination of price and technical quality, i.e. folowing the 'best value for money' principle.

This field of buffer strips constitutes the first part of a larger system, which in addition to another area with buffer strips, also includes a retention basin, both of which have been proposed later (below).

3.2 Demonstrator site The Pyrenees, Spain and France

The NBSs in the Pyrenees are managed differently from the other demonstrator case sites. Three regional organizations (now two, see below) were responsible for the proposed NBSs, with CTP as the coordinating organization: the French National Forest Office (ONF), the European Grouping of Territorial Cooperation – Space Portalet (EGTC Space Portalet) and Pays de Lourdes et des Vallées des gaves (PVLG). For legal reasons, CTP cannot receive the EU funding, and as a consequence, NGI is handling the economy for the demonstrator cases in the Pyrenees. Therefore, it was necessary to sign agreements between NGI, CTP and each of the organizations. These agreements are at this stage all completed and signed.

After issuing report D2.2, the remaining four NBS proposals from the Pyrenees were all approved (Table 2.1). However, two of the proposals have since then been called off:

Torrents, at Socques, France. This was cancelled because the proposed NBS measures were considered inadequate to significantly reduce the risk when extreme events occur. Furthermore, it would be too expensive to upscale the measures to an extent more likely to fulfil the purpose, and the uncertainty regarding its risk reducing potential would still be there. Lastly, the national park status of the area sets limitations to how the measures could be constructed.

Torrents in the Bastan Valley, France. The NBSs proposed at this site were split between two locations. Firstly, a stretch of the Bastian River, of about 1km length, was planned to be recalibrated to lower both the water velocity and the erosive capacity. The proposed measures were a combination to create a 'step and pool' long profile of the river, and a terraced cross profile to create more space for floods along the river, combined with erosion control using local rocks. The other part of the proposed measures was to remove a concrete construction that forms an obstruction for natural flow at the confluence point where the Bastan River enters the main river. This was to be combined with erosion control and a small receded barrier.

This NBS project was called off due to political, economic and bureaucratic reasons. The organization responsible for this proposal, the PVLG, was uncertain that they could complete all the work during the time span of the PHUSICOS project, even with the proposed one-year extension of the project. Local elections and the possibility of having a new local government and mayor, also adhered to this. As expenses obtained after the project's end cannot be refunded by the EU, the PVLG found the economic risk too high, and their general assembly voted against the project.

For the remaining three NBS projects, the current status is as follows:

St.Elena, Spain (erosion with landslides and rock fall) and Artouste, France (rock fall): The EGTC Space Portalet is the regional organization responsible for both these sites, and the hazards to be mitigated affects the same important road A-136 / RD-934 between France and Spain. The final agreements for the sites were not signed until 19.03.2020, and therefore practical work towards implementation has been sparse until now, whereas detailed working plans have been made. Key elements in the planning for both the sites include:

- A detailed 'road map' for the project, with planned activities per week during 2020.
- Identification of stakeholders to be involved in the Living Labs. These are different groups for each of the sites.
- Agreements with University of Zaragoza and the Polytechnic University of Madrid on the detailed design of the measures, to come up with the optimal alternative for the NBS to be implemented.
- Preparations for the tendering processes for the implementation phase, which is planned to take place during 2021.

In addition to the abovementioned planning steps, PHUSICOS project partner CREAF has visited both sites and taken soil samples as part of the baseline assessment, prior to the measures' implementation (Figure 3.1 and Figure 3.2).

Figure 3.1 Soil sampling team by the till slope at St. Elena, Spain, during late fall, 2019. (Photo by CTP)

Figure 3.2 At the road below the rock fall prone slope at Artouste (left) and soil sampling in the slope above the road (right). (Photo by CTP)

Bastan Capet, France (snow avalanches):

The organization responsible for this site is ONF, The French National Forest Office. The agreement between ONF, CTP and NGI was signed on 19.12.2019, and more time has been available for planning and actions at this site. Work carried out includes:

- A study of tree species suitable for afforestation in the release areas for avalanches, involving the following relevant organizations in addition to ONF: Conservatoire Botanique National des Pyrénées, Parc National des Pyrénées, and Département Santé des Forêts.
- Three meetings with the above organizations and other stakeholders.
- Mapping, evaluation and delimitation of the area best suited for forest as avalanche hazard control. Final choice of the avalanche path (the 'Midaou corridor') to be reforested.
- Mapping of the exact areas to be reforested, and detailed design of the planting scheme, with trees in groups of two different dimensions (Figure 3.3).
- Defining and acquiring wood supplies for the tripods.
- Tender process and selection of the supplier of 8000 seedlings to be planted in 2021.

PHUSICOS project partner CREAF visited the site during two periods in August and September 2019, to perform a soil sampling campaign and set up 32 plots for measurements of carbon storage in the soil (Figure 3.4 and Figure 3.5).

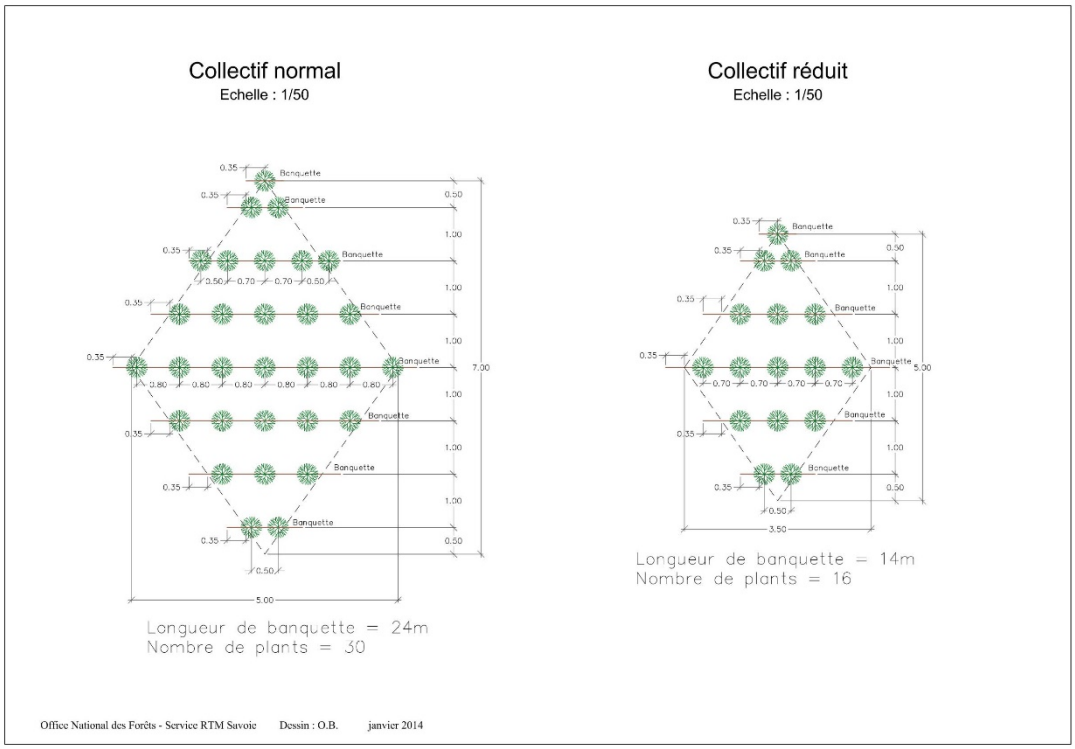

Figure 3.3 Design example of the planting in two different configurations, 7x5m / 30 plants (left) and 5x3,5m / 16 plants (right), respectively.

Figure 3.4 Site visit for soil sampling and establishing plots for measurement of carbon storage capacity of the soils in the avalanche release zone.

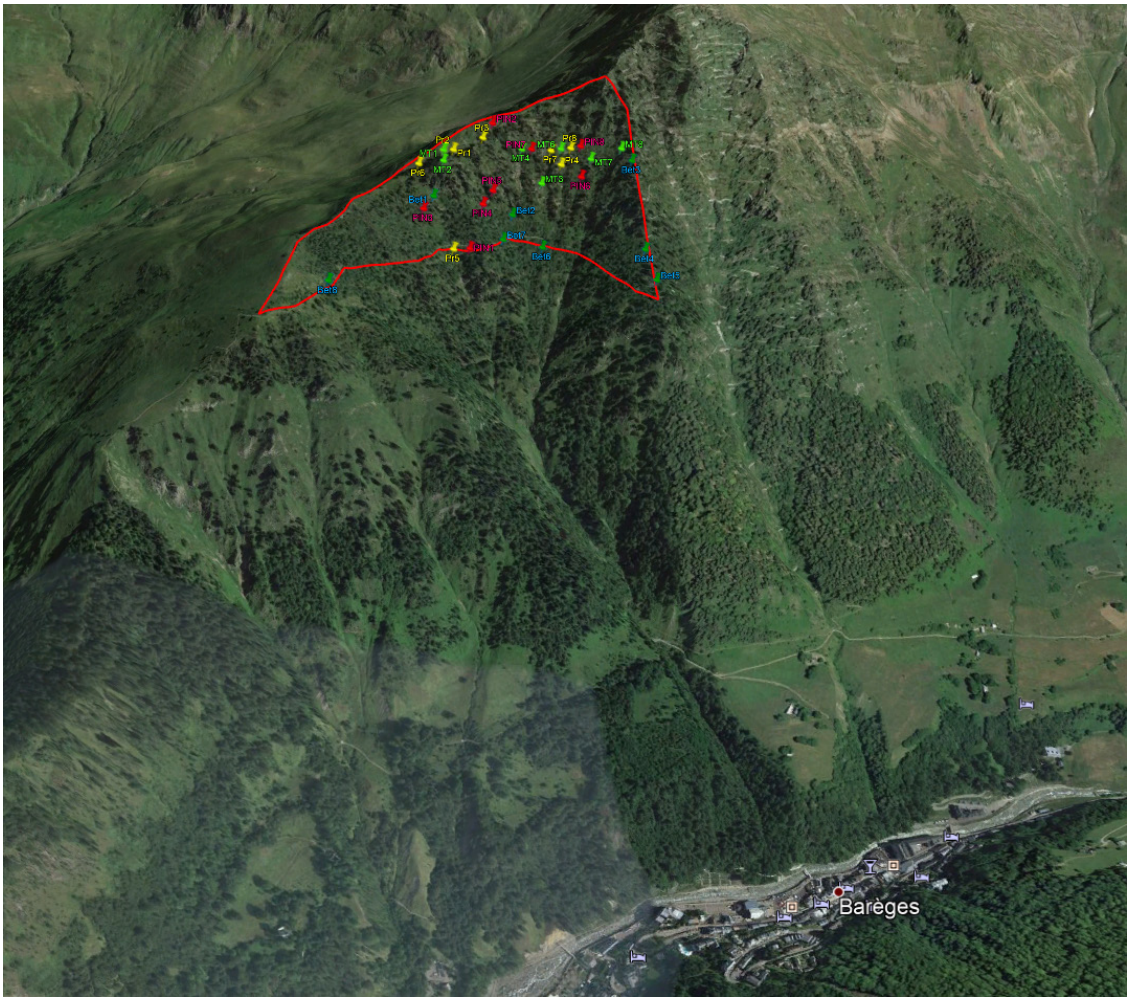

Figure 3.5 Sampling stations and plots for carbon storage monitoring in the release area of the Mideau avalanche path. The village of Barèges is seen at the bottom of the avalanche path. (Figure made with Google Earth)

3.3 Demonstrator site Gudbrandsdalen, Norway

Receded green flood barrier, Jorekstad

The proposal for a receded flood barrier at Jorekstad in the lower part of Gudbrandsdalen valley was approved in February 2019 (Table 2.1). Shortly thereafter, a call for tender for the detailed design of the measure was sent out and one consultant awarded the contract. Two events, however, have led to significant delays with regards to implementation:

Complaint from one of the bidders for detailed design

One of the bidders submitted a formal complaint, which had to be handled according to formal protocols. The tendering process itself is rather time consuming, and the handling of the complaint delayed the process for another 2-3 months.

New land use plan

A new land use plan for the area had to be made for the building of the barrier to be allowed. This is the responsibility of Lillehammer municipality, in which the site is located. The job of making the new plan had to be sent out for another tendering process. The contract for the job of re-regulation was awarded, and the draft plan has been made. However, before the plan can be approved by the municipality, it has to be out for an open public hearing for a certain time period. At this stage, the public hearing is completed, and a number of comments were received. This has led Lillehammer municipality to freeze the process, including the finalizing of the detailed design of the measure.

Main concerns are from land owners and local stakeholders. Some are directly related to the measure itself, and comprise the use of agricultural land, issues with buried drainage in the fields, compensation for loss of farmland, as well as concerns regarding the flood protection. Others have a more general character, not directly pointed at the NBS measure, and yet some are related to economic perspectives concerning the profitable gravel outtake after each flooding event.

At present (May 2020), the county administration is working with Lillehammer municipality to handle the comments and to have the new plan approved. The construction work has to be set out through a third tendering process. The aim is still to start construction in the fall of 2020, but at present this depends on Lillehammer municipality and is still uncertain. The final cost is an issue of main concern for the municipality, in case the comments from stakeholders may lead to severe changes of the original plan. Furthermore, the current Covid-19 emergency receives much attention from the local authorities, further slowing down the handling of the land use plan.

As part of the preparations for the construction of the barrier, and also as part of the baseline assessment for the site, a drone photography session was carried out over the site in the late fall of 2019, before snow covered the ground (Figure 3.6).

Figure 3.6 Drone photo of the outer parts of the Gausa river, where it meets the main Gudbrandsdalslågen river. The planned barrier will come in from the lower right, along the pile of white, plastic covered hay balls, and protect the sporting facilities and the buildings behind it. The city of Lillehammer in the far background. (Drone photography by Multiconsult).

3.4 Concept case site The Isar River, Germany

The proposed 'Look and Learn' visit was performed and reported according to the plans. A short film was made about the Isar project and NBS in general. Further relevant activity has been the preparation of the next proposal, for an NBS summer school (below).

3.5 Concept case site The Kaunertal Valley, Austria

The studies of the concept case site in the Kaunertal valley is continuously proceeding, and main activities during the reporting period of months 15-24 include:

- 18 erosion plots were installed along the succession gradient and baseline erosion measurements were completed.
- Suitable plants for revegetating the slopes were chosen and the local micro-biome screened for advantageous bacteria.

- Plans for the summer of 2020 have been made, and these include testing a common seed mixture with bacteria along the succession gradient and validate the efficiency of the NBS with erosion and ecological measurements.

The project group has been facing problems of getting enough seeds to cover the plots as planned. Hence, they have had to split the validation of the method. To validate the principle of enhancing seed growth with bacteria and reducing erosion, they will test a standard seed mixture, that has been developed for crystalline mountain ranges above 1700 m a.s.l. in the erosion plots. This will be combined with standard bacteria that has been used in agricultural practises before. To validate the selected plants with the local microbiome, laboratory tests and smaller plots are being installed in the field, where unfortunately no direct erosion measurements can be performed.

The project also continues to have an active dissemination strategy:

- Newsletters and personal meetings with stakeholders (replaced by calls and on-line meetings due to the Covid-19 situation).
- School workshop with all primary school children planned for September 2020.
- A new long-term museum exhibition in the valley, where results of the project is presented.
- Production of e-learning videos for children.

As Austria, and particularly the region of Tirol was seriously hit by the Covid-19, the plans for field work and meeting activities for the spring and summer of 2020 are on hold, and the current situation may lead to a one-year delay in the project.

4 New proposals, month 15-24

New proposals have been made only from the Serchio River Basin demonstrator case site and from the Isar River concept case site during this reporting period. Table 4.1 shows the updated list of proposed and approved NBSs at the various sites, and their stage towards implementation. However, all the sites have had significant activity, reported above, and there are proposals expected within this year, as briefly discussed below.

Table 4.1 Overview of the presently (May 2020) proposed and approved NBS projects, and their current status.

Site	Proposal	Submitted	Revised	Approved	Budget (kEuro) Total/PHUSICOS	Status / Comments
DS-Gudbrandsdalen, Norway	Receded green flood barrier	19.12.2018	14.01.2019	20.02.2019	125 000 / 73 200	Detailed design before construction. Preliminary stopped for political reasons
DS-Serchio River Basin, Italy	Buffer strips along canals in the area of Lake Massaciuccoli	11.03.2019	27.03.2019	08.06.2019	575 913 / 336 537	Under implementation
DS-Serchio River Basin, Italy	Extension of buffer strips to area with different soils.	20.12.2019	18.02.2020	14.05.2020	342 178 / 199 953	In planning stage and Living Lab activities ongoing
DS-Serchio River Basin, Italy	Retention/ sedimentation basin.	20.12.2019	18.02.2020	14.05.2020	533 894 / 311 983	In planning stage and Living Lab activities ongoing
DS-Serchio River Basin, Italy	Educational 'NBS Lab'.	20.12.2019	18.02.2020	14.05.2020	52 194 / 30 500	In planning stage and Living Lab activities ongoing
DS-Pyrenees, Spain	Landslides, Santa Elena (Spain)	30.04.2019	No revision	05.07.2019	577 763 / 346 657	Detailed planning is ongoing. University studies to optimize design. Preparing tender documents for implementation phase
DS-Pyrenees, France	Snow avalanches, Baréges (France)	30.04.2019	19.07.2019	28.09.2019	334 512 / 200 707	Detailed plans ready. Tenders out for supplies and construction. Delayed due to Covid-19
DS-Pyrenees, France	Rockfall, Artouste (France)	30.04.2019	30.08.2019	14.11.2019	452 012 / 271 207	Detailed planning is ongoing. University studies to optimize design. Preparing tender documents for implementation phase
DS-Pyrenees, France	Torrents, Bastan River (France)	30.04.2019	19.07.2019	28.09.2019	635 712 / 381 427	Called off by owner (PVLG). Cannot guarantee completion within the project period and consider the economic risk too high
DS-Pyrenees, France	Torrents, Socques (France)	30.04.2019	n/a	n/a	n/a	Called off by CTP/BRGM. Proposed NBS may not work at this site
CCS-Isar River, Germany	Look and learn' visit;	19.12.2018	No revision	22.01.2019	890 / 540 (Euro)	Visit and workshop 20.03-22.03.2019
CCS-Isar River, Germany	Summer School, Isar and Pyrenees	10.02.2020	14.02.2020	09.03.2020	89 895 / 28 615	Planned for 05-14.09.2020. Most likely delayed 1 year due to Covid-19
CCS.Kaunertal, Austria	Altitude adapted and microbe assisted seed mixture to reduce erosion in high mountain environments	22.02.2019	06.03.2019	22.05.2019	854,00 / 35,00	Most work to be covered by UNIVIE and PLUS. Only small amount (35 kEuro) set off for subcontracting

4.1 Demonstrator case site Serchio River Basin

Three new proposals were submitted from the Serchio River demonstrator case site. These have all been processed according to the agreed protocol and they were all approved on 14.05.2020 (Table 4.1).

4.1.1 Proposal P2: Buffer strips Case B: Extension of the buffer strips in the peaty areas south of Lake Massaciuccoli

This NBS represents one of several to be implemented in addition to the large state funded project on diverting fresh water from the Serchio River to the lake. A diversion pipeline will lead water to the one of the main canals, the Fossa Nuova Canal, through which it will feed into the lake. This will help decreasing the salinity of the lake, which is currently high (close to that of seawater). The water level in the lake is at sea level, and the inflow of river water will also help keep the water level from falling below sea level during dry periods, and thereby reduce the risk from inflowing sea water in these periods.

The main role of the buffer strips (Figure 4.1) is to provide a barrier and to increase the permeability of the soil along the channel bank, in such a way to intercept the runoff from the farmland by the vegetation and allow its infiltration into the soil before flowing into the canal. Furthermore, the strip vegetation, acting positively in the retention of eroded soil particles, can limit the water transfer of pollutants and play an important role in maintaining biodiversity and diversifying the agricultural landscape.

The current proposal is to establish another set of vegetated buffer strips between the agricultural fields and the system of canals. There are three hierarchic categories of canals, based on their size, which convey water into the lake, and thus also run-off containing eroded sediments and pollutants from the farmland. This proposal is similar to the first approved buffer strips proposal, affecting the tertiary (smallest) level of canals, but working in an area with different soils. Whereas the first area of buffer strips, currently being implemented, have mostly clayey soils, the new proposal is focused on an area of peaty soils (Figure 4.2). In addition to cover a greater proportion of the whole area, the two different sets of buffer strips allow comparing the effect of the measures in different soil conditions. The amount of soil eroded from corn fields can vary in range from 194 to 744 kg/ha/year, and the proponents expect to reduce the soil loss by >60% with these measures.

Another aspect of the proposed areas of buffer strips, is that they provide an opportunity to compare the NBSs with the farming practice called Conservation Agriculture (CA), which pursues the same goal (reduction of soil and nutrient loss from cultivated fields) through a different strategy. The CA is based on the abandonment of soil tillage and on the attempt to maintain soil as much as possible covered by vegetation. The CA practice also needs the introduction of permanent crops (such as fodder crops or fruit trees). However, the socio-economic conditions in of the considered area do not allow such a

deep change of the agricultural practices. Thus, it is of great interest to assess the capability of the proposed NBSs in providing similar positive effects, forming an integral part of this system of interventions, able to improve the environmental features of the lake and of the surrounding areas.

The two areas of buffer strips form parts of an integrated system, whose third part is a retention basin (Figure 4.3), subject of the third proposal from this demonstrator case site (proposal P3, below). Jointly, the two areas of buffer strips and the retention basin will affect roughly 15% of the total area of farmland southeast of Lake Massaciuccoli, thus having a great upscaling potential, both here and in the surrounding areas.

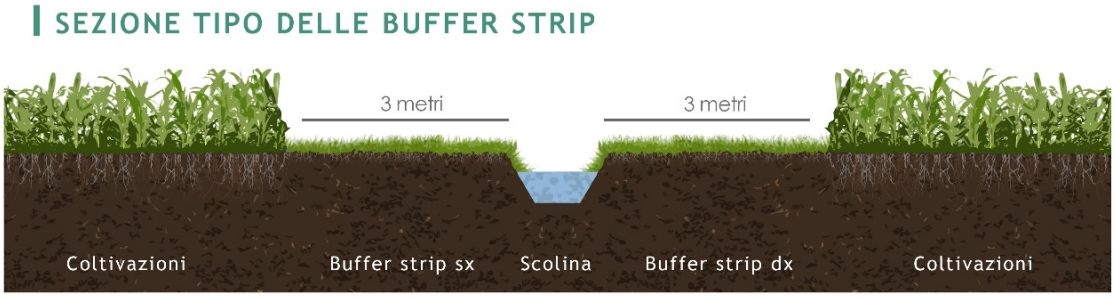

Figure 4.1 Schematic cross section of the planned buffer strips

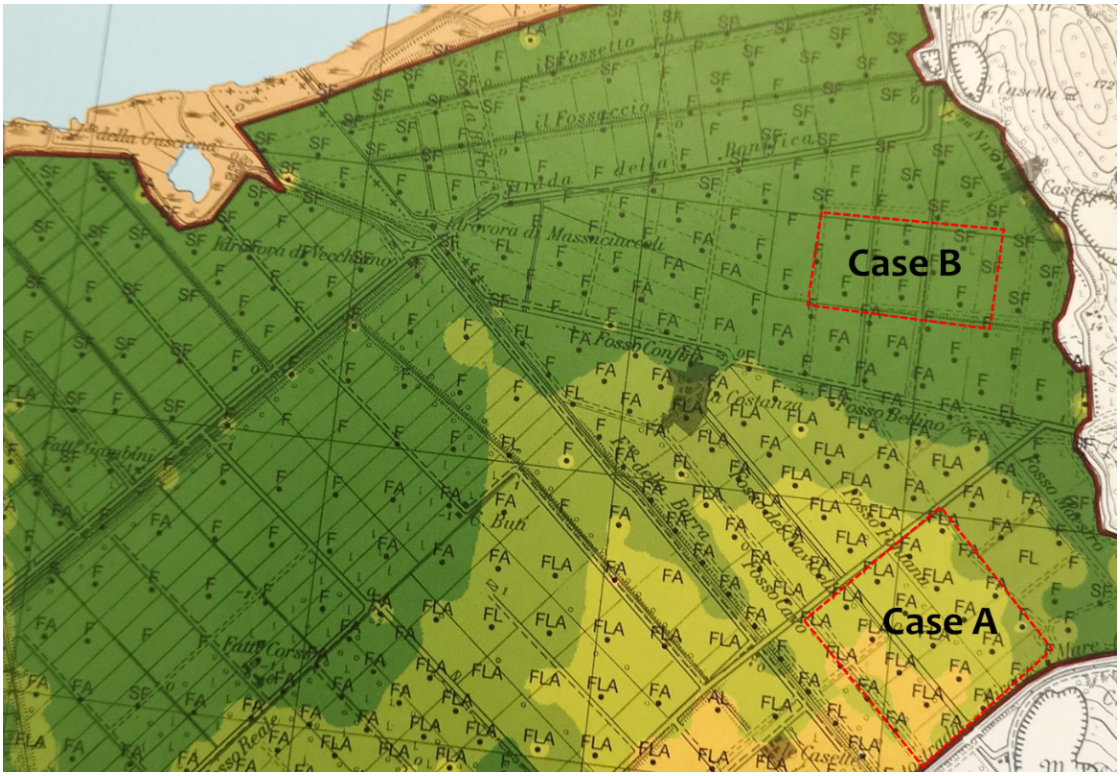

Figure 4.2 Content of organic substances in colouring from green (> 10%) to yellow (0% to 3%). Organic matter analyses are performed by the University of Pisa (Paglialunga et al., 2003).

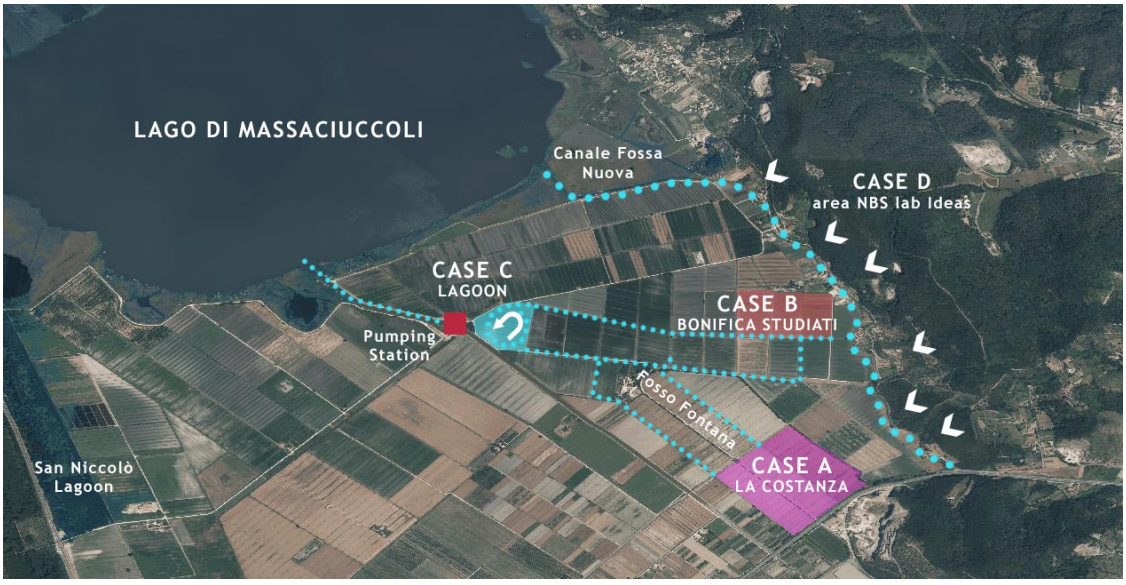

Figure 4.3 Orthophoto from 2013 showing the two areas of buffer strips (Case A and B) and the location of the retention basin (Case C). The figure also shows the main Fossa Nuova canal, to which the diversion pipeline will lead water from the Serchio River during dry periods. Case D in the hills to the east, marks the third proposal (below).

Co-benefits

In addition to the reduction of erosion and soil loss, which a serious effect of floods in this area, and of the transfer of pollutants to the canals and eventually to the lake, the proponents point at several other co-benefits from the total, integrated set of NBS measures, comprising the two areas of buffer strips and the connected retention basin (proposal P3, below):

- A general improvement of the ecosystem of the area and the lake and enhancing biodiversity.
- The larger system of interventions, which also comprises the transfer of water from the Serchio River to the canal system and the lake, lead to an increase in both water quality and quantity for the farming and other activities in the area.
- The improved ecological state will in the long run make the area increasingly attractive for activities by the citizens as well as for tourists, thus bringing economic benefits to the region.
- The proponents are in dialogue with the Tuscan Region to consider the buffer strips as 'Ecosystem Services for Payment' (PES) so that a fee can be paid to farmers who agree to cooperate, as a reward for a service provided to the community for improving the ecosystem and the environmental status of the site. Hence, this would serve as a useful test case for promoting this approach in Italy.
- The proponents observe a growing interest in the measures and in NBS in general, both among the farmers and in the public administration. Hence, if this can lead to increased use of NBS, it may again lead to savings in public investments due to reduced risk and less costly maintenance over time.

Stakeholder Involvement – Living Lab

Stakeholders involvement started with the first buffer strips proposal and was actively taken into consideration to design the measure (PHUSICOS, 2019a). A first result from the participative approach was the agreement of the strips width, set equal to 3 m on each side of the channels (Figure 4.1). The participants represented public and private organizations, of which probably the most important ones were from the agricultural side, i.e. farmers and agricultural authorities. Indeed, farmers are particularly influential stakeholders in this area. The same group of stakeholders will be activated for the Living Labs for the entire system of buffer strips and the retention basin (proposal P3, below).

ADBS has set up a detailed plan for LL sessions (Figure 4.4), in which sessions are held before (co-creation and co-design phase), during, and after implementation of the measures. The sessions during the implementation phase will also include site visits to monitor the work progress. Furthermore, ADBS puts great emphasis on the sessions planned after the measures' implementation. This is a phase when experiences can be systemized, and improvements can be decided for future NBS projects. ADBS has already reported increased interest among other farmers, and therefore, the upscaling potential is significant.

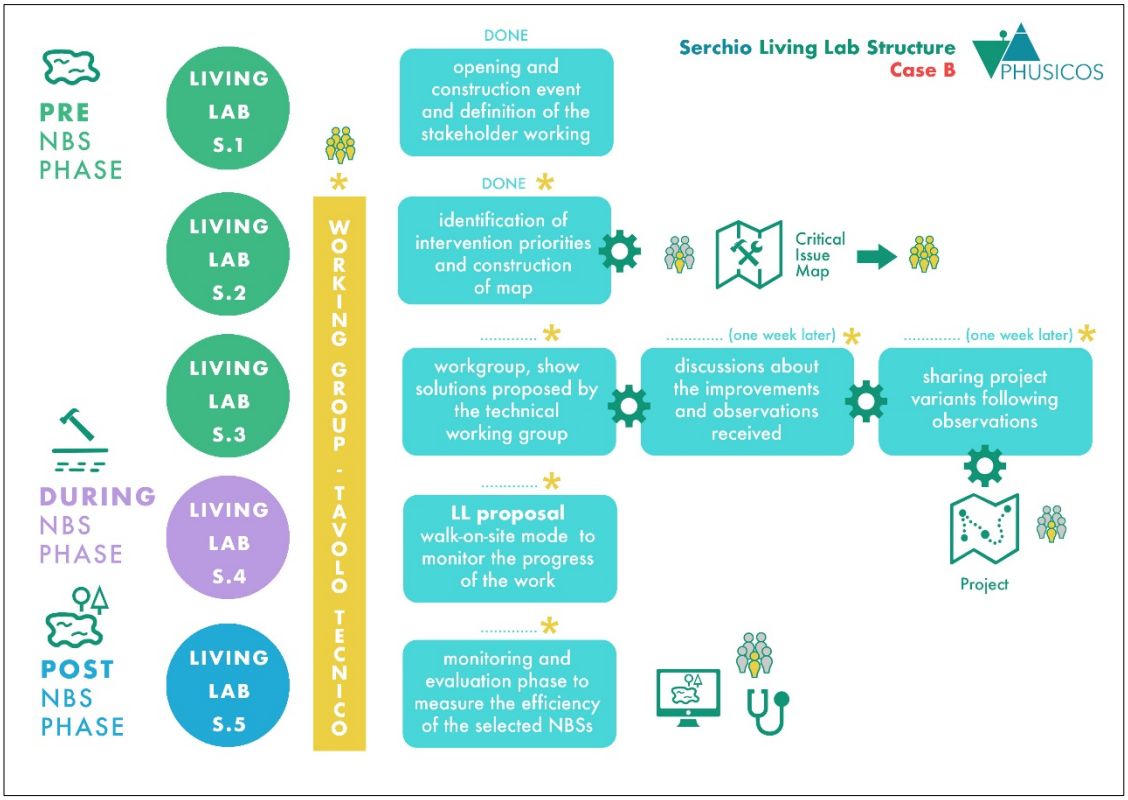

Figure 4.4 The structure of the LL designed for the proposed measures. Stakeholder meetings have already started.

The first two sessions sketched in Figure 4.4 (S.1 and S.2) have already been held and included mapping of issues that are critical to the stakeholders. The third session of the 'pre phase' is planned for this spring of 2020.

4.1.2 Proposal P3, A retention basin to improve the quality of the water supplied to Lake Massaciuccoli

The proposed retention basin (Table 4.1) forms the last part of a three-component system with the two buffer strip areas (Figure 4.3). The basin is placed immediately upstream of the main pumping station for this area and is aimed at mitigating the risk of transferring sediments and pollutants from the surface water to the pump system and further to the canal and into the lake. The basin is planned to favour soil particle sedimentation using a calculated ratio between length and width. Moreover, to force water to follow a defined path (Figure 4.5), the retention basin will be constructed by excavating and linking four treatment cells. The natural treatment of the water will be also improved using hydrophyte plants along the path. The water will enter the basin through a non-return bulkhead and then exit after having run through the vegetated path.

There is another retention basin in the area, the San Niccolò Lagoon (Figure 4.3), but this requires a pump to fill the basin, and it is not part of an integrated system, such as the NBSs proposed for PHUSICOS. Nevertheless, the existing facility was an inspiration for this proposal, with the aim of taking this further in the NBS perspective. Experience from the San Niccolò Lagoon will also be gained on the plant species to use in the new retention basin, although they most likely cannot be exactly the same.

Co-benefits and stakeholder involvement

As the proposed retention basin is the final part of an integrated system with the buffer strips, the same co-benefits apply to this proposal as for proposal P2 (above). The same status regards the Living Lab process. This will consist of the same group of stakeholders and follow the same set-up as for the buffer strips (Figure 4.4). The proponents will pay particular attention to keeping the same group of individuals through the entire process (Figure 4.6).

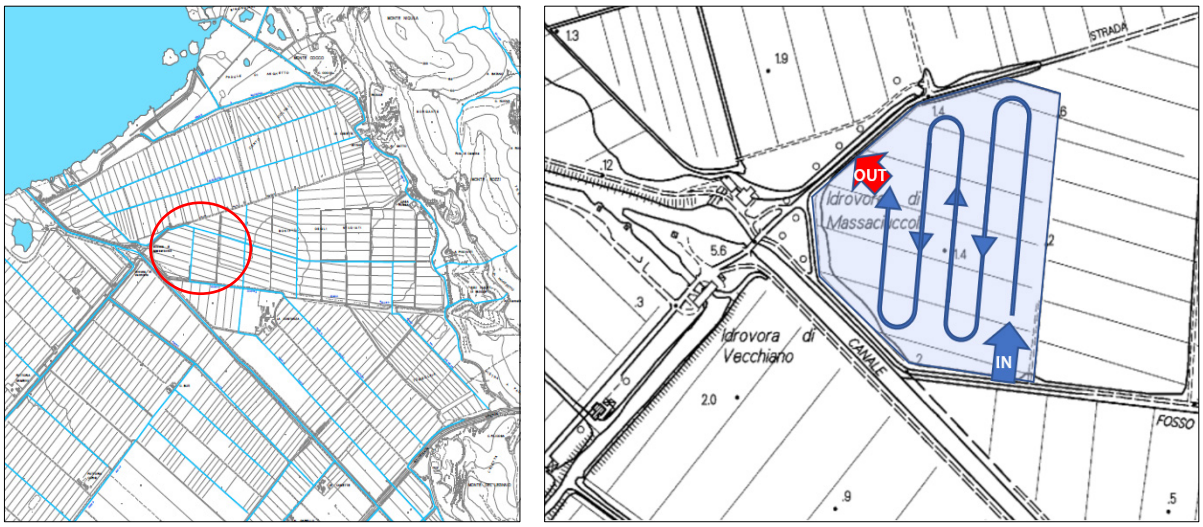

Figure 4.5 Details of the canal system and the retention basin of this proposal. The proposed water circulation system is showed respectively with the entering point (blue arrow) and the exit point (red arrow), where the pumping station is located.

Figure 4.6 Photo from a Living Lab session in October 2019, to assess and map critical issues for the proposed measures.

4.1.3 Proposal P4: Set up an "NBS lab"; Pre-conceptual ideas for tackling erosion of the eastern slopes of Lake Massaciuccoli

This fourth proposal from the Serchio River Basin demonstrator case site is an initiative for dissemination and competence building for NBS (Table 4.1). The proponents want to use experience from the other NBS measures in the area (proposals P1 (previously approved), P2, and P3, above), as well as other PHUSICOS experiences in a teaching and dissemination program (Figure 4.7). The activities are split in three actions which are targeted slightly differently between the participant groups.

The first action, termed 'Information' (Figure 4.7), comprises stakeholders involved in the Living Lab process for the other NBS measures in the area but extended to the participant groups of the other two actions in the proposal, professionals and students (see below). In addition, the media will be invited to attend. This action is to spread information about the NBS activities going on and increase the awareness of and interest for this type of measures and their many co-benefits.

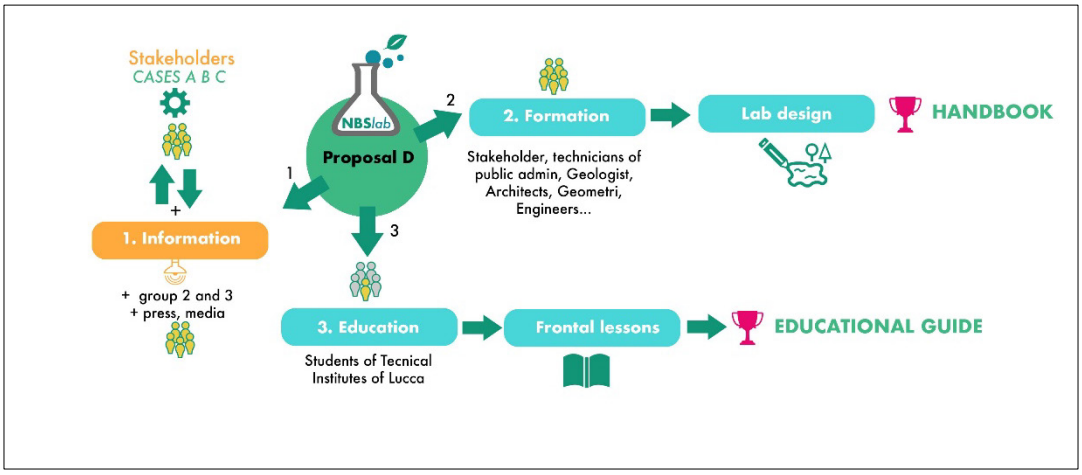

Figure 4.7 The structure of Proposal P4 from the Serchio River Basin demonstrator case site.

The second part, termed 'Formation' in Figure 4.7, is more directed towards professionals and technicians within a range of relevant fields, that also took part in the first action. The concept for this action is to involve the participants in discussion, planning and design of potential NBS measures. The action is more directly pointed at reducing the risk from erosion and landslides in the slopes to the east of Lake Massaciuccoli (Figure 4.3 and Figure 4.8). This action is also meant to comprise work and discussions in the field, and it will result in a 'handbook' of measures to mitigate erosion and landslide risk in the study area. Issues like hydraulic safety plans and programs, urban planning regulations and landscape regulations for cultural heritage will all be treated in this action.

The third action, 'Education' (Figure 4.7) is targeted at students, mostly at bachelor level, who will attend courses and workshops on all the aspects of NBSs, with the measures

around the lake and the processes involved in them, such as co-benefits and stakeholder involvement for co-creation and co-design. The aim is to make future engineers, designers, planners, landscape architects, etc. aware of NBS solutions for risk reduction, in order to integrate this into their mindset at as early a stage as possible. The activity is meant to result in an educational guidebook.

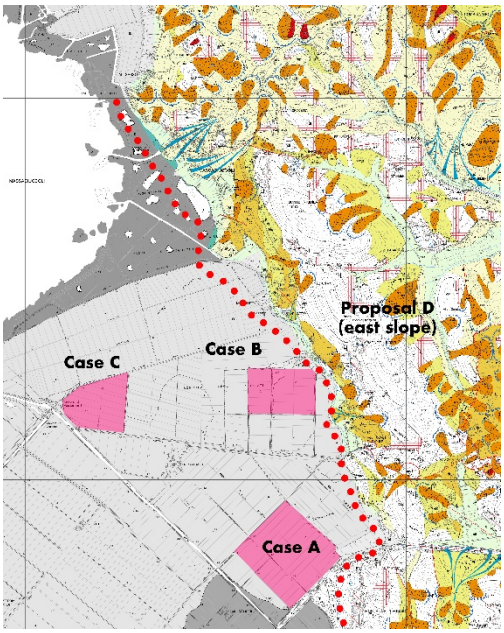

Figure 4.8 Landslide map for the eastern hills of Lake Massaciuccoli. The areas of buffer strips and retention basin are termed Case A, B and C, respectively. The red dotted line indicates the expected maximum landslide runout but does not involve evaluation of return period.

In all the actions, comparisons with more traditional 'grey' solutions will be made. The proponents will provide a balanced view and emphasize that NBSs do not represent the optimal risk reducing solution for all natural hazards, but that, in many cases, hybrid or pure traditional solutions may be the most suitable approach to mitigate the threats.

4.2 Demonstrator case site The Pyrenees, Spain and France

Two of the originally proposed 5 NBS subprojects in the Pyrenees have been cancelled during then present reporting period, month 15-24. The reasons for this, as well as other developments at the NBS sites in the Pyrenees are reported in chapter 3.2. At present, there are no more proposals under way. However, due to the cancellation of the NBSs in the Bastan Valley, which represented the most expensive planned measure, funding is available for additional proposals. This is being followed up by WP2, but no decision has been made at this stage (May 2020).

4.3 Demonstrator case site Gudbrandsdalen, Norway

No new proposals have been submitted from this demonstrator case during the present reporting period (month 15-24). The development and activities at the approved subproject at Jorekstad are reported in chapter 3.3.

There are, however distinct plans for a new proposal to be submitted during the summer 2020. The details of the measure to be proposed are not clear yet, but the objective of the measure is to reduce the risk from torrents in one of the other tributary rivers to the main river of Gudbrandsdalslågen, located further upstream from the location of the first NBS site (Figure 4.9).

The side rivers to Gudbrandsdalslågen are steep and erode in locally thick till deposits. Erosion and redeposition of material lead to increased flooding problems downstream in these rivers, and in particular where they enter the flat valley floor, meet the main river and deposit much of their sediment load. The measure to be planned and subsequently proposed to PHUSICOS is to use small ponds and lakes in the catchment for attenuating the flood. Many of these ponds and lakes have small earth dams built decades ago to ensure water supplies for both consumption and irrigation. The retention capacity can be greatly improved by marginally increasing the height of several of these dams. They are all accessible with the relatively modest machinery needed to perform the construction work, so the measures will not lead to damage the environment. Another important aspect of this measure refers to the significant number of old dams installed in the entire Gudbrandsdalen Valley and side valleys. Hence, the upscaling potential is significant, and a successful 'pilot case' can therefore be important for creating a positive general attitude regarding these types of measures.

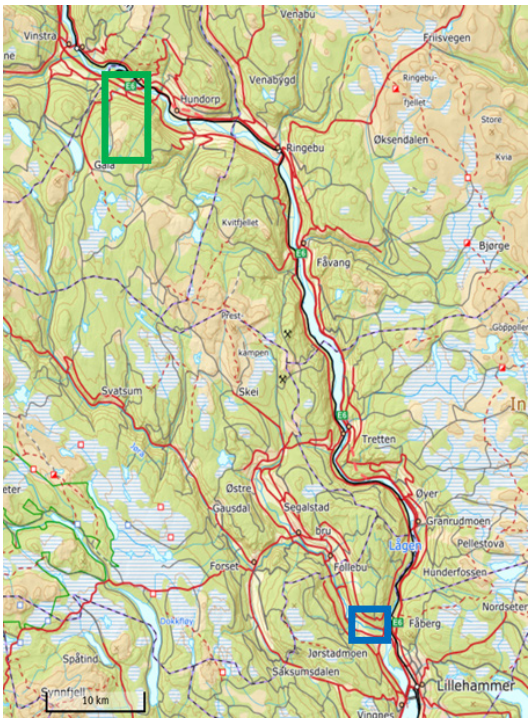

Figure 4.9 Location of the approved NBS at Jorekstad (blue square) and probable location of the next proposal (green rectangle).

The measure is now being discussed between project partner Innlandet County Administration, and local stakeholders, including the municipality and land owners, who all seem to be favourable to the plans. No formal Living Lab process has been initiated yet, however the measure is being advocated locally by two of the stakeholders, and meetings with a larger group are being planned.

4.4 Concept case site Isar River

One new proposal has been submitted and approved by the SC during the current reporting period (Table 4.1). This concerns further sharing experiences from the Isar project, combining it with experiences from a larger group of participants, and to perform practical exercises on designing NBS measures.

4.4.1 Lessons learned and new visions – A transdisciplinary, multi-site Summer School for young professionals at the Isar and in the Pyrenees (2nd Look and Learn Visit)

One of the main objectives of the CC Isar is sharing experiences in interacting with the project partners, with leaders of the demonstrator cases, with emerging scientists and managers from related projects (e.g. OPERANDEM, RECONNECT, Urban Green Up, Eklipse, NAIAD, Oppla, Think Nature) and beyond. As part of the activities planned to reach this goal, the Isar concept case has, in cooperation with the demonstrator Case Pyrenees, developed a second 'look-and-learn' action as a summer school for young professionals (scientists, government regulators, various industry sectors, spatial planners, engineers, architects, technical experts, market actors, graduate students, etc.) interested in NBS. The summer school will focus on NBSs to mitigate flood risk and is planned as a 10-days (may be reduced) hands-on event consisting of field visits, lectures, inspirational discussions and independent project work on the Isar River and the Bastan River.

Main focus of the training will be on:

- Risk mitigation
- Ecological status improvement
- Social value increase
- Economic benefit
- Upscaling and multipliers for NBS's

The summer school will offer the opportunity to all PHUSICOS partners to share their knowledge, experiences and results to the participants. For the local stakeholders, the summer school provides possibilities to raise more awareness of NBS. The format will provide opportunities for case sites and their stakeholders to benefit from knowledge exchange with young emerging professionals and scientists. The proponents hope that the summer school will provide an environment for new and creative ideas for NBS. The participants will be producing reports from their activities in the summer school.

The summer school will be widely disseminated through inviting the local press to document the activities, producing a 10 min movie, updates on Twitter and on the project website news feed, and publication of the outcomes in a relevant journal.

As a 'retrospective' concept case, active exchange with all parts of the PHUSICOS project is important for the Isar case. For the summer school, the following points are important with regards to harmonization with the other WPs of the project:

WP2: The summer school has been designed to comply with WP2 with the demonstrator and concept cases. It fulfils the upscaling and cross-case site exchange goals.
WP3: WP3 is involved through lecture and support for stakeholder-participants meetings in Lourdes (France).
WP4: The visited areas will already be in an ongoing evaluation procedure using the WP4 framework. Furthermore, leaders will participate through lectures.
WP5: Leaders will participate through lectures.
WP6: The summer school is in itself a learning action and an arena for knowledge exchange. Specific participation of WP6 is still to be identified.
WP7: Leader will participate through lectures.
WP8: The visit will be documented by local press, twitter and Instagram posts, an article for the LandschaftPlus Blog, an article for the PHUSICOS and TUM websites, and an edited film.

The original plans may be somewhat revised before performing the summer school, based on comments from the PHUSICOS Steering Committee before the approval of the proposal. The most important comment and likely change of the program is a reduction in the length of the event, as most committee members felt that 10 days is too long and may restrict the number of participants.

The current Covid-19 emergency has posed another challenge for the summer school, which was planned for early September 2020, but will now most likely be delayed for one year. The final decision on this has not yet been made (May 2020).

4.5 Concept case site Kaunertal

No new proposals are to be submitted from this concept case. Activities are described in chapter 3.5.

5 Challenges regarding implementation

The project has experienced several challenges during these first two years of the project. Most of these are described above, in the reports from the case sites, but are grouped and briefly summarized below.

Local or regional Bureaucratic processes and politics

Issues related to bureaucratic processes and politics have caused delays in both the Norwegian and the Pyrenees case studies. In the Pyrenees it also led to cancellation of the proposal for torrent control in the Bastan Valley. Although the final reason for calling off the project in the Bastan and Gavernie rivers in the end was ascribed to financial risk, the background for this is that the whole process of obtaining permissions, the tendering, and eventually implementing was expected to be too time-consuming. In addition, upcoming local elections could lead to a shift in the local authorities, in particular the Mayor, which again could lead to less positive attitude towards NBSs.

In the Jorekstad site in Norway, a new land use plan had to be developed for the area. This was not expected and came as a surprise to the proponents. When this was out for a public hearing, the amount and the character of the comments received from various stakeholders made the municipality to freeze the process, at least preliminary.

Land owners opposing the plans

This happened at the Jorekstad site in Norway, which is to be implemented on private land. In previous meetings, the attitude regarding the planned barrier was generally positive. However, as the new land use plan was out for a public hearing, different views came up, which had not previously been put forward. The municipality of Lillehammer is responsible for the plan and decided to halt the entire process until all questions are sorted out, mainly considering that some of the raised issues could potentially lead to a significant increase of implementation costs.

Tendering processes

Public procurement has to follow the set protocols for each country. This is time-consuming in itself, as it contains several steps of which each takes a certain time, usually a few weeks: Time to make and publish the tender; Time for companies to place bids; Time to review the bids and select the winner; Waiting period in case of complaints. In the case of the Jorekstad site in Norway, one of the bidders submitted a formal complaint on the decision. Complaints start yet another set of formal procedures to handle the complaint. In worst case, the tendering process may have to start over again. This did not happen at Jorekstad, however, but it still delayed the progress further.

The current Covid-19 emergency

The pandemic that struck Europe in the winter and spring of 2020 was certainly an unforeseen surprise to all. It is obvious that all the restrictions on physical meetings, travel, field work, etc. seriously affect the progress towards implementation of the proposed and approved measures. At present (May 2020), it is still unclear when normal activities can resume. The pandemic is an additional reason for the project to apply for a one year extension.

Restrictions due to special status of the land, e.g. national parks

The NBS site proposed at Socques, in the French Pyrenees (Table 2.1), was located in a national park. This placed a number of restrictions to which activities could be allowed and what visible constructions could be set up. As the Socques proposal was called off at an early stage for other reasons, it did not cause progress delays for the project. However, it emphasizes the need for detailed knowledge of any restrictions that the status of an area may put on activities.

The challenges presented above lead to delayed progress and is the reason that PHUSICOS is applying the EU for 1 year extension of the project, until 30 April 2023. Some of the obstacles could probably have been avoided by more detailed planning and preparations, such as a detailed risk assessment of all proposals, including description

of appropriate mitigation measures. Others, such as the Covid-19 situation could not have been foreseen but is still making a large impact on the progress of several of the approved measures.

Some lessons learned from the experienced challenges are:

- Early and detailed planning is important. Getting plans through to practical implementation takes more time than one possibly could think of.
- Stakeholders should be brought into the process as early as possible, if possible from scratch. Co-creation and co-design of the measures establishes 'owner-ship' and increased enthusiasm.
- The use of the stakeholders' local knowledge is important, and appreciation of good advices should be clearly shown.
- Potentially 'problematic' stakeholders should be identified, and strategies to handle these made.
- Individuals who can be good ambassadors for the project should be identified early, and close collaboration with these should be established.
- Public land should be chosen for the NBSs if at all possible.
- Procurement is time consuming. Tender documents must be as detailed as possible to avoid complaints based on formal mistakes. Complaints must be handled correctly according to the protocol and will always lead to delays.

6 Activities related to other PHUSICOS Work Packages

Deliverable D2.2 (PHUSICOS, 2019a) gave a general overview of the links between WP2 and the other work packages of PHUSICOS. Through the project experience so far, we have seen an increased need for improved coordination between WP2 and the other WPs, and particularly with WP3, WP4 and WP5. A short update on specific actions between WP2 and the other WPs is provided below.

6.1 WP3 – Service Innovation: Stakeholder involvement through the Living Lab process

WP3, led by the Technical University of Munich, TUM, has developed comprehensive tools to select stakeholders and run Living Lab sessions at the sites. These are documented in deliverables D3.1, D3.2 and D3.3 (PHUSICOS 2019b, 2019c, 2019d). The Living Lab process has started at the sites, but the progress varies. Furthermore, as the different NBSs start from different levels of pre-planning, the Living Lab sessions also have had to be tailored to the local context. One example of how the case owners have planned the Living Lab sessions is shown in Figure 4.4, from the Serchio River Basin demonstrator case site. As WP2 has close and frequent contact with the case sites, we see the benefits of a stronger coordination between WP2 and WP3, and we have

recently agreed on monthly bilateral meetings, as well as more frequent mutual information regarding communication with the case sites. This is also important to avoid double communication and also to avoid 'stakeholder fatigue' after too many messages.

6.2 WP4 – Technical Innovation: Establishment of baseline for monitoring of the NBSs

Work Package 4 of the project has developed a comprehensive framework for monitoring various aspects of the performance of the NBSs. The assessment will be done through a multi-criteria analysis of a number of indicators grouped under 5 main ambits, Risk reduction, Technical & feasibility aspects, Environment & ecosystems, Society and Local economy. The framework is described in detail in deliverable D4.1 (PHUSICOS, 2019d).

Establishment of the baseline for the indicators before any implementation of the measures take place is an extremely important first step of the monitoring. Currently, the baseline establishment has not been completed at any of the sites. The partner responsible for WP4, University of Naples, Italy, has produced separate matrices, tailor-made for each of the cases in cooperation with site owners and research partners to detect which performance indicators could be suitable for the assessment at the specific site. Indeed, being the performance assessment based upon the comparison between the baseline scenario and the developed design scenarios, the preliminary detection of parameters to be estimated (as a function of the available data, instruments and budget) is essential for the effective application of the implemented framework.

Indeed, an important feature of the framework is its flexibility, which allows its implementation in wide and different case studies. Moreover, because of its structure capability to provide quantitative scores of each scenario, it could be applied both for selecting the most suitable solution among a set of implemented alternatives (ex-ante approach) and for assessing the effectiveness of the implemented measures (ex-post approach, i.e. for the Isar River concept-case). The site owners may add or remove indicators based on relevance for the site, as long as they are grouped under the correct ambit. One such extra indicator may be ecological state of the river in the case of Jorekstad, Norway, as this is being monitored by projects other than PHUSICOS. Another indicator, suggested during the project's month 18 review, is the scale of risk mitigation, local scale or landscape scale?

At *the Jorekstad site* in Norway, data collection for the baseline assessment is ongoing in a cooperative effort between the Innlandet County Administration and NGI. In *the Pyrenees*, France and Spain, the baseline assessment is being performed jointly by the responsible regional organizations (ONF and EGTC Space Portalet), BRGM and CTP. For *the Serchio River Basin*, Italy, baseline data are being collected jointly by ADBS and UNISI / CGT. CGT has carried out remote sensing campaigns over the area of NBS measures east of Lake Massaciuccoli using various sensors mounted on drones, as well as their own aircraft. Project partner CREAF has visited the sites in Italy and the Pyrenees and taken soil samples to be analysed at CREAF's laboratory (PHUSICOS,

2020). Further results of the data acquisition and baseline analyses will be reported by the project's WP4.

6.3 WP5 - Governance innovation: Meeting the challenges

The challenges met by the site owners and described in this report form serious obstacles on the route towards implementation of the proposed and approved NBSs. Most of the problems are governance related, and therefore WP5 can be of assistance to the site owners, providing advise on how to solve the issues. In addition, these challenges are important for gaining experience with NBS implementation to be passed on to future projects, as well as to future PHUSICOS NBSs to be proposed. Based on this, a closer and more frequent communication between WP2 and WP5 is established, in which WP2 can be instrumental in conveying governance issues from the sites to WP5, as well as vice versa. One recent example is again from the Serchio River demonstrator case site, where the site owner, ADBS, is currently discussing Payment for Ecosystem Services (PES) as a possible instrument for compensating the farmers for providing land to the proposed measures. The PES system is fairly new, needs testing, and may be a topic for one of WP5's future Policy Business Forums.

7 Potential impact

The PHUSICOS project is expected to provide results with important impact on many aspects comprised by the ongoing activities. However, as the other work packages to various degrees depend on the success of WP2 in implementing the NBSs at the demonstrator case sites, it is of very high importance that the approved measures are implemented within a reasonable time frame. Challenges affecting the progress are described above, but despite these obstacles, all sites are progressing, and completion of several of the approved measures are foreseen within a year from now (within May 2021). Once implemented, we expect the impact to include positive development according to all co-benefits advocated in the proposals, in addition to greatly reduced risk from the hazards to be mitigated by the NBSs.

The most important impact to expect, however, is an increased knowledge and positive perception of NBS as an alternative approach to traditional risk reducing measures, among a wide group of stakeholders, including decision-makers at all levels. All the sites have further upscaling potential, both locally and in a wider context, and the aim and an ultimate impact is that NBS becomes an integrated solution in national regulations and guidelines across Europe.

8 Follow-up of the case sites

WP2 is following up and supporting the case sites. The experience so far, with the delays described above, indicates that an even closer follow-up and more support are needed. In particular WP2 will:

- Set up a more detailed schedule for the implementation of the approved measures, in agreement with the case owners and their research partners.
- Monitor the NBNS projects through frequent updates from the site owners.
- Discuss and agree with site owners on contingency plans.
- For future proposals, include baseline and monitoring plans, with a timeline, in the proposal.

All contact with and updates from the sites will be recorded in an Excel spreadsheet, which will be the main tool for monitoring the progress of the sites by WP2. This will also include specific actions with deadlines.

However, the responsibility for progress still lies with the site owners, who are formal PHUSICOS project partners. Their research partners and WP2 will provide support to the extent possible to ensure the optimal progress towards implementation of all the approved NBSs.

9 References

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