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JOURNAL

PROJECT

GUARDIAN - Green Urban Actions for Resilient fire Defence of the Interface Area

Riba-roja de Túria, Spain

TOPIC

Climate adaptation

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GUARDIAN Journal 2: get an update about Riba Roja de Turia's project

See on UIA website

In the second Journal of the Guardian project UIA expert Elsa Pastor reports on project progress during year 2020. She also analyses cross-cutting implementation challenges (identified by UIA as leadership, public procurement, organizational arrangements, co-implementation, monitoring and evaluation, communication and upscaling) that GUARDIAN consortium has faced, with particular attention to those related to the current COVID19 crisis.

Executive Summary

GUARDIAN is a pioneering model of sustainable and innovative management of the natural environment, which will ensure the safety of the citizens of Riba-Roja and contribute to the preservation of the Natural Park of Túria and La Vallesa.

The urban areas of Riba-Roja and Paterna, share the protected wildland zone "la Vallesa", which is part of the Natural Park "Parc Natural del Túria", located in a highly urbanised environment. The wildland-urban interface (WUI) between this park and these two cities is subject to the growing risk posed by forest fires, further impacted by the effects of climate change. This hazard is maximised by its progressive incorporation within the urban area and certain degradation, mainly due to agriculture abandonment and insufficient forestry management.

The project adopts a combined strategy based on the use of recycled water for fire mitigation and protection, providing preventive irrigation and extinction water spraying patterns automatically programmed. GUARDIAN will implement the hydraulic infrastructure to supply recycled water from the Waste Water Treatment Plant "Camp del Túria II" to the WUI area of "la Vallesa", and the elements (irrigation and sprinkler towers) which make up the defensive barrier. The operation of the fire prevention and suppression infrastructure will be based on sensor networks and forecast services processed by an automatic system. In order to support this hydraulic infrastructure, GUARDIAN will also make use of an existing wetland ("la Vallesa" pond) as an emergency reservoir. The required water quality for the project's goals will be ensured thanks to the implementation of an advanced modular water treatment implemented in the existing facility. Furthermore, GUARDIAN implementation actions will include vegetation treatment (i.e. reduction of tree density, pruning, shrub spacing, etc.) by which the ecologic conditions and the fire resilience of "la Vallesa" forest will be improved, and self-defense training for population in order to enhance risk perception, create awareness, communicate the basis of the project and improve self-protection through fire resilient gardening and household protection strategies.

The GUARDIAN consortium is led by the Riba-Roja City Council, acting as the main Urban Authority (UA) and has the Paterna City Council as Associated UA. Five more entities are included in the partnership: MEDI XXI, which is an environmental engineering company with expertise on fire risk mitigation and fire defence technological solutions; HIDRAQUA, the local water utility with long experience in the implementation of hydraulic infrastructures and water reuse; CETAQUA, a water technology centre providing R&D&I solutions to sustainable and efficient water cycle management; the Universitat Politècnica de Valencia (UPV) and the Universitat de València (UV), two public institutions of research and higher education in charge of designing the automated monitoring network of forest/weather conditions and validating the economic payback and efficiency of the project, respectively.

The present document is the second of a series of journals following the GUARDIAN project implementation process. It firstly presents the main achievements during the current reporting period (year 2020) and, following, it gathers a review of the potential challenges for implementation that the project is so far experiencing.

Key activities and interim achievements

During year 2020 GUARDIAN has experienced significant implementation advances concerning two of the three pillars above which its fire risk mitigation strategy is built (see web article 1 to recall the GUARDIAN overall strategy): 1) the innovative firefighting system involving a full hydraulic infrastructure to deliver recycled water to WUI areas; and 2) the forestry and environmental works to improve ecosystems' conditions and fire resilience in Riba-Roja and Paterna wildlands. Regarding the third pillar, which involves community education and awareness-raising, its progress has been fully affected by the current COVID19 crisis entailing the postponement of face-to-face training and dissemination activities. Despite the pandemic and other challenges commented in great detail in section 3, the implementation of GUARDIAN has generally progressed as foreseen thanks to the commitment and enthusiasm of GUARDIAN partners.

The main project implementation milestones achieved during past 2020 are summarized following the GUARDIAN water cycle (see web article 2 to recall the smart use of water in GUARDIAN): we will start by commenting on the water reclamation plant design and set-up, followed by the hydraulic infrastructure design and civil work; we will then briefly report the advances on the research regarding the unsupervised irrigation program set-up and we will end by giving an update on forest management works.

The Water Reclamation Plant set-up

HIDRAQUA and CETAQUA have been the GUARDIAN partners in charge of the design and management of the building and set-up of the Water Reclamation Plant (WRP). Installed in a corner of the Camp de Túria II waste water treatment plant and integrated in a High Cube container (figure 1), the WRP will treat water through a chain of processes devoted to provide a robust removal of organic micro-pollutants to guarantee the safe reuse of the reclaimed water for fire preventive uses (in Zoom-in 1 you will find all details regarding the WRP engineering solution). In addition, part of the reclaimed water will be contributed to the "La Vallesa" reservoir to improve the quality of this protected wetland within the Túria Natural Park.

The plant was constructed assembling all its components and testing its operation through pilot tests during summer time by a third company. By the second half of November it was transported to Camp de Túria II where previous civil engineering works (a concrete slab and pipeline and power connections were built) left the site ready to receive the WRP. The High Cube container with the WRP was successfully put in place on December 4th 2020 and during the next few months operational parameters will be adjusted to maximize the efficiency of the treatment processes and hence water quality. Water out of the WRP will be ready to be delivered meeting quality standards once hydraulic works concerning downstream water storage and distribution are completed.

Figure 1. Left: HIDRAQUA engineer briefing end-users on the GUARDIAN water cycle just in front of the just-installed WRP. Right: Water treatment equipment and pipelines constituting the WRP located inside the High Cube container.

Hydraulic infrastructure design and building works

Civil works on the hydraulic infrastructure that has to convey water from the WRP down to the wildland-urban-interface have also started during this reporting period. After completing detail engineering and obtaining project approvals by public authorities, HIDRAQUA has been in charge of implementing the first execution phase of the hydraulic infrastructure. The overall set-up includes five storage tanks and 6.5 km of pipelines that will convey water to 42 canyons located in different WUI areas within Riba-Roja and Paterna (Figure 2).

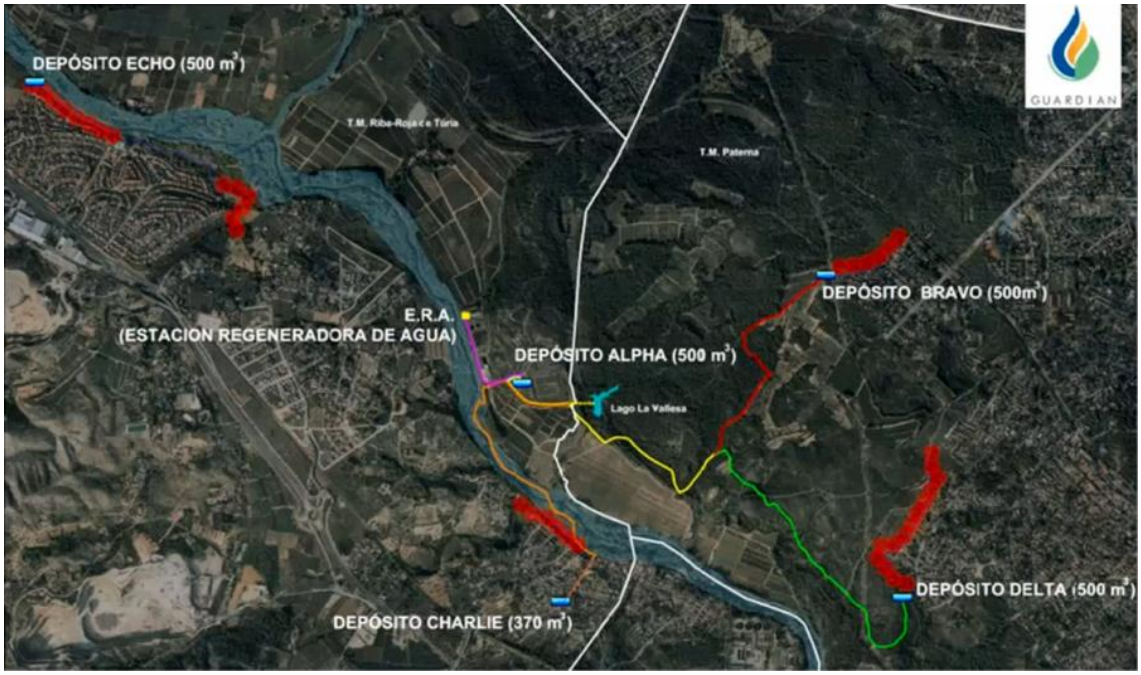

Figure 2. GUARDIAN hydraulic infrastructure scheme (northerly oriented). Spanish-English translation key: ERA – Estación Regeneradora de agua = WRP – Water Reclamation Plant; Depósito = Tank; Lago La Vallesa = La Vallesa reservoir. Recycled water is conveyed from the WRP to the main tank (Alpha) through a pressure pipe. Water from Alpha can then be pumped either to Bravo tank (to protect "Cañada Norte" settlement), or to Delta tank (to protect "Cañada Sur" settlement), or to Charlie tank (to protect "Els Pous" settlement) or to "la Vallesa" wetland (to contribute to increase ecosystems' quality). In the northwest corner, the Echo tank is also under construction to deliver water to the "Masia Traver" settlement. Water to be accumulated in Echo will be conveyed through the existing irrigation ditch. Red zones are the areas were the water canyons will be deployed.

The first civil works started on October 29th 2020 (Figure 3). All infrastructure is foreseen to be ready before summer 2021, so that the first tests of the overall fire protection system can be performed at the WUI of Túria Natural Park before the start of the fire season.

Figure 3. GUARDIAN Project manager, HIDRAQUA engineers and technicians on October 29th 2020, the day when the construction works officially started at Riba-Roja de Túria.

To highlight some of these initial works, we could mention the building of the water storage tanks. They are being built with prestressed concrete. They are buried or half-buried to minimize visual impact. Water pumps will be housed inside tanks and managed by appropriate instrumentation in an adjacent control house, together with a generator for auxiliary energy supply in case of wildfire. Figure 4 shows one of the GUARDIAN water storage tanks under construction as it was by the end of December 2020 and Figure 5 depicts a 3D recreation of how the area will look like by the end of the works.

Figure 4. A GUARDIAN recycled water storage tank under construction.

Figure 5. 3D recreation of one of the GUARDIAN water storage tanks. The tank is half-buried (with 1.8 m height above ground). The adjacent control house contains pumping instrumentation and a generator for auxiliary energy supply in case of wildfire.

Regarding the las piece of infrastructure needed to deliver water in La Vallesa forests (i.e. the water canyons and their related pipes and controllers), MEDI XXI, the environmental engineering company within the GUARDIAN consortium, has devoted a large effort conceiving the overall system: establishing the optimum location, layout and sizing in each WUI zone, and designing the towers (geometry and height) to be placed in the field so that to minimize visual impact (Figure 6). The project is now ready to be implemented during the first half of 2021.

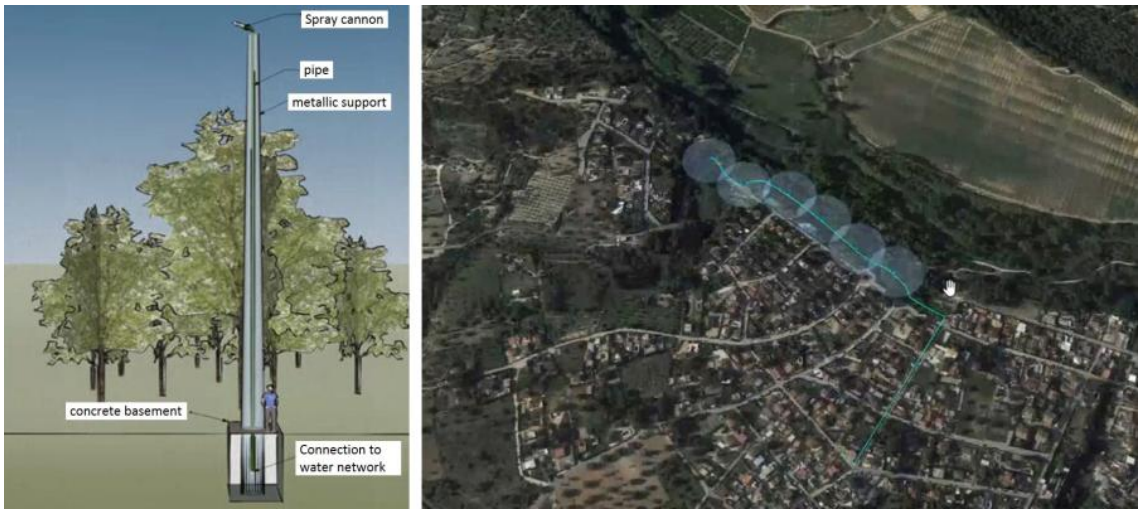

Figure 6. Details of the watering system to be implemented in Riba-Roja and Paterna. Left: Recreation of the tower vertical profile. Right: Layout of the watering zone provided by the 6 water canyons foreseen to be installed in the perimeter of "Els Pous" settlement.

Unsupervised irrigation module: experimental studies on the effect of draught in La Vallesa forest

Automatic preventive irrigation through water canyons is one of the several fire management actions that GUARDIAN is implementing at La Vallesa Wildland-Urban Interface. This is perhaps the most innovative aspect the project is working on as very few similar approaches exist worldwide. During 2020, scientist from the Universitat Politècnica de València (UPV) have undertaken front-line research to give answers on where and when preventive irrigation is effective and how much water is needed to improve forest ecological conditions to face the impact of fires. This is a critical study, as its outcomes will be used for the design of unsupervised water irrigation patterns to be applied during the fire season in Riba-Roja and Paterna WUI.

UPV research performed along 2020 has involved complex field experiments. Scientists have deployed their instruments and sensors in a specific plot representative of La Vallesa pine forest to study water dynamics (Figure

7). They are interested in soil characteristics and meteorological conditions and how these interact and drive the water status of the trees.

Figure 7. UPV scientist setting-up the experimental plot at La Vallesa natural area.

The overall set-up has allowed monitoring the soil-plant-atmosphere continuum with high precision along the day. The experimental pilot has also included irrigation tests to capture the comparative response of watered trees against those not irrigated. In web article 3 more information on this experimental campaign can be found

Forest management related works

MEDI XXI has been in charge of planning and executing forest management works in Riba-Roja and Paterna which is part of the holistic fire risk mitigation strategy designed in GUARDIAN.

Forestry works are aimed at modifying fuel available to burnt in case of fire so that to bring fire intensity down to a minimum. There are several approaches to do so, among which we highlight 1) reducing the available fuel load, 2) replacing current vegetation to other less flammable fuels and 3) isolating/partitioning large areas into smaller compartments by means of green firewall strips.

Based on ad-hoc analysis on Riba-Roja and Paterna WUI fire risk, MEDI XXI has designed a full forest management program in Riba-Roja and Paterna involving more than 37 hectares to be treated with different techniques to ensure that a fire coming from the wildland will not penetrate into urban areas. The first part of the work (started just before Christmas) consists on forest clearing to reduce the density of trees per hectare (Figure 8). MEDI XXI fire experts agree on the fact that the current density values of La Vallesa forests are far from being optimum in terms of ecosystem health and fire resilience. Natural regeneration after previous wildfires has led to unacceptable tree density values which generate species competition and disease problems, hamper infiltration towards aquifers and increase wildfire hazard. The objective of the clearing is therefore to achieve higher ecosystem's quality to ensure that La Vallesa forests face all sorts of Climate Change-induced challenges. This work has been also complemented with the elimination of cane fields in several areas of the Túria Natural Park, due to their high flammability and proneness to drive fast wildfire spread (Figure 9).

The second phase of the work involves introducing more than 2,000 plants of autochthonous Mediterranean species with less combustibility in appropriate areas to conform the so-called green firewall strips. This is planned to be performed after clearing jobs are finished.Clearing job performed at La Vallesa forest by MEDI XXI technician. The company has temporarily increased its staff by 10 new members specialized in forest management works.

FIgure 8. Clearing job performed at La Vallesa forest by MEDI XXI technician. The company has temporarily increased its staff by 10 new members specialized in forest management works.

Figure 9 MEDI XXI technician reducing fuel load of cane fields in Túria Natural Park

Review of current implementation challenges

As already seen in past UIA efforts, implementing innovating projects like GUARDIAN that require a high degree of involvement by different actors and stake-holders is a very challenging process. In this perspective, the UIA has identified seven cross-cutting challenges that might be relevant, with different meanings and intensities, for all UIA projects. These are mainly related to leadership, public procurement, organizational arrangements, co-implementation, monitoring and evaluation, communication and upscaling.

In this section we review the challenges that GUARDIAN has faced during 2020, the year of the global world-wide crisis of COVID19 and the second year of implementation of the project. The overall survey tells us that, despite the adversities that the pandemic has carried, the consortium has had enough skills and resources to overcome all of them.

In the following table a summarized analysis of how the consortium is facing the seven implementation challenges is provided. Inspired by a classic SWOT (strengths, weaknesses, opportunities and threats) analysis, we have concisely highlighted pros and cons that are helping or hampering the GUARDIAN implementation. Through a classic traffic-light system, we assess the level of risk against each challenge, where red is high, orange is medium

and green is low.

Challenge	Level	Observations	
Leadership	L	Strengths & opportunities	▸ Political support and implication from both Urban Authorities (Riba-Roja and Paterna) remains strong. ▸ GUARDIAN project has lead GUARDIAN wisely despite the pandemic.
		Weaknesses & threats	▸ Difficulties on meeting project deadlines.
Admin. Procedures: permits & tendering	H	Strengths & opportunities	▸ GUARDIAN consortium has large experience on public procurement. ▸ GUARDIAN consortium has rearranged budget (from public to private) to streamline hiring processes.
		Weaknesses & threats	▸ Delays with permits and tenders coming from administrations. ▸ Obtaining permits are in the critical path of GUARDIAN implementation process.
Cross-department working	H	Strengths & opportunities	▸ The consortium has taken advantage of online communication and team-working tools.
		Weaknesses & threats	▸ Difficulties on controlling run times due to the large number of activities overlapped in time. ▸ Social atmosphere of the workplace reduced to the minimum. ▸ Difficulties on keeping the inertia of working teams at all times. ▸ Increase of personnel adjustments in the consortium due to COVID19 crisis.

Challenge	Level	Observations	
Participative approach	M	Strengths & opportunities	▸ Key actors identified and briefed.
		Weaknesses & threats	▸ Participatory initiatives stopped due to the current COVID19 crisis.
Monitoring & evaluation	L	Strengths & opportunities	▸ Consistent internal monitoring of the project implementation plan. ▸ Indicator-based system already defined to assess project impact. ▸ Measureable project objectives clearly identified from the very start of the project.
		Weaknesses & threats	▸ Huge variety of data to be collected to assess project impact.
Communic. with beneficiaries	L	Strengths & opportunities	▸ Benefit from online tools to reach a wider audience. ▸ Difficulties on delivering complex science-based fire ecology messages due to misinformation of general public.
		Weaknesses & threats	▸ Face-to-face interaction with end-users minimized due to the pandemic.
Upscaling	M	Strengths & opportunities	▸ High degree of project scalability in different types of WUI areas (rural, touristic and metropolitan)
		Weaknesses & threats	▸ Upscaling foreseen difficulties in water irrigation patterns due to the lack of scientific knowledge.

Based on the above-gathered main points, a more detailed discussion of the seven implementation challenges is provided down below:

Leadership: The leadership of the project has remained well implemented at municipal level. Riba-Roja and Paterna city authorities have continued to actively support the Guardian project, attending to management meetings and following closely the main advances of the project (Figure 10 shows the mayors of Riba-Roja and Paterna together with HIDRAQUA technicians the day the Water Reclamation plant was set-up). As for the consortium level, the project manager keeps on leading GUARDIAN wisely. His guidance is consistent and accepted by all partners. Despite the current COVID crisis, and other difficulties that the consortium has experienced (e.g. administrative and legal undergrowth inherent to innovative projects, lack of face-to-face meetings, less fluid communication for team working and coordination, etc.), the project leader has managed to keep the cohesion of the team with a clear organizational layout, minimizing deadlines noncompliance and taking advantage of the synergies of a transversal and multidisciplinary consortium.

Figure 10. The mayors of Riba-Roja and Paterna together with HIDRAQUA technicians visiting the Water Reclamation plant on December 4th 2020.

Administrative procedures: Public procurement has been an essential part of the work during this last year. Despite the GUARDIAN consortium has large experience with it, public procurement processes have been slower, more difficult and cumbersome that what would be desired. Public contracting procedures have been very strict, involving a massive effort by the consortium (both in terms of time and resources), sometimes jeopardizing project deadlines and milestones. Therefore, GUARDIAN has moved part of the budget from municipalities to the private companies within the consortium to streamline hiring process, leading to a budget increase and hence to more financial burden and contribution from those (note that 20% of budget is not subsidized). Regarding permits and tenders, GUARDIAN partners have also made additional efforts dealing with administrations, organizations and private owners. As mentioned in past Journal, GUARDIAN project requires several types of permits, which have to be issued by different administrations with diffuse responsibilities and also by private individuals. Not without difficulties and delays, all permits have finally been issued to make the implementation of GUARDIAN actions possible at this stage (note that obtaining permits were in the critical path of the GUARDIAN implementation process of hydraulic infrastructure, water reclamation plant set-up, forest management works, etc.).

Organizational arrangements: With the progress of the GUARDIAN project, the number of activities being performed by different departments have significantly increased. This has involved organizational challenges in terms of communication, information sharing and control of run times. The consortium has adapted to virtual tools, by making use of online platforms for regular meetings and work-related networking. Social atmosphere of the workplace and informal communication channels (casual small talks, quick up-dates stopping by on the corridor, etc.) have been reduced to the minimum. By contrast, online activity has become key for a smooth organization within the consortium and within all entities taking part of it. Webinars to share knowledge (Figure 11) and to brief on project progress, instant messaging platforms for quick communication, and virtual hubs for team collaboration are the order of the day in GUARDIAN during pandemic times. Other challenges have been detected with regard to the long duration of the project. Keeping the inertia of working teams have revealed difficult, particularly in those that have to deal with cycles of working periods followed by stand-by times. Resuming work after long periods of inactivity has been especially tough due to the current crisis. Finally, it has to be highlighted that some personnel adjustments within partners have occurred (e.g. sick leaves, temporary disabilities, internal changes). While this is typical in the large companies involved in GUARDIAN, this has been also a fact in other partners, most likely induced by the COVID crisis.

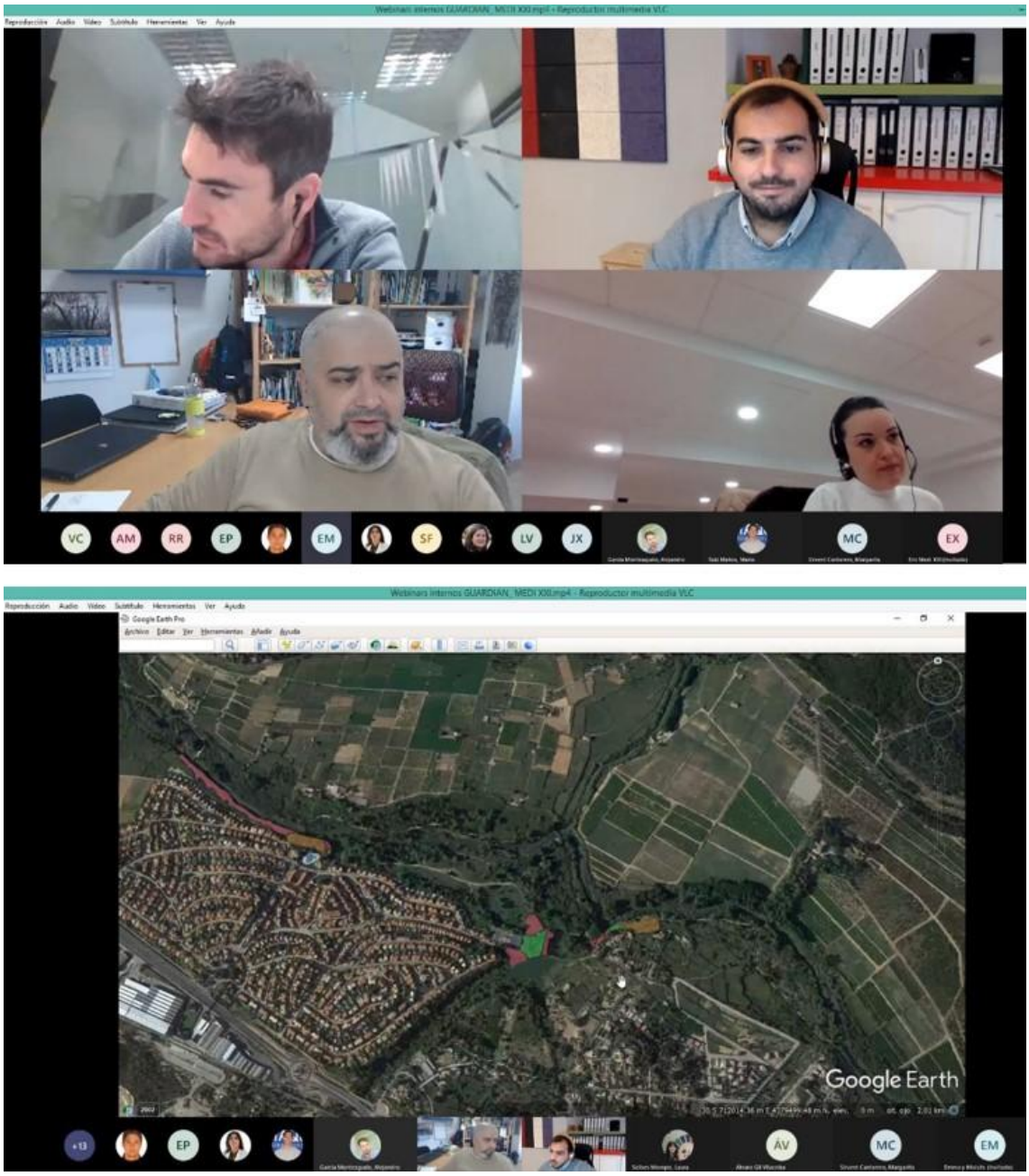

Figure 11. Two snapshots of a GUARDIAN webinar: Medi XXI presents progress of forest management works and water canyons set-up on December 2nd 2020.

Participative approach for co-implementation: GUARDIAN has already identified and briefed all key actors with a relevant role on implementation and exploitation: neighbourhood associations, environmentalist entities, local companies, WUI communities, fire, civil protection and environmental public agencies, etc. Participatory initiatives for co-design and co-implementation could take place during the first year of the project. However, the current crisis has hampered these type of activities during these reporting period. Open stakeholder consultation and briefing processes will have to be resumed when the pandemic situation allows to do so, as the engagement of all groups will be key for a successful exploitation of GUARDIAN. For example, citizens share fire management responsibilities together with the municipality, as fire prevention and protection involves not only having infrastructures ready to perform well in case of fire but having educated, aware and prepared citizens to mitigate risk and respond appropriately in case of fire. Different campaigns to empower all stakeholders (e.g. on awareness-raising, capacity building, response planning and buildings and infrastructure protection) will have to be reprogrammed to ensure motivation and commitment of all stakeholders for the rest of project life-cycle.

Monitoring and evaluation: As reported in the previous Journal, internal monitoring of the project implementation plan in terms of task compliance has been performed in timely manner through dedicated project documents (e.g. daily log, project monitoring plan, project management plan, etc.) by the GUARDIAN Steering Committee. As such, quality, costs, risks, execution time and outreach are being continuously monitored and evaluated generating a learning loop for all partners to continuously improve the quality and effectiveness of the implementation process. As for the assessment of the final impact of the project, the consortium has already defined an indicators-based system that will help capturing the achievement of results. To mention a few, GUARDIAN will consider a wide variety of aspects among which we find surface area of natural habitats conserved, production of recycled water, or population benefiting from forest fire protection measures. While it is still soon

to analyse performance indicators, the consortium has a clear idea of that data that needs to be collected for a proper assessment of the GUARDIAN success as the project objectives have been clearly defined from the very beginning.

Communication with target beneficiaries: During this last year, communication efforts have increased together with GUARDIAN implementation achieved milestones. GUARDIAN has become "evident" as forestry and hydraulic works are taking place in the Riba-Roja and Paterna communities and so the need to reach end-users and explain GUARDIAN progress at this stage. Guardian partners are fully aware that communicating some of the tasks implemented in the project is challenging, particularly those involving scientific findings which need to be translated into an appropriate language to reach general public. In addition, misinformation of fire ecology related aspects is also hindering the GUARDIAN messages to be effectively transferred. Environmental awareness has indeed increased among population but scientific-based messages have still to compete against ill-proved hypothesis and idle talks, quite frequent in non-technical forums. GUARDIAN has exploited online tools to reach end-users (digital newspapers, webinars, social media, etc.) which have turned out to be even more effective than traditional communication channels (e.g. assistance to dissemination events, fairs, congresses, etc.). Despite face-to-face communication activities with beneficiaries and end-users have been postponed due to the pandemic, the negative impact that this could have implied has been certainly minimized by an enthusiastic use of virtual means and tools by all partners. As a matter of fact, new communication means (e.g. video blog) will be released soon, as part of the job of reinventing GUARDIAN communication strategy due to the current COVID19 crisis.

Upscaling: As mentioned in the previous Journal, the potential of upscaling of GUARDIAN is very large. Mediterranean countries have many wildland-urban interface areas that are at risk during every fire season (either rural, touristic or metropolitan) and, within a climate change scenario, more WUI-fire prone areas will even arise in the following years. At this stage of the project, particular issues have been already detected regarding upscaling challenges which mainly deal with irrigation parametrization and wildfire behaviour prediction. Those aspects are key to program the use of water canyons for preventive and pre-suppression wetting, and yet the state-of-the art in these fields is still immature to have straight answers in all Mediterranean ecosystems and fuel types.

Concluding remarks

Despite the current COVID19 crisis, GUARDIAN implementation has progressed significantly along 2020. Major advances include:

- The successful set-up of the water reclamation plant
- The start of building works to execute the hydraulic infrastructure design
- The knowledge gained regarding the analysis of the soil-tree-atmosphere continuum in la Vallesa Forest
- The start of the forest management works in Túria Natural Park

As for the UIA implementation challenges, the GUARDIAN consortium has faced all of them with commitment and enthusiasm. However, some issues concerning administrative procedures and cross-department working have been tough to deal with, mainly due to the current pandemic situation which has caused significant delays in bureaucratic processes with public authorities and has hampered fluid and face-to-face communication.

The GUARDIAN consortium has converted difficulties arisen due to the global 2020 crisis in new opportunities to improve the overall progress of the project, being the use of online tools for dissemination a clear example of flexibility and reinvention in complex times.