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IPA Adriatic Holistic Forest Fire Protection Project – the year after

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Abstract

The regions around Adriatic Sea have high risk of wildfires, especially during summer due to very warm climate with low level of humidity, densely spaced Mediterranean vegetation, particularly conifer forests and lot of tourists. During fire season that is usually between July 1 and October 31, there are lot of wildfires in this region. Therefore, the biggest Croatian county Split-Dalmatia County has initiated in 2007 preparation of strategic project target to Adriatic IPA funds, based on Split-Dalmatia County holistic approach to forest fires protection and prevention. The HOLISTIC Project with full name Adriatic Holistic Forest Fire Protection has been finally accepted in 2013 as Adriatic IPA project and ended in December 2016. HOLISTIC project was focuses on the prevention and damages mitigation of the natural risks, with special focus on wildfire and earthquake risks, aiming at improvement, promotion and strengthening of institutional capabilities in implementing policies and actions to reducing the causes and damages in regions facing the Adriatic Sea. HOLISTIC project was not focused on research and development of new technologies in wildfire prevention, protection and fighting, but rather toward the application of existing technologies in fire fighters everyday tasks. Projects outputs, results and particularly pilot projects, are the main topic of this paper, including the analysis of project influences on fire fighters practice, one year after the project ending.

Note: Authors from FESB were, during HOLISTIC Project realisation, Key Experts for Work Packages connected with implementation of Information-Communication Technologies (ICT) in wildfire protection and fighting for various Dalmatian Counties.

Keywords: EU project, wildfires, forest fires, wildfire protection, ICT in wildfires, sustainable forest management.

1. Introduction

The regions around Adriatic Sea have high risk of wildfires, especially during the summer due to very warm climate with low level of humidity, densely spaced Mediterranean vegetation, particularly conifer forests and lot of tourists. During fire season that is usually between July 1 and October 31, there are lot of wildfires in this region. For example in Republic Croatia located on the east side of Adriatic Sea in the last 10 years 2.320 wildfires have been recoded that affected 84.250 hectares of forests and forest land.

Therefore, the biggest Croatian county Split-Dalmatia County has initiated in 2007 preparation of strategic project target to Adriatic IPA funds, based on Split-Dalmatia County holistic approach to forest fires protection and prevention (Stipanicev et al, 2007). The HOLISTIC Project has been finally accepted in 2013 as Adriatic IPA project under priority *2 Natural and Cultural Resources and Risk Prevention*, measure *2.2 Natural and cultural resource management and prevention of natural and technological risks*. HOLISTIC project, with full name Adriatic Holistic Forest Fire Protection, ended in December 2016 (HOLISTIC, 2013). HOLISTIC project was focused on the prevention and damages mitigation of the natural risks, with special focus on wildfire and earthquake risks, aiming at improvement, promotion and strengthening of institutional capabilities in implementing policies and actions to reducing the causes and damages in regions facing the Adriatic Sea. It has gathered 20

partners from Greece, Albania, Montenegro, Bosnia and Herzegovina, Croatia, Slovenia, Italy and Serbia, leaded and coordinated by Split-Dalmatia County. The total project budget was about 9.3 million €. HOLISTIC project was not focused on research and development of new technologies in wildfire prevention, protection and fighting, but rather toward the application of existing technologies in fire fighters everyday tasks. It gathered together almost all regions around Adriatic Sea, trying to find common, sustainable approach to forest fire prevention, protection and fighting.

The main topics of this paper are outputs and results of HOLISTIC project, particularly pilot projects, but the paper also includes the analysis of project influences on fire fighters practice, one year after the project ending.

2. HOLISTIC Project overview

HOLISTIC project has been focused on the prevention and damages mitigation of the natural risks, particularly on wildfire and earthquake risks, aiming at improvement, promotion and strengthening of institutional capabilities in implementing policies and actions to reducing the causes and potential start of natural breakdowns to improve reaction and intervention readiness, to reduce the damages in areas of regions facing the Adriatic.

The project's most important results and the respective outputs were:

1. Developed common guidelines and standard procedures for:

    - Policy and institutional enhancement for the implementation of updated and sustainable fire protection and prevention policies and mechanisms.

    - Legislative and institutional regulations for the implementation of integral and sustainable public buildings protection policies.

    - Territorial analysis of set-up methodology for fire safety.

    - Forest sustainable management aimed at reducing wildfire risks.

    - Prevention and fire fighting management, particularly in cross-border fires. Territorial analysis of set-up methodology for public and historical buildings protection policies.

2. Survey of actually applied procedures, policies and measures for:

    - Fire protection, prevention and previsions.

    - Public buildings protection from earthquakes.

3. Established static and dynamic spatial database about terrestrial, meteorological and sociological features, either measured, estimated and simulated, related to fire hazards or fire fighting policy.

4. Developed post fire monitoring and damage assessment methods integrating multi-source spatial information for land management support.

5. Harmonized fire risks data and maps.

6. Implemented up-to-date ICT solutions in pre-fire, fire and post-fire activities.

7. Staff trained in the use of ICT technologies in wild land fire prevention, protection and fighting.

8. Established network of scientific and research capacities for wildfire prevention and protection research and education based on modern technologies.

9.   Application of GIS and remote sensing technologies for prevention of fire hazard risks, advanced fire fighting and post-fire recuperation.

10.   Developed and experimented model of:

- Monitoring, surveillance and fire outbreaks early warning integrated system.

- Financial, social and eco sustainable wood life cycle (silviculture, wood waste treatment, biomass production and marketing).

- Indirect prevention campaign, diversified according to the type of user.

- Fire risks predictive models on micro-location scale adapted and tuned for Adriatic region.

- Fire behaviour modelling and spread simulation adapted and tuned for Adriatic region.

- Early warning monitoring and surveillance system adapted and tuned for Adriatic region.

- Buildings' real-time seismic vulnerability inspection and monitoring.

As usual, special work package was reserved for awareness raising activities to be undertaken by local stakeholders with the aim to achieve local ownership of the project and its results. With aims to aggregate significant added value and gain synergies, the project has accounted the experiences and results from previous EU projects and the experience made by many Beneficiaries who participated in projects addressed to the same theme of Holistic project.

All together 20 partners participate in HOLISTIC project (Figure 1). Project coordinator and lead beneficiary was Split – Dalmatia County from Croatia. The project has started in October 2013 and ended in December 2016 and the total project budget was 9.363.801,29 €.
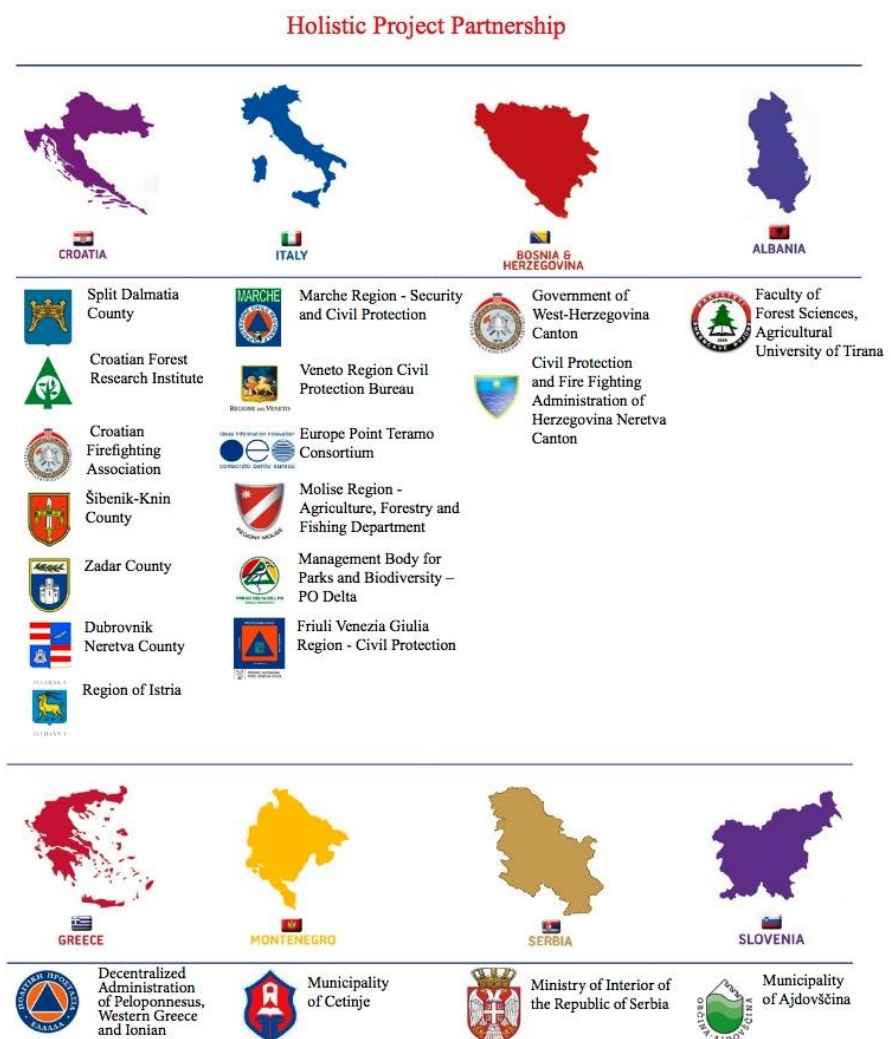

Figure 1 – IPA Adriatic HOLISTIC project partnership.

3. HOLISTIC Project outputs and results

HOLISTIC Project has intended to reduce the number and the impact of forest fires, to protect people, natural environment and properties, and in particular to promote fire prevention among rural communities in fire prone areas of regions facing the Adriatic. In addition it has intended to promote awareness and stable fire risk mitigation activities and technological improvement of territory monitoring and surveillance through the development of shared models, methods and tools for integrated and sustainable natural risk management, protection and prevention.

The project was organized in 8 work packages.

WP0 - covers preparatory activities of the partnership and project drafting and **WP1** - Project Management and Coordination ensures availability of human and technological resources, project reliability and monitoring of targets' achievement;

WP 2 - Communication and Dissemination

The aim of this Workpackage was to assure the dissemination and promotion of the project activities and achievements towards target groups inside and outside the involved territories, essential for the dissemination of the results, the capitalization of the activities and the transparency of the funds allocated to the project, assuring that the planned information and dissemination activities are able to achieve visibility among relevant target groups. The WEB Site, press conferences, press releases, newspaper articles, regional and transnational conferences and participation at International exhibition and conferences with presentations, in accord with projects milestones, represent the communication and dissemination activities. To complete them a network of stakeholders from all participating countries is built using national and thematic international conferences and the final conference, presenting the project outcomes. Figure 2 shows home page of the project Web site (HOLISTIC, 2013) that has achieved average of 509 hits per month.
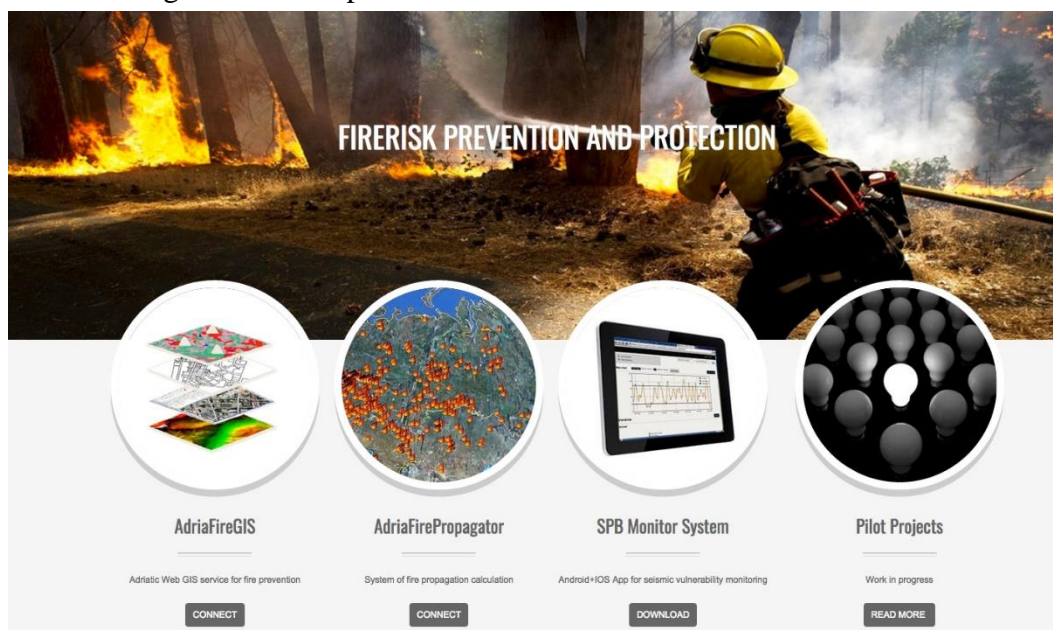

Figure 2 – IPA Adriatic HOLISTIC project Web site - http://www.adriaholistic.eu

The final results were 6 main Project meetings, 195 articles/appearances published in the press and in other media (including online media, TV, radio), 13 press conferences, 29 publications produced, 54 national/regional events and 5 international seminars. It is estimated that almost 20 000 individuals were directly reached via dissemination outputs.

WP 3 - Capitalization and sustainability

Within WP 3 one of the major achievements was production of Joint plan of capitalization. This document was based on previously identified common problems and aimed to identify common challenges and propose future actions in each specific thematic topic. The purpose of the capitalization process was to propose effective answers based on the best practices that have been analyzed through adopted methodological approach: analyzing post and current experiences in order to collect lessons learned and put in place the acquired good practice and sharing achievements in order to learn mutually. 36 case study reports have been investigated and 4 best practices selected during 10 thematic workshops and 9 regional stakeholders roundtables. Join plan of capitalization provides proposals, but their future implementation is directly linked with financial possibilities and institutional support and interest of each partner.

WP 4 - Joint management policies

WP 4 has provided a screening of an existing situation of protocols/actions regarding pre-fire, fire and post-fire activities in IPA countries that could be useful for future standardization of protocols/actions in order to have better preparedness when wildfires or earthquakes appear. Four reports has been prepared: Report of existing policies in region countries concerning pre-fire, fire and post-fire activities, Technical report with recommendation for pre-fire prevention and protection activities, Technical report with recommendation for common protocols for fire monitoring, alarming and evacuation, Technical report with recommendation for common protocols for fire fighting intervention and Technical report with recommendation for common protocols for post fire recuperation, as well as Catalogue of the state of the art in forest fire management policies in pre-fire, fire and post-fire local policies, practices and coordination mechanisms, Harmonization and standardization of pre-fire activities concerning wildland/urban interfaces, vulnerable natural and man-made infrastructures based on forest management and fire protected activities, Harmonization and standardization of pre-fire and fire activities concerning fire monitoring, alarming and evacuation and Harmonization and standardization of fire activates concerning fire fighting intervention.

WP 5 - Territorial analysis concerning wildfire prevention and fire fighting

WP 5 was dedicated to development of regional GIS system adapted for wildfire activates demands and tuned to Adriatic region and particularly to cross border cooperation in order to harmonized and improve accessibility of spatial – temporal data about landscape characteristics, vegetation, meteorological and sociological data important for wildfire fighting. Three main outcomes of WP5 package where user-friendly regional GIS service, wildfire propagation and wildfire risk prediction simulation tools. Those tools are:

- AdriaFireGIS – a multi-user wildfire Web based service accessible by all partners in region. It has collected regional GIS layers in the form suitable to be used through appropriate WMS servers in all Web based applications developed through this project (static terrestrial layers, static vegetation layers, dynamic meteorological data, wildfire sociological layers).

- AdriaFirePropagator – a multi-user, Web based service for wildfire behavior and spread simulation, useful for all firefighting activities, and

- AdriaFireRisk and AdriaFireEruptiveRisk – fire risk index based on climatological, meteorological parameters, vegetation, terrain configuration and various anthropogenic parameters that run as additional module with AdriaFirePropagator, as well as prediction of potential dangerous wildfire eruptive behavior based on terrain and meteorological parameters.

Simulations in AdriaFirePropagator can easily be run on a single click of a button after choosing the ignition point or area. In this case the simulation is run in "during wildfire" mode, where current meteorological conditions are automatically obtained (several times a day, with hourly forecast) and

used as input to simulation. In such cases, AdriaFirePropagator can be helpful to organize firefighting actions, such as unit arrangement, number of vehicles, etc.

Figure 3 - AdriaFirePropagator simulation - blue area represents fire barrier (non burnable area).

On the other hand, AdriaFirePropagator is also a highly customizable tool where most of the simulation inputs can be modified and adjusted, allowing the simulations in "before wildfire" mode. In this mode, users can adjust wind, moisture, fuel and other parameters to set conditions in which simulation will run. All this is of great importance as it allows AdriaFirePropagator to be used for training and educating firefighting personnel, simulation of different scenarios that can occur in the case of wildfire, investigation of previous wildfires, etc. Important is to emphasize that users can specify fire barriers, areas on the map that will be ignored during simulation (non-burnable areas), as well as fire fronts – areas describing initially ignited (already burning) area for the simulation.
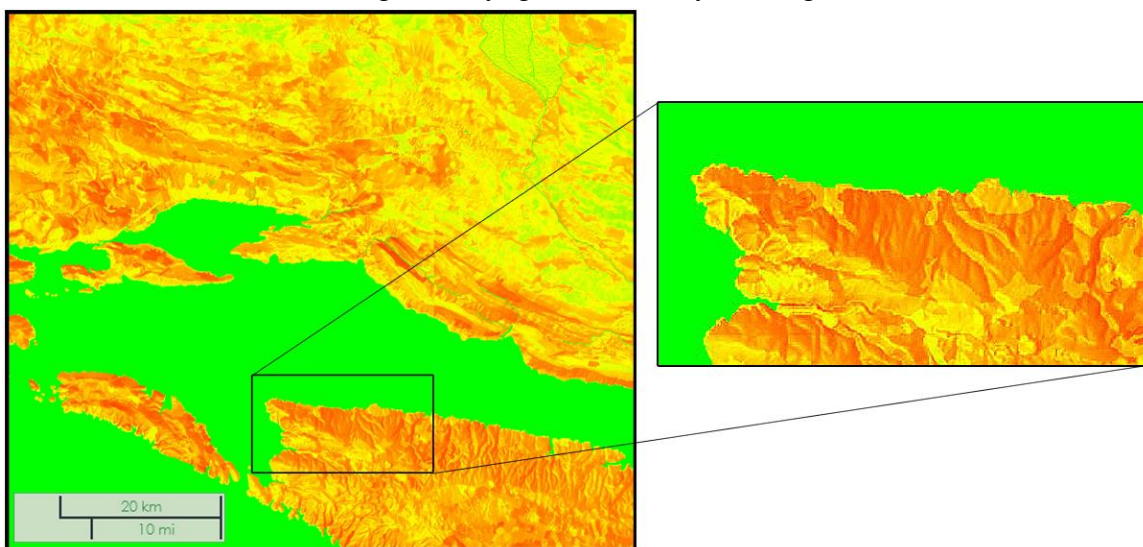

Figure 4 - AdriaFireRisk – wildfire risk index for Adriatic region during spring months

AdriaFireRisk is a numerical indicator that defines the level of fire risk at certain geographical area calculated as additional module to AdriaFirePropagator. It is based on climatological and meteorological parameters, vegetation, terrain configuration and anthropogenic parameters. Climatological and meteorological parameters give AdriaFireRisk its dynamics, while the other parameters belong to the set of static indicators. The main advantage of AdriaFireRisk over other indexes is that it is better adapted to the micro-location, that is, it is site-specific wildfire risk index. Panels have been placed on spots of important public interest sensitive to wildfires, such as national parks, city forests, protected islands. Those panels are connected to AdriaFireRisk system and show current risk at that area in real time. Along with AdriaFireRisk, eruptive wildfire risk index (AdriaFireEruptiveRisk) is also calculated using terrain and meteorological parameters as inputs in order to detect zones where dangerous eruptive fire behavior could happen.

WP 6 - Application of ICT in fire prevention and protection

In WP 6 cross border cooperation was realized through information exchange about common guidelines and standard procedures for installation of wildfire monitoring and surveillance systems and networks. Detail analysis of all commercial ground based wildfire monitoring and surveillance systems from Italy, France, Portugal, Croatia, Turkey/US, South Africa, Germany, Spain and Russia has been done. The main focus was on functional system integrated in standard wildfire monitoring services and particularly located in Mediterranean countries. Experimental and research system, although they were lot of them, have not been analyzed, because from research to real life implementation is a long way. Based on this analysis a new regional model named AdriaFireMonitor has been developed tuned and adapted for specific Adriatic surroundings.

Final outcomes od this WP 6 were establishment of Technical guidelines and specifications of wildfire video monitoring unit (wildfire observer) and wildfire video monitoring network (wildfire observer network) adapted for Adriatic region, Technical guidelines for systematic wildfire monitoring locations determinations, Emergency intervention code of conduct report with distribution of tasks, definition of coordinating bodies and User rights report with definition of accessibility and rights to use for different level users. Based on this reports partners involved in this Workpackage have identified monitoring locations for video surveillance system set-up in their regions, provide all necessary procedures for installation of advanced 3 cameras visible spectra wildfire video monitoring and surveillance systems and additionally in Istria County and Split – Dalmatia County installation of advanced 1 camera IR spectra wildfire video monitoring and surveillance systems integrated with visible spectra monitoring. Part of tis Workpackage was installation of advanced GPS tracking systems for fire fighters vehicles (each system with 5 GPS trackers) and installation of tablet based advanced system for burned area mapping, as well as supply of mobile monitoring unit to Split – Dalmatia County as Figure 5 shows and acquisition of various drone and UAV monitoring units.

Finally WP 6 has organized few regional conference concerning application of advanced ICT technologies in forest fire prevention and protection and assessment of pilot projects' achievements, but also establish a network of scientific and research capacities in region capable for forest fire research by reuse of existing research capabilities in systematic forest fire research and initiate a regional research and education activities concerning forest fire prevention, protection and fighting by strengthen research and education capabilities in region concerning fire prevention and fighting.

Figure 5 - AdriaFireMonitor – Split – Dalmatia County mobile monitoring unit

WP 7 – Reduction of fire risk by sustainable forest management

Major achievements of WP 7 have been cooperation between beneficiaries devoted to the forest sustainable management and use of forest biomass in sustainable wildfire prevention and protection. The collaboration has achieved the systematic collection, analysis and capitalization of previously implemented projects and studies and preparation of important documents useful for the utilization of forest biomass for bioenergy production. Furthermore WP 7 has implemented appealing pilot actions – the installation of six demonstrative heating plants in public buildings (primarily schools) fed with wood biomass (wood chips and wood-pellet).

WP 8 - Target Groups Education and Awareness

Thanks to efforts from all project partners and associative partners, all of them have been involved in the activities related to WP 8. Preciously 11.186 participants between the groups targeted by the project activities, in particular land owners, farmers, shepherds, hunters, tourists and inhabitants, schoolchildren and students, Civil Protection Volunteers and firefighting associations, local stakeholders and representatives of the institutional bodies of the project areas has been involved in target groups education concerning wildfire prevention and protection. 27 targeted campaigns - training & info days for schoolchildren and student have been organized, as well as 27 targeted campaigns training courses for civil Protection Volunteers and 38 targeted campaigns for general public advertising - posters, radio trail and TV appearances.

4. HOLISTIC Project influences on fire fighters practice

After the end of the project HOLISTIC project outcomes and results introduced great improvement in fire fighting policies and practices. In this section we will describe some of the most visible project outcomes and how their introduction changed and improved the practices and procedures in fire preparedness, fire fighting and fire reporting. The influence of the project will be described qualitatively in the form of good practices description. I this section we will also mention a methodology for evaluation of AdriaFireMonitor usefulness that is introduced in another paper.

The HOLISTIC project offered systematic introduction for fire fighting community to tools and applications of Information Communication Technologies that can be used to improve the overall communication, information dissemination and fire fighting. Before this, each organization used ICT tools in some aspect of their work (like using panoramic video cameras for fire surveillance, or GPS tracking for fuel consumption analysis) but without integration of those tools with one another or with other organizations. Specific outcomes of the project that will be discussed here are: AdriaFireGIS,

AdriaFireGPS, AdriaFirePropagator, AdriaFireRisk, AdriaFireMonitor and AdriaFireBurnedAreaMapping.

AdriaFireGIS provided integrated interface for spatial information presentation in the form of standardized GIS map.

Majority of fire fighting vehicles used in operative actions are equipped with the GPS tracking devices. The devices are interconnected with interface for GPS tracking maintained by Croatian Fire fighting Association (CFA). The GPS tracking routes are even made visible within GIS system maintained by Croatian National Rescue and Protection Directorate (DUZS)– The ZEOS system that overtook the task of AdriaFireGIS, due to the large amount of useful data collected and stored.

During the project HOLISTIC fire fighting commanders were trained for using AdriaFirePropagator. The usefulness of the tool showed itself when fire fighting commander of Šibenik-Knin County has used the tool for training before the season and run the simulation on location Promina were, according to his experience the wildfire was expected. He run simulations with different meteorological conditions and expected scenarios to analyse possible outcomes when the fire occurs. In August 2017 wildfire on location Promina occurred. It is reported that one of the expected scenarios happened and the wildfire lasted for almost 10 days, but fire fighters were prepared and no casualties happened. Also during the fire in Skradin region in September the AdriaFirePropagator was used to help decision for evacuation (Figure 6).

AdriaFireMonitor was the most visible project outcome. Almost each project partner installed the pilot forest fire video monitoring and surveillance system on 3 locations. The system was installed at the end of 2016 fire season so the operators had time to familiarize themselves with the system before the next season. During the 2017 fire season video surveillance and monitoring system provided fire fighting commanders video signal directly from the field and helped them make better and informed decisions. In some situations commanders reported that they had better overview of the fire with the use of the camera then the fire fighters on the field. Many fires were spotted in its ignition stage by the system, even several hours before citizens reported them. When the citizens report fire, it is easily confirmed by inspecting the area with the camera. The location of fire reported is more accurately determined because of integration with the GIS system. Also professional person can determine extent and severity of the fire that can them make better decision on number of troops and vehicles necessary for fire fighting. All operators' actions are logged and stored in the system, and these logs and records were used in assessment of usefulness of the monitoring system that is described in another paper.
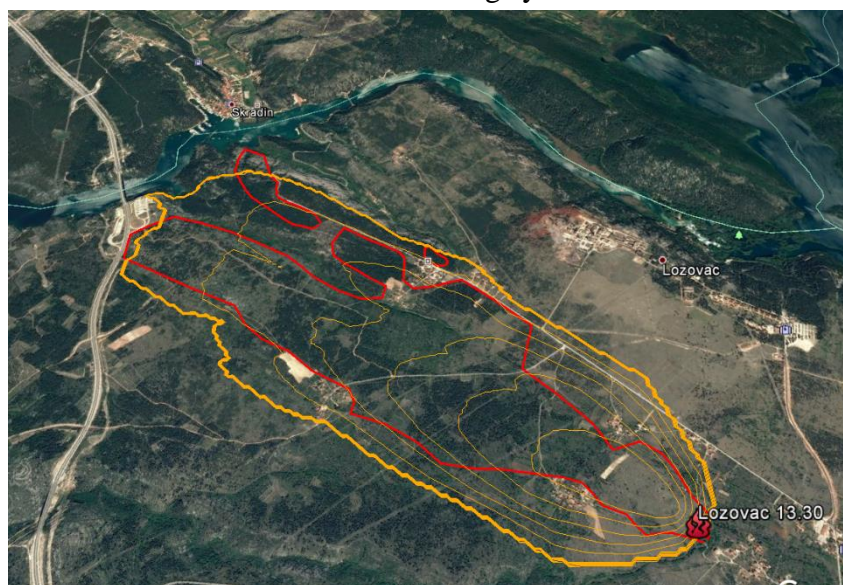

Figure 6 - Finally Comparison of fire simulation (yellow) and real fire contours (red) for the fire near Skradin in September 2017

Having in mind good experience from the pilot installation, Croatian Forests ltd invested almost 3 million EUR in the forest fire video-communication system that is extension to AdriaFireMonitor.
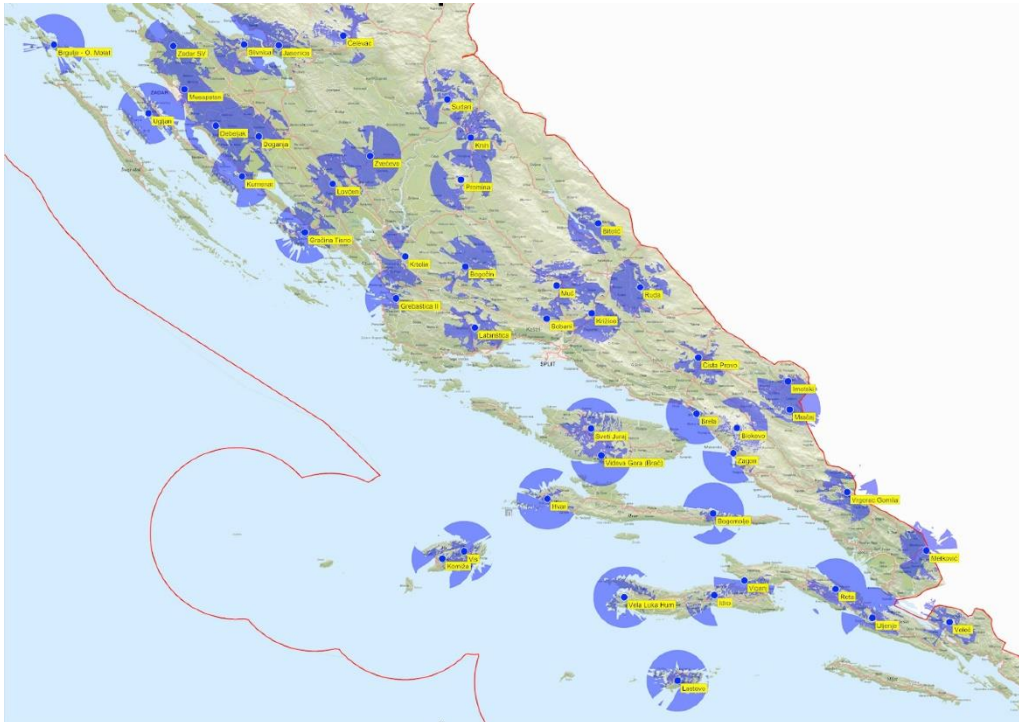

Figure 7 - Area covered by the forest fire video-communication system STRIBOR installed in summer 2018 thanks to a good practice of HOLISTIC experimental monitoring system

The system is installed in 4 coastal Counties in Croatia at the beginning of the fire season 2018. This system consists of 46 monitoring locations covering over 80% of the forests area in these, mostly endangered area.

The main leading idea embodied in specifications of HOLISTIC projects outcomes and results was using open standards and open interfaces. Following this made it possible to utilize the HOLISTC project outcomes in other crisis management situations. A Situation Headquarter was organized with the goal of being central headquarter for crisis situation management during summer fire season and put in use in the beginning of summer season of 2018. All information generated by HOLISTIC project outcomes are present at the centre and used in crisis situation for better decision making.

5. Conclusion

IPA Adriatic HOLISTIC project was more successful than we have planned in his preparation from 2007 to 2013. The project brought together almost all regions surrounding Adriatic Sea focused on the prevention and damages mitigation of the natural risks, with special focus on wildfires and earthquake risks, aiming for improvement, promotion and strengthening of institutional capabilities in implementing policies and actions for reducing the causes and potential start of natural breakdowns to improve reactions and intervention readiness to reduce the damage in areas of regions facing the Adriatic.

Implementation of HOLISTIC project activities combined in 9 WPs resulted in successful implementation of almost all planned outputs and results and achievement of main project objectives. Although number of partners was quite large (20 partners), communication between the partners went smoothly during the project implementation. Project outputs and results were very well communicated and disseminated via project Website, Facebook, YouTube and other media channels, as well as via different seminars and workshops. Last but not least the HOLISTIC project has initiated a major

breakdown in implementation of advanced ICT technologies in wildfire fighting, at least in eastern part of Adriatic. Due to the successful implementation of HOLISTIC pilot projects, in 2018, Croatian Forests invested in expansion of terrestrial wildfire video based monitoring with 46 new locations and equipment of 4 monitoring centres, integrated with wildfire behavior and spread simulation systems and advanced site specific wildfire risk index and eruption fire risk index estimation.

6. References

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