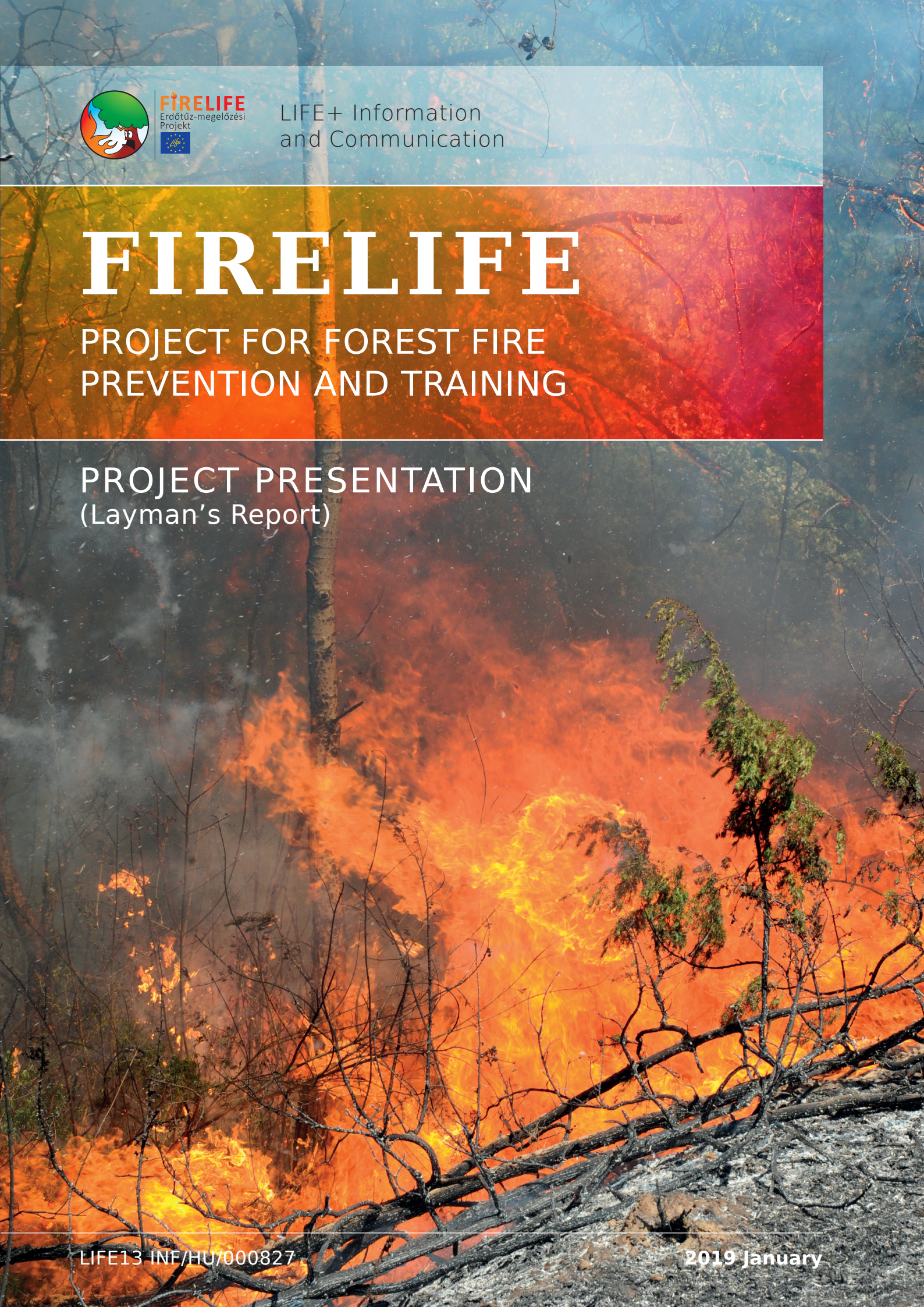
FIRELIFE
Erdőtűz-megelőzési Projekt

LIFE+ Information and Communication

FIRELIFE

PROJECT FOR FOREST FIRE PREVENTION AND TRAINING

PROJECT PRESENTATION
(Layman's Report)



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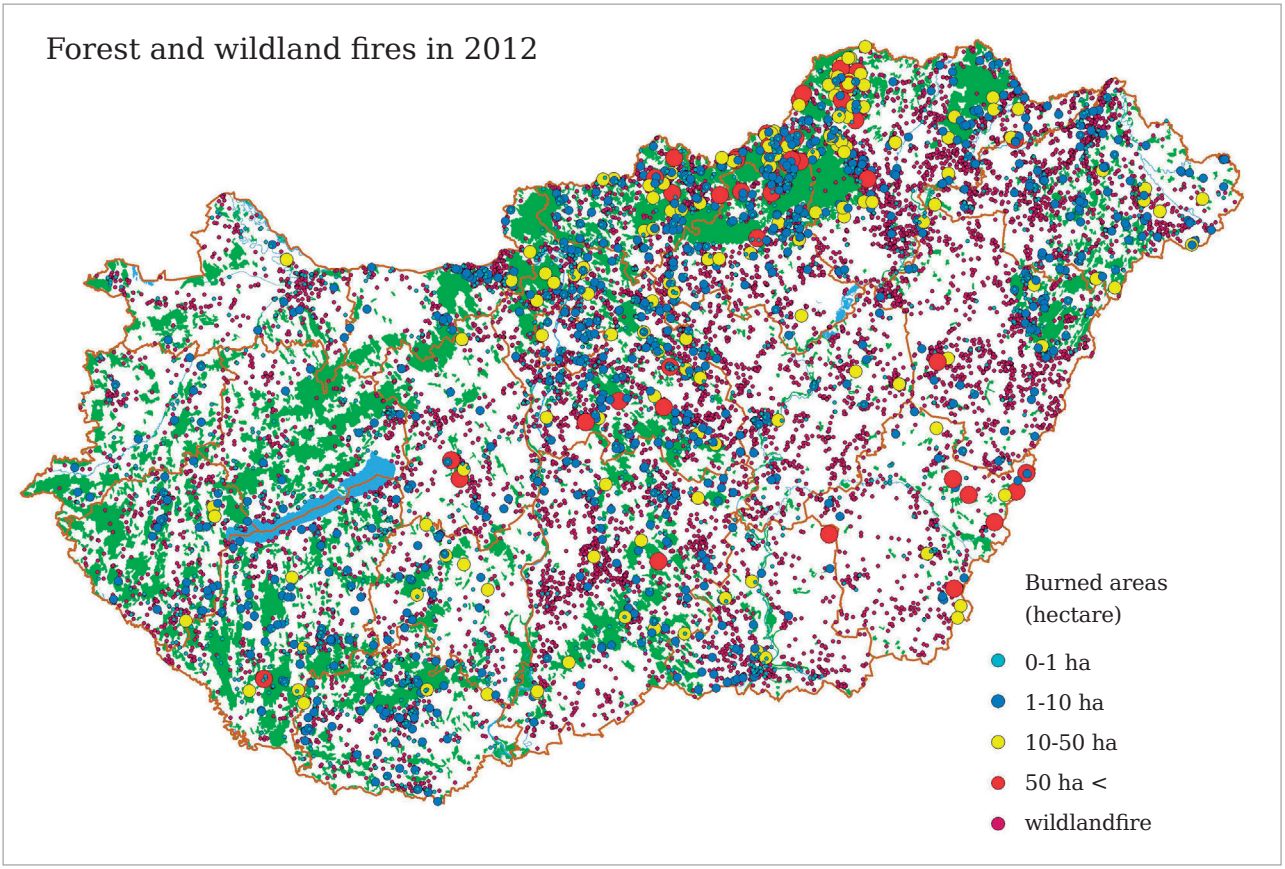
Contents

1. Introduction

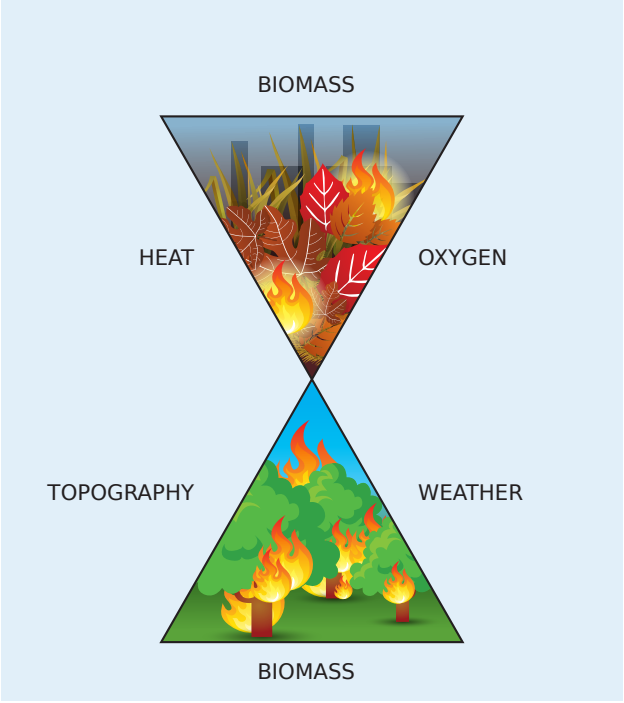
Although forest fires are classified – for statistical purposes and in everyday speech – as natural disasters, forest fires are unlike other natural disasters in that they are generally human-induced in Europe and thus in Hungary as well.

Of all fires, 99 percent originate from human causes, while biomass, landscape and land use are determined by human activities on 99 percent of Europe's and Hungary's territory. Although this is sobering, it also provides an opportunity to reduce the number, extent and damage of forest and vegetation fires, even in the short term. However, it should also be borne in mind that fire is not a problem everywhere, and in some areas, controlled burning is an important tool for forest and vegetation fire prevention.

Due to changes in land use, society and weather in Hungary, larger forest fires began to appear in the 1990s, while the number of fires and the affected area also rose sharply. In 2012, two forest fires affected about 14,000 hectares of forest, besides 13,137 wildland fires on 76,546 hectares of non-forest areas.



Forest and Wildlandfires in Hungary in 2012



As we all know, fires (including forest and vegetation fires) need three things to burn: fuel or biomass, oxygen, and heat; this is called the Triangle of Fire. What is less widely known is that the spread of the forest fire is also affected by three factors: biomass, topography and weather.

These parameters constitute the fire environment triangle. There are sides on both triangles that are determined by nature – such as oxygen, topography and weather– leaving the aspects of heat and biomass to be dealt with through prevention.

2. Forest and vegetation fires in Hungary

Although many people are unaware of it, forest fire prevention is crucial. Without it, several thousands of forest and vegetation fires occur in Hungary every year.

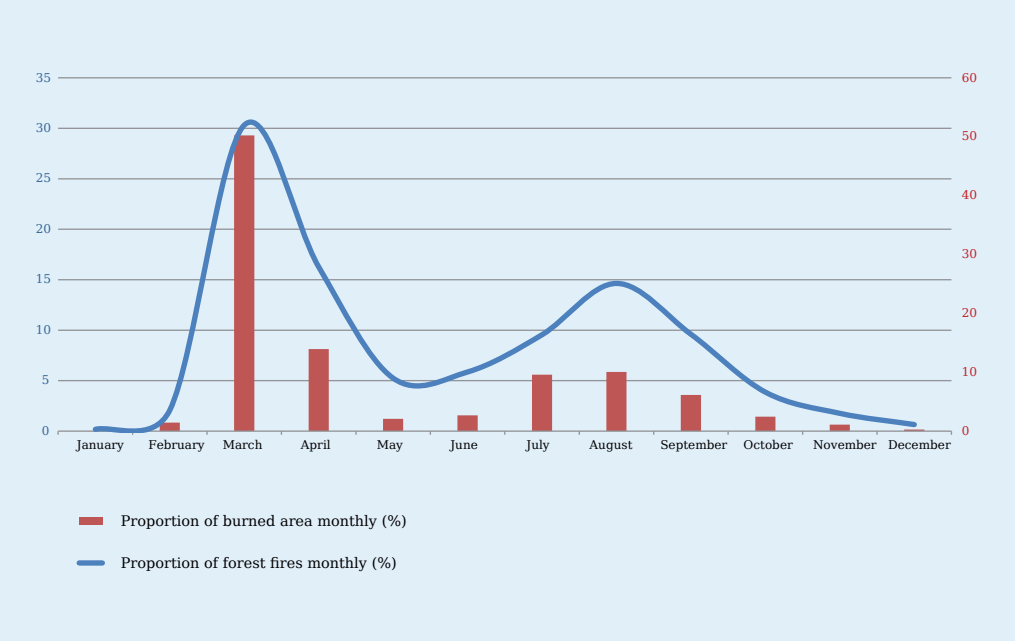
The number of fires and the area burnt has increased significantly over the past decade. In the 1990s, the size of the largest forest fire reached 100 hectares (one million square meters), while in the 2000s, the size of the largest forest fire exceeded 500 hectares, and in 2012, the largest was one thousand hectares, that is 10 million square meters.

Forest fires cannot be strictly separated from other vegetation fires burning in non-forest areas – such as meadows, reeds along shoreline, brush wastelands – because a significant proportion of fires break out in these areas, and then spread to forests.

In the forests of Hungary, so-called surface fires typically occur when leaf litter on the forest floor, other dead plant matter, or small shrubs ignite. Under unfavorable, dry and windy weather conditions, these spread to the shrub layer, and then to the crown level of trees as well, causing so-called crown fire. Primarily in peaty areas, the surface fire ignites the upper part of the soil, which results in considerable smoke formation and necessitates several weeks of efforts to extinguish the fire.

By examining the number of fires and the burnt areas, it can be established that each year, there are two distinct fire danger periods.

Based on the annual number of fires and the characteristics of the burned areas, it can also be stated that the high fire danger can occur due to the different weather conditions in the two periods. In the spring, with rising average daytime temperatures and no rainfall, the highly inflammable forest litter and dry plant matter can become flammable within a few days. As for the summer period, fire danger periods occur due to drought periods.



Monthly number of vegetation fires and the proportion of burnt area from 2012 to 2018

Fires in the spring occur as early as after the snow melts – and in years without snow, as early as from the end of February – before vegetation turns green, and a greater amount of dry herbaceous vegetation and leaves are accumulated from the previous year, which can dry out easily and quickly. Even if the weather is cold, the thin plant parts that are only a few centimeters thick can dry out within just a few days if there is no rainfall (or even within a few hours in droughty springs), and can be ignited easily.

40-45% of all spring fires in Hungary occur in the Northern Hungary region (Pest County, Borsod-Abaúj-Zemplén County, Heves County, Nógrád County).

The other group is made up of fires occurring in dry, droughty summers. In the summer, due to long periods without rainfall and hot and dry weather, forest litter and the layer of pine needles, as well as the accumulated dead twigs and branches dry out completely and can easily catch fire – primarily as a result of carelessly lit fires. These typically occur from June through August.

During this period, it is primarily pine forests that are at risk, because during times of drought, even a small litter fire can develop into a crown fire.

The majority of summer fires, unlike those in the spring period, primarily affect the Great Plains region of Hungary. In the dry pine forests of the Bács-Kiskun and Csongrád counties, there is a forest fire almost every year, although they may not be as dramatic as those seen in the summer of 2007 or in May 2012. Other pine forests that are vulnerable in the summer are those in the Bakony and Keszthely Hills.

Of all forest and vegetation fires, 70 to 75% occur during these high fire danger periods.

2.1 How do forest fires start?

Understanding the causes of forest fires is of primary importance when it comes to planning forest fire prevention programs and in designing measures to protect the environment and populations. In Hungary, due to climate and vegetation conditions, the number of forests fires started due to natural causes is negligible, accounting for about 1%.

Storms with major lightning activity without rainfall or negligible rainfall mainly occur in the summer period. In this period, the vegetation has already turned green, so this type of fire is more typical in years of drought, and in the lowland areas. Most fires are started due to human negligence or intentionally.

Based on the information obtained from the Forest Fire Information System, fires are primarily caused by cigarette butts thrown from cars, trains, or bikes; campfires carelessly left behind; careless burnings performed in small gardens or of farmland stubble; poorly organized barbecues, or poorly arranged burning of wood-cutting waste in forest areas – all of which fall into the category of acts of gross negligence. The annual burning of grassy and bushy areas near forests for the purpose of the renewal of vegetation is classified as intentional negligence (luxuria). Acts of arson are not limited to certain geographical regions.

In Hungary, due to climate and vegetation conditions, the number of naturally occurring forests fires is negligible, accounting for about 0.8%. The proportion of fires lit intentionally is minor as well, at only 1.9%. Thus, most fires are caused by human negligence.

In Hungary,
99% of forest fires
are caused by humans!

- *In dry and windy weather, flames can spread within minutes.*
- *Leaf litter and dead grass may ignite as soon as one hour after a light rain.*
- *Wind can blow embers from a campfire stacked too high, or from an open grill, up to a distance of 100-200 meters.*
- *Campfires that are not properly extinguished fires may set off a fire in a forest up to three days later*

2.2 What are the effects of forest fires?

After the ravages of fire – depending on the type and extent – it is only after a long period of time that the forest ecosystem can recover.

Forest fires not only endanger trees, but also the forest's entire ecosystem. Habitats may also be damaged as a result of high intensity fires, and ecosystems are not always able to regenerate.

Animals and their homes (nests, tree holes, burrows) may also be rapidly destroyed in forest fires. Some animals are not able to escape from fires, and even those with the ability to move quickly can suffer serious injuries.

Motorways and main roads must often be closed because of forest fires, if the wind is carrying the huge amount of smoke generated by the fire. Forrest and vegetation fires often endanger populated areas and farms as well.

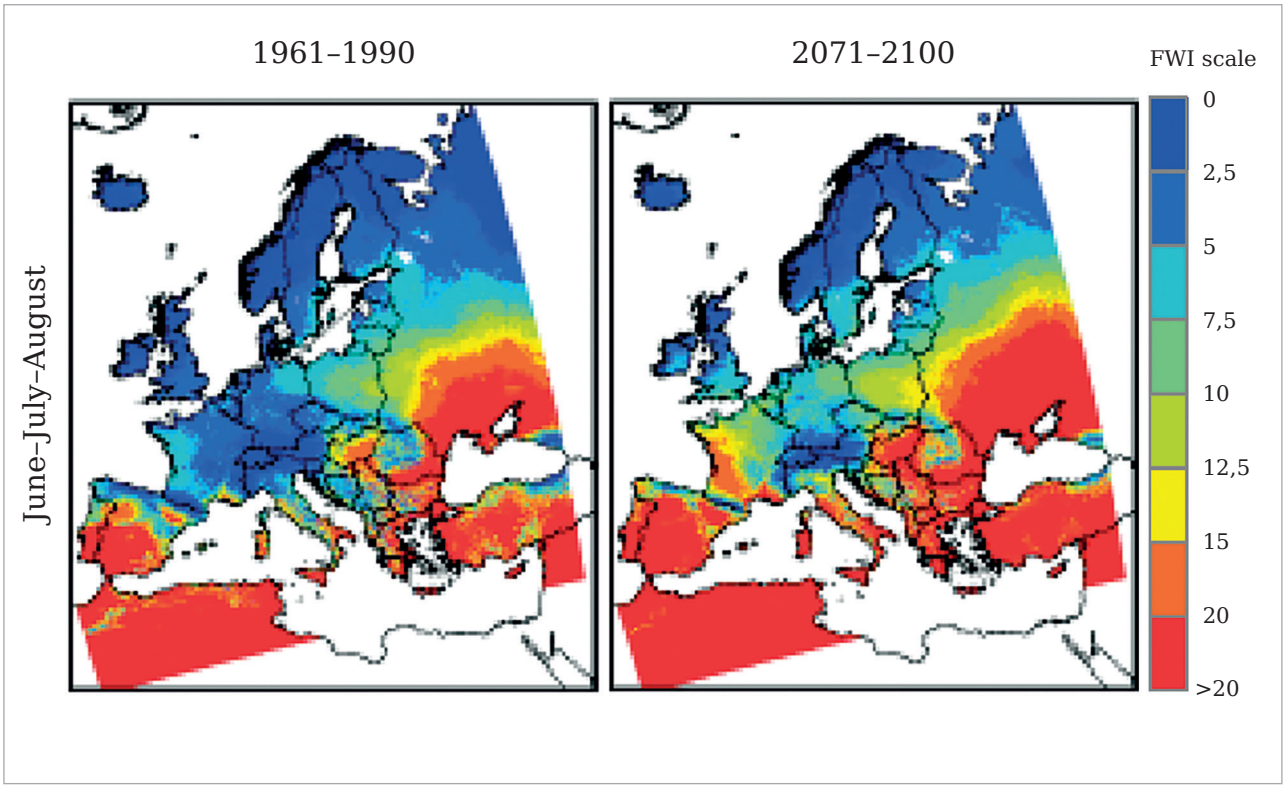
It should be always taken into account that smoke – as it can block escape routes for animals and people alike – poses at least as great a threat to the lives of forest inhabitants as fire and flames do.

2.3 Climate change and fires

Indirectly, climate change also has an effect on forest fires in Hungary.

Fire danger periods have become longer: forest fires can occur as early as in February, and we have seen forest fires in October as well. The number of fire danger days during the summer fire period has increased; the annual moving average of very hot days calculated for 10 years has tripled in the past 30 years. Even based on the most optimistic climate models, the average value of the fire weather index showing the risk of fire danger is expected to rise by 30-50% by 2050.

A map created by the European Environment Agency shows the expected changes in the Fire Weather Index (FWI) from 2070 to 2100, based on the IPPC climate model. The map shows that while fire danger in Hungary used to be similar to northern Spain and Greece, by the end of the century it will increase to reach the risk level of the Mediterranean region.



The risk of fire is heightened by the increase in extreme values in rainfall patterns. A large amount of precipitation within a short period can cause considerable damage to areas affected by forest fires, jeopardizing their renewal.

[1]*Intergovernmental Panel on Climate Change (IPCC) Climate Change scenario A2*

Forest fires that arise burn much more intensively. Fires that used to be surface fires now tend to spread to the crown of trees, and are thus more difficult to extinguish.

Due to extreme weather conditions, the size of forest fires in Hungary has increased tenfold over the last 10 years. Unfortunately, we have seen several forest fires with a size over 1,000 hectares – bigger than the area of Budapest's Districts 5, 6 and 7 put together.

Given that 99% of fires are caused by humans, the most effective defense against forest and vegetation fires is to pay attention.

3. Preventing forest fires, step by step

The FIRELIFE project is the next step in a long process which has been implemented after a long period of preparation.

Forest fire prevention is most effective – and best practices can only be implemented – if we are familiar with the fires typical of our regions, as well as their characteristics and causes.

As the importance of forest fires increases, the countries meeting because of the climate change and land use should develop their fire prevention plans step by step, since they cannot immediately integrate all of the knowledge from those countries where forest and vegetation fires have long been posing problems. This is not possible, even though the forestry, nature conservation, and firefighter professions have a tradition of supporting each other.

We have completed the following steps of preparation:

- **The first step** is to collect data on forest fires, which requires the standardization of terminology and data sets. In addition to the size and the place of origin of fires, is very important to record the type of fire, the biomass burned and the alleged cause of fires, since this information is necessary not only for forest fire prevention, but also – for example – to optimize fire fighting capacities and devices. It is entirely possible that once the data collection system is set up, it turns out that there are more or other types of fires in a specific area than was previously thought, due to inaccurate data collection.

- **The second step** is to establish the cooperation framework of government agencies involved in forest fire prevention, the elimination of any potential overlaps or conflicts of competence, as well as defining the responsibilities and the areas of cooperation.
- **The third step** is to map fire risk on a large scale and to identify the activities and groups that cause fires, as well as any non-governmental operators and scientific institutions involved in forest fire prevention.
- **The fourth step** is to create the regulatory environment (this may affect several statutes on forestry, disaster management, or nature protection), thus establishing the framework for a multi-level forest fire prevention plan, the legal institution of fire bans and forest visitation bans, and in this way raising the common data collection system to the level of statutes.
- **The fifth step** includes performing socio-economic research to elucidate background causes of fires, in order to better understand any motivations, economic, or social reasons.

Once the causes of fire are better understood, the legislative framework should be reviewed, and unrealistic legislation should be repealed if necessary. Economically and ecologically acceptable biomass management should be made possible. It is important to include measures for verification and enforcement in each regulation.

Target group-specific communication is crucial for identifying target groups and understanding socio-economic causes. Otherwise, information will not be sufficiently targeted, which is both expensive and inefficient.

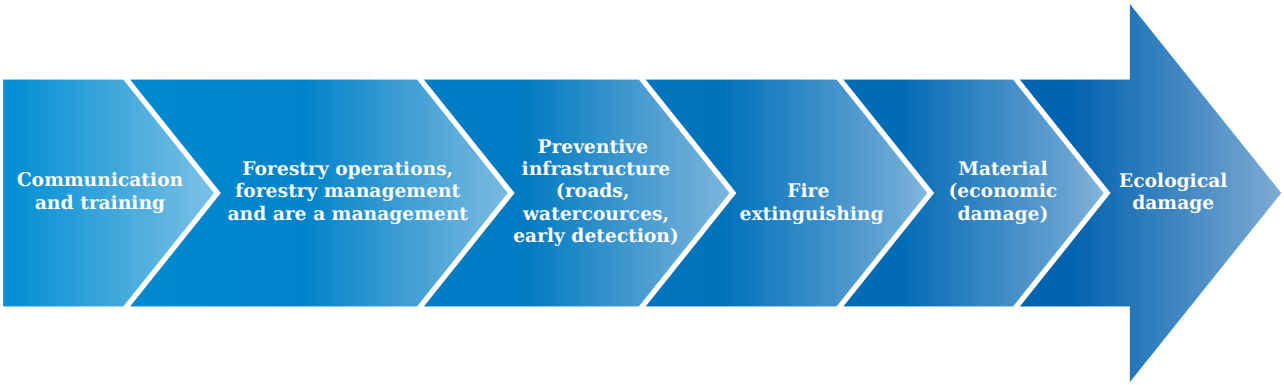
When applying for national and EU grants, it is a good idea to take forest and vegetation fire prevention criteria into account. In addition to traditional infrastructure such as fire breaks or watercourses, it is worth supporting interventions that reduce biomass – in the case of forests located at economic boundaries – and thus also the risk of fire. However, it should also be taken into consideration that certain infrastructural elements (e.g. wide fire breaks or fire monitoring systems) are only effective when implemented within a greater plan.

2006	New data collection regarding forest and vegetation fires (Twinning light project)
2007	New regulation on forest fire prevention
2008	Developing biomass models and communication concept (Forest Focus Projects) | Mandatory plans for forest fire prevention (3 levels), unified data collection system, forest fire prevention maps, allowing controlled burning in forest areas (Twinning light project)
2009	New law on forestry, fire ban based on the Fire Weather Index system
2010-11	Sociology research in counties with high fire risk (NÉBIH EI – FM project)
2012	Joint inter – institutional trainings and education
2013	Infrastructure development (fire breaks, water reservoirs, forest management measures) (Darányi Ignác Plan)
2014	FIRELIFE communication and training program
2015-	New regulation: controlled burning on agricultural lands
2020-	Wide fire breaks and fuel breaks, fire detection towers

The steps of forest fire prevention in Hungary.

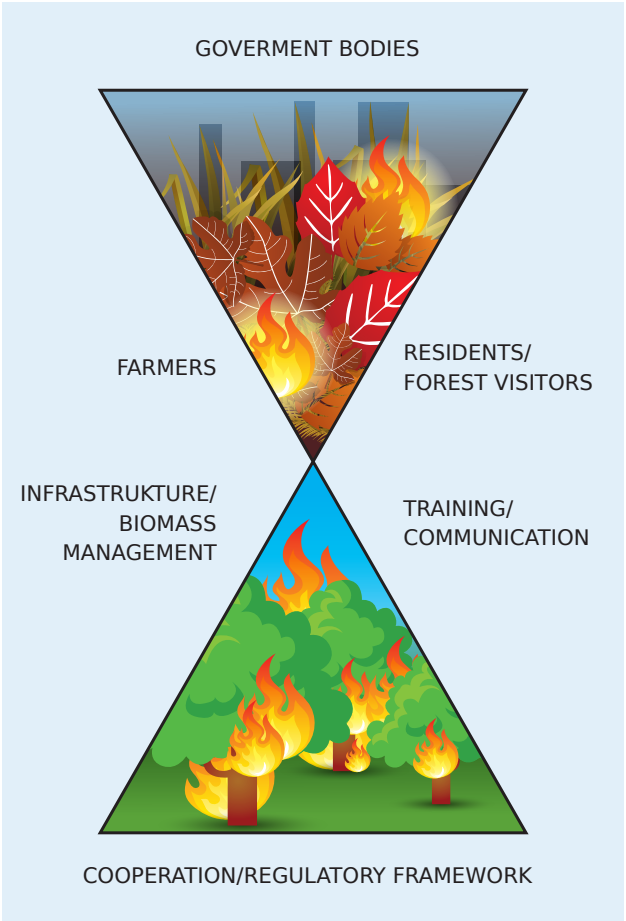
It is important to develop a joint training platform and organize workshops promoting the cooperation between different fields. An incremental approach, as well as the openness and cooperation of the parties involved is especially necessary in areas that require a paradigm shift (controlled burning, common management system, tactics for extinguishing forest fires).

The costs of various forest fire prevention activities differ significantly. The cheapest ones are training and communication, while forestry interventions aimed at forest fire prevention are many times more expensive, and infrastructure development for the purpose of forest fire protection costs several times more again. However, these are still much less than the cost of extinguishing fires and the recovery of any resulting ecological and economic damage.



In our experience, forest fire prevention measures work together synergistically, and are sometimes only effective when applied at the same time. Spending a lot of money on communication is a waste if the target groups are unknown, or if there are no tools, regulations or fire prevention concepts tailored to the specific target group. Conversely, even if these means are available, they will not be useful if the target group or another organization involved in fire prevention is not aware of them.

Using triangles again, fire prevention can be summed up in two triangles. One of them summarizes the operators, while the other summarizes the possible tools. Each side of the triangles is presented in Annex 1, where they can even be used as checklists for developing forest fire prevention activities in a district, county, region, or country – of course giving due regard to local characteristics.



4. Fire is a good servant but a bad master

People are often surprised to hear that fire is used to prevent forest fires. We will thus mention a few main points about this method of fire management.

Using fire to reduce fire danger and manage a specific area is an ancient method. Fire was used for pasture management not only by native Americans but also by Hungarian shepherds. When this method is used properly, it is much more natural and often considerably cheaper than the mechanical removal of biomass with huge power machinery. In some areas, the only real alternative to the expensive mechanical removal of biomass manually is to light fires in an appropriate, competently managed way.

The result of the previous total ban on controlled burning was that many people would set fire to the area which they wanted to burn, and then leave it unattended.

There needs to be a paradigm shift in the use of controlled burning. This requires proper communication not only in Hungary but also globally, even though a mere century ago, it was a part of normal agricultural practices in our country. The field of application has changed since then, but controlled burning is still an indispensable means of preventing vegetation and forest fires. Naturally, training, proper planning and appropriate implementation is required for its correct use. Without controlled burning, there will be more and more forest and vegetation fires occurring in our country, which burn at the worst time in ecological terms, cause significant damage to property and nature.

5. The FIRELIFE Projekt

Based on understanding the causes and background of forest fires in Hungary, as well as on the steps described in Chapter 4, the **FIRELIFE communication and training project for forest fire prevention has been aimed at those two sides of the triangle that can be controlled.**

Firstly

To draw attention to forest fire dangers using extensive, targeted communication, and also educating people on the correct use of fires in forests.

Secondly

Educating professionals from various fields on the correlations and methods of forest fire prevention and biomass management.

With appropriate communication, people will cause fewer fires, and at the same time, through the education and training of professionals, foresters and farmers – supported by proper regulations and targeted financial support – land utilization and biomass conditions can be developed that will slow down and limit the spread of forest and vegetation fires.

A special feature was that certain groups participated in the project not only as training and communication target groups, but as stakeholders as well. It is important to emphasize that FIRELIFE is a communication project where public awareness is not an secondary aim, but the main purpose of the project.

Efforts were made to use elements of participative teaching in our communications, and to provide information in a fun way, in drawings and charts wherever possible. When planning the trainings, we took into account the needs and the existing knowledge of practitioners in order to keep participants awake and interested.

6. Projekt actions

6.1 Communication Axis

In designing the communication axis of the project, we sought to choose cost-effective and elements that are sustainable or usable after the LIFE project.

Communication Plans

For the project period, a framework plan for communication target groups, messages and communication tools was prepared. Afterwards, the annual communication action plan was developed on this basis, in which both experiences and feedback could be integrated.

Printed Materials

In the first year, printed brochures were developed for the various target groups (children, hunters, foresters, farmers and hikers), but from the second year onwards they were amalgamated into a single document. The illustrated flyer with fun activities was a great success, providing tips for the whole family on how to make and put out a campfire.

Our five themed A1-sized posters were successful as well. For children, they show the dangers that forest fires pose to wild animals; for adults, the causes and the possible ways of preventing forest fire; for general audiences, we offer tips for making a proper campfire; smokers are told, in the style of a cigarette box warning, of the dangers of a dropped cigarette butt; and small land owners are informed of local fire regulations.

The forest authority, disaster management, national parks, forest owners, municipalities, schools, kindergartens and NGOs took part in the placement of posters. Thanks to this wide cooperation, the posters appeared in forest schools, classrooms, preschool hallways, medical clinic waiting rooms, on City Hall notice boards, in hostels, hotels, campsite advertisers, at railway stations and even in tobacco shops.

Events

Within the framework of the project, we highlighted the importance of forest fire prevention at various events. We worked with traditional print media at forestry industry events, but we tried to draw attention either with special tools (e.g. drip torch) or deliberately incorrectly printed roll-ups (e.g. depicting a deer with roe antlers) that made experts in the field take notice. When they came to us to report the error, they took a leaflet at the same time.

Our participation in retail, tourism, villages, forest schools, schools and other children's events were more successful than expected. We built a mobile forest fire prevention adventure trail that could easily be packed on a trailer and installed anywhere – whether in Budapest or next to a forest. At some stations on the adventure trail, we introduced children to forest fire prevention and the dangers of forest fires with drawing, creative, logical, skill-developing and other fun activities. About 700 to 800 children a day can visit the adventure trail. Its central elements are the forest fire bouncy castle and the watering wall. The bouncy castle attracts children like a magnet at any event. If you have a forest warden standing on a barrel, only one or two children pay attention, but if they can jump up and down and play with water guns, everything changesJ. Children and school classes who visited the adventure trail were awarded a Forest Patrol certificate, which they could remind them in the future as well of their experiences.

Direct Communication

In the framework of direct communication, we visited people living on farms and regularly visited the forest rest areas around Budapest. Personal communication is very effective even in the short term. No later than in the second year, we saw that everyone made sure to have enough water with them to extinguish fires. Over the four-year-period we saw that, after the initial reaction of surprise, people were always very friendly and welcoming. In addition to many friendly words and BBQ invitations, personal communication results in a lot of feedback on the effectiveness of some communication tools and handouts, and provides useful ideas for additional developments.

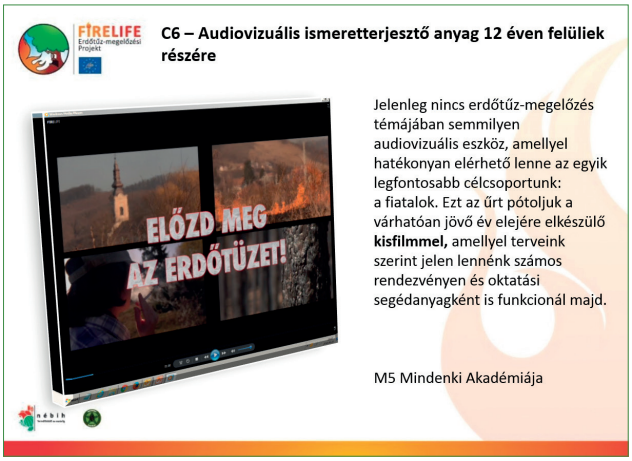
Integration of Forest Fire Prevention into Public Education

The project and the forest authority do not have enough resources to reach every student, so we considered it important to incorporate information about forest fire prevention into the school curriculum. To this end, we have prepared lesson plans, background papers, tutorials and fun activities, and finally, the topic of forest fires

was included into 4th and 10th grader textbooks. Tips and advice for setting and extinguishing campfires in the forest were included in the curriculum and textbooks of teacher trainings on environmental and forest-related issues.

Documentary and educational film about forest and vegetation fires in Hungary

The film serves two purposes. On the one hand, it presents the causes of forest fires in Hungary and the damage they do, and on the other hand, it reviews the possibilities for prevention, e.g. it teaches the viewer where, when and how to make a campfire in the forest and, more importantly, how to extinguish it properly. The film can be broadcast free of charge by television stations, but it is also an important aid in education, as the 20-minute film provides a good basis for learning the most important first steps of forest fire prevention. The film provides a basis on which the issue can be easily discussed outdoors or in the classroom.



Storybooks

Children are receptive to many topics, and especially to information about fires and forests, thus they can convey information about the careful use of fire to their entire families. Within the framework of the project, two storybooks were created: one for small children who are not yet able to read and for their parents, and one for those who are already reading independently. We have also prepared a sticker booklet because, in our experience, all children love stickers, especially if the stickers are used to solve the exercises based on a story.

Signs and billboards

About 2,000 thematic information signs in different sizes were produced in the framework of the project, all meeting the same quality and safety standards as public road signs. These boards were placed on forest paths and in rest areas by forest owners and national park patrols.

The forest authority placed them at highway car parks, but the signs were given to zoos and arboretums as well, where people learn about nature. The boards have the same colours and logos, so not only the 2x1 meter board, but also the 600 mm road sign sized board remind people of forest fires. Several foresters have prepared additional signs using the unified content and form that we designed.

During the most high-risk summer period, we have expanded our awareness-raising activities to include billboards beside motorways. For communication and traffic safety reasons, only a short message can be placed on these surfaces, but it effectively complements other communication tools.

Gifts and handouts

Children are always more enthusiastic about tasks if they know that there is a gift at the end, no matter what or how small. However, we have seen that adults are very much the same. We tried to choose handouts that are different from typcial project gifts and that are both useful for the target group and carry the fire prevention message as long as possible. Thus, in addition to the usual pencils and pens, we also gave out gym bags, reflective vests and matches.

6. 2 Training axis

Preventing forest fires is an interdisciplinary issue that requires a lot of collaboration between various professions and organizations. The purpose of the trainings was to present the causes of forest fires, the factors influencing fires and the widest range of tools for prevention. Different professionals have contributed different aspects of knowledge, some parts are a novelty for everyone, and each professional promotes forest fire prevention in their own way in their separate fields. We are convinced that well-designed support systems, a supportive forest fire prevention legal environment, cost-effective and professional prevention techniques for field forestry and nature conservation professionals, as well as fire-protection professionals who are familiar with the special characteristics of the forest are crucial for effective prevention.

In addition to on-site trainings, the materials were divided into modules and incorporated as e-learning units into the training curriculum for forestry, nature conservation and fire-fighting professionals.

7. Project results

The communication project drew attention to the forest fire problem and restarted many forest fire prevention processes that had been abandoned.

For example, the use of controlled burning as a biomass management tool has become possible again.

On the basis of the information received during the implementation of the project, we have improved the fire prohibition system, which now operates more flexibly and faster, using forest fire indices calculated by the EU JRC. Daily updated fire-prevention maps have been placed on the project's website, where related leaflets can be accessed immediately.

Many people have learned that forest fire in Hungary is also a growing risk that originates from human causes, and that it is not just something you see on TV, but which could also happen nearby.

As part of the project

250,000 leaflets and information sheets were printed

5 million brochures and flyers included forest fire information

36,500 story books were published

31 radio- and **11** tv interviews were given

25 articles on forest fire prevention were published

875 different online platforms cited the articles

59 000 people have been contacted directly

60 events in which we participated (117 event days in total)

32,000 children have completed the adventure trail

2000 information signs and **73,000** posters have been put up

950 officials have attended our trainings

8. Effects of the project

The effects of the project are presented from two perspectives: first, the target groups, and secondly, the environmental problem to be dealt with – forest fires.

8.1 Effect of the project on the target groups

In the case of some target groups, a more careful use of fire can be achieved by transferring new knowledge, while other target groups have to change their habits, which is much more difficult to achieve. Similarly to other environmental problems, measuring the effects of direct communication and training is also difficult. Model answers are often received, since few people admit to causing fire, or they prefer not think about such consequences of their activities. The project is able to prevent the damage caused by arsonists in an indirect way, as trained professionals can create biomass conditions and fire prevention infrastructure that on the one hand create unfavorable conditions for fire spreading, and on the other hand allow to quickly extinguish any fires. A continued source of difficulties in evaluation is that the alleged causes of fires are not always indicated. Therefore, we have launched a special project to improve knowledge on skills related to fire investigation.

In the next part, we set numbers aside and tried instead to present our experience in terms of the individual target groups, as well as the activities planned for the future which can provide further benefits for that target group.

Growers/Farmers

Information to owners of large farms is most effectively disseminated at trade fairs, via professional articles. They are aware of cross-checks supporting fire use and the role of the maintenance of agricultural machinery in fire prevention. Of full-time farmers, 90% are already familiar with the fire ban system and the prevention measures to be applied in agriculture. They do not burn arable stubble or grass. Small farmers are more difficult to contact, since they do not attend trade fairs and use fire in farming because of a lack of machinery. They are aware of fire rules, but continue to ignore them in many cases. Further progress can be achieved by involving village caretakers, and by using biomass management that applies to the entire settlement.

Ranch owners

Ranch owners consider forest fires as danger to their homes; 70% of respondents had experienced forest fires at their settlements. Over 90% of them were familiar with the system of fire bans, and pay particular attention to fire prevention rules. They receive information from farm caretakers, local newspapers and the media.

Hikers

Among hikers polled, 75% had seen the uniform information forest fire prevention signs placed in forests. When the project was launched, only 25% of hikers were

familiar with the correct technique for putting out campfires – this proportion increased to 65% by the end of the project. As well, 92% of hikers knew about the fire ban, and 70% of them were able to quickly find information about it on the internet. During the fire ban period, only 10% of the designated campfire sites were used – and typically in less frequented areas – because hikers warned each other of the danger. As for the future, we recommend to develop a risk rating system for designated campfire sites, and to consider it for fire bans – since there is a much lower fire risk in mountains or near streams.

Smoking drivers

This is a large target group which is hard to influence. Drivers who routinely throw cigarette butts out the window tend are often not even acting consciously. We tried to approach them via billboards along highways, posters displayed at tobacco stores, signs posted in highway rest areas, and through the media. They are aware of fire rules, however, 70% of them do not think that a cigarette butt they threw away – and which was stubbed out in their opinion – could cause forest fire. However, after the forest fire disasters in Europe in 2017 and 2018 were presented in the media, this target group's awareness of the problem increased, and the number of fires near roads decreased in the summer fire seasons of 2017 and 2018.

Students and preschoolers

It is a well-known fact that this is the target group that shows the most interest, learns the fastest and is the most rewarding insofar as information is packaged right – playfully and in an interesting way. In 2018, with assistance from our partners, all public educational institutions received our posters, and with the help of

the events, textbooks, and teacher trainings, we managed to achieve an increase from 20 to 65% in the number of children who know where and when you can light a fire in forests, and how to extinguish a campfire. An additional 20% knew some of the correct answers. These children transfer the new information to their families as well, and at hiking spots, it was often children who gave the correct answer instead of the head of the family.

Farm/Village caretakers

We reached 35% of farmers through the farm and village caretaker associations, but with the help of the disaster management officers, all municipalities in the danger areas received our information on forest fire protection.

Forest managers

We reached 100% of state forest managers and 30% of private forest managers were reached through professional events, however, those that we contacted manage 70% of Hungary's woodlands. The forest managers assisted in placing thousands of signs and boards. The was an increase in the amount of requests for infrastructure support within the rural development program, as well as in the rate of forest managers preparing forest fire prevention plans.

The public

The public was primarily reached through the tens of thousands of posters and signs posted in public institutions, as well as through our regular appearances in the media, and through the fire ban system established in connection with the project and operated on the website of the project. Unfortunately, the large forest fires in Europe also played a role in raising awareness; the important communication task in this respect was to make people understand that there is a forest fire danger in Hungary as well. Of the population, 82% knew about the forest fire prevention rules and the fire ban system. As web searches for “forest fire” or “fire ban” result in the search engines showing the website of the project, further information is quickly available.

Forestry/environmental protection professionals

The trainings for forest fire prevention were also attended by colleagues from each national park and environmental authority, who could thus later serve as “information points” in transferring such professional knowledge. According to the feedback received from the professionals, the trainings highlighted the correlations, the interdisciplinary nature of forest fire prevention, as well as the importance and results of teamwork.

Fire protection and disaster management professionals

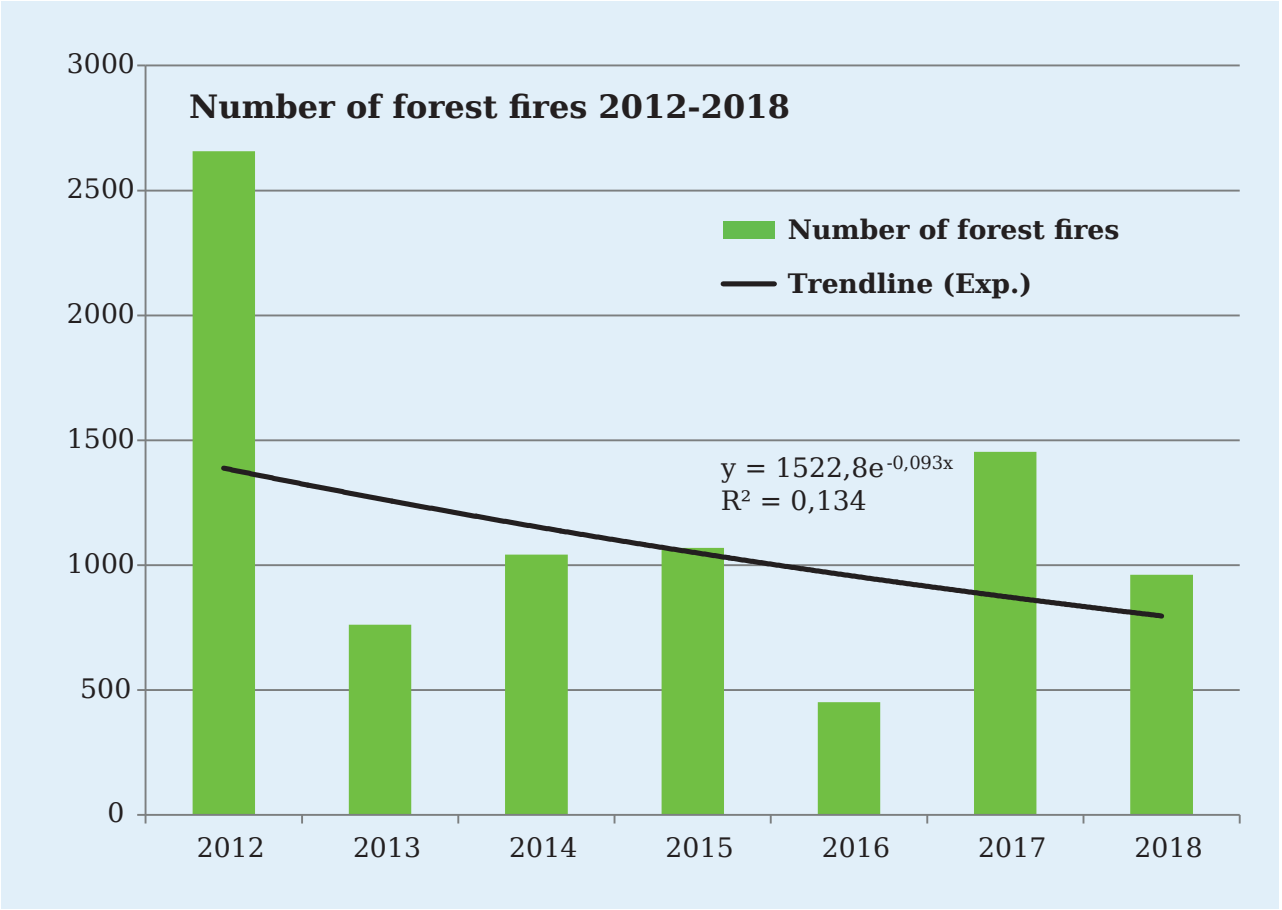
With the support of the National Directorate General for Disaster Management and the National Fire Prevention Committee, professionals from each county and from each directorate of high risk counties participated in the forest fire prevention trainings. In addition to the training participants, hundreds of disaster management professionals assisted in the distribution or personal delivery of the project’s communication materials. This huge work greatly contributed to the success of the project and to interdisciplinary collaboration.

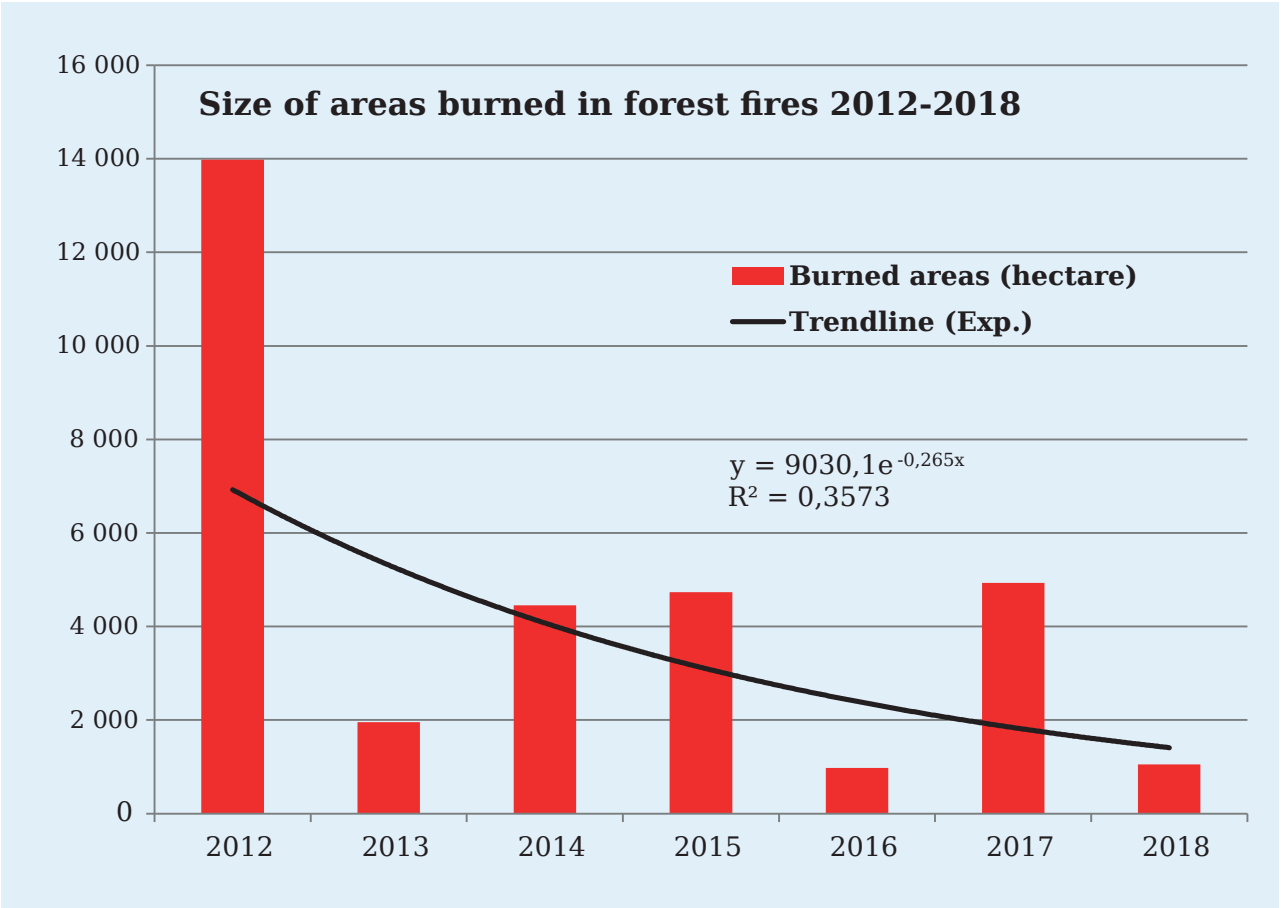
8.2. Effects of the project on forest fires

8.2.1 *Number and size of forest fires*

In addition to the results of the project in terms of communication and training, it is also very important to see the effects of the project on the number and size of forest fires. Defining this indicator is not an easy task, since we cannot tell how many forest fires would have occurred without the project, and we can only guess at how or which element of the project affected the change in the number and size of forest fires. It should be emphasized that in addition to the project, other measures aimed at forest fire prevention also have effect on the number and size of forest fires. It is likely that the number of fires was primarily affected by the project’s communication activities, while the size was affected by the project’s trainings.

The two figures show that both the number of forest fires and the size of areas burnt in forest fires decreased. There is a steeper decrease in size of the burnt area, which means that the size of the burnt area per fire has decreased: while in


Number of forest fires 2012-2018
Number of forest fires
Trendline (Exp.)
y = 1522,8e-0,093x
R² = 0,134
3000
2500
2000
1500
1000
500
0
2012
2013
2014
2015
2016
2017
2018


Size of areas burned in forest fires 2012-2018
Burned areas (hectare)
Trendline (Exp.)
y = 9030,1e-0,265x
R² = 0,3573
16 000
14 000
12 000
10 000
8 000
6 000
4 000
2 000
0
2012
2013
2014
2015
2016
2017
2018

2012 the average was 5 hectares/forest fire, in 2018 it was only 1 hectare/forest fire. This may be due to faster fire detection, better managed forests, fire breaks, or faster, more effective intervention.

8.2.2 Search for forest fire prevention indicators

During the 2014-2020 funding period of LIFE projects, it is of primary importance to select the indicators suitable for the project. From the set of indicators, we tried to choose the indicator best suited for the forest fire prevention projects, and could not find one on the list.

Other projects, reports, or statistics on forest fires usually use data on the number of fires and on the size of the burnt area for describing the forest fire risk and forest fires in a given area, county, region, or country. These data can be used to draw a number of conclusions, especially if they include additional information on the biomass conditions of the burnt areas and on the causes of fires. However, in our opinion, they are less suitable for measuring and comparing the effects of fire prevention.

It makes a difference whether 1,000 hectares were burnt in 100 fires on an area of 1 million hectares of high risk forests, or on an area of 100,000 hectares. Similarly, it also makes a difference whether there were 50 or 150 high fire risk days in the given year, since the same size of burnt area can be considered a success if the danger period was longer.

A number of fewer forest fires does not necessarily mean that there is no forest fire risk, but it can also mean that the complex system of forest fire prevention involving multiple actors works well. Although the hard work of fire prevention is not as high-profile as a fire-fighting plane, it is more efficient both economically and ecologically. If this aspect is forgotten, if a drop in fires results to resources being diverted from fire prevention, or if any element of fire prevention is neglected, sooner or later catastrophic consequences can arise.

Since there are several variables influencing forest fires, we had to define an intensity ratio where the numerator contains the data of fires occurred during the relevant period, while the denominator contains the number characterizing the potential fire risk for that period. In the case of forest and vegetation fires – where weather is an additional factor – the change in the intensity ratio is more suitable for demonstrating the effects of the measures taken.

Considering that during the project period, the size of endangered forest area and land use has not changed significantly in Hungary, the number and size of fires occurring in each year should be compared to the level of fire danger or to the length of the periods when fire can occur. Naturally, an intensity ratio could also be defined which takes into account territorial changes or the level of individual measures when the data of fires are compared.

8.2.3 Defining the level of fire danger and the criteria of a fire danger day

In order to be able to compare the number and size of forest fires in each year, the terms “fire danger day” and “area” must be defined. The spring and summer fire seasons – because of the different biomass conditions – should be separated for this purpose.

There are two issues that should always be specified:

1. When is a certain day considered a fire danger day?
2. If a certain day is considered a fire danger day, which area does it apply to?

For the first question, we should start with fire data, or with characteristic meteorological or fire risk data showing the chance for a potential fire.

In case of the second question, the criteria of the fire danger day should be applied to the area related to the data, which may result in considerable simplification.

Criteria: 2 fires, 1 hectare

When evaluating the data of forest fires, we found that a day can be considered a fire danger day when there are at least 2 such forest or vegetation fires per day with a combined size of at least one hectare. Since spring fires typically occur in grass biomass, and then spread to the forest, these two fire types should be handled together in respect of criteria. Because of the higher number of spring forest and vegetation fires and because the majority occur in Northern Hungary, this criterion can be applied nationally for the spring fire season. The downsides of this criteria are that if the number of fires decreases, or when fire prevention is significantly improved, and there is no fire on a potential fire danger day, it does not show if no fires started on a potential fire danger day.

Number of summer days and heatwave days

In the summer fire season, under warm weather conditions, light dead biomass (dry grass, forest litter) with high surface area can reach a state when it can be ignited easily, even within a few hours after a light rain. It can be stated that forest and vegetation fires can typically occur on summer days and during heatwaves. Since these data apply to Hungary, there may be areas where the conditions of fire do not exist; however, in general it can be stated that the number of summer days and very heatwave days is characteristic of the length of the summer fire season and its danger level.

Criteria system based on the Fire Weather Index

Canada's Fire Weather Index system is used by the Joint Research Center (JRC) of the European Union to evaluate the risk of forest and vegetation fire for the upcoming period. The Canadian system uses meteorological parameters to model changes in the moisture content of biomass for territorial units for which the weather data are available. In order to use the index at on operational level, its values must be validated at the member state level.

The original system detects the fire danger level of each period with the so-called Seasonal Severity Rating (SSR) value. However, we believe that it does not work for countries with spring fire seasons, because the SSR value is based on the Fire Weather Index (FWI), while fire danger level during the spring fire season is better characterized by the Fine Biomass Moisture Index (FFMC). Besides, from the

perspective of the fire prevention indicator regarding the number of fires, the dryness level of biomass on a given day at a given area was not of primary importance, but whether its dryness reached the level where it could be ignited by an ignition source. Therefore, for the purposes of our evaluation, the important thing was not how fast biomass could burn, but whether it could be ignited. Naturally, drought levels also affect the spread of fires and the size of the burnt area. Accordingly, there can be preventive actions (e.g. biomass management measures) where a different index should be used, which also takes into consideration the risk level and the expected fire spread conditions in addition to the possibility of fire occurrence.

During the spring fire season, a day was considered a high risk day if the FFMC value was higher than 75, while high risk days in the summer fire season were those when the FWI value was higher than 17.

Using this method, the smallest evaluation unit is the pixel, for which the input data of the model are available. The data of one administrative unit – village, county, region or country – are calculated by averaging the data of each pixel. This method is also suitable for managing changes in pixel size at the larger regional scale.

Since the SSC value was based on the FWI index, it can only be used for the summer fire season and, in our opinion, primarily for the evaluation of area data.

8.2.4 Characterization of fire trends occurring within the project period with the use of intensity ratios

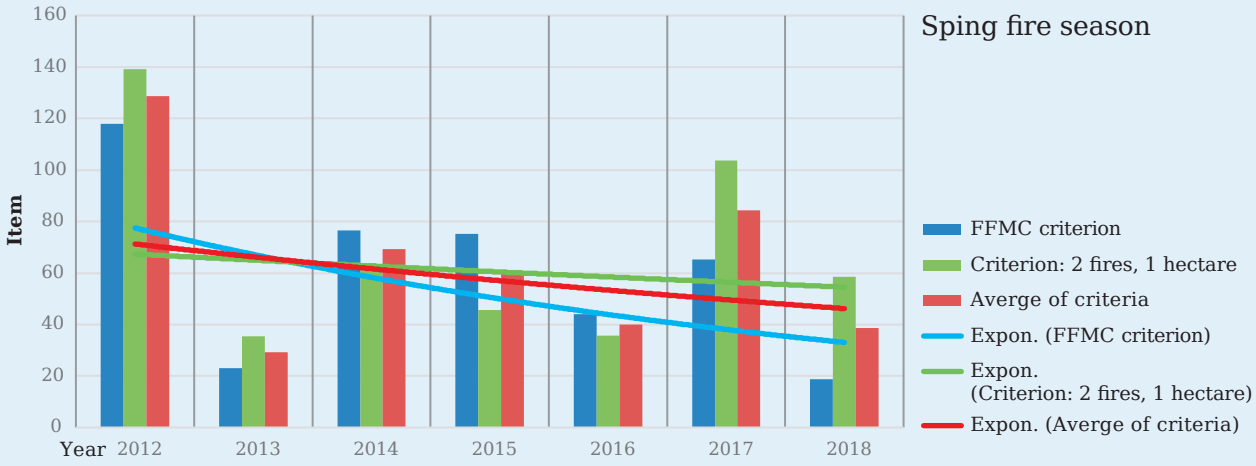
In case of the spring fire season, the intensity ratios based on the two criteria yielded very similar results. However, it

[2]*P. Debreceni – P. Pántya: Possibilities For Definition Of High Fire Danger Periods, (Engineer Military Bulletin, 2019.)*

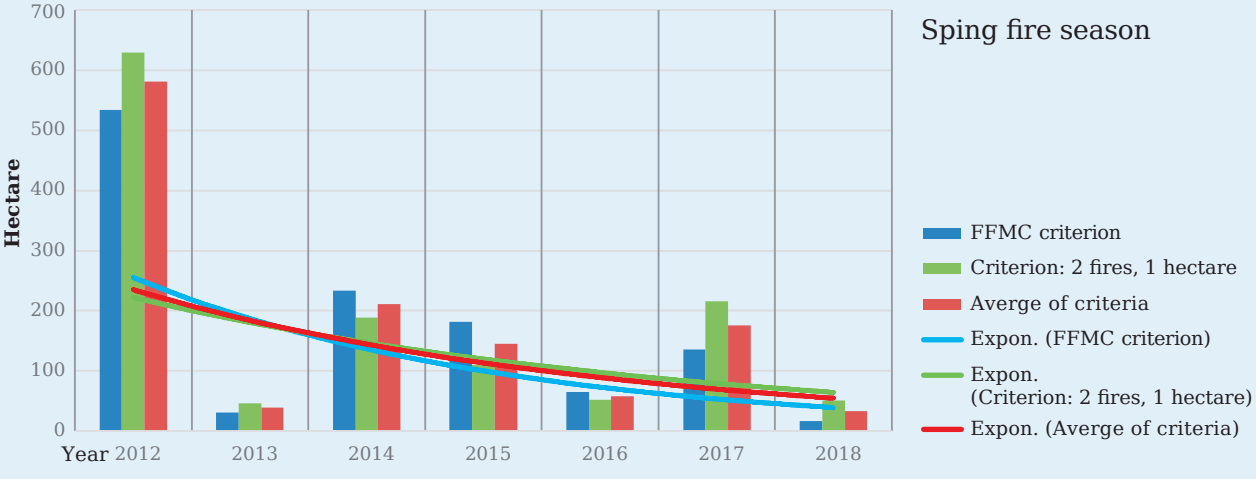
should be highlighted that the effect of the project on the number of fires during the spring fire season is smaller, because a great majority of fires in this period are caused by human behavior. That is, if people want to burn a certain area, they will light it again even after the fire was extinguished by firefighters. Permitting controlled burning is an important means to counter this practice, but as this is currently contingent on a fee, many people do not request a permit, and do the burning without it. This means that the number of spring fires includes several small, controlled burnings made without a permit. In connection with the project, we have proposed to the legislative authority to modify the licensing procedure into a reporting procedure, and perform biomass management measures for the areas that are especially affected. In the case of such small-size burnings, community-based fire management should be established in the future, in cooperation with stakeholders.

During the spring fire season from 2012 to 2018 the number of fires per fire danger days decreased by 30%, while the area burnt dropped by 70%.

Intensity ratios of the number of forest and vegetation fires
(fire/fire danger days)

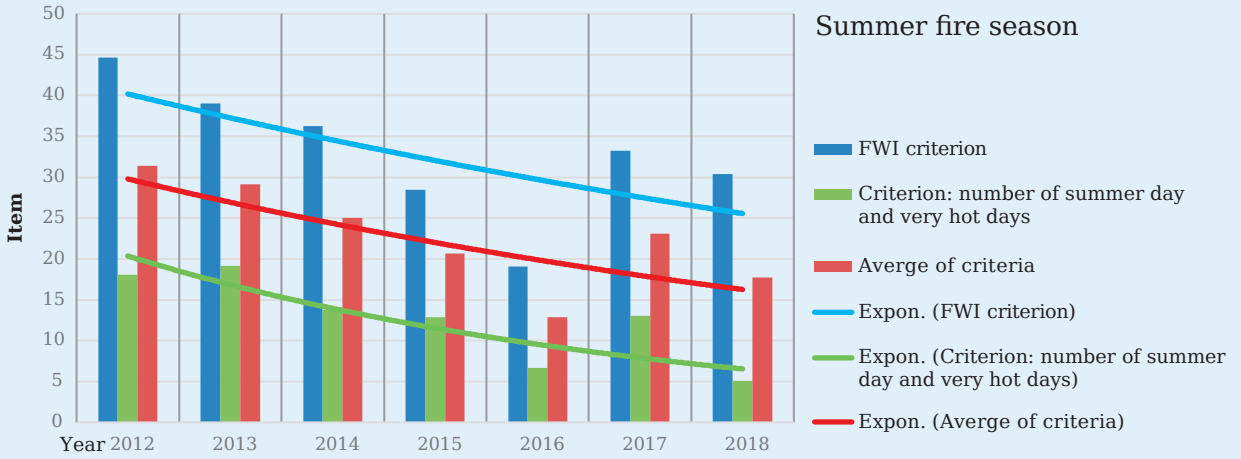


Intensity ratios of the number of forest and vegetation fires
(hectare/fire danger days)

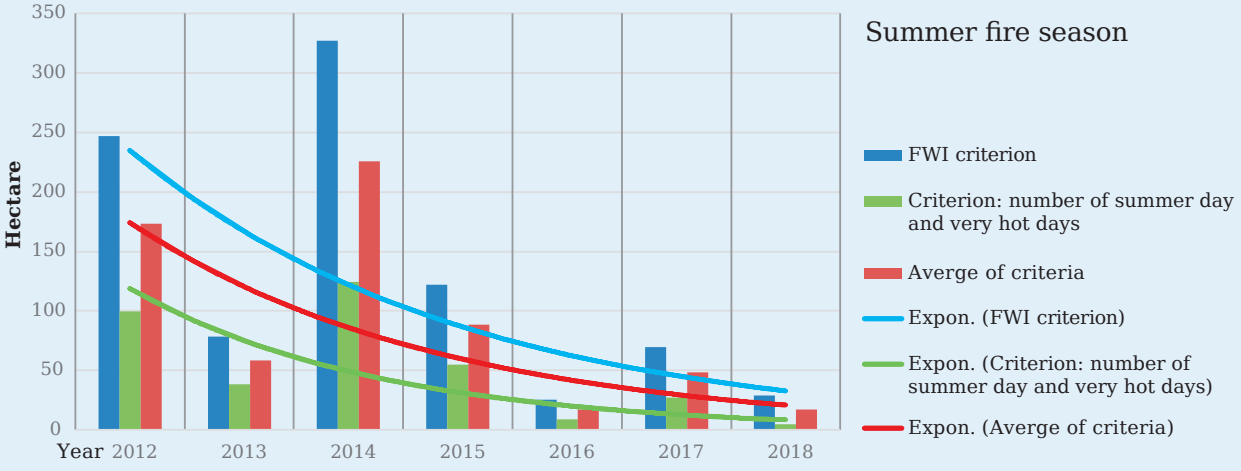


In the case of the summer fire season, the intensity ratios calculated on the basis of different criteria are almost parallel. Based on the analysis of individual fires, it can be concluded that over a similar period of time, the hot day/heatwave day criterion tends to overrate fire risk, while the FWI criterion underrates it. During the summer fire season, a decreasing trend is clearly visible from the intensity ratios, both in respect of the number of fires and the burnt area. The former shows a decrease of 30%, while the latter dropped by 90%.

Intensity ratios of the number of forest and vegetation fires
(fire/fire danger days)



Intensity ratios of the number of forest and vegetation fires
(hectare/fire danger days)



9. Acknowledgements

During the implementation of the FIRELIFE project, we encountered assistance and helpfulness in all areas. Everyone agreed that the prevention of forest fires is an important goal, and they not only shared this understanding, but were also ready to act for the cause.

We would like to express our special thanks to the Life+ program of the European Union and the Hungarian Development Bank for their support, and for making the implementation of the project possible. We would like to thank the Ministry of Agriculture, the National Directorate General for Disaster Management, the Global Fire Monitoring Center, the Hungarian Public Road Nonprofit Co., the Hungarian Tourism Agency, University of Sopron's Faculty of Forestry, the National Fire Prevention Committee, the National Forestry Association, the Association of Private Forest Owners and Farmers, the Hungarian Hiking Association, Stihl Magyarország Kft., Decathlon Stores, Sziget Cultural Management Ltd., Village and Farm Caretakers Association of Borsod-Abaúj-Zemplén County, the Village Caretakers Association of the Danube-Tisza Interfluve, State Forestry Corporations, and the national parks for their support in the implementation of the project.

Since there are always people behind the organizations, we would like to thank each forester, firefighter, nature conservation, and administration professional, as well as the staff of NÉBIH for their patience and proactive, supportive approach to the implementation of the project.

Special thanks to DG ENV and the NEEMO staff for their constructive support.

10. Annex

Forest fire prevention checklist

10.1. Sides of the organization triangle

Stakeholders and target groups
– frequently overlapping

Government

- Ministry responsible for forest management
- Ministry responsible for nature conservation
- Ministry responsible for disaster management
- Forestry authority
- Disaster management
- Environmental protection authority
- Meteorological services
- Scientific institutions, universities, research institutes
- public education bodies
- bodies responsible for tourism

Farmers and managers
(persons and entities working in area management)

- Forest managers
- National parks
- Farmers
- Wildlife managers
- Public road administration
- Railway companies
- Municipalities

The public

- Hikers
- Tourists
- Garden owners
- Smokers
- Ranch owners
- Small children
- Students

10.2. Sides of the intervention/ action triangle

Cooperation / regulation framework

- There is legislation for forest fire prevention in place
- Statistical data on the forest and vegetation fires of the past years is available
- Organizations involved in forest fire prevention cooperate with each other in an organized manner so as to coordinate prevention efforts
- Statistics reveal the cause of fires and biomass conditions.
- The affected bodies cooperate in collecting data.
- Definitions in the statistics are clear.
- The costs of extinguishing fires are recorded.
- Damages sustained are aggregated
- the legal system is familiar with preventive official inspections
- the legal system allows for preventive measures
- ratio of fire extinguishing costs to fire prevention costs
- fire danger warning system / fire ban system is operated

Infrastructure / Biomass management

- The level of forest fire risk is determined for each area.
- The level of vegetation fire risk is determined for each area.
- The support/tax system takes forest fire prevention criteria into account, and promotes biomass management
- In high risk areas, a forest fire prevention plan for farmers should be developed
- The criteria system for forest fire prevention is incorporated into the regional management plans (NATURA management plans, forest plans, settlement planning tools)
- Legislation includes provisions for biomass conditions, for establishing compulsory fire breaks, fuel breaks and safety zones (e.g. near roads and in high risk areas)

- There are urban planning statutes in place, and in Wildland-Urban Interfaces (WUI), they take forest fire prevention criteria into account
- A practice for inspecting the enforcement of settlement planning rules is in place
- Subsidies are available and easy to apply for, for the purposes of
  – fire breaks
  – early detection systems
  – biomass management interventions
- Controlled burning is allowed

Training/ Communication

- The public is aware of forest fire as a danger, as well as the causes of fire
- Professionals in the field have access to training materials for forest fire prevention
- Training materials presenting the special tactics for extinguishing forest fires are available
- Further trainings and workshops are implemented with the participation of multiple organizations
- Each operator uses a uniform system of symbols / design in their forest fire prevention communications
- Knowledge related to forest fire prevention is integrated into public education
- Training materials for agencies engaged in area management are available
- The costs of forest fire prevention communication are available for the cycle of several years
- There is a target group-specific communication plan in place
- There is free access to communication materials on forest fire prevention, and they are available for use

Project Data

Place of implementation: Hungary
Project ID: LIFE13 INF/HU/000827
Project start date: 1 July 2014
Project finish date: 31 January 2019
Project period: 55 months
Total budget: 943.830 €
Website: www.erdotuz.hu
Email: nagyda@nebih.gov.hu

Project beneficiary: NÉBIH
Main sponsor of the project: European Commission's LIFE + program
Co-sponsor of the project: Magyar Fejlesztési Bank Zrt.

Sponsors of the project:
- Ministry of Agriculture
- National Directorate General for Disaster Management
- University of Sopron Faculty of Forestry
- National Fire Prevention Committee
- National Forestry Association
- Association of Private Forest Owners and Farmers
- Stihl Magyarország Kft.

FIRELIFE
Erdőtűz-megelőzési
Projekt

AGRÁRMINISZTÉRIUM

nébih

Országos
Tűzmegelőzési
Bizottság

MFB
Magyar Fejlesztési Bank
Zártkörűen Működő Részvénytársaság

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PROJECT PRESENTATION

LIFE+ Information and Communication

2019