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Explaining the background of some of the distortions in the messages of politicians and the media - taking into account the big fires that have happened in recent years

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Abstract

Climate change makes us more and more sensitive to the problem of forest fires, which often does not prioritize professional arguments, but instead ends up in the arsenal of politicians and the media. In this article, the author points out some common but wrong interpretations through the recent large forest fires, and how both politicians and the media can distort the facts. The investigation relies primarily on news and facts related to the Amazon basin and Australian fires. The results show that both the politicians and the media, instead of a factual, framed assessment of the fires, publish partial elements that correspond to momentary interests and distort in one direction or the other, which often contain only partial truth.

Keywords: forest fire, climate change, politics, media, Amazonia, Australia

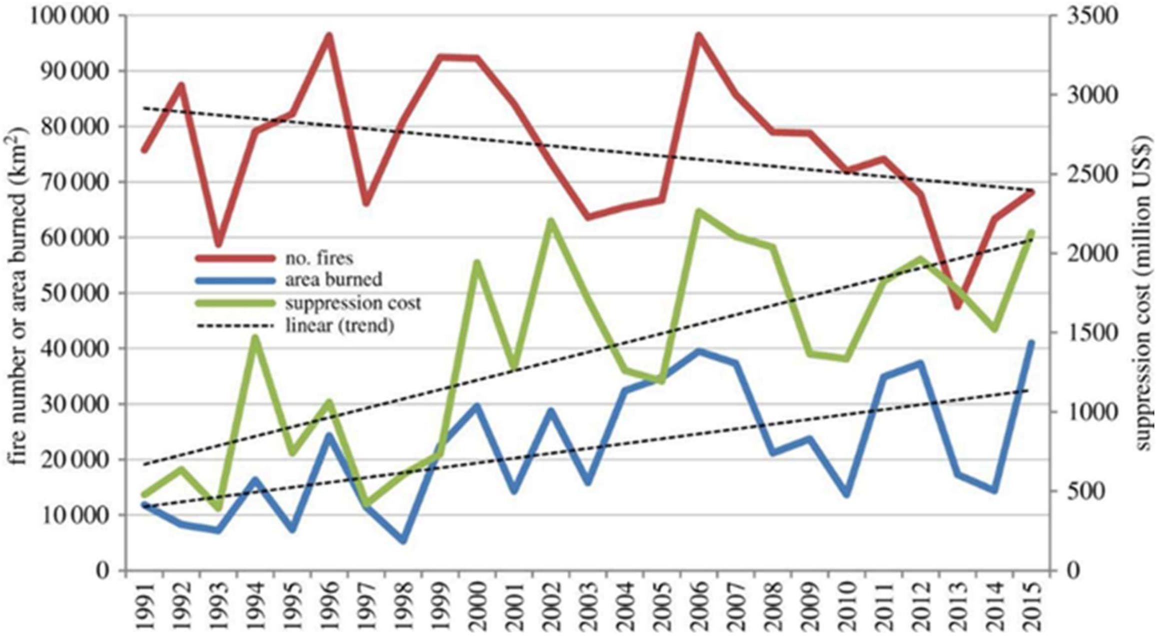
Introduction

At the latest decades humans face more and more disasters with growing damages and lost values [1]. Disaster management can have many aspects, we can focus on the prevention [2] or on the post disaster recovery [3], the first responders' activity [4], the medical aspects [5], the industrial safety [6] or the training of the organizations [7]. In case of rural fires we must to take into account the effect of climate change, that influences forest fires drastically [8] [9]. Because of the economical [10] and sociological [11] effects of disasters we should examine how messages of the media and politicians can distort the facts of the event and are able to modify our opinion.

The purpose of this study is that to demonstrate some example regarding fires where messages of both politicians and media differences from the facts of the event with its frame.

Usually, we get information about major fires from the news given by the media. We regularly hear about fires in countries that are sensitive to this, mostly claiming lives and measuring in thousands of hectares, such as the fires in California, Greece and the Amazon in recent years, the bushfires in Australia last year, and in previous years also in Greece (2018) and Portugal (2017) about raging fires that claim lives. The African continent should also be mentioned, where, albeit not so spectacularly, areas comparable to the recent Australian fire burn almost every year, for example in Congo or Angola, but their nature is different, the area regenerates relatively quickly, the fire there it is a natural element and economic factor of the life of a living community.

In recent years, two large-scale forest fires have become the focus of international attention. Earlier in time, it affected the Amazonian rainforests and, in addition to professional arguments, also caused a significant political response, which mainly criticized the forest fire policy of the current government of Brazil. In this case, it is clear that the professional arguments and opinions fell short of the political mainstream represented by the media, which is often rambling. The period of the fight against Australian forest and bushfires has been extended into 2020, which has become catastrophic despite the fact that it occurred in one of the most prepared countries and continents in the world. In relation to climate change, it is a general opinion in the public mind that the number of forest fires will increase and the damage caused by them will become more and more significant. The latter statement is supported by the statistical data of the past period, but the former is not. During the statistical analysis of the world's forest fires, we can conclude that, contrary to popular opinion, their number is not increasing, but is certainly decreasing based on the trend, but the smaller number of forest fires causes significantly more serious damage compared to the previous ones, even if the increase in the cost of extinguishing them is even more drastic there is an increase, as in damage values.



1. *Figure: The evolution of the number of forest fires, the size of the burned areas and the costs spent on extinguishing them between 1991 and 2015 [12]*

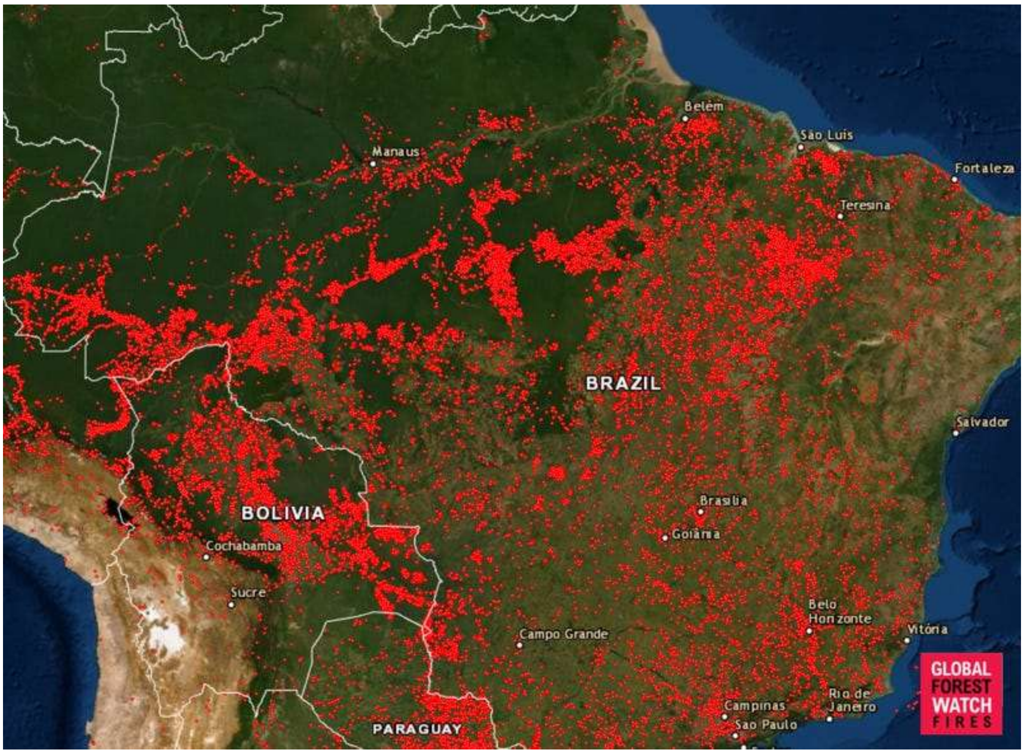
Many factors play a role in the decrease in the global number of forest fires, such as the migration of the rural population to cities in less developed countries, along with the abandonment of the "fiery" farming associated with rural life, or the transition of those who remain in the countryside to a more advanced farming method, which also largely avoids fire its application as a management factor. In more developed countries, as a natural consequence of socio-economic development, we see a clear decrease in the number of fires, in addition, we can also experience an appreciation of the role of environmental protection and forests, which also results in a decrease in the number of forest fires. Considering the above, the situation of our country is twofold. The forested areas are already approx. for three decades, they have been growing, albeit slowly, but continuously, so the risk of fires is also increasing, especially because the fire risk of fresh forest plantations is always higher than that of mature forests, with the exception of pine forests. Extreme weather phenomena also point in the direction that forest fires may become more serious in the future. These negative factors are opposed by the change in rural farming, which almost completely omits fire as a farming factor due to legal obligations, which simultaneously reduces the risk of forest fires. In the same way, the responsible behavior of forest managers also contributes to the reduction of risks, in the same way as effective action against established fires, such as the early detection and reporting of fires, the use of modern vehicles and innovative devices. As a result of various factors - similar to international trends - we can expect a decrease in the average number of fires per year in most countries, but the trend of the damage value may increase or even decrease depending on the level of preparedness, but in some years it is almost certain that it will be exceptionally high.

In addition to a brief summary of the general international situation, it is worth reviewing the two outstanding events mentioned above, which can make it understandable the relationship of different cultures living in different environments to fire, as well as how the international perception can professionally differ from the public opinion.

Forest fires at the Amazon basin

In ancient times, forest fires were a natural part of extensive forests, which were mostly caused by lightning accompanying storms. The tribes living in or around the forests adapted their economy and life to this fire frequency, and then, having the knowledge of artificially lit fire, they influenced and shaped it themselves. This phenomenon still exists today, mostly typical of Central Africa, but some areas of Asia can also be examples of it, as can the Amazon basin. In the latter case, the local people set fire to the forests for the sake of economic benefit and for a larger area that can be cultivated or grazed. Here, it doesn't even matter if the wood is used, burning it is much faster and cheaper to get to new areas, which are able to provide their users with demonstrable benefits for about 10 years. The number of burning areas shows a continuous increase every year during the dry season, the estimated value of last year's case, which received a lot of attention, is quite different, the official data put it at nearly 10,000 square kilometers. It should be noted that experts do not only take into account forest fires, but also all open natural fires, including fires in grassy, bushy, and savanna-like areas.

The Amazon basin is shared by eight countries, with a total area of approx. 6.3 million square kilometers, which occupies more than a third of South America. Although compared to 2018, the size of the burned areas almost doubled, we should know that 2019 year was not unique, since it exceeded the average of the last 10 years by 20%. We can also find values that are more blatant than this from the recent past, so the most recent year was 2016 - this is how the most recent situation is usually measured - but previously the years 2012 and 2005 were similar. In 2007 and 2010, due to the El Nino phenomenon, the number of fires was almost a third more than in 2020. It should be noted that while the fires in the Amazon basin received significant political and media attention, we hardly hear about the fires burning in Angola, Congo, or Indonesia, even though in the first two cases we know about four times (!) as many fires as in 2019 in Brazil. Don't get the author wrong, it's by no means trivializing the situation, it's just about a broader illumination of a global problem, about the extent to which the media and politics can change the focus of one - a field of expertise, even if the fires of different fields are naturally not you can always make meaningful comparisons.



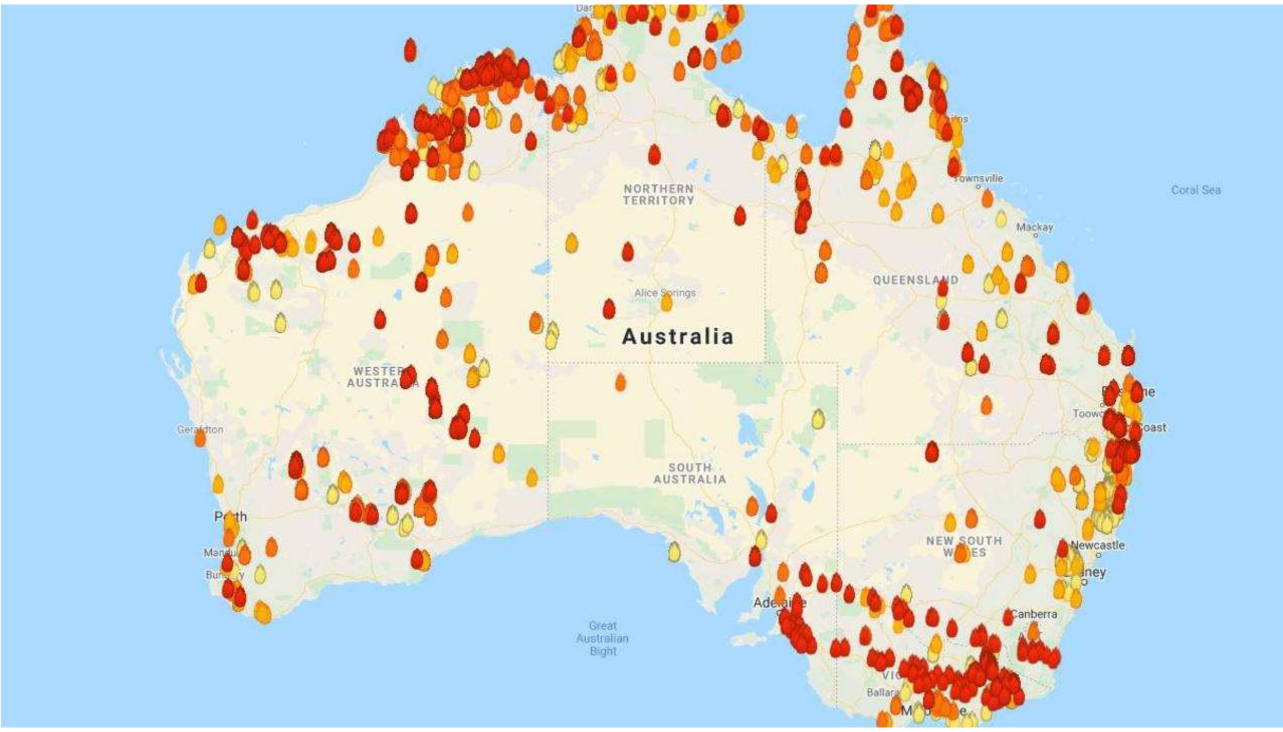
2. *Figure: Fire map of the Amazon basin at 13.08.2019, based on Global Forest Watch/Fires [13]*

In connection with the fire incident in the Amazon, we also heard about relatively quick international cooperation. At the G7 summit, the major powers agreed on an offer of 20 million dollars. Numerically, the amount may seem a lot, but compared to the total cost of extinguishing fires of this size - if we really want to extinguish them - it is quite small. It is likely that the purpose of the offer was more of a gesture, and indicated the need to start a dialogue, with the promise of the possibility of further assistance. If only aerial firefighting is considered, the cost of one operating hour depends on the aircraft used, approx. 10-20 thousand dollars per hour, which could cover the cost of 1-2 thousand flight hours. Considering the more than 20 aircraft used during firefighting, this means an average of less than 75 flight hours. In practice, this covers the cost of flying for a few days, or at most a week, which is of course a huge help in itself, but it is quite modest compared to the size of the area. In the same way, but according to a different method, according to Australian calculations, the cost of extinguishing 1 km of frontline fire by plane is approx. 140 thousand dollars, that is, the amount offered would be enough to cover about 150 km front line. Taking a front line as 1 km on average, this means the cost of extinguishing 150 fires, while the number of detected fires exceeded 40,000. Although the comparison may cause displeasure, the amount of donations made after the fire at Notre Dame in Paris exceeded 1 billion dollars anyway.

The damages caused to Amazonian forests are of course enormous, but their evaluation depends on the temporal and spatial dimension in which they are viewed. If treated as an individual case, nature can repair the damage in a relatively short time, since fire was a natural part of the development of forests for millions of years. Looking at the trends, however, it is clear that humanity has a responsibility and something to do to protect our future, since the previous fire frequency has significantly changed and accelerated due to human activity. Many fires break out every day all over the Earth, which we don't even hear about, despite the fact that in terms of their size, the situation in some African countries, such as Angola or the Congo, is almost always more serious than the 2019 year in Brazil. However, these countries are not in the spotlight either economically or politically, so the forest destruction there remains unnoticed by the average person. Without underestimating the extent of the current damage, perhaps 2019 year's Amazonian forest fires have so much benefit that they managed to generate an unprecedented amount of media and political attention, which in a lucky case could even be a catalyst for the foundation of more efficient forest management in the future, fair and expedient for nature conservation and the financing of more advanced fire protection developments.

Fires in Australia

The majority of Australia is a desert or semi-desert area, huge parts of which are covered only by sparse vegetation. Richer vegetation can be found in the coastal strip and in the eastern and north-eastern areas. The burned area exceeded 180,000 km2, during which more than 5,900 homes became uninhabitable. The burned area was twice as large as the area of our country, twenty times as large as the Amazon basin! As a result of the fire, 33 people lost their lives, 7 of whom were firefighters [14]. During the extinguishing, a fire-fighting plane and a helicopter were also lost, with their entire crew. In contrast, we know of a total of 2 deaths in Brazil that can be linked to the fires. The image below shows the distribution of Australian hot spots, on which you can see that hot spots have been detected in almost all parts of the continent.



3. *Figure: Fire map of Australia at 25.11.2019, based on MyFireWatch [15]*

The common characteristic of fire disasters of extreme severity - such as the one in Australia - is that high average daytime temperatures and very low humidity play a major role in their formation. In such conditions, the fire spreads very quickly, and the resulting combustion products leave in the midst of intense updrafts. This upwelling can be so strong that it can carry even glowing parts with it, so that new fire sources can arise even several kilometers from the front line of the fire. For this reason, the firefighters are not faced with a well-defined front line - which is common in our country - but with a rather amorphous formation, which can even trap the interveners. For fires of this size, traditional firefighting tactics are of little use, and often these fires are extinguished only by a change in the weather or by simply burning down everything that is combustible. To assess the difficulty of the task, we must take into account that firefighters working at the front line of the fire are exposed to extreme heat stress, which is why they have to wear special protective clothing and drink a lot of fluids. Despite this, their senses can quickly become exhausted and dull, which puts them at increased risk.

Based on experience, the human factor plays a decisive role in the development of forest fires. Almost all forest fires in densely populated areas, including in most countries in the European or American continent, can be traced back to irresponsible behavior. In sparsely populated or uninhabited areas, the cause of fire can also be natural, here we usually mention lightning strikes accompanying storms. The common feature of the Amazonian and Australian fires is that the extreme weather played a decisive role in their escalation, while the essential difference is that in the former, a larger segment of society is more permissive towards fires and does not consider them to be destructive as an economic factor, while in the latter it is very there is a strong social consensus for the strict protection of the current environment. Lightning also played a significant role in the formation of the Australian fires, while this cannot be said for the Amazonian fires. Despite this, unfortunately, the dominant role of the human factor was undeniable in the Australian fires as well.

In the case of forest fires, we can count on many effects, such as the deterioration of air quality due to air pollution, the reduction of diversity, and the change of our environment. Highlighting one of the many effects, research shows that global carbon dioxide emissions are approx. 20% can be attributed to forest fires. Carbon dioxide emissions from recent Australian fires was as much as about all the other annual emissions of the country combined. Hopefully, the vegetation will regain strength after a while, but here a lot depends on the rainfall. The fauna, on the other hand, is certainly more significantly damaged. Some researchers expect a 30% loss of koalas, the eventual complete extinction of some species, or their possible entry into endangered status. Of course, there have been large fires with many victims before, in January 1939, 71 people died on "Black Friday", in February 1983, "Ash Wednesday" claimed 75 lives, while in February 2009, "Black Saturday" resulted in 173 victims.

Some characteristics of suppressing rural fires

We know many methods for preventing and extinguishing forest fires. An awareness campaign by local communities and alternative economic solutions that ensure their livelihood can help avoid unnecessary destruction. Numerous programs in developing countries prove that fire can be managed well with the involvement of local communities (so-called community-based fire management). By regularly burning the undergrowth under controlled conditions, the formation of higher intensity fires can also be prevented. In addition to prevention, it is very important to detect fires as soon as possible, since it mostly depends on how quickly extinguishing can be started. Unfortunately, satellite fire detection is not yet suitable for early detection, they can usually be called effective in sparsely populated areas. During dry periods, it is common practice to use airplanes over certain areas, and even today, even to use aerial reconnaissance with drones. Fixed-installation camera fire detection systems can be effective in case of long-term danger. The means of extinguishing a fire depends on the nature of the fire. In the case of low fire intensity and low flame height, extinguishing can also be done with hand tools, such as a shovel or a spark arrester, while in the case of very intense fires, aircraft firefighting is not always able to help. In these cases, often only a change in weather can help. We can also come across a method where the combustible material is "cleaned" out of the way of the fire. In case of low fire intensity, this can also be done with the already mentioned hand tools, in case of medium intensity by using vehicles, e.g. with a bulldozer, and in case of high intensity, even so-called also by firing counter fire. In such cases, the smaller intensity fire is expected to spread towards the larger fire due to the changed micrometeorological environment, and when the two front lines meet, the fire will extinguish itself, since there is no combustible material left in any direction.

Aerial firefighting is often the most effective way to suppress forest fires, but it is known to be a very expensive solution and, unfortunately, it is not always successful. During aerial firefighting, we can use water, fire-fighting foam, or so-called retardants. The latter can be recognized by its red color in the news, but it is not used in many countries. Contrary to popular belief, the extinguishing effect of water on forest fires is very limited, at higher fire intensities, approx. In the case of a flame height greater than 10 m, it is no longer possible to extinguish a fire with it, while the problem with retardants is that they are both very expensive and polluting the environment. The use of foams is quite rare, but as a result of a Hungarian development, with less pollution and cost, they can approach the value of retardants in effectiveness. During aerial firefighting, we either throw the extinguishing agent directly on the front line of the fire, or create a moistened protective strip at a safe distance in front of it. Unfortunately, the tests show that the useful part of the water during vaccination is very small, sometimes not even 20%. A special form of aerial "firefighting" is the so-called delivery of "smoke jumpers" to the site. Perhaps those firefighters who use a parachute to reach a hard-to-reach frontline and then try to prevent the spread of the fire by themselves could be correctly translated as fire jumpers.

Summary

Fire has been present in human culture since ancient times, we live with it, it is part of our everyday life, we don't even notice it if it is present under controlled conditions. Numerous studies have proven that nature also sometimes needs renewal, for which a fire affecting a significant area can even provide effective help. The frequency of fires has been accelerated by human activity, which upsets the natural order established over thousands of years, diversity decreases, and our environment becomes poorer and more sensitive. Climate change amplifies the above effects, extreme weather makes the formation and spread of fire more favorable. That is why we also need modern solutions in the field wildfire analysis [17]. The phrases that already seem like clichés are unfortunately true, we can only do together to save our planet. I would like to note that we have to deal with the solution of the global problem in a complex way, and due to the different level of development of the different countries, we must expect conflicts. What is natural for a Western country is a waste for most African countries. International organizations, famous actors and singers, athletes tried to help with financial donations, which show that disasters do not only cross borders in terms of damage, but can also be good examples of international community engagement and assistance.

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Risks of infiltration of dangerous substances by concrete technology

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Abstract

In Hungary, a number of dangerous materials plants have been built using large quantities of concrete and reinforced concrete structures. Concrete mixes and structures have to meet a number of quality criteria, standards and tests during design, production and construction. However, due to the complexity of the concrete technology processes, a large number of risk factors have to be taken into account. These risk factors are exacerbated by the recent series of extreme meteorological anomalies. In the light of this reflection, it can be concluded that the revision of standards based on obsolete technological elements and the adaptation of new technological elements is an essential task. In addition, risk assessment, planning and evaluation are of paramount importance to protect our environment.

Keywords: dangerous materials, concrete, structure, infiltration, remediation board

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Introduction

Hungary's rivers are 2 822 km long and cover the entire catchment area of the country. Many organisations operate in the immediate vicinity of the rivers, in the floodplains. [1] Some of these organisations are subject to Government Decree 219/2011 (X. 20.) on the "Protection against Major Accidents involving Dangerous Substances" and are classified as dangerous substances plants. [2] The concrete structures of these plants are exposed to increasingly extreme weather anomalies, adverse chemical and mechanical effects on the components of the structures, and contamination effects during the extinguishing of possible fires. The operational safety of large structures in water installations and of containment areas around dangerous liquid storage tanks in industrial plants is therefore increasingly important. Permanent and localised water pollution in the vicinity of dangerous substances installations may expose large structures for water distribution and flood protection, as well as concrete and steel structures of containment areas on the site of installations, to irreversible effects which may result in their failure. Thus, serious accidents involving dangerous substances may occur indirectly.

Infiltration can occur through damage during structural weakening. The soil is then gradually saturated with the contaminant. The rate and timing of infiltration is significantly influenced by the infiltrated material and the properties of the soil. Groundwater typically covers the whole country, so leakage can result in significant contamination of the groundwater resources of the areas and regions concerned, in addition to the soil.

The storage of dangerous liquids and substances is subject to strict rules, which are contained in the NGM Decree 1/2016 (I. 5.) on "Technical Safety Requirements and Official Supervision of Storage Tanks and Storage Facilities for Dangerous Liquids or Melting Matter" [3] Storage is carried out in storage tanks, which are typically placed in a holding space. These containment areas are usually designed for the largest tank, as the combined damage of the tanks is often not taken into account. However, in order to fulfil its function, the containment area must be of the right quality and size.

Legal and standards background

According to the Basic Law of Hungary, disaster management is a national matter; the central management of protection is the responsibility of the state; and citizens have the right to know about the disaster risks in their environment, to learn the rules of protection and to participate in the protection.

In order to ensure the safety of the population in Hungary, to increase the efficiency of protection against natural and civil disasters, to strengthen the organisational structure of disaster management and to enhance the effectiveness of disaster management measures, the Parliament has enacted Act CXXVIII of 2011 (hereinafter: Kat.) on disaster management and the amendment of certain related acts. [4] Chapter IV of the Cat. deals with the protection against major accidents involving dangerous substances. In accordance with the relevant EU Seveso III Directive [5] (hereinafter: Seveso III), the Cat. is implemented in accordance with Government Decree 219/2011 (X.20.) (hereinafter: Vhr. 1.) and Government Decree 234/2011 (XI.10.) (hereinafter: Vhr. 2.). [2][6] Information on the rules of disaster prevention is provided in BM Decree 62/2011 (XII.29.). [7] In order to ensure effective prevention of disasters and emergencies, the municipalities of the country have been classified into disaster prevention classes (Class 3). The classification is based on local characteristics and features and known hazards. Decree No. 61/2012 (XII.11.) of the Ministry of the Interior amending Decree No. 62/2011 (XII.29.) on the classification of municipalities in disaster management and the rules for disaster protection is provided for. [8]

In accordance with the Environmental Liability Directive [9], Act LIII of 1995 on the General Rules for the Protection of the Environment [10] (hereinafter: the Environmental Protection Act) and Act LVII of 1995 on Water Management [11] (hereinafter: the Water Management Act) regulate the protection of environmental elements, such as surface and groundwater. The responsibilities, powers of the authorities and obligations of the operators for water quality preservation and water quality remediation are laid down in Decree 90/2007 (IV.26.) No. (hereinafter: Environmental Damage Prevention and Control Regulation) [12] and Government Regulation No 219/2004 (21.VII.) on the Protection of Groundwater (hereinafter: Favir.) [13] and Government Regulation No 220/2004 (21.VII.) on the Rules for the Protection of Surface Water Quality (hereinafter: Fevir.) [14].

The national standards body of Hungary is the Hungarian Standards Body, which is established and operates under Act XXVIII of 1995 on National Standardisation. The aim of the legislators in establishing the Act was to help provide participants in the national economy with the state-of-the-art technical knowledge that is essential for marketability. It also helps to ensure compliance with standardisation obligations under international agreements [15].

The following standards are considered to be of primary importance for publication:

– MSZ 15033:1979 Concepts and definitions for concrete and reinforced concrete structures (date of publication: 01.10.1979).
– MSZ 4715-4:1987 Testing of hardened concrete. Destructive testing of mechanical properties (date of publication: 01.11.1987).
– MSZ 16030-1:1988 Quality control of precast concrete, reinforced concrete and prestressed reinforced concrete elements. Testing (date of publication: 15.10.1988).
– MSZ 17213-1:1989 Definitions for corrosion protection in construction. Concrete and reinforced concrete structures (date of publication: 01.07.1990).
– ISO CEN/TR 15678:2008 Concrete. Controlled release of dangerous substances into soil, groundwater and surface water. Test methods for new or not yet permitted constituents of concrete and concrete products (date of publication: 01.08.2008).
– ISO CEN/TR 15177:2009 Testing of the resistance of concrete to frost. Internal structural damage (date of publication: 01.10.2009).
– MSZ 4798:2016, MSZ 4798:2016/1M:2017, MSZ 4798:2016/2M:2018 Concrete. Technical requirements, properties, construction and conformity, and conditions of application of EN 206 in Hungary (date of publication: 01.04.2016, 01.06.2017, 01.03.2018) [16]

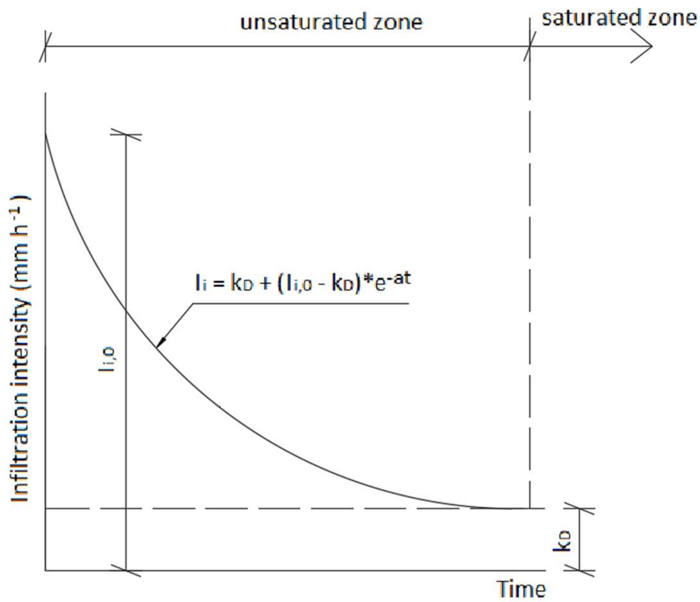
The standards described above define, among other things, basic concepts and definitions, mechanical testing methods for precast and in-situ concrete and reinforced concrete structures, and corrosion and frost resistance tests. However, the majority of these documents were introduced more than 10 years ago, so their revision is justified. This is based, for example, on the facts listed below:

– extreme weather events;
– increased impact of natural disasters;
– an increase in the proportion of inhabited areas under agricultural and industrial use;
– the emergence of new additives and repair materials, which are now subject to more stringent requirements;
– changes in the legislative environment.

Infiltration, the importance of remediation board

Industry, mining, agriculture and transport also have a significant impact on the environment, mainly through damage to the atmosphere, the geological environment and groundwater. Typically, toxic chemicals are released into the environment, accumulate and then decompose slowly, partially or not at all. The resulting contamination can have harmful effects on the population, animal and plant populations in the area and on groundwater.

From an industrial safety point of view, infiltration occurs when a liquid substance is transferred from a permanent or temporary storage medium on the soil surface or in the soil to the soil through some indirect effect. Infiltration by gravity is normally a vertical process. However, the direction, timing and rate of infiltration are significantly influenced by the physiological properties of the soil (e.g. soil type, texture, cracks, passages). In addition, the viscosity of the material is an important parameter. This is because materials with a lower internal friction will expand and percolate faster, while materials with a higher internal friction will expand and percolate slower. Infiltration as a process can be divided into three main parts. Firstly, surface infiltration is observed, where the surface is wetted through or liquid can collect in surface inequalities. In the next period, larger pores and cracks become capillaries and smaller passages become saturated as gravity forces take effect. In the third period, the soil layer(s) become completely saturated, the infiltration intensity gradually decreases and then stagnates. An infiltration curve can be constructed based on the temporality and the measured parameters (Figure 1).



1. *Figure: Horton's infiltration model (Stelczer 2000). Source: [17] Downloaded: 04.02.2020.*

The infiltration curve shows that the intensity is highest in the first minutes, when the soil is still absorbing a lot of the liquid. However, the intensity starts to gradually decrease, steadily at first, then decreases and finally reaches a state of full saturation. In the Horton infiltration model, '$I_{i,0}$' is the initial maximum infiltration intensity, 'k_D' is the characteristic infiltration coefficient of the soil in the saturated state, 'a' is the factor expressing the rapidity of the decrease in infiltration intensity, and 't' is time. [17]

The importance of infiltration as a topic for research in the context of damage restoration can be explained by. Two conditions are possible for dangerous material storage facilities on the site of each plant. One is that no containment has been installed at the repository (unlimited load in case of leakage) and the other is that it has (containment in case of leakage). Without the remediation board, a pool with an unlimited surface area can form due to damage to the container. If the remediation board is installed but damaged, the pool with a normally limited surface area may become a pool with an unlimited surface area. In either case, dangerous substances may leak into the soil and groundwater, resulting in environmental contamination and personal injury.

Risks related to concrete technology

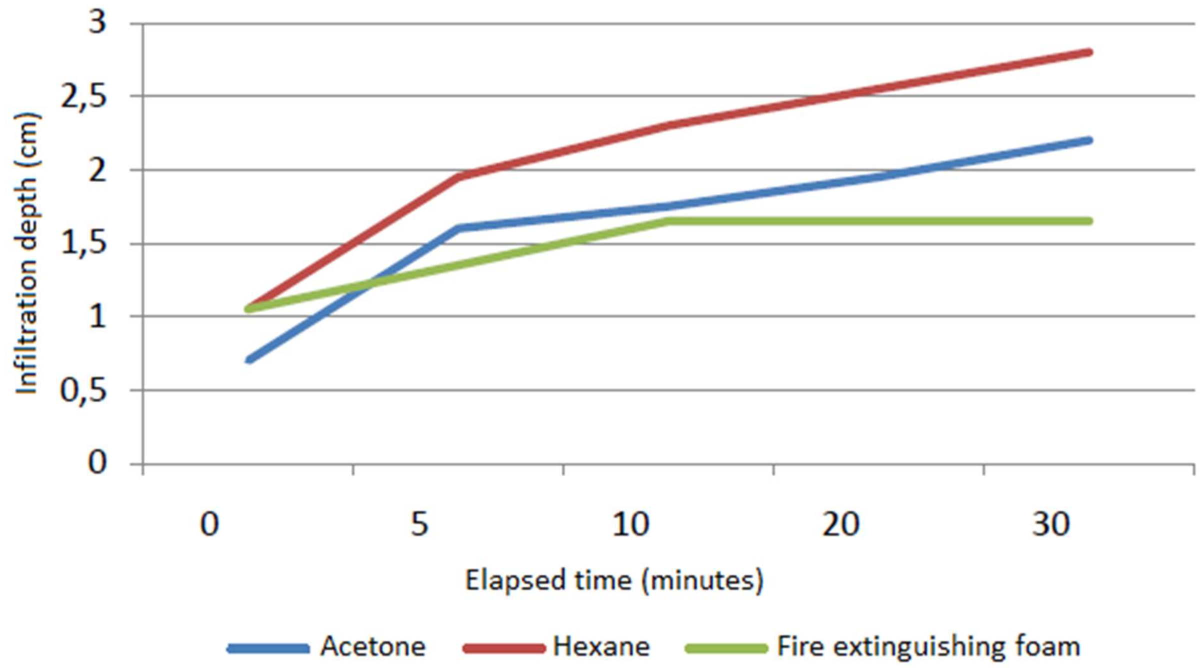
The definitions of concrete and reinforced concrete construction are given in MSZ 15033:1979. According to the standard, concrete technology is the process of mixing, transporting, batching, curing, finishing and working concrete. This concept implies that the process is a complex one, and that there are therefore a number of risks involved. In order to ensure that the concrete and reinforced concrete structures produced meet the parameters specified in the design documents, the negative effects of risk factors must be minimised. Examples of such negative effects include:

- inadequate concrete mixing, where the constituents are not mixed uniformly, resulting in an inhomogeneous mix;
- delayed delivery, where the delivery of the concrete mix from the mixing place to the place of installation is delayed and the curing processes in the mix are then in an advanced state;
- in the case of inefficient mixing, compaction and tamping operations, the mixture is placed unevenly and the desired degree of compactness is not achieved;
- failure to ensure the potential temperature and moisture content during curing and maturing will significantly reduce the resistance of the concrete to subsequent mechanical stresses. [18]

In the event that defects in the concrete technology are not detected, or repair work is not carried out after the defects have been identified, the adverse chemical and mechanical effects on the concrete and reinforced concrete structure should be taken into account. The most significant chemical effects are corrosion and the most significant mechanical effects are water infiltration, frost, abrasion, heat, fire and radiation. Protection against these effects is of particular importance in the concrete structures of industrial plants and factories, due to the presence of large quantities of dangerous substances, the increased stresses and the high load-bearing capacity. A single failure in the concrete technology can generate further destructive effects in the structure. For example, if the concrete's resistance to abrasive stresses is not designed and constructed to the correct level, the abrasion resistance factor will be lower. As the resistance to abrasion decreases, the water resistance of the concrete mix may also decrease, allowing water to seep into the interior of the structure. [18] Water infiltration can cause corrosion and freeze-thaw damage. Since the volume of water increases during freezing, the destructive effect of frozen water in the pores of concrete can result in crust cracking, crumbling, weathering and cracking. Such a chain of events can lead to an industrial accident, release of dangerous substances into the environment or a catastrophic situation. For the construction of horizontal concrete structures subject to freeze-thaw effects, the standard MSZ 4798:2016 described above applies. [16] In addition, it is an important fact that a concrete mix with the appropriate aggregate and admixture cannot permanently resist freeze-thaw effects if drainage is not provided. This is because the formation of water puddles in the absence of drainage reduces the freeze-thaw resistance factor.

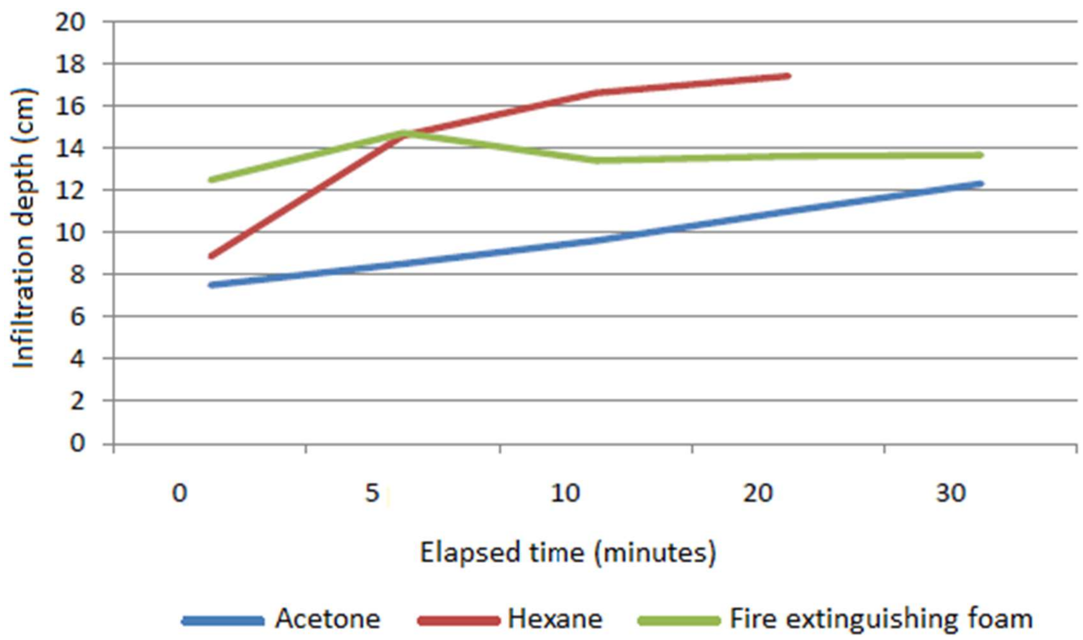
Tests and their results

In the diagram in Figure 2, the infiltration values of acetone, hexane and fire extinguishing foam in sand are shown. It can be seen that hexane leaked deepest, but did not reach a depth of 3 cm in half an hour.



2. *Figure: Infiltration depth of the tested materials for sand. Source: [19]*

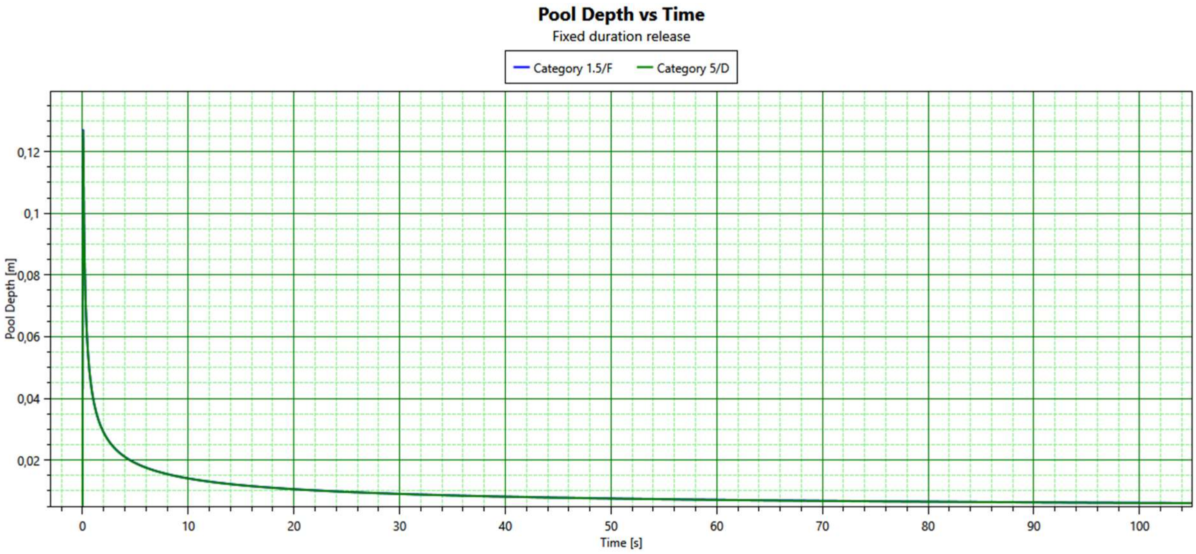
Figure 3 also shows the infiltration values of the previous three materials, but in a crushed stone medium. Here again, hexane leaked the deepest, approaching a depth of 18 cm in 25 minutes.



3. *Figure: Infiltration depth of the tested materials for 8/11 crushed stone. Source: [19]*

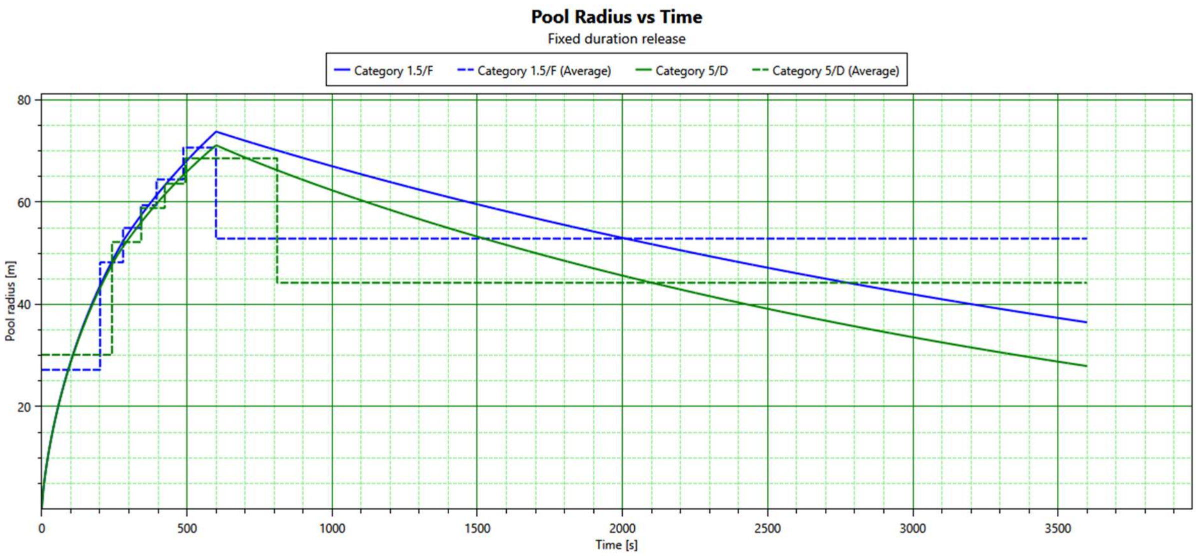
Figures 2 and 3 show that the time and intensity of the leakage are significantly influenced by the viscosity of the material and the grain size of the medium.

The results obtained after modelling a leak with DNV Safeti Lite software are illustrated in the following figures. Data used to run the model: tank containing 100 m^3 of hexane, 3 m high; average temperature of 10 °C; tank leaks with a 10-minute drain; containment 2 m high and 60 m^2 in area. Figure 4 shows a leak as a function of pool depth and elapsed time when there is no bailout.



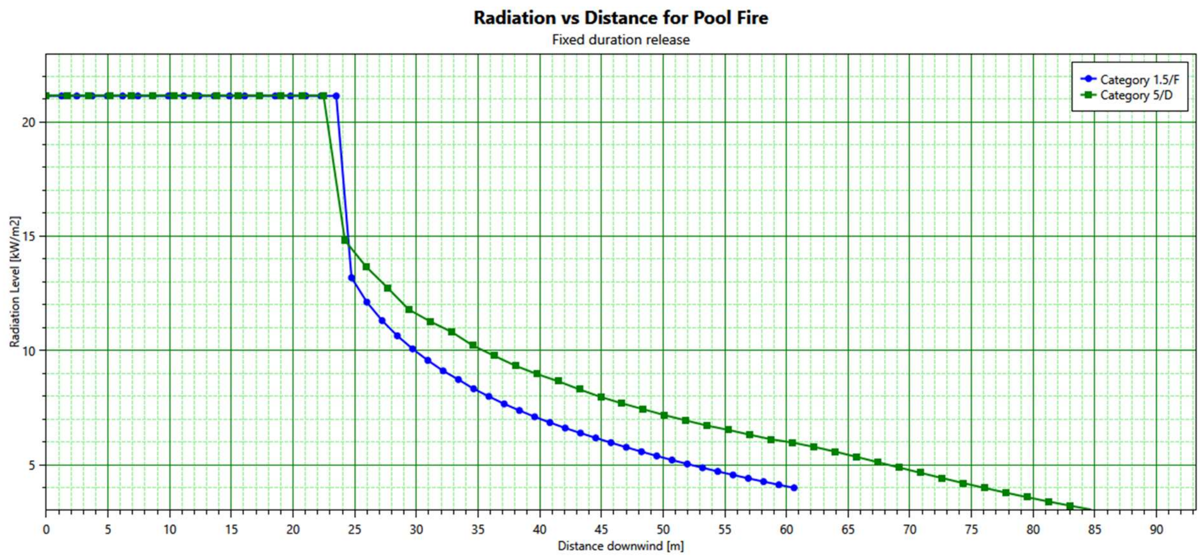
4. *Figure: Pool depth and elapsed time, without remediation board. Prepared by the authors.*

The depth of the pool started at 12 cm, and as it expands, it decreases rapidly at first, then slowly. Figure 5 shows the relationship between the area of the pool and the time elapsed. The radius of the pool reaches 70-75 m in 10 minutes, after which it starts to decrease slowly.



5. *Figure: Radius of the pool and elapsed time, without a rescue. Prepared by the authors.*

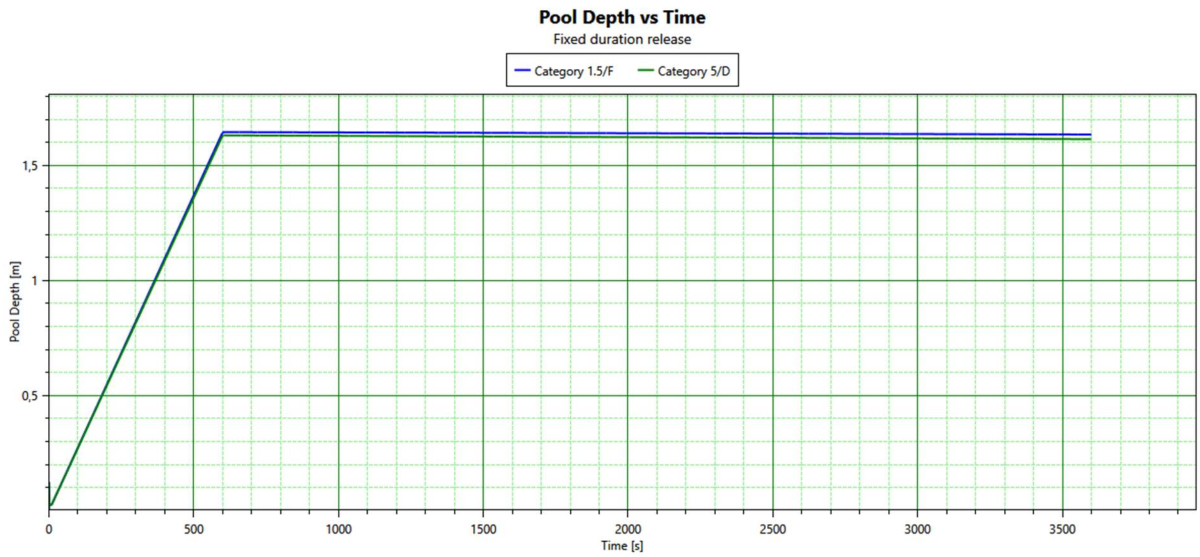
Figure 6 shows the values of the pool fire in the case of a possible ignition source. Up to 23-24 m, the thermal radiation is 21 kW/m^2. As the distance increases, the thermal radiation starts to decrease slowly.



6. Figure: Heat radiation and distance, without remediation board. Prepared by the authors.

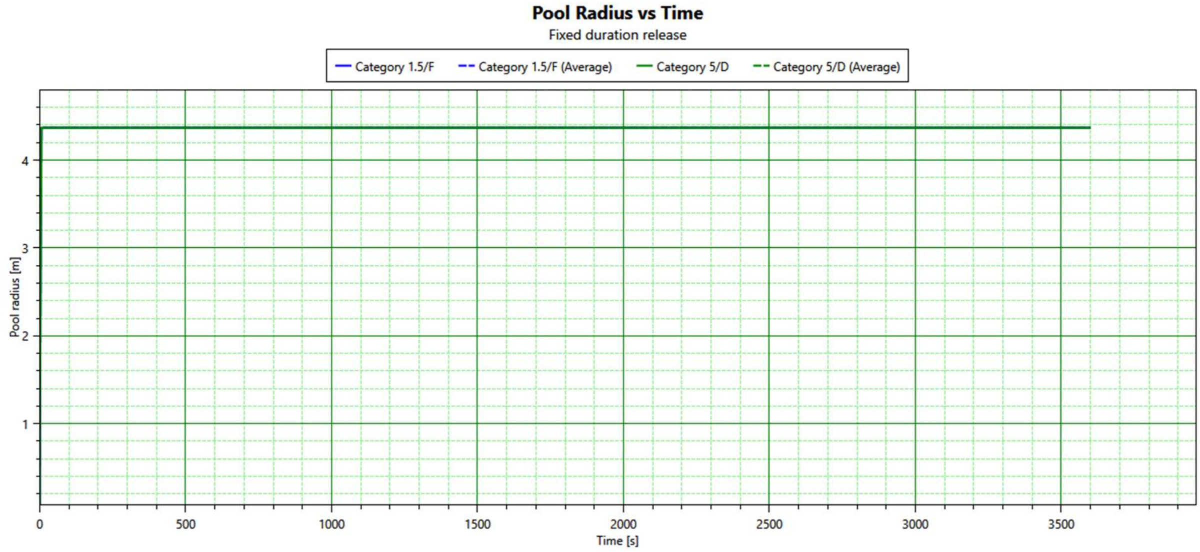
The consequence of a shallow but large pool is that the pool fire lasts for a short time, but the surface area for combustion and thus evaporation will be large.

The following figures show the previous models, but with the use of a remediation board. As shown in Figure 7, with the remediation board, the pool deepens for 10 minutes up to 1.5 m, after which, in the undamaged condition, the value starts to stagnate.



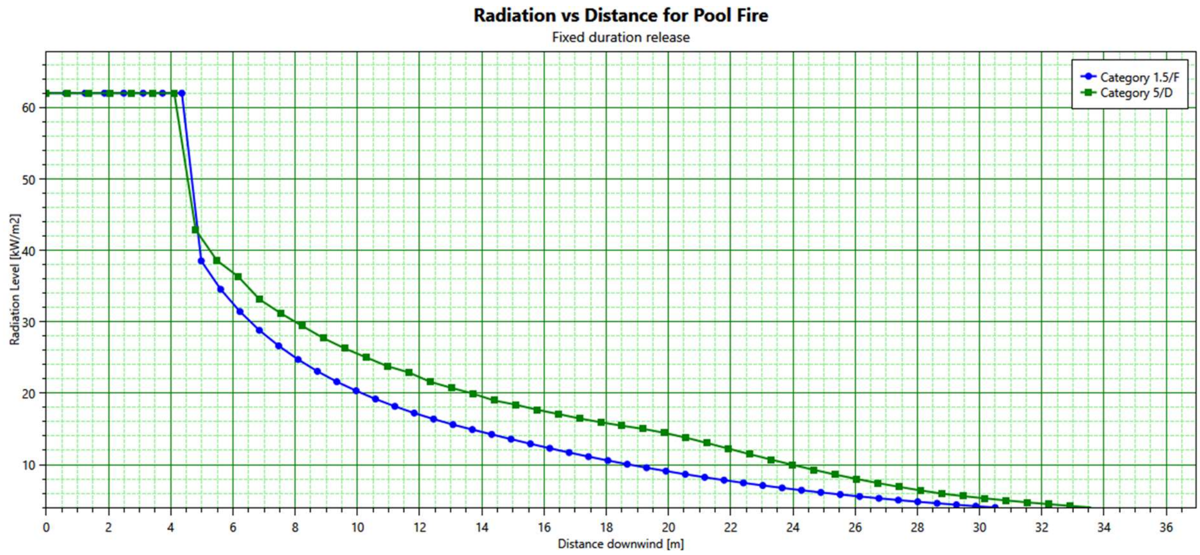
7. Figure: Pool depth and elapsed time, with rescue. Prepared by the authors.

As shown in Figure 8, when using a remediation board, the pool has a radius of 4.2 m, which is constant in the undamaged condition.



8. *Figure: Radius of the pool and elapsed time, with a rescue. Prepared by the authors.*

As Figure 9 illustrates, a much higher thermal radiation value of 61 kW/m^2 should be expected for a rescue, however, this thermal radiation is observed up to 4.3 m and then slowly decreases with increasing distance.



9. *Figure: Heat radiation and distance, with remediation board. Prepared by the authors.*

The consequence of a deep but small pool is that the pool fire will last for a long time, but the combustion and thus the evaporation surface will be relatively small.

Summary, suggestions

The concrete and reinforced concrete structures of containment areas, storage facilities and structures on the premises of plants represent a significant risk factor due to the irreversible effects they are subject to. Inappropriate and unprofessional concrete technology processes can have serious consequences for the environment. It is therefore necessary to review standards, to ensure that they are complied with during construction and to adopt a preventive, risk-reducing approach for all stakeholders in society. The increased and continuous monitoring by the authorities of existing structures and protective structures is a critical requirement, as they are subject to a high degree of chemical, mechanical and irreversible effects due to the time factor.

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Logistic challenges of firefighting in case of moving to the fire site

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Abstract

In order to protect human life, property and the environment, professional and voluntary fire departments are the first interveners in the field of disaster management in Hungary. An important element of effective firefighting can be linked to logistics. The logistic challenges of firefighting usually arise during the migration to the site. In the paper the author approaches this challenge through forest fire examples. The logistic challenges of wildfires usually arise in rural areas on dirt roads of the forest, away from the residential areas. These areas are usually difficult to approach with fire trucks that are not specifically designed to fighting against wildfires. The author examines the logistic difficulties of firefighting as a function of the effective firefighting, based on the relevant literatures and his experiences during his study trips. As a result of the paper, the effect of the loss of migration time on the efficiency of firefighting becomes visible.

Keyword: logistics, dirt road, time loss, fire truck, tipping point

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Introduction

Climate change is a challenge in many areas of science, society and life, so it also has an impact on the disaster management. Climate change provides a greater opportunity to ignite the combustible biomass, which increases the risk of wildfires worldwide. The wildland as a natural area carries many social values in itself, so people have to protect it from the fires.

Firefighting is often a very long and complex process, the main stages of it are the stop of fire spread, the stop of flame burning and the successful firefighting. The firefighting process starts from the fire alarm until the return of fire trucks to the fire stations [1]. During the process, firefighters have to face many logistical challenges [2] [3]. Several research has already been done on the logistical difficulties that arise in case of firefighting. The first thorough research in Hungary was carried out by Restás Ágoston, who examined the effectiveness of firefighting with a so-called damage - time function. In addition, he analyzed the elapsed time during the firefighting, the network of logistics bases and also their distance [4]. Other researchers primarily examine the complex tasks of the fire chief and the logistical difficulties of fire fighting in relation to the time dependence [5].

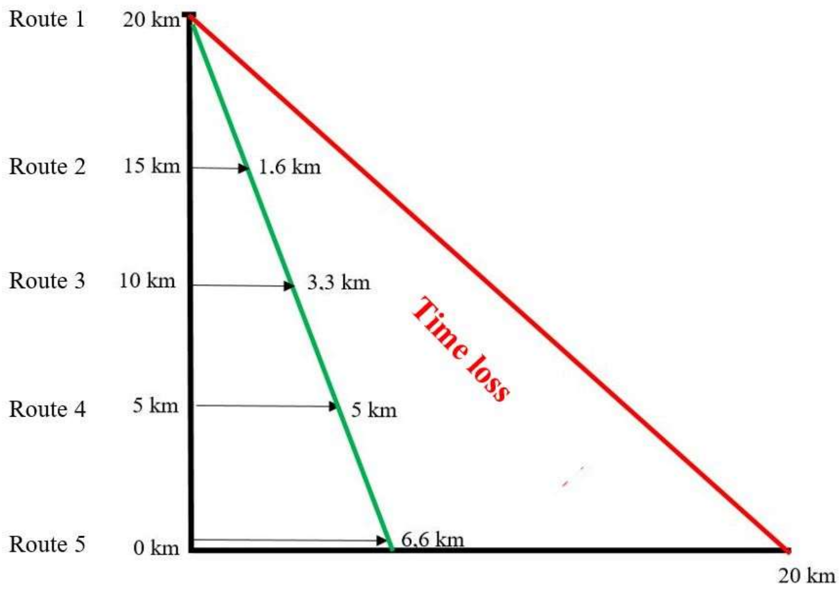
Every step of the firefighting process is a complex task, however, I consider the examination of marching to the fire site to be particularly important. The migration time affects the effectiveness of firefighting. Accordingly, it is very important for the firefighters to have the necessary conditions for a quick arrival. These can also be suitable fire trucks or special equipment. If this is not realized, then this is already an unfavorable circumstance. Such factors can include traffic, narrow, poor-quality dirt roads or even the topography. Since the time of a quick arrival is very important, I will analyze this first among these factors. The major logistic challenges of forest fires usually developed in rural areas, in many cases on dirt roads of the forest, away from the populated areas. These areas are difficult to approach with some fire trucks that are not specifically designed for these purposes. These difficulties effect of course the efficiency of firefighting. However, firefighters should be found a solution to this problem.

Examination of time loss during the marching to the fire site

In case of wildfires, fire trucks should approach the fire site on poor quality dirt roads, away from the settlements. Based on my consultations with drivers of fire trucks, I came to the conclusion that such fire sites are often on very poor quality, narrow dirt roads. From this I draw the conclusion that one of the most common logistical challenges of fighting against forest fires is the approach to the fire site. Firefighters must also be prepared for various obstacles during the marching [6] [7]. It is logical that large fire trucks move significantly slower on poor-quality dirt roads, than on good-quality driveways. An additional challenge is that the vehicles do not get stuck, so there is also the possibility of temporarily dropping out of an intervention. In the light of my investigation about the efficiency, I will present to what extent driving on a dirt road hinders the quick accessibility of a fire site. I have already examined the problem before with the help of a so-called conceptual figure [8], which I will now present after rethinking and improving it, based on a fictitious fire.

According to my assumption, a fire engine can travel at an average speed of 60 km/h on a good-quality road (driveway), and a third of that on a poor-quality, narrow dirt road, so with an average speed of approximately 20 km/h. When determining the speeds, I took into account that during the marching, not only the quality of roads, but also the traffic and the topography can influence the speed of the vehicles. The average speed of 60 km/h appears in the 48/2011. (XII. 15.) also in BM decree, which is on force, based on Section 1 (3) of the decree, it was determined that in case of municipal fire departments, the average speed of reaching an operational area must be calculated at a maximum of 60 km/h [9]. Based on it, I consider the two speeds acceptable during my research. After examining the speeds, I also assume a migration time interval. In the European Union, the measurable average travel time of firefighters is 15 minutes [10]. Based on my own judgment, the average marching time of the Hungarian fire brigades approaches, but does not yet meet, this, therefore, in my analysis, I calculate with a marching time interval of 20 minutes. The specialized literature on the subject refers to the so-called "white spots" as those areas that are not covered from a fire protection point of view, and which cannot be reached from the given professional fire department or municipal fire department within the specified 25-minute departure time [11]. This 25 minutes is an upper limit, therefore I consider the time interval of 20 minutes I have chosen to be acceptable. For my research, I edited a conceptual figure that shows how far a fire truck can travel on roads of different quality.

In case of Route 1, the marching to the fire site during the 20 minutes that I have determined is only and exclusively on driveway, so the maximum distance that can be covered is 20 km. I consider this to be the most favorable condition. In case of option 5, the vehicle travels exclusively on a poor quality dirt road, so it logically cannot cover the distance of 20 km, only a fraction of it, which is 6.6 kms and I consider it to be the most unfavorable condition. Of course, this is only a logical assumption, because in Hungary all fire stations are located in such a way that they can be accessed from the road. The figure also proves the logical conclusion that the more a fire engine travels on a dirt road, the less distance it takes in 20 minutes. In the figure, I have depicted 5 hypothetical route options, of which I have already presented the most favorable and the least favorable case (options 1 and 5). For the other road options, the distances covered are as follows. In case of Route 2, the marching takes place on a 15 km driveway followed by 1.6 km on a dirt road (which would be 5 km on a driveway). This ratio is already 10 km - 3.3 km in Route 3, and 5 km - 5 km in Route 4. The Figure 1 establishes my logical condition that traveling on a dirt road results in a significant time loss, which in turn affects the effectiveness of the firefighting.



1. Figure: Schematic figure of different migration route combinations. Source: [12]

In Table 1, I show the length of the travelled distance that fire trucks made during the six types of routes in km (in 20 minutes). In addition, I indicate the average speed of the truck on the different routes.

1. Table: Correlations of migration route options. Created by the author Source: [12]

Approach to the fire site on different types of routes			
Routes	**Traveled distance (km)**	**Average speed**	**Elapsed time**
1.	20	60 km/h	20 min
2.	16,6	50 km/h	20 min
3.	13,3	40 km/h	20 min
4.	10	30 km/h	20 min
5.	6,6	20 km/h	20 min

As a result of my research I have presented above, I came to the conclusion that some forest roads need to be widened and their quality should be improved in order to make these routes more passable by fire trucks. As a result of the analysis of the route options, I came to the conclusion that driving on a dirt road means a time loss during marching and as a result of it, the firefighters arrive late at the fire site. However, the late start of firefighting already has an effect on the lengths of the fire frontline, which makes the effective firefighting more difficult. Bad terrain conditions reduce the efficiency of the intervention not only in case of the migration, but also later on during the constant water transport. In the next chapter, I will present the possibilities of approaching the fire site with the help of some vehicles of my choice

Approaching the fire site with several vehicles

After analyzing the time loss of marching, I examine how effective it is to approach a fire site with the vehicles I have chosen, on the different types of roads. During my analyses, I consider a *driveway*, where the fire truck travels without obstacles at the above-defined average speed of 60 km/h. I consider *good-quality dirt roads* to be hard, solidly paved routes leading into the forest, on which a vehicle can travel at an average of 40 km/h. I consider forest roads that are not used by fire trucks to be *poor quality dirt roads*, where trucks can travel at an average speed of no more than 20 km/h. I consider *forest path* to be artificially created roads [13] in the forest, maintained in a treeless state, where large vehicles are no longer able to enter. I consider those small access roads in the forest as *forest trails* where, apart from pedestrians, only one-person small light vehicles can enter. I consider the *forest area* to be the part of the forest where the density of the trees allows only pedestrian access.

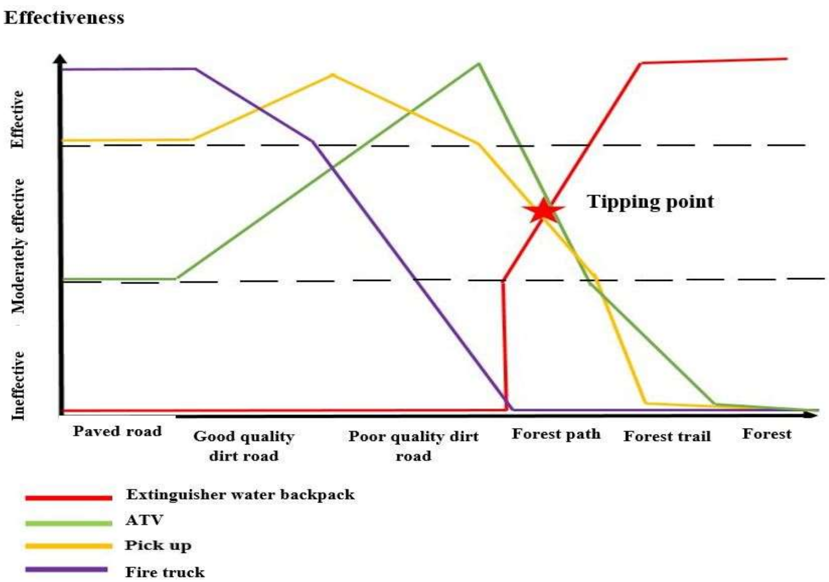
I present the different types of roads, the vehicles I have chosen (Extinguisher water backpack, ATV, pick up, fire truck) and the route options and their efficiency in Table 2. I chose these vehicles because, in connection with my logistics analysis, I wanted to present so-called light vehicles (ATV, pick up) as well as heavy vehicles (fire engine). In order to provide an authentic analysis, I also examine the pedestrian accessibility. In this framework I also examine the Extinguisher water backpack as a carry-on equipment.

2. Table: Movement possibilities of firefighting tools and fire trucks on different types of roads. Created by the author. Source: [12]

	Driveway	good-quality dirt road	poor quality dirt roads	Forest path	Forest trail	Forest area
Extinguisher water backpack	-	-	-	-	✓	✓
ATV	-	✓	✓	✓	-	-
Pick up	✓	✓	✓	-	-	-
fire truck	✓	✓	-	-	-	-

Based on Table 2, I came to the conclusion that the large fire engine travels efficiently on driveways and on the high-quality dirt road. Its application is less effective on narrow and low-quality routes. In contrast, due to its good driving characteristics, the pick-up is already suitable for effective transport even on poor quality roads, but it is no longer able to enter such narrow areas as forest paths, paths and forest trails. The efficiency of a firefighting ATV is almost the same as the pick-up, although it can travel more slowly on good quality roads. However, this is compensated by its good off-road ability, as the vehicle can even drive into narrow forest trails, with moderate efficiency. I note that there are some vehicles suitable for firefighting, up to the forest paths, which can be used to reach fire sites that are difficult to approach. The fire site can only be approached on foot on narrow paths and inside the forest area among the trees [14]. At this point, the effectiveness of the extinguisher water backpack as a tool that can be carried on the back becomes important. I also illustrate the efficiency of individual devices and vehicles in Figure 2. The curve shown below gives me the opportunity to demonstrate the efficiency of driving on the different quality roads.

Examining the figure, I came to the conclusion that the use of a large fire truck can be called effective as long as the marching takes place on easy terrain, on a wide road, that is, up to the forest paths. From this point, moving towards into the interior of the forest area, due to the worse terrain conditions, large fire trucks can no longer be used effectively, so it becomes necessary to use other types of smaller vehicles, or to approach the area on foot (with a tool). This is where the pick up and the ATV come into play, however even with these vehicles it is not possible to fully reach the densely wooded areas and trails, so as the last step of the march, a foot approach should be used and firefighting should be carried out with hand tools. As a conclusion of my analysis of the migration, I consider forest paths to be the **tipping point** of migration logistics in case of site approach.



2. Figure: Illustration of the use of individual fire trucks and technical tools on different quality roads. Created by the author Source: [12]

On the other hand, efficiency can also be determined by examining the speed of the given firefighting tool or vehicle on different quality roads [15] [16]. In Table 3, I present the average speeds for the given tool/vehicle.

3. Table: The average speed of the examined technical tools and fire trucks on different types of roads. Created by the author. Source: [12]

	Driveway	Good quality dirt road	Bad quality dirt road	Forest path	Forest trail	Forest area
Extinguisher water backpack	6 km/h	6 km/h	6 km/h	6 km/h	6 km/h	6 km/h
ATV	40 km/h	40 km/h	30 km/h	20 km/h	10km/h	-
Pick up	60 km/h	40 km/h	20 km/h	10 km/h	-	-
Fire truck	60 km/h	30 km/h	15 km/h	-	-	-

It can be seen that the effective use of vehicles on different quality roads are different. Larger and faster fire trucks are more efficient on driveways and good quality roads. It is advantageous to use smaller and better off-road vehicles on poor quality or narrow roads. Deeper in the forest area, where only forest paths and forest trails are available, only the application of hand tools are effective. It is true that with the help of these the firefighter can only move at a minimum speed, but with them any part of the forest block can be easily reached. The extra weight affects the work ability of the firefighter [17], however, the current paper does not include an analysis of this.

Summary

As a result of my analysis on the logistics difficulties in connection with the fire site approach, I examined the factors (road conditions, type of vehicles) that can be used for effective firefighting. I investigated the problem of time loss during the migration by analyzing the road conditions leading to the forest area. As a result of it, I have created a **conceptual figure** (Figure 1) on which I graphically presented the amount of time loss due to the bad road conditions. In addition, I made it visible that the longer a fire truck travels on poor quality forest roads, the slower the average speed will be.

Next, I explained the advantages and disadvantages of the tools and vehicles I chose (extinguisher water backpack, ATV, pick-up, fire truck) for the examination. I **compared the efficiency of the examined vehicles** with each other. The basis of my analysis was the approach to the fire site, as a result of it I determined that as long as the fire site is easily accessible in terrain, the use of large vehicles are effective. However, this changes as moving towards into the interior of the forest, as light vehicles already take over the efficiency in this case, primarily due to their good off-road ability. I consider **forest paths to be the tipping point** in case of the efficiency between large and small vehicles. The reason for this is that these large vehicles are no longer able to move and the efficiency shifts in favor of smaller vehicles and technical tools. The selection of the right vehicles have a major impact on the efficiency of firefighting and the extent of the resulting damage [18].

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