

Forest Fire Country Studies

Former Yugoslav Republic of Macedonia



FOREST FIRES COUNTRY STUDY
FORMER YUGOSLAV REPUBLIC OF MACEDONIA
2015

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Abbreviations

PE	Public enterprise
PEMF	The public enterprise Macedonian Forests
MAFWE	Ministry of Agriculture, Forestry and Water Economy
DPR	Directorate for Protection and Rescue
LSG	Local self-governance
TFPU	Territorial fire protection units
CMC	Crisis Management Centre
MKFFIS	Macedonian Forest Fires Information System
MFPU	Macedonian Fire Protection Union
RFPU	Regional fire protection unions
JICA	Japan International Cooperation Agency
GHG	Greenhouse gases
UNFCCC	United Nations Framework Convention on Climate Change
LULUCF	Land use, land-use change and forestry
JRC	Joint Research Centre
UN	United Nations
UXO	Unexploded ordnance
WW 1	World War One
EU	European Union
MIC	Monitoring and Information Centre
TCP	Technical Cooperation Programme
FAO	Food and Agriculture Organization
OSCE	Organization for Security and Co-operation in Europe
ENVSEC	Environment and Security Initiative
RFMC	Regional Fire Monitoring Centre
GFMC	Global Fire Monitoring Centre

I. The forestry sector, forests and fire history

1. Overview of the forestry sector

According to Article 6 of the Law on Forests (Official Gazette of FYRM No. 64 of May 22, 2009), forests in the former Yugoslav Republic of Macedonia are defined as follows:

- 1) *Forest ecosystems that exist on forest land covered with forest tree and shrub species, bare land close to the forest, as well as other bare land and pastures inside the forest, forest nurseries, forest roads, seedling plantations, forest fire cleanings, wind protection belts with an area larger than 2 a [0.02 ha], as well as forests in protected areas. Forests also consist of young stands and forest plantations with an area larger than 2 a [0.02 ha], as well as areas that are currently uncovered as a result of human activities or natural hazards, where natural regeneration has begun.*

Separate groups of trees on areas smaller than 2 a [0.02 ha], border trees in agricultural land, plantations of fast-growing tree species as well as river bank vegetation, alleys and parks in inhabited places are not considered as forest.[6]

According to Article 7 of the same law, “forest management” is defined as:

silviculture, protection and forest utilisation, through the restoration, nurture, protection, afforestation, utilisation of forests and forest land, and other activities for the maintenance and improvement of the forest's functions.[6]

Besides their basic goal, the definitions contained in these two articles of the Law on Forests (of forests, of what may not be considered as forest, and of forest management) may also be considered as a basis for defining the activities and competences of the forestry sector in terms of forest fire protection.

1.1. Forest characteristics

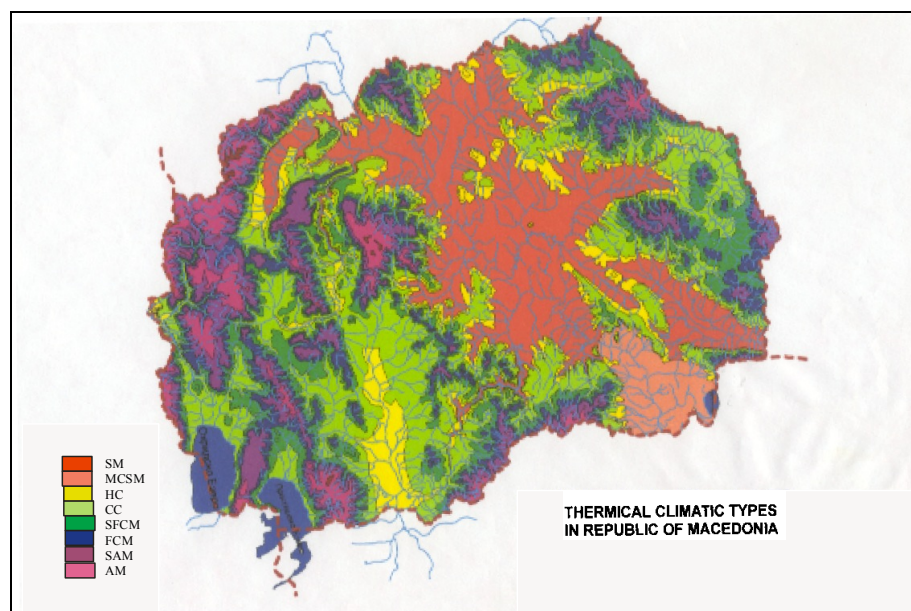
The total area of forest land in the former Yugoslav Republic of Macedonia is 1,159,600 ha, of which forests themselves cover 947,653 ha. The total standing volume in Macedonian forests is 74,343,000 m³, while the total annual increment is 1,830,000 m³ and the average annual increment per hectare is 2.02 m³. [3]

The distribution of different tree species and types of forest over the territory of the country depends of various factors, such as climate, soil and topography.

According to the climate and type of vegetation, the following thermo-climatic regions and sub-regions and forest/vegetation associations can be defined in the former Yugoslav Republic of Macedonia:

- Region with a sub-Mediterranean climate (50–500 m.a.s.l.) (Gevgelija-Valandovo region) (SM)
Querco-Carpinetum orientalis (**Oberdemend Ht.**)
- Region with a moderate continental–sub-Mediterranean climate (up to 600 m.a.s.l.) (MCSM)
Querco-Carpinetum orientalis macedonicum (**Rudski apud Ht.**)
- Region with a hot continental climate (600–900 m.a.s.l.) (HC)
Quercetum frainetto-cerris macedonicum (**Oberd Emend Ht.**)
- Region with a cold continental climate (900–1,100 m.a.s.l.) (CC)
Orno-Quercetum petraeae (**Em.**)
- Region with a sub-forest–continental–mountainous climate (1,100–1,300 m.a.s.l.) (SFCM)
Festuco heterophylla-Fagetum (**Em.**)
- Region with a forest–continental–mountainous climate (1,300–1,650 m.a.s.l.) (FCM)
Calamintha grandiflora-Fagetum (**Em.**)
- Region with a sub-alpine mountainous climate (1,650–2,250 m.a.s.l.) (SAM)
Fagetum subalpinum scardo pindicum (**Em.**)
Picetum subalpinum scardicum (**Em.**)
Myrtillo-Pinetum pencis subass. Subalpinum (**Em.**)
Pinetum mudhi macedonicum (**Em.**)
Junipero-Bruckentalium (**Em.**)
- Region with an alpine mountainous climate (above 2,250 m.a.s.l.) (AM)
grass associations [1]

Map 1. Thermo-climatic regions in the former Yugoslav Republic of Macedonia



Source: [34]

The most dominant species are beech (*Fagus moesiaca*) and various oak species (*Quercus spp.*), which make up 90 percent of the total area of native forest types. Forests mainly comprise deciduous tree species, while the share of conifers is around 11 percent of the total forest area. Around 550,000 ha of forests are categorised as coppice (low-quality forests), while around 390,000 ha are categorised as high forests (usually high-quality forests), of which around 140,000 ha are plantations (afforestation), mostly comprising coniferous tree species such as *Pinus nigra* (black pine) and *Cupressus arizonica* (Arizona cypress).

Out of the total area of forest, the share of state-owned forests is 90.14 percent, comprising 92.2 percent of the total standing volume. Privately owned forests cover 9.86 percent (94,146 ha) of the total forest area, comprising 7.8 percent of the total standing volume.[3] There are more than 200,000 parcels of forest (the average size of a parcel being 0.6 ha), which are the property of around 65,000 owners.

According to the official management plans, annual allowed removal is around 1,200,000 m³ (i.e. around two-thirds of the annual increment). The principal share of this amount is related to state-owned economic forests, while a very small part is correlated with protective and protected areas. The definite volume of annual removals is between 550,000 m³ and 750,000 m³ and

comprises mostly firewood (80–85 percent) used by households. Logs are used mostly by the domestic wood industry, while only a small share are exported.

State-owned forests for economic use are managed by the public enterprise (PE) Macedonian Forests (Makedonski sumi), while state-owned protected forests are managed by state-established national parks or other public enterprises. Private forests are managed by private owners, largely through alliances of private forest owners.

1.2. Major forestry stakeholders

The Government of the former Yugoslav Republic of Macedonia administers the forests and forest lands in state ownership through the following institutions:

1.2.1. Ministry of Agriculture, Forestry and Water Economy (MAFWE) www.mzsv.gov.mk

The State Inspectorate of Forestry and Hunting, as a body within the MAFWE, controls and supervises the enforcement of the Law on Forests, the Law on Hunting and all other laws and legally binding acts in the field of forestry and hunting. The Forestry Police, as a sector within the MAFWE, protects the forests in accordance with the Law on Forests. [21]

1.2.2. Public enterprise Macedonian Forests (PEMF) www.mkdsumi.com.mk

The public enterprise for managing state forests was founded on the basis of Government Decision No. 3028/1 of December 15, 1997 (Official Gazette of FYRM No. 65/97). It began operations on July 1, 1998, as the legal successor to the former enterprises for forest management. In accordance with Article 7 of the Law on Forests, its core activities are: silviculture, protection and utilisation of forests through the restoration, nurture, protection, afforestation and utilisation of forests and forest land, and other activities for the maintenance and improvement of forest functions. [22]

1.2.3. Saints Cyril and Methodius University of Skopje, Faculty of Forestry www.sf.ukim.edu.mk

The Faculty of Forestry in Skopje was established in 1947. Today, the faculty offers three undergraduate academic programmes, 10 postgraduate academic programmes, and doctoral studies with a tutoring system. The main mission of the faculty is education and the establishment of a highly educated and scientific staff in the field of forestry, landscape design, eco-engineering and eco-management. [26]

1.2.4. Ministry of Environment and Physical Planning

www.moepp.gov.mk

In the framework of efforts towards integration into the modern trends of environmental protection in Europe and beyond, and as an important aspect of the reform process, the Macedonian Government established the Ministry of Environment (Law on the Amendment to and Supplementing the Law on Public Administration Bodies, Official Gazette of FYRM No. 63/98).

Article 122 of the above law defines the competences of the ministry, among which those closely related to forests and the forestry sector are:

- monitoring of the state of the environment;
- protection against noise and radiation;
- the conservation of biological diversity;
- the conservation of geological diversity, national parks and protected areas; and
- the supervision of inspection in fields within its scope.

Operating within the Ministry of Environment and Physical Planning is the State Inspectorate for the Protection of the Environment, which is competent for the control of all legal and physical entities in the field of environmental protection. [27]

1.2.5. National parks

There are three legally established national parks in the former Yugoslav Republic of Macedonia.

- Pelister National Park (<http://www.park-pelister.com/>) was established on November 30, 1948, mainly in order to protect the well-preserved forest of the endemic five-needle pine *Pinus peuce* (known as the Macedonian pine, or Molika). Today, the park covers an area of about 17,150 ha. [28]
- Mavrovo National Park (www.npmavrovo.org.mk), which covers an area of 11,750 ha, was declared in 1949. In 1952 it was enlarged to its present size of 73,100 ha. Around 27,000 ha of the total area are forests. It is thought to comprise more than 1,000 types of higher plant forms, around 100 of which are extremely rare in the Balkans. [29]
- Galichica National Park (www.galichica.org.mk) is situated between Lake Ohrid and Lake Prespa and covers an area of 22,750 ha. It was declared in 1958. Nineteen different forest communities have been discovered on its territory, indicating that the vegetation in the park is very rich, including several extremely rare types of flora. [30]

Map 2. National Parks in the former Yugoslav Republic of Macedonia



Source: [35]

1.2.6. Jasen PE www.jasen.com.mk

The Jasen forest reserve was declared in 1958. It covers an area of 24,000 ha and stretches across the mountain massifs of Suva Gora, Suva Planina and Karadzha. This reserve falls into the category of special nature reserve, protecting many species of flora and fauna and other natural rarities. [31]

1.2.7. Private forest owners www.naps.com.mk

The National Society of Private Forest Owners (Nacionalno Zdruzenie na Sopstvenici na Privatni Sumi) was founded in 1997, although its current name was only adopted in 2010 (Official Gazette of FYRM No. 52 of April 16, 2010). It is a non-governmental and non-political organisation, the main mission of which is the “protection of the individual and common interests of private forest owners without affecting the principles of sustainable forest management”. The society currently has a membership of around 1,500. [32]

1.3. Fire history

One of the most detrimental factors for forests and nature in the former Yugoslav Republic of Macedonia are forest fires. According to data from the MAFWE, in the period between 2004 and 2013 there were a total of 2,465 forest fires in the country, the total burned area was 91,805.9 ha, and the total volume of burned timber 931,258.52 m³ (see Table 1). Within the same period,

there were an average of 205 forest fires per year and the average size of the burned area was 9,180 ha annually. The most severely affected year in this period was 2007, when 652 fires were recorded, resulting in 35,248.6 ha of burned area. The most severe individual forest fire occurred in 2012 in the pine afforestation near the city of Strumica, when four people were killed and 12 injured (civilians), including seven children.[19]

The total damage (burned timber volume plus suppression costs) caused by forest fires in this period has been estimated at around EUR 51,000,000. [19]

Forest fires in the former Yugoslav Republic of Macedonia are usually caused by stubble burning, the burning of pastures and arson.

Arson has emerged as a phenomenon in the last 15 years. There are two main reasons:

- pyromania, which is very rare in the former Yugoslav Republic of Macedonia; and
- economically motivated arson, mainly due to illegal logging. There have been some cases of fires being started intentionally in order to “cover” illegal logging activities already carried out. There have also been cases of arson committed in order to occupy the attention of official institutions (e.g. the Forestry Police) with fire suppression while illegal logging activities were taking place in another forest area.

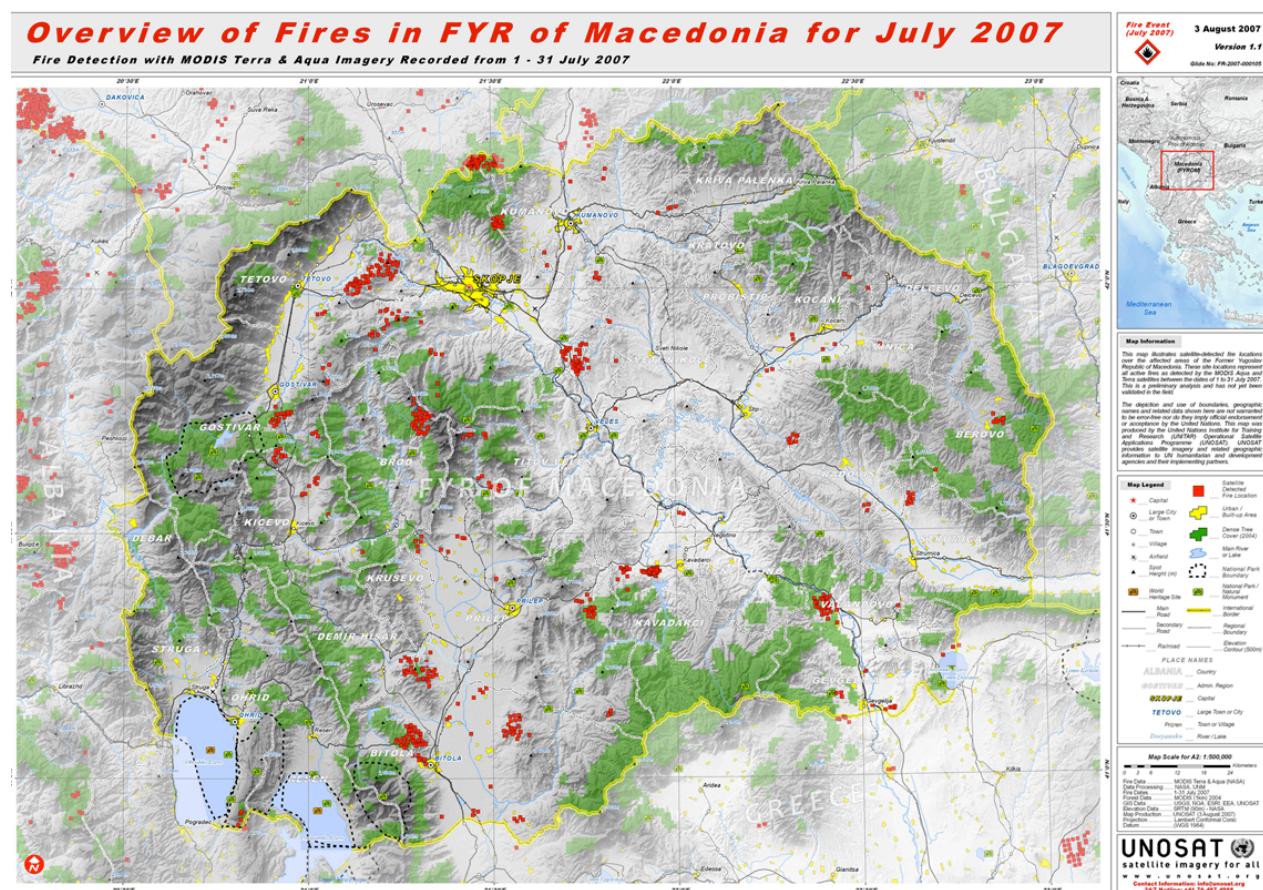
According to Articles 22 and 45 of the Law on Forests, the entity that manages the forest must arrange for the reforestation of the deforested area. Also, according to Article 58, it has to introduce “forest order” (the term “forest order” is defined in Article 12, item 40, of the Law on Forests). This implies that all trees damaged by fire must be removed from the burned area. In this case, the price of the timber is significantly lower than the official price.

Table 1. Forest fire statistics for the period 2004 to 2013

Year	Number of fires	Burned area (ha)	Burned timber mass (m ³)	Suppression costs (EUR)	Total costs (EUR)
2004	94	892.05	4,322.30	23,214.55	1,469,090.00
2005	182	1,368.00	1,063.00	42,018.11	411,181.00
2006	138	2,085.95	12,978.00	45,311.20	2,437,914.00
2007	652	35,248.60	617,678.67	386,852.46	21,494,700.00
2008	323	10,143.10	53,055.60	96,278.69	4,612,377.00
2009	38	197	756.50	313,627.00	5,812,889.00
2010	64	1,112.50	5,000.00	985,455.00	9,000,000.00
2011	390	20,856.80	65,042.80	400,153.00	1,719,105.00
2012	385	19,964.90	155,126.00	410,323.00	4,248,828.00
2013	170	6,379.12	16,235.00	115,000.00	434,333.00
Total	2,046	91,805.90	931,257.87	2,818,233.01	51,640,417.00
Average	205	9,180.00	93,125.80	281,823.30	5,164,041.70

Source: MAFWE State Inspectorate for Forestry and Hunting

Map 3. Overview of forest fires for July 2007 (MODIS Terra&Aqua Imagery)



Source: [4]

II. Legal framework and institutional set-up in the field of forest fire management

The most important legislative acts regulating the issue of forest fires in the former Yugoslav Republic of Macedonia are:

- Law on Forests (Official Gazette of FYRM No. 64, of May 22, 2009)
<http://www.pravdiko.mk/wp-content/uploads/2013/11/ZAKON-ZA-SHUMITE-19-05-2009.pdf>
- Law on Hunting (Official Gazette of FYRM No. 26 of February 24, 2009)
<http://www.pravdiko.mk/wp-content/uploads/2013/11/Zakonot-za-lovstvoto-19-02-2009.pdf>
- Law on Fire Protection (Official Gazette of FYRM No. 67/4 of September 14, 2004)
<http://www.pravdiko.mk/wp-content/uploads/2013/11/Zakon-za-pozharnikarstvoto-16-09-2004.pdf>
- Law on Protection and Rescue (Official Gazette of FYRM No. 36/04 of June 10, 2004)
<http://www.pravdiko.mk/wp-content/uploads/2013/11/Zakon-za-zashtita-i-spasuvanje-20-07-2012.pdf>
- Law on Local Self-governance (Official Gazette of FYRM No. 5 of January 29, 2002)
<http://www.pravdiko.mk/wp-content/uploads/2013/11/Zakonot-za-lokalnata-samouprava-24-01-2002.pdf>
- Law on Environment (Official Gazette of FYRM No. 53 of July 5, 2005)
<http://www.pravdiko.mk/wp-content/uploads/2013/11/Zakonot-za-zhivotnata-sredina-22-06-2005.pdf>
- Law on Nature Protection (Official Gazette of FYRM No. 67 of September 4, 2004)
<http://www.pravdiko.mk/wp-content/uploads/2013/11/Zakon-za-zashtita-na-prirodna-15-09-2004.pdf>
- Law on Crisis Management (Official Gazette of FYRM No. 29 of May 4, 2005)
<http://www.macefdrr.gov.mk/files/dokumenti/pzrdo/Zakon%20za%20upravuvanje%20so%20krizi%202005.pdf>
- Law on Agricultural Land (Official Gazette of FYRM No. 135 of November 8, 2007)
<http://www.pravdiko.mk/wp-content/uploads/2013/11/Zakon-za-zemjodelsko-zemjishite-2012.pdf>

The way in which forest fires are regulated by the above laws will be shown in greater detail within the review of the institutional set-up. According to the laws listed above, the main institutions authorised in the field of forest fire protection are:

1. Ministry of Agriculture, Forestry and Water Economy (MAFWE)

The MAFWE was established by the Law on the Organisation and Operation of the Organs of the State Administration (Official Gazette of FYRM No. 58/2000 of July 21, 2000), and its competences are described in Article 21 of the same law. The MAFWE performs activities related to:

- agriculture, forestry and water economy;
- the utilisation of agricultural land, forests and other natural resources; and
- inspection in the domains of its competences.

There are two sectors within the MAFWE related to forestry: the Sector for Forestry and Hunting; and the Sector for Forest Police. The State Inspectorate for Forestry and Hunting also operates within the MAFWE. [21]

The main purpose of the above organisational units is to secure the management of forests in accordance with Article 7 of the Law on Forests: "silviculture, protection and forest utilisation through the restoration, nurture, protection, afforestation and utilisation of forests and forest land, and other activities for the maintenance and improvement of the forest's functions".

The Sector for Forestry and Hunting is subdivided into four departments:

- The Department for Afforestation and Silviculture
- The Department for Forest Protection — Among other activities this department is obliged to monitor the situation in the field of forest fire protection and the protection of forests from other negative abiotic and biotic factors.
- The Department for Hunting — Regarding forest fires, the role of this department is to ensure the implementation of Article 23 of the Law on Hunting: "It is forbidden to burn stubble in the fields, weeds and other plant waste in hunting areas."
- The Department for the Planning of Management Activities and the Utilisation of Forests [21]

The task of the Sector for Forest Police is defined by Article 81 of the Law on Forests: "The guarding of state and privately owned forests is organised by the Forest Police."

According to Article 82 of the same act, besides guarding the forests the Forest Police has a mandate to monitor and report on the situation in forests regarding illegal logging and forest crimes, forest fires, diseases, pests and other negative impacts; to inform the authorities about the illegal appropriation of forests and forest land; and to initiate procedures within the appropriate legal institutions against law breakers.

The State Inspectorate for Forestry and Hunting is responsible for monitoring the implementation of the provisions of the Law on Forests. For this purpose there are five regional units with 22 regional inspectors covering all municipalities in the country. Competencies are defined within Chapter XI of the Law on Forests. One of the competencies is to ensure the implementation of all prescribed measures for forest fire protection by all entities that manage forests.

2. Public enterprise Macedonian Forests (PEMF)

The PEMF was founded on the basis of Government Decision No. 3028/1 of December 15, 1997 (Official Gazette of FYRM No. 65/97). It began operating on July 1, 1998, as the legal successor to the former enterprises for forest management. Its status as a subject that manages forests is determined by Article 87 of the Law on Forests: "The management of state-owned forests with economic and protective assignments is carried out by the PEMF for the management of state-owned forests. This entity manages the state-owned forests through its 30 subsidiaries. Among other tasks, the subsidiaries are responsible for protecting and taking care of the forests. [22]

The PEMF (including its subsidiaries) has a total of 2,232 employees. According to their qualifications, they comprise two with a PhD; 15 with an Msc; 410 graduates (mainly forestry engineers); 74 with two years of college; 1,140 with a high-school certificate (mainly forestry technicians); and 591 with primary school education (forestry workers).

In accordance with Article 50 of the Law on Forests, the PEMF (via all its subsidiaries) is "obliged to conduct measures for the protection of forests from illegal logging, forest fires, natural disasters, diseases, insects, illegal pasturing and other damages".

In Article 1, items 27 and 28 of the same law, the terms "fire in open spaces" and "forest fires" are defined as follows:

"A fire in an open space is the uncontrolled burning of forest and forest land, regardless of the size of the burning area, the intensity of the fire or the reason for ignition, which includes the burning of agricultural land and pastures, closer than 200 m from the forest edge."

"A forest fire is the uncontrolled burning of forest and forest land, regardless of the size of the burning area, the intensity of the fire or the reason for ignition."

In the same article, under item 29, the term "forest fire management" is defined as measures for protection against fires in open spaces, which comprise:

- 1) Prevention measures in the form of education and public awareness raising throughout the year.
- 2) Preparatory measures, carried out throughout the year, prior to the outbreak of forest fires, with the aim of making ready the institutions responsible for forest fire suppression in the event of an outbreak.
- 3) Direct measures used during a forest fire aimed at localising and suppressing the fire."

All these measures are part of the annual operating plan that each subsidiary must prepare and that the PEMF must confirm. This plan is obligatory under the Law on Protection and Rescue (Article 51).

Taking into consideration the complexity of the issue of forest fire protection, based on Article 50, paragraph 2, of the Law on Forests, the MAFWE has adopted the Rulebook on Special Measures for Forest Fire Protection. The following articles contained in the rulebook can be regarded as the most relevant:

Article 1

This rulebook shall prescribe the special measures for forest fire protection.

Article 2

The measures for forest fire protection will be determined and carried out according to the degree of the forest fire danger rating.

Part of this rulebook is also Chapter V (Minimal technical means, tools and other equipment for forest fire suppression) of Article 19.

Article 19

Legal entities in charge of forest management with up to 100 employees should provide the following technical means and tools for forest fire suppression and other equipment necessary for suppression as follows:

	Number
1. Means of transport	
1.1. Off-road vehicles	2
1.2. Freight vehicles (trucks)	2
2.1. Mobile radio stations	10
2.2. Fixed radio stations	1
3. Equipment and tools	
3.1. Chain saws	4
3.2. Axes	10
3.3. Backpack pumps (25 l capacity).	25
3.4. Shovels	40

3.5. Mattocks	10
3.6. Rakes	15
3.7. Fire beaters	10
4. Other equipment	
4.1. Battery lamps	5 + 3 in reserve
4.2. Drinking water bottles/tanks	1 for 10 persons [18]

3. Directorate for Protection and Rescue (DPR)

The directorate was established in 2005 by the Law on Protection and Rescue.

The directorate is an independent government authority created by merging the civil protection activities under the Ministry of Defence with the Inspectorate of Fire Protection under the Ministry of Interior. It comprises four sectors with 11 departments, four independent departments and 35 local offices for protection and rescue. (Figures 1 and 2)

Its competencies and scope of activity are regulated by the Law on Protection and Rescue (Official Gazette of FYRM No. 36/04 of June 10, 2004) as well as the Law on Fire Protection (Official Gazette of FYRM No. 67/4 of September 14, 2004).

In relation to forest fires, the competencies of the DPR are coordination, inspection, prevention and suppression.

Coordination In accordance with Article 51 of the Law on Protection and Rescue, “The organs of state administration, the organs of local self-governance units, trading societies, public enterprises, institutions and services are obliged to prescribe and project the organisation for the implementation of measures for protection and rescue and to implement prevention measures.” The DPR has a mandate to coordinate these activities/plans (in relation to forest fire protection) from all institutions and organs in accordance with the current laws and regulations.

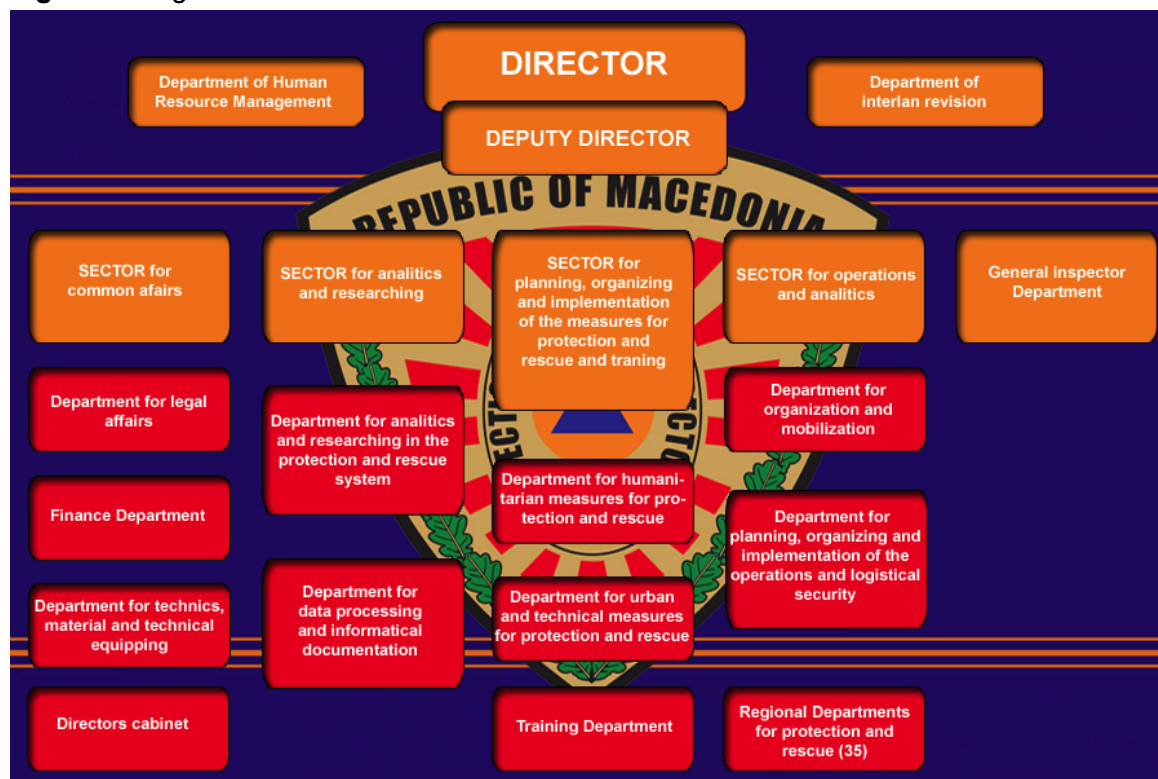
Inspection The General Inspectorate Department has a mandate to conduct inspections of all authorised institutions for forest fire protection (the PEMF, local self-governance units, and territorial fire protection units etc.) in order to check if they have prepared proper plans, taken all necessary measures for prevention and preparedness etc. in accordance with the current laws and regulations.

Prevention The DPR has a mandate to initiate procedures for the adoption of new laws or the improvement of existing laws; and to organise public awareness campaigns (independently or jointly with other institutions or organisations), educational measures (lectures) etc.

Suppression In accordance with Article 18, item 6, of the Law on Protection and Rescue, the DPR has a mandate to participate in the activities of forest fire suppression. For this purpose,

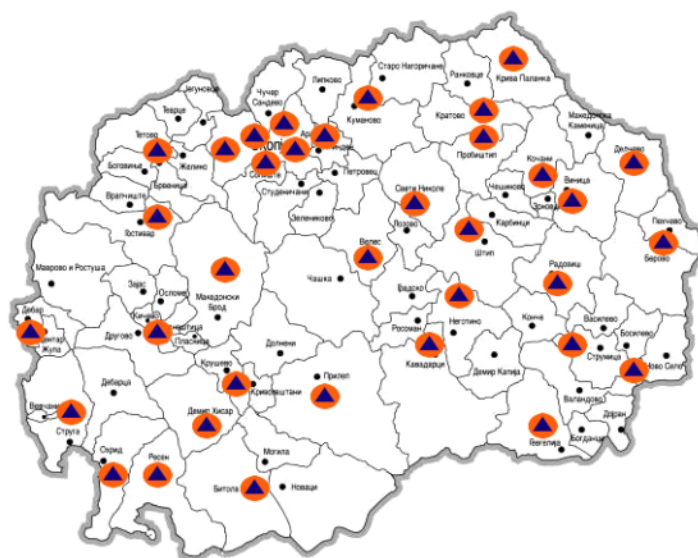
there are 35 teams for prompt response (around 700 people in total) to be engaged in the event of large forest fires. These teams are equipped mainly with hand tools. The Sector for Specialised Services with Aircraft operates three aeroplanes (Air Tractor Europe, S.L) specially equipped for forest fire suppression. [23]

Figure 1. Organisational structure of the DPR



Source: <http://www.dzs.gov.mk/>

Figure 2. Distribution of the regional departments of the DPR



Source: <http://www.dzs.gov.mk>

4. Local Self-governance units

In accordance with the Law on Fire Protection (Official Gazette of FYRM No. 67/4 of September 14, 2004) and the Law on Local Self-governance (Official Gazette of FYRM No. 5 of January 29, 2002), units of local self-governance are obliged to organise fire protection services (territorial fire protection units, or TFPUs) made up of professional firefighters. These units are mainly trained and equipped for the suppression of urban fires.

5. Crisis Management Centre

The Crisis Management Centre (CMC) was established in 2005 in accordance with the Law on Crisis Management (Official Gazette of FYRM No. 29 of May 4, 2005). The main tasks of the CMC are to:

- ensuring continuity in inter-sectoral and international cooperation, consultation and coordination in the field of crisis management;
- prepare and update the assessment of risks and dangers for resolving crises; and
- propose measures and activities for resolving crisis situations and performing other duties prescribed by law.

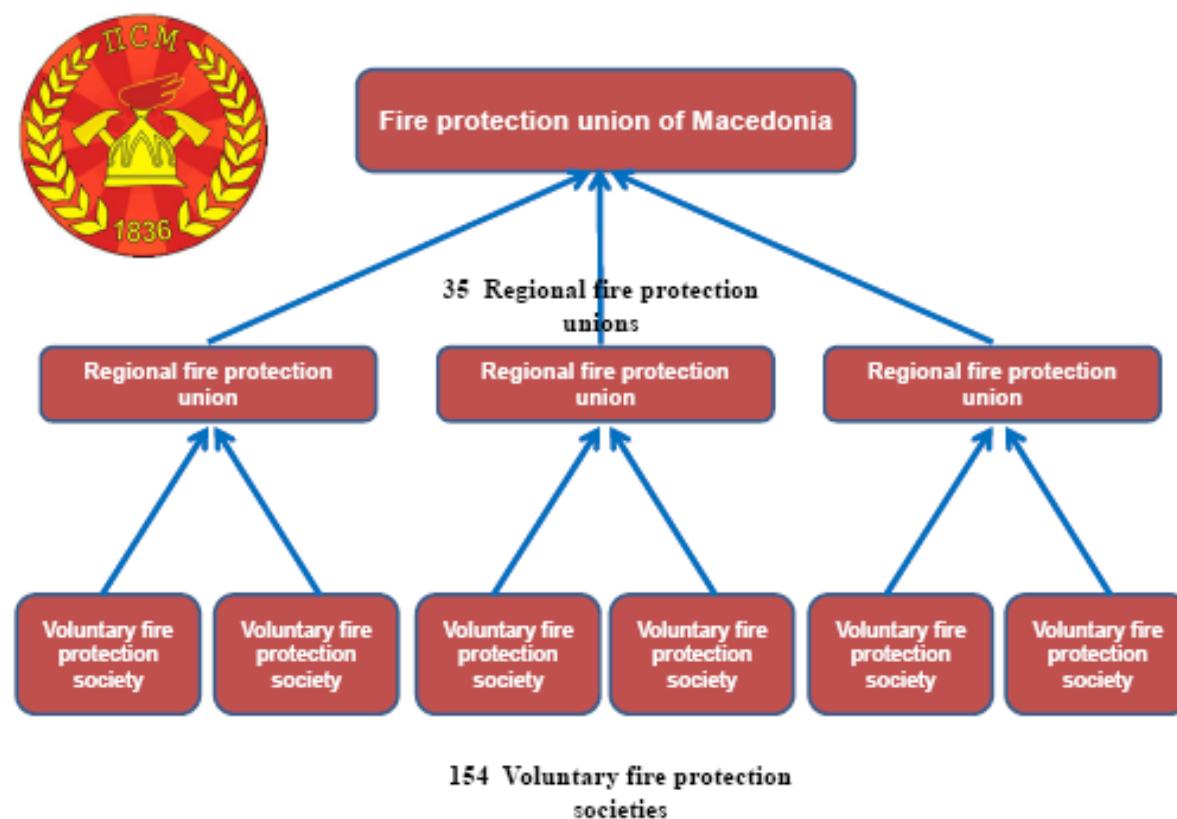
In line with this the CMC is in charge of forest fire management only during crisis situations at state level (such as the fire season in 2007, when a state of emergency was declared in the

former Yugoslav Republic of Macedonia). In 2014, within the CMC, a web-based early warning system for forest fires (the Macedonian Forest Fire Information System, or MKFFIS) was made available for public use at <http://mkffis.cuk.gov.mk/>. Certain parts of the system are available only to institutions responsible for forest fire protection in the former Yugoslav Republic of Macedonia. [25]

6. Macedonian Fire Protection Union

The Macedonian Fire Protection Union (MFPU) is an NGO that operates according to the Law on Fire Protection (Official Gazette of FYRM No. 67/4 of September 14, 2004) and the Law on Societies and Foundations (Official Gazette of FYRM No. 52 of April 16, 2010). Its basic activity, according to Article 8, Subsection 1, of the statutes of the MFPU is defined as follows: “The union implements measures and activities for preventing the occurrence of fires, for firefighting and for rescuing people, property and values jeopardised by fires, climatic distress and other accidents.” This means that the MFPU carries out measures for the prevention, pre-suppression and suppression of fires, including forest fires. The engagement of firefighters (volunteers) in forest fire suppression activities is coordinated and carried out by the Directorate for Protection and Rescue (at state and local level). Today, there are around 154 voluntary fire protection societies within the MFPU, organised in 35 regional fire protection unions (RFPUs). [16]

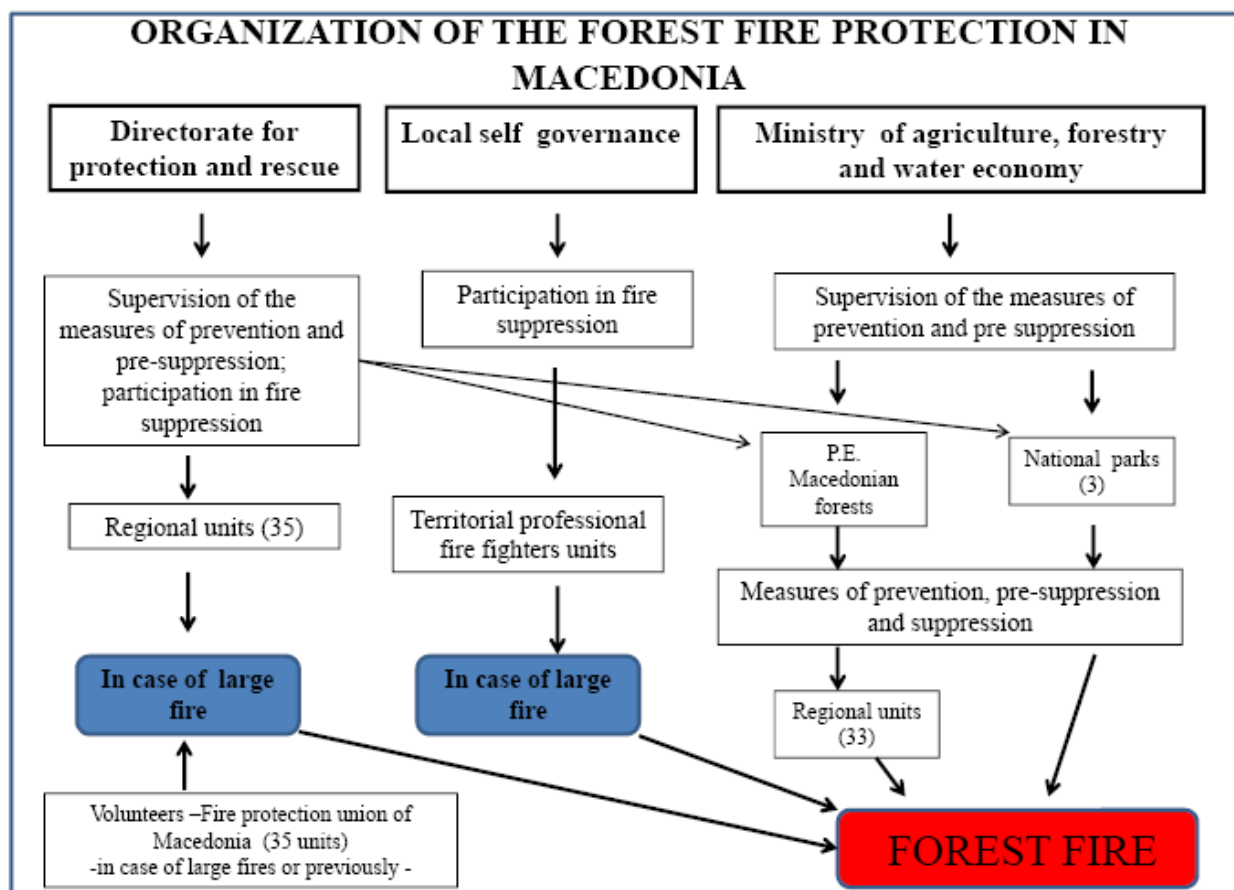
Figure 3. Organisational structure of the MFPU



Source: Nikola Nikolov, Involvement of volunteer firefighters in enhancing wildfire preparedness and response capacities in Macedonia, Novosibirsk, 2013

Taking into consideration the laws referred to above, the organisation of forest fire protection in the former Yugoslav Republic of Macedonia is illustrated in Figure 4.

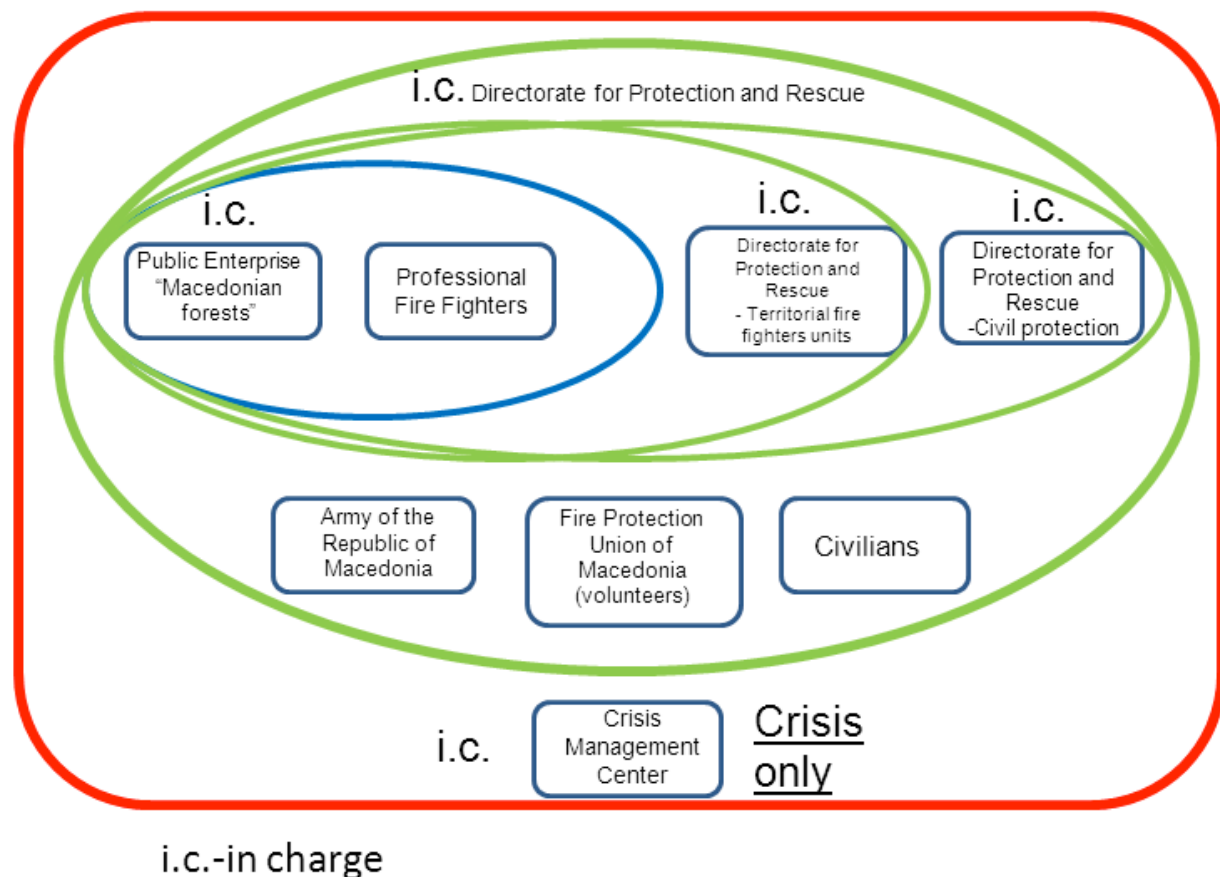
Figure 4. Organisation of forest fire protection in the former Yugoslav Republic of Macedonia



Source: Nikola Nikolov, Organization of Forest Fire Protection in the Southeast European/Caucasus Region, Seoul, 2013

Besides measures for prevention and pre-suppression, one of the preconditions for effective fire suppression is a clearly defined chain of command and coordination. According to the Law on Forests, the company/entity that manages forests has an obligation to organise the initial fire suppression response. This is usually the PEMF via its regional subsidiaries. At this point they are in charge of fire suppression actions. If a fire cannot be suppressed by the PEMF, they must call on the local fire service for support, although the PEMF is still in charge of the fire suppression operation. If the fire remains beyond their capacities, the DPR will contribute its resources. From this point the DPR is in charge of all operations, even if the MFPU (volunteers) and the army are involved. If a state of emergency is officially declared, the Crisis Management Centre will become responsible for coordinating the firefighting. This task includes the coordination of foreign assistance, for example targeting foreign aerial resources to the fire (Figure 5).

Figure 5. The command and coordination chain during forest fire suppression



Source: FAO/TCP/MCD/3201

There are regulations on the use of fire as a management tool in forestry, agriculture, protected areas and other land.

In accordance with Article 13, item 1, of the Law on Forests, setting fire to forests is strictly forbidden. Article 54 also forbids starting fires within the forest and on surrounding land at a distance of less than 200 m from the edge of the forest. In item 2 of the same article, as an exception from item 1, it is permitted to set fire under conditions and in places that are determined and indicated by the subject that manages the forest.

In accordance with Article 46 of the Law on Agricultural Land, it is forbidden to set fire to crops or stubble or to start fires near them.

According to Article 23 of the Law on Hunting, it is forbidden to burn stubble, weeds or other plant waste.

Forest fires do not always occur within the territory of a single country. Sometimes they pass the administrative borders between countries. In order to regulate all related issues and to increase the efficiency of forest fire protection (especially forest fire suppression), the former Yugoslav Republic of Macedonia has signed agreements (or agreements are being negotiated) with the following countries: Bulgaria (negotiations); Croatia (agreement signed); Montenegro (negotiations); Serbia (Memorandum of Understanding); Slovenia (agreement signed); Bosnia and Herzegovina (cooperation agreement signed); Turkey (agreement signed); France and Hungary (bilateral collaboration).

III. The impact of forest fires on the environment, economy and human health

There are different data on the damage and losses (social, economic and environmental) caused by forest fires in the former Yugoslav Republic of Macedonia, mainly because there are different approaches to calculating or estimating the damage caused by fires, and because there are several ways of defining the actual costs of forest fires.

The costs of forest fires and the losses they cause are often considered only in terms of suppression costs and losses of timber volume, while relatively little attention is given to the related losses of forest habitats and populations (including endangered species and their critically protected habitats), air and water quality, recreational opportunities, local economies, and other resources and amenities that are important to all citizens. Impacts on human health are not usually considered in terms of financial losses at all, while the tally of domestic animal or wildlife fatalities is rarely attempted or even mentioned.

In order to assist in the evaluation, the Forest Fire Damage and Consequence Assessment Methodology was developed within the framework of the CMC/Japan International Cooperation Agency (JICA) project “Technical Assistance for the Development of an Integrated System for Prevention and Early Warning of Forest Fires”. This methodology is still at the checking stage, but following its approval by all the involved institutions it will be officially adopted. However, some aspects of forest fire damage (consequences for human and forest health, biodiversity loss etc.) are still lacking from the methodology.

The main environmental consequences of forest fires are (not in order of priority):

- Forest degradation
- Deforestation
- Soil erosion
- Pest and disease outbreaks
- Biodiversity loss
- Emissions of greenhouse gases and other gases

It is very difficult to prove that a particular instance of forest degradation has been caused exclusively by forest fire. Forest degradation is typically a long-term process caused by various factors (in the case of the former Yugoslav Republic of Macedonia these include cutting, forest fires and pests) and in the former Yugoslav Republic of Macedonia it occurs mainly in oak (*Quercus spp.*) forests.

Deforestation, as a long-term process, is mainly caused by excessive cutting in Macedonian forests. Forest fires cause short-term deforestation (for a maximum of two years after the fire). After this short period the regeneration (generative or vegetative) of the forest begins, or the burned area is reforested (in accordance with the Law on Forests). However, even this short period is sufficient for the third consequence of forest fires — soil erosion.

The former Yugoslav Republic of Macedonia is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and a party to the Kyoto Protocol. In 2014, the country therefore prepared its Third National Communication on Climate Change. A national greenhouse gases inventory was compiled in the framework of this document. Under the analysis carried out for land use, land-use change and forestry (LULUCF) for the period between 2000 and 2009, forest fires were identified as the most important factor contributing to high levels of greenhouse gas emissions between 2000 and 2007.[20]

According to the Joint Research Centre (JRC), the volume of biomass burned and emissions of gases from forest fires in the former Yugoslav Republic of Macedonia up to August 31, 2007, were estimated at the following levels (x 1,000 tonnes):

- - biomass burned – 288.3
- - emissions of carbon dioxide (CO₂) – 474.7
- - emissions of carbon monoxide (CO) – 22.2
- - emissions of methane (CH₄) – 1.1
- - emissions of volatile organic compounds (VOCs) – 1.1
- - emissions of nitrogen oxides (NO_x) – 1.5

The Department of Forest and Wood Protection of the Faculty of Forestry in Skopje serves as the National Centre for the Health Monitoring of Macedonian Forests and has detected a significant problem with bark beetles (*Ips* spp.) as a consequence of forest fires. Following fires in pine forests, bark beetles regularly attack the damaged and physiologically weak pine trees. After a while infestation becomes very severe and the insects are even able to attack healthy trees. As a result, this insect species is the most important factor contributing to the decline of Macedonian forests (especially pine forests). It is very difficult to estimate the damage (whether economic or environmental) caused by infestation in relation to forest fires.

According to the MAFWE, the total damage caused by fires (burned timber mass + suppression costs) in the period 2004 to 2013 is estimated at around EUR 5.1 million. Unfortunately, there has been no assessment or calculation of the damage caused to the environment.

In accordance with the statistics provided by the DPR and the MAFWE on human fatalities and injuries during forest fires in the country in 2012, a total of four people died (two employees of

the regional office of the PEMF, one volunteer and one civilian), and 12 people were injured (seven children and five adults).

Only one comprehensive study on the consequences of forest fires in the former Yugoslav Republic of Macedonia has been carried out in the last 10 years (in 2007). Following the declaration of a state of emergency by the Macedonian Government on July 18, 2007, due to the severity of the forest fires, the assistance of the international community was requested. As part of this assistance, the United Nations Development Programme (UNDP) and the Macedonian Government, represented by the CMC, agreed that the UN would carry out an assessment once the crisis had begun to diminish. According to the agreement, the UN would examine the impact of the fires that ravaged the country in three broad areas: environmental; socioeconomic; and operational (disaster management). The task was completed in September 2007 and the final report, "Ecological Damage Assessment of the Wildfires in the Former Yugoslav Republic of Macedonia in 2007" was published in October 2007.

IV. Special issues

The most important issues in addition to those outlined above are unexploded ordnance (UXO); transboundary fires and international cooperation; rural depopulation and land-use change

Unexploded ordnance

Many forest sites and non-forest lands in the Balkan region are contaminated by land mines and unexploded ordnance (UXO) from recent conflicts. In the former Yugoslav Republic of Macedonia, the threat of UXO explosions triggered by forest fires has its origins in the First World War. The most contaminated area in the country is the 1917 front line between Strumica and Bitola (between the Central Powers in the north and the Allied Powers in the south), where large numbers of grenades and mines pose a threat to firefighters and civilians. During the fires in July 2007, for example, more than 70 ammunition explosions were recorded in the immediate vicinity of Bitola, although fortunately there were no casualties. [4]

Map 4. Distribution of the UXO in the former Yugoslav Republic of Macedonia



Source: Nikola Nikolov, Wildfires management and UXO, Land mines and Radioactivity in the region of Southeast Europe/Caucasus, Kiev, 2009

Transboundary fires and international cooperation

The behaviour of forest fires is not always predictable. In the case of large fires or inaccessible terrain, even where the course of the fire can be predicted it is not possible to control or suppress the fire. This explains why forest fires that break out in border regions generally do not remain within the limits of a single country. Although this is a rare phenomenon in the case of

the former Yugoslav Republic of Macedonia and its neighbours, it does happen from time to time. In September 2012, for example, a fire on the Albanian side of the border spread to the Mavrovo National Park, but only Macedonian firefighters were on the spot. More than 100 ha of grass and stubble near the forest were burned. In June 2012 fire spread from the Greek side of the border to Kajmakchalan, in a highly dangerous area contaminated with UXO from the First World War and two firefighting planes were engaged. In July 2012, some 20 ha of grass, shrubs and low-quality oak forests were burned near the Bulgarian border, and Bulgarian police assisted in fire suppression. No incidents have been identified of fires spreading from Macedonian territory into neighbouring countries. In order to regulate all issues and ensure the efficiency of forest fire protection (especially forest fire suppression), the Macedonian Government has signed agreements, or is negotiating agreements, with Bulgaria (negotiations); Croatia (signed agreement); Montenegro (negotiations); Serbia (Memorandum of Understanding); Slovenia (signed agreement); Bosnia and Herzegovina (cooperation agreement signed); Turkey (agreement signed); France and Hungary (bilateral collaborations). There are occasional exchanges of fire management personnel between the former Yugoslav Republic of Macedonia and neighbouring countries. [33]

Besides its bilateral and multilateral agreements, the Macedonian Government has an opportunity to send and receive assistance via the EU Civil Protection Mechanism (Monitoring and Information Centre, MIC). The EU Civil Protection Mechanism was established in 2001 to foster cooperation among national civil protection authorities across Europe. The mechanism currently includes 31 countries: all 28 EU member states in addition to Iceland, Norway and the former Yugoslav Republic of Macedonia. The mechanism was set up to enable coordinated assistance from the participating states to victims of natural and human-made disasters in Europe and elsewhere.

Rural depopulation and land-use change

Rural depopulation and land-use change have a significant impact on forest fires not only in the former Yugoslav Republic of Macedonia but throughout South Eastern Europe. In the case of the former Yugoslav Republic of Macedonia, rural depopulation is more important than land-use change. According to the national land cadastre there is no significant land-use change in the country.

Rural depopulation has an impact on forest fires in three main ways:

- Through the rural depopulation process, over the past 50 years a large area of agricultural land (arable land, pastures etc.) has been abandoned. As a result, there is an uncontrolled growth of vegetation (in the absence of grazing, harvesting etc.), which leads to the build-up of huge amounts of ideal “fuel”. This leads to a high risk of fires starting during the forest fire season in these areas. The fuel build-up also makes the forest fires very severe and difficult to control.

- Some of the abandoned areas are currently young forests, although according to the official cadastres they are still agricultural land. This means that the areas are not included in any forest management plans and are left almost without any forest fire protection measures. There is a kind of "vacuum" in terms of responsibility over these areas with respect to forest fire protection.
- Because it is mostly members of the younger generation who are leaving the rural regions, the declining populations mainly comprise elderly people. This creates a problem in terms of the early detection of forest fires, but it also affects the organisation of prompt initial response by the local population.

There are no official data for the total area of abandoned agricultural land, although it has been unofficially estimated at around 60,000 ha.

According to the Law on Fire Protection, territorial firefighting units, landowners and the Directorate for Protection and Rescue are responsible for fire management on these territories.

V. Needs for improvement in forest fire management

In general, forest fire protection measures are divided into the following categories: prevention, pre-suppression and suppression. The same approach can be used when addressing the weaknesses in the system for forest fire protection in the former Yugoslav Republic of Macedonia.

Strengthening prevention

Legal regulations with respect to forest fire protection in the former Yugoslav Republic of Macedonia are at a satisfactory level. However, there is still a need for a law or legal document that harmonises the activities of the various institutions and organisations (currently regulated by other laws or legal documents). This could be achieved through the adoption of a national plan for forest fire management. Such a document is being prepared in the framework of the FAO/TCP/MCD/3201 project "Strengthening National Forest Fire Preparedness: The Former Yugoslav Republic of Macedonia". The role, purpose and tasks of the plan are briefly described in the following paragraphs:

"The Macedonian National Fire Plan (NFP) is created to provide the safe, effective and coordinated management of wildland fires. All entities covered by this plan agree to follow the procedures, protocols and requirements included in the NFP as well as those adopted by the actions of the Steering Committee under the authorities included in this plan."

The NFP Steering Committee will be established with representatives from each of the departments and agencies covered by this plan. The individuals appointed to the Steering Committee will hold positions within the agencies, and have the authority to propose, negotiate and approve all measures authorised in the NFP. The individual members will also take appropriate actions within their agencies to ensure that policies, procedures and actions are understood and that the agencies initiate whatever process is required to comply with the requirements of the NFP.

The Steering Committee will appoint working groups to develop guidelines and protocols. The working groups will be staffed with qualified members of the appropriate agencies and organisations, including representatives from other groups not included in the Steering Committee if needed, to provide expertise and guidance. The working groups will develop plans, products (such as training materials) and guidelines. Final products will be submitted to the Steering Committee for adoption under the authority of the NFP."

Another element of prevention that needs to be improved is the organisation of forest fire prevention campaign/s (public awareness raising and educational campaigns). In accordance with certain laws, the entities that manage forests and forest lands are obliged to convey information on all measures for forest fire protection, including measures for prevention.

Campaigns of this kind are organised separately, in an uncoordinated and non-harmonised manner, conveying different messages and with some duplication.

Strengthening pre-suppression

Special attention should be given to the following pre-suppression measures: providing specialised (properly trained) forest firefighters; procuring special vehicles and tools for forest fire suppression; enhancing the quality of planning documents; and strengthening research capacities.

The existence of specialised (properly trained) forest firefighters is one of the pre-conditions for effective and efficient forest fire suppression. Currently there are neither specialised nor well-trained forest firefighters in the country, nor is there an institution for educating and training such personnel. In order to address this problem, a special training programme should be created for already active firefighters and new personnel. This would be aimed primarily towards the forestry sector (the PEMF, national parks etc.), the DPR and TFPUs. Relevant trainings have been organised occasionally within certain projects in the last couple of years, including a TCP/FAO project in 2012 and 2013 (train-the-trainers sessions); and the OSCE/ENVSEC project “Enhancing National Capacity in Fire Management and Wildfire Disaster Risk Reduction in the South Caucasus-Antalia” in 2010 and 2014.

The above issue is closely connected to the availability of appropriate equipment, tools and vehicles for forest firefighters. Well-trained personnel must also be adequately equipped. At present there is a lack of equipment (mainly of personal protective equipment), hand tools and special vehicles. Existing vehicles (off-road vehicles for initial response and special fire trucks) are very old and in poor condition. The number of hand tools is limited and the types of tools are not chosen in accordance with the specific terrain and vegetation.

Almost all fire prevention and pre-suppression measures must be prescribed and described in the framework of planning documents. In the forestry sector, these documents are 10-year management plans and annual operating plans, while under the DPR there are strategic and annual operating plans. The quality of the existing plans does not correspond to the current situation and needs.

In addition to prevention and pre-suppression measures, there are other specific issues that need to be addressed. One of these is research activity in the field of forest fire protection. The only relevant specialised national institutions in the country are the Department of Forest and Wood Protection of the Faculty of Forestry in Skopje, and the Regional Fire Monitoring Centre (RFMC) as a regional branch of the Global Fire Monitoring Centre (GFMC). Many projects have been implemented to date, but there is no programme for permanent research. Due to the increasing problem with forest fires in the former Yugoslav Republic of Macedonia, and bearing in mind the (technologically and scientifically advanced) methods currently being used in forest fire protection, the need for a better national research programme is evident.

The second specific issue is UXO. There is no precise map showing the distribution of UXO in contaminated forests and forest lands. This presents a problem during forest fire suppression activities in these areas. As yet, no methods have been defined for management, or for the tactics/procedures for forest fire suppression in these areas. Maps showing the distribution of UXO should therefore be produced. Defining the way to manage these areas and establishing procedures/tactics for forest fire suppression therefore represent a particular challenge.

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