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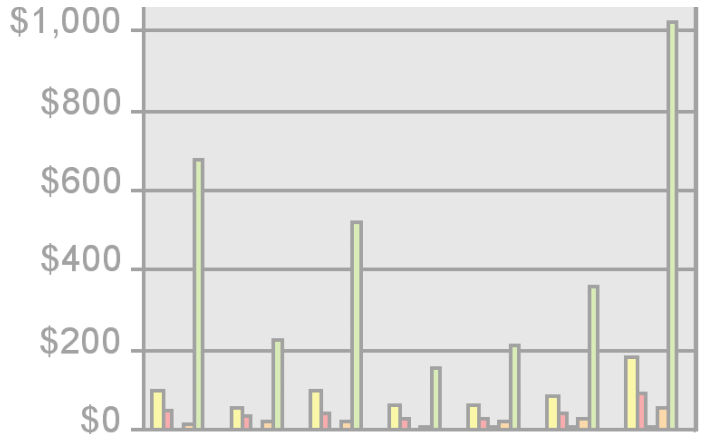

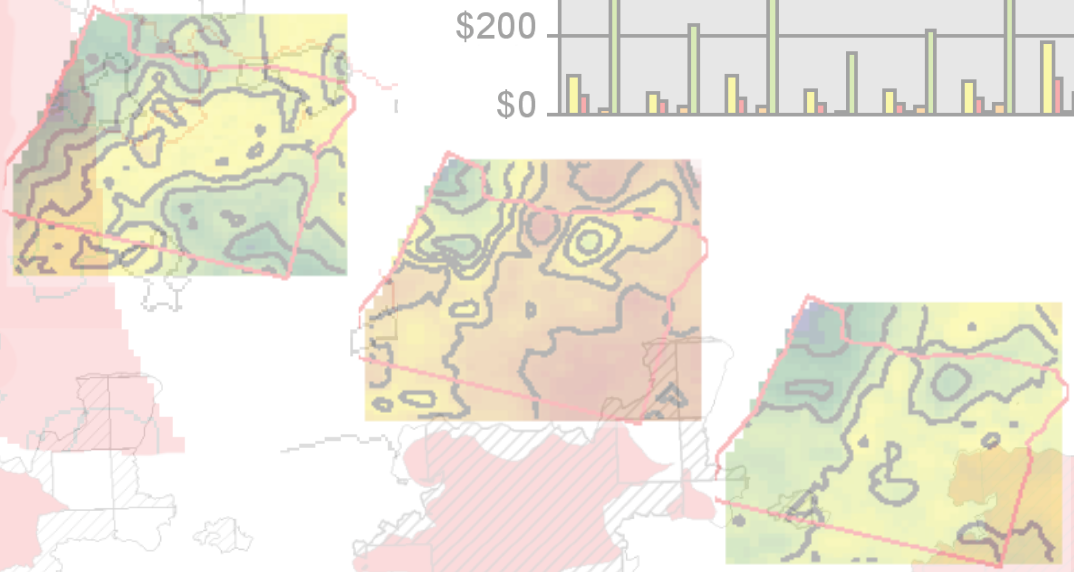

Who Should Be Responsible for Forest Fires? Lessons From the Greek Experience[1]

Gavriil Xanthopoulos [2]

Abstract

The organizations responsible for the functions of forest fire management are not the same in all countries. A variety of historical, political, social, environmental and financial reasons have resulted in a wide spectrum of forest fire management organization schemes. As fire problems, in the form of very bad fire seasons, are becoming all the time more pronounced and visible, there is often pressure for changes in the fire management structure in the affected countries, in one direction or another. Sometimes the demand for such changes is extreme, especially after major wildfire disasters. Obviously, this can lead to serious mistakes. In this paper the change in the organization of forest fire management that took place in 1998 in Greece is described in brief. The example is used to demonstrate the pitfalls and the problems and to document the need for objective criteria on how fire management should be organized in a country, given its own unique conditions.

Introduction

The organizations responsible for the functions of forest fire management, namely prevention, presuppression planning, suppression and post-fire rehabilitation, are not the same in all countries. A variety of historical, political, social, environmental and financial reasons have resulted in a wide spectrum of forest fire management organization schemes. As fire problems, in the form of very bad fire seasons, are becoming all the time more pronounced and visible, there is often pressure for changes in the fire management structure of the affected countries, in one direction or another. Sometimes the demand for such changes is extreme, especially after major wildfire disasters. Obviously, this can lead to serious mistakes, especially when new policies, legislation and regulations are prepared in a hurry, by partially informed politicians feeling the pressure of an outraged public and less-than perfectly informed mass media.

The objective of this paper is to provide an insight into this problem that will be useful when such decisions are being made. In order to do that, the paper draws from theoretical knowledge, personal experience, and real world examples. More specifically, the change in the organization of forest fire management that took place in 1998 in Greece is described in brief. The example is used to demonstrate the

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pitfalls and the problems and to document the need for objective criteria on how fire management should be organized in a country, given its own unique conditions.

Theoretical background

At a global scale, the prevailing perception when considering forest fires is that they represent a natural disaster: A threat to the people and the environment, a destructive force that must be subdued. At least, this is the picture drawn by the mass media, the "truth" in the minds of people who live in the cities, the people who have property and interests that may be destroyed by a forest fire. However, this is not the case in the minds of the shepherd who starts a fire to stimulate new vegetation growth for his animals or the farmer who burns the stubble in his field to clean it up and start a new crop. Also, this has not been so in the traditional use of fire by the American Indians or by many other cultures around the world that persisted for many centuries without damaging the environment.

The negative perception, the fear about forest fires, was built to a large extent with the development and maturing of Forestry as a scientific field: A development that started in European countries, like Germany, where forests are timber rich, wood production is very important, and fires have a small natural role.

It took many years of fire suppression in the USA, where absolute fire control in the form of the "10 AM policy" was established shortly after the development of forestry there, until problems such as fuel accumulation, steep increase in fire potential, and forest succession pathway distortion, became evident. US forestry, patterned after its European predecessor, considered fire a menace and tried to suppress it at all costs. However, starting from the most fire prone ecosystems, such as California, scientists soon started voicing their concern about the problems that were developing. In the late 1960s and 1970s the voices became stronger and the total fire exclusion policies were gradually revised. This was supported by numerous studies on fire history and fire ecology, which demonstrated the natural role of fire in many types of forest ecosystems. Prescribed burning gradually became a management tool aiming among others to reduce fuel loads where they had accumulated and to provide management solutions, such as better animal grazing conditions, where needed.

The message soon spread around the world where scientists started being more critical of total fire exclusion. It became common understanding that in those forest ecosystems where the rate of live biomass accumulation through photosynthesis and dead material build-up exceeds the rate of biomass breakdown by the slow "oxidation" processes (molds, insects, bacteria) due to the environmental characteristics, fire, which is a rapid oxidation process, is necessary to complete the circle of life, release the nutrients and the growing space and reset the ecosystem to a new start. Also, to many scientists it became evident that only if the excess biomass production is removed by people through forest stand management or fuel management, or by animals through grazing, the occurrence of fire can be reduced or controlled in such fire dependent ecosystems.

In the 1980s and 1990s fire ecology in many ecosystems around the world was studied in depth. Knowing the role of fire allows for better decisions in regard to fire management policies. In theory, then, the knowledge and the tools were in place by the 1990s for new fire management policies that would not be oblivious to the importance of sound, fire-aware, forest management, and would include tools such as prescribed burning.

The current situation

Unfortunately, the idea of fire exclusion is established too deeply in the beliefs of people around the world. Other than the scientists and probably many people who live and work in the forest and in the agricultural fields, fire remains a source of fear, a menace, for the mainstream of city dwellers, including most politicians. The practice of prescribed burning has seen significant application in the US, but very little in Southern Europe. Forest management has not been given the attention and funding it needs, and in the last decade it has experienced shifts between ministries (environment, agriculture, economy) and organizational scheme changes (from top-down structures to regional or local breakdown of structures). Furthermore, when fire disasters hit, as has been the case in many countries in the late 1990s and early 2000s, the reflexes for blind suppression of the fear causing element (fire) are all too often stimulated and societies seek "security". In a world that is turning all the time more towards strong (and costly) security forces, heavily armed and with high technology in their support, the "solution" to stop the scare of forest fires is obvious to laymen's minds: more effective fire suppression. However, this one-dimensional approach is far from complete or sound. The example of what happened in Greece in the last few years, in regard to forest fires, is worth considering, to understand the issues involved and the potential pitfalls.

The Greek example

Greece is a European country occupying an area of 130,875 km^2 in the southern tip of the Balkan Peninsula. About 60% of this area (7.9 million ha) is characterized as forest land. Tall forests constitute 2.5 million ha, of this land, the rest being evergreen shrublands and partially forested areas (3.2 million ha) or degraded lands with low vegetation of mostly thorny spiny shrubs (phrygana) (1.9 million ha). These shrublands and grasslands are mainly used for grazing. Less than half of the tall forests are timber producing forests, mainly growing at high elevations. The rest consists of "low" or coppice forests that produce mostly fuelwood and of low elevation pine forests (mainly *Pinus halepensis* and *Pinus brutia*) with little timber producing but high aesthetic value. The climate over most of Greece is typically Mediterranean, with relatively mild winters and a hot and dry summer period (Xanthopoulos 2000a).

About 2/3 of all forest lands are state owned and are managed by the Greek Forest Service (GFS) which is a state organization with a long history and very important work in the past, especially in the post second world war era, when it helped develop infrastructures such as roads and dams in the country, providing jobs and resources to rural populations. Forest management and through that timber production, was an important task of the GFS through the second half of the 20th century. However, it was mostly centered in the mountainous areas, mainly of northern Greece, were productive forests of true-fir (*Abies sp*.), spruce (*Picea abies*), high-elevation pines (*Pinus nigra* and Pinus sylvestris), beech (*Fagus sp*.) and deciduous oaks (*Quercus sp*.) grow. Low elevation pine forests were for the most part out of scientific management as the funds needed for the task were never available. In practice, there was a management scheme applied by resin collectors who cultivated these forests, securing regeneration and protecting them.

The growth of tourism that started in the 1970s, a strong economic growth and the improvement of living standards gradually drove young people away from villages and from hard work in the forests. In the 1980s the country joined the European Union. Subsidies to the resin producers were not among the policies of the EU. The low elevation pine forests were practically abandoned.

In the same period, the demand for secondary homes in coastal areas for summer vacations started growing. This trend continues today, and the same is true for the development of urban-wildland interface zones in Attica (the region around Athens) and certain other areas as people try to avoid crowded city centers. Planning for this growth was very poor. Lack of a complete land cadastre was and still is a problem contributing in this direction.

As low elevation forests were gradually left unmanaged and villages were abandoned by young people, the number of forest fires and the yearly burned area started growing steeply by the end of the 1970s. The GFS which had the task of forest protection, started acquiring firefighting means in order to control forest fires. The first specialized firetrucks were purchased around 1971 and the first Canadair CL-215 amphibian waterbombers started operating in 1974. Forest protection from fires and illegal land occupation gradually became the focus of most GFS offices in southern Greece where these problems were more pronounced, while forest management continued to be the main task in most offices of northern Greece.

In the 1980s the yearly burned area kept increasing, exceeding the 100,000 ha mark twice (1985 and 1988) (*Fig. 1*). The need to improve the firefighting

mechanism was obvious but actions in the 1980s were quite slow and funding was limited. However, starting around 1993, the GFS started getting better organized for fire suppression with only marginally higher funding, except for the addition of 200 four-wheel drive semitrucks for initial attack in its fleet. The local offices developed presuppression plans, the coordination center in Athens was improved, helicopters were introduced in fire suppression for the first time, and handcrews were trained and transported by helicopters for initial attack. Soon there were marked signs of improvement in fire statistics. Then, came the year 1998.

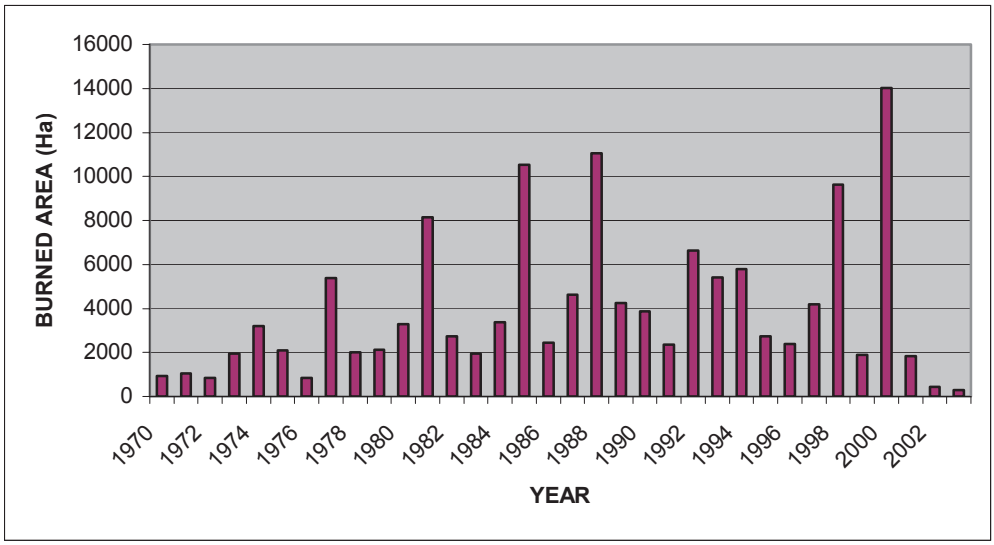

Figure 1—Evolution of yearly burned area in Greece in the 1970-2003 period.

The transfer of responsibility of forest fire suppression

The 1998 forest fire season in Greece was far from usual and certainly most controversial due to a sudden decision by the Greek government to transfer the responsibility of forest firefighting from the GFS to the Fire Service. The decision was taken at the end of 1997 and it was mainly a political one. It was prompted by what was considered poor results of the Forest Service in the previous years and did not really consider in depth all the parameters of the undertaking. Actually, it lacked any serious scientific justification or planning. During winter and spring of 1998 many voices warned about an oncoming disaster including a number of politicians, Forest Service officers, many university professors, and the few forest fire experts in the country who were not given any opportunity to offer their input (Xanthopoulos 1998).

The law about the transfer of responsibility to the Fire Service finally took effect on May 25, 1998. That left very little time to the Fire Service to seriously prepare for the challenge since the actual fire season starts by mid-June. At the same time, it was evident that no provision had been made for cooperation between the personnel of the Forest and the Fire Services at all levels. The Fire Service officers, who had been contributing in the past to forest firefighting, mainly close to urban areas and most often from paved roads, never having command on forest fire incidents, believed they knew all they needed. The significant difference between wildfires and the other types of fires they had been trained for (industrial, ship-fires, home-fires etc.) was not obvious to them.

It took only the passage of a dry cold front on July 4, 1998, that was accompanied by very strong winds (7 Beaufort scale) and the typical in such cases wind shift, to demonstrate the inadequacy of the preparation of the Fire Service. The front followed four days of lull, low humidity and extremely high temperatures which had reached 44 degrees Celsius in many parts of the country including Athens. To the surprise of the Fire Service, which did not have a fire danger prediction capability in place, more than 100 fires erupted within an hour in various parts of the country. More than 20,000 ha of forest lands burned on that day (Xanthopoulos 1999).

What followed was a preview of the rest of the fire season. Fire Service officers quickly established a belief that all fires were part of a plan against them and against the new law. Forestry people, on the other hand, insisted publicly that the Fire Service was clearly inadequate. The mass media presented and often over-emphasized this disagreement. Relations became very tense and good cooperation between Forest and Fire Service personnel was rarely the case. Even at that moment no corrective measures were taken.

The rest of that fire season was a disaster. The conditions were difficult but not extreme, but the burned area nearly reached the previous all time high. There were even some deaths, including three firefighters and a volunteer who were fighting a forest fire in a box canyon on Ymettus mountain, just a few hundred meters from the last houses of Athens, on July 17, 1998. They left their firetruck in a relatively safe place, correctly parked, having more than 1.5 ton of water and fled uphill in the canyon with the fire chasing them. They were soon overtaken by the fire and died in the open while their truck remained practically intact. The signs of lack of training and experience were quite clear.

The 1999-2003 period

At the end of the fire season of 1998 the government decided to insist on its decision. In the next years it offered heavy support to the Fire Service, including additional permanent personnel, seasonal firefighters, more aerial means, increased funding and, equally important, full political support. The number of Fire Service permanent employees increased from 6,500 to about 11,000 persons, including approximately 2,000 firefighters transferred from the GFS. About 5,000 seasonal firefighters are also employed through the summer. The number of firetrucks grew to more than 1,100. Ten (10) new Canadair CL-415 were added to the state owned aerial fleet of 14 CL-215s. Furthermore, the government allowed the Fire Service to contract private helicopters (this was not permitted to the GFS earlier), and provided the necessary funding to choose among the largest in the market. As an example, in 2003, the helicopter fleet for the summer included three (3) Erickson S-64 "AirCrane", four (4) MIL MI-26, three (3) Kamov-32T, and one (1) MIL MI-14.

The total yearly costs of fire suppression more than tripled in five years. The results were mixed: they were very good in the relatively easy fire seasons of 1999, 2001, 2002, and 2003 but in the summer of 2000 which was hot and dry the burned area reached an all time high: >140,000 ha. This can be explained mainly by the massive initial attack from the air that has become the basic principle of the Fire Service operational procedure. Under "easy" conditions, all fires are stopped immediately. However, when demand exceeds the capacity of aerial means, the ground forces are not able to control fires effectively. Of course, training and acquisition of experience gradually brings improvements in this field as well.

In the meantime, the GFS lost its political head, the General Secretariat of Forests and Natural Environment, becoming a General Direction in the Ministry of Agriculture. Furthermore, it was broken down into a region-based structure. The regional offices now belong to the Ministry of "Interior, Public Administration and Decentralization". Funding declined, and although fire prevention still remained in the responsibility of the GFS, very little can be done without the appropriate funds. One example is the lack of needed funds to maintain the network of forest roads. Another example, is abandonment of efforts to control forest fuel built-up, and even abandonment of active forest management, except of the most productive forests. The personnel of the GFS that was conditioned to a work overload during the summer, now is able to relax and enjoy vacation time freely. Very few of them would be interested to get involved again in forest fire suppression.

In the late 1990s a new political entity was created. It is the General Secretariat for Civil Protection (GSCP). Its mission is to coordinate the organization efforts of prevention, suppression and relief of all disasters, natural or technological. The GSCP became really active since 2001. In the field of forest fires it has tried a lot to bring the GFS and Fire Service to work together, for example for making common presuppression plans at Prefecture level, and it has made some progress in this respect. However, the Fire Service, with all the political support it has experienced, does not generally try to cooperate with the other state organizations. It tries to do everything by itself, even if this means duplicating means, efforts and costs.

Pitfalls and problems

The Greek example illustrates a series of pitfalls and problems that are not unique in such situations:

- The decision for transferring the responsibility of firefighting was clearly a political one. It was clearly one-sided, since it focused on forest suppression only, and there was not any scientific justification for it.
- This resulted in a very strong disagreement and finally resentment on the part of the personnel of the GFS. Much of their productive potential, including specialized knowledge and experience has been wasted. This is especially true for senior officers who had devoted a big part of their life protecting the forests they were responsible for with poor means and support.
- It could be argued that the results of fire suppression in the last three years are positive.
- However, this can also be challenged: The huge burned area in 1998 and 2000, which included many of the most vulnerable forests reducing the overall fire potential, and the mild fire seasons that followed in combination with the extreme strength of the aerial means, may be falsely hiding inadequacies that will become evident in a difficult fire season a few years from now.
- The cost of firefighting has sky-rocketed. Even if the Fire Service has or will become more effective in fire suppression than the GFS, this is achieved at a very high cost. No-one will ever know how much more successful the GFS could have been if it had received only part of the political support and funding that the Fire Service has received.
- It has been demonstrated in practice that the politicians understand very little about forest management and fire prevention through that. Their interest, and support, is devoted to “visible” aspects of forest fires such as fire suppression and prevention campaigns through the mass media aimed at the public. As soon as prevention responsibility was disassociated from suppression, the latter got all the support and funding.
- Fire prevention has suffered as, in addition to lack of appropriate funding, there is no political strength and no real mentality of fire management within the GFS:
    - No effort to work on legislation or actions in support of resin collectors, rural populations, regulation of grazing, rational planning of new urban-wildland interfaces etc.
    - No thought about development of prescribed burning projects for forest fuel control or for the development of practical and realistic grazing schemes (in order to reduce shepherd caused fires, and to prevent further grazing site deterioration).
    - No effort for dynamic forest management with principles that incorporate considerations about fire.

  - Only limited work on forest road and firebreak maintenance.
  - Only limited work on fuel reduction.
  - Limited participation in the development of presuppression plans.
- As time passes since the deprivation of forest fire responsibility from the GFS, the collective knowledge and mostly the experience of its personnel on forest fires, is being lost. This is negative both in regard to better fire-aware forest management in the future, as well as in regard to introduction of prescribed burning.

Examples from other countries

Greece is not the only example of complications in regard to fire management responsibilities in various countries. Actually, the examples of different organizational schemes are as many as the fire prone countries around the world. Others can present the situation in their own countries in much better detail, so it will not be attempted here. However, it is worth noting that, as a general rule, in countries where forest fires do not have a prominent role in shaping the forest ecosystems, forest fire suppression responsibility lies with the Fire Service. Many central and northern European countries belong to this category (Germany, United Kingdom, Ireland, Sweden…). The same is true for Japan (Zorn and others 2002). France is a special case, since the forests are not highly flammable except for the southern part where the climate is Mediterranean. Since the mid-1980s, the Forest authorities are responsible for prevention while fire suppression is in the hands of the Civil Security. The latter is responsible for city fires and all other disasters as well.

Also, Portugal, for the most part, is not a true Mediterranean country. Its climate is influenced by the Atlantic Ocean. Forest productivity is high over most of the country. Much of the native pine forest there has been replaced by eucalypt plantations, through private initiatives, increasing fire potential steeply. A centuries old tradition of a volunteer Fire Service, has brought the responsibility of all firefighting to the hands of this organization. The forestry authorities are mostly responsible for prevention.

Sometimes differences exist even within countries. For example, Spain consists of many regions, which are highly autonomous. The fire prevention and suppression responsibility scheme varies a lot between them. In the highly flammable Andalucia in the south, the forest authorities are responsible for fire suppression. In the less flammable but more forest rich Catalonia in the north forest fire suppression responsibility lies with the Fire Service. The province of Madrid, where urban areas are many and the forests are not as flammable as in Andalucia, follows a mixed model, where the forestry authorities are not completely disassociated from fire suppression.

Forestry organizations, usually in cooperation with municipal fire brigades, are responsible for fire suppression in most Mediterranean countries such as Israel (Bonneh et al. 2004), Cyprus (Hadjikyriakou 2002), and Turkey, while Italy has a complex system with many players, with a special forest firefighting organization (Corpo Forestale) and a Civil Protection Directorate in Rome having key roles (Fuschetti, 1976). In the USA, the National Interagency Incident Management System (NIIMS) coordinates the pre-suppression and fire suppression actions of

many federal land management agencies, the States and the municipal Fire Services (Xanthopoulos 2000b).

In Canada and Russia, countries with vast expanses of forest and sparse population, the forestry authorities carry the responsibility for forest fire control. On the other hand, in most of Australia, volunteer organizations, such as the New South Wales Rural Fire Service, handle all fire emergencies in an effort to cope with the problem of achieving effective fire suppression in a large country that has areas of extremely flammable vegetation but also has a relatively small tax-payer base.

The effectiveness of all the above schemes is quite variable. However, large fires seem to be inevitable wherever fuel build-up occurs, forest management does not cope with it and meteorological conditions bring fire danger to extreme conditions. When lives and private properties also get affected forest fires may even be characterized as major disasters. The fire season of 2003 was very difficult in the south of Europe, from Portugal to Italy and Croatia. Independently of who is in charge of firefighting, all these countries suffered great damages. Portugal, with its forest management problems, and France with its wildland-urban interfaces, that included tourist infrastructures, suffered most.

Of course, there are other reasons, such as social, political or economic, and cases such as inadequate suppression capability of the firefighting organizations, that lead to catastrophic fire seasons in some areas of the world. The Amazon basin in Brazil and Indonesia are two such examples. In those cases, again, who is responsible for fire suppression is not the major issue. Forest management that is beneficial for the people, education and involvement of the public, and a basic firefighting organization and infrastructure is the answer.

Criteria on how fire management should be organized

Given all the information above, it is needed to focus on the central question of this paper: Who should be responsible for forest fires? The answer, in this author's view, is far from simple, but it is not difficult. It should be based on the realization of certain general truths:

- Organizations are made of people. They give value to the organizational scheme. Forest fire suppression needs dedicated, skilled and knowledgeable people. If a specific fire management scheme works, with its people and resources, it is foolish to try to change it drastically. As the saying goes: "*if it ain't broken don't fix it*".
- In certain environments the build-up of fuels makes it impossible to avoid occasional catastrophic fires. Fire management must take this into consideration, making long-term fire damage reduction one of its central objectives.
- Copying fire management schemes, even successful ones, from one country to another is not necessarily a good idea. Differences in environmental, social, and economic conditions, educational level of people, sophistication level of the society, etc. may lead to major failures. For example, GIS systems in fire management are not the solution for countries where there is little familiarity with computers in the workplace and there are no digital data (such as DTM) available.

- In regard to fire suppression per se, any well prepared, organized, equipped, funded and managed organization can do the job, once it acquires the necessary knowledge and experience and becomes familiar with the terrain and the conditions.

Having these truths in mind, the problem becomes one of achieving fire control objectives (burned area reduction, fire losses reduction), in a cost effective way, without compromising environmental concerns (Xanthopoulos 2004). The following recommendations provide a basis for an initial assessment of the required action:

1. Avoid disturbing a system that works well in the long-term.
2. Examine if fire control successes of a recently (10-20 years) established system can be maintained in the long-term. Fire history, fuel build-up assessment, evolution of the number of fires per year, the total burned area, the number of large fires occurrence and trends of firefighting costs are variables that must be examined at a minimum. Take corrective action if needed before problems become compounded.
3. If there is talk or pressure (political, popular) for changes consider points 1 and 2 above first. The level of success (or failure) of the current system must not be judged independently of the current level of funding. Compare level of funding in other countries with similar conditions.
4. If the indication is that changes may be needed, use the table below (*Table 1*) to classify the type of environment in the country or region of interest between the six "typical" types recognized. The recommendations for each of these types will help guide the basic approach towards a new organizational scheme.
5. Realize that from that point on it is a matter of study, brainstorming, good planning, involvement of the right people and careful well planned steps in order to establish the new scheme without serious turf battles, instability or loss of potential resources.

Conclusions

In a world that changes in regard to its mentality, economics, technology, social structure, and environment (including climate change), the question of "who should be responsible for forest fires" may come-up in many countries around the world, as it has come-up in Greece. The example of Greece was used here to illustrate some of the pitfalls and potential problems. It should be studied carefully, and examples from other countries should also be considered before a decision of how forest fire suppression should be organized can be made. The question is not a simple one to answer. There are specific criteria and conditions that must be taken seriously into consideration. The recommendations provided here are not a panacea and do not reach a deep level of analysis. However, they are a first attempt to provide a guide, mainly for those trying to make political decisions with limited knowledge about the realities of forest fires, that will help them realize the seriousness of their actions and to take careful steps in the right direction.

Table 1—*Recommendations on who should be responsible for forest fire suppression for various types of forest environment.*

Type of environ-ment	Characteristics	Recommendations
A	High biomass production, high decomposition rates, fuel build-up slow, humidity generally high (tropical and subtropical environments). Forest floor biomass low.	Fire suppression demand is low. It can be handled by forestry administration, municipal fire departments, or volunteers. Cooperation between them is useful but not critical.
B	High biomass production, slow biomass breakdown. Quick fuel build-up. Highly flammable vegetation, high natural fire frequency (e.g. chaparral in California, maquis and Pinus halepensis forests in southern Europe, Mediterranean dry eucalypts in Australia).	Fire suppression demand is extreme. Fuel management including prescribed burning is essential but can only be carried out over limited areas. Fire control is costly. Cooperation of all organizations is important in order to keep firefighting costs at reasonable levels. A system like NIIMS should be considered. Emphasis must be given to good planning, e.g. of wildland-urban areas in order to reduce damages because of the occasional uncontrollable fires.
C	Medium biomass production rate, biomass decomposition rate quite good, humidity generally high, such as in temperate deciduous forests, usually at high elevations. Forest floor biomass accumulation slow, fire frequency low to medium, fire intensities low to medium.	Fire suppression is not demanding. It can be handled by forestry administration, municipal fire departments, or volunteers. Cooperation between them is useful but not critical.
D	Medium biomass production, medium rates of decomposition such as those in temperate coniferous forests mostly at higher elevations. Fuel accumulation on the forest floor is slow but fuel loads can become quite high. Low natural fire frequency but extreme fire behavior potential possible in mature stands.	Over extended landscapes the potential for occasional large wildfires exists. It is not rational to maintain a huge fire suppression mechanism. It is best to emphasize good fire-aware forest management in order to control fuel accumulation. Then, either forest authorities or municipal fire brigades can control fires successfully. If fuel accumulation has occurred, such as in parts of the USA, significant resources and good fire suppression capability is needed.
E	Low biomass production rate and low rate of biomass decomposition, such as in boreal coniferous forests. Accumulated biomass on the forest floor can reach very high levels. Very low natural fire frequency, because fuel build-up takes a long time and conditions conducive to fire are rare. Extreme fire behavior potential is possible in mature stands.	There is occasional need for large fire suppression capability. Forest management is needed where timber production is economically viable. Emphasis is needed on effective fire detection and initial attack. Knowledge of the terrain and the conditions is very important. Municipal fire brigades are not suited for such tasks and they are scarce in such environments anyway. Use of the forestry personnel for multiple functions makes sense.

F	Fine fuels, grasslands, such as in water limited environments (e.g. savannah). Fuel loads are low, fire frequency is high.	Limited fire suppression capability needed. Fire is not destructive, except to properties & livestock so planning is needed. Initial attack with relatively light, quickly mobilized resources is needed. It can be handled by forestry administration, municipal fire departments, or volunteers. In many cases, the latter coordinated by the authorities, are the best option.

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