Forest fire policy scenarios as a key element affecting the occurrence and characteristics of fire disasters [1]

Gavriil Xanthopoulos [2]

Abstract

Forest fires have been making the news with increasing frequency in the last two decades. Given the quite good predictability of forest fires as a phenomenon, the worsening of the problem is surprising and is clearly an indication of some shortcomings in the way in which various countries approach the issue. Technological advancements in firefighting should have had a decisive positive effect by now, if the problem was only a matter of fire suppression, especially given the serious general increase in firefighting budgets in this time period. However, the reality is quite different. It can easily be shown that the problem is much more complex than just improving firefighting effectiveness alone. It has to do with factors affecting the occurrence of fires, their characteristics and their destruction potential. It also has to do with environmental factors, social evolution, economic development and even politics. A one-sided approach is doomed to fail in solving the problem in the long-run.

Introduction

Modern societies, being organized in what is considered as a rational way, try to avoid disasters that affect their individual members and even their function and prosperity as a whole. However, as many occurrences of both natural and technological disasters have recently demonstrated, their efforts often fail.

Macroscopically, important factors contributing to this failure include:

- Lack of appreciation of the forces of nature and their destruction potential.

- Lack of understanding of the general problem (natural processes and phenomena, technological forces, interaction of factors, etc.), either due to scientific shortcomings or (more often) due to political short-sight or to layman's "I don't care" attitude.

- Lack of a holistic approach in preparing for and facing the problems.

- Lack of a preventive attitude at some or all levels (community, regional, country, international, from personal to political).

In the realm of forest fires, the repetition of major conflagrations every so often around the world, is a clear indication that some or all of the factors above are

---

[1] An abbreviated version of this document was presented at the 4th International Wildland Fire Conference, May 13-17, 2007, Sevilla, Spain

[2] National Agricultural Research Foundation, Institute of Mediterranean Forest Ecosystems and Forest Products Technology, Terma Alkmanos, Ilisia, 115 28 Athens, Greece. E-mail: gxnrtc@fria.gr.

present. The frequency of occurrence of large fires that make the news headlines has been increasing in the last two decades. Some of them become large-scale disasters causing serious property damage and even loss of life. This worsening of the problem is surprising, especially if one considers the quite good predictability of forest fires as a phenomenon (yearly repetition, known fire season extent, short term fire danger prediction,…), and is clearly an indication that serious shortcomings exist in the way various countries approach the issue. These shortcomings, as they relate to the overall forest fire management policies, are the motivation of this paper and are discussed below.

Forest fire policy shortcomings

There is probably no better way to describe the current situation in regard to national fire policies than the following excerpt from a 1999 report of FAO's Committee on Forestry that summarized that summarized the conclusions of a meeting on public policies affecting forest fires (FAO Committee on Forestry 1999): "The present situation of national policy development in response to wildfires is often of *ad hoc* reaction to a situation that has already developed, rather than proactive mitigation before the emergency arises. Frequently policy development does not consider the underlying causes of fire incidence and spread which may lie outside the forest sector, such as rural poverty and deprivation, or the effects of other public policies related to land use and incentives. Sometimes forest fire incidence and spread may be caused by ill-conceived forest management policies, in particular policies of total fire exclusion that have led to fuel accumulation and catastrophic fire outbreaks".

The problem with poor fire policies that have developed in response to disasters and do not address the issue globally has affected most countries with fire prone environments around the world, although the problems are quite different in the United States of America (USA) as compared with the Mediterranean countries of Europe such as Greece (Henderson and others 2005), and with the developing countries of South-East Asia such as Indonesia (Schindler 2000). Efforts to improve policies and correct problems in some cases are in progress, as for example with the Healthy Forests Initiative and Healthy Forests Restoration Act of 2003 in the USA, which were enacted mainly in response to huge disasters (The White House 2003). Although they have received significant criticism (Fingerman Johnson and others 2006), they represent an effort to correct a major policy deficiency. On the other hand, in many other countries one-sided, shortsighted policies are still in effect (Xanthopoulos 2004b). It is worth examining then the foundations on which sound fire management policies can be built, as a contribution towards changes where this is needed.

Fire prevention vs. suppression

Forest fires, as a phenomenon, have regularity, a yearly circle that logically allows people to plan for disaster management in an ordered way. Other hazards, such as earthquakes, that occur only sporadically and unexpectedly, are much more difficult to cope with, because full alertness and preventive planning are not easy to maintain when "the enemy" is completely unpredictable.

The most important element in pre-disaster planning is the effort to prevent the occurrence of a disaster. In forest fires, this effort is called "fire prevention", a term with a well-established meaning and content internationally. However, other than the specialists in the field, few people realize that there is much more to prevention than just reducing the number of fires. Actually, according to the definition of forest fire prevention included in the Vocabulary of Forest Fire Terms produced by the European Commission supported concerted action called DELFI (Conese and others 1999) fire prevention includes "all activities concerned with minimizing the incidence of destructive fires". Fire danger rating, pre-suppression planning, fire detection, forest fuel management, fire-aware forest management, specific prevention technology developments, fire statistics analysis, review and adaptation of legislation, and wildland-urban interface development planning, are some less known forest fire prevention means and activities that compliment more direct ones such as public education campaigns and forest patrols.

As explained, fire prevention is quite complex and its activities are often less obvious and impressive compared to fire suppression. The latter involves scores of firefighters, firetrucks, airtankers and helicopters. Firefighting power is immediately necessary with an obviousness and urgency beyond any doubt, when the fires are raging. Furthermore fire suppression provides good viewing material for the cameras and, when successful, the results are immediately recognizable by the public. Politicians can see that, and they can comprehend easily the need for supporting fire suppression. As a rule, money availability is rarely an issue for the fire suppression mechanism, especially at the time of crisis.

Having said that, it is worth noting the paradox that has developed in the last two decades: Technological advancements in the form of better firefighting equipment, fire modeling techniques, communications etc. in this time period, should have had a decisive positive effect by now, if the problem was only a matter of fire suppression, especially when considering the corresponding global increase in firefighting budgets. However, the reality is quite different. It can easily be shown that the problem is much more complex than just improving firefighting effectiveness alone. It has to do with factors affecting the occurrence of fires, their characteristics and their destruction potential. It has to do with environmental factors, social evolution, economic development and as such it involves policy decisions and, often, delicate political balances. A one-sided approach, focused on fire suppression only, is doomed to fail in solving the problem in the long-run. What is needed is well designed, comprehensive forest fire policies based on a good understanding of all the interacting factors and, of course, adapted to each country's environment and conditions.

Forest Fire Policy

Webster dictionary defines policy as "a definite course or method of action selected from among alternatives and in the light of given conditions to guide and usually determine present and future decisions". Policy formulation requires that there be one or more clear-cut, specific rational goal(s) against which to test alternatives.

In regard to forest fire policy, the simplest and most obvious objective is "keep fire losses as small as possible". This often seems to be "enough" for societies, governments and fire fighting organizations. However, although this objective seems

quite straightforward and rational, it isn't really so because there is no provision for the length of time (what will happen in the long-run), there is no reference to the cost, and there are no environmental constraints.

These shortcomings are responsible, to a large extent, for the failure of a one-sided fire suppression centered policy: what appears to work for a limited period of time, only hides the problem of fuel build-up. Initial success leads to a worsening problem that requires more resources and more effort a few years down the road. This leads to the need for higher budgets for fire suppression. If these become available, suppression is still successful for a few more years, the circle is repeated and the fire potential keeps getting worse. On the other hand, depending on the degree to which certain ecosystems need fire for their regeneration and health, effective long-term fire suppression may alter vegetation composition and lead to undesirable situations.

The generalization above is not the same for all environments. Mediterranean type environments have quite different responses when compared to boreal or tropical ones for example. Vegetation-as-fuel characteristics, rates of fuel accumulation, forest rotation circles, vegetation flammability periods, high fire danger periods, land use practices, etc. are quite distinct. Forest fire policies must be sophisticated, multi-objective, tailored to meet these characteristics, always taking into consideration, as a priority, the need to protect people, properties and infrastructures, and to make best use of the renewable resources for the benefit of the society.

Forest fire policy, of course, is not an abstract idea. In defining a course of action, national or regional governments must consider a number of important elements in light of their country's conditions. These elements are highlighted in brief below.

Agencies involved and their responsibilities

Some agencies such as those that carry the responsibility for forest management (e.g. Forest Service, Ministry of Agriculture, Ministry of Environment) and those responsible for emergency response (Fire Service, Civil Protection) can easily be identified, but others may also have a role to play. Depending on a country's political structure, urban planning authorities may have to contribute towards developing safe wildland-urban interfaces, Park Services or Tourism agencies may have to manage certain areas with forest fires in mind, local authorities may have to prepare municipal parks and peri-urban forests for the event of a forest fire, etc. These are only some examples. Identifying the agencies that must be involved is only the first step. It is more important that their roles must be complimentary and integrated in order to achieve the objectives of a comprehensive forest fire policy. Furthermore, this should be done not only on paper but also in practice. The latter is not an easy task, given the varying priorities these agencies have, and requires a clear mandate and willingness on the part of the administration of these agencies to cooperate. Cooperation starts from identification of roles and responsibilities, and optimally includes efforts for standardization in planning processes, training and qualification requirements, operational procedures, public education programs, etc. All these require appropriately distributed funding that matches the objectives, the responsibilities and the workload of each agency. Without it, little can be achieved.

On the other hand, distribution of funds is a tool for the governments to make this cooperation a reality.

Protection priorities / Values to be protected

Identification of what must be protected and the priorities of protection are clearly a key element of forest fire policy. The lives of citizens are obviously of top priority, without compromising, of course, the safety of firefighters. Private and public property and infrastructures are also of very high importance but there are also many other elements that must be prioritized, including obvious values such as timber and agricultural production, and less obvious ones such as water quality, soil erosion, flooding, landslides, aesthetics, etc. The importance assigned to these values is not always easy to determine (Xanthopoulos 2002).

Ecosystem sustainability

The effects of complete fire exclusion must be examined in order to determine the best possible course of action in regard to forest and fire management. This requires that the role of fire in the ecosystems involved is well known and understood. In certain less fire prone ecosystems, complete fire exclusion may be proven as a viable option in conjunction with silviculture measures and overall forest management; in other cases prescribed burning may provide some interesting management options. Full and partial protection zones as a compromise between human activities and properties on one hand and ecosystem balance on the other is another option.

Economic efficiency

Policy decisions may not ignore economics. Alternatives about the cost of various scenarios must be evaluated in regard to who carries the responsibility for what task and what is the associated cost. Fire suppression and its costs must be examined in comparison to various levels of forest management intensity, fire prevention efforts and post-fire rehabilitation costs. All the values mentioned earlier, tangible and non-tangible must also be considered. In general, finding a good mix of responsibilities distributed in an efficient way to all participating agencies is not easy, given the "turf battles" involved, but if it is achieved the results can be very good while simultaneously achieving impressive economic efficiency.

Planning

This is a more specific element of forest fire policy. It refers to the need to develop plans and management actions that directly or indirectly affect the occurrence and characteristics of forest fires.

In the last few years, wildland-urban interface development and protection has become a major planning priority and the focus of many laws and regulations in various countries, because the expansion of urban areas in the wildlands has resulted in major fire disasters. Managing such areas for safe development requires careful planning that sets scientifically based guidelines (Xanthopoulos 2004a), which in turn

requires cooperation of forestry and firefighting agencies, as well as local authorities including urban planners.

Special mention must be made to forest management. Carefully developed multiple-use forest management plans that include fire management considerations can have impressive results in controlling the fire problem while being an economically positive productive activity. Also, active rangeland management, especially when prescribed burning is used in an orderly and scientifically sound way to improve animal feed, may have impressive effects in reducing fire starts by shepherds at the peak of the fire season

All these plans can be considered as part of fire prevention either directly or indirectly: a good, in-depth fire prevention plan that prescribes the contribution of the various agencies, should constitute a major part of the overall forest fire policy.

Of course, a fire prevention plan includes more than just policies and general plans. It describes specific actions in space and time and forms the backbone of forest fire management. The latter also requires presuppression plans that describe the mobilization of the involved agencies and the way to respond to fire emergencies. Finally, planning is completed by plans for extended fire suppression and, of course, plans for post-fire rehabilitation.

Monitoring and evaluation

A cornerstone for the development of a successful forest fire policy is to understand the dynamic nature of many of the elements it involves as they were listed above. Agency structures and responsibilities change, societies evolve, new realities develop, new technologies appear, and funding needs change. Any forest fire policy must be continuously monitored in regard to its effectiveness. Solving one problem may create another. Certain areas of responsibility may not be covered adequately, or there may be overlaps. Turf battles may develop. Costs may prove too high for certain policy alternatives. Ecosystems may not behave as expected. Conflicts may develop in parts of the society. All these must be continuously re-examined and evaluated and forest fire policy may be adjusted accordingly, in the long-term, as needed.

The role of science

The role of science is inherent in all the other elements of forest fire policy described above. Forest fire science, forestry, social science, economics, urban planning, are only some of the disciplines needed to support the development of a sound forest fire policy (Chapin and others 2003). Without this support, policy measures can easily be misled. They can often be contradictory, and may lead to a dead-end that will require major corrective actions.

Evaluating forest fire policies

Following the discussion above, a forest fire policy can be considered as successful if:

- It leads, in the long term, to a decreasing level of damages to properties and infrastructures.

- It reduces the occurrence of catastrophic wildfire events.

- It maintains average burned forest areas (as a percentage of total forest land) to levels that would be expected for the type of ecosystems involved.

- It keeps the fire hazard (the part of fire danger contributed by the fuels) to acceptable levels.

- It maintains forests in a healthy and environmentally stable condition, able to perform their protective, aesthetic and economic functions.

- It secures post-fire regeneration of burned lands, and, where needed, site rehabilitation.

- It instills a feeling of security and a sense good management to the citizens.

- It maintains the budget at reasonable levels, without any steep increases.

Forest fire policy scenarios

Each country, due to historical reasons, differences in environment, extent of forests, social structure, and even coincidental factors, develops its own policies in regard to forest fires. Depending on the sophistication of the country and to the extent of the problem, forest fire policies are more or less integrated, comprehensive, and sophisticated. Two extreme examples are presented below and assessed according to the points listed above, in order to demonstrate the differences.

Fire suppression oriented policy

In such a policy, the objective is to "keep fire losses as small as possible" without many other constraints. There is no comprehensive and integrated fire policy governing all the aspects described earlier.

- The responsibility for firefighting usually belongs to a strictly firefighting agency.

- The budget for forest fires is mainly influenced by the will to control fire losses and mainly supports the firefighting agency. It tends to grow steeply after bad fire seasons.

- Cooperation between agencies is quite poor given the priority to fire suppression.

- The other elements of fire policy are neglected or are under-funded.

Assessment

- This policy may be effective in countries where forest fires are not a main environmental factor (e.g. Central European countries).

- In countries where the environment promotes frequent and intense fires, because they have a prominent role in shaping the forests, this policy can be effective only for a limited time. This temporary "success" comes at a very high cost (increased ground and aerial firefighting means) and it leads to fuel built-up in the forests (quantity, continuity of fuels).

- Lack of attention and funding for appropriate forest management leads to high hazard conditions in the forests.

- Lack of active and scientifically based range management leads to increasing uncontrolled use of fire by shepherds and ultimately to desertification.

- Lack of cooperation with city planning authorities leads to the development of dangerous wildland-urban interface zones.

- The occurrence rate of disasters drops considerably, especially in the beginning of applying such a policy. "Average bad" conditions are handled successfully but it is possible to experience major disasters in extreme fire years, which (depending on the circumstances) can become generalized (situation out of control) for significant periods of time.

- Forest health and forest succession are affected negatively.

Comprehensive fire policy

In such a policy:

- All the fire policy elements are addressed properly both at institutional level and at operational level.

- Science plays an important role in decision making.

- Cooperation of involved agencies is secured. People at the top of agencies are selected with cooperation willingness as an important criterion.

- Budgets are allocated in a balanced way in order to advance all policy elements.

Assessment

- The results in regard to occurrence of significant fire disasters initially depend on the level of firefighting capacity, given the existing forest conditions.

- In the long-term the results improve, depending on the level of funding. Forests are healthier and less fire prone; range fires are relatively rare; forest and range management provide jobs to local populations.

- Wildland-urban interface areas are well planned and safe.

- Detailed presuppression plans and forest fuel management make fire control possible even under difficult conditions.

- The probability of a very bad fire year that would create havoc over large areas is reduced. Fire disasters are infrequent and quite limited in extent.

- This policy is needed in countries where forest fires are a main environmental factor (e.g. Mediterranean countries) It is the only policy that can reduce major disasters in the long-run in such environments while at the same time keeping forests healthy and budgets under control (Xanthopoulos 2004b).

Discussion

The two policy examples presented illustrate two possible extremes. In reality, all countries have a policy between these extremes, hopefully well-adapted to their conditions. Such a policy adaptation is achieved when building, applying, evaluating and fine-tuning fire policies based on scientific knowledge. Problems arise mainly when such an objective approach is missing and policies are influenced by turf battles between the agencies involved and according to their political leverage. Also, problems arise when examples of other countries are adopted without critical evaluation. The latter may become a pitfall when international organizations and "advanced" countries try to offer help in establishing fire management policies in developing nations.

It is a challenge for operational fire managers, researchers and academics, to try and enlighten those responsible for policy development about the need for the integrated approach described above. Sometimes, the opportunity comes when disaster hits as it happened in Portugal after the disastrous years of 2003 and 2005, when many positive policy changes were enacted, including fuel management through prescribed burning, silvicultural treatments, prevention planning, etc. hoping to avoid repetition of the nightmare in the future (Xanthopoulos and others 2006). On the other hand, the catastrophic fire seasons of 1998 and 2000 in Greece only prompted huge increases in the fire suppression capacity, especially in regard to aerial firefighting means. The fire management budget nearly tripled but the funds available for prevention actually decreased. This firefighting capacity improvement did not prevent, of course, major fire disasters in wildland-urban interface areas in 2005 (Rafina, Attica) and in 2006 (Kassandra, Halkidiki, and Mani, Peloponesse) with many thousands of hectares burned, hundreds of homes damaged, and even loss of life.

Forest fire policies in the European Union

Problems may also arise from policies external to a country that may not be adapted to its environment. The European Commission should keep this in mind as its policy directives may not always reflect what is appropriate for a specific country: subsidies for grazing animals, as applied in the late 1980s, leading to an increase of the total number of sheep and goats, is one such example. In this line, a word of caution in regard to current European Union (EU) policies is needed: trying to promote a general model of organizing Civil Protection in the EU, it would be easy to move towards schemes of quick response and strong suppression, reducing emphasis on social policies and a forest management that includes fire as a consideration.

A Civil Protection umbrella over Europe and in each country is not only desirable but also needed. Its function should be to promote coordination of all agencies and resources within a country and even between countries in order to offer a safer environment to the citizens. At the European level it can foster cooperation and coordination between the countries and their respective agencies. In regard to forest fires, the EU Civil Protection initiatives should give emphasis not only to emergency information exchange (for example, EU-MEDIN project, objective 1), which is a cornerstone for cooperation and coordination, but also to disseminating information about fire policies, discussing them and evaluating them. This should lead to a harmonization of fire policies. Fire policies should be harmonized but not necessarily homogenized. Harmonizing forest fire policies, under the considerations

presented here, should be expected to bring a number of benefits including better Civil Protection, improved forest health, more efficient use of EU and National funds, better understanding of the specificities of each country and better mutual assistance. The road to this is not easy. There are many obstacles including historical reasons, power games, lack of understanding each country's concerns and conditions, and limitations in disseminating scientific information to policy makers. The need to understand the elements and the benefits of a comprehensive forest fire policy in a country comes first. It is a prerequisite for cooperating towards harmonization.

Acknowledgements

References

Chapin III, Stuart F; Rupp, Scott T; Starfield, Anthony M; DeWilde, La-ona; Zavaleta, Erika S; Fresco, Nancy; Henkelman, Jonathon; McGuire, David A. 2003. **Planning for resilience: modeling change in human–fire interactions in the Alaskan boreal forest.** Front Ecol Environ. 1(5): 255–261.

Conese, Claudio; Eftichidis, George; Guarnieri Franck; Lockwood Fred; Moreno Jose Manuel; Vallejo Ramon; Viegas Domingos Xavier; Lymperopoulos Nick. 1999. **The DELFI vocabulary of forest fire terms.** 170 p. CINAR S.A. Athens, Greece.

FAO Committee on Forestry, 1999. **Report of meeting on public policies affecting forest fires**. Fourteenth session; 1999 March 1-5; Rome, Italy. Available from the FAO web site at: http://www.fao.org/docrep/meeting/X1163e.htm.

Fingerman Johnson, Jayne; Bengston, David N; Fan, David P; Nelson, Kristen C. 2006. **U.S. Policy Response to the Fuels Management Problem: An Analysis of the Public Debate About the Healthy Forests Initiative and the Healthy Forests Restoration Act.** In: Andrews, L. Patricia; Butler, W. Bret, compilers. Proceedings of the Conference on "Fuels Management - How to Measure Success"; 2006 March 28-30; Portland, Oregon, USA. Proceedings RMRS-P-41. Fort Collins, CO: Rocky Mountain Research Station, Forest Service, U.S. Department of Agriculture; 59-66.

Henderson, Martha; Kalabokidis, Kostas; Marmaras, Emmanuel; Konstantinidis, Pavlos; Marangudakis, Manussos. 2005. Fire and Society: A Comparative Analysis of Wildfire in Greece and the United States. Human Ecology Review 12(2): 169-182.

Schindler, Ludwig. 2000. **Fire in Indonesia and the Integrated Forest Fire Management Project – IFFM.** International Forest Fire News (ECE/FAO); 23: 12-16.

The White House. 2003. **Healthy Forest: An Initiative for Wildfire Prevention and Stronger Communities.** Available from http://www.whitehouse.gov/infocus/healthyforests/

Xanthopoulos, Gavriil. 2002. **Forest firefighting organization and approaches to the dispatching of forces in the European Union: results of the workshop survey.** In: Xanthopoulos, Gavriil, editor. Proceedings of the International Workshop on "Improving

Dispatching for Forest Fire Control"; 2001 December 6-8; Chania, Greece. Mediterranean Agronomic Institute of Chania, Chania, Greece; 143-153.

Xanthopoulos, Gavriil. 2004a. **Factors affecting the vulnerability of houses to wildland fire in the Mediterranean region.** In: Xanthopoulos, Gavriil, editor. Proceedings of the International Workshop on "Forest Fires in the Wildland-Urban Interface and Rural Areas in Europe: an integral planning and management challenge"; 2003 May 15-16; Athens, Greece; National Agricultural Research Foundation, Institute of Mediterranean Forest Ecosystems and Forest Products Technology, Athens, Greece; 85-92.

Xanthopoulos, Gavriil. 2004b. **Who should be responsible for forest fires? Lessons from the Greek experience.** In: Book of abstracts of the "II International Symposium on Fire Economics, Planning and Policy: A Global View"; 2004 April 19-22, Cordoba, Spain. University of Cordoba, Spain, and USDA Forest Service, Pacific Southwest Research Station; p. 128. Full paper on CD accompanying the book of abstracts.

Xanthopoulos, Gavriil; Caballero, David; Galante, Miguel; Alexandrian, Daniel; Rigolot, Eric; Marzano, Raffaella. 2006. **Forest Fuels Management in Europe**. In: Andrews, L. Patricia; Butler, W. Bret, compilers. Proceedings of the Conference on "Fuels Management - How to Measure Success"; 2006 March 28-30; Portland, Oregon, USA. Proceedings RMRS-P-41. Fort Collins, CO: Rocky Mountain Research Station, Forest Service, U.S. Department of Agriculture; 29-46.