More forest fires in the Austrian Alps – a real coming danger?

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Abstract

This paper discusses the reasons why future natural disaster events in the Austrian Alps should include forest fires to a larger extent – with regard to increasing weather extremes, fuel amounts, and fire predisposition, as illustrated by the (spring-) summer seasons 2003 and 2006. Most fires are human-caused but during very hot and windy weather also lightning strikes or railway embankment fires may trigger forest fire outbreaks. So far, no obvious fire patterns are detectable although forest fires seem to concentrate in some "hotspots" where more prophylaxis appears desirable.

Keywords: Austrian Alps, fire causes, forest fires, forest fire management

1 Introduction

Worldwide, wildland fire events show an increasing trend. Fire ecologists commented: *„Increasing conflagrations of forests and other land throughout the world during the 1980's and 1990's have made fires in forests and other vegetation emerge as an important global concern. Both the number and severity of wildfires and the application of fire for land-use change, seem to have increased dramatically compared to previous decades of the twentieth century"* (Ahern et al. 2001). *„Projected demographic and climate change scenarios suggest that this situation will become more critical during the next few decades"* (Goldammer 2001). *"Fire, while often a natural feature of mountain ecology, may change in frequency and intensity as climate changes and mountain societies develop. Thus, fire will under some circumstances be(come) a hazard to economic, ecologic, and social functioning, while in others it can promote biodiversity, reduce hazard levels, and maintain ecological function. In any wildland fire, its management will be incorporated into overall land use and natural resources planning and management."* (GLOCHAMORE 2007)

Austrian forests are not characterised as fire ecosystems, nor have they been heavily fire-impacted so far. Storm blow-downs, bark beetle impacts, and (browsing) game ungulates are often much more critical actors in Austrian forests (Kräuchi et al. 2000). However, it is hypothesised that the risk of forest fires will increase (Badeck et al. 2003), also in Austria in near future. Therefore, it appears meaningful to document and to learn from most recent "fire seasons" in Austria, and also from former decades where information is available. This paper may help to sensitise stakeholders and decision makers about this possibility.

2 Material and methods

We collected data about forest and grassland fires (dates, localities, and other pertinent information). This data including documentation of past fire events (see the NewsArchiv) is presented in the internet by the voluntary fire fighting brigades and services (www.fireworld.at; www.wax.at). Railway embankment burns, documented as OeBB statistics by the Federal Railway Administration, was a second data source partly used in connection with a case study (Arndt 2007). An additional source was the former annual forestry statistics of the respective ministry, which with regard to forest fires became unfortunately incomplete for a period of time.

For this report, two maps of the geographic distribution of forest fires in 2003 and 2006 were prepared and complemented by a graph of the 2003 burns showing seasonal distribution of mountain and lowland forest fires. These data and graphs were partly used previously in monthly journals addressing foresters and landowners.

3 Results

The summer seasons 2003 and 2006 have illustrated how widespread forest fires may occur and how they can become an issue in Austria given adequate weather and fuel conditions (Gossow et al. 2005, Gossow & Hafellner 2006).Forests may burn nearly everywhere in Austria (figure 1) after a long drought period like in the spring-summer season 2003 that followed a very dry winter.

Also lightning-caused fires may play a major role in drought periods: Each fifth or sixth fire was caused by lightning. Documented in older forest fire statistics of Austria, there have been periods, like in the 1980's, when each fourth fire was a lightning-ignited one. Compared to former "normal" years, a trend to more summer-fires (vs. spring-fires) seems to become obvious (figure 2).

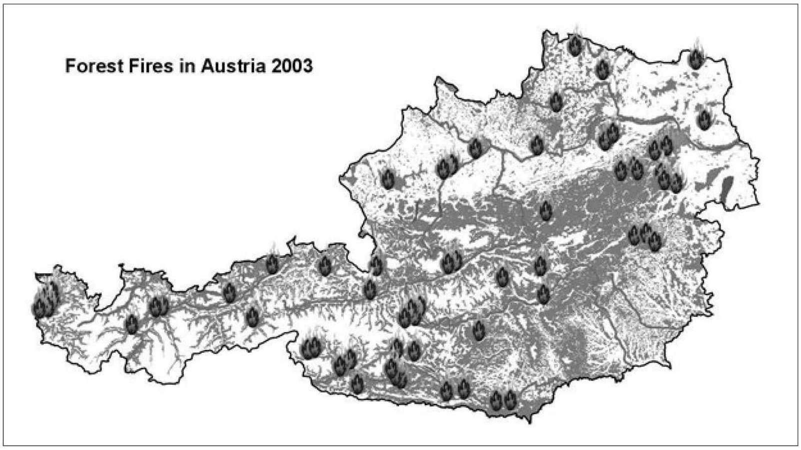

Figure 1: Austrian forest fire distribution in 2003: suitable weather and fuel conditions favor forests fires everywhere – but mostly in the Alps.

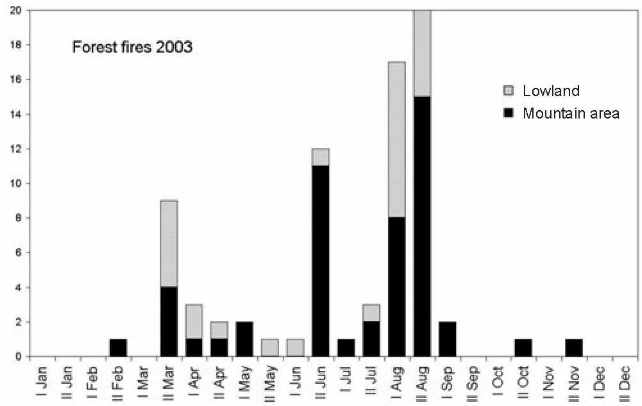

Figure 2: Number of recorded forest fires per 1st (I) and 2nd (II) half of month.

But spring fires dominated again in 2007, when nearly 50% of the recorded forest fires happened in April. In 2003, some spring fires occurred, especially in March (figure 2), but a more pronounced forest fire peak followed in August. A third peak in the second half of June coincided with the period of midsummer fires and of subsequent ritual fires in connection with Catholic feast-days that are usually ignited on mountains – like the majority of the documented burns. During the second half of July 2006, the situation differed insofar as a few extremely hot weeks – after a winter-spring season with heavy snow and rainfall, storms and floods – favoured the outbreak of some 20 forest fires within a very short fire weather window of only ten to fifteen days. Nearly half of these fires burnt in the southern part of Carinthia (figure 3), a region appearing to be(come) a fire „hot spot" in Austria. The neighbouring regions of Italy and Slovenia are already experienced with forest fires. Likewise, an area in northeastern Austria, the so-called black pine belt (*Pinus nigra austriaca)*, with very low precipitation, appears to be fire sensitive too (cf. figure 1). In the Carinthian

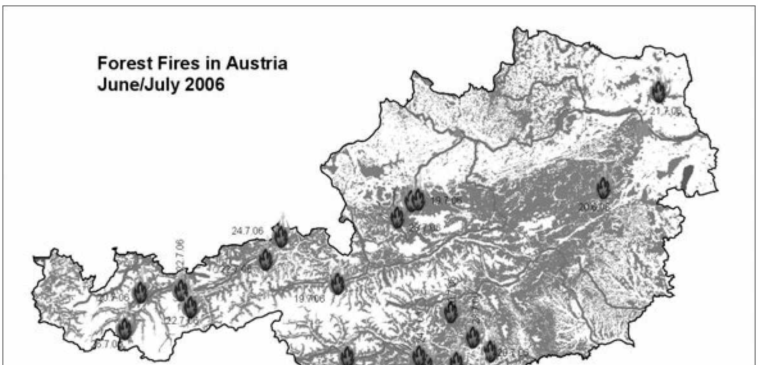

Figure 3: The forest fires in June/July 2006 concentrated during a fire weather window and dominated in Carinthia.

"hot spot", nearly half of the forest fires in 2003 were ignited by lightning strikes, more than twice as many as the Austrian average that year.

4 Discussion and conclusion

Normally, natural disasters in Austrian mountain forests are related to storm events, avalanches, and bark beetles. There has been an obvious increase since the 1980's. Forest fires in Austria, including the few larger ones, happened remarkably often on storm blow-downs. Salvage harvesting is a known cause of these forest fires (Gossow & Frank 2003). With an increase of weather extremes, fire-supportive conditions like in summer 2003 and 2006 may increase in frequency (Badeck et al. 2003, Diaz 2003, Fagre et al. 2003). As the effects of global warming are more pronounced in the Alps, weather extremes might become a bigger challenge in future. Additionally, recent temperature increase analyses and comparisons (e.g. Buchgraber 2006, Formayer 2006, Kromp-Kolb 2006, CECILIA 2007) give evidence for a developing trend of temperature increase and precipitation decrease, which may become most pronounced in the eastern and southeastern parts of the Alpine Arc.

Especially on steep slopes, hot fires have disturbing to disastrous effects on soil stability, erosion proneness, reforestation success, and forest protection demands. Austrian storm events, for example in 1990, 1999, 2002, 2007, 2008, created much uprooting in older spruce and pine stands. These events may add to the fire susceptibility, especially on steep slopes (Gossow & Frank 2003). The often incomplete salvage logging in these areas leave a lot of woody debris on the ground , thereby offering good fuel and fire spread conditions. Often also slash burning gets out of control and may ignite adjacent areas. During a fire, roots of remaining uprooted stocks may burn down and loose their connection to their soil-rockbed. The rootstocks may roll and jump downhill while burning, thus transferring fire to lower elevations. Glowing pine cones, rolling down on steep terrain after the poor ground vegetation has been burned off may operate in a similar way, as happened for example in the *"Potokkessel"* burn (Frank, orally).

Apart from suitable fire weather, the sufficient amount and dry condition of fuel is decisive. This concerns the ground vegetation necessary for a burn to start at all, and the tree tops whereto a ground fire may climb up („*crowning*"). This scenario may lead to a stand-replacing forest fire, or to less disastrous events if fire suppression can be sufficiently exhibited. However, suppression may leave behind more unburned fuel, leading to a later and even hotter fire (The Fire Paradox 2006).

Forest sites in Central Europe are generally more productive than Boreal or Mediterranean ones. That means that ground fuel amounts are potentially larger in Central Europe, whereas more fire-prone sites have usually poorer growth capacities. The respective forestry and land use practices in Central Europe may become more extensive, as it is the case in Mediterranean countries of Europe and in Eastern and Southeastern countries after the fall of the Iron Curtain (Goldammer 2002). Forestry has become more extensive in Austria, leading to more fuel accumulations. The former practice of "clean forestry" produced comparatively little fuel. This aspect has to be considered in possible fuel classification schemes, modelling operations, simulation experiments, and for a concrete fuel management. The contemporary augmentation of fuel loads (of differing combustibility) must be calibrated into the equations (what is part of the FWF-TRP project L539-N14, 2008–2011).

Another developing trend in Austrian wildland fire events involves railway embankments and attached slopes. Areas with open vegetation cover are suitable fuel sources and may burn spreading fire into forest stands above. This is especially dangerous in hilly and mountainous areas where curves and downward direction of railway tracks necessitate more frequent braking. These track sections should become part of a fire danger assessment procedure for pro- or post-phylactic measures (Arndt 2007, Gossow et al. in prep). Several landscape characteristics will have to be considered, like the physical layout of railway tracks in hilly and mountainous terrain (curviness, incline, wind tunnelling), type, size and vegetation types of embankments and adjacent slopes and forest stands, its topography, and finally its accessibility for fire fighting crews and prophylaxis measures. Adequate fuel reduction and more fire-resistant vegetation types may be appropriate prophylactic measures.

Sparks from braking trains caused forest fires in the 1960's in more than a third of the noted cases (according to unpublished data evaluation of the then still more detailed forest fire statistics of the ministry). The last few years have seen this ignition agent drastically decrease in frequency, partly due to brake-technical improvements. However train braking may become more relevant as soon as railway embankment upkeep to reduce fuel amounts and suitability becomes too negligent (Arndt 2007). Alpine railway routes are often protected from avalanche through the protective forest stands above. Stand-replacing fires in these areas would mean an increased risk of avalanche and/or rock-fall.

In Austria, fire ecological research and an integrated forest fire management have not been relevant to date. Short reports in case of major forest fire events and longer lasting fire fighting efforts appear occasionally. One example is a burn (1988) in a nature-protected gorge that was taken as an opportunity for a post-fire succession monitoring (Frank & Koch 1999, Koch 2003). The forest burns of 2003 and 2006 were documented to make foresters and land owners more aware of the risk of fire in Austria (Gossow & Frank 2003, Gossow et al. 2005, Gossow & Hafellner 2006, Arndt 2007).

As in other parts of Europe, Austrian use of controlled fire has been a prototypical tool for the management of rural and forested lands (Goldammer et al. 1997, 2004). Prescribed fire was used locally in Upper Styria even till the 1960s (Schneiter 1970). Today, such practices gain interest. On Carinthian Alpine pastures burning is used to control heather (*Calluna*) and other dwarf brushes (e.g. Kerschbaumer 2007). In Germany, biomass burning is a tool in nature reserve management used to preserve and support heather landscapes to favour black grouse (*Tetrao tetrix*) habitats, or to control fuel loads on vineyard terraces (like in the *Kaiserstuhl*: Page et al. 2001, Goldammer et al. 2004). This German example includes monitoring and research efforts on biodiversity.

The more recent wildland fires in Austrian nature reserves and national parks motivated further research. Examples of recommended research could be succession monitoring or small mammal and entomological studies in relation to fire influences on population dynamics and subsequent habitat suitability (Querner et al. in prep.). The function of larger fire events in the Alps as a landscape-designing factor have been investigated mainly from a historical perspective (Wetzel et al. 2006).

5 Summary

Fire is slowly gaining importance in Austria, not only as an adaptive management challenge and as a possible tool – as prescribed burning or other prophylactic measures - but also as an ecological factor to be studied. However, more basic research is required, as only a very preliminary catalogue exists. More targeted and experimental fire ecology and risk research, its modelling and a fire danger rating (prognosis) procedure would be instrumental. Switzerland, for instance, noticed an increase of forest fires especially in its southern regions in the early 1990's. Therefore, it became „more and more necessary to improve the forest fire management methods", with fire danger prediction methods considered as "one of the most important elements of an effective fire management strategy" (Conedera et al. 1997). Austria should definitely become more active in this respect in the very near future too.

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