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Fire in Sweden – History, Research, Prescribed Burning and Forest Certification

Since most of Sweden lies within the boreal and boreo-nemoral zones, fire has, up until recently, also played a major role in shaping the forests. Out of the total forested area of 23 million hectares (ha), only a few hundred thousand ha forest belongs to the temperate deciduous zone where presumably the rich hardwood forest composed by *Fagus, Quercus, Fraxinus, Ulmus, Tilia, and Acer* sp. has been less influenced by fire in the past. Although most of our forests are shaped by fires it is not until the recent decade forest managers and public has become aware of this. Research about fire or rather research *related* to fire has increased dramatically in the last years, largely catalysed by a growing concern for environmental issues.

At present only a fraction of the forest land burns annually (in the order of 0.017 - 0.0017%), from a few hundred hectares in wet years to a few thousand ha in a dry summer (max c. 5 000 ha). Most of the ignitions are today human caused but lightning ignitions can cause a substantial amount of the fires in dry years when periods of high pressure are followed by thunderstorms with little or no rain following. The number of lightning ignitions follow a N-S and W-E gradient where the highest amount occur in the southeastern summerdry part of the country (in the order of 0.2 ignitions per 10 000 ha and year) and the lowest lightning ignition frequency in the high altitude northern forests (a factor 0.1 or less than in the southeast) (Granström 1993).

The burned area per year which allows conclusions on the *fire frequency* or the *fire-return interval* today is very different from the past situation due to effective indirect and direct fire prevention and suppression efforts. The network of forest roads is extremely dense, even in the north and allows for early attack by fire fire-fighting crews. According to fire history studies (Kohh 1975; Zackrisson 1977; Engelmark 1984; Niklasson and Granström 2000) fires were occurring at 50-150 yr-interval in the north and down to 20 yrs in the south (Page et al. 1997, Niklasson and Granström 2000, Niklasson and Drakenberg 2001). A very rough national average of the annually burned area of about 1.7 % of the total forest area is equivalent to a 58 yr-return interval. Fire suppression became effective around 1860-1880 over most of the country and since then burned area diminished to a seemingly steady level since the 1950s. In the southern part suppression seems to have started less uniform and generally earlier. The reasons behind the rapid decline in fire frequencies is somewhat debated although there are evidence for strong human impact on the fire regime from some regions (Niklasson and Granström 2000, Granström 2001). The rapid growth of organized forestry and expanding timber industry over most of the country in the late 1800s should have had a major effect on this process.

The long time of fire suppression in combination with an increasingly intense industrial forestry has had negative consequences for many species. While the loss of old trees must be ascribed more to forestry than fire suppression, the absence of fire has pushed several hundred of fire-adapted and fire-requiring species, predominantly invertebrates, from being common to rare or even extinct in the country (Ahnlund and Lindhe 1992, Ehnström, Långström et al. 1995, Wikars 1997). A few of these species are strictly dependent on fire *per se* while the major part of this group depend on structures and processes that mainly fires provided in the past such as: openness/sun-exposure, dead wood, damaged trees with lowered vitality, fire scars, burnt ground. Another strongly negative effect from the combination of forestry and fire suppression is the lack of seral stages dominated by deciduous trees such as *Betula, Populus, Salix.* The reproduction from seeds of *Populus* and *Salix* is strongly promoted by fires and is now a rather rare event. The flagship species white-backed woodpecker *Dendrocopus leucotos* is now on the verge to extinction in Sweden being confined to older deciduous-dominated forest, typically of fire origin. Only a hundred years ago this bird was common all over the country.

Although the awareness has increased dramatically among foresters and public about fire, this has so far very little been turned into action when it comes to using fire as a tool. Although the structures, substrates and effects of fire has influenced the design of alternative management regimes (Angelstam 1998) the incorporation of fire is hampered by a lack of practitioners, anxiety for loosing control of burns and a lack of resources. In fact, according to the Swedish certification criteria under the Forest Stewardship Council as much as 5% of the annual clear-cut area should be burned. This is

hardly accomplished at present, and these burnings typically lack from a species-oriented view resulting in superficial burning of the organic layer but high tree layer mortality (Granström 2001, pers obs.). The burning for regeneration purposes had a renaissance in the period 1950-1970 (annually on the order of 10 000 ha) but ended rather abruptly due mainly to rapidly growing labour costs and rationalization of management systems.

Figure 1. Prescribed burning according to the certification standards in June 2001 on former state forest land in southern Sweden. High intensity, often mortal to left-behind trees, due to voluminous slash and ignition pattern, is a common picture in these type of fires. For large forest owners, prescribed fire is required on 5% of the annual clear-cut area to meet the FSC certification standards. See:
http://www.fsc-sweden.org/gron/Swedish%20FSC-standard1.html#6.4

Figure 2. The effects of the severe and dramatic fire of 1999 in Tyresta National Park attracts many field visitors. However, according to tree ring evidence such high-mortality burns were rare in the past. Up until the late 1600s the area burned every 30 years by low-intensity fires where after almost no fires occurred until now.

Fire research in Sweden is mainly concentrated to Umeå in the north with studies on succession, fire behaviour, and fire history (Granström, Schimmel, Niklasson, Zackrisson, Linder and others), plant-plant interactions, ecosystem functioning (Zackrisson, Nilsson, Jäderlund), paleoecology (Segerström, Hörnberg). Uppsala has a strong tradition in entomology (Wikars, Ehnström, Weslien). In southern Sweden, some paleoecological research has been done in the past (Bradshaw, Hannon, Lindbladh) but very little other research. Fire history studies has just started (Niklasson) and pilot studies in fire behaviour/flammability (Niklasson and others). A lot of the research in other fields of ecology can be ascribed to fire or has fire a common denominator. It is out of the scope here.

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