CENTRAL EUROPEAN OAKS (*QUERCUS ROBUR* AND *Q. PETREA*) FROM A FOREST HEALTH PERSPECTIVE USING THE EXAMPLE OF SOUTHWESTERN GERMANY

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PURPOSE AND SCOPE

In Central Europe, pedunculate and sessile oaks (*Quercus robur* and *Q. petraea*) are the most important oak species in forestry. They were widely promoted in the Middle Ages as coppice or sprout-seedling forests. This was mainly because of their value in pig husbandry (via acorn production) and for the production of tannin bark, firewood, or construction lumber. As a result, pedunculate and sessile oaks were widely cultivated in places outside their native ranges. Today, however, these species are highly prized for their lumber, barrel wood, and very valuable veneers.

Pedunculate and sessile oaks are widely distributed throughout the oceanic, continental, and sub-Mediterranean regions of Europe. Due to their wide climatic adaptation, they are considered to be of great importance in the context of climate change. However, it is important to be aware of the health risks to which pedunculate and sessile oaks are susceptible, which are known from several recent epidemics in Central Europe.

METHODS AND APPROACH

Oak health and mortality of oaks were inferred from crown condition surveys and by accounting for oaks from sanitation measures or salvage following disturbance. Subsequent cause and effect analyses considered data from forest pest and disease surveys, which consists of geospatial reports on pest and disease occurrence, as well as regular forest pest monitoring. Geospatial reports and timber records were collected by local foresters, and the other data were collected by the Forest Research Institute of Baden-Wuerttemberg. Climate data from the German Meteorological Service were also taken into account.

FINDINGS AND IMPLICATIONS

The last period of oak decline with significant widespread dieback occurred in the 1990s through the early 2000s. Therefore, the various potential insect pest

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and disease factors are well known. The physiology of oaks as ring-porous species plays a significant role in their susceptibility (e.g., Thomas et al. 2002).

Extreme weather conditions and in particular foliage-damaging biotic factors, especially defoliating insects and subsequent oak powdery mildew fungi (*Erysiphe alphitoides*), were important inciting factors. Notable defoliating insects include spongy moth (*Lymantria dispar*), winter moth (*Operophtera brumata*), and oak processionary moth (*Thaumetopoea processionea*). Bark-breeding beetles and various fungi, especially the oak buprestid beetle (*Agrilus biguttatus*) and honey fungus (*Armillaria* spp.), often colonized oaks weakened by other factors. The most prominent losses of oaks in southwestern Germany occurred after spongy moth defoliation, which, depending on site and weather conditions, facilitated mass outbreaks of the oak buprestid beetle as the main contributing factor (fig. 1).

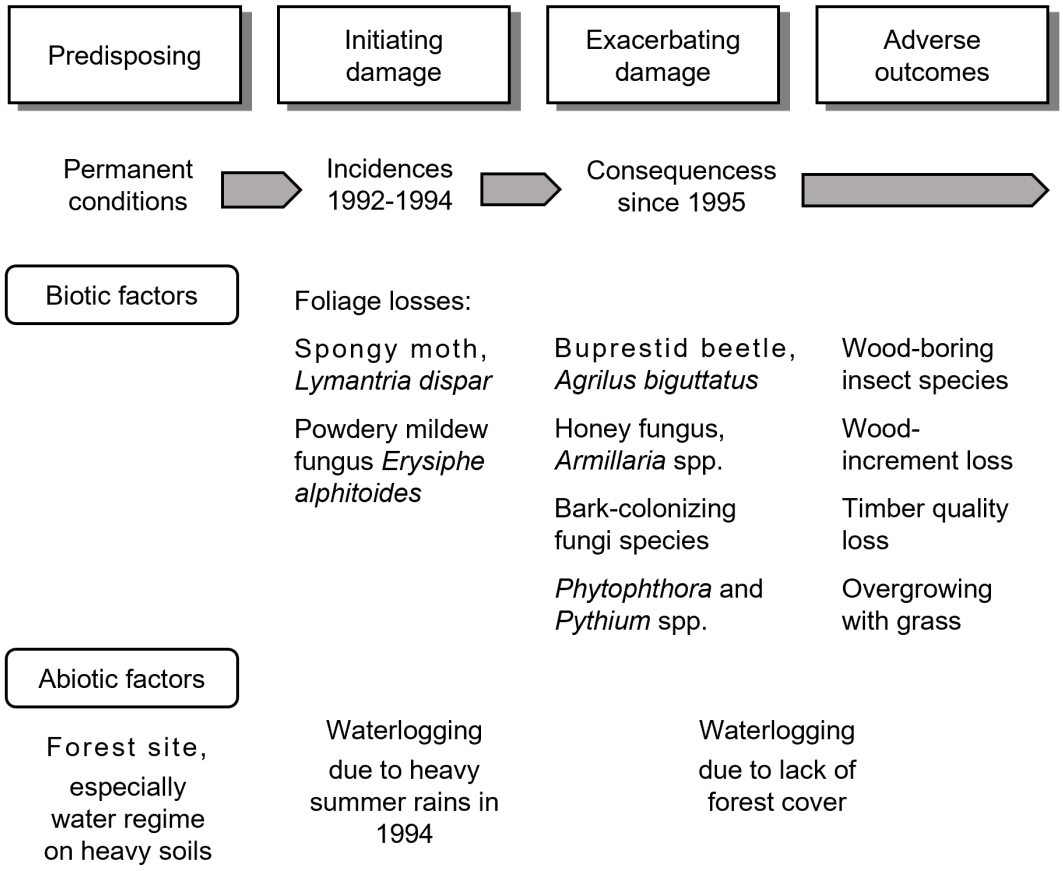

Figure 1—Damaging factors of oak dieback due to spongy moth calamity in the Bienwald Forest, Upper Rhine Valley, Germany (from Delb and Block 1999).

Control of defoliating insects, such as spongy or winter moth, may reduce levels of oak defoliation. However, the current prolonged drought represents a new challenge because it has also become a major inciting factor. Sanitation harvests are now used to contain the spread of the oak buprestid beetle, a crucial contributing factor.

It is important to learn more about the physiology and susceptibility of oaks to different stressors and disturbances, especially those likely to be exacerbated by climate change (e.g., drought and warming). The same is true for pest biology. For example, recent research on oak processionary moth suggests a possible

increased temporal mismatch between egg hatching and bud burst of host plants due to climate change, which could lead to its decline as a consequence of warming. However, this has not yet been confirmed in southwestern Germany (Wagenhoff et al. 2014).

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