

Guidelines for conducting genetic monitoring in the field: *Abies alba/Abies borisii-regis*

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Abies spp. illustrations made by Anja Rupar

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INTRODUCTION

Silver fir (*Abies alba* Mill.) and King Boris fir (*Abies borisii-regis* Mattf.) are wind-pollinated, monoecious, generally outcrossing conifer tree species, which belong to the *Abies* genus. *Abies alba* and *Abies borisii-regis* are wind-pollinated, monoecious, generally outcrossing species with a chromosome number of 2n=24. Seeds of both species are wind-dispersed. Silver fir is one of the most important forest tree species from an economic and ecological point of view in several European countries. King Boris fir is an important natural hybrid between *Abies alba* and *Abies cephalonica* growing mainly in Greece. Both species are facing many threats and challenges due to climate changes and therefore they are both considered for forest genetic monitoring.

The guidelines shortly describe Silver fir and King Boris fir, their reproduction system, environmental requirements and threats. They provide guidance on how to establish and maintain a forest genetic monitoring plot and on recording all field level verifiers and phenotypic data at the basic, standard, and advanced monitoring levels.



List of verifiers and background information with short description and observation frequency to be recorded during field work at the *Abies* spp. genetic monitoring plots

	Name	Basic level	Standard level	Advanced level
Verifiers	Mortality / survival	Counting of remaining marked trees every 10 years and after every extreme weather event/disturbance	Same as basic level	Same as basic level
	Flowering	Stand-level estimate, every year	Individual tree level observation, during two major flowering events per decade, ideally equally spaced*	Individual tree level observation, during two major flowering events per decade, ideally equally spaced*
	Fructification	Stand-level estimate, every year	Individual tree level observation, the same year as the assessment of the flowering at the standard level (regardless of the fructification intensity)*	Counting of fruit, during the same years as the assessment of flowering at the advanced level, regardless of the fructification intensity * Seeds are collected for laboratory analyses every assessed fructification event at the advanced level
	Natural regeneration abundance	Stand-level estimate, every year	Counting of seedlings 1st, 6th, 1st and 6th year after every assessed fructification event	Counting of seedlings 1st, 6th, 11th, 16th year after every assessed fructification event
Background information	DBH class distribution	/	Measurement every 10 years	Same as standard level.
	Height class distribution	/	Measurement every 10 years	Same as standard level.
	Bud break	/	Individual tree level observation, every 5 years	Individual tree level observation, every year
	Flowering synchronization	/	/	Individual tree level observation, at each assessed major flowering event



FGM plot selection

- Silver fir is a stand forming tree species
- Regular FGM scheme should be applied
- FGM of *Abies borisii-regis* due to geographically disjunct distribution, biology (e.g. hybridization) and the threats (e.g. climate change, pests and diseases), can be more challenging
- **Consultation with local foresters** Since *Abies alba* can appear in the form of groups among other tree species within mixed forest stand
- **Orto-photograph** *Abies* spp. is clearly visible and distinguished from other species in an orto-photo of the area
- **Initial field survey**

FGM plot establishment and maintenance

- FGM plot design – **50 mature reproducing trees** (DBH>15 cm) distributed over a forest stand with a distance of 30 meters between selected trees
- DBH and social class can be used as a proxy to identify a reproducing tree if the plot is being established outside of the flowering season
- Presence of sufficient density of **natural regeneration**
- In total 20 NR subplots have to be selected and marked for NR abundance assessment and sampling



Figure 1. Four stages of bud break of *Abies* spp.

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