



The Mooswald Marteloscope

Field guide



Freiburg 
IM BREISGAU



Freiburg City Forest

Freiburg, often referred to as the “green city”, is located in the Upper Rhine valley adjacent to the Black Forest in the East. The forest of Freiburg covers an area of 5,200 ha thus being exceptionally large for a communal forest. Around 60 % of the forest are located in the mountainous regions of the Black Forest while 40 %, entitled ‘Mooswald,’ are found in the lowlands of the Rhine valley. The forest area extends from 200 m in the valley to nearly 1,300 m.a.s.l. The Freiburg City Forest is dominated by the deciduous tree species beech and oak, while Norway spruce, Silver and Douglas fir constitute the most common conifers. It has been Forest Stewardship Council (FSC) certified already as early as 1999.

The ‘Mooswald’ forest consists mainly of thermophilous deciduous tree species. The once floodplain forests were heavily drained in former times which considerably affected water tables and forest composition. However, they are still referred to as riparian forests having been typical for these sites in the past. Forest restoration activities are ongoing in forest areas with the aim of again raising ground water levels.



4,831 ha

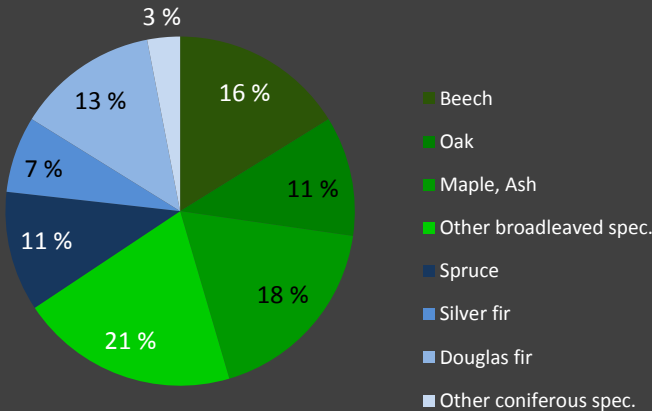
Total forest area

8.7 m³/ha

Annual increment

369 m³/ha

Actual average stock



67 %

Broadleaves

33 %

Conifers

7.5 m³/ha

is the annual cutting rate

86 %

of forest area are single tree harvest
and group selection stands

36,000 m³

is the total annual cutting rate

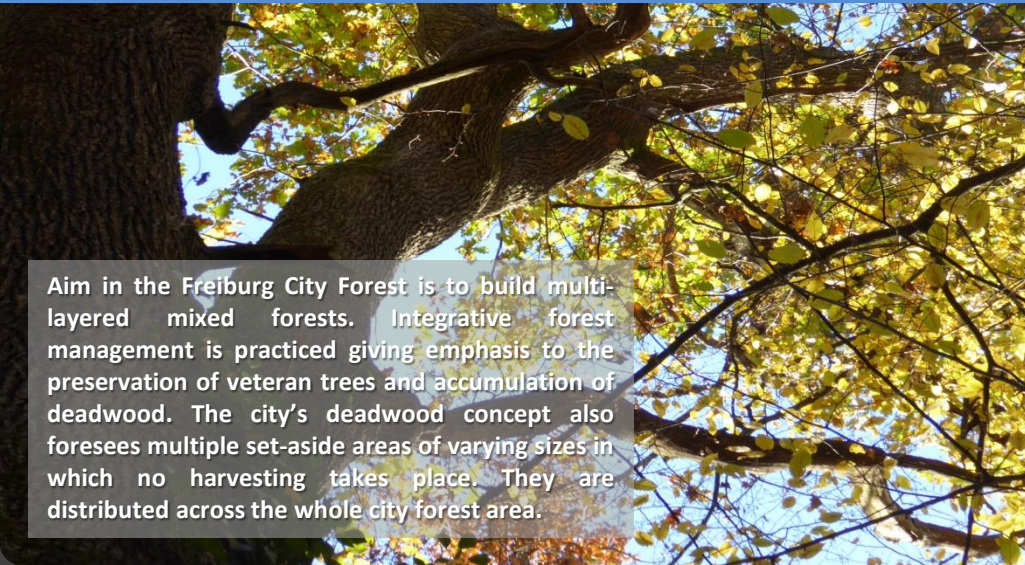
11 %

4,000 m³

of fuelwood is sold to residents of
Freiburg

of total forest area are managed
as continuous cover forests

Biodiversity concept



Aim in the Freiburg City Forest is to build multi-layered mixed forests. Integrative forest management is practiced giving emphasis to the preservation of veteran trees and accumulation of deadwood. The city's deadwood concept also foresees multiple set-aside areas of varying sizes in which no harvesting takes place. They are distributed across the whole city forest area.

Forest management in the Freiburg City Forest aims at incorporating nature and species conservation goals and the protection of natural development processes to its commercially used forests.

Already in 1994, the enterprise set aside a forest reserve and adopted a deadwood concept (1996).

46 so-called '*deadwood areas*' of around 1 ha have so far been designated for natural development with a spacing of about 1 km.

The selection of these set-aside areas is based on the presence of rare and/or protected species, the age of a stand or tree group, habitat continuity and the display of rare or important microhabitat structures.

The network of set-asides is complemented by 60 so called '*veteran and dead tree groups*' of 0.1 -

0.3 ha in size. Those serve as so called '*stepping stones*'. They should display special tree microhabitats such as large tree cavities, aeries or already recorded breeding or resting areas of protected species.

Spatial distribution of tree microhabitats plays a key role as driver of biodiversity. Therefore the city forest has given high importance to the connectivity of the different area elements. In addition individual habitat trees displaying valuable tree microhabitats are protected in regularly managed forests.

The Freiburg City Forest has also designated 5 '*reference areas*' with an average size of 22 ha in the course of FSC-certification. Due to their size they allow for observing and learning about natural development processes in forests.

12 ha

Total size of 60 habitat tree groups

10.9 %

of total forest area are set-aside

36 ha

Size of set-aside forest reserves

90 ha

Total size of 46 deadwood areas

44.3 %

are designated as Natura 2000 sites

109 ha

Total size of 5 large reference areas

870 ha

Forest stands > 100 years

19.2 m³/ha

Average amount of deadwood



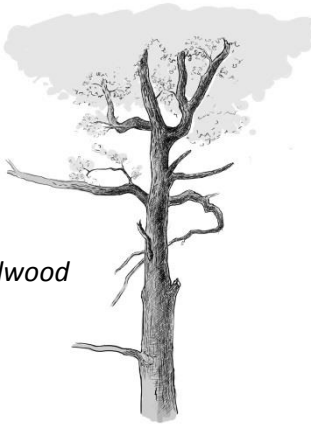
Habitat structures

Integrate+ gives particular attention to **habitat structures** in its Marteloscopes (M-scope). Large quantities of deadwood and a high density of old microhabitat-bearing trees are characteristic elements of natural forests, in particular in old-growth phases. These phases are often absent or rare in managed forests, even in forests under close-to-nature management. In selective harvests and thinnings, 'defective' trees displaying or potentially developing old-growth habitat structures are often removed.

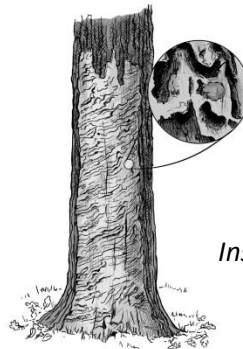
Yet, an important share of forest biodiversity is strictly or primarily dependent on such elements for their survival, especially **saproxylic** species, being species depending on deadwood.

Most species dependent of old-growth phases and corresponding habitat structures have become rare. Conservation of biodiversity in commercial forest stands is thus linked to retaining such microhabitat structures.

Crown deadwood



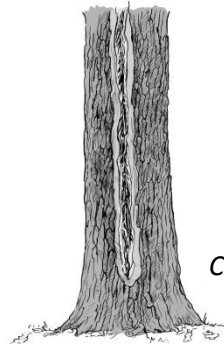
Insect galleries



Branch holes



Cracks and scars



....and Biodiversity



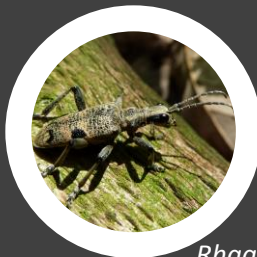
Dendrocopos medius



Myotis bechsteinii



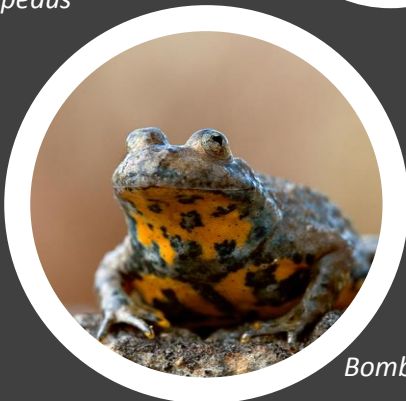
Dorcus parallelipedus



Rhagium mordax



Dicranum viride



Bombina variegata

Site conditions

Altitude:	215 m.a.s.l.
Forest ecological region:	Upper Rhine Valley / Freiburg bay
Geology/ Bedrock:	Limefree gravel (sedimented by Dreisam river in the Quaternary)
Soil types:	Gleyic brown earth
Mean annual temperature:	11.4 °C
Annual precipitation:	860 mm
Natural forest community:	<i>Stellario-Carpinetum (anthropogenic)</i>

Stellario-Carpinetum forests occur on nutrient-rich, wet-dry or wet sites, often on river flood plains, hence covering slightly drier and less frequently flooded sites than true riparian forests.

Main tree species are *Quercus robur* and *Fraxinus excelsior* in the canopy layer and *Carpinus betulus* in the mid-layer. Typical herbaceous species are *Stellaria nemorum*, *Primula elatior* and *Ranunculus auricomus*.

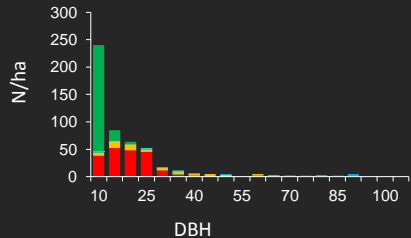


Stand characteristics

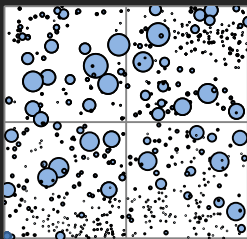
The **Mooswald** M-scope is located in a former coppice-with-standards forest of about 120 years. Older oak and ash trees are present above a dense understory of hornbeam and various other tree species.

Stand data

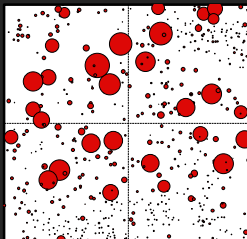
N [stems/ha]	587
BA [m ² /ha]	26.6
Volume [m ³ /ha]	319.4
Ecological value [points]	5,664
Economic value [Euro]	22,947



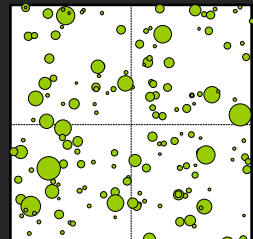
Volume
[m³]



Economic value
[Euro]



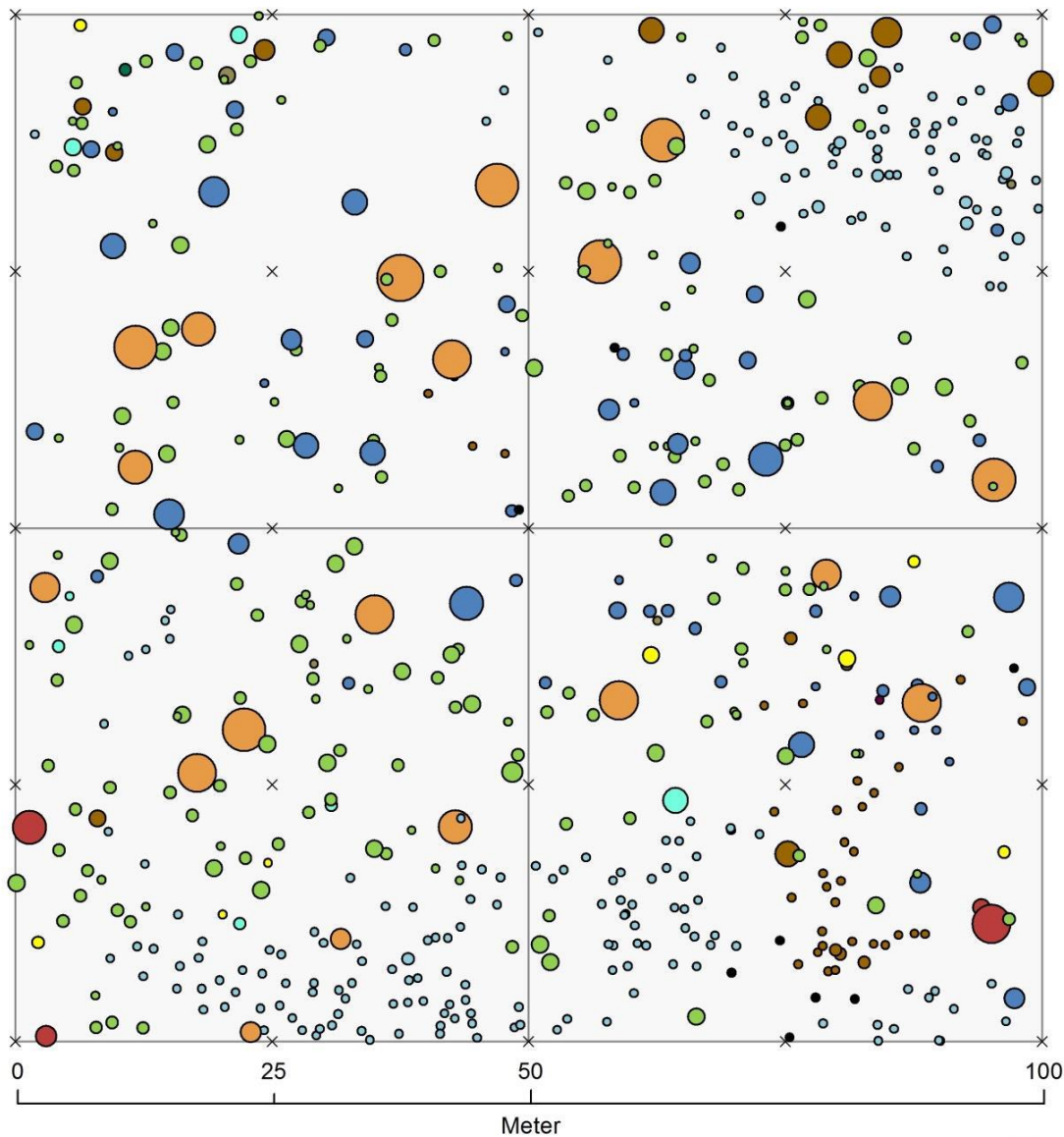
Ecological value
[points]



The **volume (in m³)** of each tree is calculated based on DBH, tree height and a volume formula for crown wood.

The **economic value (in €)** is estimated for each tree based on volume, tree assortments (timber quality and diameter) and corresponding local timber prices. Future economic values are estimated by taking into account expected future development and growth of each tree.

The **ecological value (in points)** is assessed for every tree on the basis of existing tree microhabitats, taking into account the rarity of each habitat and the duration for its development.



Tree species

- | | |
|--|---|
| ● <i>Quercus robur</i> | ● <i>Tilia cordata</i> |
| ● <i>Quercus rubra</i> | ● <i>Ulmus laevis</i> |
| ● <i>Carpinus betulus</i> | ● <i>Prunus serotina</i> |
| ● <i>Fraxinus excelsior</i> | ● <i>Corylus avellana</i> |
| ● <i>Acer pseudoplatanus</i> | ● <i>Dead trees</i> |
| ● <i>Alnus glutinosa</i> | |

DBH (cm)

- | | |
|---|--|
| ○ 7,5 - 15,0 | ○ 65,1 - 75,0 |
| ○ 15,1 - 25,0 | ○ 75,1 - 85,0 |
| ○ 25,1 - 35,0 | ○ 85,1 - 95,0 |
| ○ 35,1 - 45,0 | ○ 95,1 - 105,0 |
| ○ 45,1 - 55,0 | |
| ○ 55,1 - 65,0 | |



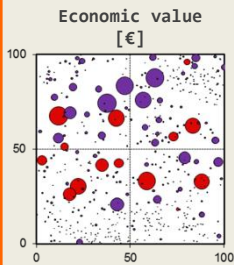
Example of interventions

A comparison of two interventions is shown as a result of a virtual tree selection exercise in the M-scope 'Mooswald'. They highlight the different outcomes regarding economic and ecological values as well as the effects on the forest structure (basal area).

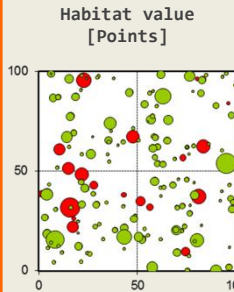
Interventions

Student K1

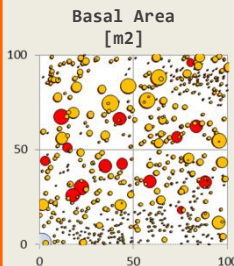
Student K6



15,740 €

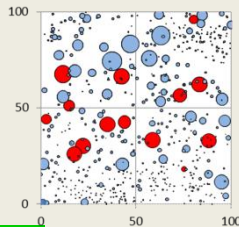


4015

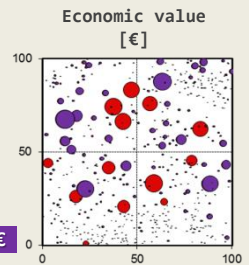
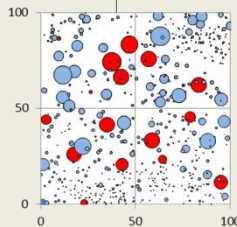


20.8m²

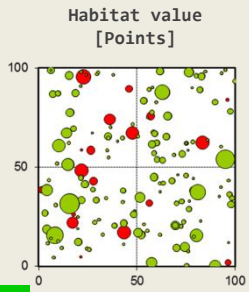
Volume
[m³]



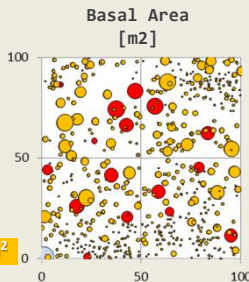
Volume
v[m³]



15,627 €



4441



20.7m²

Removal
79.6m³

Removal
84.6m³

Integrate+ is a demonstration project funded by the German Federal Ministry for Food and Agriculture (BMEL) to establish a European network of demonstration sites for the integration of biodiversity conservation into forest management.

The Integrate+ project runs from December 2013 to December 2016 and builds on a partner network from research and practice with a focus on implementation of integrative management and enhancing transnational exchange of experiences.



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