

Insects in dead wood



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Lammi, August 9th 2016

Don't mistake...



a wood plantation for a forest

wood plantation

artificial biotope close to a field

forest

natural and complex ecosystem



Wood plantation

- Homogenous structure
- No old trees
- No dead trees
- No clearings
- One planted tree species



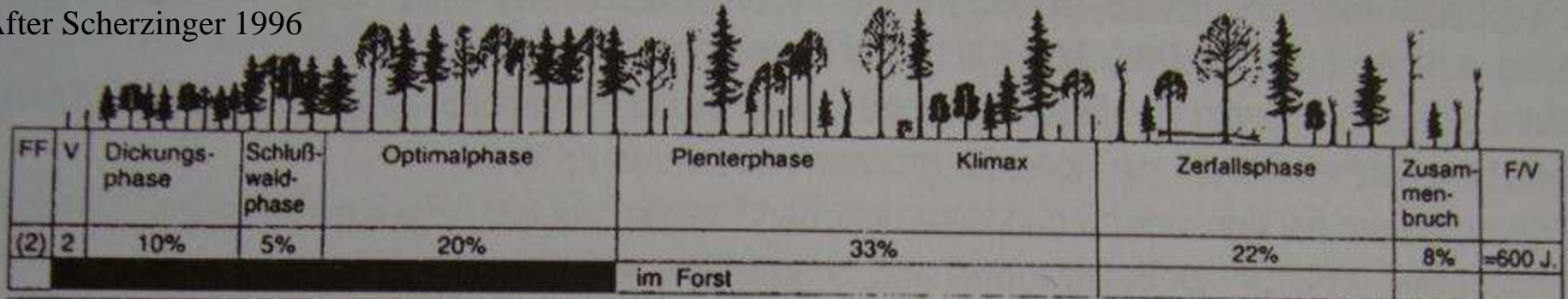
Forest

- Heterogenous structure
- Old trees
- Dead trees
- Clearings
- Many tree species
determined by biotope
conditions

... and all intermediate forest types between these two extreme cases

Succession of different stages in a primeval forest

After Scherzinger 1996



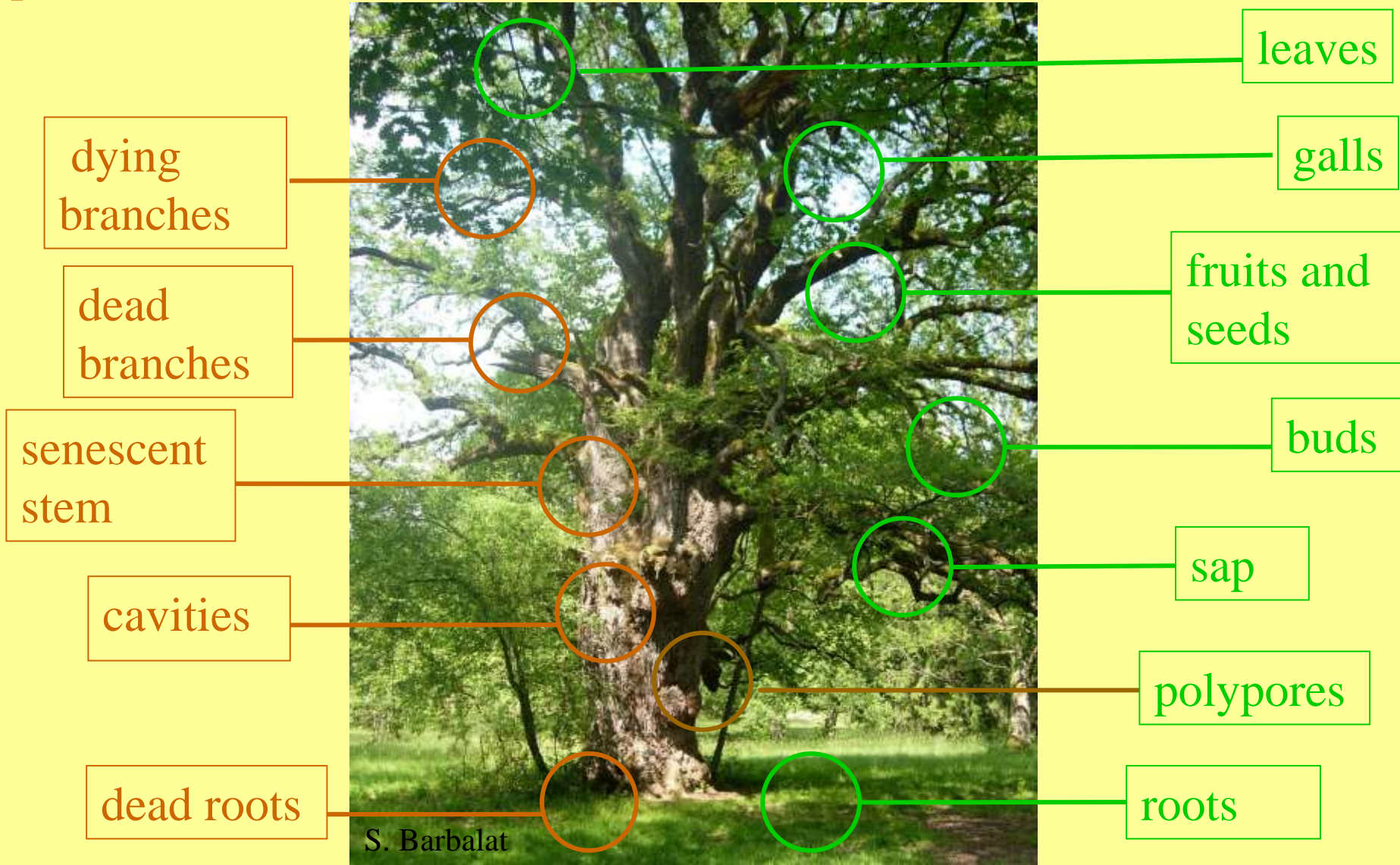
- Primeval forest cycle (Oak, *Quercus sp.*): about 600 years;
- Senescent and terminal stages last about 200 years (occupation area of these stages: 1/3 of the total forest area)
- Juxtaposition of these various stages and formation of a mosaic
- Forest is a dynamic habitat
 - “internal dynamics” depending on tree life stages
 - “external dynamics” depending on external events (storms, fires, snow, floods etc.)

dead or
dying
parts

One old tree: many habitats

living
parts

Different tree habitats colonized by insects



Insects in dead wood: 3 main orders



Hymenoptera
(wasps, ants and
bees)



Coleoptera
(beetles)



Diptera (flies and
gnats)

Insects in dead wood: 2 secondary orders



Lepidoptera
(butterflies and moths)



Heteroptera
(true bugs)

Insects in dead wood:

can be classified according to:

- systematics
- their dependance for dead wood (obligate or facultative)
- the stages of decomposition of wood (fresh dead wood to completely decayed wood)
- the place they are found in (under the bark, in the wood, in the branches, in the stem, in the roots)
- their diet (cambium, wood, decayed wood, preys...)

Dying and fresh dead wood

Examples of species feeding on sapwood under the bark



Anthaxia candens

Coleoptera
Buprestidae

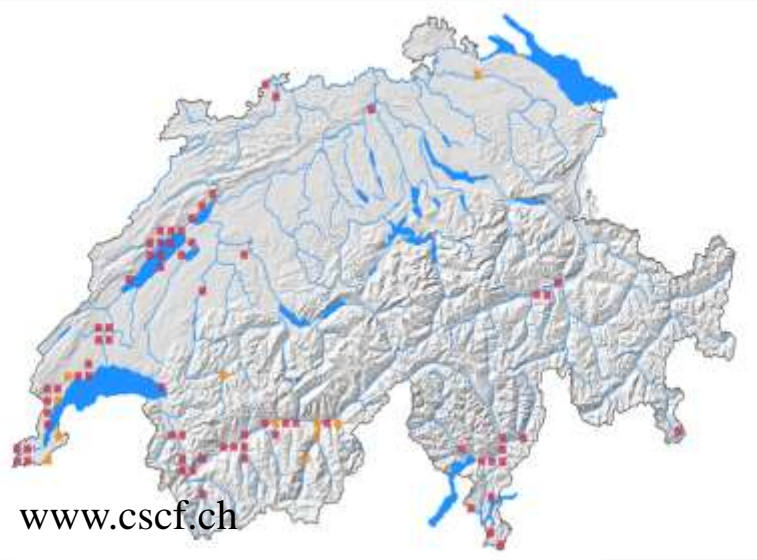
*Acanthocinus
aedilis*
Coleoptera
Cerambycidae



Ips typographus
Coleoptera Curculionidae
Scolytinae

Dying and fresh dead wood

Examples of species feeding on sapwood under the bark



Lamprodila festiva
Coleoptera
Buprestidae



Dying and fresh dead wood

Examples of species feeding on sapwood under the bark



- Coraebus fasciatus* Female lays an egg at the top of a healthy twig.
Coleoptera Larva bores a 1,5 m long gallery towards
Buprestidae branch base.
Mature larva bores a circular gallery around
branch base => death of the branch
=> new biotope for other dead wood insects

Dying and fresh dead wood

Examples of species feeding on wood in stems



*Cerambyx
cerdo*
Coleoptera
Cerambycidae



Plagionotus detritus
Coleoptera
Cerambycidae



Rosalia alpina
Coleoptera
Cerambycidae

Dying and fresh dead wood

Other insects use dead stems as nests

Camponotus ligniperda

Hymenoptera Formicidae



Xylocopa violacea

Hymenoptera Apidae



Fungus-infested wood

Insects living in wood, feeding on fungi

Platypus cylindrus

Coleoptera Platypodinae



Urocerus gigas

Hymenoptera Siricidae



Cavities



colpolon.biol.uni.wroc.pl

Prokraerus tibialis
Coleoptera Elateridae



.kerbtier.de

Phloeophagus lignarius
Coleoptera Curculionidae



btierr.de

Ampedus cardinalis
Coleoptera Elateridae



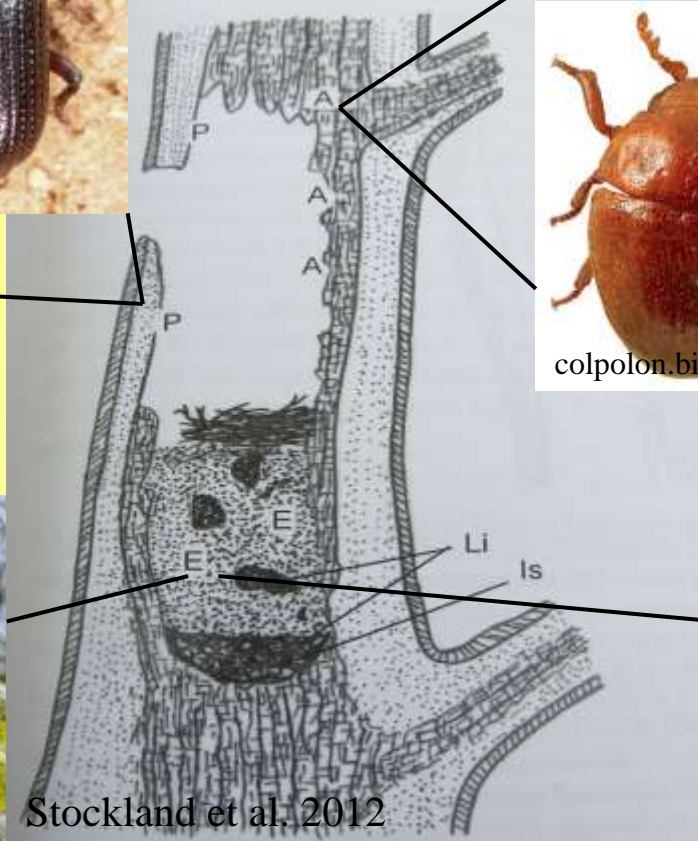
colpolon.biol.uni.wroc.pl

Anitys rubens
Coleoptera Anobiidae



S. Barbalat

Osmoderma eremita
Coleoptera Scarabaeidae



Stockland et al. 2012



stagbeetle.info

Elater ferrugineus
Coleoptera Elateridae

Water filled tree holes



wikipedia.org

*Phaonia
angelicae*
Diptera Muscidae



Stockland et al.



Diptera
Chironomidae



Myathropa florea
Diptera Syrphidae



wikimedia.org



youtube.com/watch?v=4YQOOfzrZSk

Decayed wood

Insects living in rotten stumps and roots

Lucanus cervus

Coleoptera Lucanidae



Dorcus parallelipedus

Coleoptera Lucanidae



Predators of dead wood insects



Elater ferrugineus
Coleoptera Elateridae



Thanassimus formicarius
Coleoptera Cleridae



Xylophagus ater
Diptera Xylophagidae

Film on
<https://en.wikipedia.org/wiki/Xylophagidae>

Parasitoides of dead wood insects



Urocerus gigas
(Giant Woodwasp)
Hymenoptera Siricidae



Rhyssa persuasoria
(Sabre Wasp)
Hymenoptera
Ichneumonidae

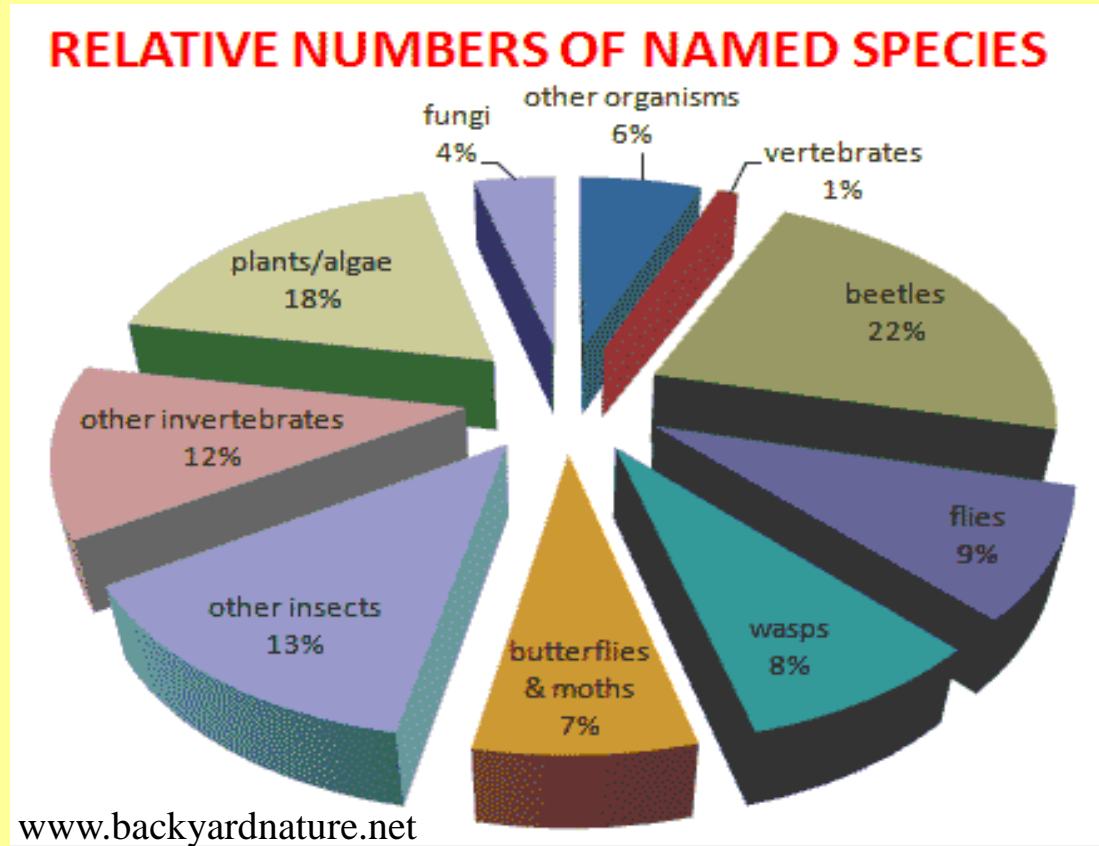
Film on

https://en.wikipedia.org/wiki/Rhyssa_persuasoria

... and many others:

- in bird nests
- on dung
- on sap
- using wood as construction material
- on wounds
- using dead wood as hibernation sites
- submerged wood...

Biodiversity, let's talk about insects

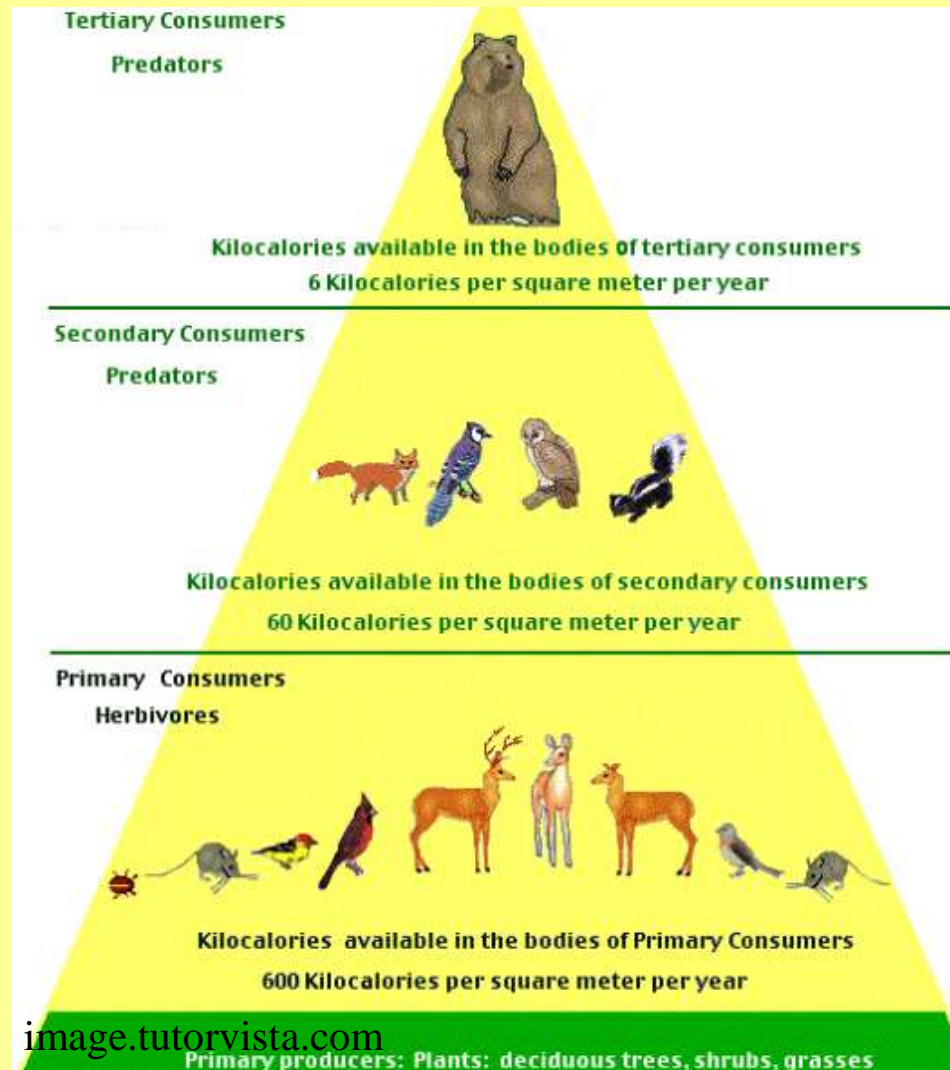


Nearly 60 % of all known species are insects

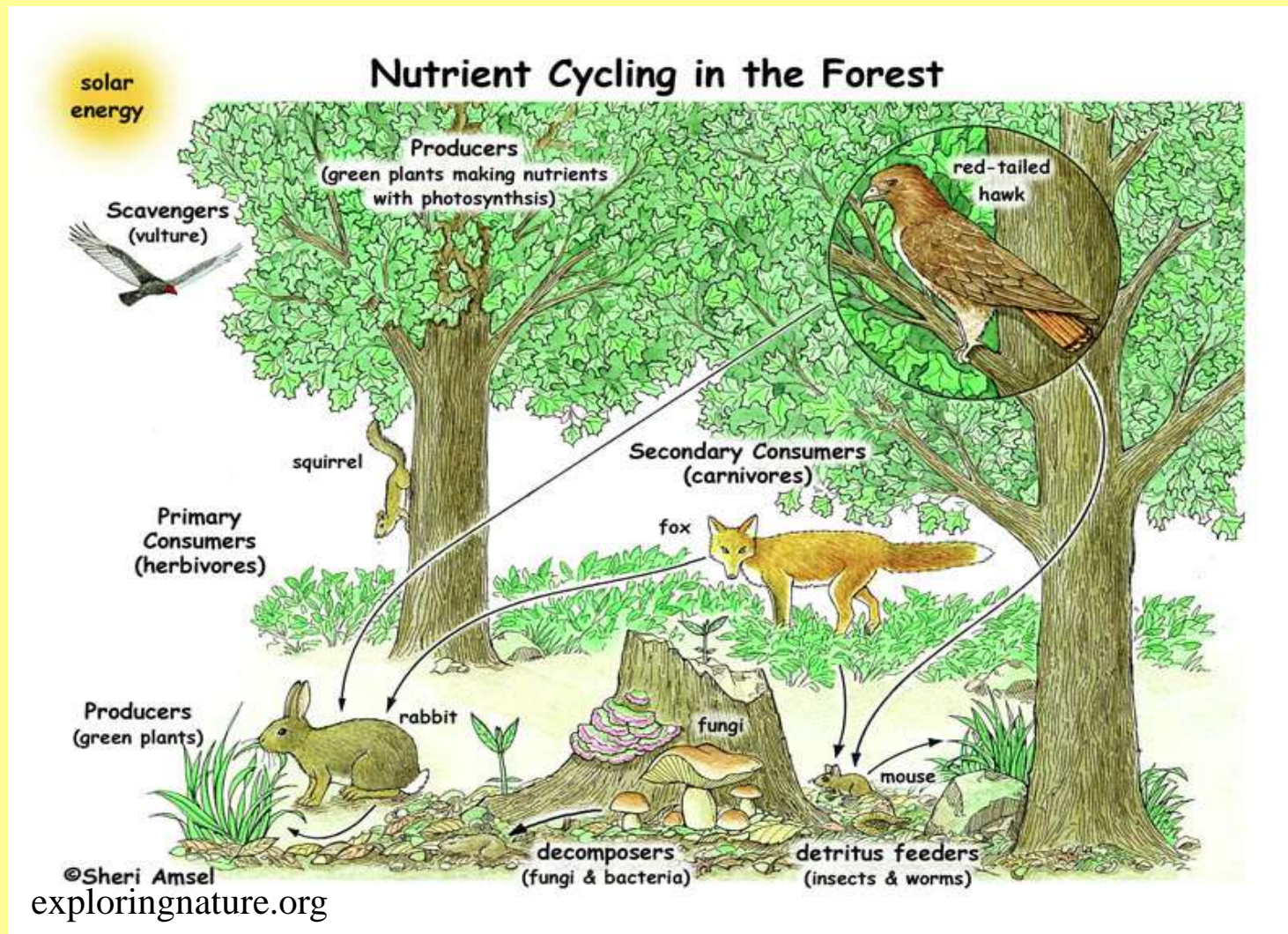
Nordic countries : 3946 saproxylic insect species

Coleoptera : 1447
Diptera : 1550
Hymenoptera : 803
Lepidoptera : 66
Hemiptera : 26
Thysanoptera : 23
Collembola 27
Raphidioptera : 4

Ecological roles of dead wood insects



Ecological roles of dead wood insects

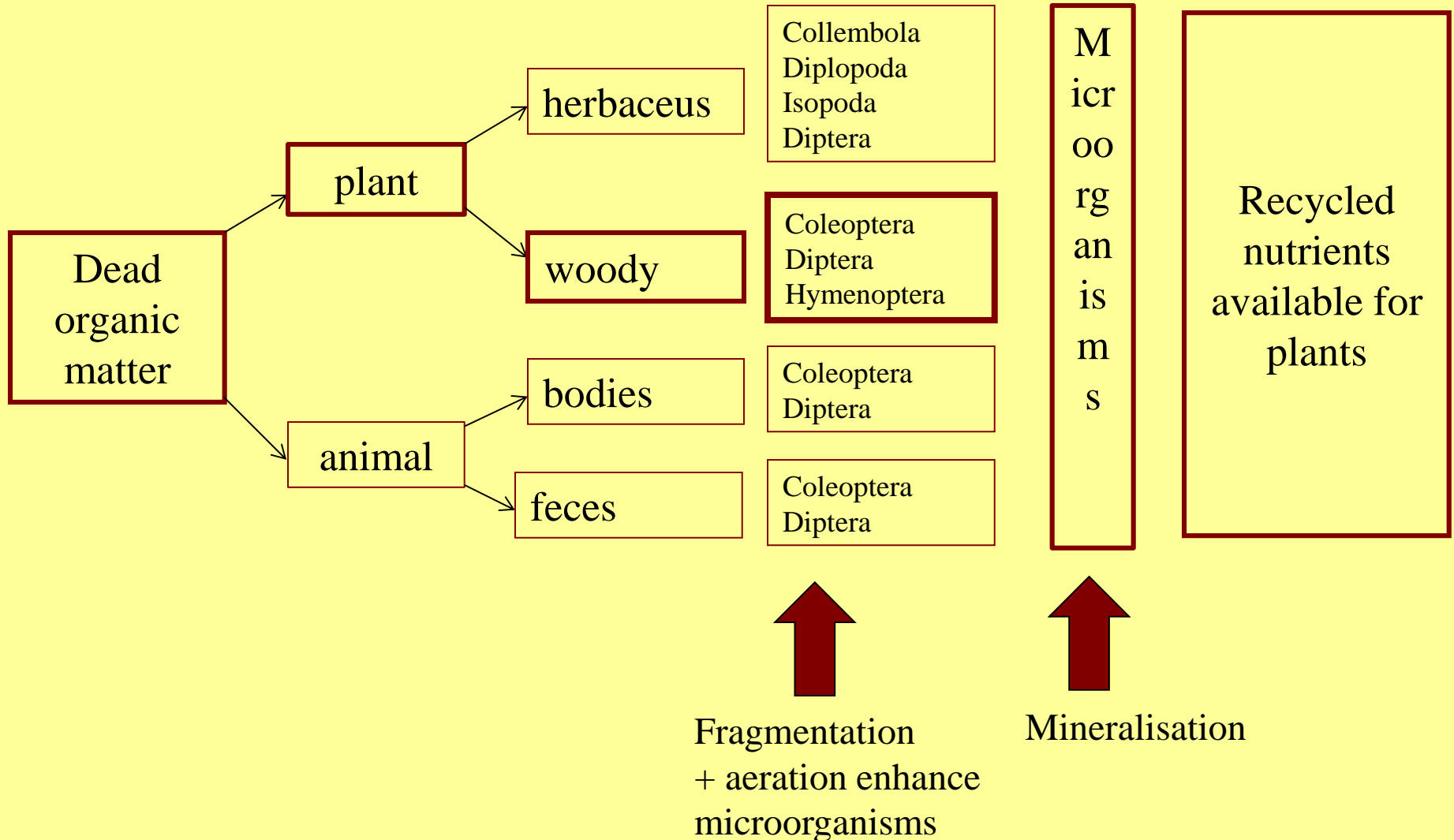


Decomposers

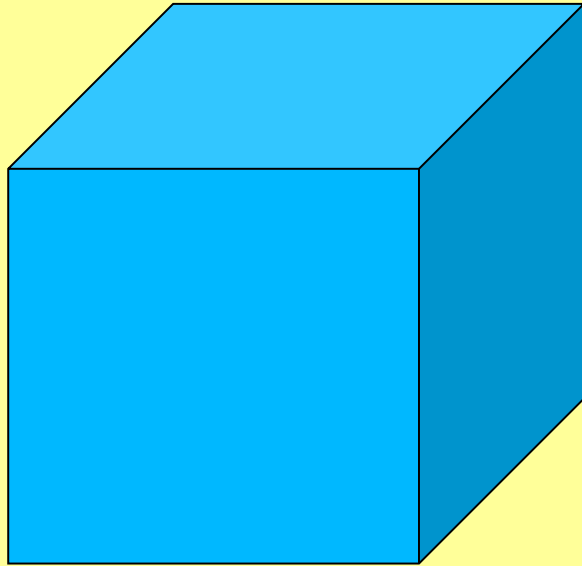
unrecognized workers

- Organic matter decomposition
- Release of nutrients contained in dead organic matter
- Provision of nutrients required by plant growth
- A very efficient association between:
 - Invertebrates (organical matter fragmentation)
 - Microorganisms (chemical decomposition)

Decomposition chains



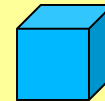
Importance of fragmentation



Ex. cube : each side is 10 cm long, **unfragmented**:

$$\text{Volume} = 1000 \text{ cm}^3$$

Available surface for decomposers = $6 \times 100 \text{ cm}^2$
= 600 cm^2



Ex. cube : each side is 10 cm long, **fragmented** in 1000 cubes of 1 cubic cm:

Available surface for decomposers
= $6 \times 1 \text{ cm}^2 \times 1000$
= 6000 cm^2

Ecological roles of dead wood insects

- Boosting wood decomposition
 - ex. Ukraine:
 - Pine tree (*Pinus sp.*) decomposition:
 - 12 years without invertebrates
 - 7 years with invertebrates
 - Oak tree (*Quercus sp.*) decomposition:
 - 20 years without invertebrates
 - 12 years with invertebrates

Stump 0-3 years



Agrilus viridis Buprestidae



Chrysobothris affinis Buprestidae



Rhagium mordax Cerambycidae

Stump 4-7 years



Anobium sp. Anobiidae



Melasis buprestoides Eucnemidae



Uleiota planata Cucujidae

Stump 8-11 years



Dorcus parallelipedus Lucanidae



Helops coeruleus Tenebrionidae



Pyrochroa coccinea Pyrochroidae

Ecological roles of dead wood insects

- Preys for predators (vertebrates and invertebrates)
- Habitat builders for wood dwelling invertebrates and for microorganisms
- Pollinators
- Feces producers (for coprophagous species)
- Bodies producers (for necrophagous species)

Present situation of dead wood insects

High number of rare species

Germany: 60% dead wood beetles on the red list

Many species have already disappeared in large areas

Relict species in a few isolated reservoirs

Old trees without successors

« Recreating » suitable habitats will last for centuries

Conservation measures

- Protect old forests with « relict » species
- Maintain and/or create corridors between forests
- Enhance structural diversity within a managed forest:
 - Stepped edges
 - Clearings
 - High number of tree species of different ages
 - Old and successor trees
 - Dead wood (different types)

Natural clearings



Windthrows



Stepped edges



Half open habitats



Wooded meadows



Orchards



Floodplains

Tree species diversity



Habitat diversity



Old trees



...and their successors



Conclusion (I)

- General measures to enhance dead wood insects are possible without species knowledge.
- Targeted measures to protect specifically threatened species require a good species knowledge, including species autoecology and localisation.

Conclusion (II)

- Biodiversity conservation must not only aim at protecting a large number of species but at conserving rare and threatened species.
- Species knowledge is essential!

Spruce bark beetle as national park manager

The example of the national park « Bavarian forest »

free summary of a presentation by
Karl Friedrich Sinner at a symposium
in Chambéry (F) 2008

(photos Nationalpark Bayerischer Wald)



Grenzenlose Waldwildnis im ersten deutschen Nationalpark

„Natur Natur sein lassen“ lautet die Philosophie, und in der Tat, nirgendwo zwischen Atlantik und Ural dürfen sich die Wälder mit ihren Mooren, Bergbächen und Seen auf so großer Fläche nach ihren ureigenen Gesetzen zu einer einmaligen wilden Waldlandschaft, einer „grenzenlosen Waldwildnis“, entwickeln.

- Park created in 1970, enlarged in 1997 to 24'000 ha.
- Bordering Sumava NP 70'000 ha.
- 99 % of the area is a forest but there are also peat bogs, ponds, lakes and pastures
- No human activity on 11'000 ha.



Spruce bark beetle : pest or architect ?



www.skogoglandskap.no

Understanding the role of this species

- Family Curculionidae Scolytinae
- About 120 Scolytinae species in central Europe
- 1 celebrity: the spruce bark beetle (*Ips typographus*)
- The spruce bark beetle colonizes almost exclusively weakened or freshly dead spruces (*Picea abies*)
- In case of pullulations, it can also colonize healthy trees



Impact of outbreak on fauna

Capercaillie ↗ (*Tetrao urogallus*)

- Irregular structures created by outbreak offer hiding places
- Increase of blueberry, food of capercaillie



Impact of outbreak on fauna

Otter (*Lutra lutra*) ↗

More light on streams

=> Increase of water temperature

=> Increase of nutrients in water

=> Increase of fish populations

=> Increase of otter populations



Impact of outbreak on vegetation

- Excellent spruce regeneration because :
 - No wood removal
 - Rich soil
 - Much light



Impact of outbreak on flora and fauna

Increase of dead wood related organisms





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www.hlasek.com

Prionus coriarius 6672



Conclusions

- Maximizing biodiversity is not the main aim.
- When natural processes can occur, typical fauna and flora of mountain habitats are enhanced.
- The spruce bark beetle is considered as the most structuring species regarding biodiversity.
- Large untouched areas allow occurrence of natural processes.

Conclusions

- In the present case, there are no economical aim. This enables to observe processes which are impossible to see in a managed forest.
- Outbreak is a source of natural regeneration.



Any question ?

