Definition of the Index of Biodiversity Potential for forests in Europe and the Mediterranean Basin (IBP EUR.MED v3.0)

IBP is a practical tool for evaluating the hosting capacity of a forest stand for animal, plant and fungal species. It thus makes it possible to easily integrate ordinary taxonomic biodiversity into day-to-day forest management by identifying the favourable factors to be preserved and the factors that can be improved (Larrieu & Gonin, 2008).

*There is a harmonized definition of IBP for **Catalonia, France and Italy**, resulting from R&D programs carried out on IBP since its creation in 2008 (see bibliography), and a definition is being finalized for **Belgium, Greece, Switzerland and all of Spain**.*

*For **other European and Mediterranean countries**, **this document gives a definition of IBP** that can be used in forests in the **Alpine, Atlantic, Continental and Mediterranean biogeographical regions** (see Figure 1). This definition is taken from existing IBP versions and may require adaptation to the regional forest context (especially the passages highlighted in yellow in this document). Any definition adapted to a new country must be carried out in accordance with the IBP extension methodology and validated by the IBP International Committee of Experts (Gonin* et al.*, 2017).*

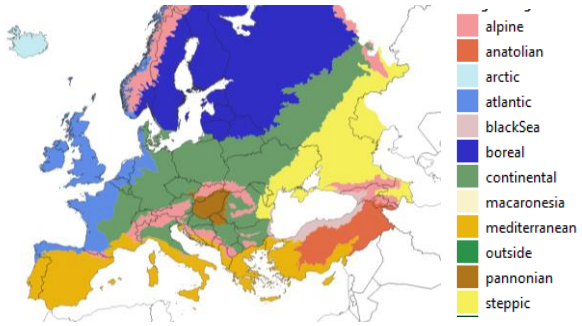

Figure 1 – Biogeographical regions in Europe (European Environment Agency, 2016)

*For the **other biogeographical regions** and the **countries not covered by the map** fig.1, use as a test one of the versions of the IBP presented in this document, choosing the one established for the region with the characteristics close to those in the area of use.*

To carry out the surveys, consult the description of the survey methods (Gonin, Larrieu, 2023) and the field sheets.

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- This document has been produced as part of the IBP improvement and extension activities, in particular through the following projects:
  - **French R&D program on the IBP** led by the National Forest Ownership Centre (**CNPF** - Centre national de la propriété forestière) and the National Research Institute for Agriculture, Food and the Environment (**INRAE UMR Dynafor** - Institut national de recherche pour l'agriculture, l'alimentation et l'environnement), with the financial contribution of the French Ministry in charge of the Environment;
  - **BIORGEST** (LIFE17 NAT/ES/568, www.lifebiorgest.eu) carried out in Catalonia and France, with the participation of the CNPF and the Forest Ownership Centre (**CPF** - Centre de la Propietat Forestal, www.gencat.cat/cpf) and the financial contribution of the European Union;
  - **GoProFor** (LIFE17 GIE/IT/000561, www.lifegoprofor.eu) carried out in France and Italy, with the participation of the CNPF and **DREAm Italia** (Società cooperativa agricolo forestale, coordinamento@lifegoprofor.eu) and the financial contribution of the European Union;
  - **GoProFor Med** (LIFE21 NAT/IT/101074738, www.lifegoproformed.eu) carried out in France, Greece, Italy and Spain, with the participation of the CNPF and DREAm Italia and the financial contribution of the European Union.

  Document **validated by the IBP International Committee of Experts**.

- **Thanks** for their contribution to the members of the BIORGEST, GoProFor and GoProFor MED projects, to the members of the IBP International Committee of Experts, to the researchers (Frédéric Gosselin…), to Céline Emberger as well as the CNPF environmental engineers and staff who tested IBP, to the members of the Steering Committee of the IBP R&D programme, to the users who gave us their opinion, to all the owners who allowed us to carry out tests, to Sarah Rotiel (CNPF-IDF) for the English version and to Jonathan Spazzi for reviewing the English.

  Translation: Sarah Rotiel (CNPF-IDF), Mark Bossanyi (markbossanyi@gmail.com), with the contribution of Jonathan Spazzi.

- The **IBP logo** is a registered trademark in the European Union. Its use is possible by respecting the definition of IBP given by the authors.

- **Reference**: Gonin P., Larrieu L., Baiges T., Palero N., Miozzo M., Corezzola S. : 2023 - *Definition of the Index of Biodiversity Potential for forests in Europe and the Mediterranean Basin (IBP EUR.MED v3.0)*. CNPF, INRAE Dynafor, 01/10/23, 12 p.

Co-funded by:

Index of Biodiversity Potential
for forests in Europe and the Mediterranean Basin

Atlantic, Continental and Alpine regions
lowlands (plain and hilly levels) and highlands (montane and subalpine levels) + Mediterranean montane level

Factors related to stand and forest management		score
A - Native tree species	Count native tree species: - from the **following list of genera** (without detailing the species), count only species that are **native to the region**: ✦ *Abies* ✦ *Acer* ✦ *Alnus* ✦ *Arbustus* ✦ *Betula* ✦ *Carpinus* ✦ *Castanea* ✦ *Celtis* ✦ *Fagus* ✦ *Fraxinus* ✦ *Juglans regia* ✦ *Juniperus thurifera* ✦ *Larix* ✦ *Malus* ✦ *Ostrya* ✦ *Picea* ✦ *Pinus* ✦ *Platanus* ✦ *Populus* ✦ *Prunus* ✦ *Pyrus* ✦ *deciduous Quercus* ✦ *evergreen Quercus* ✦ *Salix* ✦ *Sorbus* ✦ *Taxus* ✦ *Tilia* ✦ *Ulmus* - **living trees > 50 cm** in height (all growth stages) or **dead trees**	<table><tr><td></td><td>lowlands, mont.</td><td>subalpine</td></tr><tr><td>**0**</td><td>0 or 1 genera</td><td>0 genera</td></tr><tr><td>**1**</td><td>2 genera</td><td>1 genera</td></tr><tr><td>**2**</td><td>3 or 4 genera</td><td>2 genera</td></tr><tr><td>**5**</td><td>5 genera and +</td><td>3 gen. and +</td></tr></table>Maximum **score 2** if the canopy cover of all native tree species is **< 50%** of the stand described
B – Vertical structure of the vegetation	Count number of layers for all species (native or not): - from the following **5 layers**: . **herbaceous** and **semi-ligneous** . for woody species, layers occupied by **foliage**: ✦ **very low** (< 1.5 m) ✦ **low** (< 7 m) ✦ **intermediate** (7-20 m) ✦ **high** (> 20 m) - 1 tree to be counted in each layer occupied by its foliage (several layers possible for one tree) - count only layers covering at least 20% of the area described	**0** : 1 layer **1** : 2 layers **2** : 3 or 4 layers **5** : 5 layers
C - Large standing deadwood	Regardless of the species (native or not), count the number of standing deadwood **≥ 1 m high**, whether dead trees, snags or high stumps: - **large deadwood** (LDW), size at 1.3 m high: **D > 37.5 cm** (special case[1, 2]: D > 17.5 cm) - **medium deadwood** (MDW), size at 1.3 m high: **17.5 cm < D < 37.5 cm**	**0** : LDW/ha < 1 and MDW/ha < 1 **1** : LDW/ha < 1 and MDW/ha ≥ 1 **2** : 1 ≤ LDW/ha < 3 **5** : LDW/ha ≥ 3
D - Large lying deadwood	Regardless of the species (native or not), count the number of lying deadwood **≥ 1 m length**: - **large deadwood** (LDW), size at 1 m from the larger end: **D > 37.5 cm** (special case[1, 2]: D > 17.5 cm) - **medium deadwood** (MDW), size at 1 m from the larger end: **17.5 cm < D < 37.5 cm**	**0** : LDW/ha < 1 and MDW/ha < 1 **1** : LDW/ha < 1 and MDW/ha ≥ 1 **2** : 1 ≤ LDW/ha < 3 **5** : LDW/ha ≥ 3
E - Very large living trees	Regardless of the species (native or not), count the number of: - **very large trees** (VLT), size at 1.3 m high: **D > 67.5 cm** (special case[1, 2]: D > 47.5 cm) - **large trees** (LT), size at 1.3 m high: **47.5 cm < D < 67.5 cm**	**0** : VLT/ha < 1 and LT/ha < 1 **1** : VLT/ha < 1 and LT/ha ≥ 1 **2** : 1 ≤ VLT/ha < 5 **5** : VLT/ha ≥ 5
F - Living trees bearing microhabitats	Regardless of the species (native or not), count the number of living **trees bearing microhabitats**, using the instructions and typology below: - list of the **15** tree-related microhabitat (TreM) groups: ✦ **Woodpecker breeding cavities** ✦ **Rot-holes** (ø > 10 cm or > 30 cm if semi-open or open) ✦ **Insect galleries and bore holes** (ø > 2 cm) ✦ **Concavities** (ø > 10 cm, depth > 10 cm): dendrotelm water-filled or woodpecker foraging excavation or bark-lined trunk concavity or buttress-root concavity ✦ **Exposed sapwood only**: bark loss or fire scar (S > 600 cm² = A4) or bark shelter/pocket (gap > 1 cm, depth and height > 10 cm) ✦ **Exposed sapwood and heartwood**: stem breakage (ø > 20 cm) or limb breakage at the trunk (ø > 20 cm or S > 300 cm² = A5) or crack (width > 1 cm, depth > 10 cm, length > 30 cm) ✦ **Crown deadwood**: dead branches or dead top (ø >20 cm and L > 50 cm, or ø > 3 cm and > 20% of the crown is dead) ✦ **Twig tangles**: witches' broom (> 50 cm) or epicormic shoots (> 5 twig clusters) ✦ **Burrs and cankers** (ø > 20 cm) ✦ **Perennial fungal** fruiting bodies: Polypore (ø > 5 cm) ✦ **Ephemeral fungal** fruiting bodies: annual polypore or pulpy agaric (ø > 5 cm or number > 10) ✦ **Epiphytic or parasitic** crypto- and phanerogams: bryophytes or foliose / fruticose lichens or ivy / lianas (> 20% of the trunk area covered for at least one of these types), ferns (> 5 fronds) or mistletoe (10 clusters > 20 cm) ✦ **Nests** : large vertebrate nests (ø > 50 cm) ✦ **Microsoils** (crown microsoil at any position in the tree) ✦ **Fresh exudates** (fresh significant flow of sap or resin > 20 cm) - a tree is **counted several times** if it carries dendromicrohabitats from different groups - a tree supporting several dendromicrohabitats from the same group is counted only once - count a **maximum of 2 trees/ha per group** of dendromicrohabitats	**0** : tree/ha < 2 **1** : 2 ≤ trees/ha < 3 **2** : 3 ≤ trees/ha < 8 **5** : trees/ha ≥ 8
G - Flower-rich open areas	Record the % area of open areas compared to the surface described. Open areas are: - defined by the presence of **flowering vegetation** specific of open habitats (flowering plants different from those observed under cover, or identical but with more abundant flowers such as *Rubus*) - **permanent** or **temporary** - present in 3 forms, of which only the fraction clearly occupied by floriferous vegetation is counted: . **forest gap or clearing** in the stand described . **edge** of path (if the path crosses the stand described: count 2 edges if they are quite visible, otherwise only one) or **edge** with an adjacent open environment (moor, meadow, crop, open stand); surface area calculated with a standard width of **2 m** (e.g.: 35 m edge → 70 m²) . **sparse stand** or stand with **light foliage**, without clearly identifiable gaps	<table><tr><td></td><td>lowlands, montane</td><td>subalpine</td></tr><tr><td>**0**</td><td colspan="2">0%</td></tr><tr><td>**2**</td><td>< 1% or > 5%</td><td>< 1%</td></tr><tr><td>**5**</td><td>1 to 5%</td><td>≥ 1%</td></tr></table>
Factors related to the context, result of station, history or conditions but may change with forestry activities		
H - Forest continuity over time	Determine whether the forest is **ancient**, i.e. present continuously (= not cleared) since a reference date, which varies by country and corresponds to either the date of the minimum forest coverage, or a prior date, corresponding to that of a document accurately representing the forests. Otherwise, the forest is recent. - **In the office**: consult the **document** (map or aerial photo) that represents the forests at the chosen reference date; if the forest is present on this document, consult more recent documents (aerial photos, management documents, etc.) that may indicate subsequent partial (score 2) or full (score 0) **clearing**, or **replanting with full cultivation** (score 2). If no such document exists, assess whether the forests may have been cleared using ancient documents. - **In the field**: . in ancient forests: look for signs of agricultural use (low wall, cultivation terraces, etc.) indicating either partial (score 2) or full (score 0) **clearing**; in the case of a plantation, look for clear evidence of **soil disturbance over the entire area**, with full cultivation (score 2). . in recent forests: look for signs of **partial woodland continuity** (relict old trees, rocky areas that has remained wooded, etc.; score 2)	**0** : recent forest (land cleared over the entire surface) **2** : partially continuous forested state (partially clearing) or continuous but planted with full cultivation **5** : ancient forest (land not cleared, even partially, or not planted with full cultivation)
I - Aquatic habitats	Count the types of aquatic habitat types, located within or on the edge of the stand described: - in the list below: ✦ **Spring** or seepage ✦ **Small stream**, unmaintained humid ditch or small channel (width **< 1 m**) ✦ **Stream** (width: **1 - 8 m**) ✦ **River**, estuary or delta (width **> 8 m**) ✦ **Backwater** ✦ **Lake** or deep water body ✦ **Pond,** lagoon or shallow water body ✦ **Pool** or other small water body ✦ **Peat bog** ✦ **Marshy area** ✦ **Sea** or **ocean** - natural or man-made - permanent or temporary (but present apart from flood episodes)	**0** : no type **2** : 1 type **5** : 2 types and more
J - Rocky habitats	Count the types of rocky habitat types, located within or on the edge of the stand described: - in the list below: ✦ **Cliff** or rock wall higher than that of adult trees ✦ **Rock wall smaller** than that of adult trees ✦ **Rock slab** ✦ **Lapiaz** or large fresh **fracture** ✦ **Cave** or chasm ✦ **Unstable scree** ✦ **Stable rock pile** (stable scree, heap of stones, ruin, stone wall > 20 m) ✦ **Pile of boulders** > 2 m ✦ **Large rocks** (> 20 cm) or **rock outcrops other** than slab or lapiaz ✦ **Outcropping pebble bank** (outside stream bed) ✦ Deposit of **fine sediments**, sparsely vegetated (alluvial deposit outside stream bed, dune) ✦ **Loose vertical bank** or **wall of loose material**, sparsely vegetated - only count a type if its cumulative surface area **> 20 m²**	**0** : no type **2** : 1 type **5** : 2 types and more

[1] low-fertility stations: when trees cannot reach VLT size thresholds, even at the end of their life cycle; infrequent cases (often less than 10%)

[2] species that never grow to a large size (*Acer monspessulanum*, *Alnus incana*, *Arbutus*, *Malus*, *Prunus padus*, *Pyrus*, *Sorbus* other than *S. torminalis* and *domestica*…)

CNPF, INRAE Dynafor – IBP EUR.MED-ACA v3.0 (01/10/23)

Index of Biodiversity Potential
for forests in Europe and Mediterranean Basin

Mediterranean region
Thermo, meso and supramediterranean levels
(Mediterranean montane level: use the IBP definition for the Alpine region)

Factors related to stand and forest management		**score**
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[1] low-fertility stations: when trees cannot reach VLT size thresholds, even at the end of their life cycle; infrequent cases (often less than 10%)

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SUPPLEMENTS TO THE DEFINITION OF IBP V3.0

What is the field of application of the IBP? IBP is used in all types of forest, with adaptations of definition according to the biogeographical region and the vegetation level. The IBP was designed for **forest stands, regardless of the stage** of **silvicultural or natural succession** (including regeneration). In non-forest vegetation, such as thermomediterranean shrubs, or in habitats combining afforestation and open areas (e.g. agroforestry stands, dehesas), it will therefore only describe diversity with reference to the forest stage.

How to determine the biogeographic region and the vegetation level?
The biogeographic division used is that produced by the European Commission for the application of the Habitats Directive (see fig. 2; available on the EEA website in image or SIG format). At the region edge, in particular if this determination conditions the choice of an IBP version, as well as for the determination of the vegetation level, refer to more precise documents when they exist (vegetation maps, local site studies, etc.).

Fig. 2 – E.g. of biogeographic limits in France

How to determine fertility? The very low-fertility sites are those on which the trees cannot reach the VLT size threshold, even at the end of their biological cycle. They can be identified using local site studies or production tables. This situation is rare (often less than 10%), except at the top of the subalpine level where growing conditions are more difficult.

Can IBP be used in linear stands (width < 15 m)? Yes, by replacing the density per ha thresholds by density per km thresholds for 4 factors (see tab. below). However, this adaptation does not take into account the issues specific to these environments, nor the particularities linked to their shape, such as, for example, greater edge effects.

Factors	Score 0	Score 1	Score 2	Score 5
C and D – Large standing and lying deadwood (LDW: large deadwood; MDW: medium deadwood.)	LDW/km < 9 et MDW/km < 9	LDW/km < 9 et MDW/km ≥ 9	9 ≤ LDW/km < 15	LDW/km ≥ 15
E – Very large living trees (VLT: very large trees ; LT : large trees)	VLT/km < 9 et LT/km < 9	VLT/km < 9 et LT/km ≥ 9	9 ≤ VLT/km < 20	VLT/km ≥ 20
F - Living trees bearing microhabitats (TreM) Count a maximum of 9 trees/km per group of TreM[1]	trees/km < 12	12 ≤ trees/km < 15	15 ≤ trees/km < 25	trees/km ≥ 25

1: replace the rule « count a maximum of 2 trees/ha per group of TreM » (this implies having at least 3 different groups on 1 ha to have the score 5, i.e. 9 trees per group of TreM on a linear of 1 km)

Factor A - How to know if a species is native? It is necessary to place the survey in relation to the natural area of the species, which is given by the European Atlas of Forest Tree Species, the EUFORGEN maps or by any scientific studies. Archaeophytic species, present before the start of world trade around 1500, are also classified as native species when they are located in their ancient area of introduction (e.g. *Castanea sativa*, *Cupressus sempervirens*, *Juglans regia*, *Pinus pinea*). These introduction areas are usually documented in the maps mentioned above (EUFORGEN and European Atlas of Tree Species).

What species should be counted? Limit to the genera mentioned in the definition and, within a genus, to the species native to the survey region. When a genus includes shrub and tree species, only the latter are noted in the IBP (e.g. note the presence of *Salix alba* but not *Salix cinerea*); if in doubt, consult the botanical literature. To avoid errors, species names are sometimes specified (e.g. *Juglans regia* and *Juniperus thurifera*, the only species to be noted in *Juglans* and *Juniperus*). The oak is a special case with subdivision of the genus into two groups: evergreen oaks (including pseudo-evergreen species such as *Q. suber*) and deciduous oaks (including marcescent species).

Factor B - Can the same tree be counted in several layers? Yes, because this factor describes the vertical distribution of the vegetation, not the distribution of the trees according to their height.

List of semi-woody plants: plants bearing woody and herbaceous branches, in the state of undershrubs and lianas: *Erica spp.*, *Calluna vulgaris*, *Lonicera periclymenum*, *Daphne spp.*, *Solanum dulcamara*, *Ruscus aculeatus*, some small scrubs (*Genista pilosa, G. tinctoria*…), *Hedera helix*, *Vaccinium spp.*, *Rhododendron spp.*, *Rubus spp.*, etc.

Factor C and D - What is the criterion to differentiate lying and standing deadwood? A dead wood will be considered on the ground if its main branches touch the ground (which corresponds approximately to an angle of inclination of the trunk, in relation to the ground, less than 20%).

How to measure the diameter of standing deadwood? It is measured at 1.3 m high, on the upper side on sloping ground. When the height is between 1 m and 1.3 m, then measure the diameter at 1 m from the ground.

How to count a dead fallen tree that has broken or been cut into several pieces? Count only one deadwood, because these divisions have little effect on the hosting capacity.

Factor F - Are there documents to help recognize dendromicrohabitats (TreMs)? Yes: typology attached to the IBP definition + documents available on the internet: Field guide to tree-related microhabitats (Bütler *et al.*, 2020 ; attention: use the threshold values of the IBP typology which may differ slightly from those of this Guide) + WSL videos.(Bütler & Larrieu, 2023) + interactive platform (Bütler, Rosset, Larrieu, 2021).

Is it useful to differentiate the types of TreMs inside a group? No, to facilitate the survey, the TreMs are attached to one of the 15 groups and not to one of the 41 types used in the IBP, which are only described to facilitate the recognition of the TreMs.

How many times to count a tree with several TreMs belonging to different groups? As many times as groups of TreMs represented, even if these TreMs are superimposed (e.g. fungal sporophores on exposed sapwood). On the other hand, the tree is only counted once if the TreMs belong to the same type (e.g.: a single TreMs on a tree with several small woodpecker cavities) or to the same group (e.g.: a tree carrying moss and lichen is counted only once because these 2 types of TreMs belong to the same group " Epiphytic or parasitic crypto- and phanerogams ").

How can the number of living trees bearing microhabitats be capped in a survey? Count a maximum of 2 trees/ha per group of TreMs (e.g. 2 trees/ha bearing concavities, whether dendrotelms or root concavities).

What part of the tree should be observed? The trunk and its main subvertical divisions (upper log, large ascending limbs). In order to limit the observation time and the observer effect, only the most visible or specific dendromicrohabitats of the crown are observed: crown deadwood, stem or limb breakage, witch brooms, nests of vertebrates.

Do we have to look carefully at all the trees to inventory the dendromicrohabitats? No, because the IBP survey is not an exhaustive inventory, but a quick description during a walk through the stand. The thresholds used to determine the IBP score take this underestimation into account and they are relatively low compared to the numbers of dendromicrohabitats likely to be encountered. The operator must nevertheless approach a tree that appears to have a dendromicrohabitat in order to verify its presence and identify it with certainty, or move around it to adapt its angle of vision.

In a coppice stool, is an old stump counted as "Exposed sapwood only"? No if it is separated from the living stems (e.g. clearly separated at the level of the stem collar). To be counted, the cut must "affect" the nearest living stem and the "stump" must be an integral part of the living stem, with a common base, as in the case of a twin with one of the two cut stems.

Does the accumulation of litter (leaves, twigs) in the centre of a coppice stool or fork constitute a crown microsoil? Only if the organic matter has evolved enough to form humus and the litter accumulates on unweathered wood where water cannot be retained. So, on a decaying stump or in the centre of a coppice stool, the litter does not form a microsoil. In a fork, it is a dendrotelm in the presence of water or a rot-hole if the wood is weathered.

Factor G - Which species define a “flower-rich open area” as defined by the IBP? These are **all plants used by flower-visiting insects (i.e. species dependent on pollen or nectar provided by plants)**, whether herbaceous species (dicotyledonous), semi-woody species (*Rubus, Erica, Calluna*, etc.) or woody species among shrubs and under-shrubs (*Cistus, Genista, Pistacia lentiscus, Rhamnus alaternus, Rosmarinus, Ulex*...). Tree species are excluded (*Tilia*...), even if shrubby, as well as *Carex, Juncus*, grasses and ferns (see for example the list of species foraged by wild bees in France on the site www.florabeilles.org).
The floriferous open areas can be made up either of species different from those observed under forest cover (for example *Epilobium angustifolium*), or identical species, but with greater development and flowering than under forest cover (case of the bramble which is higher and more flowery in the gaps).
To be counted in the IBP, the flower-rich open areas must have a significant covering of flowering plants, capable of increasing the hosting capacity of the stand for flower-visiting species.

Factor H – Which documents should be used to characterize the forest continuity over time? It is necessary to know if the forest is ancient, i.e. present continuously (= not cleared) since a **reference date** (Cateau *et al.,* 2015), that corresponds to either the date of the minimum forest coverage (between the 19th century and the present time, depending on each country) or an earlier date if a document accurately represents the forests at that date (e.g. in Belgium: minimum forest cover around 1850, but use of the Ferraris map of 1771-1774 as a reference).
To identify ancient forests, consult cartographic or photographic documents that represent the forests at the chosen reference date. If the forest is present on this document, check that there has been **no subsequent clearing** on more recent documents (aerial photos, management documents, etc.), which would lead the forest to be considered recent.
If there is no document from the date of the minimum forest coverage or earlier, more recent documents (e.g. aerial photos) and available archives will be used to assess whether the forest has been cleared since the date of the minimum forest coverage.

What type of cultivation lowers the score from 5 to 2 in an ancient forest? These are the works carried out during plantation when they cause **disturbance of the soil over the entire surface** (preparation by full plowing, stump removal with plowing, regular maintenance by disking between the lines). Localized works (making manual or mechanical posts, subsoiling on the planting line) do not fall into this category, nor do interventions that do not disturb the horizons, such as the crushing of slash. In the absence of information or field observation confirming that the work carried out at the time of planting caused disturbances of the soil in full, the score will not be lowered.

Factor I - Are temporary humid areas counted as aquatic habitats? Only if the water remains long enough to allow the development of a specific flora or fauna, at least during one period of the year. The presence of water should therefore not be limited to flood events.

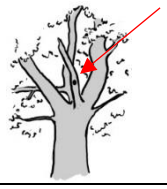
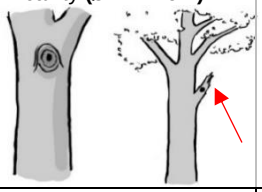
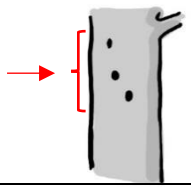
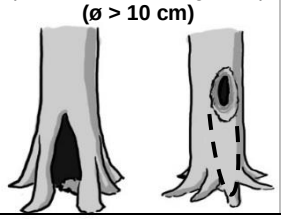
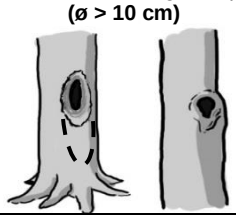
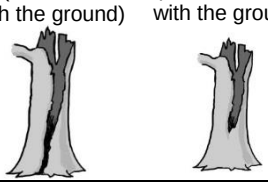
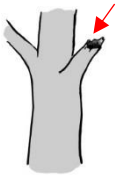
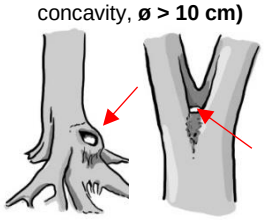
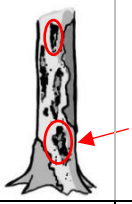
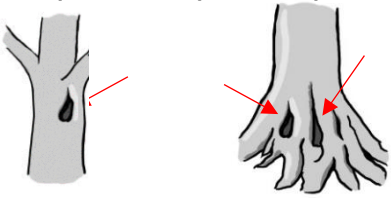
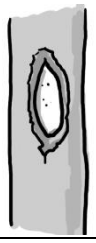
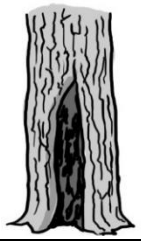
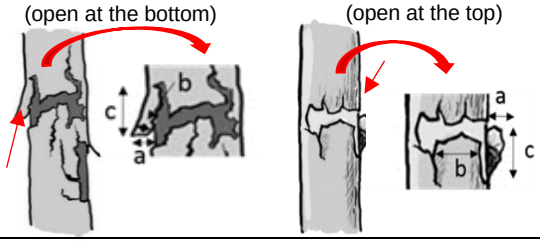
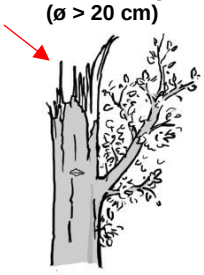
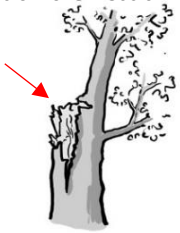
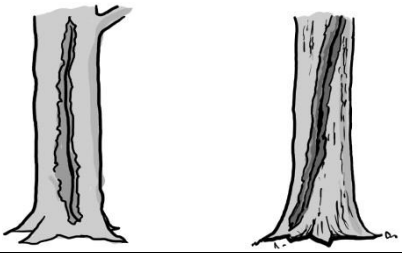
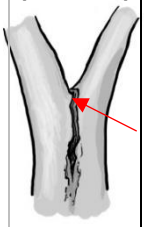
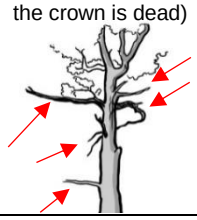
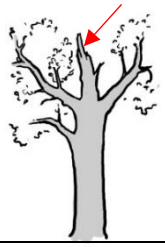
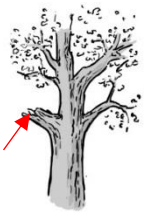
Do water-filled ruts count as aquatic habitats? No, because they are small and not always durable. Moreover, although ruts are sometimes used as a substitute habitat by certain species, it is recommended to avoid their creation.

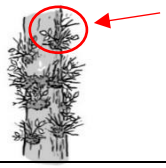
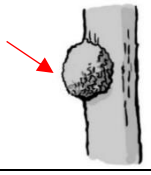
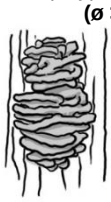
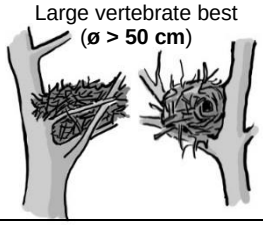
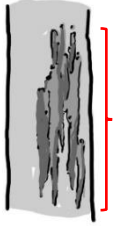
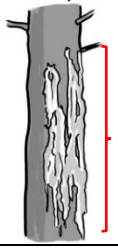
Factor J - Should rocky areas in rivers and streams be counted? Only if they are outside the river bed (defined by the high water mark, before the river overflows into the floodplain).

THE THREE TYPOLOGIES OF THE INDEX OF BIODIVERSITY POTENTIAL (IBP) USED IN V3.0

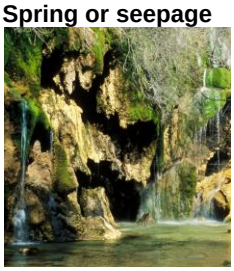
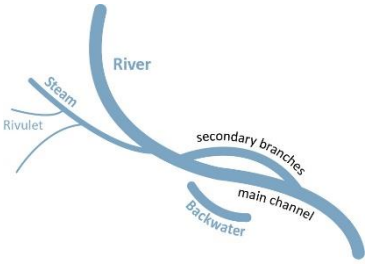
TYPOLOGY OF TREE-RELATED MICROHABITATS for temperate and Mediterranean regions

(illustrations from Larrieu *et al.*, 2018)

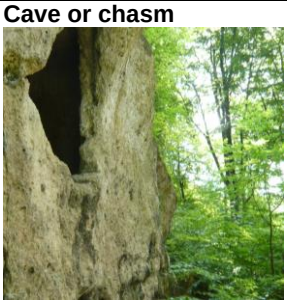
TreM groups	Types present in each of the TreM groups				
1 - Woodpecker breeding cavities	**Small** woodpecker breeding cavity **(ø < 4 cm)** 	**Medium-sized** woodpecker breeding cavity **(ø = 4-7 cm)** 	**Large woodpecker** breeding cavity **(ø > 10 cm)** 	**Woodpecker "flute" (≥ 3 breeding cavities** in line, **ø > 3 cm)** 	
2 – Rot-holes	**Trunk-base** rot-hole (in contact with the ground) **(ø > 10 cm)** 	**Trunk** rot-hole (without contact with the ground) **(ø > 10 cm)** 	**Semi-open** trunk rot-hole **(ø > 30 cm)** 	**Chimney (ø > 30 cm)** trunk-base rot-hole (in contact with the ground) trunk rot-hole (without contact with the ground) 	**Hollow** branch **(ø > 10 cm)** 
3 - Insect galleries and bore holes	Insect galleries and bore holes **(ø > 2 cm)** 				
4 - Concavities	**Dendrotelm** (water-filled concavity, **ø > 10 cm)** 	**Woodpecker foraging excavation (ø > 10 cm, depth > 10 cm)** 	Bark-lined trunk **concavity** Buttress-root **concavity (ø > 10 cm, depth > 10 cm)** 		
5 - Exposed sapwood only	**Bark loss (S >** 600 cm² = **A4)** 	**Fire scar (S >** 600 cm² = **A4)** 	**Bark shelter (a > 1 cm, « b » and « c » > 10 cm)** (open at the bottom) **Bark pocket** (open at the top) 		
6 - Exposed sapwood and heartwood	**Stem breakage (ø > 20 cm)** 	**Limb breakage** (heartwood exposed) **(ø > 20 cm** or S > 300 cm² = A5) 	**Crack (L > 30 cm, l > 1 cm, depth > 10 cm)** **Lightning scar** 		**Fork split** at the insertion **(L > 30 cm)** 
7 - Crown deadwood	Dead **branches (ø > 20 cm and L > 50 cm**, or **ø > 3 cm and > 20**% of the crown is dead) 	Dead **top (ø > 20 cm** at the lower part) 	Remnants of a **broken limb (ø > 20 cm, L > 50 cm)** 		

8 - Twig tangles	**Witches' broom (ø > 50 cm)** 	**Epicormic shoots (> 5 twig clusters)** 			
9 - Burrs and cankers	**Burr** 	**Decayed canker (ø > 20 cm)** 			
10 - Perennial fungal fruiting bodies	Perennial polypore (**ø > 5 cm**) 				
11 - Ephemeral fungal fruiting bodies	Annual polypore 	Pulpy agaric **(ø > 5 cm or number > 10)** 			
12 - Epiphytic or parasitic crypto- and phanerogams	**Bryophytes** (mosses and liverworts) (**S > 20%** of the trunk area covered) 	Foliose and fruticose **lichens** (**S > 20%** of the trunk area covered) 	**Ivy** and **lianas** (**S > 20%** of the trunk area covered) 	**Ferns (> 5 fronds)** 	**Mistletoe (10 boules ø > 20 cm)** 
13 - Nests	Large vertebrate best (**ø > 50 cm**) 				
14 - Microsoils	Crown microsoil (at any position in the tree) 				
15 - Fresh exudates	**Sap run** (fresh significant flow, **L > 20 cm**) 	**Heavy resinosis** 			

Legend - ø: diameter; S: area; L: length; l: width
For a detailed description, see WSL videos and Field Guide to Tree-related Microhabitats (Bütler *et al.*, 2020; note: use the threshold values of the IBP typology which may differ slightly from those in the Guide)

TYPOLOGY OF AQUATIC HABITATS		
Types of aquatic habitats	**How to identify them?**	**Comments**
Spring or seepage  © L.L.	A point where water emerges from underground. These habitats are limited to the point where the water seeps through. They may be a spring or an area of diffuse seepage on a slope or among rocks. Springs and groundwater seepage can give rise to small streams or marshy areas, which are defined as other habitat types).	At the point where the spring emerges, the water has the same characteristics as its underground water table: usually cool, even in summer, with a high oxygen concentration, although hot springs also exist. In either case, its characteristics differ from those of the streams or marshy areas fed by the spring. The biodiversity of these habitats is quite specific, with some species of high heritage value, such as the Killarney fern (*Trichomanes speciosum*) or the Willow-leaved loosestrife (*Lysimachia ephemerum*).
Small stream, unmaintained humid ditch or small channel  © P.G.	This type includes: > Small natural streams (width < 1 m) in the uppermost reaches of the hydrographic network. > Small man-made streams (width < 1 m), especially drainage or irrigation channels.	 The morphology and characteristics vary and are closely dependent on the rate of water flow, which in turn depends on the slope. They range from mountain torrents and cascades to meanders in lowland reaches. Rivers are mainly permanent, although some can flow intermittently in the Mediterranean region, especially the secondary river branches. Water flow may be either permanent or intermittent in small streams. The presence of specific and often hydrophilic vegetation on riverbanks or riverbeds indicates a habitat which is under water for part of the year. Water can therefore be present whether floods have occurred or not. Riverbanks and riverbeds may be governed by natural dynamics or modified by human activities. However, rivers with consolidated banks and regularly maintained ditches host far fewer species (a rough natural substrate providing shelters and anchorage is especially important when there is a current). Streams can the narrow enough to flow entirely beneath forest vegetation. Any stream or river has alternating stretches of faster or slower-moving water of different heights. As long as the water is visibly flowing, these successive stretches cannot be individualised. However, stretches with stagnant water trapped in hollows are considered as "shallow ponds and water bodies" when the water column is shallow (1 to 3 m on average) and as" lakes and deep water bodies" when the water is deeper.
Stream  © P.G.	No more than 1 to 8 m in width, streams are just downstream from small streams in the hydrographic network. As their catchment basins are small, their flow rate is low.	
River, estuary or delta  © P.G.	Over 8 m in width, these are downstream from streams. They may be subdivided into a main channel and secondary branches connected to it. Rivers may be tributaries of other rivers, while major rivers flow into the ocean or sea, sometimes forming an estuary (in which the tides mix freshwater and seawater) or a delta (when a river divides into several channels near its outlet due to the accumulation of sediment).	
Backwater  © P.G.	A section of a river corresponding to a former channel, which is usually disconnected from the main or secondary riverbed, except very occasionally when the river is in spate (see diagram below).	High seasonal variations in the volume of water and its characteristics (temperature, etc.), which influence the vegetation and fauna present.

TYPOLOGY OF AQUATIC HABITATS		
Types of aquatic habitats	**How to identify them?**	**Comments**
Lake or deep water body  © P.G.	A large, deep inland water body. (Natural or man-made).	At depths of 15 m or more, sunlight no longer penetrates and the water temperature rapidly decreases. Plant species cannot develop below 15 m. The water layers can be mixed by seasonal effects. In the case of artificial lakes (gravel pits, abandoned quarries, reservoirs, dams for irrigation, low water replenishment, hydropower, etc.), the materials used to build up the banks considerably reduce the number of species present. They are still used by wildlife for some purposes (as resting areas for ducks, for example).
Pond, lagoon or shallow water body  © P.G.	Although they are shallow (1 to 3 m in depth on average), the warming action of the sun does not always reach to the bottom of these water bodies. (Natural or man-made).	Depending on the water feeding them and where it flows from, these water bodies can be classified as: > Ponds: freshwater inland water bodies. Fed mainly by their rainwater catchment area. > Lagoons: coastal water bodies separated from the sea by a lido or dune cordon. Lagoon water may be brackish (temporarily or permanently in contact with the sea through a channel) or fresh (completely cut off from the sea and fed by surface run-off, rivers or groundwater). The shallow water promotes the development of both aquatic and amphibious vegetation (the latter being able to survive on dry land). These habitats often support highly productive flora and fauna.
Pool or other small water body  © L.L.	Small stretches of shallow, stagnant water (maximum 5000 m^2, up to 2 m in depth). The whole water column receives sunlight and plants can take root anywhere on the bottom. (Natural or man-made).	This category comprises all small shallow pools of water, including hoof prints, water barrels, drinking troughs and puddles, even if there is no aquatic vegetation due to their ephemeral nature or artificial construction. They are fed by rainwater, surface run-off or seepage. Pools can therefore be affected by climatic variations and dry up in the summer, especially in the Mediterranean zone. Ruts can host certain species but should preferably not be allowed to form as this is not compatible with good soil management.
Peat bog  © P.G.	Wetland habitat where the specific ecology has produced peat soil (organic matter that cannot break down well because of the asphyxiating conditions caused by the permanent presence of stagnant or very slow-moving water).	Peat bogs are highly diverse. Some are acid, others alkaline (also referred to as "low marshes"), and characterised by very different plant associations. Acid peat bogs are dominated by *Sphagnum* (indicators of cold climatic episodes in the past) and carnivorous plants, and alkaline bogs by *Carex*. Large peat bogs may be associated with streams or rivers and may contain stretches of water. They are also feeding, resting and reproduction zones for animal species seeking an undisturbed environment.
Marshy area  © P.G.	A wetland area where the soil is permanently saturated and often covered with a layer of stagnant water that does not form peat. The water level varies but there is always enough to support hydrophilic vegetation.	Marshes vary widely in size, occupying hollows and gently sloping land, especially in marshland regions. Marshes are often associated with springs, streams and water bodies of various types.
Sea or ocean  © P.G.	Salt water body.	The forest is rarely in direct contact with water, but some forests can be very close to water, especially on steep coastal slopes and rocky shores.

TYPOLOGY OF ROCKY HABITATS		
Types of rocky habitats	**How to identify them?**	**Comments**
Cliff or rock wall higher than that of adult trees  © P.G.	Sub-vertical rock wall several dozen metres in height, always higher than that of adult trees.	Composite habitat due to its large size. Large temperature differences on unshaded sections, very dry conditions due to wind pressure and lack of standing water.
Rock wall smaller than that of adult trees  © L.L.	Rocky wall or ledge of low height (smaller than that of adult trees).	Composite habitat rich in varied micro-reliefs, characterized by shady and cool conditions due to the presence of trees (at least in the adult stage).
Rock slab  © P.G.	An extensive sub-horizontal rocky outcrop	The horizontal surface facilitates: > Development of lithosols favourable to plant life; > Formation of small temporary pools of water.
Lapiaz or large fresh fracture  © P.G.	A carbonate rock surface with regular fissures of varying depths carved out by dissolution of the rock. This type also includes single large, deep fractures across a slab up to several metres in length.	A composite habitat made up of a rock slab or block with fissures where specific climatic and light conditions create a cool, moist and shadowy environment.
Cave or chasm  © P.G.	Only the opening is visible.	Very specific microclimatic and light conditions: > Constant temperature and humidity; > Light decreases away from the opening, sometimes to the point of complete darkness.
Unstable scree  © P.G.	An unstable accumulation of stones and rocks.	Little or no decomposing organic matter. Instability maintained by: > Shifting, e.g. by a passing large mammal; > Impacts of falling rock (e.g. from an unstable cliff).

TYPOLOGY OF ROCKY HABITATS		
Types of rocky habitats	**How to identify them?**	**Comments**
Stable rock pile  © L.L.  © P.G.	An accumulation of stabilised stones and rock, either natural (stable scree) or artificial (piled-up stones, stone wall or ruin).	Between the rocks and boulders, presence of decomposing organic matter or fine soil in smaller proportions than the rock and sometimes in only small quantities. In scree, all the communicating micro-cavities make up a particular habitat referred to as a "shallow subterranean habitat", which hosts highly specialised arthropods.
Pile of boulders  © N.G.	A pile of very large boulders (> 2 m).	Large empty spaces between boulders. Frequently produce cold humid conditions between boulders.
Large rocks or rock outcrops other than slab or lapiaz  © P.G.	These are medium-sized rock elements: > Large blocks (from 20 cm to 2 m in height, covering a significant surface area); > Rock outcrop of the underlying rock, that does not form a slab or lapiaz.	Medium rocks, moderately composite, but when many are present in a woodland, they offer habitats in different situations that are particularly attractive to invertebrates and reptiles
Outcropping pebble bank  © P.G.	An accumulation of pebbles in the floodplain of a river (all stony habitats present in the riverbed itself are included in the aquatic habitat category).	Pebbles that may shift when a river is in flood. The pebbles are often partly covered with vegetation, but only sparsely vegetated deposits are included in this type.
Deposit of fine sediments, sparsely vegetated  © P.G.	These may be fine sediment deposits: > In the floodplain of a river (the rocky habitats in the stream bed are integrated into the aquatic habitats), deposited during major floods; > In the form of a dune in the littoral zone.	These deposits are gradually vegetated and only sparsely vegetated deposits are included in this type.
Loose vertical bank or wall of loose material, sparsely vegetated  © P.G.	Unlike the rock walls, these walls are made of loose materials, but of sufficient cohesion to be subvertical. They are found: > On the banks of rivers, > Or on heavily eroded sedimentary materials.	Only deposits that are sparsely vegetated are included in this type. These walls are sufficiently loose to allow digging by birds (Bank swallows, Common kingfishers, etc.), insects, etc.

Typology of aquatic and rocky habitats from: Emberger C., Larrieu, L., Rotiel S., Gonin, P.: 2023. *Ten key factors for species diversity in forests. Understanding the Index of Biodiversity Potential (IBP). 2nd edition*. Paris: CNPF-IDF, 2023
Photos: L.L.: Laurent Larrieu; N.G.: Nicolas Gouix; P.G.: Pierre Gonin

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