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Into the woods

Overlapping perspectives on the history of ancient forest

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Chapter 2: Managing Walloon ancient woodlands as heritage

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Taking into account woodland ancientness in forest management plans as well as in wood product certification is a specificity of Walloon forest management. By combining the visions of public service and academic world views, this chapter details the historical traits of the Walloon woodlands, the influence of forestry operations and the recognition of the heritage value of ancient woodlands. Guidelines for differentiated management are provided.

A diverse history of Walloon woodlands

Abundant and precise mapping information allows woodland ancientness in Wallonia (Belgium) to be uncovered. The first reference map for Belgium was drawn around 1775 by Earl de Ferraris with outstanding geographical precision (about 1/11,520) and rich typology. Other maps from the second half of the 18th century can provide additional information, such as the French maps (Vallauri *et al.*, 2012) and the 'Seven Years' War' map (Nekrassoff, 2014). Two 19th-century (Van der Maelen and Dépôt de la Guerre) can also be used to assess land use at that time. Cross refrencing these old maps with current maps reveals an increase of 27% of the wooded area in Wallonia, from 431,000 ha to 546,000 ha, and considerable compositional changes.

Since the 18th century, large parts of Walloon broadleaved forests (which occupied about 431,000 ha on the historical maps) have been deforested for agriculture (124,000 ha or 30%) or transformed into exotic coniferous stands (108,000 ha or 26%). Only 44% of the 18th-century woodlands is still currently occupied by the original broadleaved woodlands (Table 2-1, Figure 2-1). Agricultural deforestation mainly concerns northern Wallonia (Figure 2-2), allowing the intensive development of crops on good soils, or grasslands in the wettest biotopes or valleys. Transformation into coniferous stands took place mainly in the Ardenne region (southern part), due to lower soil fertility and climatic conditions (Figure 2-2).

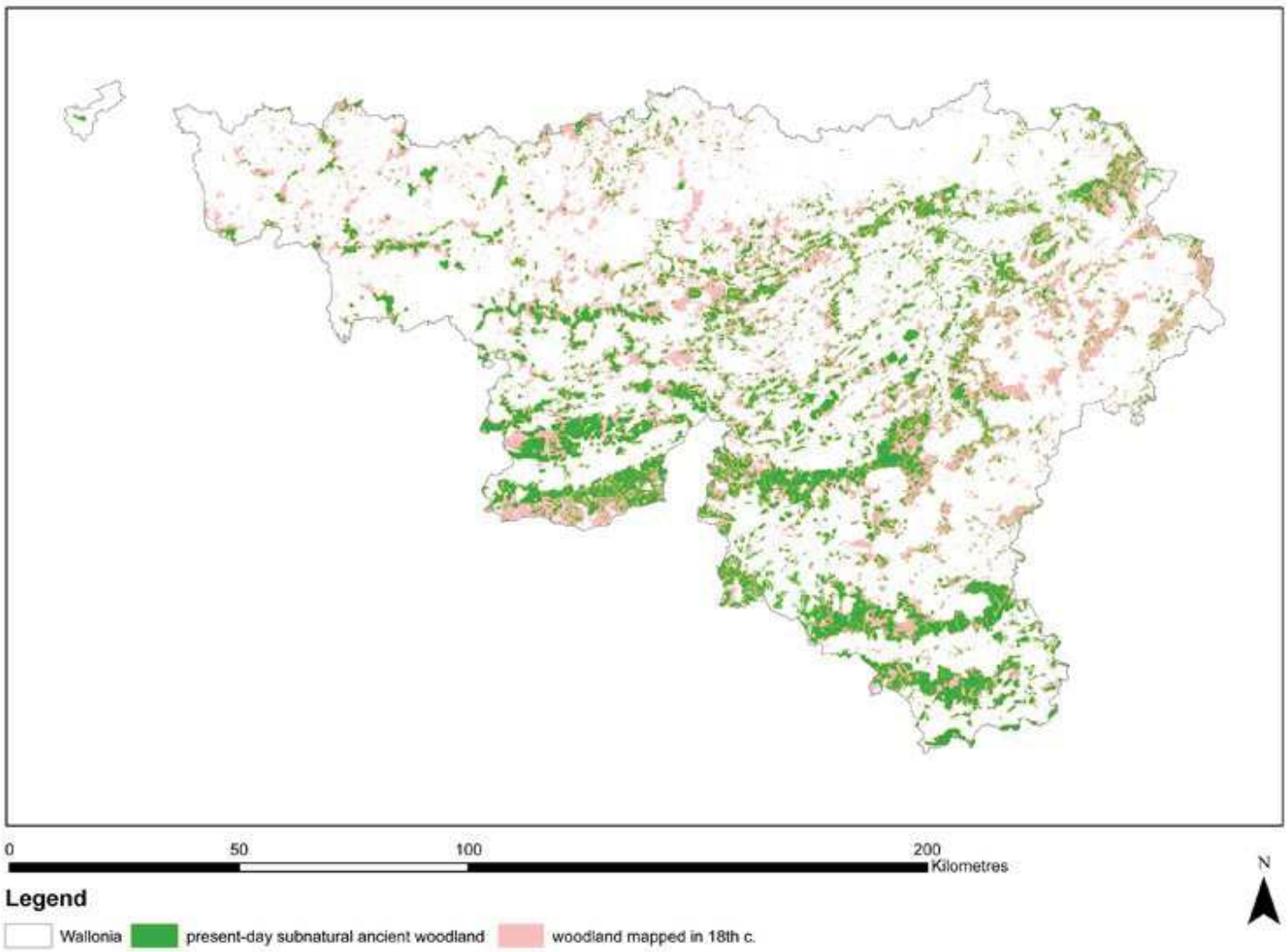

Figure 2-1: Regression of subnatural ancient woodlands in Wallonia, i.e., continuously forested broadleaved woodlands between the 18th century (woodlands mainly visible on the 'de Ferraris' map) and the 20th century. The difference is mainly due to deforestation (30%) and transformation into coniferous stands (26%).

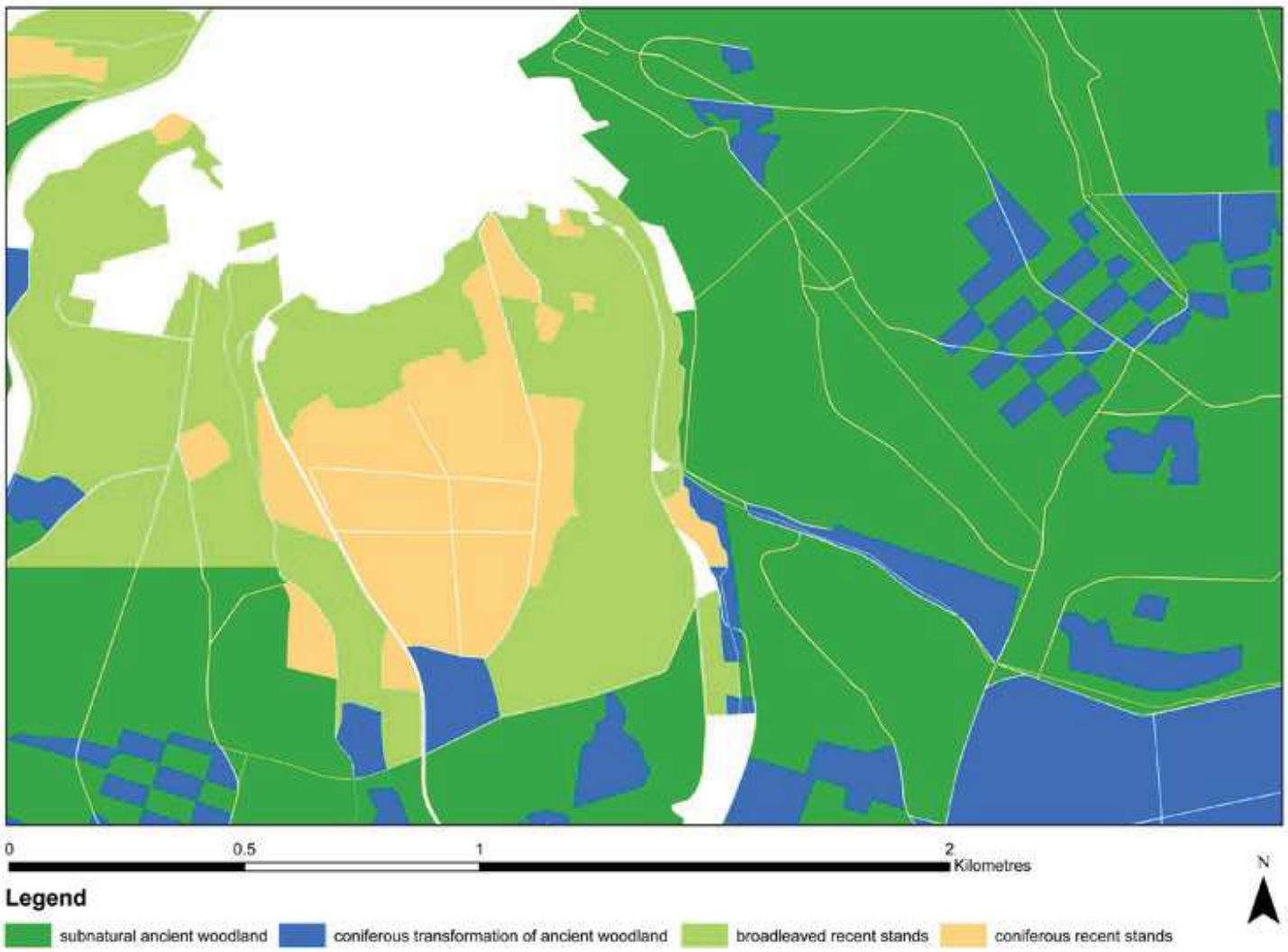

Figure 2-2: Map of woodland ancientness in Wallonia (extract).

Table 2-1: Surface area (ha) of each ancientness category.

Age level of forest massifs	Area occupied (ha)	Percentage of 18th- century forest area	Percentage of current forest area
Subnatural ancient forest	181,000	44%	33%
Resinous transformation of ancient forest	108,000	26%	20%
Temporary resinous transformation of ancient forest	800	0.2%	0.1%
Deciduous afforestation	117,000		21%
Coniferous afforestation	140,000		26%
Net deforestation since the 18th century	124,000	30%	

Walloon landscapes have been shaped by these interventions. Their intensity has varied over time but they have caused the gradual decrease of wooded area until the middle of the 19th century.

At that time, woodland area started to increase again due to the conjunction of various factors: the energy revolution (coal), a decline of sheep farming and the growing needs for wood. As a result, the current Walloon landscape is composed of three categories of woodlands (Kervyn *et al.*, 2014) with different levels of ancientness:

– subnatural ancient woodlands, with a continuous broadleaved cover since at least the second half of the 18th century, when the first land-use maps were produced (Cateau *et al.*, 2015). Relatively unaffected by anthropogenic changes, these woodlands are still in the form of native broadleaved stands, regardless of the silvicultural management;
– ancient woodlands that have been transformed, sometimes temporarily, into coniferous stands;
– recent broadleaved or coniferous stands, usually planted on heathland, grassland, arable land or, more recently, industrial land.

Subnatural ancient woodlands

Preserved for centuries, these woodlands constitute a remarkable heritage of high scientific and ecological value (Jacquemin *et al.*, 2014). Their economic, social and cultural role is also significant. Their structure and composition may have changed because of past management such as intensive coppicing, but their major characteristic is their preserved soil, which today gives them high heritage value. Developed by natural processes since the end of the glaciations, the soil has usually not been disturbed by tillage or fertilization. Possible exceptions include woodlands that have experienced slash-and-burn agriculture, but changes remained limited thanks to the absence of deep ploughing and chemical fertilization.

This exceptional continuity of broadleaved land use and soil preservation allows the conservation of a unique biological (Hermy *et al.*, 2007) and archaeological heritage (Dupouey *et al.*, 2002; Françoisse, 2015).

Long-lived species, whose life expectancy for individuals exceeds several decades, and/or philopatric species, whose dispersal abilities are limited, are typical of these ancient woodland areas. These species include many trees, but also geophytes, lichens, mycorrhizal fungi and even animals.

Conservation of old relict woodlands is considered a priority by many authors (Peterken, 1977; Vellend, 2003; Wulf, 2003).

Because of their authenticity, these woodlands are currently important natural resources, allowing our society to enjoy unspoilt places to reconnect with nature. The large number of tourists visiting these woodlands during bluebell flowering is a good example of these social and cultural roles.

Ancient forests transformed into coniferous stands

Many open broadleaved woodlands, previously harvested for charcoal, have been planted with coniferous trees, mainly since the second half of the 19th century (Thibaut *et al.*, 2007). In these plots, preparatory work for planting (clearcutting, drainage, and more recently, crushing, etc.) has weakened the biological and archaeological value, sometimes severely. In spruce stands – the most frequent coniferous stands in Wallonia – the permanent darkness and the physical-chemical changes of the soil (Nys, 1981) caused by the accumulation of needles have deeply modified the soil fauna and flora. For instance, geophyte species have disappeared from the alluvial plains (Herault, 2005). However, these woodlands have not undergone the same drastic soil transformations as is the case with current

agricultural land (ploughing, fertilization, soil improvement practices, use of herbicides, removal of vegetation and/or of soil seed bank). As a result, the potential for original broadleaved forests restoration in the long term still exists (Wulf *et al.*, 2008) after a slow recolonization of typical species. Coniferous species allowing a lush undergrowth, such as larches or pines, offer more restoration opportunities (Pryor *et al.*, 2002; Bergès *et al.*, 2017) than conifers with a dense canopy.

Recent afforestation

The Ardenne plateau has been the main focus of afforestation efforts, especially through conifer plantations. After a first wave of Scots pine plantation (in Belgium, these covered 130,000 ha at the peak in the early 20th century), spruce became the most planted species in 1895; many plots are today at their third revolution of mono-specific spruce stands. Scots pine is now only significantly species present on the poor soils of Fagne-Famenne, Ardenne and sandy regions (Thibaut *et al.*, 2007), while black pine used to be planted on the calcareous soils of the Mosane Valley and Calestienne. European larch has been rapidly neglected because of *Melampsora* epidemic, and Douglas fir has been frequently introduced since the end of the 20th century, in particular as a substitute for other coniferous species (Alderweireld *et al.*, 2015).

Most of the time, these stands have not been as converted into cropland, and they offer the possibility to restore pre-existing open habitats, whose areas have considerably decreased in the meantime, namely calcareous grassland (Delescaille, 2007), lean meadows, dry heathlands (Frankard *et al.*,2014) and wet moors (Cristofoli *et al.*, 2010). This opportunity has been promoted in the context of many European co-funded LIFE[5] projects targeting the re-creation of these natural habitats of community interest (Dufrêne *et al.*, 2015).

In addition to dense coniferous plantations, broadleaved afforestation also took place in Wallonia, namely poplar plantations mainly in Hainaut and Lorraine, and various native broadleaved species elsewhere: oak and beech plantations in the Ardenne, natural regeneration and plantation on agricultural land in Condroz, spontaneous shrubbing of calcareous slopes and moors no longer used by extensive grazing, shrubbing or plantations along transport infrastructure, slag heaps and industrial wastelands.

The significance of forest management methods

Because of their intrinsic characteristics, soils of subnatural ancient woodlands deserve special attention during forest management operations. They have better physical qualities (structure, porosity) and a specialized biodiversity (pedoflora, pedofauna, mushrooms, etc.). These parameters are the basis of mineral element recycling and water storage, which are the main drivers of soil fertility (Diedhiou *et al.*, 2009; Fichtner *et al.*, 2014; Hofmeister *et al.*, 2014). Additionally, these soils constitute the most intact and contamination-free soil reference systems, with major scientific and conservatory value (Ball *et al.*, 1981; Baeten *et al.*, 2011). Preserving these characteristics in the long term implies maintaining optimum soil functioning, namely by avoiding land-use changes, clearcuttings, tillage, amendments, fertilizers and pesticides. It is also essential to prevent soil

compaction caused by the use of increasingly heavy logging machines in forestry, especially on soils with low bearing capacity (Delecour, 1987; D'Or *et al.*, 2016). In addition to the alteration of flora and soil fauna, the anaerobiosis of woodland soils due to compaction is one cause of forest dieback (Goutal-Pousse *et al.*, 2014; Lüscher *et al.*, 2015). Many Walloon forests are already affected by this problem (Herbauts *et al.*, 1998), which is difficult to mitigate. Restricting soil compaction to marked logging paths is highly recommended and increasingly implemented. Cable logging could also be a more widely used option to limit damage on sensitive soils and steep slopes.

Geophyte plants, microflora and soil microfauna are sensitive to tillage operations such ashwood crushing. Superficial decompaction (cover crop) gives spectacular seedling brushes (Delvingt *et al.*, 1996), but its long-term impact on the superficial soil structure and function is poorly controlled. This practice, fortunately undeveloped in broadleaved forests, must be prohibited, except for the sole purpose of restoring the functioning of highly degraded areas of forest habitats (e.g., former logging roads).

These guidelines are also essential for the conservation of archaeological remains preserved in forests. On the basis of the LIDAR surveys carried out in 2013 in Wallonia, it turns out that a great diversity of archaeological structures can be detected in some ancient woodlands: Roman temples, tumuli and other funerary structures, stacking stones, old roads, traces of iron ore exploitation and metallurgical infrastructures, sand pits, marl and about 200,000 charcoal kiln sites (Hardy *et al.*, 2012; Françoisse, 2015; Hardy, 2017). Silvicultural operations disturbing the soil microrelief (disking, rotary grinding, stumping, heavy machinery, etc.) have a negative impact on the conservation of these remains (Prignon, 2015). Despite the fact that they reflect past human activities, these vestiges are not incompatible with woodland ancientness because of the ecosystem ability to restore in the very long term (several centuries, exceeding the cartographic threshold which allows us to define ancient woodlands from 18th century maps). The results of Dupouey *et al.* (2002) and others point out that even about 1,200 years after human occupation in the woodland, traces are still detectable; however, the slow but real recolonization of ancient forest species in recent woodlands has also been observed (Hermy *et al.*, 2007).

Finally, another element of degradation of subnatural ancient woodlands results from their contiguity of exotic species plantations, whose seeds have a strong dispersal capacity. Due to a lower consumption by wild herbivores, the undergrowth is thus frequently colonized by spruce. In the Ardenne, this gradual transformation occurs when subnatural ancient woodlands are surrounded by spruce stands. This proximity could also compromise the maintenance of the naturalness of ancient Ardenne woodlands through the aerial dispersion of calcium and magnesium amendments used to correct pH in contiguous conifer stands, impeding the acidophilous flora (Dulière *et al.*, 1999).

Recognition of the heritage value of ancient woodlands in forest management

Incorporating this ancientness concept into forest management provides an appropriate focus on high conservation value woodlands. Taking them into account is indeed important when establishing forest

management plans. In Wallonia, the Forest Code and the Programme for the Endorsement of Forest Certification (PEFC) certification process contribute in a useful way to this achievement. The PEFC charter asks for the identification of ancient woodlands and assigns particular importance to them in forest management (PEFC, 2017), in particular by promoting natural regeneration and preservation of soils and flora during logging (PEFC, 2016).

Improved tourism development of ancient woodland areas

Because forests in Wallonia are frequently close to large urban centres and constitute original and relatively coherent landscape complexes, they are popular recreational areas (Colson *et al.*, 2012). Together with the other natural environments often associated with them, they have a high socioeconomic potential through the development of high value-added eco-tourism (Farcy *et al.*, 2015). Various initiatives are currently being launched to promote natural capital, notably with the concept of 'Forêt d'Ardenne', which is characterized by a predominance of subnatural ancient woodlands and significant naturalness (FTLB, 2017).

Guidelines for consideration of woodland ancientness in forestry

To ensure the conservation of subnatural ancient woodlands, differentiated management is required. Such management must emphasize ecosystem conservation, particularly through the protection of its soil (which must be considered a complex organism) and vegetation, offering the living conditions needed by specialized forest biodiversity. The following guidelines are recommended:
– Maintain or restore the rich structure and specific composition of natural habitats, in particular by promoting natural regeneration and strictly controlling the pressure of large herbivores on regeneration. Indeed, since they exert a differentiated pressure on vegetation (e.g., browsing of oaks, maples, ash regeneration), herbivores can induce a modification and a simplification of the stand composition and associated biodiversity;
– As much as possible, limit coniferous transformations and natural seeding of coniferous species, e.g., by avoiding the plantation of coniferous cells isolated in subnatural ancient woodlands;
– Limit clearcuttings and avoid associated techniques such as rotary grinding, stump grinding, grading (i.e., removal of the top layer of soil and the vegetation that covers it) or windrowing;
– Whenever possible, restrict the circulation of machines to a few marked logging paths, or consider cable logging;
– Do not apply pesticides (Forest Code) or inputs (amendment or fertilizer).

In addition, the more general objectives of ancient woodland management should be:
– to consider management on a wide scale (e.g., forest) when the spatial configuration and land status allow it;
– to ensure dialogue with the Walloon Heritage Agency;
– to highlight the biological and archaeological value of ancient woodlands in tourism communication.

Nowadays, new pressure is put on broadleaved forests because of their lower wood productivity. Since 2008, when the Forest Code called for the long-term stability of the balance between coniferous and broadleaved stands at the Walloon region scale, the socioeconomic (more favourable

to the harvesting of coniferous trees), ecological and environmental conditions have led to a decrease in the surface area of coniferous stands. A failure to question the Forest Code relevance on this issue has led to debates on the transformation of broadleaved surfaces into coniferous stands. If this were to happen, it would be wise to prioritize the transformation of recent broadleaved stands, which occupy a cumulative surface of 117,000 ha (out of which 86,000 ha are outside Natura 2000 sites, see Table 2-2) and are more likely to respond to the concerns justifying these transformations.

Table 2-2: Proportion of each ancientness category in public woodland and in the Natura 2000 network.

Woodland ancientness	**Surface area (ha)**	**Percentage on public property**	**Percentage in the Natura 2000 network**
Subnatural ancient woodland	181,000	63%	48%
Ancient woodland transformed into coniferous stands	108,000	53%	21%
Ancient woodland temporarily transformed into coniferous stands	800	46%	59%
Recent broadleaved stands	117,000	26%	26%
Recent coniferous stands	140,000	35%	17%

If some forest owners who do not have recent broadleaved stands consider deforestation or transformation of subnatural ancient woodland into coniferous stands, and despite the irreversible and non-compensatory impact of these actions, several principles should be respected:
– avoid coniferous plantations in infertile and poor soils, such as peat, white clay soils, podzolic soils, steep slopes, etc. and reserve the production of high quality coniferous wood where it will be economically justified;
– avoid sites of high heritage interest such as woodlands within the Natura 2000 network or woodlands containing rare or threatened species and habitats, sites within large-area subnatural ancient woodlands, sites with archaeological remains or with a high naturalness revealed by flora indicating woodland ancientness. Although their indicator value has not yet been fully established statistically in Wallonia, the following geophytes can be cited: among rhizome plants: *Blechnum spicant, Convallaria majalis, Luzula luzuloides, Maianthemum bifolium, Mercurialis perennis, Paris quadrifolia, Polygonatum multiflorum;* among bulbous plants: *Allium ursinum, Anemone nemorosa, A. ranunculoides, Gagea spathacea, Galium odoratum, Hyacinthoides non-scripta, Narcissus pseudonarcissus, Ranunculus auricomus*;
– restrict transformation to parcels of low heritage interest, such as woodlands that were formerly mowed or stripped. These can be recognized by several characteristics. In addition to the absence of the above mentioned geophytes, visible traces of clearing can sometimes still be observed, such as microrelief and the presence of a typical soil horizon. In the Ardenne, slash-and-burns can also be recognized by the unnatural dominance of pedunculate oak on dry soils, as the species was formerly favoured in woodlands, either for ease (Poskin, 1934) or for its better tannin content;
– group the new coniferous plantations, rather than disperse them, in order to limit the effect of the lateral natural seeding and the aerial drift of the possible calcium and magnesium amendments in the surrounding broadleaved forests;
– consider first planting larches or pines – rather than shade tolerant species such as spruce or Douglas fir – as they allow the development of a more diversified undergrowth, natural regeneration, and the potential restoration of the original habitat at the end of a forest revolution. These tree species

are also very suitable for mixed stands (broadleaved and coniferous) that better combine coniferous production with habitat protection.

Perspectives on territory development

Following social evolution, a growing number of non-forest activities are exploiting woodland surfaces: infrastructure for heat and power generation from forest biomass, new roads, telecommunication pylons, industrial areas, recreation areas, quarries, agricultural zones, etc. Analysis of these projects, which digress from the initial allocation of the woodland area, should explicitly take into account the woodland ancientness. The same goes for tourism facilities or wind turbines in woodlands. The Walloon territorial development code states that these activities cannot irreversibly challenge the character of the zone.

Conclusion

Awareness of the heritage value of subnatural ancient woodlands is recent. In addition to communication that highlights this unique natural legacy, these forests must benefit from a differentiated management approach where conservation is paramount. In Wallonia, the Forest Code allows the application of this vision to all public woodlands. Sustaining the goods and services provided by forest while preserving ancient woodlands is a new challenge for forest managers. To be fully taken into account, the recommendations issued may require support and clarification to be implemented. This multi-secular heritage, passed down through generations of foresters, deserves to be preserved for future generations.

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