Kocanda – an example of multifunctional forest management during forest stand transformation

C 16

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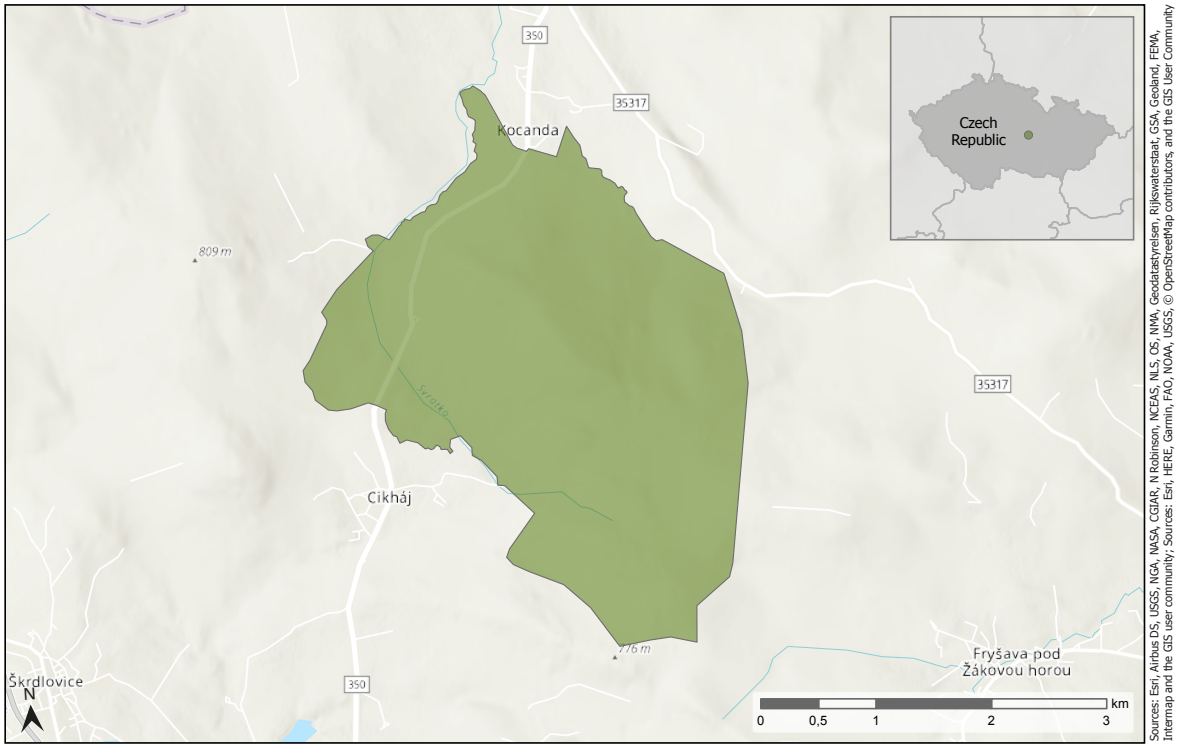
Context, legal frame, and ownership structure

The Kocanda Forest District (FD Kocanda) is a part of a private family estate. The total area of FD Kocanda is 932.34 ha (while the area of the whole forest estate is 5775 ha). FD Kocanda is located in the administrative areas of the Kocanda and Cikháj villages (district of Žďár nad Sázavou) in the central part of the Czech Republic. The villages of Kocanda and Cikháj are the only human settlements within the perimeter of the area. FD Kocanda lies in the



< Fig. C16.1. This is where everything starts. An atmosphere of microclimate in the forest of Kocanda (Photo: Jiří Bína).

Statement

"Conversion of pure, coniferous and even-aged forest stands is nothing all-new because its necessity was clearly formulated already in nineteenth century, but there are not many examples of (mid-)advanced stages of forest transformation in Central Europe – one of them is Forest District Kocanda in the Czech Republic."

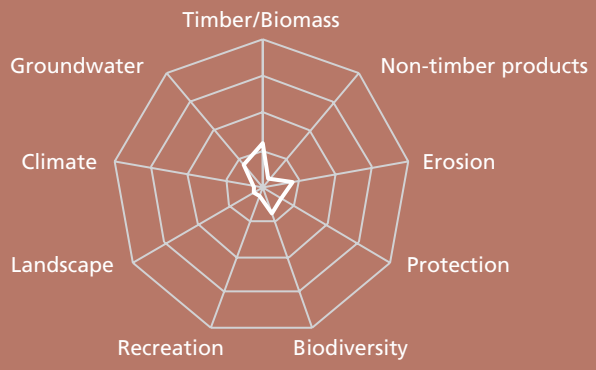


Table C 16.1. General information of Kocanda forest district.

Forest community (main types)	Acidophilous montane beechwood *(Lazulo-Fagetum montanum)* changing locally into the floriferous beechwood *(Eu-Fagion)* in the area surrounding Žákova hora; spruce-fir beechwood *(Fageta piceoso-abietina)*
Total forest area	932.34 ha (17.46 ha where forest management and human interventions are strictly prohibited)
Forest Management	Conversion into uneven-aged forestry with parallel conversion of tree species composition by underplantings; irregular shelterwood system with maximally extended regeneration period within every particular spatial entity (from the level of a tree cohort to the level of a forest stand)
Total volume	ca. 440 m³/ha (402 805 m³ for the whole FD Kocanda)
Annual growth	ca. 11.9 m³/ha (not based on the statistical inventory methods but based on the algorithms of the age-class forest, and thus calculated with highest possible precision)
Annual use	ca. 12.8 m³/ha
Deadwood (standing and lying)	Unknown; this factor has not inventoried yet; however, deadwood is retained locally
Altitude	647 to 810 m a.s.l.
Geology	Ancient (Proterozoic) metamorphosed two-mica bedrocks: muscovite-biotite migmatites or orthogneisses of Svratka Crystalline (southern part of the Bohemian Massif)
Ownership	Private; Kinský Žďár, a.s. (joint stock company), Zámek 1/1, 591 01 Žďár nad Sázavou; ID 46901523
Protected area (total)	103.47 ha (38.1 ha = the category of the forests of National Natural Preserve – core zone and expanded part + an overlap with the category of the forests for biodiversity enhancing and genetic sources protection; 62.4 ha = the category of the forests for biodiversity enhancing and genetic sources protection; 2.97 ha = I. zone of the Žďárské vrchy Protected Landscape Area – special importance of the ecosystem for the birds´ protection) + 39.03 ha of Natura 2000 (overlapping with above described areas)
Nature protection area (Natura 2000)	39.03 ha; CZ0610401 – Žákova hora
Protective function	National Natural Preserve – core zone and expanded part; forests for biodiversity enhancing and genetic sources protection; I. zone of the Žďárské vrchy Protected Landscape Area – ecosystem of special importance for the protection of birds

Svratka River basin and it extends from 647 to 810 m a.s.l. and is characterised by a continuous complex of forests. The summit of the hill, Žákova hora (the highest point in the area at 810 m a.s.l.), is approximately in the middle of FD Kocanda.

Since 1994, these forests have been undergoing a process of conversion from pure Norway spruce *(Picea abies)* stands shortly after the restitution of the forest property (in 1993). There were two categories of the forest stands within the whole forest estate after the restitution as a consequence that two different State Forest Enterprises had managed the estate before that applying different forest management approaches. FD Kocanda lies in the part which was managed by a clear-felling system until 1993. In the other part of the property, a shelterwood system had been applied. A clear decision was made in 1993 to convert the forest management from the clear-felling system and from pure Norway spruce stands towards more stable, diverse, mixed forest managed by the shelterwood system, and at later (more developed) stages to convert it continually further into a close-to-nature forestry. Two people were largely responsible for application of the new management approach – Forest Administration Director Dipl. Ing. Pavel Bednář (senior; died 2000) and the local forester Jiří Bína. Assoc. Prof. Jaroslav Švarc (died 2002) also influenced the implementation of the new system.

At the beginning of 2009 and then again at the beginning of 2011, the area of FD Kocanda expanded beyond the original borders. When comparing the new areas to the original FD Kocanda, the lower level of both transformation advancement and forest stand structure development have been realised.

The mean annual total precipitation is 740 mm, and mean annual temperature ranges from 5 °C to 6 °C (Tolasz *et al.* 2007). According to the geo-botanical standardisation, the area is characterised by two main forest communities: the dominant forest community is the acidophilous montane beechwood *(Lazulo-Fagetum montanum)* which changes into the floriferous beechwood *(Eu-Fagion)* in the area surrounding Žákova hora (Mikyška 1971). The geological basement is made up from the ancient (Proterozoic) metamorphosed two-mica bedrocks (muscovite-biotite migmatites or orthogneisses) of Svratka Crystalline that represents the southern part of the Bohemian Massif. On these acidic to neutral bedrocks medium deep, sandy and loamy-sand oligotrophic Dystric Cambisols and Cryptopodzols, with a lack of bases, are mainly formed (Rejšek 2009; Janík *et al.* 2016). Thus, the area consists of mainly acidic sites where the main biogeocoenoses are *Fageta piceoso-abietina* and *Piceeta abietina sphagnosa inferiora* et *superiora* (Bednář and Bína 2018).

Portrait of the Kocanda Forest District

"Our mission is to manage the forest with respect to the forest ecosystem stability, vitality and biodiversity encouragement and parallel with the full utilisation of the production potential of the forest sites and forest stands. Our long-term target is to achieve supreme possible stability, vitality and biodiversity of managed forest stands in the future and maximal employment of the nature automation within all silvicultural measures and interventions after (and with limited extend also during) the forest stand transformation process."

Forest history and cultural heritage

This territory at the boundary between Bohemia and Moravia was difficult to travel through because of the large forests and abundant peat bogs and swamps. The Cistercian monastery in Žďár nad Sázavou was established in 1252 to support settlement in this region. Soon after that, silver and iron mining began, and the first, primitive, metal works started to develop. These required a large amount of charcoal, and the extensive forests supplied the wood needed for this. The forest area soon began to decrease, and the tree species composition began to change, as well. By the first half of the sixteenth century, it had become difficult to supply the charcoal to new ironworks as the available wood reserves were close to being exhausted (Novotný and Horák 1968).

While in the areas near rivers, the forests were heavily devastated due to the increasing consumption of wood, the forest complex near Žákova hora was spared thanks to its remote situation; at the beginning of nineteenth century there was on one access road to the area (Švarc 1993 cited in Vrška *et al.* 2002). The structure of forest stands near Kocanda were described in 1797 as:

Fig. C 16.2. The core zone of the Žákova hora National Nature Preserve represents 17.46 ha of the natural forest that has been influenced only slightly by human activities in the history due to difficult accessibility and other factors (Photo: left, Eckart Senitza, 2018; right, Pavel Bednář, 2019).

Norway spruces with silver firs and a lot of European beeches between them, sycamore and Norway maples here and there, and elms and aspens are dispersed. The majority of the forest district consists of over-aged coniferous and broadleaved trees; other forests stands are between 80 and 100 years of age. The regeneration looks good, except for the parts browsed by cattle (Novotný and Horák 1968).

However, it is also mentioned that despite the very swampy soil at the hillside of Žákova hora, random cuts were done in these originally virgin forests, and thus some parts of the forest stands were sparse (Nožička 1957; Novotný and Horák 1968). Sycamore *(Acer pseudoplatanus)* trees were distinctively present in the mixture of tree species around Žákova hora. The sycamores were used for production of maple sugar, especially during the Napoleonic wars; and thus additionally plantings for this purpose took place (Nožička 1957; Švarc 1993 cited in Vrška *et al.* 2002).

In general, the forests in the Žďár region at that time had been devastated and misused in many other ways – cattle grazing, cutting grass, raking of the forest floor, harvesting and removal of stumps, and illegal logging. Forest management was fully under the influence of ironworks, and the forests were over-exploited. It became evident that the forests were no longer able to supply the ironworks, and in 1886 the last blast furnace in the region was closed (Novotný and Horák 1968).

Significant changes of the forest management took place after the 1850s (Švarc 1993 cited in Vrška *et al.* 2002). Pure and even-aged forest stands of Norway spruce were gradually established under the direction of the chief forester Havránek. This was also connected with age-class forest management and a use of the clear-felling system. As in many places, the forest managers hoped for highly productive forest stands and easy and simple management (Novotný and Horák 1968). However, within the area immediately surrounding Žákova hora, the forest stands remained largely untouched (Vrška *et al.* 2002).

In 1920, when a forest management plan was prepared, the forests were managed by the Forest Director Antonín Bakesh and his son, Dipl. Ing. Karel Bakesh. The plan clearly indicated an attempt for a transformation into the shelterwood system and a retreat from clear-felling system; it was very important that, following from a recommendation by Antonín Bakesh, a part of the forests near Žákova hora were excluded from common forest management, and thus the nature conservation of today's Žákova hora National Nature Preserve (NNP) was purposefully started (Novotný and Horák 1968).

When Antonín Bakesh died in 1926, his son, Karel Bakesh, took over the mission of his father. However, a large part of the forest was totally destroyed by a large windstorm on 26–27 October 1930. The storm ravaged the forest stands and by

July 1931 a total of 463 000 m³ of salvage wood (on an area of 5624 ha of the forest property) had been processed; sparse forest stands were repeatedly damaged over the course of the following years by snow and wind damage, and thus those disturbances in the period of 1930–1933 caused large-scale clearings covering an area of 1600 ha (i.e. the sudden deforestation on nearly 30 % of the area of the forest property). The total volume of salvage felling within the property reached more than 1 million m³, while in the administration of Cikháj (representing 2015 ha including forests of FD Kocanda), the salvage felling was 304 916 m³ (i.e. 151 m³/ha on average for the Cikháj-area) (Novotný and Horák 1968).

In 1941, the estate was put under Nazi receivership; when WWII ended, the property was owned by the Kinský family until February 1948. On 1 January 1949, the forest property was incorporated into the Forest Enterprise (FE) Žďár nad Sázavou of the State Forests; later it was split into FE Přibyslav and FE Nové Město na Moravě. In the forests of FE Přibyslav there was a clear effort to follow the pre-war management using the shelterwood silvicultural system. However, in FE Nové Město (where FD Kocanda was located) diverged from this approach and to a large extent the clear-felling system was employed (Novotný and Horák 1968).

The entire property was returned to the ownership of the Kinský family in 1992. As of 1 February 1993, the operation and administration of the revived estate was restored and Dipl. Ing. Pavel Bednář (senior; died 2000) was appointed Forest Director; the forester in FD Kocanda had been Jiří Bína since that time until his retirement in February 2020.

Aims of the Kocanda Forest District

It was necessary to establish long-term forest management within the newly restituted forest property in 1993. Although entire spatially, the newly formed forest estate was rather incoherent with respect to the stand structure and tree species composition. In about half of the area (that part managed by the shelterwood system within FE Přibyslav in the previous decades), the forest stands achieved certain forest stand structure heterogeneity (more or less developed; initial stages of structural encouragement prevailed) and tree species composition was also slightly shifted from pure composition towards mixed composition mainly by admixture of silver fir and European beech. By contrast, the forest stands in the administration of Cikháj (the part managed by clear-felling system within FE Nové Město na Moravě) had homogeneous age-class structure and pure species composition. It was very important to unify the silvicultural treatment across the whole property. With regard to the situation (pure, even-aged Norway spruce monocultures on the half of the property) and considering all risks and threats of such forest stands – a clear decision was made to transform tree species composition and, at the same time, to convert clear-felling system to shelter-wood system with future prospect of conversion to further follow-up uneven-aged forestry forms in the later stage of the transformation process (Bednář 2009).

The transformation was initiated by Pavel Bednář (senior). In addition, it was also supported by Assoc. Prof. Jaroslav Švarc and Prof. Vladimír Tesař as independent authorities from the outside of the company. The incorporation of these concepts into a forest management plan was made by Dipl. Ing. Jiří Fišera through a pioneering forest management plan for the 1999–2008 period (Bednář 2009).

In general the goals defined in 1990s (described above) about the forest transformation into close-to-nature forestry have been met and fully employed only in FD Kocanda. In the remaining part of the forest property, a departure from those goals since ca. 2010 has taken place. It means that the prevailing silvicultural approach in all other forest districts of the forest property is a wedge felling system combined with elements of both the clear-felling system and the shelterwood system (through a two-phase shelterwood cut). By contrast, the forest management in FD Kocanda has been continuing with long-term forest transformation – i.e. by the transformation under a continuous cover scheme (fig. C 16.3).

Applied management system

The forest management approach is characterised by the main target of the forest stand transformation, i.e. parallel conversion of tree species composition and conversion of the forest management; thus, transformation under a continuous cover scheme is strictly implemented. Applied silvicultural

Fig. C 16.3. The transformation process has its own silvicultural technique that is implemented through specific interventions within particular part of a forest stand space and has its specific schedule, as well. A typical element is the so-called 'foundation of the regeneration felling system' represented by a strip shelterwood cut where areas for underplanting by absent tree species are combined with areas prepared for natural regeneration of Norway spruce (growing under the more closed overstorey canopy shelter to control its growth and vigour). This photo shows an example of European beech underplanting with subsequent natural regeneration of Norway spruce (location: 206 Cc 10/1) (Photo: Jiří Bína, 2020).

treatment is represented in particular by the main principles as follows: (i) maximally extended regeneration period (not only a regeneration period of the entire forest stand, but of any particular small spatial forest area, aiming at maximal forest structure encouragement); (ii) long-term individual quality selection in the overstorey aiming mainly at enhancement of the quality of the target trees; (iii) underplanting of the absent tree species – mainly European beech *(Fagus sylvatica)* and silver fir *(Abies alba)* (fig. C 16.4) – and their growth beneath the canopy for their proper growth, morphological development and structural development over many decades; combined with (iv) a natural regeneration of Norway spruce under the canopy (controlled in it growth and vigour by sequential overstorey canopy opening); (v) a maximal possible employment of the nature automation; (vi) encouragement of any naturally regenerated tree species admixture; (vii) strict avoidance of creation of any larger gaps or even clearings; (viii) maximum enhancement of the forest stand vitality, stability and biodiversity, and encouragement of various forest functions and services.

If an admixture, as shown in Figure C 16.5, is present it is used for natural regeneration. The natural regeneration of Norway spruce and European beech, which were present in this forest stand has been combined with artificial regeneration of silver fir (which was absent in the initial stand). This creates a stand with the desirable, target composition of the tree species, the Hercynian mixture. The successful development and growth, as well as the full (both productive and ecological) employment of each species is enabled by appropriate silvicultural treatment. This creates sufficient and favourable ecological conditions for development of all species and allows each to grow vigorously without any one species out-competing the others.

Fig. C16.4. A view into the interior of the forest stand and the 'foundation of the regeneration felling system' at the point where the mixed underplanting (silver fir and European beech) connects to the subsequent natural regeneration of Norway spruce; one foundation consists of many underplantings within its length jointly connected by naturally regenerated areas (it is possible to see another underplanting in the upper right corner). Various light conditions have to be created within a forest stand to encourage the forest structure as much as possible when the long regeneration period (both at stand and any partial spatial level) is essential (location: 202 Bb 7/1) (Photo: Pavel Bednář, Jiří Bína 2018).

Fig. C16.5. A very rare case is when a valuable admixtures of any other tree species is present in the forest stand overstorey because there were dominating pure Norway spruce stands before the transformation started. (location: 210 Ee 9/1b) (Photo: Jiří Bína, 2018).

Economics

The total yearly harvest ranges from 11 000 to 12 000 m³ when the long-term share of the roundwood (quality III. A–C) is stabilised as ca. 60 % with the long-term average price of 75 €/m³ in the last decade. The remaining share of 40 % (represented mainly by pulpwood for various purposes and low-quality roundwood) has been sold at an average price of 37 €/m³ for the last decade (short-term price oscillations are neglected). The costs for a harvest and a wood extraction to a wood dump have ranged between 15 €/m³ and 19 €/m³ for a long time.

Costs for tending of young forests (at the growing stage up to 2 m in height) coming from natural regeneration must be considered, as well. When the 'nature automation', as a process of close-to-nature forest management, is used to the greatest extent possible, the individual selection prevails, applying mainly positive selection from above (supressed tree cohorts are left to self-thin). This approach represents ca. 70–90 % of the area that is tended (being actually only an addition to self-thinning especially where the shelter of the overstorey canopy is not optimal). Schematic measures represent the remaining 10–30 % of the total area for tending (where approx. 1.8–2.0 m cut strips are altered by 0.5 m strips of remaining natural regeneration) and it is applied in those areas where the shelter of the mature canopy is not optimal (mainly because of disturbances etc.). The individual treatment represents costs of about 70 €/ha and the schematic measures about 500 €/ha when the area was about 70 ha in the last decade (forest management plan 2009–2018); because of the further development of the forest transformation process, the area has increased to about 130 ha that is planned for the current decade (forest management plan 2019–2028). Regeneration of Norway spruce accounted for 74.9 % of the regenerated area in the last decade (2009–2018) and 25.1 % of the regeneration was made up of other the target tree species: silver fir – 6.3 %; European beech – 18.3 %; Sycamore – 0.3 % and black alder *(Alnus glutinosa)* – 0.2 %). However, when the natural regeneration of Norway spruce was dominant (98 %), other tree species usually had to be planted

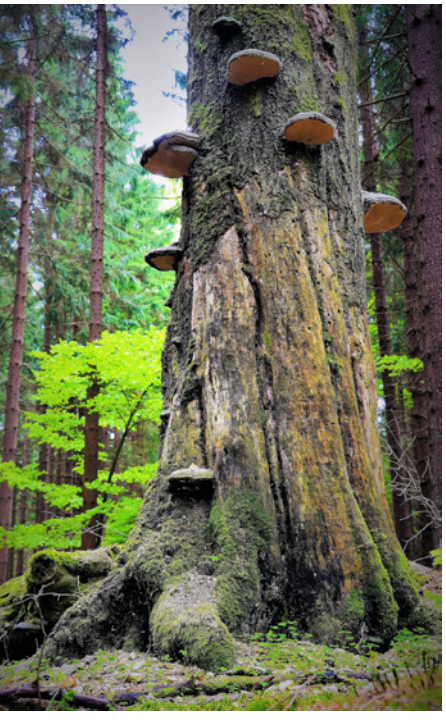


Fig. C 16.6. Any opportunities to enhance biodiversity in the managed forest stands are purposefully used for this target (location – left: 206 Dd 7; right: 210 Bb 12) (Photos: Jiří Bína, 2017).

when they were absent in the forest stands (all of the silver fir and black alder were planted, and 60 % of European beech was planted with the remaining 40 % being natural regeneration coming from the rare valuable mature admixture of European beech or seed from the Nature Preserve).

The conversion of tree species composition represents substantial costs in those forest stands where the artificial regeneration is essential (because of the lack of seed sources) when the total costs range from about 7500 to 8000 €/ha for planting and fencing (and fence disposal) of European beech and silver fir underplantings. As a consequence, within FD Kocanda, there are currently 290 fenced underplantings of European beech and silver fir (total fenced area of 31.2 ha and total fence length of 38.5 km).

However, natural regeneration represented 81 % (regardless of tree species) of the total regeneration in the last decade. This has a significant positive impact on the economics. Considerable savings are created mainly by natural regeneration of Norway spruce compared to its artificial regeneration that represents about 3700 €/ha (in comparison with the much lower costs for tending of Norway spruce natural regeneration as described above).

Ownership structure

The private owner is the Kinský family through the joint stock company Kinský Žďár where Constantin Norbert Kinsky has owned a 68.80 % stake, and his brother Charles Nikolas Kinsky a 31.20 % stake of shares in the company since 2018 (Šebestová 2019).

Important services and products

The most important products and services of the forests of FD Kocanda are:

i) wood production;
ii) nature conservation in the Žákova hora NNP;
iii) water protection and hydrological function as it is the source of the Svratka River and many small springs;
iv) biodiversity encouragement and genetic sources protection because of the forest stand transformation towards close-to-nature forestry and the occurrence of the Žákova hora NNP that is managed in its expanded part through implementation of the ecological forestry;
v) importance for microclimatic and ecosystem regulation functions and as a migration corridor in the landscape – it is a part of the large compact complex of the forests in the central part of the Czech Republic;
vi) scientific importance where many studies have been done in the NNP about the dynamics of the nature forest and where in the managed forests stands various silvicultural issues have been observed (e.g. several diploma theses; one PhD thesis) and where permanent research plots aiming at various silvicultural, eco-physiological, hydrological and others issues have been established;
vii) educational and enlightenment purposes – many seminars and workshops both at national and international levels have been arranged, and these events have been covered by the local and national media; universities from within and outside the Czech Republic used the area for practical training;
viii) a wide range of forest practitioners have attended various events and there have been many articles about applied forest management in forestry journals; potentially, there will be many more as an Exemplary Forests and Exemplary Forests of Pro Silva (containing also an inventory plot for repeated inventories) were established here in 2017;
ix) tourist importance – the area is popular with tourists and there are marked trails supplemented even by educational panels containing information about the area;
x) importance for a hunting – hunting is another important activity in the landscape and important heritage, as well.

Conservation of rare species

Žákova hora NNP is one of the most valuable (within the top 10) natural forests that have been preserved in the Czech Republic (otherwise characteristic by cultural landscape); it is unique because of its history when it was established within the private forest property based on the recommendation of Antonín Bakesh in 1929 (with subsequent official Ministry declaration in 1933) (Vrška *et al.* 2002). There are many rare species both from fauna and flora, including: *Dentaria enneaphyllos; Circaea alpina; Veronica montana; Leucojum vernum; Cara-*

bus coriaceus; Sinodendron cylindricum; Aglia tau; Triturus alpestris; Ficedula parva; Ficedula hypoleuca; Aegolius funereus; Columba oenas; Nyctalus leisleri; Sorex alpinus and others (Staněk 2009).

Nature conservation

FD Kocanda covers the Žákova hora NPP (figs C 16.2 and C 16.5). The whole area of FD Kocanda is also a part of the Žákova hora Supra-regional Bio-centre (within the Net of Ecological Stability of Landscape in the Czech Republic – ÚSES), the largest supra-regional bio-centre in the entire Žďárské vrchy Protected Landscape Area. An area of Natura 2000 was established there (CZ0610401 – Žákova hora; 39 ha). Within 17.5 ha of the core zone of the Žákova hora NNP all human activity is prohibited, and within the surrounding of about 21 ha of the expanded part an ecological forestry has been being applied. There are 86 ha of the special-purpose forest stands that are managed though different special-purpose forestry approaches (for a biodiversity enhancing and genetic sources protection; or in the I. zone of the Protected Landscape Area for the protection of birds; or by an employment of the ecological forestry in an expanded part of the Nature Preserve). The nature conservation was started here based on the recommendation of the Forest Director Antonín Bakesh. Over 20 % of biomass in the core zone is made up of deadwood (Vrška *et al.* 2002). The Nature Preserve represents extraordinary value for biodiversity and genetic resources protection, and it is also the main source of findings about forest dynamics (in the right picture C 16.2. there is fungus *Hericium coralloides*). Stem position maps of trees with DBH ≥10 cm were carried out in the core zone in 1974, 1995, and 2011 (Janík *et al.* 2016). For instance, the constant increment of sycamore share has been observed for the last many decades; however, sycamore recruits are not spatially associated to individual gap makers and have a highly clustered distribution when the number of individuals grew mostly through the increase of existing clusters. Thus, an increment of its share can be spatially and temporally limited process (Janík *et al.* 2016).

Figure C 16.7 allows a view into the interior of the forest stand, under the crown canopy layer of the homogeneous and even-aged stand of Norway spruce being regenerated by means of a large-scale shelterwood cut, with European beech natural regeneration differentiated by age and space and spread (from the core zone) under the Norway spruce shelter, completed with a mosaic-like and cluster-formed natural regeneration of Norway spruce. The specific features of ecological forestry in the expanded part of the Žákova hora NNP are reflected by the distinctively higher proportion of deadwood left in the forest.

Recreation

The area is well used by tourists and there are marked trails supplemented even by a few of educational panels. The locality is very popular for many different reasons (e.g. large forest complex; well-known National Nature Preserve; important historical events during WWII; close location to larger ponds; Žďárské vrchy Protected Landscape Area; well-developed tourist infrastructure; the top of Žákova hora is one of the highest points in the region, etc.). Thus, the importance for the tourism is significant. There are a few small villages in the surrounding area.

Strengths and weaknesses

A potential problem for the near future is that the forest management plan is based on the methodology designed for management by age-classes, and this is currently the only possible alternative according to the Czech Forest Act; a change to the legislation has been widely discussed at many different levels (including at ministerial level) for a long time. However, even the legislation change will not provide a full solution to the problem. The reason is because, potentially, the distinction between FD Kocanda and the rest of the forest property will gradually increase in the future (if the current different approaches continue) – the longer the time that different forest management is applied, the more distinct the differences of forest structure (and other forest entities) will become. This can start to be a problem when the forest management plan is prepared for the whole forest property. Thus, for the rest of the forest property the recent methodological approach will be used effectively in the future while the enhanced forest structure in FD Kocanda will require a different methodological approach based on the statistical forest inventory where, among others, the harvest maturity will be determined by target diameter rather than based

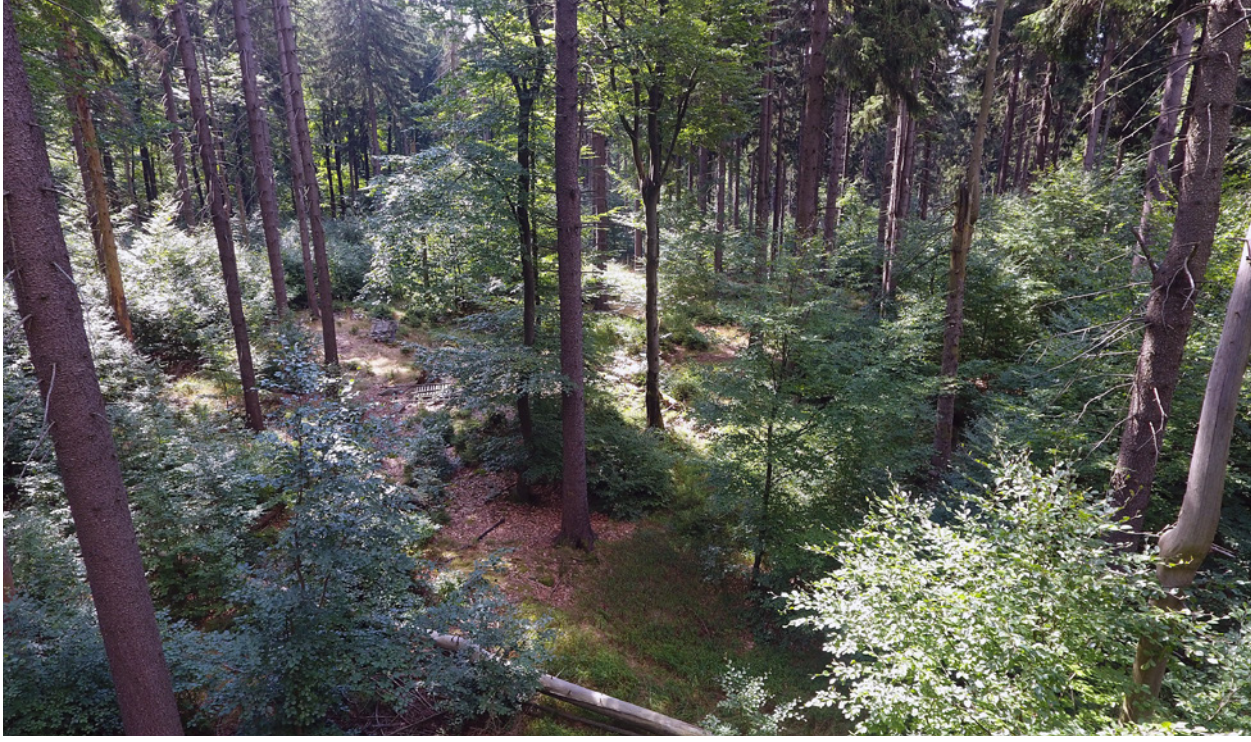


Fig. C16.7. An example of ecological forestry in the expanded part of the Žákova hora National Nature Preserve (location: the border of 207 Cc 11/1a on the left-hand side and 207 Cc 15/3b/1b on the right-hand side) (Photo: Pavel Bednář, Jiří Bína 2018).

on age, etc. A second potential threat is represented by the 'human factor' after retirement of the local forester (working here for many decades) in 2020 and when the all-new top management was simultaneously engaged at the same time; however, recent short-term employment of a new forestry staff brings a general optimism with regard to this issue. Considering that there have been other similar examples of forest stand transformations, and as Souček (2018) analysed, if such transformations fail it has been because of their interruption most often caused by the fact that forest owners or newly coming foresters deflected the forest management from the previous transformation.

Conclusion

FD Kocanda is an important and valuable example of a large forest area under long-term forest transformation (parallel tree species conversion and forest management conversion). This is an issue mainly in the Czech Republic, but also to a certain extent in other parts of Europe. The transformation has been applied here for more than 25 years and during this period many forest functions and services have been being fulfilled and even deliberately encouraged (such as biodiversity and nature protection as forest functions in the expanded part of the Nature Preserve where the ecological forestry has been applied). These functions are also encouraged in production stands when the vitality, stability, biodiversity, and production of the forest stands have been enhanced under the applied forest management system. FD Kocanda is an important area from the viewpoints of research, forestry production, and public education. The main threat are the hypothetical future decision of stakeholders to convert the forest management back to simplified management systems and subsequent sudden forest structure unification and nature automation losses which both have been so intensively enhanced in recent decades. Forest management within FD Kocanda is an extraordinary example of how large areas of pure, even-aged, coniferous secondary monocultures can be progressively transformed and how fairly advanced stages of this process can be achieved over a relatively short time; in addition, it is magnificent example of how uneven-aged silviculture corresponds well with enhancement of multiple forest functions/services.

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