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The conservation value of Bulgaria's old-growth forest.

A literature review

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1 ABSTRACT

Forest experts recognise the pressing need for greater protection of what OGF remains in Europe, but the conservation value of OGF still needs to be communicated to the general public and decision makers in government and business. Even the term OGF is little known or understood.

This literature review describes the unique nature of OGF habitat and how its structural diversity promotes biodiversity. It also explores the scientific value of OGF – in terms of informing forest management practice - and its function in carbon sequestration and flood prevention. The key questions of 'how much is enough?' in protection terms is explored, primarily from a species-centric perspective and the public's 'Willingness to Pay' concept highlighted as a tool to aid decision-makers, by translating conservation and ecosystem service value into a tangible, monetary value.

While the literature offers some evidence and tools to support the argument for greater OGF conservation, more questions are ultimately posed and presented as recommendations for Bulgaria's OGF conservation, notably in the form of further field and desktop research to bolster evidence of Bulgaria's OGF value.

CONTENTS

2 INTRODUCTION

All European native forests have been altered by some type of harvesting, 'leaving just 1.6% (3 million ha) of natural, or old-growth forest left' (Rosenvald, 2011). Dead wood-associated (saproxylic) and old-growth species, are therefore among the most threatened in European forest ecosystems (Lachat and Butler, 2009).

Within Europe, Bulgaria's large protected areas amount to 578000 ha or 5.2% of the country and all have relatively extensive old-growth forest (Veen *et al*, 2010). Knorn *et* al (2012) report that 72% of old-growth forest (hereafter referred to as OGF) disturbance takes place **within** so-called protected areas. Logging – whether illegal or legal – is at present, the major threat to OGF ecosystems (Veen *et al*, 2010) and protection, in its current form, is not an effective counter to that threat.

The conservation value of and threats to OGF are widely stated and recognised in the literature (Veen *et al* 2010, Molina *et al 2006,* Montgomery *et al* 2006, Juutinen 2007 to name a few), but clear scientific arguments for conservation are difficult to find. The scientific community have perhaps accepted the conservation value of OGF habitat, but left political and corporate decision-makers and the general public behind. Even the process of defining and labelling OGFs is a source of confusion, with Peskletvits (2011) referencing eleven interchangeably-used terms in the literature: "ancient, antique, climax, late-successional, mature, old, original, primary, primeval, pristine and virgin", to which the author could add 'natural'.

2.1 SCOPE

The purpose of this literature review is to identify scientific arguments and lessons learned from other European countries and where relevant, the rest of the world, which could be applied to the conservation of Bulgaria's OGFs.

There are a large number of OGF studies across a wide range of subjects, from forestry economics to preserving a specific lichen species. To remain current and work with a manageable volume of literature, studies from over ten-years ago and those not printed in English or published in peer-reviewed journals, are outside the scope of this review; unless secondary references.

3 THE SIGNIFICANCE OF OLD-GROWTH FOREST (OGF)

3.1 DIVERSE HABITAT

Pesklevits *et al* (2011) refer to OGF as having '**spatial heterogeneity** at multiple scales, in a non-uniform way', due to the natural disturbance regime that occurs over a long period of time in OGF. The spatial heterogeneity means that there are more habitat niches in OGF, which in turn translates into greater species diversity. Ranius *et al* (2009) found that for one habitat in particular – tree hollows, which support invertebrates, birds and mammals – the older the stand, the more likely that hollow trees would exist. Specifically 'at ages of 200–300 years, 50% of the trees had hollows. Among trees <100 years old, less than 1% had hollows, while all >400-year-old trees had hollows'.

Decaying wood is another key factor for species richness in OGF and crucially comprises snags and downed logs at **varying stages of decay**, serving as both habitat (Juutinen, 2008) and food at the foundation of the ecosystem.

3.2 CARBON SEQUESTRATION AND FLOOD PREVENTION

OGF provide **ecosystem services**, but the literature suggests that they do so on a larger scale than other forest types, particularly in terms of carbon sequestration. Luyssaert *et al* (2008) found that OGFs 'accumulate carbon for centuries and contain large quantities of it', all of which would move back to the atmosphere along with soil carbon if disturbed. Research into OGF in the Carpathian Mountain region also found that carbon is stored at

higher levels when compared to young and managed forest (Holeska *et al*, 2009 and Leeton *et al*, 2010 in Knorn *et al,* 2012).

Woody detritus is not only a key habitat and food component for OGF, but it 'can reduce erosion and store nutrients and water' (Wirth *et al*, 2009), and in doing so, protect from flooding.

3.3 SCIENTIFIC VALUE

Remaining OGFs have great scientific value, in acting as an ecological baseline and 'the best source to understand processes essential for functioning woodlands' (Veen *et al,* 2010). Those processes are still not fully understood. Rosenvald *et al* (2010) found 'a significant but unexplained **old-growth effect**', after food supply and stand structure variables were taken into account, in their comparative study of bird communities in mature stands for managed harvest and those in OGF. This suggests that there are other, yet identified, variables that increase bird communities in OGF compared to mature managed stands.

Scientific information relating to OGF has great practical applications as it can be used to improve the biodiversity and resilience of managed forest.

4 HOW MUCH IS ENOUGH?

Qualitative statements dominate the literature on this subject: '…it is not just old growth, but also large contiguous areas of old growth that are important for maintaining biodiversity' (Anand *et al*, 2013). 'Next to time, spontaneous development of a forest also needs space' Veen *et al* (2010) go on to recommend that 'focus [in Bulgaria] should be on protecting large areas (national and nature parks), with virgin [OGF] as the main component.' What do these statements mean in practical conservation terms? How much is enough?

Lohmus *et al* (2004) believe that 'the general 10% minimum level of strict protection holds as a rule-of-thumb if there is no time or data for detailed analysis'. This 10% figure was

posited by the IUCN 24 years previously (Anon, 1980). The verification of this 10% figure seems to be one of the key questions to be solved by forest and nature conservation research (Bucking, 2003). Wirth *et al* (2009) have considered a wealth of research in the field of species and community ecology threshold figures and believe that general rules for protection area can be defined, with large mammals and birds requiring >100ha. Wirth *et al* (2009) also define the minimum structural area as the 'smallest area which is needed to allow, in the long term, all forest development phases to occur'. Based on studies elsewhere in Europe (Czech Republic, Slovakia and Hungary), Wirth *et al* (2009) calculate a minimum structure area of 40ha for Carpathian beech forest.

4.1 QUALITY AS WELL AS QUANTITY

As well as understanding how much OGF is enough, the spatial heterogeneity that supports biodiversity in OGF needs to be considered. The question of 'quality' relates to different types of dead wood (snags and downed logs), different sizes of wood and different decaying phases. Wirth *et al* (2009) describe 'the relationship between the disturbance regime and OGF occurrence as fundamental, as it may promote or destroy OGF'. Wirth *et al* (2009) advocate a need for large old trees, large snags, diverse tree community, large logs, a multi-layered canopy, structural complexity, canopy gaps and wide-spacing of large trees. Replicating or preserving OGF ecosystems therefore demands an understanding of this complexity.

4.2 INDICATOR SPECIES

The literature is species-centric when illustrating the importance of OGF and establishing conservation requirements. Molina *et al* (2006) carried out an unprecedented survey and monitoring programme in the Pacific northwest of America, of 1120 OGF species. The aim was to provide habitat in the form of protected reserves, using the Northern Spotted Owl as the umbrella species. An expert panel used maps and an understanding of forest conditions to identify requirements for sustaining viable populations of each species, in a qualitative assessment.

Similarly, but on a more manageable scale, Lachat and Butler (2009) compiled a list of fifty-five saproxylic and OGF species of conservation concern in Switzerland based on expert recommendations. Stighall *et al* (2011) also support this type of approach, positing that 'efficient conservation planning in managed forest landscapes requires knowledge about the location and functional habitat of specialised species'. Blasi *et al* (2010) also advocate a multi-taxon approach: 'sampling overall biodiversity would be the most effective means of evaluating forest management systems.' However, they recognise that this is not always pragmatic and instead follow Lindenmayer *et al's* (2000) subset of species approach, whereby researchers can extrapolate data based on a smaller subset. Blasi *et al* (2010) state that 'data related to different taxonomic groups yields information on the usefulness of those groups as indicators of the occurrence of other taxa, or of biological diversity.'

Stighall *et al* (2011) narrows the focus still further, by referring to growing evidence (Mikusinski *et al*, 2001; Mild & Stighall, 2005; Roberge & Angelstam, 2006 and Roberge *et al*, 2008) that the white-backed woodpecker *Debdrocopos Leucotos* is a useful 'indicator and umbrella species for forest conservation and restoration planning' and modelling habitat for this species is 'expected to yield information with conservation benefits beyond this species itself'. Stighall *et al*'s (2011) review of literature indicates that the area required by individual breeding pairs of the white-backed woodpecker is in the range 50 - 100 ha. Perhaps by conserving white-backed woodpecker habitat, other OGF species would have adequate habitat to maintain their population levels.

Within the literature there is no full or representative list of species and their OGF requirements in Bulgaria (light, habitat range, habitat type, food source).

5 MEASURING VALUE

Niedzialkowski *et al* (in Knorn *et al*, 2012) highlight the reality that OGF conservation competes with forestry, constrains other land uses, and may foster conflicts with livelihoods. The value of conservation therefore needs to be compared and balanced against the value of harvesting and Juutinen (2008) advocates the use of market-based approaches, as they are attractive to decision makers.

Juutinen (2008) devised a formula to calculate the value of forests, with quantifiable thresholds translating into conservation objectives. Juutinen's calculation is based in part on the public's 'Willingness To Pay (WTP)' – which is changeable, like any market price, and dependent on public engagement and understanding of OGF benefits. WTP research does provide evidence that nature has a concrete value for people (Clayton and Myers, 2009). Harvesting OGF has a clear, accessible monetary value and WTP may put OGF protection in the same tangible bracket, making the two options comparable.

A potential income stream directly associated with OGF is ecotourism. Aciksoz *et al* (2010) determined the sustainable ecotourism potential of OGF in Turkey and see it as an 'important instrument used for contribution to preservation of the natural landscape'. The literature does not describe Bulgaria's OGF ecotourism potential and this could be included in OGF value calculations.

6 CONCLUSION AND RECOMMENDATIONS

The literature broadly describes the ecological significance of OGF, but it does not present accessible scientific arguments to support conservation requirements.

Gaps in understanding need to be plugged through effective communication, so that decision makers (political decision-makers, corporate decision-makers and the general public) are better-equipped. This process will need to be swift if it is to compete with the tangible – in monetary terms - profits associated with harvesting OGF and costs associated with enforcing OGF protection.

Based on this literature review, the following questions remain and are recommended as action points.

Calculating value

i. What is the illegal and legal logging supply chain (what businesses are involved) and critically who within it would be open to OGF conservation messages?
ii. What is the projected harvest rate of OGF and what is the likely revenue from this. How long can this revenue stream last – is it sustainable?

iii. Identify the general public's Willingness To Pay for OGF in Bulgaria.

iv. Using Juutinen's (2008) methodology, or other market-value approach what is the value per hectare per year of Bulgaria's OGF in its natural state?

v. Using Aciksoz *et al*'s (2010) example, determine the sustainable and sensitive ecotourism potential of OGF in Bulgaria.

Field research and monitoring

vi. Based on random sampling and comparing natural OGF and managed forest in Bulgaria, how significant is the difference between the two, in species diversity terms?

vii. Survey and monitoring of the white-backed woodpecker as an umbrella species, as suggested by Stighall *et al* (2011).

Defining how much is enough, in conservation terms

viii. Using Lachat and Butler's (2009) methodology, identify a list of representative species, across all taxa, for Bulgaria's OGF. By way of a table-top exercise, identify each species' minimum requirements, in terms of food, habitat type and range. What is the minimum viable population size for each species and based on this, what is the minimum area of OGF that needs protection from anthropogenic disturbance.

Communication

ix. Using conservation psychology principles, what is the most effective way to communicate the significance, value and threats to OGF to Bulgaria's public, politicians and corporations?

x. What lessons can be learned from the literature and applied to managed OGF in Bulgaria, to improve their biodiversity and resilience.

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