Supplementary Material:

Table S1. Search strategy tab/List of papers included in review/Lists of papers excluded from the review.

Page nb	Google Scholar	Google Scholar	Google Scholar	Google Scholar	Web of Science	Web of Science	Web of Science
	Keywords: forest AND management AND planning AND biodiversity AND indicators Custom range 1990-2020 About 50,700 results Selected: 59 papers	Keywords: "forest management planning" AND biodiversity AND indicators Custom range 1990-2020 4 220 results Selected: 29	Keywords: "forest management planning" AND "biodiversity indicators" Custom range 1990-2020 318 results Selected: 27	Keywords: forest AND management AND planning AND biodiversity AND indicators Custom range 2019-2020 About 16,700 results Selected: 23	Keywords: forest AND management AND planning AND biodiversity AND indicators Time-span: 1990-2020 Refined for research articles and reviews 303 results Selected: 41	Keywords: "forest management planning" AND biodiversity AND indicators Time-span: 1990-2020 Refined for research articles and reviews 23 results Selected: 8	Keywords: "forest management planning" AND "biodiversity indicators" Time-span: 1990-2020 Refined for research articles and reviews 3 results Selected: 1
1.	Butchard et al. 2010; Noss 1999; Lindenmayer et al. 2000; Noss 1990; Franklin 1993; Failing & Gregory 2003; Feris & Humphrey 1999; Lindenmayer et al. 2006	Franklin 1993; Angelstam & Petterson 1997	Franklin 1997; Humphrey et al. 1999; Monkkonen et al. 2014; Angelstam et al. 2004a,b; Angelstam & Dönz-Breuss 2004	Versluijs et al. 2019; Augustynczik et al. 2019a, 2020;		Jayathunga et al. 2020; Vangansbeke et al. 2017; Karahalil et al. 2017; Trivino et al. 2017	Trivino et al. 2017
2.	Hagan & Whitman 2006; Lindenmayer 1999; Angelstam & Petterson 1997	Edenius & Mikusiński 2006; Romero-Calcerada & Luque 2006	Gao et al. 2014; Makela et al. 2012; Romero-Calcerada & Luque 2006	Barsoum et al. 2019; Lõhmus & Lõhmus 2019; Evans et al. 2019		Standovar et al. 2016; Baskent et al. 2008; Edenius et al. 2006;	

3.	Simberloff 1999	Gao et al. 2014; Monnkonen et al. 2014; Angelstam et al. 2004a	Trivino et al. 2016; Laarmaan et al. 2009; Lexer et al. 2000; Angelstam et al. 2004b	Brown et al. 2020; Parisi et al. 2020;	Tracz et al. 2019; Augustynczik et al. 2019a; Bertini et al. 2019; Lelli et al 2019	Baskent et al. 1996
4.	Smith et al. 2008; Barbati et al. 2014; Brockerhoff 2008	Suter et al. 2002; Humphrey etal.1999; Siitonen et al. 2001	Anselme et al. 2010; Sippola et al. 2014	Augustynczik et al. 2019b; Pohjanmies et al. 2019;	Blattert et al. 2018	
5.	Maleque et al. 2009	Angelstam et al. 2004b; Makela et al. 2012; Ferris et al. 2000		Reise et al. 2019; Muurinen et al. 2019; Selkimäki et al. 2019; Miina et al. 2020; Mölder et al. 2019	Ozdemir et al. 2018; Naumov et al. 2018;	
6	Jonsonn & Jonsel 1999; Uuemaa et al. 2013; Stephens et al. 2007	Fridman & Walheim 2000; Pukkala et al. 1997; Lexer et al. 2000; Baskent et al. 2005	Redon et al. 2014; Ezquerro et al. 2016	Bujoczek et al. 2020	Angelstam et al. 2018;	
7	Romero-Calcerada & Luque 2006; Heink & Kowarik 2010; Angelstam et al. 2004a		La fond et al. 2015		Korkmaz et al. 2018; Vangansbeke et al. 2017;	
8	Linnell et al. 2000; Fridman & Walheim 2000		Mart´ın-Queller et al. 2011; Motz et al. 2010	Lelli et al. 2019;		
9	Tischendorf & Farig 2003; Baskent & Jordan 1996; Mortberg et al. 2007		Pach & Podlaski 2015	Lecina-Diaz et al. 2019	Karahalil et al. 2017; Trivino et al. 2017	

10	McElhinny et al. 2005; Angelstam et al. 2003; Fabbio et al. 2003; Mikusinski et al. 2001	Angelstam et al. 2004b; Laarman et al. 2009			Santos et al. 2016; Standovar et al. 2016
11	Leitao & Ahern 2002; Puumalainen et al. 2002; Poiani et al. 2000; Lindermayer & Likens 2009; Muler & Brandl 2009; Ranio & Niemela 2003; Rodrigues & Books 2007	Trivino et al. 2016			
12	Corona et al. 2011; Frank et al. 2012; Schnidler et al. 2013; Simberloff 1999;		Vangansbeke et al. 2017; Angelstam et al. 2018	Broome et al. 2019	Loehmus et al. 2016
13	Roberts & Gilliam 1995; Nilsson et al. 2001; Roberge et al. 2008a; Roberge et al 2008b;	Anselme et al. 2010	Naumov et al. 2018		Kovac et al. 2016; Mura et al. 2015; Lafond et al. 2015;
14	Dale & Byeler 2001				
15	Roberge & Angelstam 2006; Thompson 2006;		Badalamenti et al. 2017		
16	Mönnkönnen et al 2014		Bazile et al. 2016		Redon et al. 2014;
17	Suter et al. 2002		Treiynis et al. 2016	Hanish et al. 2019	
18	Winter et al. 2012; Humphrey et al. 1999				
19					Rudolf et al. 2012 Lundstrom 2011; Lohmus et al. 2012
20	Angelstam 1997			Magg et al. 2019	
21				Dantas de Paula 2019	
22		Suchant & Braunisch 2004			Rubio et al. 2011

23	Nascimbene et al. 2009	Mönkönnen 1999; Redon et al. 2014			Gil- tena et al. 2010; Alday et al. 2010;
24					Maleque et al. 2009;
25	Kangas et al. 2015	Lafond et al. 2015	Pesonen et al. 2010		Mullen et al. 2008; Roberge et al. 2008a; Baskent 2008;
26		Masom & Zapponi 2015			Cullota et al. 2007; Edenius & Mikusiński 2006; Ericsson 2006;
27	Siitonen 2001			Velázquez et al 2019	Oxborough et al. 2006; Gittings et al. 2006
28	Fleishman et al. 2006	Mikolas et al. 2015; Mura et al. 2015			Maleque et al. 2006; Rempel et al. 2004;
29		Roberge et al. 2015			
30	Schindler et al. 2008				
31					de Warnaffe & Devillez 2002
32					Ferris et al. 2000; Noss 1999;
33					Baskent & Jordan 1996; Hanley 1996

Papers included in the review:

1. Karahalil et al. 2017
2. Rubio et al. 2011
3. Jonsson & Jonsell 1999
4. Torras & Saura 2008
5. Roberge & Angelstam 2004
6. Smith et al. 2008

7. Schindler et al. 2008
8. Schindler et al. 2013
9. Romero-Calcerrada & Luque 2006
10. Roberge et al. 2008a
11. Roberge et al. 2008b
12. Müller & Brand 2009
13. Mikusiński et al. 2001
14. Angelstam & Dönz-Breuss 2004
15. Angelstam et al. 2018
16. Anselme et al. 2010
17. Badalamenti et al. 2017
18. Basile et al. 2016
19. Gao et al. 2014
20. Humphrey et al. 1999
21. Laarmann et al. 2009
22. Lafond et al. 2015
23. Mart´ın-Queller et al. 2011
24. Motz et al. 2010
25. Naumov et al. 2018
26. Pach & Podlaski 2015
27. Pesonen et al. 2010
28. Redon et al. 2014
29. Sippola et al. 2014
30. Treinys et al. 2016
31. Trivino et al. 2016
32. Vangansbeke et al. 2017
33. Ferris et al. 2000
34. Fridman & Walheim 2000
35. Kangas et al. 2015
36. Mikoláš et al. 2015
37. Mura et al. 2015
38. Roberge et al. 2015
39. Suchant & Braunisch 2004
40. Suter et al. 2002

41. Gittings et al. 2006
42. Rudolf et al. 2012
43. Lõhmus et al. 2016
44. Mullen et al. 2008
45. Oxbrough et al. 2006
46. Ozdemir et al. 2018
47. Santos et al. 2016
48. Standovár et al. 2016
49. Morelli 2015
50. Thingstad et al. 2018
51. Montané et al. 2016
52. Stachura-Skierczynska & Kosinski 2016
53. Bottalico et al. 2017
54. Keren & Diaci 2018
55. Kosewska et al. 2018
56. Ranius et al. 2016
57. Keren et al. 2017
58. Asbeck et al. 2019
59. Parisi et al. 2019
60. Güthlin et al. 2014
61. Czeszczewik et al. 2015
62. Kaufmann et al. 2017
63. Lindberg et al. 2015
64. Coote et al. 2013
65. Morelli et al. 2013
66. Thers et al. 2017
67. Straw et al. 2017
68. Renner et al. 2018
69. Purahong et al. 2014
70. Pakkala et al. 2015
71. Paffetti et al. 2012
72. Cullota et al. 2015
73. Kovač et al. 2016
74. Ambrosio et al. 2018

75. Durak & Durak 2016
76. Mikulova et al. 2019
77. Wei et al. 2020
78. Lecina-Diaz 2019
79. Parisi et al. 2020
80. Lešo et al. 2019
81. Miina et al. 2020
82. Augustznczik et al. 2019a
83. Barsoum et al. 2019
84. Broome et al. 2019
85. Kermavnar 2019
86. Lohmus & Lohmus 2019
87. Lelli et al. 2019
88. Magg et al. 2019
89. Velasquez et al. 2019
90. Muurinen et al. 2019
92. Bujoczek et al. 2020
93. Bertini et al. 2019
94. Tratcz et al. 2019

Reviews and synthesis removed from the list:

1. Noss 1999
2. Lindenmayer et al. 2000
3. Noss 1999
4. Noss 1990
5. Failing & Gregory 2003
6. Feris & Humphrey 1999
7. Lindenmayer et al. 2006
8. Hagan & Whitman 2006
9. Lindenmayer 1999
10. Angelstam & Petterson 1997
11. Simberloff 1999;
12. Brockerhoff 2008
13. Maleque et al. 2009

14. Uuemaa et al. 2013
15. Stephens et al. 2007
16. Heink & Kowarik 2010
17. Angelstam et al. 2004a
18. Linnell et al. 2000
19. Tischendorf & Farig 2003
20. McElhinny et al. 2005
21. Angelstam et al. 2003
22. Fabbio et al. 2003
23. Leitao & Ahern 2002
24. Poiani et al. 2000
25. Lindermayer & Likens 2009
26. Ranio & Niemela 2003
27. Rodrigues & Books 2007
28. Corona et al. 2011
29. Simberloff 1999
30. Roberts & Gilliam 1995
31. Nilsson et al. 2001
32. Dale & Byeler 2001
33. Thompson 2006
34. Winter et al. 2012
35. Angelstam 1997
36. Siitonen 2001
37. Fleishman et al. 2006
38. Edenius & Mikusiński 2006
39. Makela et al. 2012
40. Ezquerro et al. 2016
41. Angelstam et al. 2004b
42. Pukkala et al. 1997
43. Baskent et al. 2005
44. Baskent et al. 1996
45. Mönkönnen 1999
46. Masom & Zapponi 2015
47. Baskent & Jordan 1996

48. Korkmaz et al. 2018
49. Rempel et al. 2004
50. Eriksson et al. 2006
51. Molder et al. 2019

Research papers removed with reasons:

1. Butchard et al. 2010 (we couldn’t extract forest biodiversity indicators)
2. Franklin 1993 (not from Europe)
3. Barbati et al. 2014 (we couldn’t extract forest biodiversity indicators, and the context is focused on policy decisions on biodiversity)
4. Mörtberg et al. 2006 (not forest ecosystems)
5. Frank et al. 2012 (could not extract biodiversity indicators and ecosystems not defined)
6. Mönnkönnen et al. 2014 (the focus is not biodiversity assessment, but the competitiveness of timber production and biodiversity)
7. Nascimbene et al. 2009 (the scale is a tree)
8. Alday et al. 2010 (we could not identify how biodiversity was calculated)
9. De Warnaffe & Devillez 2002 (not written in English but French)
10. Gil-tena et al. 2010 (the focus is not biodiversity assessment)
11. Lundstrom et al. 2011 (the scale is the region)
12. Jayathunga et al. 2020 (couldn’t access)
13. Hanish et al. 2019 (not from Europe)
14. Dantas de Paula 2019 (the scale is global)
15. Evans et al. 2019 (the focus is not biodiversity assessment, but tree dieback)
16. Augustznczik et al. 2020 (could not extract biodiversity indicators)
17. Lohmus et al. 2012 (could not access the paper)
18. Augustznczik et al. 2019b (could not extract biodiversity indicators)
19. Brown et al. 2019 (not from Europe)
20. Pohjanmies et al. 2019 (focus is not biodiversity assessment)
21. Reise et al. 2019 (the scale is national)
22. Selkimäki et al. 2019 (could not extract the indicators)
23. Versluijs et al. 2019 (the scale is biome)

Table S2. Biodiversity attributes and indicators used in the literature sorted by type of biodiversity (structure, composition, function).

Biodiversity type	Attribute	Explanation	Biodiversity indicator	Author

Structure	Deadwood (DW)	Deceased laying or standing trees, branches, pieces of wood, wood stamps...	DW volume; coarse woody debris (pieces of DW); standing DW; laying DW; DW logs...	Karahalil et al. 2017; Jonsson & Jonsell 1999; Torras & Saura 2008; Smith et al. 2008; Roberge et al. 2008a; Angelstam & Dönz-Breuss 2004; Badalamenti et al. 2017; Laarmann et al.2009 ; Lafond et al. 2015; Pesonen et al. 2010; Redon et al. 2014; Sippola et al. 2004; Trivino et al. 2016; Ferris et al. 2000; Fridman & Walheim 2000; Roberge et al. 2015; Mullen et al. 2008 ;Standovár et al. 2016; Keren & Diaci 2018; Coote et al. 2013; Parisi et al. 2019; Kaufmann et al. 2017; Bujoczek et al. 2020; Muurinen et al.2019; Augustynczik et al. 2019; Barsoum et al. 2019; Lohmus &Lohmus 2019; Parisi et al. 2020; Lešo et al. 2019; Kovač et al. 2016
			Decay stage	Bujoczek et al. 2020
	Naturalness	The level of human influence in the forest	Uneven-age stands	Stachura-Skierczynska & Kosinski 2016;Roberge et al. 2008b
			Large trees	Angelstam & Dönz-Breuss 2004; Badalamenti et al. 2017; Lafond et al. 2015; Kangas et al. 2015; Roberge et al. 2015 ;Standovár et al. 2016; Roberge et al. 2008b; Stachura-Skierczynska & Kosinski 2016; Lohmus &Lohmus 2019; Lešo et al. 2019; Wei et al. 2020
			Mature trees/forests	Torras & Saura 2008; Redon et al. 2014; Gittings et al. 2006; Angelstam & Dönz-Breuss 2004 ;Standovár et al. 2016; Badalamenti et al. 2017; Stachura-Skierczynska & Kosinski 2016;
	Forest inventory variables	-	Volume	Paffetti et al. 2012 ; Bottalico et al. 2017; Kovač et al. 2016
			Diameter heterogeneity	Pach & Podlaski 2015; Redon et al. 2014; Keren et al. 2017; Bottalico et al. 2017; Kaufmann et al. 2017; Bertini et al. 2019; Wei et al. 2020
			Canopy cover	Smith et al. 2008; Gao et al. 2014; Coote et al. 2013; Bujoczek et al. 2020; Kermavnar et al. 2019; Parisi et al. 2020; Lešo et al. 2019
			Tree height	Paffetti et al. 2012; Bottalico et al. 2017; Bertini et al. 2019; Parisi et al. 2020
			Basal area	Paffetti et al. 2012 ; Bottalico et al. 2017; Bertini et al. 2019; Augustynczik et al. 2019; Parisi et al. 2020; Miina et al. 2020; Wei et al. 2020; Kovač et al. 2016

			Biomass	Bottalico et al. 2017; Bertini et al. 2019
			Stand age	Coote et al. 2013; Lešo et al. 2019; Miina et al. 2020
			Tree density	Bertini et al. 2019; Barsoum et al. 2019;
	Vertical structure	Stratification, layers of understory and overstory vegetation	Vegetation in three layers	Smith et al. 2008; Gao et al. 2014; Humphrey et al. 1999; Mura et al. 2015; Kaufmann et al. 2017; Muurinen et al.2019; Kermavnar et al. 2019; Lešo et al. 2019; Mikulova et al. 2019
			Shrub layer	Coote et al. 2013
			Litter cover	Smith et al. 2008; Lešo et al. 2019; Mikulova et al. 2019
	Horizontal structure	Density of vegetation cover		Mura et al. 2015
			Open space	Mullen et al. 2008
			Spacing	Smith et al. 2008; Mullen et al. 2008
			Proximity of old woodlands	Coote et al. 2013
	Microhabitats	Habitat small in size (e.g. a tree, small water pool)		Parisi et al. 2020; Smith et al. 2008
			Tree-related micro habitats	Roberge et al. 2008b; Ozdemir et al. 2018; Standovár et al. 2016; Asbeck et al. 2019; Augustynczik et al. 2019
	Fragmentation	The level of fragmentation and the connectivity of habitats		Schindler et al. 2018; Angelstam et al. 2018; Basile et al. 2016; Schindler et al. 2008
			Patch diversity, size, shape and aggregation, core area	Kovač et al. 2016; Schindler et al. 2008; Basile et al. 2016; Schindler et al. 2018
			Edge density, contrast	Basile et al. 2016; Schindler et al. 2018
	Topographic elements	Physical properties of the area	Slope	Tratcz et al. 2019; Augustynczik et al. 2019; Lešo et al. 2019; Mikulova et al. 2019
			Elevation	Augustynczik et al. 2019; Lešo et al. 2019
Composition	Species richness	The number of species per number of individuals or biomass		Schindler et al.2013; Lelli et al. 2019
	Plant species diversity	The number of species per e.g. stand or landscape	Plants	Gao et al. 2014; Durak & Durak 2016
			Woody plants	Schindler et al. 2013; Kermavnar et al. 2019; Lecina-Diaz et al. 2019
			Shrubs	Torras & Saura 2008; Martín-Queller et al. 2011; Gittings et al. 2006; Wei et al. 2020

			Trees	Torras & Saura 2008; Badalamenti et al. 2017; Gao et al. 2014; Martín-Queller et al. 2011; Motz et al. 2010; Redon et al. 2014; Sippola et al. 2004; Ferris et al. 2000; Kangas et al. 2015; Barsoum et al. 2019; Kermavnar et al. 2019; Lohmus &Lohmus 2019; Parisi et al. 2020; Kovač et al. 2016
			Ground vegetation	Rubio et al. 2011; Humphrey et al. 1999; Lafond et al. 2015; Gittings et al. 2006; Mullen et al. 2008
			Native species	Roberge et al. 2008b; Mikulova et al. 2019
			Invasive tree species	Standovár et al. 2016
	Endangered species	species threatened with declining or extinction		Anselme et al. 2009; Ranius et al. 2016
	Valuable flora and fauna	Animals and plants of particular ecological value		Kangas et al. 2015; Lelli et al. 2019
	Individual species	-	Orchids	Schindler et al.2013;
			Spiders	Smith et al. 2008; Mullen et al. 2008; Kosewska et al. 2018; Coote et al. 2013; Barsoum et al. 2019
			Hoverflies	Smith et al. 2008; Humphrey et al. 1999; Gittings et al. 2006; Straw et al. 2017
			Butterflies	Magg et al. 2019
			Saprophylic beetles	Ranius et al. 2016; Parisi et al. 2019; Magg et al. 2019; Parisi et al. 2020
			Carabid beetles	Kosewska et al. 2018; Barsoum et al. 2019; Parisi et al. 2020
			Ground-living beetles	Lindberg et al. 2015
			Meadow vipers	Anselme et al. 2009
			Capercaillies	Trivino et al. 2016;Mikoláš et al. 2015; Suchant & Braunisch 2004, Suter et al. 2002
			Woodpeckers	Romero-Calcerrada & Luque 2006; Roberge et al.2008a; Mikusiński et al. 2001, Basile et al. 2016; Trivino et al. 2016 ; Lõhmus et al. 2016
			Black storks	Treinys et al. 2016
			Hazel grouses	Trivino et al. 2016
			Long-tailed tits	Trivino et al. 2016
			Flying squirrels	Trivino et al. 2016
			Red foxes	Güthlin et al. 2014

	Taxa	Taxonomic group of any rank, such as a species, family, or class.	Birds	Czeszczewik et al. 2015; Morelli 2015; Lindberg et al. 2015; Coote et al. 2013; Morelli et al. 2013; Renner et al. 2018; Bujoczek et al. 2020; Velasquez et al. 2019; Magg et al. 2019; Lelli et al. 2019; Augustynczik et al. 2019; Broome et al. 2019; Lecina-Diaz et al. 2019; Lešo et al. 2019
			Bryophyte	Jonsson & Jonsell 1999; Smith et al. 2008; Humphrey et al. 1999; Kaufmann et al. 2017; Coote et al. 2013; Barsoum et al. 2019; Broome et al. 2019
			Coleoptera	Jonsson & Jonsell 1999; Müller & Brand 2009; Humphrey et al. 1999; Mullen et al. 2008
			Flying arthropods	Barsoum et al. 2019
			Fungi	Jonsson & Jonsell 1999; Angelstam & Dönz-Breuss 2004; Sippola et al. 2004; Ferris et al. 2000; Kinga et al. 2012; Thers et al. 2017; Lelli et al. 2019; Broome et al. 2019; Ambrosio et al. 2018
			Moss	Mikulova et al. 2019
			Lichens	Jonsson & Jonsell 1999; Angelstam & Dönz-Breuss 2004; Kaufmann et al. 2017; Lelli et al. 2019; Broome et al. 2019; Lohmus &Lohmus 2019; Miina et al. 2020
			Liverworts	Broome et al. 2019
			Resident birds	Roberge & Angelstam 2006
			Small terrestrial birds	Schindler et al.2013
			Vascular plants	Smith et al. 2008; Humphrey et al. 1999; Kaufmann et al. 2017; Coote et al. 2013; Lelli et al. 2019; Barsoum et al. 2019; Broome et al. 2019; Mikulova et al. 2019
			Orthopterans	Schindler et al.2013;
			Amphibians	Schindler et al.2013; Velasquez et al. 2019; Broome et al. 2019
			Bats	Renner et al. 2018
			Reptiles	Schindler et al.2013; Vangansbeke et al. 2017; Velasquez et al. 2019; Magg et al. 2019; Broome et al. 2019
			Mammals	Velasquez et al. 2019; Magg et al. 2019; Broome et al. 2019
Function	Disturbance	Natural or human induced changes in ecosystem	Proportion of plots with uprooting	Roberge et al. 2008b; Angelstam & Dönz-Breuss 2004
			Proportion of plots with periodic flooding	Roberge et al. 2008b
			Uprooted trees	Bujoczek et al. 2020
			Rockfall	Standovár et al. 2016
	Mortality	Dying of forest trees	Individual tree mortality	Laarmann et al.2009

Tree sp. regeneration		Saplings and shoots	Bujoczek et al. 2020; Cullota et al. 2015
		Type of regeneration	Kovač et al. 2016; Lohmus & Lohmus 2019; Standovár et al. 2016
Nutrient cycling	The movement of nutrients in the environment	Leaf litter nutrient cycling	Purahong et al. 2014
	Soil properties	Available Phosphorus (P)	Smith et al. 2008
		Nitrogen	Durak & Durak 2016
		Nutrients	Kermavnar et al. 2019; Mikulova et al. 2019
		Thickness of organic layer	Kermavnar et al. 2019;
		Ph	Kermavnar et al. 2019; Durak & Durak 2016; Mikulova et al. 2019

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Table S3. Correlation.

Author	Indicators used in the study	Positive correlation	Negative correlation	Method	Tool	Scale
Karahalil et al. 2017	Deadwood, crown closure, understory trees, altitude, stand age	Deadwood volume and that of living trees, crown closure, altitude ($p < 0.01$), and stand age ($p < 0.05$).	he number of understory trees ($p < 0.01$) and DW	Pearson correlation	SPSS 16.0 ™ software.	Stand
Jonsson & Jonsell 1999	the abundance of dead trees, overall habitat diversity, stand age, total richness of bryophytes	A strong correlation ($P < 0.05$) between the abundance of dead trees, overall habitat diversity and stand age		Principal Component Analysis (PCA)		Stand
		Mosses and vascular plants		Pearson correlation coefficients		1 ha
		the number of indicator species of wood-living fungi and vascular plants		Pearson correlation coefficients		1 ha
		Total richness of bryophytes and wood-living fungi		Pearson correlation coefficients		0.25 ha
		wood-living fungi and wood-inhabiting beetle species		Pearson correlation coefficients		1 ha
		wood-living fungi and the total number of beetle species		Pearson correlation coefficients		1 ha
		number of wood-inhabiting beetle species and number of fungi indicator species	number of indicator bryophytes and number of wood-inhabiting beetle species	Pearson correlation coefficients		1 ha
Smith et al. 2008	bryophytes, vascular plants, spiders, hoverflies and birds; structural and functional attributes	Dunnock, Wren and Blackbird with bird richness and abundances; Species richness of forest vascular plants, bryophyte and spiders increased with forest age; available P was positively correlated with vascular plant species richness	Goldcrest with bird species richness; Total bird species richness in Older forests was negatively correlated with site elevation	ANOVA/t-tests for categorical variables and correlation (Pearson's r) for continuous variables		Stand
Coote et al. 2013	bryophytes, vascular plants, spiders	Bryophyte species richness and relatively high canopy cover plantations on poorly drained soils; bird species		ANOVAs or t-tests	SPSS (2007); R Development Core	stand

	and birds; structural and functional attributes	richness and more open plantations with high shrub cover; coarse woody debris and forest-associated bryophytes; Both proximity to old woodland and stand age and forest associated vascular plants; stand age and forest-associated spiders		for categorical variables and correlation analysis (Pearson's) for continuous variables.	Team (2012) using the ppcor package (Kim 2011)	
Mikusińs ki et al. 2001	the richness of woodpecker species (strongly related to forest and those visiting other habitats) and richness of other forest bird species (strongly related to forest and those visiting other habitats)	White-backed and Tree-toed woodpeckers (strongly related to forest) and forest bird species diversity		Linear regression analysis		landsca pe
		White-backed and Tree-toed woodpeckers (strongly related to forest) and bird species diversity strongly related to forest				
Gao et al. 2014	Stand structure parameters (canopy coverage, age of canopy trees, tree species composition and canopy stratification); soil classes (9); plant species diversity	soil class, stand structure parameters and plant species diversity/composition are all positively correlated in general; semi-open canopy and plant species diversity in young and middle-aged stands; plant diversity had a strong positive association with soil pH in mesic to moist soil conditions in temperate and boreal regions		General Linear Mixed Model	Microsoft Office Excel 2007	Stand
Humphre y et al. 1999	syrphid (hoverflies) and carabid (ground beetles) community composition and diversity, and stand structure and field layer vegetation.	vertical stand structure showed the best correlation with species richness and diversity of both carabids and syrphids				Stand
	individual tree mortality and composition and deadwood					

	structure as an indicator of naturalness					
Laarmann et al.2009	mean deadwood mingling index (DMi), nature value score, diversity index of mortality causes (CMDI), number of mortality causes (CM) and recent deadwood volume (RDV5)	Nature value score significantly correlated with the diversity index of mortality causes (CMDI), indicating that CM are more diverse in semi-natural stands		Spearman correlation matrix		Stand
Sippola et al. 2004	species richness of polypores and timber variables; and between CWD volume and the management intensity.	The results show that the species richness of polypores in the boreal forest is connected not with the fertility the gradient of the forest site type, but with the amount and quality of CWD.		Spearman's non-parametric correlation		Stand
Treinys et al. 2016	Macrohabitat scale(Proportion of deciduous, coniferous, mixed forest and water body in a 2.8-km radius; Hydrological network density, km/km2) Nesting territory scale (Volume proportion of pine, spruce, broadleaves…; Shortest distance to the forest edge Shortest distance to the paved road Shortest distance to the dirt road	distances to the forest edge and to houses were strongly interrelated; the coniferous proportion around nests at the macrohabitat scale correlated with the pine proportion at the nesting territory scale (r = 0.74,) and the pine proportion at the nesting territory scale correlated with the pine proportion at the nest site scale (r = 0.55).				Stand and landscape
Vangansbeke 2017	crested tit (Lophophanes *cristatus*), coal tit (*Periparus ater*), nightjar (*Caprimulgus europaeus*) and common lizard (*Zootica vivipara*) for estimation of biodiversity of a patch	Coal tits seemed to prefer closed high forest without open patches, without too much recreation and from age class 81–100. Crested tits had a higher probability of occurrence in large high forest stands, with	The probability of occurrence of the coal tit was strongly negatively related to a higher recreation pressure and to the amount of adjacent open patches	General linear model	R 3.0.1 (R Core Team 2013), using the multimodel inference package (MuMIn)	Stand

		the low recreational intensity and a limited amount of border with open habitat. The probability of occurrence for churring nightjars was higher in smaller stands with a high amount of adjacent open habitat. Also, some stand age classes had a much higher probability of occurrence for nightjars, particularly stands from age class 81–100, 21–40 and uneven-aged stands.			
Ferris et al. 2000	macrofungi species and plot environmental variables	Positive relationships were recorded between the increased volume of deadwood and the number of species of wood saprotrophs, and also between the species richness of ectomycorrhizal fungi and the number of tree species present in each plot. Significant correlations were also recorded between the number of parasitic fungal species and soil pH (a positive response to increasing alkalinity), and between the number of litter colonizing saprotrophs and tree species richness	the number of species of litter saprotroph was found to be negatively correlated with the number of tree species present in each plot	Pearson correlation	Stand
Suchant & Braunisch 2004	Capercaillie and stand variables (forest stand type, canopy closure, age class, species mixture, successional stage, stand height, vertical stratification, ground vegetation, soil type and cover as well as height of blueberry Vaccinium myrtillus)			Pearsons correlation coefficient and logistic regression	Stand

	Capercaillie and landscape variables (Altitude (m), Forest cover %, Slope^{0}, Linear infrastructure m ha^{-1}, Exposition)			Pearsons correlation coefficient and logistic regression		Landscape
Suter et al. 2002	relationships between vegetation structure and avian diversity	Both Capercaillie and mountain birds responded positively to forest structure characterized by intermediate openness, multistoried tree layer, presence of ecotonal conditions, and the abundant cover of ericaceous shrubs		multiple-regression analysis		Stand
Gittings et al. 2006	forest road width; open space area with species the richness of the forest; small open space; large open space; open scrub hoverfly species groups	species richness of the open space fauna positively correlated with forest road width; Species with larvae feeding on the foliage of trees and shrubs associated with the presence of broad-leaved woody vegetation; Species with larvae developing in surface water habitats associated with wet habitat features.		Pearson’s correlations		Stand
	habitat structure and hoverfly species richness	nearly 80%, of the species associated with open space habitats rather than closed-canopy forest		ordination analyses of the habitat parameters; non-metric multidimensional scaling analysis (NMS)		
Oxborough et al. 2006	open space on ground-dwelling spider assemblages	At a large scale the total amount of open space within 200 m of sampling plots positively correlated with species richness and abundance.		Pearson’s correlation		Stand and landsape
Montané et al. 2016	V. myrtillus and overstory and understory	V. myrtillus showed mostly positive associations with grasses and mosses.	Overstorey cover negatively influenced V. myrtillus cover, its height, and particularly, the number of fruits	Chisquare ($\chi 2$) and 2 × 2 contingency tables derived from presence/absence of the two cover types from the series of point contacts, including Yates’s correction (Kent & Coker 1992).	R Development Core Team 2011	Stand and landscape

Czeszczewik et al. 2015	Bird assemblages and forest management practices	The basal area of live trees had a positive effect on the abundance of birds	the density of live trees had a negative significant effect on bird abundance and species diversity	Not clear	R Development Core Team 2010	Stand

References:

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File S1: Definitions

Alpha diversity refers to the diversity within a particular area or ecosystem and is usually expressed by the number of species (i.e., species richness) in that ecosystem (Whittaker 1972).
ALS Airborne laser scanning, also commonly known by the acronym LiDAR (Light Detection And Ranging) is an active remote sensing technique, used to record the surface of the earth, specifically the topography of large areas of terrain and objects on appearing on it. (gmv.cast.uark.edu/scanning-2/airborne-laser-scanning)
Beta diversity is diversity between ecosystems (Whittaker 1972).
Compositional variables should represent the types of elements that are characteristic of forests with a high degree of naturalness (Roberge et al. 2008b);[87]
Coppice systems consist of stands that originate from stool shoots or suckers of vegetative origin (Mura eta l. 2015).
Coarse Woody Debris (CW), i.e., deadwood pieces with diameter >= 7 cm (Lafond et al. 2015).
Diversity is 'the variability among living organisms from all sources including among other things, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This definition includes diversity within species, between species and of ecosystems' (Convention on Biological Diversity 1992).
Double Brest Height (DBH), is the height at which tree diameter is typically measured (1.3m above the ground). (http://www.fao.org/3/ae578e/AE578E06.htm)
Indicator species are expected to indicate the status of an environment or to serve as proxies for a larger number of species (Hawskwort & Rose 1970; Block et al. 1986; Furness & Greenwood 1993 Mikusinski et al. 2001).
Indicandum (i.e. the indicated aspect of biodiversity).
Light detection and ranging (LiDAR), 'also known as laser detection and ranging (LaDAR) or optical radar, or ALS (Airborne laser scanning) is an active remote sensing technique which uses electromagnetic energy in the optical range to detect an object (target), determine the distance between the target and the instrument (range), and deduce physical properties of the object based on the interaction of the radiation with the target through phenomena such as scattering, absorption, reflection, and fluorescence' . (https://link.springer.com/referenceworkentry/10.1007%2F978-3-319-23386-4_44).

Fine woody debris, i.e., of deadwood pieces with diameter < 7 cm (Lafond et al. 2015).
Focal species approach is based on the idea that conservation of specialised and area-demanding species can contribute to the protection of many naturally co-occurring species (Lambeck 1997; Hess & King 2002; Roberge & Angelstam 2004; Naumov et al. 2018).
Forest biodiversity is the diversity of all forms of life and its organisation within the forest area (Winter et al. 2011; Hunter 1990).
Functional variables concern the processes that are characteristic for naturally dynamic forests as well as the anthropogenic processes that tend to move the ecosystems away from naturalness (Roberge et al. 2008b); [87].
Forest of high conservation value as any forest area which has been officially recognised as important for the conservation of forest biodiversity **(**Roberge et al. 2008a); [88].
Forest naturalness is a 'complex issue converging forest dynamics, disturbances at different scales, adaptation to changing the environment and human influence. Also, the level of naturalness is the extent to which human influence has affected the current forest structure and here forests are classified as e.g. old-growth, natural, recovering, or commercial forests, depending on the signs of management activities' (Uotila et al. 2002; Laarmann et al.2009).
Forest inventories gather compositional and structural information from samples that represent large areas and are used for monitoring of national or regional forests (Standovár et al. 2016).
Gamma diversity is a measure of the overall diversity for the different ecosystems within a region (Whittaker 1972).
Large trees- e.g., trees with diameter > 70 cm (Lafond et al. 2015).
Macrofungi are those species of fungi which produce a relatively conspicuous sporocarp (fruiting body); this group includes many Basidiomycetes (excluding rusts, smuts and yeasts) and some Ascomycetes (Pezizales) (Watling 1995).
Silvopastoral systems (dehesas or montado) are 'the integration of trees and shrubs in pastures with animals for economic, ecological and social sustainability' (http://www.fao.org/3/i1880e/i1880e09.pdf). These systems are typical in southwestern regions of the Iberian Peninsula (Mart´ın-Queller et al. 2011).
Species richness is the number of species, **species diversity** is the number of species in relation to their abundances and **species density** is the number of species per unit area. Different indexes can be used to measure species diversity (e.g. McIntosh index, which requires a number of individuals of all species; or Berger-Parker index which requires a number of individuals of the most abundant species and a total number of individuals) Lexer et al. (2000).
Structural variables refer to the spatial configuration of the elements, to their quantities and to habitats found in natural forests (Roberge et al. 2008a).
Forest birds are species that forage or nest in trees and that can breed in extensive forestland.
The natural forest can be defined as an idealized virgin forest condition that is not influenced by large-scale, systematic human activity (Bradshaw, 2005; Laarmann et al.2009)
The participatory GIS (Geographic Information System), recommends ways to collect, model, and visualize the local information and opinions with GIS tools (Kangas et al. 2015).
Remote sensing is defined as 'the art, science and technology through which the characteristics of objects/targets either on, above or even below the Earth's surface are identified, measured and analysed without direct contact existing between the sensors and the objects or events being observed' (https://www.sciencedirect.com/topics/earth-and-planetary-sciences/remote-sensing).
Tree species diversity, based on the number of species and their relative abundance in basal area (Lafond et al. 2015).

Umbrella species are 'species whose conservation confers protection to a large number of naturally co-occurring taxa' (Fleishman et al. 2000; Roberge & Angelstam 2004; Roberge et al. 2008a).
DNA **metabarcoding: '** is an approach that combines DNA barcoding with next-generation sequencing (NGS), which enables sensitive high-throughput multispecies identification on the basis of DNA extracted from complex samples (Taberlet et al. 2012). DNA metabarcoding uses more or less universal polymerase chain reaction (PCR) primers to mass-amplify informative DNA barcode sequences (Straats et al. 2016; Fahner et al. 2016). Subsequently, the obtained DNA barcodes are sequenced and compared to a DNA sequence reference database from well-characterized species for taxonomic assignment (Taberlet et al. 2012; Fahner et al. 2016)' (Arulandhu et al. 2017).

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