

1 **Extension, advice and knowledge systems for private forestry: understanding**
2 **diversity and change across Europe**

3 **Abstract**

4 The decisions and actions of private forest owners are important for the delivery of forest
5 goods and services. Both forest ownership, and policies related to forest owners, are
6 changing. Traditionally in most countries, government extension officers have advised and
7 instructed forest owners, but this is evolving, with greater importance given to a range of
8 actors, objectives, and knowledge types. Drawing on literature and mixed data from 10
9 countries in Europe, this paper explores how forestry advisory systems can be
10 conceptualized, and describes their current situation in Europe. Drawing parallels with the
11 concept of AKIS (Agricultural Knowledge and Information Systems), we propose the term
12 FOKIS (FOrestry Knowledge and Information Systems), as both a system (a purposeful and
13 interdependent group of bodies) and a method for understanding such systems. We define
14 four dimensions for describing FOKIS: owners, policy goals, advice providers, and tools. We
15 find different roles for extension in countries with centrally controlled, highly regulated
16 forest management, and advisors in regions where forest owners have more freedom to
17 choose how to manage their forest. We find five trends across Europe: increased flexibility,
18 openness and participation of owners as sources of information; increasing reliance on
19 information and persuasion rather than enforced compliance; a shift of attention from
20 timber to a wider range of ecosystem services such as biodiversity and recreation; a shift of
21 funding and providers from public to private sector; emergence of new virtual
22 communication tools. The approach provides a way to make sense of comparisons and
23 change in FOKIS, and opens up an important research field.

24 **Keywords:** family forestry, knowledge exchange, policy tools, private forest owners,
25 regulation, technology transfer

26 **1 Rethinking forestry extension as a system**

27 Society has high expectations of forests to deliver a wide range of ecosystems services, in
28 the context of sustainable forest management and the Sustainable Development Goals
29 (United Nations, 2015), and policy has to balance the expectations of different stakeholder
30 groups. In Europe, where more than 53% of the forest area is owned by private owners, of

31 which in turn at least 65% is owned by individuals and families (FAO, 2015; UNECE,
32 forthcoming), forest management outcomes depend on the decisions and actions of these
33 owners.

34 Both forest ownership, and the ways in which policy seeks to influence the behaviour of
35 private forest owners, are changing. Private forest ownership across Europe is highly diverse
36 and includes individuals and families, industrial and financial investment companies,
37 communities and commons, as well as third sector organizations. The number of private
38 owners is increasing, the average size of forest holding is decreasing, and owners are
39 becoming less attached to the land and to their ancestral communities (UNECE,
40 forthcoming; Weiss et al., 2019). Forest owners are facing changing policy expectations and
41 pressure from markets and citizens to adjust forest management.

42 Consequently, the roles and settings for communication between policy and practice are
43 becoming more diverse. This paper aims to enhance our understanding of forestry advisory
44 systems for private forest owners, by first drawing on wider work to develop a framework
45 for comparisons, and then comparing countries with different and changing actors (owners,
46 advisers and policy makers), ownership structures, and political economies. We use an
47 approach based on systems, i.e. the 'components and processes' that constitute the field of
48 interest (Bellamy et al., 2001). This basic level of systems thinking in turn provides a platform
49 for more dynamic approaches that embrace diversity, shared learning and pathways to
50 adaptability and transformation (Armitage et al., 2009), but that level of sophistication
51 requires work beyond the scope of this paper. We aim to describe the main components of
52 the system in Europe, and as a basis for identifying regional patterns and current trends in
53 the organisation and practice of advisory services and knowledge exchange. We also reflect
54 on the value of taking a systemic approach to understanding forestry extension
55 developments, as the basis for a wider research programme.

56 **1.1 Policy tools for engaging private forest owners**

57 Governments and other stakeholders seek the cooperation of private forest owners to
58 support and implement policy objectives such as continuous wood mobilization, climate
59 change mitigation and adaptation, or conservation of biodiversity. To influence private
60 owners' decisions and behaviours, they use coercive, remunerative (rewarding) and
61 normative (influencing) strategies (Vedung, 1998). These are packaged as policy instruments

62 including regulation, financial incentives, and information or education, a typology
63 popularised as ‘sticks, carrots and sermons’ by Bemelmans-Videc et al. (1998). Different
64 national and regional contexts favour different mixes of policy tools from the highly
65 regulated forests of former socialist countries to Sweden’s highly deregulated ‘freedom with
66 responsibility’ (Bouriaud et al., 2015; Fischer et al., 2010; Lawrence and Dandy, 2014;
67 Löfmarck et al., 2017).

68 Concerns about the efficacy of policy tools have prompted a large body of research into
69 forest owners’ responses to policies and programmes designed to encourage change.
70 Results are mixed. Resistance to state intervention is typical, in countries as politically
71 distinct as USA and Romania (e.g. Ma et al., 2012a; Nichiforel and Schanz, 2011). Many
72 studies look for ways to understand and predict which owners will engage or not, with policy
73 instruments. Contributing factors are social (such as age, gender, family tradition),
74 geographical (such as distance from urban areas), or resource-based (such as size of holding,
75 income, and length of ownership), which are not easily influenced by policy (Karppinen,
76 2012; Serbruyns and Luyssaert, 2006). Incentive programmes have often been judged too
77 complex and poorly communicated, with excessive paperwork and many organizations
78 involved. A common problem with incentive-based policy instruments has been poor
79 awareness among landowners (Hibbard et al., 2003; Sun et al., 2009), who prefer one-to-one
80 site visits with a professional; outcomes can improve when financial incentive mechanisms
81 are combined with active advice (Kilgore et al., 2007; Lawrence and Dandy, 2014;
82 Ovaskainen et al., 2017). The quality and suitability of communication modes is at the heart
83 of many studies examining the effectiveness of advisory services and programmes,
84 highlighting the need for mutual trust, as well as understanding differences in cultural
85 perceptions, beliefs, motivations and terminology, particularly in the Nordic countries and
86 the USA (Davis and Fly, 2010; Hujala and Tikkanen, 2008; Krantz et al., 2013)

87 **1.2 Diverse and changing forest ownership**

88 Across Europe, private ownership is increasing, and the characteristics of forest owners have
89 been changing in recent decades. Contributing factors include: restitution in some former-
90 socialist countries; privatisation of state forests; market exchange; new forest ownership
91 through afforestation or natural succession on abandoned farmland; and heirs with different
92 lifestyles compared with their forebears (Weiss et al., 2019; Živojinović et al., 2015).

93 These changes in ownership, coupled with wider social, political and economic change,
94 create new stimulus for innovation in forest advisory systems. For example in Romania and
95 Croatia, following the shift from centrally-planned to capitalist economies, public forests
96 have been (partially) returned to the descendants of those who owned them before the
97 second World War. This has required the establishment of new forestry administrative
98 offices to provide extension services to the new private owners (Lawrence, 2009; Weiland,
99 2010). Cooperative governance mechanisms such as forest owners' associations have
100 become more prevalent especially in central eastern and south eastern Europe where,
101 again, newly restituted or privatised forests create large numbers of small scale forest
102 owners with little forest management experience (Sarvašová et al., 2015). In contrast, in
103 northern Europe the main trends affecting forest ownership are changing lifestyles of
104 existing and new generations of owners, particularly through urbanisation and employment
105 patters that rely less on income from the land (Weiss et al., 2019). Forest advisory services in
106 these regions, particularly the Nordic countries where forestry is an important part of the
107 economy, are influenced by new information and communication technology, and growing
108 interest in peer-to-peer learning approaches (Hamunen et al., 2015a; Hokajärvi et al., 2009).

109 **1.3 Conceptual framing for the study**

110 With change in ownership, policies, and advisory methods, we need a systemic way to
111 comprehend the diversity and change of forestry advice within private forestry and the
112 influences each of these components have on each other. To study this, we must include the
113 actors and knowledge processes involved in a range of activities including extension, advice,
114 forest management services, consultancy, decision support systems, regulation,
115 administration, knowledge transfer, knowledge exchange, education, information, guidance,
116 forest services, and outreach.

117 Conventionally, forestry education and outreach activities have focused on knowledge
118 transfer from professionals to landowners. For decades it has been the state officers' duty to
119 conduct law enforcement and orientate forest owners' practices (Appelstrand, 2012; Ma et
120 al., 2012b; Steyaert et al., 2007). In recent decades, shifts towards more participatory
121 approaches aim to decentralise and empower local involvement in forest management
122 decisions (Böcher, 2012; Johnson et al., 2006; Kueper et al., 2013; Lindahl et al., 2017;
123 Mendes et al., 2011; Vangansbeke et al., 2015).

124 Schut et al. (2014) describe four stages in the evolution of agricultural extension and
125 knowledge systems, from the technology transfer period (1950s–1980s), through top-down
126 farming systems approaches (1980s-1990s) to the opening of a more inclusive approach
127 described as Agricultural Knowledge and Information Systems (AKIS) which aimed to
128 integrate different types of knowledge and participatory research. AKIS developed in the
129 1990s as a route to a more holistic approach to knowledge, and have been reinvigorated in
130 recent years with a shift from *information* to *innovation* system (Curry et al., 2012; Knierim
131 et al., 2015).

132 There is no comparable synthesis of change in forestry extension and knowledge processes.
133 Given the changes in forest ownership, expectations of owners, and shifts in policy
134 approaches, it is timely to take such an overview. We do so by adapting definitions of AKIS,
135 to define the FOKIS (FOrestry Knowledge and Information System) as a purposeful
136 assemblage of actors, organisations and their interactions, intended to influence forest
137 management behaviour. A system is more than a network; it encompasses the actors,
138 linkages, purpose and practices of a defined field of human endeavour (Carlsson et al.,
139 2002). As a system which includes human values and behaviours, the FOKIS is a ‘soft system’
140 in which people take decisions in relation to purposeful and meaningful action, based on
141 interaction with multiple actors (Checkland, 2000; Checkland and Scholes, 1990). In soft
142 systems, there are therefore many different perceptions of the problem and the goal
143 (Cundill et al., 2012). These multiple actors, perspectives and goals are highly relevant to the
144 context of private forest management. Our definition is therefore a basic, working definition
145 which enables us to make a start in exploring FOKIS across Europe, recognising the diversity
146 of perspective and the value of knowledge processes, without taking on the task of
147 evaluating the impacts and effectiveness of different FOKIS. [The conceptual framework](#)
148 [provided here, can be further developed for research, evaluation and / or operational](#)
149 [guidance.](#)

150 **2 Research design**

151 **2.1 COST Actions as interdisciplinary and transdisciplinary research**

152 This work was facilitated by a [COST](#) Action project, FACESMAP (Forest Land Ownership
153 Changes in Europe: Significance for Management and Policy). [COST Actions are networks](#)
154 [dedicated to scientific collaboration, funded by the European Union, explicitly designed to](#)

155 complement national funding sources. The funding covers networking tools, such as
156 meetings, conferences, workshops, short-term scientific missions, training schools,
157 publications and dissemination activities. Participants' travel and subsistence costs are
158 included, but there is no funding for time or new data collection. The COST Action is
159 therefore a special approach which creates the opportunity to bring together experts from
160 different countries, disciplines and occupations, to share experience and ideas, but not to
161 collect new data. Like other Cost Action projects (e.g. Menzel et al., 2012; Verkerk et al.,
162 2014) our outputs made best use of the opportunity by identifying a need and addressing it
163 through the development of a conceptual framework. This paper describes that work, as a
164 platform for future work on forestry advisory systems.

165 Participants in FACESMAP included forestry practitioners and consultants, natural and social
166 science researchers, forest scientists, UNECE representatives, national level policy-makers,
167 non-governmental interest groups and association representatives. FACESMAP participants
168 analysed literature and secondary data to produce a set of country reports available for
169 participants to analyse (Živojinović et al., 2015). The authors of this paper established a
170 working group to use this and additional data, to address the objectives of this paper.

171 FACESMAP also provided a context in which the group visited and interacted with forest
172 owners, managers, extension officers, advisers and policy makers, in eight European
173 countries. The opportunities for gathering new information therefore included field trips and
174 stakeholder workshops (Feliciano et al., 2019), keynote speakers at FACESMAP meetings,
175 literature shared within the group, and methods developed specifically to make sense of
176 diversity and change in forest advisory systems in Europe. Thus, although the core group
177 consisted of self-selected experts in their own disciplines and geographical contexts, we
178 benefited from interaction with a wide range of other stakeholders.

179 **2.2 Process**

180 This approach thus incorporated methods that were both interdisciplinary (integrating social
181 and natural science methods) and transdisciplinary (uniting researchers, practitioners and
182 policy advisers). It has been argued that research on complex sustainability problems
183 requires constructive input from various communities of knowledge, in order to increase
184 legitimacy, ownership, and accountability for the problem (Lang et al., 2012), and as work
185 that results in 'the restructuring of disciplinary knowledge and / or the creation of new

186 shared knowledge' (Jakobsen et al., 2004). Like many cross-disciplinary processes our
187 approach needed to be participatory, iterative and reflective (Fazey et al., 2014; Lang et al.,
188 2012), to help participants from very diverse backgrounds develop consensus about the
189 language and dimensions. This required multiple sequential meetings where we discussed
190 our findings, summarised them, and sought approval or further need for clarification.
191 Ultimately, we needed to find modes of description which all participants understood and
192 agreed.

193 We built on transdisciplinary work (Lemieux et al., 2014; Harrison et al., 2013) by developing
194 a process for the stepwise development of knowledge together through two interacting
195 tasks: iterative mutual valorisation of dimensions of a FOKIS, and the variations of those
196 dimensions in each country; and cross-country comparisons to describe relationships
197 between dimensions of FOKIS and country specific forest policy factors.

198 The authors of this study, who constitute the research group, met six times and developed
199 an approach that ensured involvement of each individual member of the research group in
200 cross-cutting analysis and syntheses. Steps of the process included:

- 201 1. identify, based on inputs from each participant, the context dependent elements
202 that characterize the FOKIS across different regions;
- 203 2. develop a proforma to gather information about country-specific approaches and
204 experiences (see Table 1);
- 205 3. gather data to address each proforma topic from FACESMAP country reports and
206 their authors, fact-checking consultations with experts (e.g. lawmakers, forest
207 authorities), forest policy and legal documents, and consultations with policy
208 colleagues (see Table 1);
- 209 4. conduct cross-cutting analysis of information collected by proforma (see section 2.4
210 below);
- 211 5. select the most helpful indicators from national statistics, to describe national /
212 regional contexts;
- 213 6. collectively agree necessary and sufficient dimensions to describe our systems
214 proforma (see section 2.4 below);
- 215 7. explore ways of conceptualising the links between these;
- 216 8. draw out key themes.

217 **Table 1 Guide topics for questionnaire**

218 *Forest legislation includes acts, decrees, strategies, policy programmes and guidelines

219 ** Secondary data includes statistics, research reports and evaluations

220 *** Expert opinion includes fact-checking communications

Context dependent elements	Topic addressed	Type of questions	Source of data
Forest policy context	Q1. type of forest policy and regulatory framework	Closed	Forest legislation*; review of government organisation
	Q2. requirements for <u>forest management plan (FMP)</u>	Closed	Forest legislation
	Q4. main forest policy objectives	Closed	Forest legislation
Forest owners' interests	Q3. how is the FMP used by the forest owners?	Closed	Forest legislation Secondary data** analysis
	Q5. what do forest owners want from the advisory system	Semi-closed	Secondary data analysis
	Q6. what wider discourses shape the ideas and activities of private forest owners?	Semi-closed	Secondary data analysis
Components of advisory system	Q7. who are the providers of advice and what are their aims?	Open	Forest legislation Secondary data analysis Expert opinion***
	Q8. which sources of advice do forest owners in fact use?	Open	Secondary data analysis Expert opinion
	Q9. qualifications and accreditation of stakeholder	Open	Forest legislation
	Q10. who pays for which kind of advice?	Open	Forest legislation Secondary data analysis Expert opinion
Impact and change	Q11. what do we know about the success of these approaches?	Open	Secondary data analysis Expert opinion
	Q12. how is this system changing?	Open	Secondary data analysis

221 The data was compiled by reviewing and summarizing information in the COST country
222 reports referred to above (Živojinović et al. 2015). This information was enriched with the
223 present authors' knowledge of their own countries and through short fact-checking
224 interviews with other country report authors as well as forest practitioners and managers.
225 The aims of the study did not require more nuanced data, which would not have been
226 feasible under this type of funding mechanism.

227 In summary our data sources consisted of policy and legal documents (forest legislation,
228 policy programmes); expert opinion (clarification from key informants on points of law such
229 as the application of forest management plans); and secondary data including national
230 statistics and consultancy reports about the uptake of advisory services. Our study was not a
231 literature review, but (mainly through the country reports) included published and grey
232 literature that helped to answer the questions listed in Table 1.

233 Some questions are 'closed', i.e. the answer is provided by legislation and is not open to
234 interpretation. Others are 'open' and could not be answered with yes / no or fixed menus of
235 responses, because they are subject to opinion or interpretation. For example, payment for
236 different types of advice may be established in law (and therefore require simply fact-
237 checking), or may be evolving as society and forest ownership changes (and therefore be
238 subject to interpretation by experts). These interviews helped to highlight issues and
239 variations across countries; they were not designed to provide qualitative data for
240 systematic analysis. The intention was to understand variation that needed to be captured in
241 the conceptual framework developed in this paper.

242 **2.3 Study countries**

243 Ten countries were included, based on the availability of researchers who wanted to
244 participate. Contributors were FACESMAP participants who were interested in studying
245 FOKIS and capable of providing information from their own country. During the process, a
246 few additional countries were invited and joined the group to ensure a better geographical
247 and institutional balance across Europe. The ten are distributed across four MCPFE regions
248 (FOREST EUROPE et al., 2011):

- 249 • North Europe: Finland, Sweden, Estonia, Latvia;
- 250 • Central West-Europe: Belgium, France, United Kingdom;

- 251 • Central East-Europe: Poland, Romania;
 252 • South-West Europe: Portugal.

253 Participating countries vary with respect to economic, social and institutional indicators
 254 (Table 2). Private owners hold the majority of the forest in the study countries, with the
 255 exception of Poland (19%) and Romania (36%). Private forest holdings below 10 hectares are
 256 predominant in Belgium (96%), France (96%), Poland (99%), Portugal (93%), and UK (92%).
 257 whereas the share of small holdings is much lower only in Finland (47%) and Sweden (35%).
 258 Countries also vary with respect to the legal framework regulating private forestry which
 259 imposes different level of restrictions on private forest owners (Nichiforel et al., 2018).

260 **Table 2. Forest ownership main characteristics/features in study countries**

No	Indicator	BE	EE	FI	FR	LV	PL	PT	RO	SE	UK
[1]	Total forest areas (<u>10⁶ ha</u>)	0.68	2.23	22.2 1	16.9 8	3.35	9.43	3.18	6.86	28.0 7	3.14
[2]	Share of forest area (% from total land area)	23	51	73	31	54	31	35	30	69	13
[3]	Share of forests in private ownership (% from [1])	53	59	69	75	51	19	97	34	78	72
[4]	Average size of private forest holdings total / (non-industrial) (ha/owner)	2.7	9.4 (6.4)	35.0	3.7	10.8	1.5	(5.6)	2.6	89.1 (61)	5.3
[5]	Total numbers of holdings in private ownership (<u>10³</u>)	132	113 (107)	442	3313	148	1122	409	830	(329)	413
[6]	Share of private forest holdings below 10 ha from [5] (%)	96	81	47	96	78	99	93	99	35	92
[7]	Share of round wood removals from private ownership (%)	29	57	91	89	51	5	91	37	89 (60)	55
[8]	Area of all forest covered by management plans or equivalent (% from [1])	53	74	n.a.	43	92	77	23	82	n.a.	43
[9]	FSC certified forest area	4	64	7	0	30	74	12	39	44	51
	PEFC certified forest area (% from [1])	44	53	79	48	51	77	8	0	41	45
[10]	Contribution of the overall forestry sector to GDP (%)	0.6	4.3	4.3	0.6	6.5	1.6	1.6	1.9	2.9	0.4

261 Data sources: [1], [2], [7]: Eurostat (<http://ec.europa.eu/eurostat/data/database>) (2015).
262 [3]: FACESMAP country reports (Živojinović et al., 2015).
263 [4], [5], [6], [8]: FOREST EUROPE/UNECE/FAO
264 (http://w3.unece.org/PXWeb2015/pxweb/en/STAT/STAT__26-TMSTAT1/) (2010).
265 [5] and [6]: data for EE, SE, PT, RO are from national statistics.
266 [9]: FSC® (<https://ic.fsc.org/en/facts-and-figures>) and PEFC™ (<https://www.pefc.org/about-pefc/who-we-are/facts-a-figures>) (2017).
267
268 [10]: FAO (Lebedys and Li, 2014) (2011).
269 Values in brackets represent data for non-industrial private owners based on available
270 national statistics.

271 2.4 Data analysis and framework development

272 Through a series of meetings and email discussions involving all the co-authors, over the
273 course of a year, we conducted two levels of analysis. First, we carried out a cross-cutting
274 analysis of information collected by questionnaire by entering all response into an excel
275 spreadsheet. Each member of the research group took one or two questions, and prepared a
276 qualitative summary of the responses, variations and patterns in those responses. Each
277 question was summarised by at least two members of the research group. In this way, all
278 members became familiar with the approaches used in each of the ten countries, and
279 started to identify ways in which they varied.

280 The second stage of analysis built on this joint understanding, and iteratively refined our
281 concept of the core principles that help to describe a FOKIS. Earlier working versions of
282 FOKIS included a longer list of dimensions/subheadings. In refining this list, we considered
283 and took inspiration from AKIS descriptions, soft-systems viewpoints summarised by
284 CATWOE (customers, actors, transformation process, worldview, owners, environmental
285 constraints) from Checkland (2000), and the ARA (actors, resources, activities) model of
286 business networks (Håkansson and Johanson, 1992).

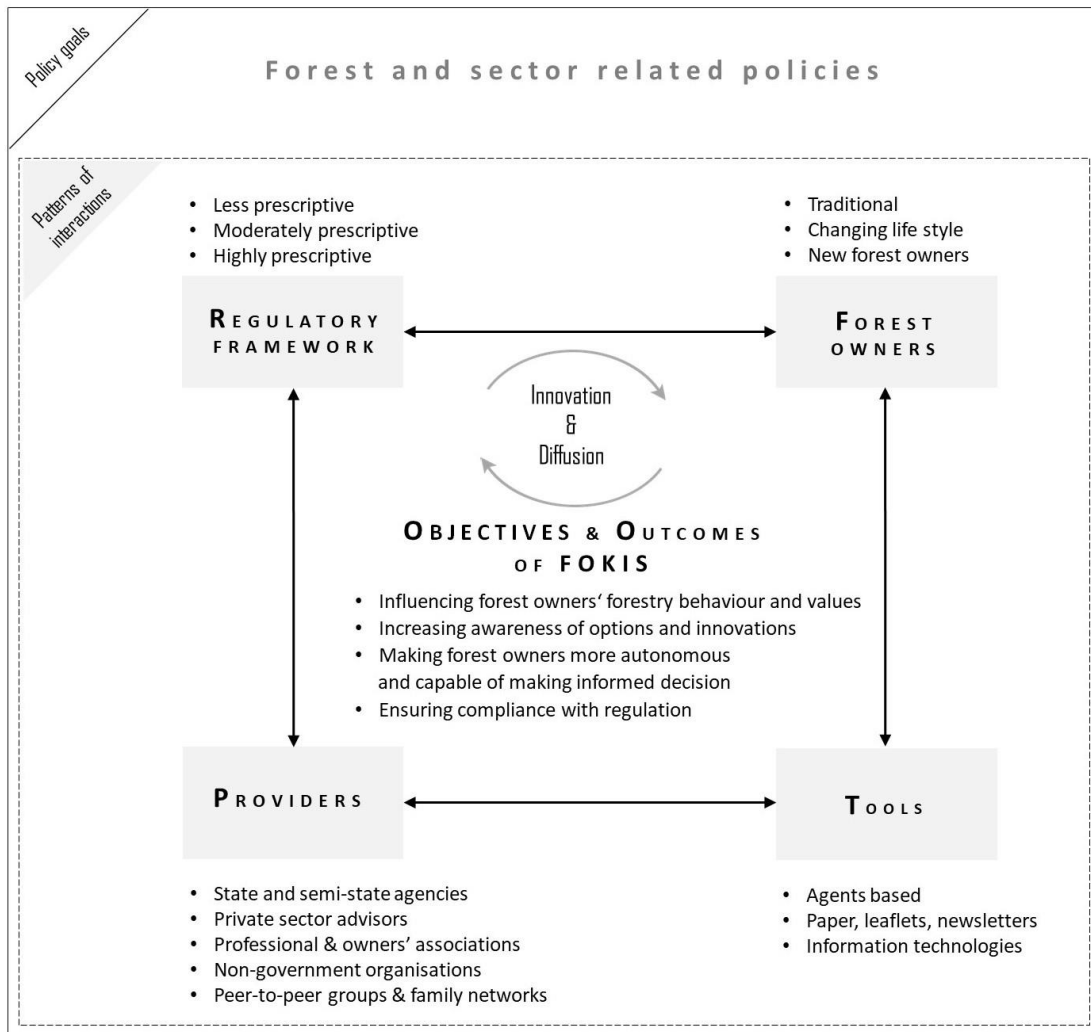
287 After several rounds of revision, we agreed on four key dimensions which apply in the wide
288 range of contexts, and which we collectively found were both *necessary* (i.e. the FOKIS was
289 not well described if any dimension was missing) and *sufficient* (i.e. by including these four
290 dimensions, we did not leave out any important category of information about the FOKIS).
291 The four dimensions are:

- 292 1. FOREST OWNERS: characteristics, diversity, types, and objectives for forest management
- 293 2. POLICY OBJECTIVES: the aims of those making and delivering policy, which are served by
294 the advisory system; 'policy' is not exclusive to the state, but can include the
295 objectives of, for example, NGOs and / or owners' associations
- 296 3. ADVICE PROVIDERS: the people who act as sources or channels of information; they may
297 include consultants, extension agents, researchers, or other forest owners
- 298 4. TOOLS AND PROCESSES: the methods used to inform, educate, train or share
299 knowledge between forest owners

300 **3 Results**

301 Information about these four dimensions of the FOKIS are summarised for ten countries in
302 Europe in Supplementary Table 1. In the following sections we describe the main findings for
303 each dimension. We then summarise with an overview of geographical variations, and of key
304 trends over recent decades. A central interest of the AKIS / FOKIS approach is innovation,
305 and we conclude the results section with an example of innovation in each country, as a
306 pointer to further lines of research. Figure 1 provides a schematic summary of the
307 relationship between these dimensions.

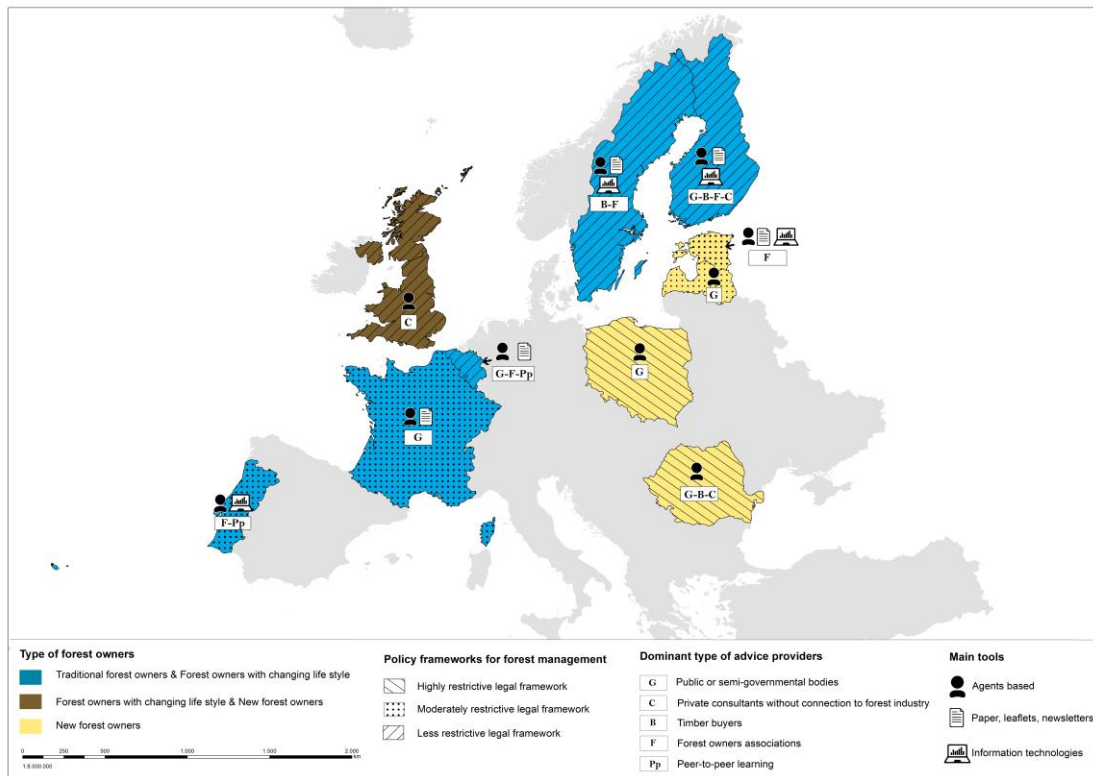
308 **Figure 1. An analytical framework for exploring the components of the FOKIS**



309

310 These dimensions are summarised for each study country in Figure 2. Table 2 and Figure 2
 311 provide highly aggregated information about the forest owners in each country. The
 312 statistics in Table 2 illustrate the range of contexts covered by the study. The importance of
 313 forestry in the national economy indicates attention given to forestry extension, while
 314 numbers of owners and average sizes of forest holdings indicates need for extension
 315 services. The degree of management reflected in management plans and certification might
 316 indicate levels of forest owner engagement.

317 **Figure 2. FOKIS dimensions in the study countries**



318

319 3.1 Dimension 1: The forest owners

320 Coherent statistical data sources that would allow reliable, consistent and detailed analyses
 321 of public and private forest ownership, comparisons of family forests with corporate
 322 ownership, understand the effect of parcel size at European level, are limited (Weiss et al.,
 323 2019). Basic information on who owns forest land is incomplete or unavailable in some
 324 countries (Portugal, UK, Romania), while in other countries forest owners' structure,
 325 motivations, and behaviour have been documented for decades (Finland, Sweden).
 326 Nevertheless, collectively the quantitative and qualitative data sources used in FACESMAP
 327 allow us to describe the main patterns and trends.

328 Many of the country responses highlight changing ownership, and the emergence of both
 329 new owners and new types of owners. Trends in changing forest ownership arise through
 330 land transactions, cultural and societal changes, and changing land use (Weiss et al., 2019).
 331 Researchers have highlighted the need to refine sociological understanding of how these
 332 'new' owners different from traditional owners and to tailor forestry advice to the increasing
 333 diversity of owner types (Häyriinen et al., 2014; Karppinen, 2012; Van Herzele and Van
 334 Gossum, 2008).

335 Legislative changes affect Eastern and Central European countries (ECE), through restitution
336 or re-privatisation of forest land that was formerly nationalised under socialist governments.
337 The restitution process is often gradual and at times chaotic. In Romania, restitution laws
338 passed in 1991, 2000 and 2005 led to an increase in individual private forest ownership,
339 from 0% to 19%. In Estonia restitution was intended to be achieved by 2016 and the (still
340 incomplete process) has opened discussion about sustainable use of private forest resources
341 (Teder et al., 2015). In Latvia, private forest ownership rose from 15% to 45% between 1994
342 and 2001, but 60% of owners reported that they lacked experience and knowledge of
343 forestry (Vilkriste, 2008).

344 Other land transactions include forest purchase on the open market. FACESMAP analysis
345 suggests wide variation in terms of land market activities (Živojinović et al., 2015). Belgium
346 (Flanders), Estonia, Portugal, Romania and UK are examples where an active market includes
347 land investors and speculators, while in countries where families have owned land for
348 centuries land markets are much less active (e.g. Sweden). Finland belongs to the latter
349 group but has recently evidenced growing interest of institutional investors in forest land
350 market (Official Statistics of Finland (OSF), 2019). In France, the large-scale property market
351 (>100 ha) is stable whereas the small-scale property (1-10 ha) market is very active (SAFER
352 and SFCDC, 2017).

353 Cultural changes among forest owners affect particularly Baltic and Central West-Europe
354 countries which have a long tradition of private forest ownership but where economic and
355 technological development, changes in education and employment, and newly urban
356 lifestyles, affect the value systems and time availability of forest owners. Forest owners in
357 many countries are increasingly distant from their forest holding. For example, in France one
358 third of forest owners need at least two hours to go to their forest holdings and 25% never
359 go to their forest (MAAF, 2014). In Sweden 29% of forest holdings are owned by (partly)
360 non-residents, and owners' work in their forests has decreased over the last 20 years
361 (Lidestav et al., 2015). For those who remain committed to forest management, distance
362 and lack of time may encourage them to delegate or contract decision-making to a trusted
363 advisor (Bergstén and Keskitalo, 2019; Kronholm, 2016; Mattila and Roos, 2014).

364 Land abandonment, and subsequent natural regeneration of woodland, is an important trait
365 in parts of Central East-Europe, often accompanied by uncertainty about landownership
366 (Gutman and Radeloff, 2016; Rendenieks et al., 2015), and in southern Europe where lack of

367 rural employment is more influential (Agnoletti, 2014; Vitali et al., 2017). Concerns about
368 fragmentation and increasing numbers of smaller forest parcel sizes characterise land
369 ownership in Central-West and East-Central Europe (Weiss et al., 2019). In the less forested
370 countries of Central West-Europe, policies prioritise increased forest planting, as in the UK,
371 Belgium, Denmark and Netherlands (Lawrence and Dandy, 2014; Madsen, 2003; Van
372 Gossum et al., 2010; Van Herzele et al., 2005). Both natural regeneration and tree planting
373 turn existing landowners into owners of forest, thereby creating types of ‘new forest
374 owners’ with particular support needs.

375 There have been many attempts to group forest owners into types in order to more
376 effectively predict their behaviour or target advice and incentives, but recent reviews
377 question the usefulness of this (Ficko et al., 2018). For example, in many cases older owners
378 are found to be less likely to manage their forest or harvest timber, and more likely to
379 outsource forest work, but in some cases, older owners are more likely to harvest (Conway
380 et al., 2003; Favada et al., 2007; Novais and Canadas, 2010; Rodríguez-Vicente and Marey-
381 Pérez, 2009). Such typologies need to be specific to context, and to be based on easily
382 accessible variable that usefully predict behaviour.

383 **3.2 Dimension 2: Policy objectives addressed by FOKIS**

384 The EU Forest Strategy provides a framework for implementing sustainable forest
385 management and supporting Member States’ decisions on forests (European Commission,
386 2013), but national legislation has considerable autonomy. National policy relevant to
387 forestry has been described as ‘piecemeal’; it increasingly focuses on biodiversity, climate
388 change and new energy sources (Winkel, 2017; Wydra, 2013). There are implicit tensions
389 between these goals, and each country (or region) aims to balance its policy goals for forests
390 with its particular regulatory context. Thus, many countries aim to increase wood harvests,
391 and all are trying to protect biodiversity in their forests, but some give freedom to the
392 owners to choose to follow these goals, while others oblige the owners to conform with a
393 central body of forest law which prescribes treatments (Nichiforel et al., 2018). The result is
394 a wide range of approaches, in which extension and advisory services perform roles ranging
395 from inspection and instruction, to consultation and encouragement.

396 The forest management plan acts as a focus for these differences. In some countries, it is a
397 requirement of all owners (Romania), in others, only of larger landowners (France), to

398 demonstrate good practice in applying for grants (UK) or as a voluntary mechanism for
399 sharing information and as a prerequisite to be certified (Sweden). In Finland, forest
400 management plan used to be a state-subsidized product and an important informational
401 policy tool (Tikkanen et al., 2010), but it was deregulated in early 2010s to be open for
402 various service providers on the market.

403 Where owners have more freedom in deciding how to manage their forests, diverse advisory
404 services have arisen. In Sweden for example, the government has (since 1993) abandoned
405 approaches based on close regulation, monitoring and enforcement, and the responsibility
406 for balancing production, environmental, and social values has been shifted towards private
407 actors. In this highly deregulated system, priority is given to soft policy instruments such as
408 information and education, advice and voluntary agreements. This introduces institutional
409 uncertainty as forest owners do not know where the bounds of responsibility and
410 compliance with regulatory frameworks are (Löfmarck et al., 2017).

411 In post-socialist countries, the top-down, state- or expert-led approach is still commonly
412 used, and advice concentrates on ensuring compliance with regulation. In Poland and
413 Romania, forest policy still relies strongly on command-and-control instruments imposing
414 management rules in private forestry (Bouriaud et al., 2015). In Poland, the Forest Act
415 (1991) designates the district governor as responsible for supervising forest management in
416 privately owned forests, and final decisions rest with the state officer (Adamczyk et al.,
417 2015). In Romania, the regulatory framework of forest management is based on state-
418 defined technical norms applicable regardless of ownership. All forest management plans
419 and decisions, including tree selection and reforestation techniques, are made by the forest
420 administration, creating power asymmetries where the role of the forest expert is to
421 implement rules which may not be understood or accepted by forest owners (Abrudan,
422 2012). While Estonia and Latvia have moved away from direct state intervention in private
423 forest management (Bouriaud et al., 2013), the state continues to influence forest owners'
424 forestry practices. For example in Estonia, although advisory services are provided by
425 accredited private advisors, they are paid for by the state.

426 In some countries, forest owners' representatives negotiate forestry objectives at national
427 and local level, including the objectives of advisory programmes, through membership
428 organisations. In France, for example, the National Wood and Forest Scheme (2016-2026)
429 uses continuing education programmes negotiated at national and regional level by the

430 CNPF (National Centre for Private Ownership) and the Ministry of Agriculture and Forests.
431 This co-definition of advisory programmes is strategic, and aims to ensure that policy
432 makers' objectives, advisory providers' offers, and forest owners' needs are in line.

433 An enduring policy challenge is to attract more owners into advisory programmes (e.g.
434 Korhonen et al., 2013). Whereas traditional, industrial, medium and large-scale forest
435 owners are more easily identified and engaged, others (sometimes labelled 'passive', 'new',
436 or 'small-scale') are less easily accessed by advisory services. In Belgium, Finland and France,
437 priority is given to advising less frequently reached owners. In Wallonia (Belgium), a 'Support
438 unit for small private forests' created in 2012 focuses on owners with less than 5 ha, to
439 provide them with information to manage their forest, link with forestry professionals, and
440 create viable 'forest management groups'. In Finland and Sweden regional advisory
441 campaigns target female forest owners. To attract distant forest owners in Finland, timber
442 buying companies and owners' associations have increasingly established services in larger
443 cities since the 1990s (Hamunen et al., 2015b).

444 **3.3 Dimension 3: Providers of advice**

445 In all ten countries, forestry advice is provided by a mix of actors from the state, private and
446 NGO sectors, rather than one traditional forest extension service. Overall, we see a shift in
447 balance from public advisory services, towards private forest advisors and NGOs providing
448 advice to owners. We distinguish five main types of advisers:

449 **1. State and semi-state agencies:** centrally organised, or in countries with federal
450 governments, forest services are often provided at provincial or regional level. The role of
451 these agencies ranges from support for compliance with legislation and regulation, to
452 increasing the awareness of opportunities for owners to manage and earn income. In some
453 post-socialist countries (Latvia, Poland, Romania), state advisory bodies are powerful, and
454 intervene to enforce regulatory control of private forest management. This has undermined
455 trust between owners and government agencies, and provokes sometimes negative
456 attitudes and poor cooperation (Vilkriste and Zālīte, 2015), sometimes leading to failure to
457 enforce policy goals (Scriban et al., 2017). In many Western countries, regulatory control is
458 looser, and state agencies have suffered budget and staff cuts for several decades. In France,
459 the semi-state agency (CNPF) has capacity to advise only 1.5% of the 1.5 million private
460 forest owners, and only 1000-3000 attend long-term education programmes (CNPF, 2012).

461 **2.** Private sector advisors: while governmental advisory services are declining, the
462 numbers and types of private advisory services are increasing in all countries. These include
463 contractors, consultants (France and UK), administrators (Romania), timber buyers (Finland,
464 France, Latvia, Sweden, Romania). In some (Finland), governmental advisory bodies have
465 also been privatized and deregulated. Many private advisory bodies are accredited by the
466 State (Belgium, France, Estonia, Latvia, Poland, Romania), or by professional associations
467 (UK, Portugal) and certification bodies (Sweden). Others provide advice, but are not official
468 (accredited) advisors. Long-established networks of forest professionals in Western Europe,
469 where most professionals depend economically on consultancy activity, contrast with more
470 recent networks in East-Central Europe where it is difficult to make a living in this way. In
471 Estonia, 80% of accredited forest advisors were not working full-time as consultants in 2013
472 (Erametsakeskus, 2013). However, in Romania the number of private forest districts has
473 increased rapidly, by 2011 covering 23% of the total forest area (Abrudan, 2012). In Western
474 countries, market competition can affect long-standing private advisors. In France for
475 example, semi-public bodies and private consultants must compete with forest cooperatives
476 which have emerged as a key player over the last two decades. In Sweden and Finland,
477 owners have become more reliant on timber companies, and consultants must now
478 compete with their timber focussed colleagues (Löfmarck et al., 2017)

479

480 **3.** Associations and cooperatives: In Estonia, Latvia, Finland, Portugal, and Sweden,
481 forest owner associations (FOAs) offer comprehensive forestry service, advice and training
482 to their members. In Sweden and Finland this is a long-standing approach whereas in the
483 post-socialist countries this is a new approach. In Romania the national FOA advises mainly
484 on legal disputes referring to land titles (Debrunner et al., 2015). In Estonia, the Forest Act
485 (2006) shifted delivery of advisory services from the state services to FOAs. In Poland, only
486 14 associations of private forest owners exist, because of a historically conditioned aversion
487 to collective organizations (Adamczyk et al., 2015). In many western countries this is an area
488 of change and innovation. In France, forest owners cooperatives are now the first source of
489 advice for 50% of very small-scale owners and 27% of medium-scale owners (25-100ha)
490 (Toppan, 2011). As FOAs become key players, they can become key policy stakeholders
491 (France, Sweden, UK). In Portugal, FOAs have increased from fewer than 20 FOA (in 1990) to
492 166 (Feliciano et al., 2015) and become connected to a federation of local FOAs representing
493 their interests at the national and international levels.

494

495 **4.** Non-government organisations: NGOs are significant advisory providers in Latvia,
496 Poland, Romania and the UK, often focussing on environmental issues. In the UK, NGO
497 programmes encourage farmers and other landowners to plant trees for biodiversity and
498 water management. In Romania, in the context of active debates about illegal logging,
499 environmental NGOs offer trainings to increase awareness of protection of pristine forests,
500 and support compensation mechanisms for private owners (Nichiforel et al., 2015). In
501 Finland in turn, NGOs participate in advisory work, for example with publishing silviculture
502 guidelines (see Keto-Tokoi et al., 2016).

503

504 **5.** Peer-to-peer groups: informal advisory networks include peer-to-peer learning,
505 defined as a 'two-way reciprocal learning activity' (Boud et al., 2001) where all group
506 members can learn from each other and help others to learn (Topping and Ehly, 2001). In
507 Finland and Sweden, peer-to-peer groups have existed informally for decades, but only
508 recently recognized within forest advisory systems, inspired by emerging woodland owners'
509 peer-learning research in the USA (Hamunen et al., 2015a; Kueper et al., 2013; Rickenbach,
510 2009). As shown in the AKIS context (Dolinska and d'Aquino, 2016), peer-to-peer learning
511 creates a community of practice where landowners collectively construct knowledge,
512 discourses, norms and practices. Knowledge produced by owners is distinct from that of
513 professionals and extension workers (Goulet, 2013), and is seen to complement the
514 prevailing extension practices (Hamunen et al., 2015a).

515 European research on forest owners' peer networks (e.g. Hamunen et al. 2015) has
516 recognized the importance of unofficial and informal knowledge exchange occasions.
517 Opportunities for such informal knowledge exchange can be cultivated by, for example,
518 leaving space and time in trainings and field trips, and facilitating bottom-up groups by
519 offering social media facilitation or free meeting premises. One may foresee that this type of
520 active space-creation may be pivotal in capitalizing the identified promises of peer learning
521 in future. Furthermore personal and social networks are recognised in the decision-making
522 process, as forest owners may not always trust professional advice providers (Gootee et al.,
523 2010).

524 **3.4 Dimension 4: Tools and methods**

525 Extension uses a wide range of communication tools; across our study region new virtual
526 and digital tools have influenced the FOKIS, but personal interaction is still important, and

527 more participatory and interactive methods have become popular, or at least expected.
528 With the emergence of digital technologies since the late 1990s, advisory providers can
529 mobilize a wider variety of communication channels. However training and printed materials
530 are still important, because forest owners are often older than the general population and
531 sometimes also characterised by a lower education level (Belgium, France, Romania,
532 Sweden) (Schmithüsen and Hirsch, 2010).

533 Digital technologies have transformed information exchange, enabling distance learning, e-
534 learning, web and mobile applications, e-newsletters, and virtual communities. In Sweden,
535 forest owners increasingly can access on-line information on legislation, forest condition
536 based on remote sensing data, and management recommendations. Several advisory
537 organizations provide distance learning courses for forest owners (e.g. Linnaeus University in
538 south Sweden, CNPF in France). Digital tools can also provide services that traditional public
539 advisers have been reluctant to provide, such as information on market conditions and
540 timber prices. In Finland, 29 roundwood buyers' and sellers' organizations recently
541 developed and introduced an electronic timber marketplace, freely accessible to all owners
542 from 2017. The new service (kuutio.fi) provides owners with real-time market information
543 with instant access to information on wood sales, contacts of sellers, and tenders, allowing
544 either empowered (e.g., via forest owners' association) or self-active timber sales process.

545 New methods characterised extension in post-socialist countries, in the early years of
546 capitalist economy. In Latvia seminars for forest owners were very popular in the first years
547 of extension work during the restitution process. The State forest service (SFS) reported
548 545 seminars with 7,607 participants in 2000 but only 47 seminars with fewer than
549 500 owners in 2007. Similarly, the amount of printed material has declined considerably,
550 with most now available on the internet. In Romania the national association of forest
551 owners (Nostra Silva) uses web based tools, social media and press releases to inform its
552 members about legislative changes that can impact on owners' interests (Debrunner et al.,
553 2015).

554 Traditional face-to-face interactions have also evolved to include thematic discussions, field
555 trips, roundtables, direct contact between 'experts' and 'learners', and forest fairs.
556 Stakeholder consultation processes, organized during elaboration of Natura 2000
557 management plans or as part of the forest certification process, provide opportunities for
558 owners to interact with forest and environmental experts in a more active way.

559 **3.5 Patterns, trends and innovation**

560 Summarising the range of findings across our ten countries, we sought to identify patterns
561 (in space) and trends (in time), for each of the four dimensions.

562 Spatial differences are both geopolitically and ecologically founded (Figure 2). In countries
563 where traditional forms of ownership predominate (Belgium, Finland, France, Portugal,
564 Sweden), and those where neoliberal political systems have prevailed (Finland, Sweden, UK)
565 the state concedes more freedom to private forest owners in deciding forest management
566 objectives. It has also created the conditions for a high diversity of consultants and agents,
567 from the private and NGO sectors. In post-socialist countries, the issue of ‘new forest
568 owners’ has been addressed through different policy instruments. The Baltic States (Estonia,
569 Latvia) provide relatively high freedom to forest owners, supported by advice from owners’
570 associations and private advisors; nevertheless, the state remains involved by accrediting
571 and financing the advisors. In contrast, in Romania the state requires each forest owner to
572 have an administrative contract with a state or private contractor who supervises the
573 application of silvicultural law. One other geographical pattern is evident: in the Nordic
574 countries where forestry is highly industrialised and significant in the national economy,
575 timber buyers have also taken on a substantial advisory role.

576 Despite geographical differences, there appear to be more commonalities when we consider
577 recent trends in FOKIS. Table 4 summarises ways in which the four dimensions are changing,
578 with examples.

579 **Table 4: Summary of current state of forest advisory system, trends and examples**

580 [PFO = private forest owner]

Current situation	Trends	Example
Profile of owners		
<ul style="list-style-type: none"> • High variation in ‘pre-knowledge’ (from basic notion to quasi-expertise) • High variation in primary and secondary socialisation (identity, community) • High variation in the interest of owners (from short term 	<ul style="list-style-type: none"> • Traditional PFOs are more often challenging prevailing management norms • Some call for information on alternative management approaches; some find their own approaches by themselves 	<p>In France, the demand for basic courses has been stabilizing (CNPF, 2012). This trend may represent transfer of new forest owners’ demands towards mid or high level, or a total delegation of the forest management to experts and co-op foresters.</p>

profit seekers to indifferent or absentee owners)	<ul style="list-style-type: none"> • New or absentee PFO are targeted with informational instruments to increase their awareness on management options 	
Policy objectives of advice		
<ul style="list-style-type: none"> • Influencing PFOs' forestry practices/behaviour and values • Increasing awareness of options and innovations • Ensuring compliance with regulation • Making PFOs more autonomous in their decision making 	<ul style="list-style-type: none"> • More emphasis on specific aims rather than general awareness raising; e.g. profitability, biodiversity, afforestation, cooperation • New challenges are coming from the environmental regulations (e.g. Natura 2000 sites) which require new tools for advice 	In Finland , programmes to focus advice on generational transfers of private forest estates (with a further aim to increase wood supply and promote active and more diverse use of forests)
Providers of advice		
<ul style="list-style-type: none"> • Government training bodies (generally centrally organised) • Professional advisors and consultants (often very diverse and more or less specialized on specific topics), in some countries accredited by the State or within the organization • Peer-to peer self-help networks (within forest owners' associations or in even less informal ways) 	<ul style="list-style-type: none"> • Weakening/disappearance of public advisory services, in particular in Eastern European countries where the forest advisory system becomes less and less centralized • Emergence of private forest advisors and NGOs providing advice to PFOs 	In Romania , the governmental agency supervises compliance with the law, while most trainings for PFOs are organised with environmental NGOs. These highlight the need to respect the forestry regime, aiming for diverse forest structure and biodiversity. NGOs and private consultants hired by industry have supported implementation of forest certification in private forests. Public consultations related to forest certification are an important communication tool between PFOs, ENGOs and forest administrators
Approaches and tools		
<ul style="list-style-type: none"> • Wide variety of communication channels, and diversity supporting: <ul style="list-style-type: none"> ○ Agent-based tools (through education and training sessions) 	<ul style="list-style-type: none"> • From agents-based support to technical-devices support (during field visits and face to face communication, in demonstration forests and workshops) • Reliance on PFO's cooperatives, clubs and networks as platforms for 	In Estonia decrease in the need for advisory services, as younger and/or more computer friendly forest owners have started to submit the Natura 2000 payment application via the internet. In Sweden , communication with forest owners is increasingly based on web tools for PC and mobile

<ul style="list-style-type: none"> ○ Traditional publications (magazines, leaflets, journals...) ○ New communication and information tools (web, smartphones, e-newsletters, virtual communities) ● Cost-sharing varies between Government pays, PFO pays and mixed modes 	<p>peer-to-peer advice is increasing to complement professional guidance</p>	<p>units, where forest owners can log in for information on forest data, nature conservation areas, treatment proposals, advice about forest management, etc. for their forest estate. These tools <u>are</u> used by the Forest Agency, timber buyers' organisations and forest owner associations.</p>
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581 These trends reflect both underlying and contextual patterns of change in forest ownership
582 and advisory systems, and also areas of innovation where owners, advisor and / or policy
583 makers have responded to changing pressures and opportunities, with novel approaches.
584 Each team member provided an example to illustrate innovation in her or his country, where
585 innovation was understood as a new and potentially transformative component or feature
586 of the existing FOKIS. The examples therefore reflect contextualised understandings of what
587 is innovative (Supplementary Table 2), and include:

- 588 1. institutional innovation: public organisation (BE), forest intervention zone (ZIFs)
589 (Portugal), community woodland association (Scotland, UK);
- 590 2. digital innovation: e-tools and web portal (France, Sweden);
- 591 3. market innovation: certification (Poland), e-marketplace (Finland).

592 We can also identify different pathways for innovation. Grassroots developments include
593 the association of new community woodland owners in Scotland. Other pathways include
594 adoption and adaptation of ideas from elsewhere, for example support offered by timber
595 buyers and forest management companies from Austria, Finland or Sweden to help private
596 owners achieve certification in Romania. Systems themselves can foster change to meet the
597 new conditions, or to move beyond them. Sometimes this is led by actors within the FOKIS,
598 sometimes it is simply an attempt to cope with change.

599 **4 Discussion and conclusions**

600 **4.1 Consistent trends in FOKIS**

601 Despite the diversity of historical, social, economic and political contexts, analysis of the
602 FOKIS in these ten European countries reveals a consistent move away from traditional
603 extension based on technology transfer. A more diverse range of services and providers is
604 emerging, in parallel with the pluralistic approach in agricultural advisory services (Birner et
605 al., 2009; Faure et al., 2012). This move is characterised by five trends typical of the majority
606 of our ten countries:

- 607 1. FOKIS have become more democratic, participatory and negotiated. Forest owners are
608 increasingly seen as sources of experience, and participants in peer-to-peer knowledge
609 sharing.
- 610 2. There is a move from strict regulatory control to incentive and persuasion. Not all policy
611 regimes allow the same level of freedom but increasingly forest knowledge systems
612 move from top-down to inclusive, bottom up and horizontal communication (such as
613 peer networks) and from a silo approach to a joined-up approach.
- 614 3. Policy requirements for advisory services are shifting from a focus on timber production
615 to wider priorities including ecosystem services such as biodiversity and recreation,
616 climate change mitigation and adaptation, with more recently a return to economic
617 objectives, now competing with these other ecosystem services.
- 618 4. Much of the provision of advisory services has moved from the public to the private
619 sector, with increasing competition between knowledge providers and shifts in
620 relationships of trust.
- 621 5. New virtual communication, support and tools do not completely replace human
622 interactions but increase the possibilities for owners to be in charge of their own
623 information and decision processes.

624 **4.2 Value of a systems approach**

625 In the introduction we recognised that our working definition of a FOKIS, as a 'purposeful
626 assemblage of actors, organisations and their interactions, intended to influence forest
627 management behaviour' is not a very ambitious definition of a system; other definitions
628 would apply more rigorous criteria, expecting the system to be working as a whole, to have
629 purpose, and to be characterised by emergent properties (Eddy et al., 2014; Flood, 2010;

630 Folke et al., 1996). Our approach here relies more on the conceptualisation of a system as an
631 organising tool for research and analysis. We do not yet have evidence that the FOKIS
632 operates as a coherent entity in any geographical or political unit; indeed our research
633 approach here is not sophisticated enough to do that. What we have done, is use the idea of
634 a FOKIS as an inclusive guiding concept to begin understanding who is participating, in what,
635 why, and how, in different countries. Further research may reach a higher sophistication of
636 systemic analysis of a FOKIS as a functioning entity.

637 Recent analysis of the agricultural counterpart of FOKIS comes to similar conclusions about
638 the value of systems thinking for research AKIS, and the lack of evidence for coherent
639 integration of different strands (Knierim and Prager, 2015). Our work here is a first step
640 towards organising the field. We conclude that the FOKIS is rarely considered intentionally
641 as a system by stakeholders and policy-makers. By asking more about the vision or intention
642 of FOKIS policy, we may reveal internal incoherencies and possible explanations for failures
643 of policy programmes in achieving goals. Incoherencies of a FOKIS sometimes also reflect the
644 incoherencies of forest-sector policies (e.g. biodiversity vs bioenergy and wood
645 mobilization). Furthermore, 'systems' are rarely totally coherent, efficiently unified and
646 stable. It is likely that the FOKIS evolves in response to these creative interfaces where
647 things are not clear and where people and organisations try to tackle specific problems with
648 innovative solutions.

649 A further interesting consequence of this conceptualisation of FOKIS as a soft system is that
650 there are multiple actors with multiple perspectives, values and objectives. The FOKIS can be
651 directly contrasted with the linear, 'top-down' technology transfer model which exists to
652 serve only the objectives defined by (public) policy and the promotion of scientific
653 knowledge and legal objectives. As a descriptive tool, FOKIS includes those owners who have
654 been identified in many studies as disengaged, passive, uninterested or absent (Hujala et al.,
655 2013; Petucco et al., 2015), and the focus on owners as one dimension encourages an
656 understanding of those owners and their objectives. In contrast, if used as a policy
657 instrument, the FOKIS provides an understanding of entry points and suitable approaches
658 for working with different types of owners. Innovation can occur in any of the dimensions: in
659 policy, advisors, owners or methods. In a systemic approach, innovation may be supported
660 by understanding it in relationship to the other actors and processes (Rametsteiner and
661 Weiss, 2006).

662 In the agricultural domain, it is recognised that AKIS has more often been a research tool
663 than an operational reality, and ‘technology transfer’ remains at the centre of many
664 government approaches (Schut et al., 2014). As a research approach, however, it is helpful
665 to think about knowledge exchange as a system of actors and processes, not only as an
666 organising framework but also because it fosters inclusivity and avoids prejudging outcomes.
667 It moves us beyond equating FOKIS with the extension or advisory services; instead we treat
668 them as *part* of the system, as a means to help with ‘problem solving, information sharing
669 and innovation generating processes’ (Knierim et al., 2015). The system perspective helps to
670 understand innovation, as a complex non-linear phenomenon arising from multiple
671 interactions (Jarský, 2015; Rametsteiner and Weiss, 2006). The problems are solved, and
672 innovation generated, by all the actors, but particularly by the forest owners and managers.

673 **4.3 Deconstructing expertise**

674 Overall these changes represent a diversification and liberalisation of information, and
675 something like an open market in terms of advice. This raises new questions of expertise,
676 reliability and accuracy of information, and trust between actors. Like its agricultural
677 equivalent (Compagnone and Simon, 2018), the commoditization of knowledge and the rise
678 of a client-oriented perspective may lead to a fragmentation of the advisory system, to a
679 decrease in information exchange among advisors and to an inequality of access particularly
680 in less economically-favoured countries.

681 On the one hand, we see an increase in ‘non-professional’ sources of advice; and on the
682 other, a decrease in trust and coherence of professional sources of advice.

683 The non-professional sources include forest owners and their peers and, in a rather different
684 way, the proliferation of information available on the internet. Forest owners are often
685 characterised as passive, traditional, lacking in technical and policy knowledge, but owners
686 have common-sense and practice-based knowledge, experience in their own forests.
687 Research increasingly highlights the value of individual owners’ social networks. Friends and
688 neighbours are important as trusted and credible sources of information and advice in forest
689 management decisions in the USA (e.g. Kittredge et al., 2013; Knoop and Rickenbach, 2011),
690 and in Europe (Bieling, 2004; Pregernig, 2000; Stoettner and Ní Dhubháin, 2019).

691 Turning to the professional sources, it can be argued that liberalisation of advisory sources
692 strengthens the need for stability in the FOKIS, and the inclusion of skilful educated
693 personnel. Some countries have reacted with a tightening of accreditation methods
694 (Estonia) and importance attached to professionally accredited status (UK). These are
695 responses to a deeper challenge to the concept of expertise, which in pluralistic
696 environments can come under strain. For example public regard for the expertise of
697 foresters fell in Romania following the end of communism, while professional foresters in
698 Canada are required to make judgements about the value of other specialists' and lay
699 knowledge (Lawrence, 2009; Wood, 2004). Increasing uncertainty in forestry (based on
700 climate uncertainty and socioeconomic change) has also been characterised as a threat to
701 expertise, because it undermines the knowledge authority of professional advisor (Lidskog
702 and Lofmarck, 2015). These trends require new thinking about expertise, and rethought,
703 transformative education and training of professional advisors (Buchy and Hoverman, 2000).
704 A international survey found that it is not always part of the extensionist's culture to build
705 trust and support with the learners (Johnson et al., 2007). Emergence of more participatory
706 group and peer learning approaches indicates a need to renegotiate professional expertise
707 and expert's roles so that they are also communication specialists with facilitator's skills (Ma
708 et al., 2012b).

709 This is an important and developing area of research. For example, Sagor and Becker (2014)
710 found that landowners in Minnesota, USA appear to prefer receiving information not from a
711 single authoritative source, but from a variety of sources, including known and trusted
712 peers. They are explicitly valuing diversity and relationship, over authority. The ongoing
713 changes in the cultures and structures of forest ownership, and in the range of forestry
714 advice providers, highlights the need to understand the owners and their relationships with
715 advisors (Stoettner and Ní Dhubháin, 2019). Owners' willingness to participate in advisory
716 programmes, and ability to absorb new information, are related to their perceptions of the
717 advice providers (Gootee et al., 2010; Kilgore et al., 2015), and virtual and non-virtual
718 interaction mutually reinforce each other (Materia et al., 2015). Several have highlighted the
719 need to adapt the advisory offer according to the diversity of forest owner profiles (Kuipers
720 et al., 2013). It is interesting to note the ways in which components of the system interact;
721 for example, trust can be built through recurrent meetings which encourage interaction with
722 unknown people and reinforcing existing ties with known ones (Gorritz-Mifsud et al., 2019).

723 4.4 From description to evaluation

724 Our analysis of the situation in ten European countries aimed to describe characteristics of
725 the FOKIS as a general concept, as a means to understand diversity and change. A next step
726 would include evaluation of the outcomes of different kinds of FOKIS in different contexts.
727 Here we can look to agriculture for a lead; AKIS studies are several decades ahead, but
728 knowledge of impacts is still poor (Knierim and Prager, 2015; Prager et al., 2017).

729 As well as assessment of individual services, we need criteria for assessing the functionality
730 of the system as a whole, its ability to innovate and adapt. Little work has been done to
731 explore the adaptation of advisory systems, competition or cooperation between advisory
732 providers, services and programmes to different political, cultural and ecological contexts.
733 One approach is modelled by a study which distinguishes between governance structures,
734 capacity and advisory methods, in pluralistic agricultural advisory services (Birner et al.,
735 2009). This question of 'fit' between knowledge system (AKIS or FOKIS) and context
736 promises interesting work which links methodological and policy studies. Current
737 approaches to knowledge exchange have been criticised for ignoring the complexity of
738 translating different types of knowledge (Hulme, 2014), and importing standardized models
739 of extension from one context to another does not generally work well (Birner et al., 2009).

740 The systems approach is supportive of action research (Flood, 2010) by linking context with
741 content, and examining change from within the system. It also helps to conceptualise the
742 need for components to adapt to each other. In the quest for effective communication,
743 advisory actors may deliberately choose their audiences and communication methods. The
744 strategic choices required may be very different for public, private, and non-profit actors
745 who all have different objectives and aims in their participation in the FOKIS, but they may
746 become aware of their positions and establish partnerships (Swanson and Samy, 2002).
747 Forest extension workers in Germany have had to adapt their working practices as forest
748 owners (and institutions) change, and bring new objectives to their land management
749 (Schraml, 2006). A comparable, yet slow, institutional adaptation has taken place in Finland
750 where a renewal of forest legislation in 1996 initiated incorporation of biodiversity
751 conservation in forestry and forestry professionals' working practices, alongside the lifestyle
752 change pattern of forest owners (Karppinen et al., 2015; Primmer, 2011). These outcomes
753 are adaptive; they do not represent a pre-defined 'success' but a survival and continuing
754 functionality, based on mutual change in methods, owners, advisors and objectives.

755 Our study represents a beginning, a new field where we can make sense of FOKIS history,
756 diversity and innovation. There are numerous studies of forestry extension, advisory
757 programmes, peer-to-peer networks, and the roles of forest owners associations. The work
758 of developing a more systemic approach will consider the knowledge of actors in the system,
759 the links between them, and the impacts and effectiveness.

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