



HAL
open science

Developing the persona method to increase the commitment of non-industrial private forest owners in French forest policy priorities

Maxence Arnould, Laure Morel, Meriem Fournier

► To cite this version:

Maxence Arnould, Laure Morel, Meriem Fournier. Developing the persona method to increase the commitment of non-industrial private forest owners in French forest policy priorities. *Forest Policy and Economics*, 2021, 126, pp.102425. 10.1016/j.forpol.2021.102425 . hal-03155739

HAL Id: hal-03155739

<https://hal.univ-lorraine.fr/hal-03155739>

Submitted on 16 Feb 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Developing the persona method to increase the commitment of non-industrial private forest owners in French forest policy priorities

Maxence Arnould^{a,b,c}, Laure Morel^a, Meriem Fournier^b

^a Equipe de Recherche sur les Processus Innovatifs (ERPI), Université de Lorraine, 8 rue Bastien Lepage 54000 Nancy, France

^b UMR Silva (INRAE, AgroParisTech, Université de Lorraine), 14 Rue Girardet, 54000 Nancy, France

^c Agence pour la Transition Ecologique (ADEME), 20 avenue du Grésillé, 49004 ANGERS, France

1. Introduction

According to data from the 28 European countries included in the FACESMAP¹ national reports (Živojinović et al., 2015), 60% of the forest area in Europe is privately owned. A significant part of this private forest ownership is highly fragmented with 60% of the owners owning less than one hectare (Schmithüsen and Hirsch, 2010). The very small size of these properties creates a multitude of difficulties in mobilizing wood (landlocked plots, high operating costs...) (Pezdevšek Malovrh et al., 2017; Orazio et al., 2017; Rauch and Gronalt, 2005; Stern et al., 2013). This results in difficult forest management (Lawrence, 2018; Weiss et al., 2012) and sometimes even total absence (Petucco et al., 2015), which leads to under-exploitation of timber compared to organic production (Levers et al., 2014). Thus, current forest policies place this under-exploited resource at the heart of their concerns because of its potential positive impact on climate change (notably through carbon storage in wood products and substitution of fossil fuels) (Geng et al., 2017; Nabuurs et al., 2013). In the long term, they also advocate a sustainable increase in wood harvesting from current levels (European Commission, 2018; Nabuurs et al., 2007), including priority action in fragmented private forests that hold a large part of the under-exploited resource (Colin and Thivolle-Cazat, 2016; Wilnhammer et al., 2012). Thus, in order to involve the owners of fragmented private forests in sustainable forest management approaches aimed at mobilizing wood, European countries have implemented numerous measures that result in financial incentives, regulatory and legal frameworks, cooperatives of owners, financing and material inputs, technical and governance interventions, etc. (Lawrence, 2018, Orazio et al., 2017). However, there is no doubt that these measures and all the efforts that have been associated with them for many years have not fully resolved the problems of wood mobilization in the in fragmented private forests (UNECE-FAO, 2020; Forest Europe, 2015). These failures could be explained by the introduction of measures that do not take into account the different types of forest owners (Pezdevšek Malovrh et al., 2015; Weiss et al., 2019).

¹ COST Action FP1201 FACESMAP on “Forest Land Ownership Change in Europe: Significance for Management and Policy” (2012–2016) Country Reports, including the following countries: Austria (AT), Bosnia and Herzegovina (BA), Belgium (BE), Bulgaria (BG), Switzerland (CH), Czech Republic (CZ), Germany (DE), Estonia (EE), Greece (EL), Spain (ES), Finland (FI), France (FR), Croatia (HR), Hungary (HU), Ireland (IE), Lithuania (LT), Latvia (LV), FYR Macedonia (MK), Norway (NO), Poland (PL), Portugal (PT), Romania (RO), Serbia (RS), Slovenia (SI), Slovakia (SK), Sweden (SE), Turkey (TR), United Kingdom (UK). Website: <http://facesmap.boku.ac.at/>.

It should be noted that policy-makers and the forest sector have expressed great concern about fragmented private forests, particularly because of their low intensity of forest management and high diversity of ownership (Lawrence, 2018; Pezdevšek Malovrh et al., 2017). It has become necessary to classify these owners according to their current or expected management behavior (Ficko et al., 2019). Thus, researchers then began to develop typologies of private forest owners (PFO), also known as typologies of Non-Industrial Private Forest (NIPF) owners (Harrison et al., 2002). Ficko et al. (2019) conducted an analysis of the methods and uses of the different types of owners developed from 1985 to 2015 in Europe and show the diversity of existing forest owner typologies. Out of the 124 labels identified, private forest owners were most often referred to as multiobjective, recreationists, investor, indifferent and conservationists. These typologies are primarily based on owners' objectives (Ficko et al., 2019), but others are based on the current behavior of NIPF owners regarding management processes (Novais and Canadas, 2010), or sometimes on structural factors (Hoggl et al., 2005) or on mixed or multidimensional attributes (Hujala et al., 2013; Lidestav, 2010; Selter et al., 2009). To design these typologies, many methods have been used in the literature. First of all, design methods are mainly quantitative, using ad hoc data and cluster analysis (e.g. Ficko and Boncina, 2013; Kumer and Štrumbelj, 2017; Kuuluvainen et al. 1996; Novais and Canadas, 2010; Serbruyns and Luyssaert, 2006), sometimes qualitative using individual interviews (e.g. Hugosson and Ingermarson, 2004; Hujala et al., 2007; Nichiforel and Schanz, 2011; Stanislovaitis et al. 2015) or rarely mixed using a combination of both (e.g. Van Herzele and Van Gossum, 2008). In addition, the classification method can be inductive or deductive (Boon et al., 2004; Emtage et al., 2007). In a recent study, Von Willert and Krott (2019), proposes a new "IT - based activating of forest owners" approach which aims at engaging owners through communication technologies. It should be noted that the purpose of many typologies was to provide detailed guidance to policy makers and practitioners in the design of policy instruments (Ficko et al., 2019). The literature on ownership typologies makes the assumption that each of the identified ownership types is likely to accept or reject various policy instruments depending on its motivations and objectives (Urquhart and Courtney, 2011). Danley (2019) shows that the benefits of designing different policy instruments for different types of owners may be limited. He indicates that owners may reject and not use policy instruments that are nevertheless designed and adapted to precisely meet their objectives. We therefore conclude that for all reviewed typologies, NIPF owners are the future users of the designed policy instruments but they are not considered explicitly like this in all classification methods. We suggest that user-centered design processes, based on a solid understanding of the intended users and summarized by the citation "knowing your user" (Holden et al., 2017) would be more appropriate to the objective of increasing the impact of forest policy on owners' behavior. Norman (2002) indicates that this process is a philosophy based on user needs and interests, with an emphasis on developing usable and understandable products and services. This process includes a central tool for knowing future users, which is the persona method (Nielsen, 2004). The principle of this method is to design a product or service for each persona identified in order to satisfy all the likely users they represent (Cooper, 1999). According to Miaskiewicz and Kozar (2011), they help to put into practice the fundamental principle of user-centered design: "Get to know the user, because he or she is not you". Then, our research question is the following: Can the persona method, adapted to NIPF owner typologies design, improve the design of policy instruments for better acceptance, adoption and use by owners? In this study, although we will not be able to fully answer the question, we will provide first answers by developing the persona method to the design of NIPF owner typologies, using and adapting Adlin and Pruitt's methodology (2010) "The Essential Persona Lifecycle: Your Guide to Building and Using Personas". The Vosges territory (Eastern France) has been chosen to prototype the method. After presenting the theoretical aspects of the persona method, a further section will present more accurately the context, and why this

territory is a good candidate to implement such a methodology based on collective knowledge shared between actors of forest management and policy. Then, in a later section, we will propose our general research method inspired by Adlin and Pruitt (2010) focusing on the first two stages of this study, fully concerned with the design of personas. Next, we will present our results regarding the types of personas and their composition. Finally, in a discussion section, we will deepen our methodological contributions related to our adaptation of the persona method to the forest sector, as well as our first contributions to improve the wood mobilization in the NIPF, we will also discuss the limitations of our study before concluding by further research perspectives.

2. Theoretical framework

2.1 User-Centered Design (UCD)

2.1.1 Definition and various currents

The design of new products and services must respond precisely to the needs and expectations of users in order to achieve maximum success (Von Hippel, 2001). The literature indicates that it is essential to design products and services that meet users' needs and expectations in order to facilitate user ownership (Nielsen, 1994). This is achieved through user-centered design, which takes users and their needs into account throughout the design process (Nielsen, 1994). This approach places the user and the task he has to accomplish at the center of the design process (Mayhew, 1999). Various currents of user-centered design have developed over the last few decades. The main ones are user innovation (Von Hippel 1986), participatory design (Muller and Kuhn, 1993), emotional design (Norman, 2004; Crossley, 2003), user experience (Miller, 2005), contextual design (Beyer and Holtzblatt, 1998), interaction design (Moggridge, 2007). All these approaches share the common goal of trying to integrate user uses into the design process (Von Hippel, 2001). Use is defined as "the fruit of individual (habits) and collective (customs) experiences and beliefs in frameworks of action other than those immediately given in the observation situation" (Maline et al., 1994). It includes practices, but also opinions, representations and the meaning that the user gives to the product when interacting with it (Hugrel and Thomazeau, 2000).

2.1.2 The main applications in the forestry sector

In the forestry sector, user-centered design has been little applied (Weiss et al., 2020a). However, Weiss et al. (2020b) indicate that greater attention to users is needed in both commercial and non-commercial uses of forests. Indeed, a few existing studies show the importance of end-user and public knowledge and perceptions for industrial strategies and forest policies (Stern et al., 2018; Toivonen and Kowalkowski, 2019). Among these main studies, Troncoso et al. (2007) conducted a study to design a technological innovation taking into account users' views to reduce the use of traditional biomass fuels to combat the health effects of indoor air pollution. Lindgaard Christensen et al. (2011) in their study on models and collaborators of innovation in the primary sector indicates that firms that deliver directly to end-users are more likely to be innovative than those that deliver to the processing or wholesale links in the value chain. Klenk and Wyatt (2015) in their study on the design and management of multi-stakeholder research networks indicates that producers and users need to co-construct solutions to foster innovation to address the challenges facing the forest sector. Thiger et al. (2017) proposed a product innovation to address the problems and needs related to the use of wood products by builders in construction projects. This product innovation based on empathic

design is based on the understanding that users of a wood product have needs that may only become apparent when a product is used. Overall, the forest-related literature calls for stronger stakeholder participation and user orientation in future research projects (Feliciano et al., 2019).

2.2 Persona method

2.2.1 Definition and advantages compared to User-Centered Design Methods

As mentioned in the introduction, the UCD includes a central tool for identifying and understanding future users, which is the persona method (Nielsen, 2004). This method was proposed in 1999 by Cooper, who questioned the notion of the user. He states that "referring to a person too generically leads designers to imagine products, services and systems that, when designed for the many, are ultimately unsuitable for anyone". This method suggests thinking about designing a product or service with a specific user, near-real person, with special features, a typical face and a distinctive name (Cooper, 1999). Personas promote user-centered design and enhance creativity in the design process (Brangier et al., 2011). As descriptive models of archetypal users, they are a generalization of the goals, motivations and behaviors of many individuals (Marshall et al., 2015). Other authors extend this definition and propose to consider personas as fictitious persons representing the needs, requirements, goals and personal characteristics of a group of users (Cooper, 1999; Pruitt and Adlin, 2006). Thanks to its evocative potential, the persona method makes it possible to reflect on the characteristics of products or services that could correspond to the expectations of current or future users (Chapman et al., 2008). It is precisely this evocative potential that distinguishes personas from other methods with which they can be articulated: "The critical difference between personas and scenarios or task analysis is that the latter methods are not generative. Scenarios and tasks tend to capture key properties of specific situations. However, they do not enable designers to think about new situations" (Matthews et al., 2011). In addition, personas differ from another method, the Thought Aloud (TA) protocol (Lewis, 1982), which aims to gain an in-depth understanding of user behavior in tasks, as personas also allow for the design of use scenarios by creating empathy (Miaskiewicz and Kozar, 2011). Finally, there are other useful models that can be used as tools for the interaction designer, such as workflow models and physical models, but Cooper et al. (2007) found that personas are the strongest, and that it is possible to integrate the best of other modelling techniques into a persona.

2.2.2 Methods for designing personas and their application

In the literature, there are many methods for designing personas. In this section, we will present several methods with their context of application to show the diversity of use of personas. Cooper et al. (2007) propose seven steps for designing personas applied to digital technology. Adlin and Pruitt (2010) in "The Essential Persona Lifecycle: Your Guide to Building and Using Personas" propose five phases for designing personas in an internal company approach. Vincent and Blandford (2014) propose an eight-step method for developing and testing a rigorous and empirical persona building process for interactive medical device developers. Holden et al. (2017) propose a ten-step process for the development and use of personas by designers in health and healthcare. Jung et al. (2017) propose five steps for generating personas using real-time data from social media (Automatic Generation of Personas). Carey et al. (2019) propose a method based on one-on-one interviews to develop and test environmental personas as design tools. Stevenson and Mattson (2019) recently proposed to increase the accuracy of personas by creating a computerized persona generator. The method was applied to define representative personas for motorcycle taxi drivers in Brazil.

3. Study context and area

In France, forest policies are introducing the law of the future for agriculture, food and forestry (LAAAF) in 2014. This law responds to the need for a change in forestry policy and the development of the timber sector to meet international challenges (combat against climate change, sustainable development, etc.). To implement this law, the French government created the National Forest and Wood Program 2016-2026 (PNFB) in 2016, which sets the orientations and the four main objectives of forestry policy for a ten-year period. Under this Program, a target is set to increase wood mobilization by 12 million m³ per year by 2026, with priority action in poorly managed private forests and those without sustainable management documents. According to Colin and Thivolle-Cazat (2016), it is precisely these properties that can provide additional resource, as public forests as well as managed large private forests are fully harvested under sustainable management. Indeed, it should be noted that 75% of French forests are privately owned and belong to 3.5 million owners (CNPF, 2015), 2 million of which own less than one hectare. Thus, a significant part of this private forest is highly fragmented (NIPF) and many owners are not involved in sustainable forest management approaches contributing to wood industrial resource. Our study is part of this context and will attempt to provide solutions to policy makers including the design of the personas of NIPF owners. As mentioned in the introduction, we will develop our prototype of the persona method in the Vosges department (Eastern France). Vosges hosts a huge diversity of forest ownerships. It is composed of diverse forests (hardwood and softwood, mountains and lowlands, plantations and semi-natural forests, public and private). Indeed, this department is covered by about 290000 hectares of forests and 48% of wooded areas, making it the third most wooded department in France (IGN, 2018). This forest (surface area) is composed of 55% deciduous trees (mainly sessile and pedunculate oaks and common beeches) and 45% conifers (common spruce and pectinated firs) (IGN, 2013). The annual harvest in this department is approximately 1.2 million m³: 640,000 m³ of softwood, 160,000 m³ of hardwood and 400,000 m³ of industrial and energy wood (Agreste, 2015). We chose this department as the target area because it is an interesting prototype for several reasons:

- In this area, there are clear local policies in favor of the development of the forest bioeconomy that are fully in line with national objectives about wood mobilization (DRAAF Grand-Est and Fibois, 2019; Peyron, 2016).
- We can empower a wide range of local forest stakeholders to co-construct and improve our method. Indeed, a complete set of actors (public and private forest managers, wood industries, hunters, local agencies of public institutions, etc.) are working for the development of the bioeconomy in this territory (DRAAF Grand-Est and Fibois, 2019).
- This department represents well the situation of the European private forest with a diversity of forests, owners and also a strong fragmentation of the private forest which represents about 113,000 hectares (IGN, 2013) for 48623 owners, of which about 44,000 own less than 4 hectares and 34,000 less than 1 hectare (CRPF, 2006). We suppose that this territory will allow us to have a first research study that is fairly representative of the NIPF in Europe.

4. Research method

Following our literature review on methods for designing personas presented in Section 2., we chose to adapt the method of “The Essential Persona Lifecycle: Your Guide to Building and Using Personas” by Adlin and Pruitt (2010) to design NIPF owner typologies. We chose to use this method because it is one of the only ones that clearly describes each step in the process of creating personas, their use throughout a research study, and finally their implementation

through concrete examples from real-life experiences (Vincent and Blandford, 2014). This method includes five phases:

- 1) Family Planning, to identify the problems you are trying to solve
- 2) Conception and Gestation, to organize the hypothesis and design the personas
- 3) Birth and Maturation, to create a communication campaign for the personas
- 4) Adulthood, to use the personas specifically to help you design, develop, evaluate, and launch your product
- 5) Life achievement and retirement, to measure the success of the persona creation effort and create a plan for reusing or retiring the personas.

In our study, in accordance with our objectives, we will focus on phase 2 "Conception and Gestation" which is the step of designing the personas as part of the complete process of Adlin and Pruitt (2010). However, we will present our method from the "Family Planning" phase that we carried out before conception and gestation (for this phase the results will not be presented, this is not the purpose of the paper).

4.1 Family planning

In the "family planning" phase, it is necessary to determine which problems need to be solved and with which materials (data sources, actors, etc.). In this section we present our research method adapted from the steps of Adlin and Pruitt (2010):

1st step: Define the objectives. The objectives of this study were defined upstream with the study partner organizations during the construction of the research project.

2nd step: Set up a design team. In order to set up our design team, we carried out a Strategic Analysis (SA). We based ourselves on studies by Marques et al. (2020), Reed et al. (2009) and Wang and Aenis (2019). SA helps to understand which stakeholders are interested in a project, what their needs and relationships are, so that the whole group can participate effectively in decision-making (Wang and Aenis, 2019). In our study, SA enabled us to identify, understand and analyze stakeholders in order to build our design team to design our personas. In Table 1, we show the composition of our persona design team. We built a team with a wide range of stakeholders who share different opinions and practices because we wanted to bring together a lot of knowledge and skills to design our personas. In addition, it should be noted that we have integrated into this design team owners' representatives (heads of associations, cooperatives, syndicates, etc.) who are acquainted with all types of owners, allowing us to have very diverse representations.

Table 1
Our design team

Stakeholder	Quantity
Advisory organization for NIPF owners	2
Elected representative (deputy of a town hall)	2
Environmental Association	1
Forest owners syndicate	1
Forestry Project Territory Animator	1
Forestry School	1
Hunting association	1
Industry	1
Private forest managers	2
Public institution	4
Research and development department	1
Research Laboratory	1

3rd step: Create an action plan with objectives, interests and a timeline for the design team. We developed a comprehensive action plan during the construction of the research project that follows the five phases of “The Essential Persona Lifecycle: Your Guide to Building and Using Personas”.

4th step: Identify data sources that will assist in the design of personas. To identify data sources, we conducted a literature review based largely on the study by Ficko et al. (2019). In addition, we have also carried out literature reviews at the French level and in the Vosges department. We identified the existing owner typologies, the variables that characterize them, etc.

4.2 The conception and gestation

Once the "family planning" phase was finished, we were able to carry out the main phase related to the purpose of this paper, "conception and gestation". According to Adlin and Pruitt (2010), this phase is the beginning of the creation of personas. During this phase, it is necessary to organize the hypothesis and to transform the data into information and the information into personas. This is the phase in which data is used to create attractive representations of individual users that the design team can use for planning, design and development. To carry out this phase, we have adapted the six steps recommended by Adlin and Pruitt (2010) as follows:

1st step: Identify the categories of personas (make assumptions about the types of personas). In this first step, the design team identified the categories of NIPF owners in our target area who:

- own less than 25 hectares²
- are not involved in sustainable forest management approaches.

2nd step: Skeletons creation. Skeletons are very brief (usually bulleted) lists of distinctive data points for each subcategory identified. Skeletons help the design team move from thinking about user categories to focusing on specific details. In this step, the design team created skeletons of the identified categories of personas. To help the design team create skeletons, the authors proposed a blank persona (blank sheet) based on scientific literature and research hypothesis to propose a composition of personas adapted to the objectives of the study (this blank persona was proposed only to help the design team create skeletons, the design team could modify and validate this blank persona). Here is its composition in four parts (Appendix A):

1) The identity of the owner, which is divided into three sub-parts:

- the name of the persona who will make it unique, identifiable and memorable (Cooper, 1999)
- the owner's objectives related to her ownership to facilitate product and service design decisions (Adlin and Pruitt, 2010)
- a brief summary of the owner's identity to give the impression that the persona actually exists. For this purpose, personal data (attitudes, motivations, needs, etc.) and biographical data (personal experience, life story, etc.) are used (Cooper, 1999; Goodwin, 2009).

This part has been proposed because, from a methodological point of view, the analysis of the identity of personas makes them credible, easily memorable and humane (Nielsen, 2002).

² In France, properties of less than 25 hectares are considered as small private forests (Elyakime et al., 2015) because all properties larger than 25 hectares must have a Simple Management Plan (Sustainable Management Document) and are therefore theoretically managed (Colin and Thivolle-Cazat, 2016).

- 2) Property information: Characteristic variables. For this part, the design team will need to define characteristic variables to represent and differentiate NIPF owners in the target territory. This part has been proposed because personas are based on variable assumptions that allow for the identification and differentiation of user types based on their behaviors (Cooper et al., 2007).
- 3) Part with the analysis of the behaviors, current uses, needs and frustrations of NIPF owners, which are essential elements of the personas method (Cooper, 1999; Nielsen, 2002). Indeed, the analysis of user behaviors makes it possible to situate a future product or service in a global perspective according to the values and beliefs of the personas (Nielsen, 2002). And, the analysis of current usage provides information on the environment in which the future product or service will be used (Cooper, 1999). Analysis of user needs serves to remind stakeholders that their own needs are not necessarily those of the end user (Billestrup et al., 2014), thus facilitating the implementation of a design that focuses on the real needs of persona (Cooper, 1999). Through needs analysis, personas can reduce the gap between the perceived and actual goals of users (Pruitt and Adlin 2006). Frustration analysis helps to create more empathy for stakeholders (Rind, 2007), thus making it possible to anticipate some user reactions in order to predict their behaviors in future use scenarios (Goodwin, 2009).
- 4) A SWOT matrix (Learned et al., 1969) (strengths, weaknesses, opportunities and threats) to analyze the internal (strengths and weaknesses) and external (opportunities and threats) environment of each persona for its wood mobilization. The matrix was proposed because it can be successfully applied as a participatory planning method, as it encourages discussion between members of a team (Pickton and Wright, 1998), the authors hypothesized that it would facilitate exchanges within the design team. In addition, it can guide discussion and interaction among experts, particularly when defining strategic priorities (Terrados et al., 2007). Finally, the authors also hypothesized that the SWOT matrix could lead to the emergence of coherent use scenarios (within the framework of step 3 of “The Essential Persona Lifecycle: Your Guide to Building and Using Personas”) according to the types of personas for the design of policy instruments. Indeed, in the literature, the SWOT matrix has been used in several studies to formulate scenarios in different contexts (e.g. Naghedhi et al., 2020; Quiceno et al., 2019).

3rd step: Process the data. In this step, the authors linked the identified skeletons to the data collected during the literature review conducted at the “family planning” phase. The authors compared the data from the scientific literature with the data from the design team to refine the objectives and segments (characteristic variables) based on the scientific literature.

4th step: Prioritize the skeletons. Authors have skeletons, so the design team needs to assess the importance of each skeleton in achieving the main objective of the study. In this step, the design team has identified a subset of the skeletons that will become personas of the NIPF.

5th step: Develop selected skeletons into personas. This step consists of enriching the skeletons to create personas by adding data, concrete and individualized details, and some narrative elements to give them personality and context. During this step, the design team enriched the skeletons defined in the previous steps.

6th step: Validation of personas. Once the details have been added, it is important to verify that your final personas still reflect your data. During this step, the authors and the design team validate the personas together.

5. Implementation, data collection and analysis

5.1 Co-creation workshops

For the implementation of the first two steps "Identify the categories of personas" and "Skeletons creation", we conducted two co-creation workshops with the design team (Schuurman et al., 2015). Co-creation aims to achieve mutually appreciated results that are the result of the active engagement of all stakeholders and users in a design process (Schnurr, 2017; Von Hippel and Oliveira, 2011). We chose to implement co-creation workshops because they allow for sharing and addressing different points of view and promote a better alignment of collective intent (DeFillippi and Roser, 2014; Lee et al., 2012). Thus, two co-creation workshops were conducted with the design team. The workshops lasted 3 hours with the same author as orchestrator³. The first workshop was conducted with a sample of six stakeholders who were acquainted with the NIPF (stakeholders who work daily with the NIPF owners) in the target territory. The second workshop was conducted with six other stakeholders who, this time, had more limited knowledge of the NIPF (none of the stakeholders were specialized in working with NIPF owners). These two workshops allowed us to obtain data from two very different perspectives on the NIPF. Then, for the implementation of steps three and four "process the data" and "prioritize the skeletons," we transcribed all of the sheets of paper (from both workshops) written by the design team into a word processor, keeping the written terms as they were (to the nearest word). The orchestrator's notes have also been transcribed in their entirety in the same folder. We were then able to concatenate all the notes collected in the two workshops to allow the authors to improve the skeletons and compare them with the literature. Finally, with the help of literature and other exchanges (telephone and e-mail) with the design team, the authors selected the most important and relevant skeletons from the two workshops for personas writing.

5.2 Individual interviews

For the implementation of the fifth step " Develop selected skeletons into personas ", we presented the results of the co-creation workshops in individual interviews. Indeed, we supplemented and enriched our priority skeletons from our co-creation workshops in six semi-directive individual interviews (Savoie-Zajc, 1997; Nakashima, 1990). We chose the semi-directive interview because it allows us to gather information in an open format (Giorgi, 1997) by guiding the interviewee towards a subject without imposing it. Our interviews allowed us to collect life stories and concrete examples from the interviewees (Lallemant et al., 2016). They were conducted with people from our design team who had not been invited to the co-creation workshops. The interviews all lasted between 1h05 and 1h40 and always met two conditions:

- They took place on the premises of the actors interviewed
- They were conducted by the same investigator (an author)

Following the individual interviews, handwritten notes on the sheets of paper were transcribed into the same word processing file used for the co-creation workshop. The interviewer's notes containing the responses to the interview guide were also transcribed into the same file, respecting the exact words of the interviewees. Once all the data was transcribed, the authors integrated them into the skeletons. In this way, the authors enriched the skeletons to make them realistic by reflecting on the questions: What exactly do your field staff look like and how do

³ The orchestrator is an actor who orchestrates the whole network of actors. He plays an active role in the development of innovation and seeks to build trust between stakeholders and users in the network in order to stimulate goal-oriented collaboration (Nyström et al. 2014).

they behave? What can they do or not do? The short sentences in the skeletons were supplemented with contextual elements, adding situations, actions, and events. The authors then had exchanges (telephone and e-mail) with the design team to finalize the first draft of the personas.

5.3 The committee of validation and finalization of personas

For the implementation of the sixth step "Validation of personas", we have set up a committee in charge of validating and finalizing the personas. This committee was composed of six people from our design team. Three people came from our first co-creation workshop and three others from the second co-creation workshop. Based on the same co-creation workshop methodology, it lasted 3 hours. The data collected was transcribed into the same word processing file as for the previous steps to obtain the final personas of the NIPF owners.

6. Results

6.1 Types of personas

In this section, we will present the eight types of personas obtained, specifying their objective related to their property and indicating elements about their identity.

The self-consumer of firewood

The self-consumer of firewood is a landowner who collects his wood without any commercial objective but only by taking the volume necessary to meet his personal heating needs. The design team nicknamed him "the wood picker" because he only takes the stems, he wants without necessarily following silvicultural principles beneficial to his stand.

The wealth curator

The wealth curator generally obtained his property by inheritance. Aware of this acquisition, he is attached to his family property and has the will to keep it until the end of his life in memory of his family. Within these properties, the activity is often weak or absent due to a lack of knowledge of the forest by the owner, a fear of touching his family property and an undivided property.

The rational investor

The rational investor carries out timber felling in order to economically develop his property in the long term according to the principles of silviculture. He generally reconciles economic, environmental and social aspects in his forest. In addition, he manages his property in a sustainable manner by investing in renewal work, exploitation, etc.

The opportunist

The opportunist harvests timber without respecting good silvicultural practices, he only wants to make a maximum economic profit in the short term. He is selling his wood opportunistically to the buyer who offers him the highest price offer without worrying about his identity.

The disinterested

The disinterested has no interest in his property and therefore does not carry out any activity on it. In a co-creation workshop, one private forest manager said: "We must avoid wasting too much time with these owners, they are often indecisive and do not care about their property". Another private forest manager replied, "Yes, that's true. I think the reason may be due to

several explanations: a physical distance from their property or a co-ownership situation or a lack of knowledge of forestry".

The biodiversity conservator

The biodiversity conservator wants to conserve plant and animal biodiversity on his property.

Two cases can define this owner:

- An active owner who develops appropriate habitats
- An owner who does not carry out any intervention on his property and leaves nature to regulate itself.

The recreational

The recreational use their property for forest-related recreational activities such as walking, gathering... A particular case may define this owner when he uses his property for recreational hunting. One stakeholder stated: "These are owners who are generally active on their property to meet their recreational needs. They also often take care of the aesthetic, landscaping and sanitary aspects of their property".

The non-knowledgeable

The non-knowledgeable is an owner who has no knowledge of his property. During a co-creation workshop, one stakeholder stated: "These owners are referenced in cadastral databases, very often they have inherited a very small parcel but are not aware of their property ownership or forget it over time because it means nothing to them".

6.2 The composition of the personas

The results of our composition of personas are organized in six parts presented below. On the one hand, the four parts proposed by the authors in section 4 have been validated by the design team. On the other hand, the design team proposed to add two other parts in the composition of the personas. To illustrate our results, Appendix B presents an example of a persona "Self-consumer of firewood".

6.2.1 The parts proposed by the authors and validated by the design team

1) The identity of the owner

The design team validated the part on the identity of the owner proposed by the authors. This part is composed of three sub-parts:

- the name of the persona
- the owner's objectives
- a brief summary of the owner's identity

2) Property information: The seven characteristic variables

The design team validated this part. It is composed of the characteristic variables that allow to identify and compare owners. Our results consist of seven variables and their possible values that were defined by the design team (Table 2). In addition, a classification according to three states (rare, occasional and frequent) has been added, making it possible to precisely define the frequency of situations encountered for each persona.

Table 2

Our seven key variables and their possible values.

Variables	Possible values
Area	Less than 1 hectare
	From 1 to 4 hectares
	From 4 to 10 hectares
	From 10 to 25 hectares
Distance between residence and property	Less than 10 km
	From 10km to 100km
	+ more than 100km
How to obtain your property	Inheritance
	Purchase
Action(s) carried out on the property (cuts, works...)	Supported
	Alone
Development(s)	Runways, partitions
	Place of deposit
Sustainable management document	Yes
	No
Landlocked property	Yes
	No

3) A part specific to the personas: behaviors, current uses, needs, and frustrations

This part has been validated by the design team. The behaviors, current uses, needs, and frustrations of NIPF owners were identified and analyzed. The design team indicated the importance and novelty of these elements compared to a NIPF owner typologies. The team also noted the value of identifying and understanding these elements in order to improve the design of policy instruments.

4) A SWOT matrix for its wood mobilization

The SWOT matrix proposed by the authors was validated by the design team. This matrix is therefore included in the personas to analyze the strengths, weaknesses, opportunities and threats for the mobilization of owners' wood in order to develop use scenarios for the design of policy instruments. The design team indicated that this SWOT matrix was easy to read and would likely be very accessible to politicians and practitioners.

6.2.2 Parts added by the design team

1) Tips for communicating with the owner

The design team proposed adding a section called "Tips for communicating with the owner" as they indicated that communication with the NIPF is an essential element for integrating them into sustainable forest management approaches aimed at wood mobilization. The design team clarified that communication should be an integral part of designing future use scenarios that will result in policy instruments. In addition, the design team even added a specificity in this section, a division with "to avoid" and "to do". They indicated that the "to avoid" advice was more important than the "to do" advice because if a mistake is made in communicating with the landowner, it is difficult to regain his trust.

2) Ideas for use scenarios

The design team proposed to add a section called "Ideas for use scenarios". The design team indicated that the solutions identified for each persona will provide precision for the design of policy instruments. In addition, she added that this part will make it easier to adapt future policy instruments to the solutions identified for each persona in order to meet policy, scientific and practical needs.

7. Discussion

7.1 The methodological contributions

7.1.1 Qualitative implementation

Firstly, our qualitative implementation seems to address one of the important success factors for wood mobilization in the NIPF. Indeed, the literature indicates difficulties in getting stakeholders to work together to design more effective policy instruments (Lawrence, 2018; Orazio et al., 2017). Thus, in our study, we propose an implementation where stakeholders collaborate to design a common discussion tool, the personas, which will then facilitate the design of policy instruments. Personas allow stakeholders to come together around common representations and thus promote communication around user needs (Long, 2009). We can assume that this characteristic of personas allows for an initial collaboration to design a common discussion tool and then to facilitate subsequent collaborations that would be more conflictual, especially for the design of policy instruments.

Secondly, our implementation to design personas promotes co-creation, which in turn helps to build trusting relationships between stakeholders and target users (Dupont et al., 2019). Indeed, we have integrated in our workshops owners' representatives with stakeholders, a relationship of trust has been created and could greatly facilitate the use of policy instruments (Lawrence, 2018; Stern et al., 2013). Trust between owners and stakeholders is recognized as an important success factor for wood mobilization in the NIPF (UNECE-FAO, 2020). Forest owners tend to trust people with whom they deal persistently over time, on the basis of common interests and with whom they have a positive experience (Hujala and Tikkanen, 2008; Stoettner and Ní Dhubháin, 2019). Thus, we will need to be vigilant in our user-centered design process to properly develop trusting relationships between owners and stakeholders over time with co-creation steps that bring together common interests and create positive experiences such as the design of our personas.

7.1.2 The six parts that compose the personas

The six parts that compose the persona can provide methodological guidance for the future design of NIPF owner typologies. In our first part, "The identity of the owner", we find the same information as in existing NIPF owner typologies, particularly for those that are made with the owner's purpose in mind (Ficko et al., 2019). For the second part, "Property information: The seven characteristic variables", our seven characteristic variables are identical to those in the literature (e.g. Ficko and Boncina, 2013; Kumer and Štrumbelj, 2017; Weiss et al., 2019). However, the possible values and frequency states allow us to refine our identification and comparison of owners. The more precise these variables are, the more realistic the typologies can be, and this is what makes the strength of personas. Next, we have the part with the analysis of the behavior, current uses, needs, and frustrations of the owners. This part is characteristic of the persona method, it brings a strong added value to literature because it allows a better understanding of who the owners of NIPF are. Moreover, it will allow

these elements to be taken into consideration throughout the process of designing policy instruments. Indeed, without accurate information on objectives, needs and motivations, it is difficult to design solutions (Carey et al., 2019).

Next, the part "A SWOT matrix for its wood mobilization" will allow us to facilitate the implementation of use scenarios using strengths to eliminate and limit their weaknesses and also exploit opportunities to counter threats. Moreover, this matrix has already been used in the forestry sector to define strategies for wood mobilization (Rauch, 2007) or cooperation of forest owners (Blinn et al., 2007). In our case, and according to the feedback from our design team, this matrix could facilitate exchanges within the design team and the understanding of personas. For the "Tips for communicating with the owner" part, it discusses one of the success factors related to wood mobilization, which is the adaptation of oral communication from stakeholders to the owner (Lidestav and Berg Lejon, 2013; Von Willert and Krott, 2019). Indeed, the literature indicates that technical interaction may be more important for owners who are already motivated or organized (Asikainen and Routa, 2014). While for disinterested or conservative owners, communication based on information, advice and services is recommended, and not on the financial aspects (Górriz-Mifsud et al., 2019). This part will enable stakeholders to adapt oral communication with owners. Finally, the part "Ideas for use scenarios" allows to have initial ideas of scenarios of uses based on the content of the persona. These ideas for use scenarios give stakeholders the opportunity to immerse themselves in real-life situations experienced by owners (Miaskiewicz et al., 2008), and this immersion makes it possible to predict user behavior in different circumstances (Pruitt and Grudin 2003). It should be noted that Ficko et al. (2019) indicate that it is now preferable to try to predict the behavior of owners rather than work on actual situations. Perhaps personas can provide answers to the literature on this topic. These ideas for use scenarios will help to prepare future co-creation steps to design very practical policy instruments adapted to different types of owners, as recommended by Pezdevšek Malovrh et al. (2017).

7.2 The personas method to contribute to a better use of policy instruments by the forest owners

Our results show that our personas are similar to existing NIPF typologies. For example, our persona "The Self-Consumer of Firewood" resembles the " Household Foresters" described by Stanislovaitis et al. (2015), our persona "The recreational" has similar characteristics to Urquhart and Courtney's (2011) " Amenity Owner", and our persona "The Rational Investor" has similar characteristics to Bieling's (2004) "The Economically Interested". In this study, we did not seek to find new types of owners, but to identify and understand those who are the target of our study objective: the owners of NIPF in the Vosges department. This research work will then allow us to co-construct policy instruments by taking into account the specificities of the personas throughout the design process. It should be noted that the literature calls for reflection on the potential adoption of policy instruments by forest owners to increase wood mobilization (Lawrence, 2018). The acceptance, adoption, and use of policy instruments appears to be an important success factor in mobilizing wood in NIPF (Danley, 2019). Our study applies a user-centered approach, which allows for greater acceptance, adoption and ownership of the innovation (Bobillier-Chaumon and Dubois, 2009; Terrade et al., 2009). One of the reasons personas improve the design of solutions is the empathy they create (Miaskiewicz and Kozar, 2011). Empathy can be defined as the ability to recognize an emotion in others (Decety, 2002). It allows the design team to focus emotionally on the future users of the study throughout the design process (Miaskiewicz and Kozar, 2011) and also allows the design team to ask themselves to what extent the solution is acceptable and usable by the personas (Baxter and Courage, 2005). Thus, we sought to design our personas by creating empathy so that the design

team develops an emotional understanding and identification with the NIPF owners. We introduced empathy by asking questions about NIPF owners in the design of the personas: Will they be able to benefit from policy instruments? Will they be able to use them easily and comfortably, not with frustration but with pleasure? "How would the "wealth curator" react to this? Or "The rational investor"?"

With empathy, it is no longer just a matter of reporting observable and measurable facts, but also of integrating the thoughts and feelings of users (Suri, 2001). Empathy thus allows personas to bring new elements to understand forest owners (needs, frustrations, etc.), it might be promising in the future to combine personas and their empathic capacity with other scientific methods (e.g. quantitative) that have been used for the design of owner typologies.

7.3 Possibility of reproducing and adapting this method in other territories

Our paper has been designed with the hypothesis that it will allow the reproduction and adaptation of our method of designing personas in other territories (in other French or European regions). But how to reproduce and adapt our method in different contexts and territories? Indeed, we know that territories are defined as complex evolutionary systems comprising many actors and different characteristic variables (Moine, 2006). In fact, one of the main questions that geographers ask themselves is to understand how space and location influence the practices and systems of actors (Agnew and Livingstone, 2011). Moreover, timber harvesting is a personal and cultural practice, which leads to difficulties in transferring solutions from one context to another (Rauch et al., 2015; Wippel and Becker, 2008). Despite these difficulties from the literature, we propose to use our experience to provide some important points that will allow us to validate our hypothesis regarding the reproduction and adaptation of the method in other territories.

First of all, it will be necessary to gather a design team with diverse actors within the target territory with very different opinions and points of view (economic actors, those who defend the environment, others who value the recreational aspects in the forest, etc.) and who also have a different legal structure: public, private and other civil society actors. The aim is to take into account the different objectives of the stakeholders that compose the design team in order to identify and understand the owners of the NIPF without forgetting any elements.

Secondly, we believe that the role of the researcher as orchestrator is very important specially to conduct the co-creation phases. Indeed, the researcher must ensure that all stakeholders speak and should not interpret what stakeholders say, but must ensure that the words expressed are accurately reflected. He will also have to manage conflicts between stakeholders in order to find a consensus, particularly in the drafting of personas.

Finally, we suggest that researchers implementing this user-centered design process in the forestry sector work in collaboration with research institutions specializing in forestry science and user-centered research. A mutual contribution of two of these specialist institutions, as in our study, seems to be a good advantage and strength.

7.4 Main limitations of this study

First of all, from the point of view of the literature, our first limitation concerns two lacks in our composition of personas:

- Our results do not contain information on the gender of the owners. However, several studies highlight the importance of gender in the context of wood harvesting behavior (Kuuluvainen et al., 2014; Lidestav and Berg Lejon, 2013). During implementation, the author who was a orchestrator and interviewer emphasized the importance of gender for the design team. However, the design team did not wish to differentiate gender in

personas. Many stakeholders indicated that these personas could represent both men and women and that differentiation was not mandatory. However, we would like to explore this further, to test the assumption that adding gender to the NIPF owner personas can be relevant.

- Our results do not contain information on the age of the owner. Yet the age of the owner appears to be important in management choices and harvesting decisions (Juutinen et al., 2020). Our design team did not include age in the results of the study because they considered that for the majority of personas, the influence of age was not strong enough (probably because owners they know are all quite old) and decisive in relation to other variables.

We may wonder if our design team did not influence the choice not to consider age and gender in the design of our personas. We could ask ourselves whether the same research study, in the same territory, but with a different design team with, for example, people in marketing positions in forestry companies, sociologists or anthropologists would have incorporated these two elements in the personas.

Finally, we wish to conclude this section with another limitation related to our design team. Even if it seems very operational because it is composed of many practitioners, we think that it still lacks policy makers. Indeed, the number of practitioners makes the persons very credible and very close to the reality on the ground, but the lack of policy makers could have negative consequences on the future design of policy instruments. Yet, we have four public institutions and two elected representatives but we think that we lack policy makers who represent the state authorities. These stakeholders would bring a political vision and knowledge to our research work to facilitate the design of policy instruments. In the future, we will have to expand our design team with more policy makers, otherwise our personas may not be effective.

8. Conclusion and research perspectives

Our main question was: Can the persona method, adapted to NIPF owner typologies design, improve the design of policy instruments for better acceptance and use by owners? Our study answered a first part of the question by providing methodological contributions as it showed that the persona method can be adapted to design NIPF owner typologies. In our target area, we consider owners as future users of policy instruments aimed at involving them more in sustainable forest management approaches aimed at wood mobilization. Actually, our personas have been designed to develop new policy instruments and improve existing ones to enable better acceptance and use by forest owners. Therefore, our first research perspective is the realization of the complete process of the "The Essential Persona Lifecycle: Your Guide to Building and Using Personas" by designing use scenarios to place our personas in real situations in order to design future policy instruments within our target territory. Our second research perspective focuses on how our persona design is suitable not only to meet forest bioeconomy policy (increasing wood harvesting) but all forest policies (biodiversity conservation, climate change adaptation and mitigation, etc.). We need to test if co-creation workshop more oriented to these policies would have been defined the same personas. Finally, as a result of this study, we believe that future research on NIPF typologies could be more effective by combining existing approaches (quantitative or qualitative) with the persona method to obtain information on their future users. This future research could also place researchers in the role of orchestrator in order to bring together forest sector stakeholders (who have divergent points of view) to achieve a common goal through co-creation. Researchers could then be at the origin of the development of more strengthened collaborations with practitioners and politicians to achieve greater effectiveness of ownership typologies for the design of policy instruments.

Acknowledgments

We would like to thank all the actors who participated in the study and who are already presented in the article. We would particularly like to thank the ADEME, which has placed its trust in us and is funding this multidisciplinary research between the UMR Silva (University of Lorraine, INRAE and AgroParisTech) and the Research team on innovation process (ERPI, University of Lorraine).

Appendix A: Blank Persona

Name		Summary and stories	
Objective(s) related to his property			
Property information : Characteristic variables			
Behaviors / Current Uses			
Needs		Frustrations	
For its wood mobilization			
Strengths		Weaknesses	
Opportunities		Threats	

Appendix B: Persona "Self-consumer of firewood"

The self-consumer of firewood "the wood picker"

The self-consumer of firewood is a landowner who collects his wood without the objective of wood production it but only by taking the volume necessary to meet his personal heating needs. The name "the wood picker" can be attributed to him because his harvest is often compared to the "picking": he only takes the stems he wants without necessarily following silvicultural beneficial principles to his stand.

Objective(s) related to his property

Harvesting firewood for personal consumption

Property information : Characteristic variables

<p>Area</p> <p><input type="radio"/> Less than 1 hectare</p> <p><input checked="" type="radio"/> From 1 to 4 hectares</p> <p><input type="radio"/> From 4 to 10 hectares</p> <p><input type="radio"/> From 10 to 25 hectares</p>	<p>Distance between residence and property</p> <p><input checked="" type="radio"/> Less than 10 km</p> <p><input type="radio"/> From 10km to 100km</p> <p><input type="radio"/> more than 100km</p>	<p>How to obtain your property</p> <p><input checked="" type="radio"/> Inheritance</p> <p><input type="radio"/> Purchase</p>	<p>Action(s) carried out on the property (cuts, works...)</p> <p><input type="radio"/> Supported</p> <p><input checked="" type="radio"/> Alone</p>
<p>Development(s)</p> <p><input type="radio"/> Runways, partitions</p> <p><input type="radio"/> Place of storage</p>	<p>Sustainable management document</p> <p><input type="radio"/> Yes</p> <p><input checked="" type="radio"/> No</p>	<p>Landlocked property</p> <p><input type="radio"/> Yes</p> <p><input checked="" type="radio"/> No</p>	

Behaviors / Current Uses

- Exploits his firewood with his own equipment (chainsaws, tractors, etc.)
 - Is not afraid to exploit his wood
- Is not very sensitive to environmental and social aspects

Needs

- Wishes to keep the freedom to exploit his firewood
- Prefer to remain independent rather than be part of a "supply chain circuit"

Frustrations

- Do not like to respect the principles of forest management
- Rejects the advice of forest stakeholders,

For its wood mobilization

<p>Strengths</p> <ul style="list-style-type: none"> • Has a good knowledge of the local inhabitants (farmers, neighboring owners...), which facilitates its operations <p>Opportunities</p> <ul style="list-style-type: none"> • Its network may allow the creation of working partnerships with other forest owners (this owner is a local resource person) 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Perceives its property as a source of supply (beware of the level of levy: over- or under-exploitation) • Has a limited and personal vision of forest exploitation • Has its own vision of silviculture (which is not necessarily adapted to timber production and product marketing) <p>Threats</p> <ul style="list-style-type: none"> • May have a lack of knowledge about forest harvesting safety under current laws • Lack of knowledge of legal and tax laws • Does not follow the economic prices of the timber market
--	--

Tips for communicating with the owner

To avoid

The "lesson giver" approach. At first, do not give him any advice (silvicultural, operational...). He could close in on himself quite easily. Be present as a simple listener and get to know his property before you assert yourself in the discussion.

To do

- This owner must be met on the property (in the heart of his property).
- Prove your arguments by example (take him to managed plots to illustrate your point).
- Even if you feel that trust is building, this owner will remain difficult to advise, do not be frustrated. Try to inform them gently about the potential improvements for their population by making them aware of their future value and the importance of transmission.

Ideas for use scenarios

- Offer him an estimate or sale of wood to help him understand the potential added value of his lumber compared to firewood
- Implementation of a silviculture system that makes it possible to combine the production of timber and firewood (Example: coppice under a forest) by helping enhance the value of its timber and to designate its firewood rods to be harvested. Don't forget to give them the freedom to use their firewood by raising their awareness of safety.
- Suggest that they write a sustainable management document (if they do not already have one)

References

- Adlin, T., Pruitt, J., 2010. *The essential persona lifecycle: Your guide to building and using personas*. San Francisco: Morgan Kaufmann.
- Agnew, J., Livingstone, D., 2011. *The sage handbook of geographical knowledge*, SAGE Publications Ltd, London.
- Agreste, 2015. *La forêt privée française en France métropolitaine : structure, propriétaires et potentiel de production*, Numéro 30, Agreste les dossiers.
- Asikainen, A., Routa, J., 2014. Arising radical and incremental innovations for supply chains of residual forest biomass. In *Proceedings of the Nordic Baltic Conference OSCAR14 Solutions for Sustainable Forestry Operations*. R. Björheden (ed.), pp. 76. <http://jukuri.luke.fi/handle/10024/518242>.
- Baxter, K., Courage, C., 2005. *Understanding Your Users : A practical Guide to User Requirements Methods, Tools and Techniques*. San Francisco: Morgan Kaufman, ISBN : 978-1558609358.
- Beyer, H., Holtzblatt, K., 1998. *Contextual design: defining customer-centered systems*. San Francisco, Calif.: Morgan Kaufmann.
- Bieling, C., 2004. Non-industrial private-forest owners: possibilities for increasing adoption of close-to-nature forest management. *Eur. J. For. Res.* 123, 293–303. <https://doi.org/10.1007/s10342-004-0042-6>
- Billestrup, J., Stage, J., Bruun, A., Nielsen, L., Nielsen, K.S., 2014. Creating and Using Personas in Software Development: Experiences from Practice, in: Sauer, S., Bogdan, C., Forbrig, P., Bernhaupt, R., Winckler, M. (Eds.), *Human-Centered Software Engineering, Lecture Notes in Computer Science*. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 251–258. https://doi.org/10.1007/978-3-662-44811-3_16.
- Blinn, C.R., Jakes, P.J., Sakai, M., 2007. Forest landowner cooperatives in the United States: a local focus for engaging landowners. *J. For.* 105, 245–251.
- Bobillier-Chaumon, M., Dubois, M., 2009. L'adoption des technologies en situation professionnelle : quelles articulations possibles entre acceptabilité et acceptation. Dans : *Le travail humain* 72(4), p. 355.
- Boon, T.E., Meilby, H., Thorsen, B.J., 2004. An empirically based typology of private forest owners in Denmark—improving the communication between authorities and owners. *Scand. J. For. Res.* 19 (suppl.4), 45–55.
- Brangier, E., Bornet, C., Bastien, J.M.C., Michel, G., Vivian, R., 2011. Mesure de la capacité des personas à générer des idées dans la conception de projets WEB. *Le Travail Humain*, 75(2), 121-145.
- Carey, M., White, E.J., McMahon, M., O'Sullivan, L.W., 2019. Using personas to exploit environmental attitudes and behavior in sustainable product design. *Appl. Ergon.* 78, 97–109. <https://doi.org/10.1016/j.apergo.2019.02.005>.
- Centre Régional de la Propriété Forestière Lorraine-Alsace, 2006, *Schéma Régional de Gestion Sylvicole de Lorraine*.
- Centre National de la Propriété Forestière, Forestiers privés de France, 2015, *Les chiffres clés de la forêt privée*.

- Chapman, C. N., Love, E., Milham, R. P., El Rif, P., Alford, J. L., 2008. Quantitative evaluation of personas as information. In Proceedings of the Human factors and ergonomics society annual meeting, New York, 1107-1111.
- Colin, A., Thivolle-Cazat, A., 2016, Disponibilités forestières pour l'énergie et les matériaux à l'horizon 2035, IGN-FCBA, ADEME, Tome 1 : Rapport février 2016.
- Cooper, A., 1999. *The Inmates Are Running the Asylum*, New York, Macmillan.
- Cooper, A., Reimann, R., Cronin, D., 2007. *About Face 3: The Essentials About the Interaction Design*. Indianapolis: Wiley.
- Crossley, L., 2003. Building emotions in design. *The Design Journal* 6 (3): 35-45.
- Danley, B., 2019. Forest owner objectives typologies: Instruments for each owner type or instruments for most owner types? *For. Policy Econ.* 105, 72–82. <https://doi.org/10.1016/j.forpol.2019.05.018>.
- Decety, J., 2002. Naturaliser l'empathie. *L'encéphale*, 28, 9-20.
- DeFillippi, R., Roser, T., 2014. Aligning the Co-Creation Project Portfolio with Company Strategy. *Strategy & Leadership*, 42(1): 30–36. <https://doi.org/10.1108/SL-10-2013-0075>.
- DRAAF Grand-Est, Fibois, 2019. Programme Régional de la Forêt et du Bois de la région Grand Est 2018-2027.
- Dupont, L., Mastelic, J., Nyffeler, N., Latrille, S., Seulliet, E., 2019. Living lab as a support to trust for co-creation of value: application to the consumer energy market. *J. Innov. Econ. Manag.* 28, 53.
- Elyakime, B., Cabanettes, A., Loisel, P., 2015. Faut-il s'intéresser à la petite et moyenne forêt privée française ? *Rev. For. Fr.* LXVII - 1-2015 - AgroParisTech, 2015.
- Emtage, N.F., Herbohn, J.L., Harrison, S.R., 2007. Landholder profiling and typologies for natural resource management policy and program support: potential and constraints. *Environ. Manag.* 40 (3), 481–492.
- European Commission, 2018, *A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment*, https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf.
- Feliciano, D., Blagojević, D., Böhling, K., Hujala, T., Lawrence, A., Lidestav, G., Turner, T., Weiss, G., Zivojinovic, I., Ludvig, A., 2019. Learning about forest ownership and management issues in Europe while travelling: the Travellab approach. *Forest Policy Econ.* 99, 32–42.
- Ficko, A., Boncina, A., 2013. Probabilistic typology of management decision making in private forest properties. *For. Policy Econ.* 27, 34–43.
- Ficko, A., Lidestav, G., Ní Dhubháin, Á., Karppinen, H., Zivojinovic, I., Westin, K., 2019. European private forest owner typologies: A review of methods and use. *For. Policy Econ.* 99, 21–31. <https://doi.org/10.1016/j.forpol.2017.09.010>.
- Forest Europe, 2015. *State of Europe's Forests 2015*. Food and Agriculture Organization of the United Nations.
- Geng, A., Yang, H., Chen, J., Hong, Y., 2017. Review of carbon storage function of harvested wood products and the potential of wood substitution in greenhouse gas mitigation. *For. Policy Econ.* 85, 192–200. <https://doi.org/10.1016/j.forpol.2017.08.007>.

Giorgi, A., 1997. De la méthode phénoméno- logique utilisée comme mode de recherche qualitative en sciences humaines: théorie, pratique et évaluation. in Poupart J., Deslaurier JP., Groulx LH., Laperrière A., Mayer R, & Pires AP., *La recherche qualitative: enjeux épistémolo- giques et méthodologiques*, Montréal : Gaëtan Morin, 309–340, 405p.

Goodwin, K., 2009. *Designing for the Digital Age: How to Create Human-Centered Products and Services*. Wiley, Indianapolis, IN.

Górriz-Mifsud, E., Olza Donazar, L., Montero Eseverri, E., Marini Govigli, V., 2019. The challenges of coordinating forest owners for joint management. *For. Policy Econ.* 99, 100–109. <https://doi.org/10.1016/j.forpol.2017.11.005>.

Harrison, S., Herbohn, J., Niskanen, A., 2002. Non-industrial, smallholder, small-scale and family forestry: What's in a name? *Small-scale For. Econ. Manag. Policy* 1, 1–11.

Hogl, K., Pregernig, M., Weiss, G., 2005. What is new about new forest owners? A typology of private forest ownership in Austria. *Small Scale For. Econ. Manag. Policy* 4 (3), 325–342.

Holden, R.J., Kulanthaivel, A., Purkayastha, S., Goggins, K.M., Kripalani, S., 2017. Know thy eHealth user: Development of biopsychosocial personas from a study of older adults with heart failure. *Int. J. Med. Inf.* 108, 158–167. <https://doi.org/10.1016/j.ijmedinf.2017.10.006>.

Hugosson, M., Ingermarson, F., 2004. Objectives and motivations of small-scale forest owners; modelling and qualitative assessment. *Silva. Fenn.* 38 (2), 231–271.

Hugrel, C., Thomazeau, R., 2000. *Diagnostic environnemental par les usages. Sciences appliquées de l'INSA de Lyon, Environnement*. Lausanne - Lyon: Presses polytechniques et universitaires romandes (PPUR).

Hujala, T., Pykäläinen, J., Tikkanen, J., 2007. Decision making among Finnish non-industrial private forest owners: the role of professional opinion and desire to learn. *Scand. J. For. Res.* 22, 454–463.

Hujala, T., Tikkanen, J., 2008. Boosters of and barriers to smooth communication in fa- mily forest owners' decision making. *Scand. J. For. Res.* 23 (5), 466–477. <http://dx.doi.org/10.1080/02827580802334209>.

Hujala, T., Kurttila, M., Karppinen, H., 2013. Customer segments among family forest owners: combining ownership objectives and decision-making styles. *Small Scale For.* 12 (3), 335–351.

IGN, 2013, résultats d'inventaire forestiers : département des Vosges (France), campagne 2009-2013.

IGN, 2018, Institut Géographique National, mémento 2018 France.

Jung, S.-G., An, J., Kwak, H., Ahmad, M., Nielsen, L., Jansen, B.J., 2017. Persona Generation from Aggregated Social Media Data, in: *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '17*. Presented at the 2017 CHI Conference Extended Abstracts, ACM Press, Denver, Colorado, USA, pp. 1748–1755. <https://doi.org/10.1145/3027063.3053120>.

Juutinen, A., Tolvanen, A., Koskela, T., 2020. Forest owners' future intentions for forest management. *For. Policy Econ.* 118, 102220. <https://doi.org/10.1016/j.forpol.2020.102220>

Klenk, N.L., Wyatt, S., 2015. The design and management of multi-stakeholder research networks to maximize knowledge mobilization and innovation opportunities in the forest sector. *For. Policy Econ.* 10.

- Kumer, P., Štrumbelj, E., 2017. Clustering-based typology and analysis of private small-scale forest owners in Slovenia. *For. Policy Econ.* 80, 116–124. <https://doi.org/10.1016/j.forpol.2017.03.014>.
- Kuuluvainen, J., Karppinen, H., Ovaskainen, V., 1996. Landowner objectives and non-industrial private timber supply. *For. Sci.* 42 (3), 300–309.
- Kuuluvainen, J., Karppinen, H., Hänninen, H., Uusivuori, J., 2014. Effects of gender and length of land tenure on timber supply in Finland. *J. For. Econ.* 20 (4), 363–379.
- Lallemand, C., Gronier, G., Robillard-Bastien, A., 2016. Méthodes de design UX: 30 méthodes fondamentales pour concevoir et évaluer les systèmes interactifs.
- Lawrence, A., 2018. Do interventions to mobilize wood lead to wood mobilization? A critical review of the links between policy aims and private forest owners' behaviour. *For. Int. J. For. Res.* 91, 401–418. <https://doi.org/10.1093/forestry/cpy017>.
- Learned, E. P., Christensen, C. R., Andrews, K. R., Guth, W. D., 1969. *Business Policy: Text and Case* (rev. ed.), Homewood, IL: Richard D. Irwin.
- Lee, S., Olson, D., Trim, S., 2012. Co-Innovation Convergences, Collaboration and Co-Creation for Organizational Value. *Management Decision*, 50(5): 817–831. <https://doi.org/10.1108/00251741211227528>.
- Levers, C., Verkerk, P.J., Müller, D., Verburg, P.H., Butsic, V., Leitão, P.J., Lindner, M., Kuemmerle, T., 2014. Drivers of forest harvesting intensity patterns in Europe. *For. Ecol. Manag.* 315, 160–172. <https://doi.org/10.1016/j.foreco.2013.12.030>.
- Lewis, C., 1982. Using the "thinking-aloud" method in cognitive interface design. Yorktown Heights, N.Y., IBM T.J. Watson Research Center.
- Lidestav, G., 2010. In competition with a brother: Women's inheritance positions in contemporary Swedish family forestry. *Scand. J. For. Res.* 25 (Suppl. 9), 14–24.
- Lidestav, G., Berg Lejon, B., 2013. Harvesting and silvicultural activities in Swedish family forestry – behavior changes from a gender perspective, *Scandinavian Journal of Forest Research*, 28:2, 136-142, DOI: 10.1080/02827581.2012.701324.
- Lindgaard Christensen, J., Dahl, M., Eliassen, S., Nielsen, R., Richter Østergaard, C., 2011. Patterns and Collaborators of Innovation in the Primary Sector: A Study of the Danish Agriculture, Forestry and Fishery Industry. *Ind. Innov.* 18, 203–225. <https://doi.org/10.1080/13662716.2011.541105>.
- Long, F., 2009. Real or Imaginary: The effectiveness of using personas in product design. In *Proceedings of the Irish Ergonomics Society Annual Conference*, 1-10.
- Maline, J., Preto, P., Midler, C., 1994. *Simuler le travail : une aide à la conduite de projet*. ANACT. Outils et méthodes. Montrouge Hauts-de-Seine, France.
- Marques, M., Juerges, N., Borges, J.G., 2020. Appraisal framework for actor interest and power analysis in forest management - Insights from Northern Portugal. *For. Policy Econ.* 111, 102049. <https://doi.org/10.1016/j.forpol.2019.102049>.
- Marshall, R., Cook, S., Mitchell, V., Summerskill, S., Haines, V., Maguire, M., Sims, R., Gyi, D., Case, K., 2015. Design and evaluation: end users, user datasets and personas. *Appl. Ergon.* 46, 311–317.
- Matthews, T., Whittaker, S., Moran, T., Yuen, S., 2011. Collaboration personas: a new approach to designing workplace collaboration tools. In *Proceedings of the 2011 annual conference on Human factors in computing systems*, 2247-2256. New York: ACM. doi:10.1145/1978942.1979272.

Mayhew, D. J., 1999. The usability engineering lifecycle : a practitioner's handbook for user interface design. In CHI'99 Extended Abstracts on Human Factors in Computing Systems (p. 147-148). ACM.

Miaskiewicz, T., Sumner, T., Kozar, K.A., 2008. A Latent Semantic Analysis methodology for the identification and creation of personas. In Proceedings of CHI 2008, 1501-1510. New York: ACM.

Miaskiewicz, T., Kozar, K.A., 2011. Personas and user-centered design: How can personas benefit product design processes? *Des. Stud.* 32, 417–430. <https://doi.org/10.1016/j.destud.2011.03.003>.

Miller, J., 2005, The user experience [internet], *Internet Computing*, IEEE, vol. 9, no. 5, pp. 90 – 92.

Ministère de l'agriculture de l'agroalimentaire et de la forêt, 2016. Programme National de la Forêt et du Bois 2016-2026.

Moggridge, B., 2007. *Designing interactions*. Cambridge, Mass.: MIT Press.

Moine, A., 2006. Le territoire comme un système complexe : un concept opératoire pour l'aménagement et la géographie. *L'Espace géographique*, vol. 35, no 2, p. 115-132.

Muller, M.J., Kuhn. S., 1993. Participatory design. *Communications of the ACM* 36 (6): 24-28.

Nabuurs, G.J., Masera, O., Andrasko, K., Benitez-Ponce, P., Boer, R., Dutschke, M., Elsiddig, E., Ford-Robertson, J., Frumhoff, P., Karjalainen, T., Krankina, O., Kurz, W.A., Matsumoto, M., Oyhantcabal, W., Ravindranath, N.H., Sanz Sanchez, M.J., Zhang, X., 2007. Forestry. In *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Nabuurs, G.-J., Lindner, M., Verkerk, P.J., Gunia, K., Deda, P., Michalak, R., Grassi, G., 2013. First signs of carbon sink saturation in European forest biomass. *Nat. Clim. Change* 3, 792–796. <https://doi.org/10.1038/nclimate1853>.

Naghedi, R., Alavi Moghaddam, M.R., Piadeh, F., 2020. Creating functional group alternatives in integrated industrial wastewater recycling system: A case study of Toos Industrial Park (Iran). *J. Clean. Prod.* 257, 120464. <https://doi.org/10.1016/j.jclepro.2020.120464>

Nakashima, D.J., 1990. *Application of native knowledge in EIA: Inuit, eiders, and Hudson Bay oil*, Ottawa: Canadian Environmental Assessment Research Council

Nichiforel, L., Schanz, H., 2011. Property rights distribution and entrepreneurial rent seeking in Romanian forestry: a perspective of private forest owners. *Eur. J. For. Res.* 130, 369–381.

Nielsen, J., 1994. Enhancing the explanatory power of usability heuristics. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems* (p. 152-158). ACM.

Nielsen, L., 2002. From user to character: an investigation into user-descriptions in scenarios. In *Proceedings of the 4th Conference on Designing interactive Systems: Processes, Practices, Methods, and Techniques*, London, England, 99- 44. New York: ACM.

Nielsen, L., 2004. Personas – communication or process? In *Proceedings of the Seventh Danish HCI Research Symposium*, 25-26.

Norman, D., 2002. *The design of everyday things*. New York: Basic Books.

Norman, D.A., 2004. *Emotional Design Why We Love (or Hate) Everyday Things*. New York: Basic Books.

- Novais, A., Canadas, M.J., 2010. Understanding the management logic of private forest owners: A new approach. *For. Policy Econ.* 12, 173–180.
- Nyström, A.G., Leminen, S., Westerlund, M., Kortelainen, M., 2014. Actor roles and role patterns influencing innovation in living labs. *Ind. Market. Manag.* 43 (3), 483e495.
- Orazio, C., Kies, U., Edwards, D., Montoya, R.C., Nataša Lovrić, Hayes, S., Green, T., Schreiber, R., Koch, M., Dhubain, A.N., Kerr, G., Mart-Jan Schelhaas, Gert-Jan Nabuurs, Lawrence, A., Tidey, P., Olivar, J., Sabin, P., Kitching, A., 2017. Handbook for wood mobilisation in Europe. Measures for increasing wood supply from sustainably managed forests. <https://doi.org/10.13140/rg.2.2.30261.78568>.
- Petucco, C., Abildtrup, J., Stenger, A., 2015. Influences of nonindustrial private forest landowners' management priorities on the timber harvest decision—A case study in France. *J. For. Econ.* 21, 152–166. <https://doi.org/10.1016/j.jfe.2015.07.001>.
- Pezdevšek Malovrh, Š., Nonić, D., Glavonjić, P., Nedeljković, J., Avdibegović, M., Krč, J., 2015. Private forest owner typologies in Slovenia and Serbia: targeting private forest owner groups for policy implementation. *Small Scale For.* 14, 423–440.
- Pezdevšek Malovrh, Š., Kumer, P., Glavonjić, P., Nonić, D., Kisin, B., Avdibegović, M., 2017. Different Organizational Models of Private Forest Owners as a Possibility to Increase Wood Mobilization in Slovenia and Serbia. *Croat J Eng* 15.
- Peyron, J.-L., 2016. Bioéconomie et innovations dans la filière forêt-bois. *Rev. For. Fr.* <https://doi.org/10.4267/2042/61858>.
- Pickton, D.W., Wright, S., 1998. What's SWOT in strategic analysis? *Strateg. Chang.* 7, 101–109.
- Pruitt, J., Grudin, J., 2003. Personas: practice and theory. In: *Proceedings of the 2003 Conference on Designing for User Experiences*. ACM, San Francisco, California.
- Pruitt, J., Adlin, T., 2006. *The Persona Lifecycle: Keeping People in Mind Throughout Product Design*. Morgan Kaufmann.
- Quiceno, G., Álvarez, C., Ávila, R., Fernández, Ó., Franco, C.J., Kunc, M., Dyner, I., 2019. Scenario analysis for strategy design: A case study of the Colombian electricity industry. *Energy Strategy Rev.* 23, 57–68. <https://doi.org/10.1016/j.esr.2018.12.009>
- Rauch, P., Gronalt, M., 2005. Evaluating organizational designs in the forestry wood supply chain to support forest owners' cooperations. *Small-scale Forest Economics, Management and Policy* 4(1): 53–68.
- Rauch, P., 2007. SWOT analyses and SWOT strategy formulation for forest owner cooperations in Austria. *Eur. J. For. Res.* 126, 413–420.
- Rauch, P., Wolfsmayr, U.J., Borz, S.A., Oberwimmer, R., Ketikidis, C., Vasiljevic, A., Stauder, M., Mühlberg, C., Derczeni, R., Oravec, M., Krissakova, I., Handlos, M., 2015. SWOT analysis and strategy development for forest fuel supply chains in South East Europe. *For. Policy Econ.* 8.
- Reed, M.S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C.H., Stringer, L.C., 2009. Who's in and why? A typology of stakeholder analysis methods for natural resource management. *J. Environ. Manage.* 90, 1933–1949. <https://doi.org/10.1016/j.jenvman.2009.01.001>.

- Rind, B., 2007. The power of persona. *The pragmatic marketer*, 5(4), 18-22.
- Savoie-Zajc, L., 1997. L'entrevue semi-dirigée, in B. Gauthier (éd.), *Recherche sociale: de la problématique à la collecte des données* (3e éd., pp. 263-285). Sainte-Foy : Presses de l'Université du Québec.
- Schmithüsen, F., Hirsch, F., 2010. Private Forest Ownership in Europe. Geneva Timber and Forest Study Paper 25. UNECE/FAO, Geneva.
- Schnurr, B., 2017. How My Product Works and How it Looks: Effects of Functional and Aesthetic Co-Creation and the Role of Product Expertise. *Creativity & Innovation Management*, 26(2):152–159. <https://doi.org/10.1111/caim.12212>.
- Schuurman, D., 2015. Bridging the Gap between Open and User Innovation? Exploring the Value of Living Labs as a Means to Structure User Contribution and Manage Distributed Innovation, *Communication Sciences*, Ghent University. Available at: <https://biblio.ugent.be/publication/5931264/file/5931265.pdf>.
- Selter, A., Hartebrodt, C., Brandl, H., Herbohn, J., 2009. A Critical Comparison of Typologies of Small-Scale Forestry in Baden-Württemberg Derived Using Single and Multiple Criteria. *Small Scale For.* 8, 25–42.
- Serbruyns, I., Luysaert, S., 2006. Acceptance of sticks, carrots and sermons as policy instruments for directing private forest management. *For. Policy. Econ.* 9, 285–296.
- Stanislovaitis, A., Brukas, V., Kavaliauskas, M., Mozgeris, G., 2015. Forest owner is more than her goal: a qualitative typology of Lithuanian owners. *Scand. J. For. Res.* 30, 478–491.
- Stern, T., Weiss, G., Bostrom, C., Huber, W., Koch, S., Schwarzbauer, P., 2013. Identifying measures for wood mobilisation from fragmented forest ownerships based on case studies from eight European Regions. *Jahrbuch der Österreichisch- en Gesellschaft für Agrarökonomie* 22(1): 19–28.
- Stern, T., Ranacher, L., Mair, C., Berghäll, S., Lähtinen, K., Forsblom, M., Toppinen, A., 2018. Perceptions on the Importance of Forest Sector Innovations: Biofuels, Biomaterials, or Niche Products? *Forests* 9, 255. <https://doi.org/10.3390/f9050255>.
- Stevenson, P.D., Mattson, C. A., 2019. The personification of big data. *Proceedings of the Design Society: International Conference on Engineering Design*, 1(1), 4019–4028. <https://doi.org/10.1017/dsi.2019.409>.
- Stoettner, E.M., Ní Dhubháin, Á., 2019. The social networks of Irish private forest owners: An exploratory study. *For. Policy Econ.* 99, 68–76. <https://doi.org/10.1016/j.forpol.2017.09.008>.
- Suri, J.F., 2001. The next 50 years: Future challenges and opportunities for empathy in our science. *Ergonomics*, 44(14), 1278-1289. doi: 10.1080/00140130110105850.
- Terrade, F., Pasquier, H., Reerinck-Boulanger, J., Guingouain, G., Somat, A., 2009. L'acceptabilité sociale : la prise en compte des déterminants sociaux dans l'analyse de l'acceptabilité des systèmes technologiques. Dans : *Le travail humain* 72(4), p. 383.
- Terrados, J., Almonacid, G., Hontoria, L., 2007. Regional energy planning through SWOT analysis and strategic planning tools: impact on 978-1-7281-3401-7/18/\$31.00 2020 IEEE renewables development”, *Renew. Sust. Energ. Rev.* 11, 1275–1287.
- Thiger, E., Woxblom, L., Roos, A., 2017. Empathic design for wood product innovation based on genuine customer needs – A test application on Swedish builders, *Wood Material Science & Engineering*, 12:3, 118-128, DOI: 10.1080/17480272.2015.1056226.

- Toivonen, M., Kowalkowski, C., 2019. Foundations of service research and service- dominant logic. In: Hujala, T., Toppinen, A., Butler, B. (Eds.), *Services in Family Forestry*. World Forests. vol 24 Springer, Berlin.
- Troncoso, K., Castillo, A., Masera, O., Merino, L., 2007. Social perceptions about a technological innovation for fuelwood cooking: Case study in rural Mexico. *Energy Policy* 35, 2799–2810. <https://doi.org/10.1016/j.enpol.2006.12.011>.
- United Nations Economic Commission for Europe (UNECE), the Food and Agriculture Organization of the United Nations (FAO), 2020. *Who owns our forests? Forest ownership in the ECE region*. United Nations.
- Urquhart, J., Courtney, P., 2011. Seeing the owner behind the trees: a typology of small- scale private woodland owners in England. *For. Policy Econ.* 13, 535–544.
- Van Herzele, A., Van Gossum, P., 2008. Typology building for owner-specific policies and communications to advance forest conversion in small pine plantations. *Landsc. Urban Plan.* 87, 201–209.
- Vincent, C.J., Blandford, A., 2014. The challenges of delivering validated personas for medical equipment design. *Appl. Ergon.* 45, 1097–1105. <https://doi.org/10.1016/j.apergo.2014.01.010>.
- Von Hippel, E., 1986. Lead users: a source of novel product concepts. *Management science* 32 (7): 791-805.
- Von Hippel, E., 2001. Perspective: User toolkits for innovation. *Journal of Product Innovation Management*, 18(4), 247–257. Doi : 10.1111/1540-5885.1840247.
- Von Hippel, E., Oliveira, P., 2011. Users as Service Innovators: The Case of Banking Services. *Research Policy*, 40(6): 806–818. <https://doi.org/10.1016/j.respol.2011.03.009>.
- Von Willert, M., Krott, M., 2019. IT-based mobilization of milieu-bound forest owners: Bi-production of innovative tools by research and practice. *For. Policy Econ.* 104, 139–145. <https://doi.org/10.1016/j.forpol.2019.04.011>.
- Wang, J., Aenis, T., 2019. Stakeholder analysis in support of sustainable land management: Experiences from southwest China. *J. Environ. Manage.* 243, 1–11. <https://doi.org/10.1016/j.jenvman.2019.05.007>.
- Weiss, G., Gudurić, I., Wolfslehner, B., 2012. *Review of Forest Owners' Organizations in Selected Eastern European Countries (No. 30)*, Forestry Policy and Institutions Working Papers. Rome.
- Weiss, G., Lawrence, A., Hujala, T., Lidestav, G., Nichiforel, L., Nybakk, E., Quiroga, S., Sarvašová, Z., Suarez, C., Živojinović, I., 2019. Forest ownership changes in Europe: State of knowledge and conceptual foundations. *For. Policy Econ.* 99, 9–20. <https://doi.org/10.1016/j.forpol.2018.03.003>.
- Weiss, G., Ludvig, A., Živojinović, I., 2020a. Four decades of innovation research in forestry and the forest-based industries – A systematic literature review. *For. Policy Econ.* 120, 102288. <https://doi.org/10.1016/j.forpol.2020.102288>
- Weiss, G., Emery, M.R., Corradini, G., Zivojinović, I., 2020b. New values of non-wood Forest products. *Forests* 11 (2), 165.
- Wilnhammer, M., Rothe, A., Weis, W., Wittkopf, S., 2012. Estimating forest biomass supply from private forest owners: A case study from Southern Germany. *Biomass Bioenergy* 47, 177–187. <https://doi.org/10.1016/j.biombioe.2012.09.044>.

Wippel, B., Becker, G., 2008. Holzmobilisierung im Kleinprivatwald Ergebnisse der Pilotprojekte in Eifel und Lausitz – Abschlußbericht, Wood mobilization in small private forests: results of the pilot projects in Eifel and Lausitz, Final report].

Živojinović, I., Weiss, G., Lidestav, G., Feliciano, D., Hujala, T., Dobšinska, Z., Lawrence, A., Nybakk, E., Quiroga, S., Schraml, U., 2015. Forest land ownership change in Europe. In: COST Action FP1201 FACESMAP Country Reports, Joint Volume. EFICEEC-EFISEE Research Report Vienna (BOKU). University of Natural Resources and Life Sciences, Vienna, Austria (693 pp.).