



Studies of Family Forest Owners in the USA: A Systematic Review of Literature from 2000 through 2019

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Abstract

In the USA, there are an estimated 9.6 million families, individuals, trusts, estates, and family partnerships, collectively referred to as family forest owners, who control 110 million ha of forestland or 39% of the country's forests. Between 2000 and 2019, 640 peer-reviewed articles were published that focused on family forest owners in the USA. These articles were published across 95 sources with the Journal of Forestry, Forest Policy and Economics, Small-scale Forestry, and Journal of Extension being the most common. Most articles focused on geographic or participatory subsets of family forest owners with many doing cross-subset comparisons, such as between program participants and non-participants. Quantitative methods, and in particular surveys, were the most common data collection techniques, but qualitative, simulation, and synthesis approaches were also applied. Theoretical frameworks were scant across most studies with behavioral change models being the most common frameworks among those studies that did explicitly include one. Forest management and policies and programs were the most common topics, but the relative frequency of topics changed over time with topics such as forest management decreasing and legacy increasing. Much has been learned about family forest owners, but there is still much that is unknown. Harmonization across studies could help to increase comparisons and allow for drawing of broader conclusions. Continuing to borrow ideas from other fields and stronger incorporation of theoretical frameworks could also help further this scientific field, but it is also important that attention is paid to the implications of the research to ensure it has the greatest possible impact on the threats and challenges facing family forests.

Keywords Nonindustrial private forest owners · Private forest owners · Literature review · United States (USA)

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Introduction

An estimated 110 million ha of forestland in the United States of America (USA), excluding interior Alaska, are owned by an estimated 9.6 million families, individuals, trusts, estates, and family partnerships (Butler et al. 2021). These family forests, as they are collectively known, control 39% of the forestland in the USA, an area greater than any other forest ownership category in the country. As the fate of America's forests lies largely in the hands of these millions of ownerships, they have been the focus of hundreds of research studies investigating their management behaviors and characteristics going back to at least the 1940s (Barracough and Rettie 1950). This article summarizes the literature related to family forest ownerships in the USA published from 2000 through 2019 to better understand what is currently known about family forests in the USA and explore potential future research directions. This is not the first article to summarize this literature, but it is the first that we are aware of that does so using a formal, systematic approach and is unique in its scope and timespan.

Family forests, or similar types of ownerships, control a substantial proportion of the forest resources across many countries (FAO 2015: Table 45). In the USA, terms such as nonindustrial private forest owners and private forest owners have been used as synonyms for family forest ownerships or as broader ownership categories of which family forest ownerships are a subset. Many parts of Europe use these same terms, but other parts of the globe commonly use terms such as smallholders and the concept often includes practices such as joint forest management and community forestry (Harrison et al. 2002). Collectively these groups can be thought of as “small-scale forestry,” although in the USA these ownerships range in size from less than a hectare to many thousands of hectares.

A series of publications by Hodgdon et al. (2007, 2011) provided annotated bibliographies of family forest ownership literature in the USA. They found that many of the studies were at the state-level and used varying techniques to collect and analyze data limiting their ability to make comparisons. Some common themes they found across the literature were that size of family forest ownership holdings was decreasing, age of owners was increasing, ownership objectives were diverse with amenity values generally dominating, most owners did not have management plans nor had they sought management advice, and harvesting was positively associated with size of holdings.

Straka (2011) provided a synthesis of literature related to the “Family Forest Problem” in the USA—i.e., the “perennial” topic related to the “under production” of timber emanating from family forests. They provide a taxonomy of this corpus which categorized research objectives into: ownership characteristics; ownership practices; methodological; increasing forest management; economic analyses; and product marketing. Their summary concluded that size of holdings was a key limiting factor to timber production, there was a disconnect between owners' actions and intentions, incentives were an effective way to motivate owners, and timber production was not the primary ownership objective. Suggestions

from the author for future research directions were related to owner motivations, parcellation, and the impacts of incentives and regulations.

Comparing the research literature on family forest ownerships in the USA and Sweden, Fischer et al. (2010) found many consistencies in topics and approaches between the two countries. Research in both countries initially focused on timber supply questions, but both evolved to include broader topics, such as landowner attitudes, and neither fully embraced grounding studies in theories from the social sciences. A key conclusion was the potential for multidisciplinary approaches to advance the field.

Other studies have synthesized literature looking at more focused topics related to family forest owners. Beach et al. (2005) and Silver et al. (2015) provided syntheses of literature specifically examining family forest ownership management practices. Common predictors of management practices included size of holdings, stumpage price, and absentee ownership. Silver et al. (2015) noted that most studies failed to measure actual behaviors. A review of literature related to size of forest holdings (Hatcher Jr. et al. 2013) showed this to be a long standing, but still pertinent, issue with implications for management planning, resource utilization, and other topics. Using a vote-count approach to examine the factors associated with family forest ownership behavior, Floress et al. (2019) found that of the 38 articles analyzed that used statistical models, most focused on participation in landowner incentive programs. Ownership objectives, landowner actions, knowledge, and size of forest holdings were among the most common variables used in the models that Floress et al. summarized.

In their paper synthesizing studies on the decision making of family forest owners, Amacher et al. (2003) asked “Is there anything left to study?” Based on the authors’ conclusions and simply on the number of articles that continue to be published on this topic, the research community appears to emphatically believe there is indeed much to still be learned. We hope this article provides a summary of the current state of family forest owner research in the USA and contributes to a direction for future research.

Methods

A systematic literature review was conducted for research published on family forest owners in the USA. This approach used a protocol outlined by Jesson et al. (2011) which required clearly defining the scope, data sources, article inclusion criteria, and techniques for synthesizing information. The specific questions being addressed are: what is currently known about family forests in the USA and what are potential future research directions?

Scope

The scope of this literature synthesis was peer-reviewed research published between 2000 and 2019, inclusive, focusing on the attitudes, behaviors, or other characteristics of family forest owners in the USA.

Data Sources

The literature was identified using a database maintained by the Family Forest Research Center, Scopus, ProQuest, Google Scholar, and snowball sampling. The Family Forest Research Center, a joint venture between the USDA Forest Service and the University of Massachusetts Amherst, maintains a literature database (www.zotero.org/groups/526589/ffo_lit_db) that was initiated by the lead author of this article over two decades ago with a focus on peer-reviewed literature on the attitudes and behaviors of family forest owners. While many of the references in this database fell outside the inclusion criteria for this project, it provided initial seeds for the other searches and helped ensure key articles were not missed. Scopus (www.scopus.com) and ProQuest (www.proquest.com) are commercial citation databases that contain metadata from most peer-reviewed journals. Google Scholar (<https://scholar.google.com>) provides citations from many of these same journals, but also includes other reference sources. The literature cited in all of the articles that met the inclusion criteria were reviewed to capture missing materials (i.e., snowball sampled), as were the literature citations in the additional articles. The citations and electronic copies of all articles were stored in a project folder in a Zotero citation database (www.zotero.org).

Inclusion Criteria

For articles to have been included in the final data set, they needed to substantively focus on family forest owners in the USA, have final versions (as opposed to pre-prints, online first, or other versions) published between 2000 and 2019, and be published in a peer-reviewed outlet. To identify the articles in the citation databases, “family forest*”, “family forest own*”, “nonindustrial private forest own*”, “NIPF”, and “private forest own*” were used as search terms, where the asterisks indicate wildcards that returned any form of the root phrases with different endings. The focus of the articles had to center on human dimensions (e.g., attitudes and behaviors); articles focusing on biophysical attributes were excluded. The aim of the article had to be to contribute new knowledge directly related to family forest owners, it was not sufficient that the results had implications for family forest owners. Unless they were analyzed in conjunction with family forest owners, papers examining community forestry, industrial forest owners, Tribal/indigenous forest owners, or public forest owners were excluded. The geographic scope had to cover all or part of one or more USA states. Articles comparing family forest owners in the USA to family forest owners in other countries were retained. When geographic scope was uncertain (e.g., an article was theoretical in nature), geographic scope was determined based on the institution of the lead author. The sources had to be a peer-reviewed journal or a USDA Forest Service scientific report (e.g., a peer-reviewed general technical report). Excluded were materials that were largely commentaries or opinion pieces, theses, dissertations, reports (other than USDA Forest Service reports), law reviews, and non-peer reviewed gray literature. All of the candidate

materials were screened against these criteria based on their titles, abstracts, keywords, and metadata.

Synthesis Techniques

Based on titles, keywords, and abstracts, articles were coded in terms of sub-populations and geographies of interest, methods, and topics. Topics were identified using an open coding approach (Strauss and Corbin 1998). Coding was done using the NVivo software package (QSR International 2019). A codebook was drafted prior to coding and then modified after an initial read through of the articles (see Table 1 and Supplemental Materials: Appendix 1).

Data were analyzed using a combination of qualitative and quantitative approaches. Numbers of articles were tabulated in terms of year published, outlets, populations, geographies, methods, and topics. To further visualize the topics, a word cloud based on the 150 most common words in the titles and keywords, excluding common words such as ‘a,’ ‘the,’ and ‘and’ and search terms such as ‘family’ and ‘forest’, was generated with the size of the words proportional to frequency using the R wordcloud package (Fellows 2018). The trend in articles published per year was modeled using a local polynomial regression (LOESS). The relationships between number of articles and family forest ownerships and family forest acreage per state were quantified using Spearman rank correlation coefficients (ρ_s). All data analyses were conducted using the R statistical programming environment (R Core Team 2019).

Results and Discussion

There were 640 scientific, family forest owner articles published between 2000 and 2019 that were analyzed in this paper. There was a steady increase in the annual number of articles published between 2000 and 2013, when the number of articles peaked at 44, followed by an average of 35 publications per year (Fig. 1).

Table 1 Categories of codes used to describe scientific articles focused on family forest owners in the USA

Code category	Description
Attitudes	Owner or expert attitudes and perceptions
Behaviors	Reported behavior measures
Data	Data source used
Geography	Geographic area of focus
Methods	Analytical methods used
Population	Specific population of interest
Research	Potential new research directions discussed
Solutions	Proposed actions to rectify perceived problems
Topics	Thematic focus

For detailed codes see Supplemental Materials: Appendix 1

The initial growth in number of publications may reflect increased interest in the topic, increased funding for this type of research, or a combination thereof, and the eventual decrease or leveling off may reflect a maturation of the research field.

The full list of materials used in this article is available in the Supplemental Materials: Appendix 2 and are available, along with family forest owner literature not meeting the specific inclusion criteria (e.g., published outside of 2000–2019 or not focused on the USA), in the publicly available citation database maintained by the Family Forest Research Center (2021).

Journals

The articles appeared in 94 journals plus the USDA Forest Service reports. The most common outlet was the *Journal of Forestry* ($n=92$) (Fig. 2) representing 15% of the articles. Other common outlets, with 5% or more of the articles, were *Forest Policy and Economics*, *Small-scale Forestry*, and *Journal of Extension*. Four of the top ten journals, *Journal of Forestry*, *Forest Science*, *Northern Journal of Applied Forestry*, and *Southern Journal of Applied Forestry*, were published by the Society of American Foresters.

The foci of the journals varied, including: broad forestry topics; human dimensions across all natural resources fields; policy; economics; and allied natural resource fields, such as recreation or wildlife management. Some of these outlets, and the subsequent articles, placed greater emphasis on applied findings, while others required greater emphases on statistical analyses or theoretical components.

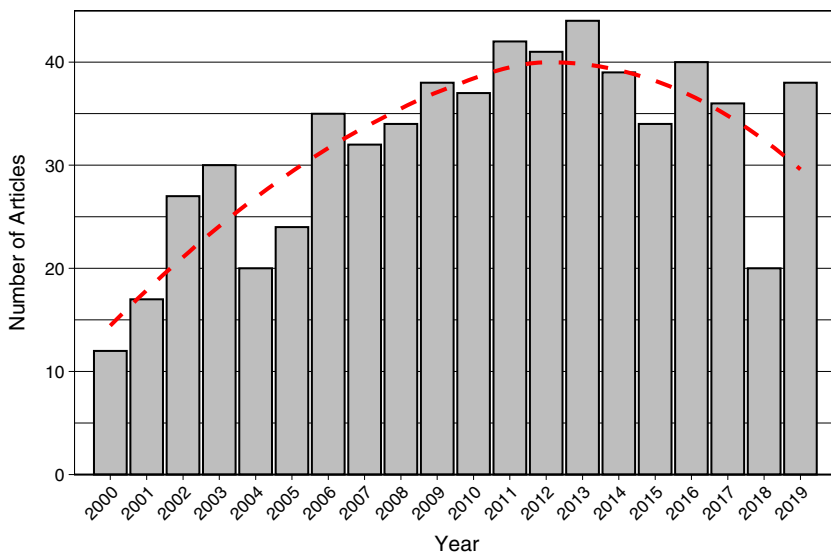


Fig. 1 Number of scientific articles focused on family forest owners in the USA by year, 2000–2019. The red, dashed line is a trendline fitted using local polynomial regression (LOESS)

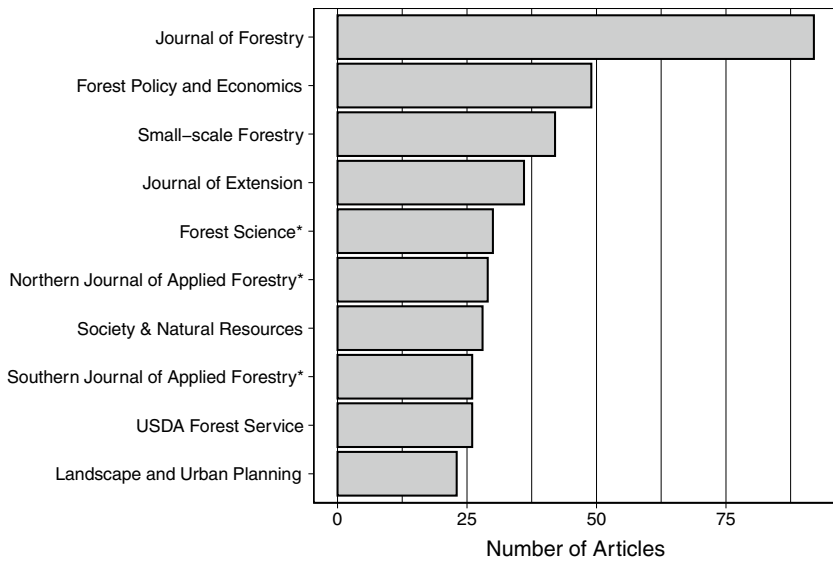


Fig. 2 Number of articles related to family forest owners in the USA published between 2000 and 2019 for the top ten journals/outlets based on number of articles. *The Northern, Southern, and Western Journals of Applied Forestry were merged with Forest Science in 2013

A number of journals began during the time period covered by this literature synthesis, such as *Small-scale Forestry* and *Forests*, and so the contributions from these sources will likely continue to grow. The *Northern*, *Southern*, and *Western Journals of Applied Forestry*, which were listed separately in this analysis, ceased being stand-alone publications during the focal time period and merged with *Forest Science* in 2013. The influence of special issues focused on family forestry was seen in specific journals, such as the special issue in *Landscape and Urban Planning* in 2019. Although there are now many publication outlets, the loss of the three *Journals of Applied Forestry*, and despite the merger of them with *Forest Science*, has negatively impacted the ability of researchers to distribute results of studies of a practical nature.

Sub-Populations of Interest

Although the terminology varied, the selection criteria ensured all articles addressed topics focused on the attitudes, behaviors, and other attributes of family forest owners of the USA. Family forest owners was the most common term used to describe this group, but the terms nonindustrial private forest owners (NIPF), small-scale forest owners, and sometimes simply private forest owners were also synonymously (or nearly synonymously) used. The use of these other terms has been decreasing, but in some disciplines, such as economics, some of the alternative phrases persist. These terms were similar to what was seen in the international literature (Harrison et al. 2002).

Most articles focused on subsets of family forest owners, such as participants in specific programs or geographies and many assessed similarities and differences between a population subset and the rest of the population (e.g., absentee landowners versus resident owners). Specific population subsets included absentee landowners (e.g., Petrzela et al. 2013), farmers (e.g., Huff et al. 2019), program participants (e.g., Potter-Witter 2005), group members (e.g., Starr and McConnell 2014), and heirs' property owners (e.g., Hitchner et al. 2017). Service providers examined included consulting foresters (e.g., Conrad et al. 2010), policy administrators (e.g., Ellefson et al. 2007), and loggers (e.g., Cushing et al. 2018).

Between 2000 and 2019 there were 102 national-level studies published, 143 regional (i.e., multi-state) studies, 354 studies focused within single states, and the other 41 studies were aspatial (e.g., simulation models or syntheses). The effort was not evenly distributed across the USA with Oregon (e.g., Fischer 2011), Mississippi (e.g., Chhetri et al. 2018), New York (e.g., Kelly et al. 2016), and Wisconsin (e.g., Rickenbach et al. 2006) having the highest number of state-specific studies (Fig. 3). This distribution is correlated with the number of family forest ownerships ($\rho_s = 0.69$) and area of family forestland ($\rho_s = 0.67$), using the ownership and acreage numbers reported in Butler et al. (2021), and is often associated with individual researchers and research groups.

Data Sources and Methods

The data sources and methods varied across studies. Quantitative methods were the primary methods used in over half (53%) of the studies, qualitative methods were the primary methods used in 13% of the studies, simulations, policy reviews, and research syntheses were the primary methods used in 27% of the studies, and the remaining 8% of the studies used a combination of methodological approaches.

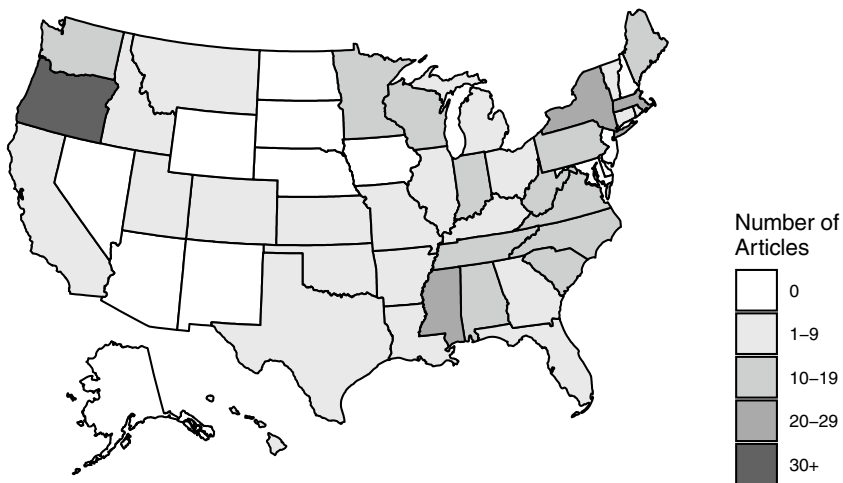


Fig. 3 Number of state- or sub-state-level ($n=354$) articles related to family forest owners in the USA published between 2000 and 2019

Qualitative data collection approaches included semi-structured interviews (e.g., Cacciapaglia et al. 2012), ethnographic techniques (e.g., Hitchner et al. 2017), and focus groups (e.g., Daniels et al. 2010). While not being able to estimate population-level attributes, qualitative approaches provide deeper insights into topics and in particular the reasoning behind specific actions or inactions than can be obtained from other methods. Qualitative data analysis commonly involves coding transcripts and other materials to identify emergent themes. A grounded theory approach was often ascribed to the coding methods, but researchers often failed to use the coding processes detailed by grounded theory methodologists (e.g., Charmaz 2014). A phenomenological approach has been used to garner important insight into how people conceive of specific topics, such as the word forest (Andrejczyk et al. 2016b) or the concept of forest management (Steiner-Davis and Fly 2004). More use of qualitative methods could be helpful for addressing some of the most vexing and complicated questions related to family forest owners.

Survey methods were the most common (78%) quantitative techniques used. Many survey-based studies used probability sampling that allowed for extrapolation of population-level attributes. While standard methodologies for designing and implementing surveys (e.g., Dillman et al. 2014) were often followed, the unique attributes of family forest owner populations influenced survey implementation and errors in observations. The dominant mode for implementation of family forest owner surveys was self-administered, mail-back questionnaires due in large part to property tax records, which typically only contain owners' names and addresses, being the primary data source for constructing sampling frames. Reported response rates for the surveys ranged from 0.06 to 0.65 (mean=0.35; median=0.34), but whether these were actually response or cooperation rates (as defined in AAPOR 2016) was often unclear. The studies with the highest response rates tended to be evaluations of programs (e.g., Allred et al. 2011) and there were also regional differences with response rates tending to be higher in the upper Midwest, in states such as Wisconsin, and lowest in the South, in states such as Mississippi (e.g., Butler et al. 2016b). Additional steps to increase response rates described in family forest owner studies included: use of appropriate language (Andrejczyk et al. 2016b), greater numbers of contacts (Clendenning et al. 2004), better visual design of survey and packaging materials (Clendenning et al. 2004), use of "priority" mailings (Clendenning et al. 2004), drop-off/pick-up techniques (Allred and Ross-Davis 2011), and use of token financial incentives (Butler et al. 2017a); all of which can be cost neutral when considering the fewer numbers of contacts needed to reach desired numbers of responses. In general, response biases appear to be low, but this is difficult to accurately assess. The area of greatest potential bias appears to be related to more active or engaged owners responding more often than others (e.g., Butler et al. 2016a), but more research is needed.

Most of the surveys asked relatively straight forward questions about owners' attitudes, behaviors, demographics, and other ownerships characteristics. Six percent of the articles used data directly from the from the USDA Forest Service, National Woodland Owner Survey (Butler et al. 2016b) and many more replicated questions from it. Additional efforts are needed to increase comparability among studies, such as more harmonization of questions, methods, analyses, and metadata

reporting. Over a dozen studies used more complex contingent valuation or related survey designs aimed at understanding respondents' willingness to participate in various programs or markets (e.g., Matta et al. 2007; Miller et al. 2012). While these studies were hypothetical, they provided important insights for policy and program design and implementation.

Spatial components were incorporated into 4% of the studies. Some created spatial products, like forest ownership maps (e.g., Butler et al. 2014), some added spatial data to other models (e.g., Vokoun et al. 2010; BenDor et al. 2014), and others examined spatial relationships (e.g., Satake et al. 2007; Poudyal et al. 2019). A few papers investigated spatiotemporal dynamics, largely in the context of parcellation and other parcel characteristics (e.g., Donnelly and Evans 2008; Ko and He 2011). While challenging, combining the richness of social (and biophysical) surveys with spatiotemporal components would allow for unprecedented insights akin to those found in long-term public health studies.

A handful of studies paired landowner data with field measured biophysical attributes of their forests (e.g., Munsell et al. 2009). These studies had limited observations due to costs and logistical barriers, but these data pairings provided critical information about on-the-ground conditions, how they related to owner attributes, owners and, typically, the programs in which the owners were involved.

Analyses of quantitative data spanned from simple descriptive statistics to complex, multivariate models. For some studies, such as the USDA Forest Service, National Woodland Owner Survey (Butler et al. 2016b), the primary outputs were tabular results in terms of ownerships and acreage. Other descriptive studies often provided summaries in terms of respondents, i.e., population-level estimates were not generated. Logistic regression was a common analysis method used to study, among other topics, program participation (Rasamoelina et al. 2010), intentions to sell carbon (Miller et al. 2012), and parcellation (L'Roe and Rissman 2017).

Thirty studies conducted segmentation analyses, either by themselves or as inputs into other models or processes. This was most often done by applying a clustering (e.g., k-means) analysis to a principal components analysis (PCA) based on ownership objective (e.g., Majumdar et al. 2008). These efforts typically yielded 3–4 groups which were given descriptive names such as Thoreau, Muir, and Jane Doe (Finley and Kittredge 2006) or enthusiast, retreat, preservationist, and passive owners (Aguilar et al. 2013) to help convey and differentiate the overall characteristics of the groups. This approach was often put forth as part of a solution to low program enrollment and other challenges—the programs or communications about the programs needed to target specific segments. And while this approach certainly has many merits beyond treating family forest owners as homogenous groups, concerns have been raised about the veracity of the groupings and their linkages to actual behaviors (Ficko et al. 2019; Floress et al. 2019).

Financial analyses were the basis for some studies. For example, the relative tax burden under different scenarios were calculated (e.g., Cushing and Newman 2018). These analyses showed the substantial impacts taxes had, but calculations were largely theoretical and it was unclear what the actual impacts were on owners' behaviors.

Agent based models (ABMs) allow for investigations of behaviors, interactions, and cumulative impacts based on sets of roles, rules, and initial starting conditions. Researchers have modeled family forests owners' reactions to forest policies (Zupko and Rouleau 2019), biomass harvesting (Rouleau and Zupko 2019), and timber harvesting (Leahy et al. 2013; Huff et al. 2015; Henderson and Abt 2016). These models succeeded in showing emergent properties of the systems, but were, by inherent design, contingent upon the underlying data and rules. ABMs are still relatively rudimentary, and many are challenged by data constraints, but the current models are intriguing and there is a lot of growth potential.

To overcome inherent weaknesses in qualitative and quantitative methods, mixed methods approaches can be used to combine their respective strengths and address research questions more robustly (Bliss and Martin 1989). Indeed this is what Hodgdon et al. (2011) suggested was necessary for more fully understanding the values and motivations of family forest owners. Unfortunately, mixed methods studies are difficult to effectively conduct, require a diversity of skill sets, are often expensive, and take longer to implement. Through increased collaboration and direction from funders, these challenges can be overcome.

Theoretical Approaches

In general, the theoretical basis for explaining family forest owner behaviors, or other attributes, in the published literature was cursory or, more commonly, not explicitly stated. This is despite calls for increased incorporation of theoretical approaches and evidence for the efficacy of such approaches (e.g., Absher et al. 2009). Of the theories that were used, most came from psychology, economics, or marketing. The psychological theories tended to focus on behavior change related to norms and attitudes. The economic theories tended to focus on the factors influencing behaviors related to financial factors. The marketing theories tended to focus on increasing the efficacy of communications. But there was a lot of overlap among the theoretical frameworks.

Of the studies that explicitly incorporated theories, the Theory of Planned Behavior (Ajzen 1991), Theory of Diffusion (Rogers 2003), and the economic theory of utility maximization were the most common. Parkhurst et al. (2002) used Game Theory to model owners' decisions. There were also some newer theories that were being applied, such as Service-Dominant Logic (Berghäll 2018; Hujala et al. 2019) and the Transtheoretical Model (Quartuch et al. 2021), although the latter is outside the timeframe of this literature review.

Increasing knowledge of family forest owners about forest conservation options was a common topic for many policies and programs and some researchers have embraced the theories espoused by pedagogy (Radtko and Munsell 2010). Adults learn differently than children and this has implications for outreach and related forestry efforts. While most adults, and family forest owners, enjoy acquiring knowledge, most do not want to do so via traditional classroom or top-down approaches (Falk and Dierking 2010).

Topics

Topics covered were categorized into 11 broad categories (Fig. 5), all of which had multiple subcategories (see the codebook in Supplemental Materials: Appendix 1). Most articles were classified into more than one category or subcategory. The most common category was forest management followed closely by policies and programs and owner characteristics, while topics such as methods and legacy were addressed much less frequently. The prevalence of some topics was very consistent over time, such as programs and policies, and other topics showed considerable variation, such as legacy increasing substantially in the latter part of the study period (Fig. 6).

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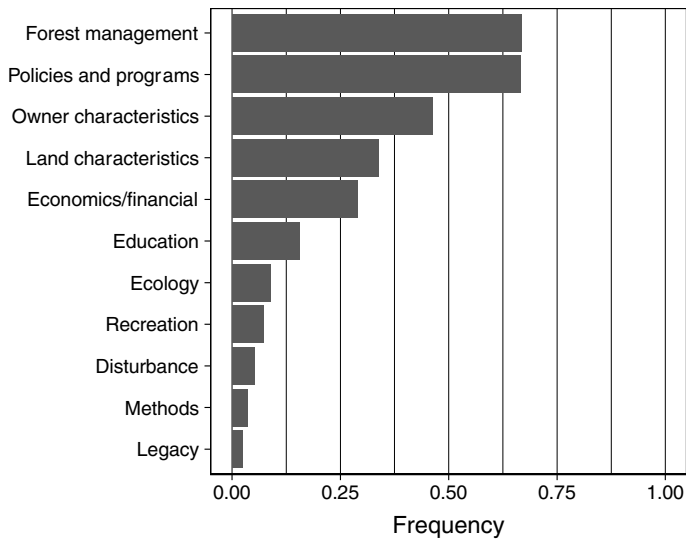


Fig. 5 Frequency of topics of articles related to family forest owners in the USA published between 2000 and 2019

Forest Management

The forest management category included articles focused on specific actions related to, among other topics, timber harvesting, bioenergy and biomass extraction, carbon sequestration, and wildlife habitat management. Most forest management articles combined the specific activity with aspects of owner and land characteristics, policies, economics, or a combination thereof.

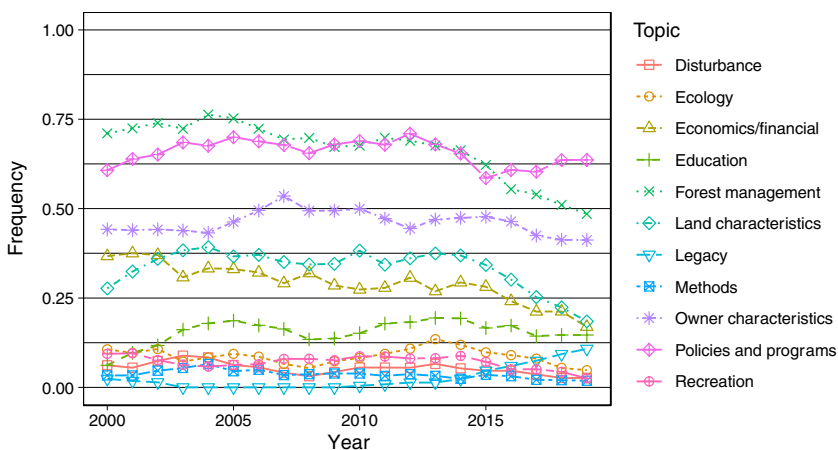


Fig. 6 Five-year moving averages of the frequencies of topics for articles related to family forest owners in the USA published between 2000 and 2019

Apart from wholesale land use conversion, timber harvesting is the human activity that has the largest direct impacts on forest structure and composition, it can generate substantial income for the owner, and is critical to the nation's timber supply. As such, it is logical that this activity has received the greatest attention and has been the focus of two review papers. As Beach et al. (2005) and Silver et al. (2015) found, the factors generally correlated with increasing timber harvesting included stumpage price, volume of growing stock, site quality, site accessibility, size of forest holdings, and years of education. Factors generally found to be negatively correlated with harvesting included absentee ownership, owners' income levels, owners' ages, and non-timber ownership objectives. Instead of looking just at whether a harvest has occurred or not, a few studies looked at harvesting intensity (e.g., Thompson et al. 2017). There were also noted challenges faced by loggers (Cushing et al. 2018) and an understanding that timber revenue may be insufficient to cover land holdings costs (D'Amato et al. 2010). It is a bit surprising that high-grading and other deleterious impacts have not been more widely studied, but this may have to do with the challenges in quantifying high-grading and pairing this with landowner attribute data. A lot is known about factors impacting harvesting decisions. There is general agreement among the studies with many specific differences attributable to geographies and variables tested. More studies that incorporate field observations is a next potential step in timber harvesting modeling.

A specific type of harvesting that received a lot of attention, especially from 2010 to 2015, was biomass harvesting (e.g., Gruchy et al. 2012; Markowski-Lindsay et al. 2012; Aguilar et al. 2013). Biomass is typically defined as low-grade wood that can be harvested for bioenergy purposes. Although its benefits are debated, it is considered an important renewable energy source and an opportunity for owners to remove otherwise unmarketable trees. Low biomass prices necessitate harvesting it with higher value sawlogs or other materials (Buchholz et al. 2019). Many landowners open to general timber harvesting also appear to be open to biomass harvesting and appreciate the improved aesthetics (i.e., clearing of more downed material) that it can afford. Opportunities for commercial biomass harvesting is very location dependent due to hauling costs to processing facilities. Many landowners do not know where wood harvested from their land goes. And as such, most of the general timber harvesting literature should apply to this topic, and biomass supply will be a function of landowner and land characteristics (Butler et al. 2010; Brinckman and Munsell 2012).

Afforestation, the conversion of non-forest land to forestland, and reforestation, the reestablishment of trees following a timber harvest or other disturbance, is a topic relevant to a number of policies including protection of riparian habitats and carbon sequestration (discussed below). In terms of motivations for afforesting, Ross-Davis et al. (2005) found that legacy, wildlife, and conservation attitudes were the greatest drivers amongst landowners in Indiana. Other studies showed that incentives, including cost-sharing and free or reduced cost planting materials, had positive impacts on afforestation rates (Kline et al. 2002; Ruseva et al. 2015).

Agroforestry was another management practice that received some attention. While it is not as important for subsistence farming in the USA as it is in many developing countries, agroforestry practices that intersperse crops or grazing with

trees have potential ecological, economic, and cultural benefits. For example, pine straw, which is used for landscaping purposes, offers substantial financial rewards for landowners, competes well with sawtimber values, and provides for continual income flows. However, viable pine straw production is only available to owners meeting particular requirements, including the right forest types and land/harvesting conditions (Dyer et al. 2015), as is the case with many agroforestry practices. In general, it will be difficult for the financial returns from agroforestry, or forestry, to outcompete the returns from productive agricultural lands (Frey et al. 2010). Even if not financially lucrative, agroforestry and activities that involve the management for and/or collection of non-timber forest products can increase connections between owners and their forests.

Policies and Programs

Policies aimed at influencing family forest owner behaviors have taken the form of market-based solutions, tax incentives, regulations, assistance programs, and education programs. A common discussion point for many in the forest policy arena has been the “small-scale forestry problem” (Straka 2011). In general this means the perceived under-supply of timber from family forests and/or low management intensities often associated with smaller holding sizes (Hatcher Jr. et al. 2013). While family forest owners on average manage less intensively than many corporate owners, some manage quite intensively, and family forest owners’ aggregate behaviors make sense given their objectives and the constrained rationality that dictates their perceived options.

Forest certification is a market-based mechanism to support the sustainable supply of commercial timber. Family forest program participation was low, as of 2013 less than 5% of the family forest land was certified (Butler et al. 2016a). Program requirements and costs were major obstacles for many owners, as were concerns associated with loss of autonomy (Rickenbach 2002; Kilgore et al. 2007; Leahy et al. 2008). Factors found to be positively associated with certification included having received advice (Mercker and Hodges 2007; Creamer et al. 2012), having a management plan (Creamer et al. 2012), cost-share participation (Ma et al. 2012), plans to harvest sawlogs (Ma et al. 2012), and education level (Mercker and Hodges 2007). Factors negatively associated with certification included program requirements (Kilgore et al. 2007), having non-timber ownership objectives (Creamer et al. 2012), and having the land associated with a farm or ranch (Ma et al. 2012). While increased awareness is often touted as the solution to many problems, Leahy et al. (2008) found that increased information about forest certification programs increased pre-conceived predilections. Group certification is another option being pursued but can be challenging to design and implement and has not yet resulted in large increases in certified acreage.

An emerging market with potentially important implications for family forest owners, and climate change mitigation, is carbon sequestration (Galik et al. 2013). Forests already contain vast amounts of carbon, but the most efficacious mechanisms (e.g., afforestation, maintenance of existing forest cover, or enhanced forest

management) to increase this storage are debated (Adams et al. 2011). While programs aligned well with many owners' management practices, there were substantial barriers due to conflicts with program requirements, e.g., loss of autonomy (Fischer and Charnley 2010; Miller et al. 2012), and high costs for entry (Kerchner and Keeton 2015). The willingness to enroll varied widely depending on the specifics tested, but overall was predicted to be low (Fletcher et al. 2009; Markowski-Lindsay et al. 2011; Kelly et al. 2017). Despite substantial estimates (e.g., > 50% of owners) of interest (Thompson and Hansen 2013; Miller et al. 2014; Khanal et al. 2016b), costs for enrolling owners may be prohibitively high (Latta et al. 2011) and vary depending on forest conditions, i.e., productivity (Huang and Kronrad 2001). Thus, more realistic estimates of enrollment potential are warranted (Alhassan et al. 2019). Other program attributes identified as challenges included management (or non-harvesting) requirements and term lengths (Fletcher et al. 2009; Markowski-Lindsay et al. 2011; Wade and Moseley 2011; Dickinson et al. 2012; Miller et al. 2012). Fletcher et al. (2009) found longer term lengths were preferred. Owner attributes positively associated with enrollment included non-timber ownership objectives (Miller et al. 2012; Khanal et al. 2016b), concern about climate change (Miller et al. 2012), being a newer landowner (Miller et al. 2012), and having higher education (Thompson and Hansen 2013). Acreage and absentee ownership had mixed effects (Miller et al. 2012; Thompson and Hansen 2013), which may be related to study location. Studies have identified low information/awareness as a barrier (Dilling and Failey 2013; Miller et al. 2015) and have suggested the need for additional, tailored communications (Khanal et al. 2016a, 2017; Kelly et al. 2017) and indeed tools and guides have been created to assist landowners (Cason et al. 2006; Diaz et al. 2009; Van Deusen 2010). Aggregation approaches, similar to group certification, may be able to reduce the transaction costs and address other barriers (White et al. 2018), but require coordination among organizations and sufficient interest from and rewards for owners.

Numerous programs at national, state, and local levels implemented by public, non-governmental, and private entities have been established to provide landowners financial and technical assistance. Transaction costs for programs were often high and long-term impacts were often uncertain (Cox et al. 2013). In general, there was low awareness about these programs among family forest owners with participation based on a combination of owner, land, and program attributes (Kauneckis and York 2009), and hindered by onerous application processes, high levels of requirements, and low perceived benefits. Many voluntary programs appeared to be attracting owners who were already active (Potter-Witter 2005) and the effectiveness of programs to change behavior has been questioned (Andrejczyk et al. 2016a). One program consistently shown to induce behavioral change is the Conservation Reserve Program which was responsible for the planting of millions of hectares of marginal agricultural land across the USA (Kline et al. 2002), but retention of these plantations once the contracts end was not assured. A disconnect exists between the non-financial objectives of many owners and the financial motivation assumptions underlying many of these programs (Daniels et al. 2010). Kilgore et al. (2015) found educational assistance may be equally or more effective at influencing behavior as compared to management plans or cost-share assistance.

Taxation concerns many family forest owners (Butler et al. 2016a). Taxes and preferential tax programs were studied through financial analyses and, less commonly, measuring impact on owner behavior. Taxes potentially impacting family forest owners included property, income, and inheritance, but property taxes had the greatest impact (Butler et al. 2012). Preferential property tax programs have been around for over 100 years (Jacobson and McDill 2003) and aim to maintain forest cover, ensure continual timber supply, and achieve other policy objectives, but large market and other exogenous forces make program impacts minimal, short term, or simply unknown (Meier et al. 2019; Jacobson and McDill 2003). Enrollment in many preferential programs tended to be low (e.g., Fortney and Arano 2010). Low familiarity with programs was a common reason given for low enrollment (Fortney et al. 2011), but there were also issues raised related to disconnects with ownership objectives/practices (e.g., requirements for active management) and issues caused by the relative complexity and requirements of some programs (Fortney and Arano 2010; Butler et al. 2012). Factors identified as being associated with enrollment included larger holdings, higher incomes, and ownership objectives (Meier et al. 2019).

Depending on the part of the country, forestry policies take on higher or lower degrees of regulatory approaches (Ellefson et al. 2007). In Mississippi, a state with voluntary best management practices (BMPs), knowledge about BMPs was low, even among members of county forestry associations (Londo and Auel 2004) that typically include more active, and presumably more knowledgeable, landowners. Knowledge has been shown to influence attitudes of family forest owners towards BMPs, but these attitudes do not always translate into actions (Munsell et al. 2006) and social networks may be a stronger indicator of adoption (Knoot and Rickenbach 2011).

Some regulations aim to protect riparian areas or the habitats of species of special concern, but no single approach will meet all conservation goals. A portfolio approach, a mix of different policy tools, has been advocated by some (Doremus 2003) along with a call for more attention towards owners' attitudes and norms related to these policies (Ward et al. 2018). Participation in habitat conservation programs was influenced by size of holdings (Mehmood and Zhang 2005), management practices and objectives (Mehmood and Zhang 2005; Sorice and Conner 2010), and owners' attitudes towards the programs (Sorice and Conner 2010; Olive and Raymond 2011).

Conservation easements, the voluntary selling or giving away of development rights, is one of the most powerful conservation tools in the USA. Current enrollment levels are relatively low but increasing (Butler et al. 2016a). Owners' attitudes towards easements have been shown to be a function of internal and external cognitive factors (Vizek and Nielsen-Pincus 2017). Brenner et al. (2013) found that "active" owners in New York State were more interested in easements than "non-active" owners, but "active" typically had more to do with recreation and gathering of nontimber forest products than traditional timber management practices, and this finding was supported by Song et al. (2014) in a national study of easement participation.

A cornerstone of landowner assistance is educational outreach, often done through university extension programs. As with other programs, it has been noted that there are different audiences and differing levels of knowledge that need to be incorporated into the programming (Hiesl 2018). Largely through extension programs, master forest owner programs and other peer-to-peer networks have been created that have shown very positive impacts on knowledge sharing (Allred et al. 2011), especially when targeted at specific segments, such as female landowners (Redmore and Tynon 2011).

Owner Characteristics

To varying degrees, all of the articles described owner characteristics. Sometimes they were the focus of the publication (e.g., Butler et al. 2016a), sometimes the data were provided as background/contextual information, and often were used to distinguish among people who were participating and not participating in various programs and activities.

How landowners view their land and activities is often different from how foresters and other natural resource professionals view it. Qualitative research has found that terms such as “forest” often have different meanings among different groups (Andrejczyk et al. 2016b) and what was considered management was often different as well (Steiner Davis and Fly 2010). These disconnects can lead to poor program and service design and misunderstandings about who is targeted or eligible.

Regardless of whether they were of random samples of family forest owners or surveys of owners enrolled in specific programs, amenity values were consistently found to be the dominant forest ownership reasons. Analysis of an open-ended question about reasons for owning showed eight broad categories (and many sub-categories): environment, recreation, investment/income, home, non-instrumental, family, farm/ranch, and incidental (Bengston et al. 2011). Daniels et al. (2010) described motivations for family forest ownership and management as a trilogy of “forest continuity, benefit to the owner, and doing the ‘right thing.’” To simplify often multifaceted ownership objectives, segmentation analyses, described earlier, reduce the dimensionality of the data and typically yielded three to four clusters ascribed names such as timber, multiple objective, and non-timber (Majumdar et al. 2008) or woodland retreat, supplemental income, working the land, and ready to sell (Butler et al. 2007).

An important attribute of family forest owners is whether they have their primary home, a secondary home, or a farm associated with their forestland. Absentee owners may have similar levels of interest in conservation as resident owners, but may not participate in cost-share programs at the same levels (Petrzelka et al. 2012). Huff et al. (2019) found attitudes and management practices not to be significantly different between farmers and non-farmers, but they did note the potential for additional communication pathways for farmers.

Family forest owners, or more precisely the self-reported primary decisionmakers, were more likely to be older, be men, have attained higher formal education, earn higher annual incomes, and be less racially and ethnically diverse than the

general population (Butler et al. 2016a). The number of minority landowners has been decreasing (Christian et al. 2013) and although the general attitudes toward land ownership were found to be similar between minority and non-minority owners, minority owners tended to have lower incomes, own land for longer, be less engaged in active management, and were less likely to be enrolled in assistance programs (Gan et al. 2003).

Many family forests are owned by married couples with the men being the ones who are often seen as being more involved in management decisions (Butler et al. 2016b). The differences between male and female landowners was being explored (Butler et al. 2018) and more programming targeted at female landowners was being delivered (Redmore and Tynon 2011). While many attributes appeared similar between male and female owners, female owners were more likely to have inherited their land and less likely to have recently conducted forest management activities (Butler et al. 2018).

The age of family forest owners was substantially higher than the general population; 12% of the general population of the USA was 65 or older in 2013 (U.S. Census Bureau 2019) compared to 48% for family forest ownership primary decision makers for the same time period (Butler et al. 2016a). Owner age has been shown to be correlated with many behaviors and attributes and the advanced age of many owners is a harbinger for land transfers. The influences of age was related to a combination of both cohort and life stage effects (Butler et al. 2017b).

Land Characteristics

Size of forest holdings has important direct and indirect impacts on family forests. In defining (family) forests, there are often minimum size thresholds used to define (family) forests, typically 0.4 ha (1 acre) in the USA, frequently higher thresholds (e.g., 4 ha) are used for defining specific populations of interest, and occasionally upper thresholds are used to cap what is considered a “small-scale” landowner. Due to economies of scale and increased opportunities provided by greater acreage, there were different opportunities and challenges faced by owners based on size of holdings, although small-scale operations can be commercially viable under the right conditions (Moss and Hedderick 2012). The challenges faced by managing smaller holdings has led to a call for new service providers to occupy the gap between arboriculturists operating in urban and suburban settings and foresters and loggers working in more rural settings (Hull et al. 2004; Hull and Nelson 2011). Size of holdings was positively correlated with many attributes including timber harvesting (Beach et al. 2005; Silver et al. 2015; Floress et al. 2019), having a forest management plan (Elwood et al. 2003), and being aware of environmental issues (Caron et al. 2012). In most circumstances it was the log transformation of size of holdings that was most predictive, an indication of a stronger differentiation at the lower end of the size spectrum. Equally important to the patterns of size of holdings were trends in terms of parcellation and consolidation and the factors effecting them (Anderson et al. 2012; Stone and Tyrrell 2012).

Related to parcellation are general patterns of housing development and the intermix of housing and natural environs—the wildland urban interface. The USDA Forest Service’s Forest on the Edge project analyzed the relationships between housing density and family forests (Stein et al. 2005). Willingness to sell was related to a complex set of factors including pressure from surrounding lands (BenDor et al. 2014) and this factor can be used to help identify conservation priority areas (Theobald and Hobbs 2002).

Economics/Financial

A number of studies were related to the economics of family forests, many of which dealt with the “small ownership problem” (Straka 2011). D’Amato et al. (2010) calculated that timber harvesting may be insufficient to cover the holding costs of forestland, especially for smaller acreages and places where property taxes were high and there were concerns about whether the logging industry will be able to adapt operating on smaller holdings (Rickenbach and Steele 2006). The inability of forestry to outcompete other land uses, such as agriculture, has also been part of the justification for incentive (Frey et al. 2010) and taxation programs (Jacobson and McDill 2003).

There are also broader market forces that are influencing general ownership patterns, development pressures, and timber values. The conversion of vertically-integrated forestry companies to other ownerships, including timber investment management organizations (TIMOs) and real estate investment trusts (REITs), presented opportunities and challenges for family forest owners (Bliss et al. 2010). The disaggregation of the holdings provided opportunities for land acquisition by other, including family, owners. And although there was increasing reliance from mills on open markets, which should help with market access for family forest owners, there were numerous mill closures that reduced the number of buyers.

Ecology

Many owners have affinities for unique, local ecological features, such as water bodies and specific wildlife species. Wildlife, and nature in general, were consistently rated as important reasons for owning family forestland including for consumptive, passive, and intrinsic reasons. But family forest ownership patterns, and in particular parcellation, causes issues for wildlife management (Parkhurst et al. 2002; Brooks 2003). Increasing owners’ awareness of landscape-level issues was suggested as a means for increasing participation in ecosystem-based management programs (Creighton et al. 2002).

Cross-boundary cooperation is required to meet many of the challenges facing forests, including wildfires, invasive species, and pest infestations. Many family forest owners indicated inclinations towards management that spans ownership boundaries (Belin et al. 2005), but the degree to which they were interested in participating depended on the specific activities, the partners, and their personal motivations (Ferranto et al. 2013). Cooperation was reported to be influenced by trust, ideology,

and perceived power (Bergmann and Bliss 2004) and actively involving owners in the decision-making process should increase the feelings of self-governance and increase participation rates (Creighton et al. 2002). Amacher et al. (2006) found that providing information about fire mitigation and owners financially contributing to cost-share programs had substantial impacts on reducing social losses from wildfires. Factors contributing to owners being more likely to reduce fire hazards included living on or near their land, awareness of landscape-level conditions, and having markets for low grade materials (Fischer 2011).

Recreation

Recreation, be it hunting, hiking, or other activities, was another important reason for many people to own forestland and often these activities involved people other than just the owners, such as other family members and friends. Most family forest owners reported not allowing public access, but those that did tended to have larger parcels, lived on their land, owned a farm/ranch, and did not own for personal hunting purposes (Snyder and Butler 2012). Of particular concern for owners can be hunters, due to safety concerns and degradation of the owners' hunting experiences. Another recreation issue was related to off-highway or all-terrain vehicles with low allowance of public access on family forests due to concerns related to noise, safety, and environmental damage, but the willingness was very different if it involved friends or family (Becker et al. 2010). There were also other non-recreational access issues reported, such as for indigenous people accessing non-timber forest products (Ginger et al. 2011).

Legacy

Legacy was a topic of interest to many owners, be it keeping the land in the family or conserving the land for all future generations. This issue becomes more acute given the age distribution of owners discussed above. This has led to studies of intergenerational land transfer (Markowski-Lindsay et al. 2017, 2018) and development of tools to assist owners in this process (e.g., Withrow-Robinson et al. 2013).

Of particular relevance to the legacy of many African American, and some other, landowners, were the challenges faced by heirs' properties, compounding issues related to racial inequities. When land is passed to future generations, but without the estate going through a probate process, the title to the land can become muddled and this issue is compounded as it passes onto subsequent generations and the number of owners increases exponentially. This causes issues for wealth accumulation, forest management, and other factors (Hitchner et al. 2017). Efforts have been initiated to help owners clear these titles, but the process can be slow, expensive, and contentious (Schelhas et al. 2018). Solutions that address issues faced by African-American landowners will likely help all family owners (Christian et al. 2013).

Solutions/Implications

Most journals require some discussion about the implications of the findings and potential solutions to underlying issues. These commentaries vary from a sentence or two of broad platitudes to in-depth and insightful suggestions. Not treating family forest owners as a homogeneous group was a common theme. Through segmentation it was hoped that policy goals will be better aligned with owners' goals (Gan et al. 2003; Ross-Davis et al. 2005), which were often at odds with each other.

Increasing awareness of opportunities was a common suggestion to increase participation in programs (e.g., Londo and Auel 2004). While awareness is certainly necessary, it may not be sufficient. The likelihood of an owner participating in a program will be greatly diminished if the program fails to meet a self-perceived need of the owner or if it has attributes that are incompatible with the owner's values or reasons for owning their land. Awareness is often accomplished through education, but traditional top-down approaches are not the most effective means for reaching owners and more can be taken from andragogy, i.e., the study of adult learning (Merriam 2001). Interestingly, traditional written materials were still preferred by owners (Butler et al. 2016a). These materials can work as a "foot in the door" and facilitate future interactions. Often at the forefront of these educational efforts are extension foresters, but the resources being provided to extension programs has been dwindling (Sagor et al. 2014).

How and from whom family forest owners receive information has been the focus of a number of studies, among both family forest owners (e.g., Gorczyca et al. 2012; Sagor and Becker 2014) and the people and organizations providing services to them (e.g., Knoot and Rickenbach 2014; Fischer et al. 2016). Combined, these networks, either through informal channels (Kittredge et al. 2013) or formal peer-network programs (Kueper et al. 2013), create social capital that can be very influential in terms of forest management practices. Unfortunately the social networks of organizations with shared missions do not always coalesce (Fischer et al. 2016).

Conclusions and Future Research Directions

With 640 articles published on America's family forest owners between 2000 and 2019, much is known about their attitudes, behaviors, and the programs, policies, and services impacting them, but there is still much to be learned. A confounding factor in making comparisons across the published literature was differences in how variables were defined, collected, and analyzed. Harmonization would allow for greater comparisons among studies and can be a catalyst for innovation by encouraging researchers to more fully build upon previous studies as has been done in other fields (e.g., McRoberts et al. 2009). A first step in this process can be greater emphasis on publishing meta-data (e.g., requiring, where applicable, the inclusion of survey instruments as supplemental materials) so that, at a minimum, comparability can be assessed.

By the nature of current funding mechanisms, research follows the money. This helps ensure that research is addressing relevant topics, but it can also be

an impediment for research innovation. It would be interesting to know where an unfettered group of family forest researchers would choose to focus their attention. This could lead to some esoteric research, but it could also lead to many novel and impactful research directions. For example, what would happen if we moved beyond forests, looked at the totality of land owned, and studied the processes that influence the most critical forest conservation action—keeping forests as forests.

It is important that family forest owner research not become too insular. Indeed, some of the most innovative research over the past two decades has come from adopting ideas from outside fields. Of particular import has been the infusion of theoretical frameworks, such as the Theory of Planned Behavior (Ajzen 1991) and concepts associated with social marketing (Butler et al. 2007). It is difficult to know where the next breakthroughs will come from, but futurists are trying to do just this (Bengston 2016) and collaboration and cross-fertilization are certain to be a part of it. There are more theories and frameworks from psychology, sociology, economics, systems theory, and other fields that can be applied.

The purported implications (and actual applications) of much of the published research is dubious and often consists of a line or two of well-trod platitudes, e.g., a need to increase awareness of a program or to tailor messaging to specific segments of owners. While these statements may be accurate, the scientific community is failing to answer many pressing questions such as those related to program effectiveness. One way of breaking the insular research cycle may be to embrace participatory action research (Vaughn and Jacquez 2020) or similar approaches that focus on the co-generation of knowledge and increasing collaboration between researchers and stakeholders. It is also important that more emphasis (and rewards) be placed on the transfer of knowledge that should occur after research is completed.

There is a lack of clear, empirical evidence in the published literature on if and how policies, programs, and services are influencing family forest owner behaviors and the broader benefits flowing to society. There are studies that show varying levels of correlations, but they generally lack the methodological controls or theoretical foundations to substantiate causal relationships. One of the concepts from other fields that has received only passing attention in the family forestry literature is evidenced based practices (Hall and Roussel 2012). What we ultimately want to know is:

- Are policies, programs, and partnerships having a meaningful, positive impacts in terms of their stated goals?
- Are they improving the overall state of family forests and family forest owners?

In general, we simply do not know. Granted these are complex systems, but insufficient effort is being put towards monitoring and evaluation to fill this void. Without this information it is impossible to assess efficacy and make scientifically informed improvements.

A number of articles point towards the potential of emerging markets, such as carbon sequestration, to generate income for landowners and spur related management activities. While studies demonstrate great potential impacts, there are few that present compelling empirical evidence that actual changes are occurring. This could

be related to the markets still being developed or the assumed impacts being less than expected, and again more empirical-based research is needed. In some cases, it will be combining multiple programs that will likely lead to behavior change (Frey et al. 2010).

Seventy-eight percent of family forest owner research relies on quantitative, often survey-based, approaches, there are a number of informative qualitative studies too and some quasi mixed methods approaches, but studies that fully embrace a mixed methods approach are lacking (an illustrative exception is Jansujwicz et al. 2013). Mixed methods studies (Creswell 2014) are difficult to implement and can be time consuming and expensive, but they are needed to answer questions about what is happening and why.

The published literature indicates program success has been mixed at best. And what we do know is largely corollary, and not casual, in nature. For example, talking to a forester is correlated with participation in programs, but it is unclear if people talk to foresters because they are interested in programs, if foresters create the interest, or if it is a combination of both. The directions of these relationships have important implications for how programs are designed and the roles of different organizations, including public forestry agencies, in program design and delivery. Still, it is clear that complexity, awareness, and mismatch with ownership objectives are barriers for more widespread adoption and there is a clear need for studies that help uncover the causal relationships using evidenced-based, mixed methods studies or other comparable approaches.

Since controlled studies are not feasible for most studies involving family forest owners, long-term panel studies, such as the Nurse's Health Study (Colditz et al. 1997), could be used where groups of individuals are followed over long timeframes, often decades, to understand factors associated with attributes of interest. This approach, especially if coupled with the collection of biophysical data (e.g., coupled human–natural systems), could lead to unprecedented understanding of the myriad factors influencing family forests and family forest owners, but it will take substantial investments and time to yield results. The USDA Forest Service's National Woodland Owner Survey (Butler et al. 2016b), particularly when combined with Forest Inventory and Analysis plot data, provides long-term monitoring, but not necessarily in the depth that is required to address some of the most pressing questions. Establishing long-term study sites like (or built on) the U.S. National Science Foundation's Long-term Ecological Research network of research sites would help fill this gap.

Another approach that will help bridge this gap between correlation and causation is more explicit incorporation of theoretical frameworks, more experimental work, and more pre-post intervention studies. As Emanuel Kant is claimed to have stated: "Experience without theory is blind, but theory without experience is mere intellectual play." Theory cannot prove causality, but it allows potential causal pathways to be better defined and leads to greater understanding of overall systems. Systems theory or similar approaches designed for understanding complex processes may facilitate further advancements by identifying the critical components of the targeted behaviors and how interventions can have the greatest impacts.

While much of the past research has focused on, or been influenced by, the “perennial American family forest problem” (Straka 2011) of perceived irrational timber harvesting practices, research has branched into other attributes related to family forests owners. Future research will likely continue to focus on: timber harvesting, climate change; payments for ecosystem services (especially carbon); and forest certification. Emerging topics that deserve additional consideration include the role of family forests in: diversity, equity, inclusion, and justice (DEIJ) issues; increasing the quality of people’s physical and mental health; small-scale (e.g., <4 ha) land management; and considering the full set of land uses, not just forests in isolation. In addition, those who provide services to family forest owners deserve additional study, in particular loggers who may prove an elusive, or at least reticent, group to study.

Moving forward, we need to build upon what we know, but also look beyond just the forests, beyond just forestry, and beyond our own geographic boundaries. There is much that can be learned from cross-country comparisons, especially among countries with similar forest ownership patterns, and across land uses (e.g., literature focusing on farmers or ranchers) but substantive differences, such as land use policies, will influence comparability. Some studies have compared the USA to other countries including Australia (Fraley 2012), Canada (Quartuch and Beckley 2013), Portugal (Campos et al. 2009), Spain (Campos et al. 2009), and Sweden (Fischer et al. 2010). Many inter-country comparisons that do not include the USA, e.g., focus on European nations, also have potential implications for the USA (e.g., Matilainen et al. 2018; Weiss et al. 2019). Although the easiest comparisons are with countries from the Global North with similar ownership patterns, there are important learnings that can come from other parts of the world as well. In places like Africa, the focus tends to be more on livelihoods and subsistence and the role that land tenure can play in increasing the quality of life (Barrow et al. 2016), topics that may resonate more with specific segments of family forest owners in the USA. A logical expansion of this literature review is a systematic review of small-scale forestry literature from around the world.

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