

Research Article - social sciences

## Forest Farming: Who Wants In?

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### Abstract

Forest farming is an agroforestry practice defined as the intentional cultivation of nontimber forest products (NTFPs) underneath a forest canopy. Forest farming perspectives and preferences among family forest owners are generally understudied, particularly in Appalachia, where many marketable native NTFPs species are found. We surveyed Appalachian family forest owners in fourteen Southwest Virginia counties about their interest in forest farming and likelihood of leasing land for this purpose. We also asked about the owner's residency and historical connection to the region as well as contemporary land uses, and identified the following types of uses: absentee and vacationers, newcomers, longtime farming residents, and longtime nonfarming residents. We mailed 1,040 surveys and 293 were returned (28.9%). Forty-five percent were interested or extremely interested in forest farming and 36% were likely or extremely likely to lease land. Rates of interest in forest farming and leasing were similar across owner types, suggesting broad appeal among family forest owners.

**Study Implications:** Forest farming of nontimber forest products (NTFPs) and leasing forestland for this practice is broadly appealing across diverse family forest owners in Appalachia. Opportunities to scale profitable forest farming are on the rise, potentially improving family forest management and spurring regional economic development. Study results indicate there is a critical mass of family forest owners interested in forest farming who could potentially supply cultivated NTFPs. Forest management professionals and stakeholders would benefit from considering how they can assist family forest owners who are interested in forest farming.

**Keywords:** forest owner typology, family forest owners, nontimber forest products, specialty forest products, agroforestry

Humans have long harvested food, medicine, and craft materials from Appalachian forests (Hufford 2003, Cavender 2003, Moerman 2009, Moerman 2010, Freedman 2017). Nontimber forest products (NTFPs) is a catchall term defined as products other than

timber that people derive from woodland plants, trees, and fungi (Frey et al. 2016, Chamberlain et al. 2018b). The mixed mesophytic forests of the Appalachian Mountains include hundreds of thousands of acres of prime habitat for many NTFPs that are commonly

harvested for both commercial and subsistence use and that hold cultural, spiritual, and religious significance within the region for indigenous people and long-settled and recent immigrants (Greene et al. 2000, Hufford 2003, Cavender 2003, Moerman 2009, 2010, Chamberlain et al. 2018b, Lake et al. 2018). Well-known examples include American ginseng (*Panax quinquefolius*), black cohosh (*Actaea racemosa*), goldenseal (*Hydrastis canadensis*), black walnuts (*Juglans nigra*), ramps (*Allium tricoccum*), elderberries (*Sambucus canadensis*), pawpaws (*Asimina triloba*), morel mushrooms (*Morchella* spp.), galax (*Galax urceolata*), and grapevines (*Vitis* spp.).

Although Appalachian NTFPs are harvested and used personally by many who live in the region, they are also common in many herbal and cosmetic retail products, as well as household decorations and culinary industries, which constitute a rapidly growing multibillion dollar market supporting a vast enterprise of wild harvesting, local trade, product aggregation, and global sales (Greene et al. 2000, Hufford 2003, Vaughan et al. 2013, Chamberlain et al. 2018a, b, Frey et al. 2019, Kruger et al. 2020a). As this industry grows, sustainability has become a key issue because, although some NTFPs can handle extensive and continual harvesting, many cannot (Bierzychudek 1982; Sanders and McGraw 2005; Albrecht and McCarthy 2006; Van Der Voort and McGraw 2006; Chamberlain et al. 2019). Today, a growing number of NTFP-dependent companies seek sustainable, high-quality raw materials because they and many of their customers want to know where these materials come from and whether they are responsibly sourced (Craker and Gardner 2005; Laird et al. 2005; Chittum et al. 2019).

Forest farming is an agroforestry practice that involves intentionally cultivating or stewarding NTFP species in the understory of a forest and is often promoted as a way to conserve threatened NTFP species (Chamberlain et al. 2009, Mudge and Gabriel 2014). Forest farmers are the people who grow and sell marketable NTFP crops in the forest understory (Chamberlain et al. 2009). Agroforestry is defined as an “intensive land-use management that optimizes the benefits (physical, biological, ecological, economic, and social) from biophysical interactions created when trees and/or shrubs are deliberately combined with crops and/or livestock” (Gold and Garrett 2009, p.46). Agroforestry practices, such as forest farming, merge production and conservation into a single but diversified and highly productive land use system and, although these practices often bring with them

complexities and challenges, many are still interested (Trozzo et al. 2014a, 2019, MacFarland et al. 2017).

Interest in forest farming among landowners in the United States is thought to be tied to ecological and economic benefits between or in lieu of timber harvesting (Workman et al. 2003, Valdivia and Poulos 2009, Barbieri and Valdivia 2010). However, only a few NTFP species can be profitably farmed when raw material is sold at the same price point as wild-harvested NTFPs (Teel and Buck 1998, Burkhart and Jacobson 2009). Yet forest farming price points can be much higher and thus profitable because some companies pay top-dollar for materials that are traceable to a forest, person, community, and management regime. Verification and labeling programs, such as the Forest Grown Verified Program administered by United Plant Savers, help in this regard by certifying forest farms. Anecdotally, from projects we have been involved in and popular media publications, we know that prices are being paid upwards of 10 to 20 times the wild-harvested prices reported in Kruger et al. (2020b).

Trade in raw material from forest farms is relatively small compared to wild harvesting, but the potential for growth and economic impact is substantial (Kruger et al. 2020b). This is particularly true for Appalachia, where subregions like the Blue Ridge and Alleghenies are heavily forested (Loveland and Acevedo 2016) and home to numerous marketable NTFPs that have evolved in their climate and topography. Further, forestland in Appalachian states is roughly 85% privately owned, mostly by families (Butler et al. 2016b). If national trends are an indicator (e.g., Kaetzl et al. 2012, Butler et al. 2016a), then it is highly likely a substantial portion prioritize nontimber objectives (e.g., aesthetics, biodiversity, and privacy) over timber production.

A number of socioeconomic factors may also influence forest farming in Appalachia. For one, rural flight and amenity migration are key features of the region, which involves long-time residents leaving for economic opportunities and newcomers moving to the area in search of rural lifestyles and landscapes (Gosnell and Abrams 2011). At the same time, the US is in the midst of the nation’s largest-ever intergenerational transfer of forestland, which has shifted the nature and needs of owners (Butler et al. 2016a). Another factor is the number of absentee forest owners nationwide, which exceeds 25% and continues to grow (Butler and Leatherberry 2004, Butler et al. 2007). Changes in consumer demographics and forest ownership patterns in Appalachia are shaping new NTFP preferences and

approaches to sourcing, which include forest farming practices (Trozzo et al. 2019) and leasing arrangements similar to agriculture (Hamilton 2011).

In this study, we measured and compared the extent to which Appalachian family forest owners in 14 counties in Southwest Virginia are interested in forest farming or leasing a portion or all of their forestland for production. We also grouped family forest owners into types based on land use and residency characteristics and explored whether owner types differ in terms of their interest in farming or leasing. We anticipated at least similar levels of interest in forest farming to those reported in studies of other regions (around 40%) and expected the levels of interest in leasing to be less. We also hypothesized that differences would be observable between residents more or less interested regarding their residency characteristics, land use, size, and cover, experience harvesting NTFPs, frequency of visiting their woodlands, and demographics. Results will improve our understanding of the potential for scaling forest farming on family forestland in the heart of Appalachia and the impacts on possibilities for market growth of forest-farmed products. Our study can also inform the creation of bioeconomic development policies and technical assistance to support forest landowners interested in forest farming. Additionally, increased forest farming could help improve conservation of NTFP species, increase quality assurance for products made with raw material from these species, and provide income opportunities for forest landowners in the region.

## Literature Review

Interest in forest farming as a contemporary North American agroforestry practice has been studied in a few places in the US in the last 20 years. Landowners in six Northwest Florida counties were surveyed in 2003 and 40% of the respondents wanted to learn more about the practice (Workman et al. 2003). In 2005, Pennsylvania landowners were studied and 36% of respondents were interested in agroforestry practices such as forest farming (Strong and Jacobson 2005). Almost 40% of the forest owners studied in Missouri in 2010 were inclined toward forest farming (Barbieri and Valdivia 2010). These results demonstrate that many landowners are interested in forest farming, yet owners in the heart of Appalachia, a hot bed of global NTFP trade, have not been similarly studied.

More generally, research on the factors affecting adoption of agroforestry practices such as forest

farming suggest that age, gender, income, and education are important. In most studies, younger respondents are more interested in agroforestry and likely to view forest farming as an income-viable practice (Pattanayak et al. 2003, Strong and Jacobson 2005, Arbuckle et al. 2009, Valdivia and Poulos 2009). Gender may also play a role in interest with some women reporting greater interest in specialty crop production compared to other possibilities such as timber and livestock (Strong and Jacobson 2005). Studies on agroforestry interest have also found respondents with higher levels of education reported greater levels of interest (Pattanayak et al. 2003, Arbuckle et al. 2009). A similar pattern has been noted with income levels positively correlating to agroforestry interest (Pattanayak et al. 2003).

Several studies report that farmers are less interested in agroforestry practices when compared to non-farming owners (Arbuckle et al. 2009, Barbieri and Valdivia 2010, Trozzo et al. 2014a, b). Research has also shown that owners of large parcels were less interested in agroforestry practices compared to owners of smaller lots (Trozzo et al. 2014a). Perhaps more important is that several studies found that higher levels of awareness may matter more because landowners who are familiar with agroforestry practices, regardless of parcel size, are often most interested (Arbuckle et al. 2009, Valdivia and Poulos 2009, Trozzo et al. 2014a). These findings suggest that parcel size and land use are important determinants of initial interest in agroforestry, but the position of some evolves as awareness increases.

Motivations also play a role in interest in agroforestry practices. Interest in multifunctional riparian buffers among landowners in Southwest Virginia who are livestock producers has been found to be less than nonproducers who are motivated more by nonmonetary objectives, such as wildlife habitat. However, livestock producers' interest could change if supporting mechanisms such as cost-share are available (Trozzo et al. 2014b). Similarly, when broadening out to agroforestry in general, it has been found that landowners who value recreation and environmental objectives often are more interested initially in agroforestry (Arbuckle et al. 2009). Despite these differences in interest levels based on land use and objectives, it is uncommon for respondents to dismiss agroforestry completely (Trozzo et al. 2014b).

Social marketing research typically includes population segmentation and message design (Tyson et al.

1998). These methods have been used to group forest owners into types and test hypotheses (e.g., [Munsell et al. 2008](#)) and design outreach programs (e.g., [Butler and Leatherberry 2004](#)). Landowner typologies are common in agroforestry research as well (e.g., [Strong and Jacobson 2005](#), [Barbieri and Valdivia 2010](#), [Trozzo et al. 2014b](#), [Commender et al. 2020](#)), and two studies specifically included measures of landowner interest in forest farming ([Strong and Jacobson 2005](#), [Barbieri and Valdivia 2010](#)).

[Strong and Jacobson \(2005\)](#) segmented Pennsylvania forest owners into four types based on product-specific adoption preferences: timber, livestock, specialty crops, and nonadopters. Specialty crop respondents (36%) were most interested in growing NTFPs in forest farming systems. In general, people in this segment worked off-farm (77%) or were retired (18%), and many owned smaller parcels (2.5 to 10 acres). They also were mostly female (60%). Specialty crop owners were interested in quality of life factors such as providing food for their family and land stewardship goals like improving wildlife habitat.

[Barbieri and Valdivia \(2010\)](#) divided landowners in Missouri into two types based on recreation activities: ruralists and productivists. Ruralist respondents (47%) primarily participated in recreation (e.g. walking/hiking, nature/wildlife contemplation, hunting) and were more often interested in forest farming (47%) than productivists (25%), who focused on extractive activities. Ruralists share similarities with [Strong and Jacobson's \(2005\)](#) specialty crop segment in that both were most interested in forest farming when presented with a suite of potential land uses and agroforestry practices. Respondents in both types also were mostly nonfarmers (72%) focused on working and interacting with their land as part of a broader rural lifestyle. This is in line with findings reported in [Valdivia and Poulos \(2009\)](#), where monetary motivations were not primary drivers of interest in forest farming.

Social marketing also has been used to characterize family forest owners and their management preferences beyond agroforestry practices ([Kluender and Walkingstick 2000](#), [Butler and Leatherberry 2004](#), [Kendra and Hull 2005](#), [Butler et al. 2007](#), [Majumdar et al. 2009](#), [Munsell et al. 2008](#)). For example, [Kendra and Hull \(2005\)](#) described a new generation of forest owners who are more motivated in their land management by lifestyle goals and other characteristics of the “back-to-the-land” movement. Similarly, other woodland owner studies have reported substantial interest among forest landowners in amenity over

financial goals ([Butler et al. 2007, 2016a](#)) as well as an orientation toward environmental conservation and lifestyle preferences ([Kleunder and Walkingstick 2000](#)). Yet, other studies have found that forest landowners are motivated by a more even mix of consumptive and nonconsumptive goals ([Majumdar et al. 2009](#), [Kuipers et al. 2013](#)) or, likewise, a combination of amenity and income opportunities ([Salamon et al. 1997](#), [Butler et al. 2007](#)).

The phenomenon of contemporary amenity migration is likely reflected in the lifestyle and environmental objectives observed among forest owners. Amenity migration is defined as the “movement of people based on the draw of natural and/or cultural amenities” ([Gosnell and Abrams 2011](#), p. 303). Often called “rural restructuring,” it is considered a result of globalization expressed through the outmigration of longtime residents in search of economic opportunities and immigration of many urbanites and suburbanites seeking a rural lifestyle ([Gosnell and Abrams 2011](#)).

Amenity migration has been found to influence forest management and NTFP harvesting. Research has shown that motivations for contemporary forest food and medicine use in Appalachia differ between newcomer and longtime residents. Newcomers have been found to balance monetary, environmental, and lifestyle motivations, whereas long-time residents more deeply stressed financial motivations and also emphasized lifestyle motivations ([Trozzo et al. 2019](#)). Newcomers also often have smaller parcels, leaving them with fewer traditional forest management options ([Butler and Leatherberry 2004](#), [Rickenbach and Kittredge 2009](#)). However, forest farming is possible on smaller parcels and can serve as an entryway to work with newer landowners on diversifying and expanding forest management.

In addition to parcel size, absenteeism is on the rise in the US ([Petzelka et al. 2013](#)) and affects forest management because the motivations and actions of absentee owners often differ from resident owners ([Conway et al. 2003](#)). These owners are less likely to maintain working forests because they have little interest in timber production and are notoriously hard to motivate ([Conway et al. 2003](#), [Rickenbach and Kittredge 2009](#), [Petzelka et al. 2013](#)). Many also have stated conservation objectives ([Bond et al. 2018](#)), but, in reality, they consistently fall behind resident owners when it comes to implementing associated practices ([Kendra and Hull 2005](#), [Rickenbach and Kittredge 2009](#)). However, up to 30% of forest owners in the South lease their forestland for managed uses, mostly for hunting and grazing, but

some for timber production and other recreational activities (Butler et al. 2008).

Despite Appalachia's iconic position in NTFP supply chains, there is little in the way of forest owner research pertaining to interest in forest farming. We sought to study family forest owners in a region of Appalachia with longstanding NTFP markets. The goal was to gauge their interest in forest farming and leasing land for this practice in the context of cultural legacy, residential characteristics, land use, experience, and demographics.

## Methods

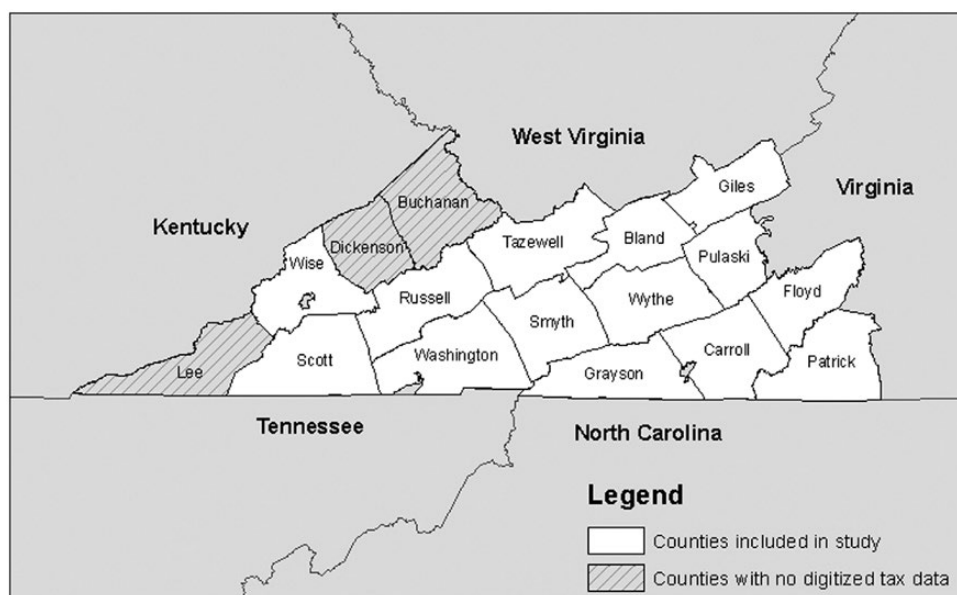
We surveyed forest owners in 11 Southwest Virginia counties who own five or more acres of forests. Southwest Virginia was chosen because there are longstanding markets for numerous NTFPs and representation of three different physiographic provinces in Appalachia (Blue Ridge, Ridge and Valley, Alleghany Plateau). Counties included in this study maintained digitized tax parcel boundaries and associated meta-data that were used to generate our study population (Figure 1).

Five acres was selected as the lower sampling threshold because forest farming is possible on small parcels (Burkhart and Jacobson 2009, Chamberlain et al. 2009). We also decided to delimit sampling to five

acres and above because this parcel size offers sufficient information for remotely assessing forest habitat using a geographic information system. ARC Map 10.4 was used to identify the forest owner population by overlaying digitized county tax parcel data with the 2011 National Land Cover Dataset. We removed all public lands and company holdings and aggregated the acreage among landowners who have multiple parcels in one county.

The final study population included 44,736 family forest owners. We stratified the population before sampling to proportionally represent counties in the study area, followed by a second stratification of county subpopulations to represent different acreages of forestland. Acreage categories were exponential: 5–9, 10–19, 20–39, 40–79, 80–159, 160–319, 320–639, and more than 640 acres. We randomly sampled 1,040 family forest owners from the double stratified population frame. Sampling was based on a 95% confidence level projection with an assumed 0.03 margin of error (Dillman et al. 2014).

The sample frame of family forest owners was surveyed according to Dillman et al. (2014) in a process reviewed and approved by the Institutional Review Board (IRB# 17–951). This included a prenotice letter, survey, and thank you/reminder post card sequence, followed by a replacement survey for nonrespondents. We assessed nonresponse bias by comparing demographic data



Created by Katie Trozzo, November 2017

**Figure 1.** Fourteen Appalachian counties in Southwest Virginia included in the study of family forest owner interest in forest farming and leasing. Counties are named and coded in white.

between early and late respondents using chi-square analysis (after Groves et al. 2002), although we were unable to compare respondents with nonrespondents as we did not have alternative contact information for our sample of forest landowners (e.g., email or phone numbers).

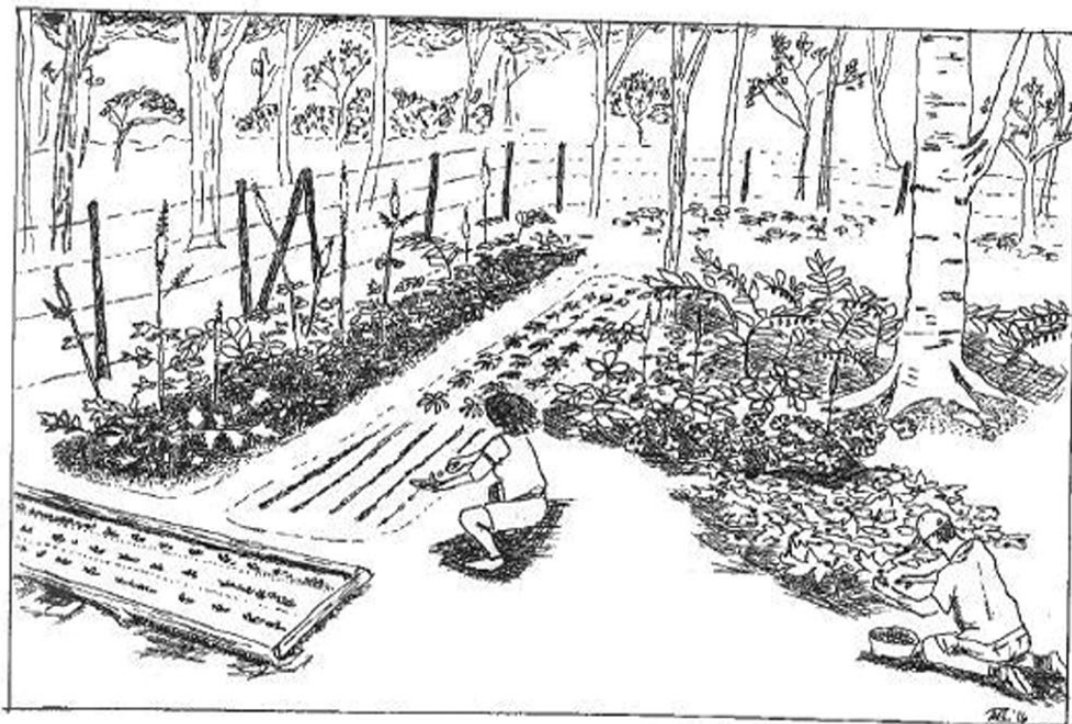
Interest in forest farming and likelihood of leasing land was gauged using Likert-type scales. The survey included an image of an intensive forest farming operation (Figure 2) in support of a set of definitions of forest farming (Table 1) from which owners based their responses to questions about their interest levels in the practice. The image clearly distinguished forest farming to ensure respondent comprehension. We measured interest in forest farming and leasing likelihood on a five-point Likert-type scale. Interest in forest farming was measured using: 1 = “not at all interested,” 2 = “not interested,” 3 = “neutral,” 4 = “interested,” and 5 = “extremely interested.” Likelihood of leasing land for forest farming was measured using: 1 = “not at all likely,” 2 = “not likely,” 3 = “neutral,” 4 = “likely,” and 5 = “absolutely likely.”

Owners were asked to assess their experience with harvesting NTFPs using a dichotomous response option. They also were asked to provide information about residency (i.e., absentee, full-time, part-time)

and historical connection to the study area (i.e., if they grow up in the study region or not). The survey asked for demographic data and responses about land management activities, farming and retirement status, and the frequency with which they visit their forestland. Owner objectives were determined to be consumptive or nonconsumptive by asking respondents to select the top three reasons they own land (adapted from Butler et al. 2016c). We conducted geospatial analyses in ArcMap 10.4 to calculate respondent parcel size, forest acreage, and percent forested acreage.

Consumptive motivations included growing and selling timber, hunting, making money, growing and selling specialty woodland crops, diversifying financial portfolios, and land investment. Nonconsumptive motivations included scenery, nature, wildlife protection, personal recreation, keeping land in the family, and privacy. Respondents were categorized as either consumptive or nonconsumptive based on how they chose their top three objectives. If they chose two or more consumptive objectives, they were grouped consumptive and vice versa (after Trozzo et al. 2014b).

We analyzed survey data in IBM's SPSS 26.0 using descriptive statistics, two-step cluster analysis, and a nonparametric Kruskal-Wallis test. Two-step cluster analysis was used to segment respondents into



**Figure 2.** Illustration by Elizabeth Moore of a forest farming operation included on the cover of the survey of family forest owners in 14 Southwest Virginia counties. The image was also used in support of the definition of forest farming presented to survey respondents.

**Table 1.** Forest farming and nontimber forest products (NTFPs) definitions provided in a survey of family forest owners in 14 counties in southwestern Virginia.

Forest farming <sup>a</sup>	Forest farming is a practice where people intentionally grow or manage nontimber crops to sell in woodlands (see image in <a href="#">Figure 2</a> ). Forest farmers invest time and money in their operation like any other farmer and generally seek to sell their products at the best prices possible. It is different from wild harvesting because crops are cultivated or actively managed in their native forest habitat. Most crops are generally slow growing, but forest farming can complement a variety of forest-management objectives by providing products to sell between timber harvests or as an alternative to cutting timber all together.
Nontimber forest crops <sup>b</sup>	Nontimber forest crops are marketable forest products other than timber that grow naturally in wooded habitats. Crop types include food, medicine, decorative materials, and landscaping materials. Examples include elderberry, black walnuts, ramps, tree saps for syrup, pawpaw, edible mushrooms, black cohosh, ginseng, goldenseal, galax, grapevine, and pine straw.

<sup>a</sup>Adapted from [Chamberlain et al. \(2009\)](#) and [Mudge and Gabriel \(2014\)](#). <sup>b</sup>Adapted from [Chamberlain et al. \(2018a\)](#).

homogenous types (following [Trozzo et al. 2014b](#)). The procedure allows for segmentation using both continuous and categorical data, and the silhouette measure of cohesion and separation represents cluster quality. A silhouette between 0.5 and 1.0 indicates that intra-segments are adequately similar and inter-segments are adequately different. Drawing from the literature, we clustered respondents into types based on their responses to questions about residency in Southwest Virginia, whether they grew up in the region, and whether they farm.

We tested for statistically significant differences in forest farming interest and leasing likelihood responses between owner types using a Kruskal-Wallis test. The Kruskal-Wallis test is a nonparametric analog to a one-way ANOVA and is appropriate for nonnormal parametric data and nonparametric data from measures such as ordinal Likert-type survey scales ([Field 2005](#)). Descriptive statistics were used to study how demographics, residency, historical connection to the study area, current land management, use and visitation, experience harvesting NTFFPs, and consumptive versus nonconsumptive objectives vary across types of family forest owners.

## Results

Twenty-five surveys were returned because the respondent noted they did not own forested land due to change in ownership since the latest tax records or error in the geospatial measurements. Our sample frame was accordingly adjusted to 1,015. We received 293 surveys for a response rate of 28.9%. We found no significant differences between early and late respondents

in terms of age, gender, income, education, retirement status, farming status, parcel and forest acres owned, residency, childhood connection to the region, and interest in leasing land for forest farming. However, interest in forest farming differed significantly between early and late respondents ( $p$ -value < 0.05). More early respondents were interested or extremely interested in forest farming (49.3%) compared to late respondents (34.2%). Nonresponse bias is possible due to the response rate and the fact that we did not survey nonrespondents.

Overall, 45.4% of respondents were interested or extremely interested in forest farming. They owned 4,942 acres of forestland, which accounted for 46.6% of respondent holdings ([Table 2](#)). Nearly one-third of the respondents (32.2%) were not interested in forest farming and 22.5% were neutral. Thirty-six percent of the respondents were likely to lease their land for forest farming. This group owned 4,355 acres of forestland, which accounted for 43.4% of land held by respondents. The percentage of those likely to lease was less than those who are not interested (42.1%) or neutral (21.9%), and they owned less forested acreage.

Four family forest owner clusters were identified based on residency in the region, historical connections to the region, and farming status ([Table 3](#)). The silhouette measure of cohesion and separation was 0.7, indicating a good fit. Types included absentee and vacationers ( $n = 61$ ; 23.3%), newcomers ( $n = 46$ ; 17.6%), longtime farming residents ( $n = 60$ ; 22.9%), and longtime nonfarming residents ( $n = 95$ ; 36.3%).

Regarding the breakdown of the clusters, well over 80% of the absentee and vacationers did not live in the study area, and the remaining lived there only

**Table 2.** Responses to Likert-type questions in a survey of family forest owners in fourteen Southwest Virginia counties. Questions pertain to interest in forest farming and likelihood of leasing for this purpose. Also reported are acreages owned by respondents across all responses.

Categories	Not At All			Extremely		
	Interested	Not Interested	Neutral	Interested	Neutral	Absolutely likely
Forest farming: Does forest farming interest you?	21.5% (n = 62) 19.8% 2098 (Total = 10,619)	10.7% (n = 31) 8.2% 873	22.5% (n = 65) 25.5% 2706	25.3% (n = 73) 25.2% 2673		20.1% (n = 58) 21.4% 2269
Leasing: Would you lease your woods for others you trust to forest farm?	27% (n = 75) 22.8% 2290 (Total = 10,031)	15.1% (n = 42) 11.4% 1147	21.9% (n = 61) 22.3% 2239	15.5% (n = 43) 20.5% 2060		20.5% (n = 57) 22.9% 2295

Note: Percentages have been rounded so may not add up to 100.

part time. In this same type, two-thirds (65.6%) did not grow up in the region and none actively farmed. Almost all respondents in the newcomer type lived in the region full time (93.5%). None of them grew up in the region, but the majority actively farmed (58.7%). Almost all longtime farming residents lived in the region full time (96.7%), grew up in the region (100%), and actively farmed (100%). All longtime nonfarming residents lived in the region full time (100%) and grew up in the region (100%), and none of them actively farmed.

Age distribution was generally similar across owner type, but longtime farming residents included more respondents under the age of 39 (Table 4). In addition, newcomers and longtime nonfarming residents had more respondents between the ages of 40 and 59 and over 80 than the other types. Although gender across clusters was generally similar, newcomers had the greatest percentage of female respondents and longtime farming residents had the greatest percentage of male respondents. Percentages were also similar for those who are retired in each cluster, though newcomers had a slightly higher percentage.

Absentee and vacationers, and newcomers had higher percentages of respondents with bachelor's or graduate degrees (60% and 71.1%, respectively) compared to longtime farming (40.7%) and nonfarming residents (31.9%). These groups also had a higher percentage of respondents that make more than \$100,000 per year, (38.3% and 47.4%, respectively) compared to 23% of longtime farming residents and 20% of longtime nonfarming residents. Absentee and vacationers had the highest percentage of respondents making more than \$150,000 and newcomers had the highest amount making \$100,000 to \$149,999. Longtime farming residents had the highest percentage that make \$50,000 to \$99,999 per year, and longtime nonfarming had the highest percentage earning \$25,000 to \$49,999 per year.

Owner types also differed in terms of their experience harvesting NTFPs, the frequency they visited their woods, and their reasons for owning land (Table 5). Newcomers and longtime farming residents had the greatest percentage of respondents who had harvested NTFPs in their woods (37.2% and 33.9%, respectively) compared to longtime nonfarming (21.6%) and absentee and vacationers (7.4%). Newcomers had the greatest percentage of respondents who visited their land often or all the time (83.7%), followed by longtime farming residents (67.9%) and longtime nonfarming residents (65.9%). Absentee and



**Table 3.** Four types of family forest owners from 14 Southwest Virginia counties. Types were determined by two-step cluster analysis using survey measurements of residency, personal regional history, and farming status. The percent and number of respondents for each variable are listed for each owner group.

Variables	Categories	Family Forest Owner Types ( <i>n</i> = 262)			
		Absentee and Vacationers (23.3%) ( <i>n</i> = 61)	Newcomers (17.6%) ( <i>n</i> = 46)	Longtime Farming Residents (22.9%) ( <i>n</i> = 60)	Longtime Nonfarming Residents (36.3%) ( <i>n</i> = 95)
Live in SW VA	Full time	0% ( <i>n</i> = 0)	93.5% ( <i>n</i> = 43)	96.7% ( <i>n</i> = 58)	100% ( <i>n</i> = 95)
	Part time	14.8% ( <i>n</i> = 9)	2.2% ( <i>n</i> = 1)	3.3% ( <i>n</i> = 2)	0% ( <i>n</i> = 0)
Grew up in SW VA	No	85.2% ( <i>n</i> = 52)	4.3% ( <i>n</i> = 2)	0% ( <i>n</i> = 0)	0% ( <i>n</i> = 0)
	Yes	34.4% ( <i>n</i> = 21)	0% ( <i>n</i> = 0)	100% ( <i>n</i> = 60)	100% ( <i>n</i> = 95)
Farm	No	65.6% ( <i>n</i> = 40)	100% ( <i>n</i> = 46)	0% ( <i>n</i> = 0)	0% ( <i>n</i> = 0)
	Yes	0% ( <i>n</i> = 0)	41.3% ( <i>n</i> = 19)	100% ( <i>n</i> = 60)	0% ( <i>n</i> = 0)
	No	100% ( <i>n</i> = 61)	58.7% ( <i>n</i> = 27)	0% ( <i>n</i> = 0)	100% ( <i>n</i> = 95)

**Table 4.** Demographics and characteristics of respondents in four types of family forest owners from fourteen Southwest Virginia counties. Percent or mean are reported for each category.

Variables	Categories	Absentee and Vacationers (%) ( <i>n</i> = 61)	Newcomers (%) ( <i>n</i> = 46)	Longtime Farming Residents (%) ( <i>n</i> = 60)	Longtime Nonfarming Residents (%) ( <i>n</i> = 95)
Age (year)	≤39	1.8% ( <i>n</i> = 1)	2.3% ( <i>n</i> = 1)	5.2% ( <i>n</i> = 3)	2.2% ( <i>n</i> = 2)
	40 to 59	30.9% ( <i>n</i> = 17)	36.4% ( <i>n</i> = 16)	25.9% ( <i>n</i> = 15)	33% ( <i>n</i> = 30)
	60–79	60% ( <i>n</i> = 33)	50% ( <i>n</i> = 22)	63.8% ( <i>n</i> = 37)	53.8% ( <i>n</i> = 49)
	≥80	7.3% ( <i>n</i> = 4)	11.4% ( <i>n</i> = 5)	5.2% ( <i>n</i> = 3)	11% ( <i>n</i> = 10)
Gender	Female	28.1% ( <i>n</i> = 16)	31.8% ( <i>n</i> = 14)	22% ( <i>n</i> = 13)	28.6% ( <i>n</i> = 26)
	Male	71.9% ( <i>n</i> = 41)	68.2% ( <i>n</i> = 30)	78% ( <i>n</i> = 46)	71.4% ( <i>n</i> = 65)
Education	High school or less	10% ( <i>n</i> = 6)	8.9% ( <i>n</i> = 4)	30.5% ( <i>n</i> = 18)	29.7% ( <i>n</i> = 27)
	Some college	20% ( <i>n</i> = 12)	13.3% ( <i>n</i> = 6)	15.3% ( <i>n</i> = 9)	23.1% ( <i>n</i> = 21)
	Associates/Tech degree	10% ( <i>n</i> = 6)	6.7% ( <i>n</i> = 3)	13.6% ( <i>n</i> = 8)	15.4% ( <i>n</i> = 14)
	Bachelor's degree	28.3% ( <i>n</i> = 17)	42.2% ( <i>n</i> = 19)	28.8% ( <i>n</i> = 17)	19.8% ( <i>n</i> = 18)
Income	Graduate degree	31.7% ( <i>n</i> = 19)	28.9% ( <i>n</i> = 13)	11.9% ( <i>n</i> = 7)	12.1% ( <i>n</i> = 11)
	≤\$24,999	4.2% ( <i>n</i> = 2)	10.5% ( <i>n</i> = 4)	10.4% ( <i>n</i> = 5)	12.9% ( <i>n</i> = 9)
	\$25,000–\$49,999	21.3% ( <i>n</i> = 10)	18.4% ( <i>n</i> = 7)	14.6% ( <i>n</i> = 7)	40% ( <i>n</i> = 28)
	\$50,000–\$99,999	36.2% ( <i>n</i> = 17)	23.7% ( <i>n</i> = 9)	52.1% ( <i>n</i> = 25)	27.1% ( <i>n</i> = 19)
Retired	\$100,000–\$149,999	10.6% ( <i>n</i> = 5)	31.6% ( <i>n</i> = 12)	14.6% ( <i>n</i> = 7)	10% ( <i>n</i> = 7)
	≥\$150,000	27.7% ( <i>n</i> = 13)	15.8% ( <i>n</i> = 6)	8.3% ( <i>n</i> = 4)	10% ( <i>n</i> = 7)
Harvested NTFPs	Yes	50.8% ( <i>n</i> = 30)	59.1% ( <i>n</i> = 26)	51.7% ( <i>n</i> = 31)	54.8% ( <i>n</i> = 51)
	No	49.2% ( <i>n</i> = 29)	40.9% ( <i>n</i> = 18)	48.3% ( <i>n</i> = 29)	45.2% ( <i>n</i> = 42)
Visit woods	Yes	7.4% ( <i>n</i> = 4)	37.2% ( <i>n</i> = 16)	33.9% ( <i>n</i> = 19)	21.6% ( <i>n</i> = 19)
	No	92.6% ( <i>n</i> = 50)	62.8% ( <i>n</i> = 27)	66.1% ( <i>n</i> = 37)	78.4% ( <i>n</i> = 69)
	Often-all the time	14.8% ( <i>n</i> = 8)	83.7% ( <i>n</i> = 36)	67.9% ( <i>n</i> = 38)	65.9% ( <i>n</i> = 58)
Reasons for owning land	Sometimes	38.9% ( <i>n</i> = 21)	14% ( <i>n</i> = 6)	28.6% ( <i>n</i> = 16)	19.3% ( <i>n</i> = 17)
	Rarely-never	46.3% ( <i>n</i> = 25)	2.3% ( <i>n</i> = 1)	3.6% ( <i>n</i> = 2)	14.8% ( <i>n</i> = 13)
	Nonconsumptive	84.6% ( <i>n</i> = 44)	83.7% ( <i>n</i> = 36)	73.6% ( <i>n</i> = 39)	76.7% ( <i>n</i> = 66)
	Consumptive	15.4% ( <i>n</i> = 52)	16.3% ( <i>n</i> = 7)	26.4% ( <i>n</i> = 14)	23.3% ( <i>n</i> = 20)

\*Total *n* within categories does not always add up do total *n* within the clusters due to nonresponse for certain variables.

**Table 5.** Descriptive statistics pertaining to parcel size, forest size, and percent of parcel that is forested for four types of family forest owners from fourteen Southwest Virginia counties.

Cluster	Descriptive	Parcel Size (acres)	Forest Size (acres)	% Parcel Forested
Absentee and vacationers ( <i>n</i> = 61)	Median	27.6	20.1	88.7
	Stdev	52.9	38.8	16.7
	Min	5.5	5.0	27
	Max	294.5	178.1	100
Newcomers ( <i>n</i> = 46)	Median	28.6	18.8	79.0
	Stdev	84.0	73.1	20.0
	Min	5.0	5.0	32
	Max	537.0	469.6	100
Longtime farming residents ( <i>n</i> = 60)	Median	48.4	19.3	61.2
	Stdev	79.0	46.9	27.0
	Min	9.2	6.3	4
	Max	356.8	207.9	100
Longtime nonfarming residents ( <i>n</i> = 93)	Median	27.0	18.7	76.4
	Stdev	41.9	34.1	24.4
	Min	5.2	5.2	12
	Max	218.2	182.8	100

vacationers had the greatest percentage of respondents who visited their woods rarely to never (46.3%) or sometimes (38.9%). Absentee and vacationers, and newcomers had a greater percentage of members reporting nonconsumptive reasons for owning land (84.6% and 83.7%, respectively) when compared to longtime farming and longtime nonfarming residents (73.6% and 76.7%, respectively).

Parcel size, forest size, and percent of parcel forested differed between each owner type (Table 6). Longtime farming residents had the largest parcels (48.4 median acres), but shared similar forest sizes with other types because their parcels had a smaller percentage of forest area (61.2%). Absentee and vacationers had slightly larger percentages of forested area (88.7%) compared to newcomers (79%) and longtime nonfarming residents (76.4%).

Kruskal-Wallis test results indicated that forest owner clusters did not differ significantly with respect to their interest in forest farming and leasing likelihood (Table 6). However, trends among the types were apparent. Longtime nonfarming residents (43.6%) were less interested in forest farming than longtime farming (48.3%), absentee and vacationer (49.1%) and newcomer (51.1%) residents. Further, newcomers had fewer who reported disinterest in forest farming (15.6%) than other groups (absentee and vacationers 32.8%, longtime farming 28.3%, longtime nonfarming 34%). When it came to leasing, absentee and vacationers more often selected higher levels of leasing likelihood (47.5%), followed by longtime farming

residents (37.3%), newcomers (29.5%) and longtime nonfarming residents (30.5%).

## Discussion

Close to half of the family forest owners in this study were either interested or highly interested in forest farming (45.4%). This percentage is higher than rates of interest in forest farming observed in northern Florida (40%), Missouri (38.6%), and Pennsylvania (38.6%) (Workman et al. 2003, Strong and Jacobson 2005, Barbieri and Valdivia 2010). In terms of land base, interested or highly interested owners accounted for 46.6% of the forested acreage among all respondents, which could mean a significant amount of land available for forest farming of NTFPs and the potential for adding value to the forests of Appalachia (Frey et al. 2020).

Thirty-six percent of family forest owners in this study were interested in leasing a portion of their land for forest farming. These owners possessed 43.4% of the forested acreage among respondents. This potential is similar to that among forest owners in the South (30%) who rent land for grazing, hunting, and timber production (Butler et al. 2008). It also points to the existence of a potential form of forest leasing that has not been explored as a broad strategy in the study region. Interestingly, the percentage of forested acreage tied to owner respondents who reported being likely or highly likely to lease forestland for forest farming is higher than the proportion (35%)

**Table 6.** Kruskal-Wallis tests for statistical significance between four types of family forest owners from fourteen Southwest Virginia counties regarding forest farming interest and likelihood of leasing. Mean scores reported for each type also are reported.

Variable	Type Means				Kruskal-Wallis Test	
	Absentee and Vacationers ( <i>n</i> = 61)	Newcomers ( <i>n</i> = 46)	Longtime Farming Residents ( <i>n</i> = 60)	Longtime Nonfarming Residents ( <i>n</i> = 95)	<i>t</i> -Statistic	Asymptomatic Significance
Forest farming interest <sup>a</sup>	3.08	3.47	3.35	3.05	2.63	0.45
Likelihood of leasing <sup>b</sup>	3.25	2.75	2.90	2.68	5.54	0.14

<sup>a</sup>Response scale is 1 to 5 with 1 being not interested at all and 5 being extremely interested.

<sup>b</sup>Response scale is 1 to 5 with 1 being not at all likely and 5 being extremely likely.

of agricultural land rented in Appalachia (Bigelow et al. 2016).

Twenty-five percent of the respondents who were interested or highly interested in forest farming also were likely or highly likely to lease their land for this practice, which differs from trends in farmland rentals across the US, where only 8% is rented by owners who also farm (Bigelow et al. 2016). Most people who rent farmland are not actively involved in farming themselves, but similar rates of interest in forest farming and leasing among respondents indicates that an additional level of agreement and social cooperation may be necessary to navigate lease terms and balance the potential of collaborative forest farming.

Trends of absenteeism and amenity migration were apparent in our study with clear differences between family forest owner types based on residency and farming status, yet some differences also existed within the groups. For example, the percentage of absentee and vacationer respondents reported in our study is similar to that of the national average (Butler and Leatherberry 2004, Butler et al. 2007). Further, although almost all newcomers lived full time in the region, a small percentage resided part time or not at all in the study area. It is possible those residents may have purchased land for vacation purposes, but also may intend to live there full time in the future (Stewart 2002).

Just over half of the newcomers indicated that they farm, which reflects diversity among amenity migrants, some of whom want to farm, whereas others move to the region for scenery, a rural lifestyle, or to raise a family (Kendra and Hull 2005). This trend may also factor into why longtime residents were more

likely than newcomers and absentee and vacationers to own land for consumptive reasons, such as income and investment. Though lower, longtime farming and nonfarming residents also regularly reported nonconsumptive over consumptive forest ownership values, which deviates from extractive characterizations of longtime resident land use (e.g., Law and McSweeney 2013) and acknowledges, similar to others studies, that motivations of land ownership often span across both consumptive and nonconsumptive goals (Salamon et al. 1997, Butler et al. 2007, Majumdar et al. 2009, Kuipers et al. 2013). Our finding of interest among all owner types, despite differences in motivations, differs from other agroforestry studies that found owners more interested in agroforestry focused more on nonconsumptive motivations (Arbuckle et al. 2009, Valdivia and Poulos 2009, Barbieri and Valdivia 2010, Trozzo et al. 2014b).

Newcomers differed slightly from other types of family forest owners in terms of gender, retirement status, and forest visitation. They had greater numbers of females, especially compared to longtime farming residents, which may be a product of recent growth in female farmers in the US (Perdue and Hamer 2019). Newcomers also have a slightly higher percentage who are retired, perhaps reflecting the fact that many amenity migrants are retirees (Nelson et al. 2004). They also had the greatest percentage that frequently visited their forest. Some of this could be related to the novelty of ownership among new residents and that natural and lifestyle amenities are a major draw (Kendra and Hull 2005, Butler et al. 2007, Butler et al. 2016a).

A substantial portion of longtime farming and nonfarming residents also frequently visited their

forest, perhaps due to proximity or longstanding cultural traditions (Lake et al. 2018). However, longtime nonfarming residents were less likely to report harvesting NTFPs, which may be due to the fact that they are not as actively involved in production as longtime farming residents and many of the newcomers. It also may be a natural outgrowth for farmers who are curious about products they can harvest from forestland (MacFarland et al. 2017).

Despite different rates of forest visitation, all owner types possessed a similar median amount of forested acres, which indicates limited disproportionality of ecosystem impact from potential forest farming adoption of any one owner type, which is not always the case (Trozzo et al. 2014b). Longtime farming residents tended to own larger parcels, similar to trends found elsewhere (Butler and Leatherberry 2004, Rickenbach and Kittredge 2009). However, due to smaller percentages of forest cover, often in relation to open agricultural land, they owned similar amounts of forested acreage when compared to other owner types. Absentee and vacationers owned parcels with the greatest amount of forest cover, which could be a product of secondary residences that do not include additional land uses. Either way, unlike another agroforestry study conducted in the region, it appears parcel size did not factor into interest among owner types (Trozzo et al. 2014a).

Results indicated that owner types were equally interested in forest farming and likely to lease regardless of residency, regional connections, and farming backgrounds. We found the differences in education among owner types did not translate to differences in interest in forest farming and likelihood of leasing, differing from other agroforestry studies that have found education and income positively correlate with interest levels (Pattanayak et al. 2003, Arbuckle et al. 2009) and women potentially having more interest in agroforestry practices (Strong and Jacobson 2005). Overall, interested and likely respondents made up less than half of the owner respondents, but the similarity of their responses between types signaled that potential for forest farming cuts across a broad base of family forest owners in Appalachia. This finding is similar to that of MacFarland et al.'s (2017) meta-analysis, which revealed that interest in agroforestry includes people with a diversity of backgrounds and land management approaches.

Although our study has contributed to a greater understanding of interest levels in forest farming and leasing among forest landowners in Appalachia, we

acknowledge some of its limitations. Whereas early and late respondents were similar across most study variables (e.g., age, gender, likelihood of leasing for forest farming), interest in forest farming was significantly higher among early respondents, suggesting that the rate of interest may taper among nonrespondents, leaving room for the possibility of interest levels in our study being overestimated. Further, although comparing early and late respondents is helpful for understanding nonresponse bias, it is not as robust as comparing nonrespondents to respondents, which would have been more ideal if we had access to alternative contact information or demographic variables for our population.

## Conclusion

Levels of interest in forest farming and likelihood of leasing observed in this study have important implications in the evolution and growth of intentional NTFP supply chains in Appalachia and beyond. Many rural areas in the region and others such as the Ohio River valley and Pacific Northwest experience similar trends in rural demographic fluctuation, distressed forest-dependent economies, and land-use diversity. Although we did not estimate potential production, results of this study suggest that the potential scale of forest farming in the region could be substantial even if only a small portion of family forest owners that are interested eventually take up the practice.

Growth in forest farming also could improve the economic situation in many rural communities, particularly given that studies and anecdotal evidence demonstrate that consumers of NTFPs increasingly seek and pay more for the sustainable and traceable products that are possible through forest farming (Craker and Gardener 2005, Laird et al. 2005). Further, leasing and other agreements could improve access for cultivation among landless forest farmers. Forest farming also may serve as a gateway to more active forest management among family forest owners as they tend to favor nontimber over timber objectives (Butler et al. 2007, 2016a), and more regular attention to the understory through forest farming activities may improve forest ecosystem health and lead to interest in overstory management to support stewardship and cultivation of understory crops (Chamberlain et al. 2019).

Forest farming interest, as shown in this study, cuts across diverse owner objectives and norms and reveals that the practice is worthy of support among forest management professionals and stakeholder

organizations who support family forest owners in Appalachia. Policies and programs that build capacity among technical service providers and forest farmers could create broad impacts to NTFP conservation, forest health, market growth for forest-farmed NTFPs, and profitability for family forest owners. Specifically, technical assistance, education, networking, marketing assistance, cost-share, insurance programs, and land use and economic development policy could increase adoption of this practice (Burkhart and Jacobson 2009, MacFarland et al. 2017, Weiss et al. 2019). Additionally, further research on specifics of cultivation and stewardship of NTFP species and other production and marketing details is important for ensuring sustainability and success of forest farmers (Burkhart and Jacobson 2009, Chamberlain et al. 2019, Frey et al. 2019).

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