



# An Economic Evaluation of the Pennsylvania State Forest System

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## **Executive Summary**

Approximately 58 percent of the land in Pennsylvania is forestland (USDA Forest Service, 2016), and the Pennsylvania state forest system accounts for approximately 13 percent, or 2.2 million acres, of that land (Pennsylvania Department of Conservation and Natural Resources, 2016b). Over two-thirds of Pennsylvania's counties (48 out of 67) have state forestland within their boundaries (Pennsylvania Department of Conservation and Natural Resources, 2016b).

In addition, the entire state is divided into 20 state forest districts so that the Pennsylvania Bureau of Forestry, which is under the Department of Conservation and Natural Resources, can provide technical assistance to private forest landowners, and provide forest-related public services to the general public within the district boundaries.

Pennsylvania forestlands provide economically beneficial forest ecosystem services that include ecological services (e.g., air purification), forest goods (e.g., timber), and socio-cultural benefits (e.g., recreation).

This research explored the economic benefits of the Pennsylvania state forest system and how the system contributes to the well-being of Pennsylvanians. The research also explored current state forest governance practices, including the payment-in-lieu of taxes (PILT) system that was established to provide monetary payments to local government jurisdictions (county, municipal, and school district) that have non-taxable state forestland within their jurisdictions.

To estimate income derived from the state forest system, the researchers compiled and analyzed 5 years of data (2012-2016) from the Bureau of Forestry that detailed sales of state forest goods (e.g., timber, gas and oil). Over the 5-year period, the state forest sold about \$632 million of forest goods, with oil- and gas-related sales accounting for about 80 percent of the total, and timber-related sales accounting for 18 percent of the total. On average, there were 544 bids and 141 timber sales each year. The difference between the minimum bid price and the sale price was about \$62,000, on average.

The researchers also used existing data to conduct economic contribution and impact analyses for recreational trips made to state forestlands. For the contribution analysis, the researchers used existing expenditure data – how much people spend on recreational trips made to state forestlands – from visitor-use-monitoring surveys conducted specifically for Pennsylvania’s state forests (Pennsylvania Department of Conservation and Natural Resources, 2016a). According to the data, the total estimated annual expenditures associated with state forest visitation were nearly \$400 million. The major industries associated with the expenditures were lodging, restaurants, groceries, and gasoline, which accounted for 87 percent of the total. The estimated total economic contribution to Pennsylvania’s economy related to these state forest recreational trips was 5,122 jobs, \$180 million in labor income, \$454.7 million in total output, and \$266.7 million in value-added effects. The data also suggest that for every three jobs created by state forest visitation spending, one additional job will be created in Pennsylvania’s economy; and that every \$1 of direct output resulting from state forest visitation spending generates an additional \$0.89 of output in Pennsylvania’s economy.

For the economic impact analysis, the researchers used existing expenditure data from survey-based estimates of how much out-of-state visitors spent on trip- and equipment-related items for hunting, fishing, and wildlife-watching in Pennsylvania in 2011. The activity was scaled to the level of the state forest system using wildlife tourist survey results (i.e., 16 percent of expenditures were estimated to have been spent on trips to state forestlands). The total estimated annual expenditures associated with state forest visitation were approximately \$93.4 million. The estimated total economic impact to Pennsylvania’s economy of spending related to these out-of-state state forest recreational trips was 1,716 jobs, \$64 million in labor income, \$117.4 million in total output, and \$94 million in value-added effects. The data also suggest that for every three jobs created by out-of-state state forest visitation spending, one additional job will be created in Pennsylvania’s economy; and that every \$1 of direct output resulting from out-of-state state forest visitation spending generates an additional \$1.25 of output in Pennsylvania’s economy.

The researchers also used nonmarket-based research approaches to estimate state forest value. In collaboration with the Penn State Center for Survey Research, the researchers conducted a contingent valuation survey of 609 randomly selected Pennsylvania adults. As part of the survey, respondents were asked how much they would be willing to pay each year in extra state taxes to conserve and expand Pennsylvania state forestlands. Almost two-thirds (62.5 percent) responded that they would be willing to pay something. Of that two-thirds, about half said they would be willing to pay less than \$50 and half said more than \$50. A higher percentage of urban residents (64.8 percent) compared to rural residents (56.2 percent) stated that they would be willing to pay something. The average value, which includes those who were not willing to pay anything, was \$63.12, with a \$5.08 margin of error. The average of just those willing to pay something was \$101.06, with a \$7.36 margin of error. The average for urban residents was \$60.87, with a \$5.16 margin of error, and the average for rural residents was \$69.28, with a \$12.70 margin of error. Survey respondents were also asked how many days they go to a Pennsylvania state forest for recreational activities (in a typical year). The most common response (more than one third of respondents) was less than once a month but greater than a single visit per year (i.e., between two and 11 visits a year). A little less than one third of the respondents indicated that they do not typically visit a state forest at all to recreate. The number of days spent recreating was 13.20 days, on average, with a margin of error of 1.4 days. The number of days for rural residents was 19.15 days per year (4.1 margin of error), on average, with a median of 4 days per year. The number of days, on average, for urban residents was 11.08 days per year (1.2 margin of error), with a median of 4 days per year. The research also found that having personal experience with a state forest improved the odds of being willing to pay something each year in extra state taxes to conserve and expand Pennsylvania state forestlands.

To assess state forest governance practices, the researchers interviewed 55 district and assistant district foresters from each of the 20 state forest districts. Interviews were open and conversational, and included exploring how forest management practices include leveraging stakeholders and how these practices reflect forest value. Similar themes emerged from the interviews, which included how the

multiple roles of the forest manager – while demanding – provide an array of value; how district personnel levels are dwindling and may ultimately affect the ability to govern the forest appropriately; how increasing demands of multiple state forest user groups are many times at odds with one another; and how partnerships with individuals and organizations external to the Bureau of Forestry help to ensure the quality of the state forest system. The researchers also analyzed the Pennsylvania PILT system for state forestland and compared it to 10 peer states. According to data provided by the Bureau of Forestry, in 2016, PILT payments were made to 386 local governments, 158 school districts, and 51 county governments statewide, for a total of \$7.7 million, or about \$2.57 million to each jurisdictional level. The PILT payment was set at \$1.20 per acre per jurisdictional recipient (i.e., \$3.60 total per acre), but has since increased to \$2 per acre per jurisdictional recipient (i.e., \$6 total per acre) per Act 85 of July 13, 2016. The research on state forest PILT systems in 10 peer states suggests that Pennsylvania’s flat-rate of \$6 PILT per acre appears adequate compared to the PILT average-per-acre of peer states. Some states do not have a PILT system at all for state forestland. Those that do tend to have substantially more complicated PILT calculation systems than Pennsylvania’s, but come up with relatively similar payments.

It is important to note that while the research explored multiple aspects of the state forest system, it did not capture the entire value of Pennsylvania’s state forest system. Capturing all values that the state forest system provides to Pennsylvanians was beyond the scope of the study. For example, the research did not consider the value of carbon sequestration or water purification, which are forest services that are estimated at providing billions of dollars in value annually (Virginia Department of Forestry, 2006, 2015; National Association of State Foresters, 2017). Exploring these values in-depth deserves further consideration.

Some policy considerations from the research were to: consider ways to increase individuals’ personal experiences with state forests, especially among those individuals who have not visited a state forest; consider how revenue generated from recreational activity may help offset the increased burdens

of the activity; consider ways to reduce administrative burdens through advances in technology; and consider ways to expand the leveraging of partnerships that support state forest district operations.

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## Introduction

Forestland provides vast tangible and intangible benefits that promote human well-being. These benefits are the result of multiple forest ecosystem services that can be thought of as ecological services (e.g., climate regulation, air purification), goods (e.g., timber, wild game), and socio-cultural benefits (e.g., recreation, furthering science) (Stenger, Harou, & Navrud, 2009). Different types of forest systems provide different types of services. The estimated dollar value of these services varies widely both within and between services, but are generally considerable (Ninan & Inoue, 2013). Estimating the value of a forest system ultimately requires understanding how the multiple forest ecosystem services increase human well-being. Some forest services are priced goods, meaning an estimation of monetary value may be able to be associated with that service (e.g., selling timber). However, many other forest services are unpriced, which complicates value estimation because they are difficult to estimate in monetary values (e.g., climate regulation, recreation) (Krieger, 2001). In addition, there are numerous sources of data and methods of analysis that will produce different indices of “value.” Despite the difficulty in estimating the value of forest services, it is important to attempt to inform policy development that promotes capitalizing on the potential economic benefits the forest provides while doing so in a responsible and sustainable manner (Ostrom, 2009).

There are many conventional research approaches used by economic valuation researchers that measure both market-based economic benefits (i.e., priced goods) (Dahal, Henderson, & Munn, 2015; South Carolina Forestry Commission, 2017a) and nonmarket value (e.g., cultural value) (Virginia Department of Forestry, 2006). Researchers who explore forest valuation suggest that evaluations of forest systems that have policy implications should not overlook nonmarket valuation techniques to present a balanced assessment (Freeman, 2003; Krieger, 2001). Like all forest systems, Pennsylvania’s state forest system provides vast tangible and intangible benefits through multiple goods and services. Research that emphasizes estimates of both priced goods produced by the forest and of its intangible value offers state government – both policy makers and state administration – a multi-pronged perspective

to inform decision making. Of the many forest evaluation studies that have been conducted globally (e.g., Ninan & Inoue, 2013) and in the United States (e.g., Krieger, 2001), the researchers are unaware of studies that have focused specifically on the state forestland in Pennsylvania. This is unfortunate as forestlands are vital to Pennsylvanians: approximately 58 percent of the land in Pennsylvania is forest (USDA Forest Service, 2016); and the Pennsylvania state forest system accounts for approximately 13 percent, or 2.2 million acres, of that forestland (DCNR, 2016b). The state forest system is divided into 20 districts that are spread throughout the state (see map in Appendix A).

In addition to understanding the value of forest systems, there is a need for scientific research on how to ensure forest sustainability so that forests continue to provide value (Ostrom, 2009). Doing so requires analyzing the interactions and relationships between the forest system itself, the resource units it produces (e.g., trees), the system of governance that manages the system (e.g., state government agencies and policies), and the users of the system (e.g., Pennsylvania citizens) (Ostrom, 2009). The primary system of governance for the Pennsylvania state forest system is the Bureau of Forestry (BOF) within the Department of Conservation and Natural Resources (DCNR). A key factor in successful governance of forest systems is the ability to proactively foster government oversight that is adaptive to the demands of local context (Koontz, Gupta, Mudliar, & Ranjan, 2015) – a practice that is difficult without maintaining relationships with stakeholders outside of traditional state government offices. One important relationship involves the payment in lieu of taxes (PILT) system, which is a practice that was established to provide monetary payments to local government jurisdictions (county, municipal, and school district) that have non-taxable state forestland within their jurisdictions. While public lands can offer various economic opportunities to a surrounding community, loss of revenue from taxation on potential properties has been a widespread cause for concern. PILT is an intergovernmental tool used to mitigate this issue by providing a recurring revenue source. Many local governments in Pennsylvania receive PILT payments – over two-thirds of Pennsylvania’s counties (48 out of 67) have state forestland within their boundaries (DCNR, 2016b). Whether a calculated PILT is sufficient to replace property tax revenue is a cause for

debate. A recent increase in the PILT payments that was made part of Pennsylvania's fiscal year 2016-2017 state budget – the Commonwealth currently pays a flat PILT rate of \$2 per acre of state forestland to each of three local government jurisdictions, for a total of \$6 per acre – illustrates the timeliness of the need to review the current system to help assist with determining the adequacy of the increase.

The research conducted within this project provides valuable information on the economic benefits of state forestland from both a market and nonmarket perspective, as well as provides insight on current forest governance practices. It is the hope of the researchers that this information will help inform the planning and management of the Pennsylvania state forest system. Using market-based research approaches, the researchers compiled and analyzed historical data from the Bureau of Forestry that detailed sales of forest goods (e.g., timber, gas and oil). They also used existing data sources to conduct economic contribution and impact analyses of recreational trips made to state forestland. Previous analyses have been conducted that estimate the economic impact of several forest ecosystem products and services, such as forest products (Dahal et al., 2015), sport fishing (Munn, Hussain, Spurlock, & Henderson, 2010; Upneja, Shafer, Seo, & Yoon, 2001), recreational hunting activities (Munn et al., 2010; Poudel, Henderson, & Munn, 2016), and wildlife watching (Munn et al., 2010).

The researchers also used nonmarket-based research approaches to estimate state forest value. Prior research that attempted to estimate non-priced forest services used stated preference methods – “any survey-based study in which respondents are asked questions that are designed to reveal information about their [respondents] preferences or values” (Freeman et al., 2014, p. 383). The researchers conducted a contingent valuation (CV) survey – a stated-preference method that requires respondents to place a monetary value on a public good or service in a hypothetical situation – with randomly selected adult Pennsylvanians. They also examined the impacts of research conducted on state forestland. Such research has been viewed as an economic benefit as it increases the availability of useful knowledge and forms networks of learning (Salter & Martin, 2001).

Regarding forest governance practices, the researchers explored how the governance system in Pennsylvania sustains forest value by exploring the relationships between the state system of governance for the forest (i.e., Bureau of Forestry) and those that are impacted by the system (e.g., citizens, local governments). This included exploring how forest management practices include leveraging stakeholders and how these practices reflect forest value; and exploring how the Pennsylvania PILT system, which impacts the relationship between the state and local governments, compares to PILT systems in other states.

## **Goals and Objectives**

The central aim of the research project was to use multiple research approaches to provide insight into how the Pennsylvania state forest system contributes to the well-being of Pennsylvanians (i.e., how it provides value). The project was divided into four projects goals. Each goal was associated with four research areas that provide different insight on the value of the state forest. The research approaches used both quantitative and qualitative data to present a holistic perspective of the value of the state forest system. It is important to note that these research approaches are comprehensive but do not consider all value of the state forests, which is a limitation that is discussed in further detail in the conclusion.

The first goal and associated research approach was to use market-based research approaches to estimate the economic benefits derived from goods produced by the state forest system and to estimate the economic contribution of state forest services (i.e., hunting, fishing, and recreation). The researchers collaborated with the Bureau of Forestry (BOF) to identify and obtain data related to priced goods and services produced by the forest system (i.e., data that details income derived from state forestland usage). This data was analyzed to produce estimates of income derived from state forestland use. The researchers also used IMPLAN to conduct economic impact and contribution analyses of trips made to state forestland using visitor expenditure data from existing sources (i.e., BOF Visitor Use Monitoring Surveys and U.S. Fish and Wildlife National Survey of Fishing, Hunting, and Wildlife-Associated Recreation).

The second goal and associated research approach was to use nonmarket-based research approaches to provide insight on the value of the state forest system. The researchers collaborated with the Penn State Center for Survey Research to include a short contingent valuation (CV) survey in the spring 2017 Penn State Poll. This included asking survey participants what they would be willing to pay for the intangible benefits of state forestland. The researchers analyzed the results of the CV survey and the demographics that are included in the poll. As a separate non-market research approach, the researchers also conducted an analysis of research products (i.e., journal articles, dissertations, theses) that resulted from research projects that were conducted on state forestland.

The third goal and associated research approach was to investigate state forest management practices and how they are related to forest valuation. This involved interviewing district foresters and assistant district foresters in all 20 state forest districts. The researchers conducted a qualitative analysis of the interviews to uncover how state forest management practices relate to adaptive governance and forest valuation.

The fourth goal and associated research approach was to analyze the state's Payment In Lieu of Taxes (PILT) payment system to determine the adequacy of the current system. This involved analyzing PILT payment data received from BOF, researching the legislative history of Pennsylvania's PILT system, and comparing the system with other states' PILT systems. Since states vary in methodology used to calculate PILT payments, the review of PILT methodologies across similarly landscaped states will shed light on the adequacy of Pennsylvania's system.

## **Methodology**

### **Project Goal One: Utilize Market-based Research Approaches**

The research team met with BOF employees to discuss data that is available that would detail priced goods and services that come from the state forest system. Based on these conversations, BOF gathered data across multiple BOF program areas and provided it to the research team. The team

reviewed the data and associated BOF reports to determine potential data elements to analyze and report. The data spans 5 years (2012-2016) and was managed and analyzed using Microsoft Excel and Access. The primary objective was to analyze the data to estimate the income derived from priced state forest goods and services across the 5 years of data. Data reviewed was related to timber sales, firewood sales, oil and gas land leases and royalties, right-of-way requests, land and water use agreements, leased campsites, and state-owned cabin leases. Totals and averages were calculated per year and for the 5-year aggregated time span. The timber sale data was the most detailed and afforded the research team the ability to create additional timber-based measures (e.g., average difference between minimum bid and awarded bid prices). Aggregate income totals were not adjusted for inflation.

An additional objective of goal one was to use IMPLAN – a widely used input-output economic modeling tool – to conduct economic contribution and impact analyses of trips made to state forestland for hunting, fishing, and other recreation activities. Economic contribution analysis refers to understanding how activities that originate within a region contribute to that regional economy. In terms of this research, it refers to how general visitation to a Pennsylvania state forest contributes to Pennsylvania’s economy. Economic impact analysis refers to understanding how activity that originates outside the region impacts a regional economy. In terms of this research, it refers to how visitation to a Pennsylvania state forest from out-of-state individuals impacts Pennsylvania’s economy.

The IMPLAN modeling process produced annual dollar estimates of the direct, indirect, and induced effects of the economic contribution and impact of state forest trips to Pennsylvania’s economy (IMPLAN Group LLC, 2015). Direct effects represent the economic activity in industries directly supported by state forest visitor expenditures (e.g., lodging, sporting goods). Indirect effects represent the inter-industry effects of those expenditures, such as hotels where visitors are staying pay utility companies to keep the lights on. Induced effects represents the economic activity created by individuals employed in industries supported by visitor expenditures (e.g., employees buying groceries and paying

rent). The research team modeled the annual economic contribution and impact of the state forest system on Pennsylvania using the IMPLAN Pennsylvania State Total data file.

The researchers used two different sources of input data for the IMPLAN modeling. The first was BOF Visitor Use Monitoring (VUM) Surveys (DCNR, 2016a), which were used for the contribution analysis. The VUM surveys are an in-depth and systematic approach to monitoring recreation on Pennsylvania state forests that includes exploring “visitors’ use patterns... expectations, spending patterns, desires, and satisfaction levels” (DCNR, 2016a). Part of the VUM survey process involves surveying state forest visitors about trip expenditures and estimating visitation patterns based on traffic counts on state forestland (see DCNR, 2016a for detailed VUM reports that describe the VUM survey process and complete results). The research team used visitor expenditure data and annual recreation visitation estimates from 10 districts with a completed VUM survey (i.e., Buchanan, Delaware, Elk, Forbes, Michaux, Moshannon, Sproul, Susquehannock, Tiadaghton, and Tioga). To reach estimates for the entire state forest system, the researchers used the annual estimated average expenditures of the 10 known districts for the remaining 10 unknown districts (i.e., Tuscarora, Rothrock, Gallitzin, Bald Eagle, Clear Creek, Pinchot, Cornplanter, William Penn, Weiser, and Loyalsock).

The data collection and estimation process is consistent across all surveys (see any one of the VUM survey reports for a detailed description of expenditure data collection and the visitation estimation process; DCNR, 2016a). The definition of a “recreation visit” to a state forest is broad. The VUM surveys provide the following explanation:

A State Forest recreation visit is defined as “one person entering and exiting a State Forest for the purpose of recreation” (English et al., 2001). A single visitor may participate in any number of activities and visit any number of sites within a single visit. Also, a single visit can last multiple days or might be one person or group visiting a single site on a day trip for any amount of time. (DCNR, 2016a)

There are 10 expenditure categories in the VUM surveys that were matched with IMPLAN industry sectors. The matching is not an exact process – certain expenditure categories may plausibly be

matched with different industry sectors. The matching process was informed by prior IMPLAN analyses of outdoor recreation (Poudel, Henderson, & Munn, 2016) and studies of Pennsylvania recreation (McGrath, Primm, & Lafe, 2016). All expenditures except outfitter-related expenses were matched to a single IMPLAN industry. Outfitter-related expenses were equally divided into two different IMPLAN industries. Table 1 displays the matched expenditures and IMPLAN industries.

*Table 1: VUM Expenditures Matched with IMPLAN Industry Sectors*

<b>VUM Survey Expenditure Category</b>	<b>IMPLAN Industry Sector Name</b>	<b>IMPLAN ID</b>
Motel, Lodge, Cabin, B&B, etc.	Hotels and motels, including casino hotels	499
Camping Fees	Other accommodations	531
Restaurants & Bars	Full-service restaurants	501
Groceries	Retail - Food and beverage stores	400
Gasoline and oil	Retail - Gasoline stores	402
Local Transportation (bus, shuttles, etc.)	Transit and ground passenger transportation	412
Outfitter Related Expenses (guide fees and equipment rentals)	Employment services (guide fees)	464
	General and consumer goods rental except video tapes and discs (equipment rentals)	443
Outdoor Recreation and Entertainment (park fees, movies, mini-golf, etc.)	Other amusement and recreation industries	496
Sporting Goods	Retail - Sporting goods, hobby, musical instrument and book stores	404
Souvenirs, Clothing, Other Misc.	Retail - General merchandise stores	405

*Source: Expenditures (DCNR, 2016a); IMPLAN sector and ID (IMPLAN Group LLC, 2015).*

The researchers calculated estimated annual expenditures for each expenditure category for each district with VUM data available. This was completed by first multiplying the average amount spent by all visitors in an expenditure category by the annual estimated state forest recreational visits to that particular forest district. Table 2 is an example district. Total annual expenditures for each category for the entire state forest system was calculated by summing the total annual expenditures per category across the entire state forest system (i.e., 10 forest districts with VUM survey data and 10 districts matched to similar districts that had VUM survey data available). By using individual district expenditures and visitation estimates, the researchers created a weighted model that is more accurate than a model that uses expenditure averages across districts multiplied by an average of visits across districts. This method

places more importance on the expenditure amounts in districts with large annual estimated state forest recreational visits (e.g., Michaux with 338,103 visits) than those with smaller estimated visits (e.g., Delaware with 88,726 visits).

*Table 2: VUM Expenditure IMPLAN Model Example*

<b>Delaware State Forest</b>	<b>Average Amount Spent for All Visitors</b>	<b>Estimated Annual Recreational Visits</b>	<b>Total Annual Expenditures</b>
Motel, Lodge, Cabin, B&B, etc.	\$10.50	88,726	\$931,623.00
Camping Fees	\$0.00	88,726	\$0.00
Restaurants & Bars	\$20.73	88,726	\$1,839,289.98
Groceries	\$19.05	88,726	\$1,690,230.30
Gasoline and oil	\$29.83	88,726	\$2,646,696.58
Local Transportation	\$0.00	88,726	\$0.00
Outfitter Related Expenses (Guide fees)	\$0.21	88,726	\$18,632.46
Outfitter Related Expenses (Equipment rentals)	\$0.21	88,726	\$18,632.46
Outdoor Recreation and Entertainment	\$1.25	88,726	\$110,907.50
Sporting Goods	\$3.15	88,726	\$279,486.90
Souvenirs, Clothing, Other Misc.	\$2.50	88,726	\$221,815.00

*Source: Modified from VUM surveys (DCNR, 2016a).*

The total annual expenditures per expenditure category for the entire state forest system were entered into IMPLAN as industry change events, with the expenditure dollar amounts reflected in industry sales. The event year selected for each event was 2014 – the VUM surveys were collected between 2012 and 2016, and 2014 was both the average and median event year when considering all 20 districts. For the four industry sectors that were retail trade sectors, the event value selected was gross retail sales (i.e., what is paid by a customer as shown on a receipt) as this is the value collected through the VUM surveys. Local purchase percentages – amount of the industry sale that occurred within the study region – were set at 100 percent since the expenditure data was collected for expenditures made within 50 miles of the state forest site (i.e., how much VUM respondents reported that they spent within 50 miles of the forest; DCNR, 2016a), which largely fall within the study region (i.e., Pennsylvania). Since no information other than categorical expenditures was available, no further adjustments were made

to the industry change events. IMPLAN estimates the remaining event values (i.e., employment, employee compensation, and proprietor income) based on IMPLAN's regional data.

The second data source was the Pennsylvania-specific results of the U.S. Fish and Wildlife 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Census Bureau, 2015). This data was used as the input data for the impact analysis because it contained annual expenditure estimates for recreational trips made by out-of-state visitors. This analysis was limited to out-of-state- visitors because doing so affords the ability to focus solely on money coming into Pennsylvania's economy that would not have otherwise been spent in Pennsylvania. The survey estimated that 10 percent of the hunters, 19 percent of the anglers (i.e., fishers), and 38 percent of the wild-life watchers were nonresidents of Pennsylvania (U.S. Census Bureau, 2015). The expenditures are survey-based estimates of how much out-of-state visitors spent on trip- and equipment-related items to hunting, fishing, and wildlife-watching in Pennsylvania in 2011. The expenditures are based on all hunting, fishing, and wildlife-watching activities within Pennsylvania, thus the activities needed to be scaled to the level of the state forest system. The researchers estimated the scaling by using results from the 2016 Pennsylvania Wildlife Tourist Survey (Ryan, 2017), a research project sponsored by the Center for Rural Pennsylvania. The survey asked respondents which types of land in Pennsylvania they typically use for outdoor wildlife activities. Sixteen percent of respondents indicated they use state forestland. This 16 percent was applied to each individual expenditure estimate to estimate the amount spent on trips to state forestlands.

The researchers followed a similar expenditure-to-IMPLAN-sector categorization process as was done with the VUM survey data that was informed by previous research (Poudel et al., 2016; McGrath et al., 2016). However, the expenditure data in the U.S. Fish and Wildlife survey is substantially more detailed than the VUM survey data and is split between fishing, hunting, and wildlife-watching expenditures. The researchers kept the expenditures separate while categorizing, but included all expenditures from hunting, fishing, and wildlife-watching in the same final model. The entire model expenditure and IMPLAN sector categorization is provided in Appendix B. In summary, there were eight

trip-related expenditure categories for hunting, fishing, and wildlife watching (e.g., food, lodging); two additional trip-related expenditure categories for fishing (e.g., bait); 11 equipment-related expenditure categories for hunting (e.g., firearms); six equipment-related expenditure categories for fishing (e.g., fishing rods); and 10 equipment-related expenditure categories for wildlife-watching (e.g., binoculars). After applying the 16 percent state forest modifier, the survey data suggests that out-of-state residents spent approximately \$56.2 million on trip-related expenditures (\$5.6 million on hunting, \$15.8 million on fishing, and \$34.7 million on wildlife-watching), and \$37.2 million on equipment-related expenditures (\$9.1 million on hunting, \$7.5 million on fishing, and \$20.6 million on wildlife-watching).

The input of data into IMPLAN followed a similar process as the VUM survey data. The primary difference was that all expenditures were entered as 2011 event year activities as the survey data was collected for 2011 expenditures.

## **Project Goal Two: Utilize Nonmarket-based Research Approaches**

The first nonmarket-based research approach was a contingent valuation (CV) survey. The purpose of the CV survey was to estimate the value of the state forest system from the perspective of Pennsylvania citizens. The CV method relies on a brief survey that includes explaining to respondents what they are being asked to value (i.e., the intangible benefits of the state forest system) and how much they would be willing to pay for what they are being asked to value.

The CV survey was conducted by the Penn State Center for Survey Research at Penn State Harrisburg (CSR) as part of its spring 2017 Penn State Poll. The poll is a telephone survey of adult (aged 18 or older) Pennsylvania citizens. The sample drawn for the poll used a dual-frame approach consisting of both a representative RDD (random-digit-dial) landline telephone sample and a RDD cell phone sample. Marketing Systems Group (MSG) of Horsham, Pennsylvania constructed the sample frames. The landline sample consisted of telephone numbers selected at random from all zip codes throughout Pennsylvania using a random-digit-dial sampling procedure. This type of sample frame is a single stage EPSEM (equal probability of selection method). Although this sampling technique includes working,

non-working, unassigned, and business telephone numbers, it guarantees that every residential landline telephone number (listed, unlisted, and non-published) in Pennsylvania has an equal chance of being selected. This allows for generalizability to the Pennsylvania population with landline telephones. To minimize bias of a sample that relies solely on landlines, CSR completed interviews with respondents from both RDD landline and RDD cell sample frames. Working, non-working, and unassigned cell phone numbers were included in the sample to ensure that all cell phone numbers had an equal chance of being selected. The geographic characteristics associated with cell phone numbers are broad due to the portability of numbers and a subscriber's ability to choose an area code regardless of his/her location of residence. Because of these circumstances, there is geographic uncertainty when the sample is pulled. As a result, CSR screened for geography to ensure that all participants actually resided in Pennsylvania. The poll took place between March 8 and April 18, 2017 and was conducted by a trained interviewing team who used state-of-the-art surveying technology (Center for Survey Research, 2016).

CV surveys can be conducted via mail, telephone, or in-person, each with their advantages and disadvantages (Boyle, 2003). The research team chose to conduct the CV survey by using the CSR Penn State Poll for multiple reasons. For example, the format of a brief CV survey was able to fit into a telephone poll format, the poll is conducted over a short period of time, CSR guarantees a relatively large sample size, and participating in an omnibus poll helps defray costs of conducting such large telephone (or mail) surveys independently.

The research team designed the CV survey (see Appendix C) based on recommendations from the expansive literature on CV methodology (Freeman, Herriges, & Kling, 2014) and consulted with the survey experts from the CSR when finalizing the CV survey to create a survey that would best illicit responses when being conducted by telephone. A typical CV survey can be broken-down into three parts: the introduction, the willingness-to-pay (WTP) question, and supplemental questions that are asked to support the survey results. The introduction briefly describes the good or service being valued in a neutral

fashion. The service being valued in the current survey was the ecological services provided by the state forest system (e.g., water purification).

The WTP question used in the survey was an open-ended elicitation format – respondents were asked to provide a dollar value and were not provided dollar value options. The open-ended format was most adaptable to a uniform, large-scale telephone survey as other types of elicitation formats (e.g., offering respondents progressively decreasing or increasing dollar values) were not. In addition, the open-ended format affords relatively straight-forward analysis.

Supplemental questions in CV surveys typically involve basic demographic questions. This information was collected as part of the larger poll and included age, sex, race, ethnicity, education, income, political affiliation, and geographic location. The research team also included three supplemental questions specific to the CV survey: two attitudinal questions – one regarding government’s role in environmental improvement (Wiser, 2007) and one regarding the importance of the public service being valued (Donahue & Miller, 2006) – and a question that assessed the respondent’s experience with the public service being valued (Donahue & Miller, 2006; Stenger, Harou, & Navrud, 2009). These questions were included to provide additional insights on respondents’ characteristics in relationship to their WTP responses.

Upon completion of the poll, CSR provided to the research team formatted results of CV survey and poll demographic questions. The research team calculated a rural/urban variable for each respondent using his/her reported county of residence. The team applied the rural/urban definition used by the Center for Rural Pennsylvania (2014): “A county or school district is rural when the number of persons per square mile within the county or school district is less than 284.” A list of the rural and urban counties is provided in Appendix D. Frequencies and descriptive statistics for demographic and CV questions were calculated using IBM SPSS Statistics 24. The research team also conducted statistical tests (i.e., logistic regression modeling) to determine which respondent characteristics best predicted how a respondent

answered the WTP question (i.e., whether they would or would not be willing to pay anything greater than \$0 each year in extra state taxes to conserve and expand Pennsylvania's state forestlands).

In addition to the CV survey, a second non-market research approach was conducted. This involved analyzing research products (i.e., scholarly journal articles, doctoral dissertations, master's theses) that resulted from research projects that were conducted on state forestland. The research team received data from the BOF that was associated with State Forest Research Agreements (SFRAs) that were filed with the BOF from 2008 through 2016. SFRAs are submitted to BOF by researchers seeking to use state forestlands to conduct various types of research. The SFRAs are reviewed and approved or denied. The research team used data from the SFRAs (i.e., project title, primary and secondary researcher name, primary and secondary researcher email, and affiliated institution) to determine whether research products resulted from the corresponding research projects. The research team also reviewed information provided from BOF related to research projects funded by the BOF to provide the bureau with practical solutions to problems regarding forest management. Most of these projects result in useful applied knowledge for the bureau to use for forest management guidelines or policy, and not in formal academic research products (e.g., journal articles), yet some result in both. The "Long Term Oak Regeneration and Dominance" project was selected by the research team to highlight an example of a BOF-funded project that resulted in both applied knowledge for BOF and academic research products.

The methodology for exploring the SFRA research followed that of Belter (2013). The research team conducted both an article-search method and an author-identification method. Based on conversations with BOF staff it was understood that much of the research conducted on state forestland is applied research, such that the results are typically provided to the public or research funders rather than articles produced for scholarly journals. To capture these publicly available reports, the researchers conducted the article-search using Google Scholar, which was selected because it contains records of various non-academic reports that are not included in typical academic article databases (e.g., Web of Science). The research team used the SFRA project title and researchers' names to identify potential

articles or reports associated with the research. Products that were identified by one research team member were verified by an additional team member. Articles or reports were searched for indication that data used in the research was obtained (at least in part) from Pennsylvania state forestlands.

The author-identification method involved communicating with the researchers for each SFRA project. Researchers' email addresses were included as part of most SFRA records. In cases where a researcher's email address was unavailable, the research team used the researcher's name and organizational affiliation (e.g., university) to search the internet for a current email address. The research team emailed researchers and asked them to identify research products that resulted from the SFRA project. This method afforded the opportunity to confirm products discovered from the article-search method as well as add additional products that were not discovered prior to contacting the authors.

Data collected from the article-search and author-identification methods were entered into a Microsoft Excel spreadsheet with the associated SFRA records. Web links to found research products and Google Scholar citation counts were recorded for each identified product. Research products that were scholarly journal articles were also searched and marked within Web of Science, which is an online multi-disciplinary citation indexing service that is like Google Scholar but is more stringent in terms of scholarly quality of citations. The articles that were found in Web of Science were grouped by SFRA year and were then analyzed by the service's built-in research tools to identify citation counts and general category of the article.

### **Project Goal Three: Investigate State Forest Management Practices**

Qualitative interviews were conducted with district and assistant district foresters of the DCNR Bureau of Forestry to explore state forest management from individuals on the "front lines" of forest management. These individuals were selected because they were assumed to be knowledgeable and experienced in state forest management, which was expected to result in rich information collection. There is one district forester per district who is responsible for the overall planning and operation of the district. Most districts have two assistant district foresters (some have one or three) who are responsible

for assigned program areas (e.g., maintenance, timber, recreation, etc.). Interviews were scheduled with each of the 20 state forest district offices with the assistance of the assistant state forester. Most interviews were conducted in-person, and telephone interviews were used when scheduling difficulties arose. In-person interviews are generally preferred over telephone as they generally produce richer qualitative information, yet telephone interviews have merit and are more practical at times than scheduling in-person interviews (Irvine, Drew, & Sainsbury, 2012). Qualitative interviewing is similar to conducting semi-structured interviews, which fall between structured interviews – when a series of questions are asked in order with little variance from the questions allowed – and unstructured interviews – when a general topic exists but there is no defined question format for the interview. The interviewer is to remain flexible during the interview and to guide the interview based on the responses given (Rubin & Rubin, 2005). The interviews focused on discussing what was relevant to the interviewees (within the realm of state forest management), not what was in the interest of the interviewer. This required starting interviews with “grand tour” questions that are designed to incite conversation (Simmons, 2011). A list of these questions is provided in Appendix E. Not all questions were asked in all interviews and the course of the interview dictated subsequent questioning. However, the interviewer was primarily focused on understanding how certain key variables related to adaptive governance of forests (e.g., collaboration with nonprofits and volunteers, learning, leadership) are carried out in state forest management practices, how these variables impact state forest operations, and how they relate to forest valuation.

Permission to audio record the interviews was requested for most of the interviews to facilitate qualitative analyses. If an interviewee did not want to be recorded, the interviewer took hand written notes during the interview instead. The interviewer also recorded hand written interview observation notes following the interviews. The audio recordings were transcribed by research assistants. The interview transcriptions and the interview notes were loaded into Atlas.Ti (Scientific Software Development GmbH, 2016) – computer software designed for qualitative data analysis. Open coding of the transcriptions and notes was conducted using both in vivo codes – description of what is going on – and analytic codes –

conceptualizing what is happening. Comparison of codes across interviews resulted in the emergence of common themes and concepts (Holton & Walsh, 2017). Common themes were validated through interrater reliability: multiple team members who transcribed multiple interviews verified common themes.

#### **Project Goal Four: Analyze Pennsylvania’s Payment In Lieu of Taxes (PILT) Payment System**

The research team received 6 years of PILT payment data (2012-2016) as part of the data request from BOF discussed in project goal one. The data was divided into PILT payment recipients – county governments, municipal governments, and school districts. Descriptive statistics of the data were calculated by recipient group by year.

The second aspect of the project goal involved researching Pennsylvania’s PILT system and other states PILT systems that were specific to state forestland to draw comparisons between Pennsylvania’s systems and the others. The research team used data from the USDA’s Forest Inventory and Analysis National Program to make an informed decision about states with comparable forestland to research (U.S. Department of Agriculture Forest Service, 2016a). Other states’ proximity to Pennsylvania also informed the selection. The team selected Maryland, Michigan, Minnesota, New York, New Jersey, North Carolina, South Carolina, Virginia, Vermont, and West Virginia. The research was primarily qualitative and was comprised of legislation and policy research. Legislative data was collected from internet searches of legal and legislative databases. In addition, the research team conducted telephone or email correspondences with state agencies to obtain PILT information. The team developed an interview script containing research questions about PILT practices. This script was distributed by email or telephone to each state’s environmental and taxation agencies as these were the most accessible stakeholders.

Research efforts to collect information on other states’ PILT systems proved to be problematic – there was little information publicly available and state agencies contacted were not particularly

responsive. In response to these difficulties, the research team also reviewed the federal PILT system, which includes payments for all federal land, including national forests. Publicly available data for federal PILT payments to Pennsylvania counties by PILT amount by acre per county was reviewed and comparisons made to Pennsylvania’s PILT payments.

## Results

### Project Goal One: Utilize Market-based Research Approaches

**Estimates of income derived from state forest system.** Table 3 displays the income derived from the sale of priced goods and services that were produced by the state forest system from 2012 through 2016. Income was grouped into three categories, which are detailed in subsequent tables. Total income over the 5 years examined is approximately \$632 million. Oil- and gas-related sales account for the majority of the income in each year, ranging from 79 percent (2012) to 86 percent (2014) of the total each year. Across all 5-years, oil and gas sales accounted for 83 percent of the total, timber-related sales accounted for 15 percent, and other income accounted for 1 percent. The figures were not adjusted for inflation.

*Table 3: Total Income Derived from State Forest Goods and Services*

<b>Year</b>	<b>Timber-related</b>	<b>Oil &amp; Gas</b>	<b>Other</b>	<b>Total Income</b>
2012	\$23,648,717	\$77,436,263	\$2,143,711	\$103,228,692
2013	\$22,136,347	\$123,509,192	\$2,235,644	\$147,881,184
2014	\$24,061,715	\$146,319,507	\$2,261,262	\$172,642,484
2015	\$20,775,679	\$81,466,652	\$2,349,029	\$104,591,360
2016	\$26,418,214	\$74,689,585	\$2,422,089	\$103,529,888
5-year total	\$117,040,672	\$503,421,199	\$11,411,736	\$631,873,607

*Source: Data provided by Pennsylvania Bureau of Forestry.*

Table 4 displays the details of the oil- and gas-related sales. There are three types of income: gas storage rental, oil and gas lease rental, and oil and gas lease royalties. Most income comes from lease royalties, which accounted for 92 percent of the total income across the 5 years.

*Table 4: Oil and Gas Related Income*

<b>Year</b>	<b>Gas Storage Rental</b>	<b>O&amp;G Lease Rental</b>	<b>O&amp;G Lease Royalties</b>	<b>Total Income</b>	<b>Total Acres Leased for O&amp;G</b>	<b>Average per Acre</b>
2012	\$2,731,718	\$2,967,309	\$71,737,236	\$77,436,263	390,405	\$198
2013	\$2,655,891	\$3,377,284	\$117,476,017	\$123,509,192	390,405	\$316
2014	\$2,805,499	\$9,097,595	\$134,416,413	\$146,319,507	384,727	\$380
2015	\$2,788,402	\$5,419,395	\$73,258,855	\$81,466,652	343,386	\$237
2016	\$2,773,101	\$5,660,214	\$66,256,270	\$74,689,585	333,804	\$224
5-year	\$13,754,611 (total)	\$26,521,797 (total)	\$463,144,791 (total)	\$503,421,199 (total)	368,545 (average)	\$273 (average)

*Source: Data provided by Pennsylvania Bureau of Forestry.*

Table 5 displays the details of the other income. Income derived from right-of-way requests are the most substantial, followed by leased campsites. The income derived from land and water use agreements and state-owned cabin leases are minimal. Every year, there are 66 land use agreements, 72 average water use agreements, and 86 state-owned cabin leases, on average. In comparison, there are 1,050 right-of-way agreements and 3,981 leased campsite agreements, on average, every year. Leased campsites are "... a small parcel of state forestland (approximately 1/4 acre) that is leased to an individual, or to a group of individuals, to maintain a cabin [owned by the leaser] solely for recreational purposes" (DCNR, 2018b). On the other hand, state-owned cabin leases are where the state owns both the land and the cabin. The lease price for a leased campsite was a standard \$200 a year for each of the 5 years studied. The average lease price for a state-owned cabin increased from approximately \$260 for 2011 through 2015 to approximately \$317 in 2016.

Table 5: Other Income

Year	Land Use Agreements	Water Use Agreements	Right-of-ways	Leased Campsites	State-Owned Cabin Leases	Total Income
2012	\$4,809	\$24,623	\$1,296,253	\$795,600	\$22,427	\$2,143,711
2013	\$5,309	\$20,264	\$1,391,645	\$796,000	\$22,427	\$2,235,644
2014	\$5,409	\$22,289	\$1,414,738	\$796,400	\$22,427	\$2,261,262
2015	\$18,769	\$25,320	\$1,485,514	\$797,000	\$22,427	\$2,349,029
2016	\$18,600	\$24,918	\$1,556,165	\$797,000	\$25,407	\$2,422,089
5-year total	\$52,895	\$117,414	\$7,144,313	\$3,982,000	\$115,115	\$11,411,736

Source: Data provided by Pennsylvania Bureau of Forestry.

Table 6 displays the details of timber-related income. This is income derived primarily from the sale of sawtimber, which accounted for 89 percent of the 5-year total. Including the sale of pulpwood to the total timber stumpage contracts increases the share of the 5-year total to 93 percent. The total income over the 5 years examined is approximately \$117 million.

Table 6: Timber-related Income

Year	Sawtimber Executed Contracts	Pulpwood Executed Contracts	Total Timber Stumpage Contracts	Misc. Forest Products	Other income*	Total Income
2012	\$20,878,961	\$425,351	\$21,304,311	\$176,070	\$2,168,336	\$23,648,717
2013	\$18,693,212	\$1,345,014	\$20,038,226	\$205,580	\$1,892,541	\$22,136,347
2014	\$21,289,509	\$813,947	\$22,103,456	\$247,931	\$1,710,327	\$24,061,715
2015	\$18,618,744	\$966,297	\$19,585,042	\$208,563	\$982,074	\$20,775,679
2016	\$24,609,136	\$793,349	\$25,402,485	\$176,165	\$839,564	\$26,418,214
5-year total	\$104,089,563	\$4,343,958	\$108,433,520	\$1,014,309	\$7,592,842	\$117,040,672

\*Includes additional miscellaneous contract invoices and income (addendums, performance deposits), contract extensions, and non-contract invoices (gas and mineral ROW timber invoices, restitutions, fines, gifts, etc.)

Source: Data provided by Pennsylvania Bureau of Forestry.

Table 7 displays additional details of timber stumpage contracts. A total 77,261 acres were sold across 703 sales over the 5 years examined. Each year, 15,452 acres, on average, were sold at an average cost of \$1,404 per acre. The number of sales each year was relatively consistent, with 2012 having the fewest (128) and 2016 having the most (156). The number of bids received each year was very consistent, with 544 bids, on average. The average number of bids was four per sale each year. The average amount per sale was about \$154,244 across the 5 years. The final amount per sale typically exceeded the minimum bid price set by BOF for that sale. Of the 703 sales over the 5 years, 91 percent were at least

\$1,000 over the minimum bid price, 81 percent were at least \$5,000 over, 55 percent were at least over \$25,000 over, and 38 percent were at least \$50,000 over. One-third of the sales were at least double the minimum bid price that was set for that sale. The average overage was \$68,612 for the 5-year period.

*Table 7: Timber Stumpage Contracts Details*

Year	Total Timber Stumpage	Acres Sold	Average Amount per Acre	Total Sales	Total Bids	Average Amount per Sale	Average Minimum Bid Price	Average Sale/MinBid Difference
2012	\$21,304,311	12,618	\$1,688	128	544	\$166,440	\$100,982	\$65,458
2013	\$20,038,226	16,955	\$1,182	146	564	\$137,248	\$84,208	\$53,040
2014	\$22,103,456	14,440	\$1,531	135	523	\$163,729	\$95,727	\$68,002
2015	\$19,585,042	14,056	\$1,393	138	536	\$141,921	\$83,538	\$58,383
2016	\$25,402,485	19,192	\$1,324	156	550	\$162,836	\$98,825	\$64,012
5-year average	\$21,686,704	15,452	\$1,404	141	544	\$154,244	\$92,586	\$61,849

*Source: Data provided by Pennsylvania Bureau of Forestry.*

Miscellaneous forest products include small permit sales of various forest products. While this category accounts for only 1 percent of the total 5-year income, it is notable that the primary driver of this category is the sale of firewood (see Table 8), which accounts for about three-fourths of the 5-year income in this category.

*Table 8: Firewood Subset of Miscellaneous Forest Products*

Year	Misc. Forest Products	Firewood Sales	Cords of Firewood	Average Dollar Amount per Cord
2012	\$176,070	\$128,127	8,024	\$16
2013	\$205,580	\$141,389	8,916	\$16
2014	\$247,931	\$201,124	9,722	\$21
2015	\$208,563	\$167,607	8,055	\$21
2016	\$176,165	\$112,811	5,383	\$21
5-year total	\$1,014,309	\$751,059	40,100	\$19

*Source: Data provided by Pennsylvania Bureau of Forestry.*

**IMPLAN economic contribution analysis using visitor use monitoring survey data.** The first IMPLAN analysis used expenditure data from BOF Visitor Use Monitoring (VUM) Surveys, which are

an in-depth and systematic approach to monitoring recreation on Pennsylvania state forests that includes exploring “visitors’ use patterns... expectations, spending patterns, desires, and satisfaction levels” (DCNR, 2016a). The total annual expenditures by category and in total for the model that used annual expenditure averages for districts that were without VUM data are presented in Table 9. The total estimated annual expenditure associated with state forest visitation in this model is nearly \$400 million. Four of the 11 categories – lodging, restaurants, groceries, and gasoline – accounted for 87 percent of the total.

*Table 9: VUM IMPLAN Model Annual Expenditures by Category*

<b>Model: 10 known / 10 average Districts</b>	<b>Total Annual Expenditures</b>	<b>Percent of Total</b>
Motel, Lodge, Cabin, B&B, etc.	\$90,321,206	22.7%
Camping Fees	\$8,499,284	2.1%
Restaurants & Bars	\$85,227,835	21.4%
Groceries	\$78,023,697	19.6%
Gasoline and oil	\$92,836,417	23.3%
Local Transportation	\$229,910	0.1%
Outfitter Related Expenses (Guide fees)	\$1,895,023	0.5%
Outfitter Related Expenses (Equipment rentals)	\$1,895,023	0.5%
Outdoor Recreation and Entertainment	\$1,774,755	0.4%
Sporting Goods	\$19,776,804	5.0%
Souvenirs, Clothing, Other Misc.	\$18,025,206	4.5%
<b>TOTAL</b>	<b>\$398,505,159</b>	
<b>TOTAL ANNUAL ESTIMATED VISITORS</b>	<b>3,644,740</b>	

*Source: Modified from VUM surveys (DCNR, 2016a).*

IMPLAN’s model result summary from the expenditure and visitation data from the VUM surveys is presented in Table 10. The results represent the economic contribution to Pennsylvania for a year of recreational trips made to its state forests. Dollar figures are represented in 2017 dollars and are automatically adjusted by IMPLAN for inflation. As stated previously, direct effects represent the economic activity supported directly by state forest visitor expenditures; indirect effects represent the inter-industry effects of those expenditures; and induced effects represent the economic activity created by individuals employed in industries spending their income that is attributable to the original

expenditures. Total effects are the sum of direct, indirect, and induced effects. The effects are expressed by multiple economic indicators of industries associated with recreational trips to state forests: employment represents the total number of full-time and part-time jobs; labor income represents all wages and salaries, payroll benefits, and income of sole proprietors; output represents the total dollar value of the industries' production; and value-added represents the difference between total output and the cost of intermediate inputs (excluding labor), and is a preferred measure of economic contribution (McGrath et al., 2016). The estimated total economic contribution to Pennsylvania's economy of spending related to state forest recreational trips is 5,122 jobs, \$180 million in labor income, \$454.7 million in total output, and \$266.7 million in value-added effects.

An additional way to interpret the results is to use IMPLAN's social accounting matrix (SAM) multipliers. These capture the ripple effect throughout the economy – how a small change in expenditures associated with recreational trips to state forests can have a larger impact than expected to Pennsylvania's economy (Poudel et al., 2017). The multipliers are calculated from the model results by dividing the total effect (i.e., the sum of the direct, indirect, and induced effects) by the direct effects. The 1.36 multiplier for employment suggests that for every three jobs created by state forest visitation spending, one additional job will be created in Pennsylvania's economy. The 1.89 multiplier for output suggests that every \$1 of direct output resulting from state forest visitation spending generates an additional \$0.89 of output in Pennsylvania's economy.

*Table 10: VUM IMPLAN Model Result Summary*

<b>Impact Type</b>	<b>Employment</b>	<b>Labor Income</b>	<b>Output</b>	<b>Value-Added</b>
Direct Effect	3,766	\$103,841,905	\$240,615,402	\$141,758,170
Indirect Effect	498	\$32,986,882	\$89,990,301	\$52,517,921
Induced Effect	858	\$43,211,677	\$124,137,649	\$72,498,851
Total Effect	5,122	\$180,040,464	\$454,743,352	\$266,774,942
SAM Multipliers	1.36	1.73	1.89	1.88

*Source: IMPLAN Group LLC (2015).*

The top 10 IMPLAN sectors in Pennsylvania that benefit the most from state forest visitation in terms of employment are presented in Table 11. Like other economic analyses of outdoor recreation

(Poudel et al., 2016), the sectors are predominantly retail sectors associated with outdoor recreation, food and accommodation services, and gasoline stations. These 10 sectors represent 78 percent of the entire employment contribution of state forest visitation. They also represent 60 percent of the value-added contribution.

*Table 11: VUM IMPLAN Model Top Ten IMPLAN Sectors (Employment)*

<b>Sector</b>	<b>Description</b>	<b>Employment</b>	<b>Labor Income</b>	<b>Output</b>	<b>Value-Added</b>
501	Full-service restaurants	1,902	\$41,246,485	\$89,543,131	\$46,345,860
499	Hotels and motels	854	\$32,558,541	\$92,501,874	\$58,336,060
400	Retail - Food/bev stores	391	\$11,256,547	\$23,475,150	\$14,985,052
402	Retail - Gasoline stores	212	\$7,014,154	\$12,249,606	\$7,397,636
404	Retail - Sporting goods	177	\$4,056,808	\$8,794,906	\$5,308,200
500	Other accommodations	171	\$5,156,878	\$8,690,711	\$5,601,256
405	Retail - General merch stores	105	\$2,794,088	\$6,637,993	\$4,022,632
440	Real estate	72	\$1,994,007	\$17,700,006	\$13,872,490
464	Employment services	63	\$2,471,226	\$4,424,657	\$3,441,463
503	Other food/drinking places	51	\$1,449,026	\$2,066,097	\$1,218,496
<b>Top 10 sector totals</b>		<b>3,999</b>	<b>\$109,997,760</b>	<b>\$266,084,130</b>	<b>\$160,529,144</b>
<b>Percent of Total Contribution</b>		<b>78%</b>	<b>61%</b>	<b>59%</b>	<b>60%</b>

*Source: IMPLAN Group LLC (2015).*

**IMPLAN economic impact analysis using U.S. fish and wildlife data.** The second IMPLAN analysis used expenditure data from the Pennsylvania-specific results of the U.S. Fish and Wildlife 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (U.S. Census Bureau, 2015). The total annual expenditures by category and in total for the model that used hunting, fishing, and wildlife-watching for out-of-state visitors is in Appendix B. The total estimated annual expenditure associated with state forest visitation in this model is approximately \$93.4 million. The two largest expenditure categories were food and transportation, which accounted for 34 percent and 13 percent of total, respectively.

Table 12 shows IMPLAN's results for the out-of-state-visitor model. The numbers represent the economic impact to Pennsylvania for a year of hunting, fishing, and wildlife-watching trips made to its state forests by out-of-state visitors. In other words, money coming into Pennsylvania's economy that

would not have otherwise been spent in Pennsylvania. Dollar figures are represented in 2017 dollars and are automatically adjusted for inflation by IMPLAN. The estimated total economic impact is 1,716 jobs, \$64 million in labor income, \$117.4 million in total output, and \$94 million in value-added effects. The SAM multiplier for employment suggests that for every three jobs created by out-of-state state forest visitation spending, one additional job will be created in Pennsylvania’s economy. The 2.25 multiplier for output suggests that every \$1 of direct output resulting from out-of-state state forest visitation spending generates an additional \$1.25 of output in Pennsylvania’s economy.

*Table 12: Out-of-State Visitor IMPLAN Model Result Summary*

<b>Impact Type</b>	<b>Employment</b>	<b>Labor Income</b>	<b>Output</b>	<b>Value-Added</b>
Direct Effect	1,296	\$41,352,002	\$52,272,176	\$55,184,324
Indirect Effect	111	\$7,404,483	\$20,797,532	\$12,284,404
Induced Effect	309	\$15,229,547	\$44,353,278	\$26,569,451
Total Effect	1,716	\$63,986,032	\$117,422,986	\$94,038,179
SAM Multipliers	1.32	1.55	2.25	1.70

*Source: IMPLAN Group LLC (2015).*

The top 10 IMPLAN sectors in Pennsylvania that benefit the most from out-of-state state forest visitation in terms of employment are presented in Table 13. Like the analysis of the model with in-state visitors, the sectors are predominantly retail sectors associated with outdoor recreation, food and accommodation services, and gasoline stations. However, this model has more variation in sectors. This is most likely due to the more detailed expenditure data entered into the model. These 10 sectors represent about one-third of the entire employment and value-added impact of out-of-state state forest visitation.

Table 13: Out-of-State Visitor IMPLAN Model Top Ten IMPLAN Sectors (Employment)

Sector	Description	Employment	Labor Income	Output	Value-Added
400	Retail - Food/bev stores	595	\$17,813,469	\$11,418,339	\$23,775,641
402	Retail - Gasoline stores	209	\$6,406,729	\$2,112,470	\$7,528,464
404	Retail - Sporting goods	166	\$3,617,347	\$7,234,449	\$4,575,444
406	Retail - Misc. store retailers	99	\$1,552,270	\$2,735,552	\$1,698,773
385	Sporting and athletic goods manufacturing	45	\$2,762,670	\$4,642,991	\$4,262,827
349	Travel trailer and camper manufacturing	36	\$1,945,015	\$8,583,339	\$2,813,281
395	Wholesale trade	32	\$2,680,235	\$7,779,930	\$5,037,594
14	Animal production, except cattle/poultry/eggs	31	\$498,476	\$735,824	\$951,648
398	Retail - Electronics and appliance Stores	30	\$1,360,559	\$513,122	\$865,313
440	Real estate	25	\$545,504	\$5,576,600	\$4,117,704
<b>Top 10 sector totals</b>		<b>1,266</b>	<b>\$39,182,274</b>	<b>\$51,332,616</b>	<b>\$55,626,689</b>
<b>Percent of Total Contribution</b>		<b>32%</b>	<b>36%</b>	<b>19%</b>	<b>35%</b>

Source: IMPLAN Group LLC (2015).

## Project Goal Two: Utilize Nonmarket-based Research Approaches

**Contingent valuation (CV) survey.** The final Penn State Poll dataset (which includes the CV survey) was 609 adult Pennsylvania residents. On average, the interview was completed in about 14 minutes. A total of 25,505 different phone numbers (6,886 landline numbers and 18,619 cell phone numbers) were dialed during the data collection. The margin of error for this survey was plus or minus 4.0 percentage points, with the conventional 95 percent degree of desired confidence. This means that, in a sample of 600 respondents where the distribution of responses is within the vicinity of 50 percent, there is a 95 percent chance that if all households and individuals with telephones in Pennsylvania were surveyed, the results would not differ from the survey findings by more than 4.0 percentage points. A more extreme distribution of question responses would have a smaller error range. Suppose that 80 percent of the respondents answer “Yes” and 20 percent answer “No,” then the sampling error in this case would be 3.2 percentage points. That is, each percentage has a sampling error of plus or minus 3.2 percentage points.

Calculating dual-frame outcome rates is challenging due to the difficulty of determining final dispositions and eligibility statuses for cell phone numbers. When researchers try to reach respondents on

cell phones, it is important to remember that the potential respondents can be doing any number of things, including driving, flying, walking in a noisy environment, etc. Because respondents may be temporarily unavailable and may not be able to be screened for eligibility or be invited to participate in the study, it may be difficult to determine the numbers' final dispositions. Further, it can be difficult to interpret cell phone operator messages. Until this situation is resolved, the number of cases with unknown eligibility will be higher as compared to landline samples.

Survey outcome rates can be measured through response and cooperation rates. Estimating accurate response rates for large-scale phone surveys is difficult because it is impractical to estimate how many phone numbers are valid (i.e., the exact denominator to calculate the rate is unknown). In the current study, the survey's cooperation rate was calculated through a series of steps. First, separate rates were calculated for each of the sample frames (landline and cell) using the American Association of Public Opinion Research's (AAPOR) Cooperation Rate 3 (COOP3) formula. The COOP3 rate is obtained by dividing the number of completed interviews by the sum of the number of completed interviews, the number of partially completed interviews, and the number of respondents who refused to participate. AAPOR sets an industry standard for consistent reporting across the survey research field (AAPOR, 2017). The survey cooperation rate for the landline portion of the sample was 68.7 percent, and the cooperation rate for the cell portion of the sample was 62.1 percent.

Since households with both landlines and cell phones could be included in both sample frames, the calculation of the final cooperation rate must take this overlap into account. Based on telephone estimates from the National Center for Health Statistics, it was estimated that the landline-only frame covered 7.4 percent of the population, the cell-only frame covered 35.2 percent of the population, and the overlap (households with both a landline and cell phone) covered 55.1 percent of the population. Those without telephone service (2.3 percent) were excluded (Blumberg & Ganesh, 2016). The overall cooperation rate equals the sum of 0.361 times the landline cooperation rate and 0.639 times the cell

phone cooperation rate. Therefore, the overall cooperation rate for the Spring 2017 Penn State Poll was 64.5 percent

To ensure that the poll results were not biased toward any demographic group, the results of the survey were compared to the demographic characteristics of Pennsylvania's population using the U.S. Census Bureau's State Population Estimates July 1, 2015 State Population Estimates, U.S. Census Bureau, Population Division (U.S. Census Bureau, 2016a). Various weights were applied to the responses for certain groups who were over- or under-represented in the survey's results to better represent Pennsylvania's population as a whole. The applied weights gave each case a value so that the percentage of responses in the sample approximated the known percentage in the population. After making comparisons to U.S. Census data, it was determined to weight the responses as a function of each respondent's age and sex. A comparison of the spread of rural (26.1 percent) versus urban (73.9 percent) survey respondents (based on county of residence) to the Census data indicates that the survey data is highly reflective of the rural-urban spread in the general Pennsylvania population (25.5 percent and 74.5 percent, respectively). Thus, the results were not weighted on rural or urban status given that the differences are less than 1 percent and that adding additional weights increases the margin of error. A list of the rural and urban counties is provided in Appendix D.

Table 14 displays the age and gender categories that were used for the weighting process, the number of respondents interviewed within these categories, the number of expected interviews according to Census data, and the resulting weights applied to normalize the survey data to Pennsylvania's U.S. Census population demographics. All survey results were calculated and are reported here using the weighted survey results.

Table 14: Weights Applied to Survey Data

	Interviewed	Expected	Weight Factor
<b>Male</b>			
18-24 years	29	37	1.312421
25-34 years	42	51	1.1791433
35-44 years	43	45	1.0458841
45-54 years	63	53	0.8363389
55-64 years	74	52	0.7088557
65-74 years	55	34	0.6120095
75 years and over	27	23	0.855595
<b>Female</b>			
18-24 years	20	36	1.789707
25-34 years	27	49	1.8316137
35-44 years	32	45	1.4162961
45-54 years	47	54	1.1516452
55-64 years	63	55	0.8803025
65-74 years	47	38	0.8171348
75 years and over	40	36	0.9027218

Source: Spring 2017 Penn State Poll.

Table 15 displays the results of the demographic survey questions. In general, respondents were non-Hispanic, white females who were 48 years old, on average. Most respondents attained some level of college education (78 percent), lived in a household with a pre-tax annual household income of at least \$60,000 (59 percent), and resided in an urban county (74 percent).

Table 15: Demographic Profile of Survey Respondents

	Number	Percent
<b>Gender</b>		
Male	294	48.3%
Female	315	51.7%
<b>Age Category</b>		
18-34 years	173	28.4%
35-64 years	305	50.1%
65 years of age or older	131	21.6%
<b>Ethnicity</b>		
Hispanic	24	4.0%
Non-Hispanic	581	96.0%
<b>Race</b>		
White	512	86.0%
Black - African American	42	7.0%
Some other race (includes 2+ races)	42	7.0%
<b>Education</b>		
High school diploma/GED or less	135	22.2%
Some college (two-year, technical, and Associate's degree)	217	35.6%
College degree (Four-year college graduate)	145	23.8%
Graduate work	112	18.4%
<b>Income</b>		
Less than \$30,000	100	18.7%
\$30,000 to \$59,999	117	22.0%
\$60,000 to \$99,999	152	28.4%
\$100,000 or more	165	31.0%
<b>Region</b>		
Northwest	43	7.1%
North Central	47	7.8%
Northeast	64	10.6%
Southwest	100	16.3%
South Central	112	18.3%
Southeast	243	39.9%
<b>Political Affiliation</b>		
Republican	192	32.9%
Democrat	216	37.0%
Other (Independent, Libertarian, and No Affiliation)	176	30.1%
<b>Rural / Urban County</b>		
Rural	159	26.1%
Urban	450	73.9%

Note: Numbers may not add up to 609 due to rounding, as well as the exclusion of "don't know" and "declined to answer" responses. Source: Spring 2017 Penn State Poll.

CV surveys are carefully designed to elicit an accurate willingness-to-pay (WTP) response. However, the WTP scenarios may be viewed by some potential respondents as unusual and, therefore, individuals may not know how to respond. The current survey was designed following established procedures (Boyle, 2003) and elicited an 84 percent response rate to the WTP question: How much would you be willing to pay each year in extra state taxes to conserve and expand Pennsylvania’s state forestlands? Tables 16 and 17 display the results of the WTP question for the total sample as well as the total sample divided into rural and urban county residents. Table 16 displays the frequencies. Of those that provided a response for the total sample (509), almost two-thirds (62.5 percent) stated they would be willing to pay something in extra state taxes to conserve and expand Pennsylvania’s state forestlands. Of the two-thirds willing to pay something, about half gave a response that was less than \$50 and half greater than \$50. A higher percentage of urban residents (64.8 percent) compared to rural residents (56.2 percent) stated that they would be willing to pay something. Like the total sample, about half of both the urban and rural residents gave a response that was less than \$50 and half greater than \$50.

*Table 16: Willingness-to-pay Frequencies*

Response	Total Sample (n=509)		Rural Residents (n=137)		Urban Residents (n=372)	
	Count	Percent	Count	Percent	Count	Percent
Not willing to pay anything in extra state taxes	191	37.5%	60	43.8%	131	35.2%
Willing to pay something in extra state taxes	318	62.5%	77	56.2%	241	64.8%
WTP \$1-\$20	95	29.9%	21	27.2%	74	30.8%
WTP \$21-\$50	74	23.3%	25	32.2%	49	20.3%
WTP \$51-\$100	85	26.7%	14	18.3%	71	29.6%
WTP More than \$100	64	20.1%	17	22.4%	47	19.3%

*Source: Spring 2017 Penn State Poll.*

Table 17 displays descriptive statistics for the willingness-to-pay results. For the total sample, the average value including those willing to pay nothing was \$63.12, with a \$5.08 margin of error. The average of just those willing to pay something was \$101.06, with a \$7.36 margin of error. Reported values varied substantially ranging from \$1 to \$1,000. Of those willing to pay something, the most

common response (mode) was \$100. As stated earlier, urban residents were more likely than rural residents to be willing to pay something, but rural residents were willing to pay about \$8 more, on average, than urban residents: the average for urban residents was \$60.87, with a \$5.16 margin of error, and the average for rural residents was \$69.28, with a \$12.70 margin of error. The median WTP was similar for both groups: \$10 for rural, \$11.25 for urban. An independent samples t-test was conducted to determine if the difference between the averages for rural and urban residents was statistically significant (i.e., the difference was not due to chance). The test results suggest that, with 95 percent confidence, the \$8.41 mean difference between rural and urban residents was not statistically significant, so there was no difference between the two groups in terms of the average amount they were willing to pay.

*Table 17: Willingness-to-pay Descriptive Statistics*

<b>Response</b>	<b>Count</b>	<b>Mean</b>	<b>Median</b>	<b>Mode</b>	<b>Lowest</b>	<b>Highest</b>
Total Sample	509	\$63.12	\$10	\$0	\$0	\$1000
Total Sample: willing to pay something	318	\$101.06	\$50	\$100	\$1	\$1000
Urban Residents	372	\$60.87	\$11.25	\$0	\$0	\$520
Urban Residents: willing to pay something	241	\$93.98	\$50	\$100	\$1	\$520
Rural Residents	137	\$69.28	\$10	\$0	\$0	\$1000
Rural Residents: willing to pay something	77	\$123.29	\$50	\$50	\$1	\$1000

*Source: Spring 2017 Penn State Poll.*

The results of the three additional CV questions are provided in Tables 18, 19, and 20. Table 18 displays the results of the attitudinal question directed at the importance of state forest conservation. Nearly all respondents (95.8 percent) agreed to some degree that it is important to protect and conserve state forestland; 75 percent strongly agreed. This suggests Pennsylvanians overwhelmingly support the state forest system and forest conservation. There was little difference between rural and urban residents in terms of agreement with state forest conservation (92.5 percent of rural residents and 96.9 percent of urban residents).

Table 18: Attitudinal Question 1

It is important to protect and conserve state forestland	Total Sample (n=609)		Rural Residents (n=159)		Urban Residents (n=450)	
	Count	Percent	Count	Percent	Count	Percent
Strongly disagree	13	2.2%	5	3.3%	8	1.8%
Somewhat disagree	8	1.4%	3	2.1%	5	1.1%
Somewhat agree	130	21.4%	37	23.3%	93	20.7%
Strongly agree	453	74.4%	110	69.2%	343	76.2%
Neither disagree nor agree	4	0.7%	3	2%	1	0.2%

Source: Spring 2017 Penn State Poll.

Table 19 displays the results of the attitudinal question that asked if the government should require everyone to pay for environmental improvements. Almost three-quarters of all respondents (71.9 percent) agreed. Similar to the attitude question regarding conservation importance, there was little difference between rural and urban residents (73.3 percent of rural residents and 71.5 percent of urban residents).

Table 19: Attitudinal Question 2

The government should require everyone to help pay for environmental improvements	Total Sample (n=609)		Rural Residents (n=159)		Urban Residents (n=450)	
	Count	Percent	Count	Percent	Count	Percent
Strongly disagree	72	11.8%	21	13.1%	52	11.5%
Somewhat disagree	83	13.6%	20	12.7%	63	14%
Somewhat agree	238	39.1%	63	39.8%	175	38.8%
Strongly agree	200	32.8%	53	33.5%	147	32.7%
Neither disagree nor agree	11	1.8%	2	1.4%	9	2%
Don't know	3	0.5%	-	-	3	0.6%
Decline to answer	2	0.3%	-	-	2	0.4%

Source: Spring 2017 Penn State Poll.

Table 20 displays the results the state forest experience question that asked how often the respondent visited a state forest to recreate. For the total sample, the most common response (38.4 percent) was less than once a month but greater than a single visit per year (i.e., between two and 11 visits a year). Almost one third of the respondents (32.1 percent) indicated that they do not typically visit a state

forest at all to recreate. The days spent recreating was 13.20 days, on average, with a margin of error of 1.4 days. Rural residents spent 19.15 days, on average, per year (4.1 margin of error), and a median of 4 days per year. Urban residents spent 11.08 days, on average, per year (1.2 margin of error), and a median of 4 days per year. An independent samples t-test was conducted to determine if the difference between the mean averages for rural and urban residents was statistically significant. The results suggest that, with 95 percent confidence, the 8.07 mean difference between rural and urban residents was not statistically significant, meaning there was no difference between the two groups in terms of average visitation days per year.

*Table 20: Experience Question*

<b>In a typical year, how many days do you go to a Pennsylvania state forest for recreational activities?</b>	<b>Total Sample (n=602)</b>		<b>Rural Residents (n=159)</b>		<b>Urban Residents (n=443)</b>	
	<b>Count</b>	<b>Percent</b>	<b>Count</b>	<b>Percent</b>	<b>Count</b>	<b>Percent</b>
None	193	32.1%	48	30.2%	145	32.7%
1 day	32	5.3%	12	7.5%	20	4.5%
2-11 days (< once a month)	231	38.4%	55	34.6%	176	39.7%
12-24 days (one to two times/month)	67	11.1%	17	10.7%	50	11.3%
25-51 days (> twice/month, < once/week)	44	7.3%	13	8.2%	31	7.0%
52 days or more (Once/week or more)	35	5.8%	14	8.8%	21	4.7%

*Source: Spring 2017 Penn State Poll.*

**Statistical tests and models (i.e., logistic regression models) were constructed and tested to determine which respondent characteristics (i.e., variables) predicted a WTP response.** The statistical model takes into consideration all characteristics included in the model when determining which characteristics best predict the WTP response. The final model included demographic characteristics (gender, race, age, education, income, political affiliation, and rural or urban county of residence), a characteristic related to agreement with attitudinal question 2, and a characteristic related to the experience question (i.e., if the respondent responded with any days of visitation). Typical CV analyses include demographic characteristics, and attitudinal and experience characteristics when available. Attitudinal question 1 was omitted from the model because the overwhelming majority of respondents (95.8 percent) were in agreement with the question, which makes it inappropriate for this

analysis. The results indicated that the only characteristics that were statistically significant in predicting whether a respondent was willing-to-pay anything were age, the characteristic related to attitudinal question 2, and the characteristic related to the experience question. The other demographics were not statistically significant. The results suggest that the odds of being a respondent who was willing to pay anything greater than \$0 decreased with respondent age (e.g., a 20 year old had 2 times higher odds to be willing to pay than a 44 year old); respondents that agreed with the question, “The government should require everyone to help pay for environmental improvements,” had 4.5 times higher odds of being willing to pay than respondents that did not agree with the question; and respondents that indicated they typically recreate at least once a year on state forestland had 2 times higher odds of being willing to pay than respondents that did not recreate at all on state forestland.

**Bibliometric analysis of research on state forestland.** The types of state forest research agreements (SFRAs) received by the BOF to conduct research on state forestland are primarily biology-based and span a wide-range of biological disciplines (e.g., forest ecology, zoology, geology, pedology, mycology, hydrology, herpetology, entomology). Some requests are also received that cross into non-biological disciplines (e.g., archaeology). Table 21 displays the number of SFRAs and research products from years 2010 through 2016. The count of SFRAs does not include administrative data requests, requests that were made but were not carried out, or requests that were not approved. Over the 7 years analyzed, there was a total of 167 SFRAs, with about 24 SFRAs, on average, a year. The research products reported in Table 21 are the result of both the article-search and author-identification methods. The research from these SFRAs produced a total of 83 research products, with about 12 on average per year. Since the research process – research proposal, data collection, calculating results, and writing a final product – can take several years it is logical that SFRAs prior to 2014 produced substantially more products than those in recent years. Over the full 7 years analyzed, 57 percent of the products were academic journal articles, 25 percent were masters’ thesis, 17 percent were reports, and 10 percent were doctoral dissertations.

Table 21: SFRA's and Research Product Types

SFRA Year	SFRAs	Research Products	Journal Article	Public Report	Masters' Thesis	Doctoral Dissertation
2010	20	13	9	3	1	1
2011	22	17	15	2	3	0
2012	23	14	7	1	6	1
2013	36	22	8	6	5	4
2014	16	6	3	1	1	1
2015	22	7	3	1	3	1
2016	28	4	2	0	2	0
7-year Total	167	83	47	14	21	8
Year Average	23.9	11.9	6.7	2.3	3.0	1.6

Source: Pennsylvania Bureau of Forestry; Google Scholar.

Table 22 displays the results of the citation analysis of the research products. Google Scholar citations are based on all research products as they were all discoverable within the Google Scholar search. The Web of Science citations are based on a subset of the articles that were discoverable in Web of Science. The Web of Science citations can also be considered a subset of the Google Scholar citations, but serves as an additional check on citations that are more academically rigorous than Google Scholar. As expected, the numbers of citations tend to increase the further back in time, largely due to the longer length of time an article has to be cited. There was a very highly-cited geology article in 2014 – it received 92 Web of Science citations and 93 Google citations – that is the cause of a spike in the trend.

Table 22: SFRA Research Products Citation Analysis

SFRA Year	SFRAs	Research Products	Google Scholar Citations	Web of Science Articles	Web of Science Citations
2010	20	13	254	10	149
2011	22	17	192	7	178
2012	23	14	27	4	19
2013	36	22	24	5	11
2014	16	6	106	3	104
2015	22	7	18	2	4
2016	28	4	55	1	6
7-year Total	167	83	678	32	471
Year Average	23.9	11.9	96.9	4.6	67.3

Source: Pennsylvania Bureau of Forestry; Google Scholar; Web of Science.

The research team received a sizable response from researchers during the author-identification method, with about two-thirds of those contacted responding (86 responses out of 129 SFRA with accurate email contact information). In addition, many researchers were enthusiastic to share information about their SFRA-related research and provided additional information that was not formally requested by the research team. For example, many researchers indicated that their SFRA research was presented at academic conferences, that they have pending scholarly journal articles based on the SFRA research, and that the SFRA projects helped to train numerous undergraduate students. Some researchers also expressed their thanks to conduct research on state forestland. For example, one researcher replied “In my opinion, the SFRA program strikes a balance between allowing legitimate researchers access to the state forests and protecting the beautiful asset the state forests represent. By knowing who is in there and what they are doing relative to the forest, the state can protect the asset for future generations.”

The researchers that submitted SFRA from 2010 to 2016 came from a variety of institutions and organizations. Of the 167 SFRA, there were 163 requests that contained some sort of organizational affiliation. There were 70 unique organizations across the 163 records. Several organizations submitted multiple requests over the 7 years studied. Table 23 displays the results of the SFRA organizational information. The majority of both SFRA (72 percent) and unique organizations requesting SFRA (57

percent) were colleges or universities. Penn State University at University Park had the most requests (40), followed by Shippensburg University of Pennsylvania (12), and Indiana University of Pennsylvania (8). The federal departments represented included the U.S. Geological Survey, U.S. Department of Agriculture, U.S. Department of Energy, and U.S. Department of Environmental Protection. Different agencies and research branches accounted for the full 12 organizations (e.g., USDA Forest Service Northern Research Station). The Western Pennsylvania Conservancy submitted seven SFRA requests. Examples of other private or nonprofit organizations that submitted requests are Trout Unlimited (four requests) and North Pocono CARE (two request); organizations that have an interest in the well-being of the state forest system.

The research team was able to obtain location information for all 163 records with organizational affiliation information. Three-quarters of the requests (122) came from Pennsylvania organizations and slightly over half of the organizations (40) are located in Pennsylvania. Sixteen other states accounted for 39 requests, with Virginia and West Virginia accounting for six requests each. Two requests were received from the University of Guelph in Ontario, Canada. About half (19) of the colleges or universities that requested SFRA requests are based in Pennsylvania. Most of the rest are eastern U.S. universities; however, there was one request from Oregon State University and two from Kansas State University.

*Table 23: SFRA Organizational Information*

Organization Type	Number of SFRA Requests	Number of Unique Organizations
College or University	117	40
Federal Department Locations	18	12
Conservation District	12	5
Other Private/Nonprofit	16	13

*Source: Pennsylvania Bureau of Forestry.*

The research team also contacted the researchers involved with the “Long Term Oak Regeneration and Dominance” project, which is an ongoing BOF-funded research project (i.e., not a SFRA project) that started in the early 2000s. This oak regeneration project is focused on providing applied knowledge to BOF regarding regenerating oak trees on timber lands. However, the project has also resulted in several research products, including 19 journal articles and five published conference

proceedings. Seventeen of the 24 publications were discoverable in Web of Science. The 17 publications were cited 331 times by 269 different articles for an average of 19.47 citations per project publication. When also factoring in the 269 articles that cited the original 17, the total number of cited articles skyrockets to 4,443 articles.

### **Project Goal Three: Investigate State Forest Management Practices**

A total of 20 district and 35 assistant district foresters were interviewed. Five interviews were conducted by phone and 50 in-person. Forty-eight in-person interviewees consented to being audio recorded; no phone interviews were recorded. At least two individuals from each of the 20 state forest districts were interviewed. Most interviews lasted approximately 30-45 minutes, but may have been longer or shorter depending on the course of the interview. The “grand tour” questions opened the interview discussions to varying topics; however, there were many interviews where the same topics and concerns emerged during the conversation. These common topics and how interviewees discussed these topics are reported below.

**Multiple roles of the forest manager.** The interviews revealed that state forest management requires wearing numerous hats. Forest managers are expected to keep their districts running smoothly. This starts with human resources and extends to timber management, planning for large scale recreation events, safety and enforcement, regulating campsites, maintaining trails, nurturing relationships with private landowners and surrounding communities, cleaning up after storms and fires, acquisition, educating the public, long-term planning and sustainability, plant and wildlife inventory, addressing consumer issues, and controlling pests, invasive species, and diseases that could jeopardize the forest. With so many demands and budget constraints, foresters are forced to conduct substantial prioritizing of tasks. Timber management and road maintenance are top priorities across all districts, with increasing recreation demands becoming another major priority. Managers are able to select a small handful of other priorities with the limited resources and time that are left. Yet most tasks are put on hold when certain disasters or issues arise that need immediate attention (e.g., fire suppression, invasive pests), which is

commonplace while attempting to manage a complex social ecological system. Several interviewees believed that forestry, as a profession, has moved away from its traditional stewardship focus in favor of ongoing problem remediation.

**Forest district personnel levels.** Maintaining sufficient personnel levels is a concern expressed by many managers. Many managers are concerned about the dwindling position compliment, primarily due to a lack of ability to replace retirees' positions and fill positions that become vacant when individuals leave. One manager stated "You lose a position, you never get it back, so I see that as our biggest challenge. Trying to keep the same level of quality that people expect." Compliment is particularly short in forest ranger and maintenance positions, which are vital to ensure the safety of visitors to state forests. Many managers expressed concern about the inability to maintain the quality of state forest roads, with such a dwindling maintenance compliment. In addition to the inability to obtain maintenance positions, it is becoming increasingly difficult to fill those positions when they do become available due to uncompetitive pay and lack of benefits for the seasonal maintenance positions. One manager stated "What we pay our equipment operators doesn't compare to what a private contractor or some other company pays an equipment operator. In the private world, they're making \$40 an hour. Here, we start them at \$14 and if they stay for 20 years, they get up to \$20."

**Multiple user group demands.** Many districts expressed both enthusiasm and concern with the seemingly increasing use of the state forest for recreational purposes. The enthusiasm is based in the idea that with more people visiting and using the resource, more people may become educated about the resource and the bureaus mission to conserve it. On the other hand, with increased use comes increased demands, which many times conflict across user groups. Forest managers must undergo a balancing act of who gets to do what. While most districts believe that hunting – a traditional recreational use of the state forest – is decreasing, there are new user groups looking to use the resource. High impact activities that require large parcels of land – such as ATV and UTV riding – have many advocates, but also many

opponents. Such high impact activities have the ability to damage the wild character forest experience for other users.

Increased use of the state forest also places increased demands on personnel at all levels. For example: maintenance must ensure roads are in good condition; rangers must ensure visitors are safe and are respecting the resource; and clerical staff must coordinate camp sites and provide information for visitors to local offices. In relation to the increasing use, many districts also expressed concern with unrealistic expectations of new users. All districts expressed the desire to maintain the wild character of state forestlands, yet some new users do not appear to be aware of what this entails. There is a common problem with individuals who visit state forestlands and who look for amenities and vendors. They are bringing state park expectations to a state forest setting, which sometimes leads to negative reflections on the bureau. For example, one manager stated

“... because people show up and each camp only has a picnic table and a fire ring.... they send us a scathing email about how they had to leave that night because the ticks were so horrible, the mosquitoes were rampant, and there was no bathroom facility. We do our best to disclose that there are no amenities.”

While not prominent across all districts, many districts are seeing an increase in organized event requests, such as large-scale trail runs or mountain biking events. These events are an additional recreation-based activity that draw substantial time and energy from district resources. If the event does not have a substantial volunteer base, more burden falls to the district. Permits, inspections, and infrastructure preparation and subsequent repair are often required. Concentrated heavy use of trails – particularly in unfavorable weather conditions (e.g., rain) – can have substantial impact on the trail system. If events occur week after week, the impact snowballs.

**Partnerships.** All forest districts indicated that they have relationships with individuals and organizations external to the bureau. The number of relationships and the depth of the relationship vary by district and by partnering organization. Forest managers offered mostly positive sentiments toward

these relationships. Districts partner with many different organizations, including other Pennsylvania state agencies (i.e., Bureau of State Parks, PennDot, Pennsylvania Game Commission, Department of Environmental Protection), U.S. Forest Service (e.g., Allegheny National Forest), universities, local governments, museums, state legislator offices, private companies (e.g., gas companies, lumber companies), non-profits (e.g., Keystone Trail Association, Pennsylvania Parks and Forests Foundation), and local conservation districts. Many districts also have a strong volunteer base, either through individual volunteers or through the establishment of a “Friends Group” fostered by the Parks and Forests Foundation. One forest manager noted, “I can’t speak enough about our partnerships and how critical they are to the overall operations of the district.”

Every relationship helps to support a particular goal of the district. The bureau’s partnerships with Parks and PennDOT are notably important because they are mutually beneficial. Many state parks are surrounded by or are in close proximity to state forestland and all state forests contain some level of road infrastructure, which fosters the sharing of resources. Many forest managers interviewed said that they are often able to share equipment, materials, manpower, and expertise with PennDOT and Parks. Volunteerism is especially helpful in understaffed districts. Volunteers assist the bureau with trail and campsite maintenance, which might otherwise not be addressed due to higher priority demands placed on bureau staff. Groups of volunteers that are affiliated with certain recreation activities (e.g., hiking, mountain biking) are particularly important as they tend to hold each other accountable in maintaining the resource and encouraging others to do the same.

#### **Project Goal Four: Analyze Pennsylvania’s Payment In Lieu of Taxes (PILT) Payment System**

Tables 24 through 27 show the results of the PILT payments made to local governments, school districts, and counties from 2012 to 2016. Table 24 displays information on cumulative PILT payments. The total cumulative PILT rate for the years reported is \$3.60 per acre. As detailed in tables 25, 26, and 27, each of the three governmental entities receive one-third of the cumulative PILT (i.e., \$1.20 per acre).

The total payment and total acreage by year do not change across these tables as it is the same PILT rate per acre (\$1.20) and total state forest acreage subject to the PILT across governmental entities. As noted below, legislation passed in 2016 has increased the PILT to \$2.00 per acre per recipient (\$6.00 cumulative PILT); thus, figures for 2017 (unavailable for the current study) will be substantially higher. Using the 2016 acreage and the \$6.00 cumulative PILT, it's estimated that the 2017 total PILT payment would be about \$12.8 million, with each governmental entity group receiving \$4.2 million.

The number of recipients, average payment per recipient, and median payment per recipient change based on jurisdiction (i.e., local government, county government, or school district). However, there is little change across time due to the PILT payment remaining a stable \$1.20 during this period. Slight increases in total payments are a result of the BOF acquiring more state forestland, as indicated by the increase in total acreage subject to PILT. For local governments, the average and median payment per recipient decreased over the 5 years, largely due to more recipients with smaller acreage being added into the total. The same is true for school districts. For county governments, there was little change in average payments since the number of recipients remained stable at 51 across all 5 years. There were larger changes in median payments due to the wide variability in size of payments and small number of recipients.

*Table 24: Cumulative PILT Payments Made to All Governmental Entities*

<b>Year</b>	<b>Cumulative PILT Rate</b>	<b>Total Payment</b>	<b>Total Acreage</b>	<b>Number of Recipients</b>	<b>Average Payment</b>
2012	\$3.60/acre	\$7,559,388	2,099,830	552	\$13,695
2013	\$3.60/acre	\$7,562,724	2,100,757	552	\$13,701
2014	\$3.60/acre	\$7,571,691	2,103,247	552	\$13,717
2015	\$3.60/acre	\$7,677,030	2,132,509	585	\$13,123
2016	\$3.60/acre	\$7,717,281	2,143,689	595	\$12,970

*Source: Data provided by Pennsylvania Bureau of Forestry.*

Table 25: PILT Payments made to Local Governments

Year	PILT Rate	Total Payment	Total Acreage	Number of Recipients	Average Payment	Median Payment
2012	\$1.20/acre	\$2,519,796	2,099,830	358	\$7,039	\$2,361
2013	\$1.20/acre	\$2,520,908	2,100,757	358	\$7,042	\$2,394
2014	\$1.20/acre	\$2,523,897	2,103,247	358	\$7,050	\$2,446
2015	\$1.20/acre	\$2,559,010	2,132,509	380	\$6,734	\$2,110
2016	\$1.20/acre	\$2,572,427	2,143,689	386	\$6,664	\$2,003

Source: Data provided by Pennsylvania Bureau of Forestry.

Table 26: PILT Payments Made to School Districts

Year	PILT Rate	Total Payment	Total Acreage	Number of Recipients	Average Payment	Median Payment
2012	\$1.20/acre	\$2,519,796	2,099,830	143	\$17,621	\$3,660
2013	\$1.20/acre	\$2,520,908	2,100,757	143	\$17,629	\$3,787
2014	\$1.20/acre	\$2,523,897	2,103,247	143	\$17,650	\$3,787
2015	\$1.20/acre	\$2,559,010	2,132,509	154	\$16,617	\$2,847
2016	\$1.20/acre	\$2,572,427	2,143,689	158	\$16,281	\$2,845

Source: Data provided by Pennsylvania Bureau of Forestry.

Table 27: PILT Payments Made to County Governments

Year	PILT Rate	Total Payment	Total Acreage	Number of Recipients	Average Payment	Median Payment
2012	\$1.20/acre	\$2,519,796	2,099,830	51	\$49,408	\$13,346
2013	\$1.20/acre	\$2,520,908	2,100,757	51	\$49,430	\$13,346
2014	\$1.20/acre	\$2,523,897	2,103,247	51	\$49,488	\$13,909
2015	\$1.20/acre	\$2,559,010	2,132,509	51	\$50,177	\$21,115
2016	\$1.20/acre	\$2,572,427	2,143,689	51	\$50,440	\$22,090

Source: Data provided by Pennsylvania Bureau of Forestry.

The research team conducted legislation and policy research of Pennsylvania's PILT system and 10 other states. The states that were found to have no PILT system for state forestland included Maryland, North Carolina, South Carolina, Virginia, West Virginia. The states with a PILT system for state forestland included Michigan, Minnesota, New Jersey, New York, and Vermont. As stated earlier, publicly available information on other states' systems was limited, thus data on federal PILT payments made to Pennsylvania was also reviewed.

**Review of Pennsylvania PILT legislation.** On May 17, 1929, the Pennsylvania General Assembly enacted Act 591, “Forest Reserves Municipal Financial Relief Law.” This act declared that the commonwealth would make a fixed appropriation for lands acquired by the state:

“An Act providing a fixed charge, payable by the Commonwealth, on lands acquired by the State and the Federal Government for the forest reserves, or for the purpose of preserving and perpetuation a portion of the original forests of Pennsylvania, and preserving and maintaining the same as public places and park; and the distribution of the same for county, school, township, and road purposes in the counties, school districts, and the townships where such forests are located; and making an appropriation.” (P.L. 1798, N. 591)

Act 591 first put the spotlight on the economic impact of Pennsylvania forests. Rather than assess PILT at the same rate of property taxes, Pennsylvania has designated a flat fee per acre. This amount has fluctuated over the years, ranging from \$0.13 to \$6. Act 591 was later amended and eventually repealed to reflect changes in the state economy. The Act was amended in 1963, 1980, 1984, 1995, 2006, and 2016. On April 6, 1980, the General Assembly specified an amount of \$0.13 per acre of forestland annually payable by the commonwealth on the first day of September. A total appropriation of \$371,000 “or as much thereof as may be necessary” was allocated to the Department of Environmental Resources for “charges in lieu of taxes” to counties, school districts, and townships with Pennsylvania forestlands (HB 805, No. 1980-32), which totaled the PILT to \$0.39 per acre. The legislature made a slight increase to \$0.20 per acre per recipient in 1984. With Act 49 of 1995, the PILT was raised to \$0.40 per acre, to be paid to each recipient, which was a total PILT of \$1.20 per acre. Eleven years later, Act 102 of 2006 raised the PILT an additional \$0.80 to each of the three recipients, which totaled \$1.20 per acre per recipient and \$3.60 per acre in total. Most recently, Pennsylvania’s Act 85 of July 13, 2016 changed the PILT law such that for any land owned by DCNR, which includes state forestland, each county, school district, and township where the land is located is to receive an annual sum of \$2 per acre, for a total of \$6 per acre.

**Review of states without state forest PILT legislation.** The Commonwealth of Virginia is home to 68,626 acres of state forestland across 24 individual forests. Conservation of the Virginia State Forest System is supported primarily by the sale of forest products and services. Counties in Virginia do not assess a PILT for state-owned property at this time. According to §15.2-5423, “Payments in lieu of property taxes; license tax,” all Virginia governments are exempt from making payments to other governmental authorities in lieu of taxes. Email correspondence with the Virginia State Parks office within Virginia’s Department of Conservation and Recreation provided some insight:

I am not sure if any of the localities in Virginia are currently doing that. We are not being billed for any of our State Park lands. In Virginia it is often a combination of the State Forests, State Parks and prisons that make a locality consider that. I recall hearing that one of the counties we were located in had threatened to do so but Forestry reminded them that they actually received proceeds from the timber sales which would stop if they pursued it and that was that. Forestry would be the best one to contact.... Unfortunately I don’t work with anyone at the Headquarters since they are not even part of our Natural Resources Secretariat (they are under Agriculture).  
(Nancy Heltman, Visitor Services Director of VA Parks, August 7, 2017)

Inquiries with Virginia Forestry were unanswered. While Virginia does not allow local governments to receive PILT for state forestland, the commonwealth has made some tax concession for conservation. According to §58.1-512, “Land preservation tax credits for individuals and corporations,” a tax credit program for forest conservation has been in place since 2000 (Virginia Department of Forestry, 2017).

The West Virginia landscape contains eight state forests, covering a span of more than 70,000 wooded acres (West Virginia Division of Forestry, 2017). According to §7-11B-18, “Payments in lieu of taxes and other revenues,” Part (b), it would appear that the opportunity of a PILT for West Virginia state forestland would exist: “The lessee of property that is exempt from property taxes because it is owned by this state, a political subdivision of this state or an agency or instrumentality thereof, which is the lessee of any facilities financed in whole or in part, with tax increment financing obligations, shall execute a payment in lieu of tax agreement that shall remain in effect until the tax increment financing obligations are paid.” Additional information on potential PILTs in the state was not found through internet searches.

The West Virginia Division of Forestry and a County Assessor were contacted to request details on any possible PILTs for state forestland, but both inquiries were unanswered.

The South Carolina Forestry Commission regulates five state-owned tracts of forestland that make up a network of 92,511 acres (South Carolina Forestry Commission, 2017b). The state does not appear to institute a PILT for that land. According to the South Carolina Department of Revenue (2017), the state does have a “fee-in-lieu” program to supplement lost property tax revenue, but this does not apply to state-owned forestland. The “fee-in-lieu” program is used largely for economic development purposes and has a highly negotiable rate. Inquiries about the lack of a PILT for state forestland were made to the South Carolina Department of Revenue, which redirected inquiries to the South Carolina Department of Commerce. A response was received from South Carolina’s Richland County Assessor’s office who confirmed what was known: “The only people who pay a ‘fee-in-lieu-of’ are businesses or development projects who have an agreement to pay a ‘fee-in-lieu-of’ instead of property taxes...every piece of state property I’ve ever encountered in Richland County was tax exempt.” (Terry Fancy, August 8, 2017). Inquiries made to the Forestry Commission were not answered.

Forestry is North Carolina’s largest manufacturing business sector in the state, with the forestry sector producing \$18.5 billion in gross sales in 2016 (North Carolina Forestry Association, 2016). In 2014, North Carolina attempted to establish a non-standing State Payment in Lieu of Taxes Study Commission. However, it appears that this commission did not fully assemble or produce an outcome, and is currently considered to be expired. Inquiries on why the state has not adopted a PILT program for its state forestlands were directed to Ron Meyers of North Carolina’s Forest Service. North Carolina’s state forest system is relatively small at approximately 55,000 acres. A telephone interview revealed that this small size of the North Carolina state forest makes a PILT in this case “too small to deal with” (Ron Meyers, August 7, 2017).

The Maryland state forest system is comprised of 145,394 acres which are managed by the Maryland Forest Service (Maryland Department of Natural Resources, 2017). Maryland has not found the

need to supplement local budgets with PILT revenue for state forestland. Customer service from the Maryland Department of Natural Resources was unable to provide further details (email August 7, 2017). It is believed that, like North Carolina, the small size of the state forest system makes implementing a PILT system impractical.

A Cornell University study determined that roughly \$4.6 billion of the New York's annual economy is from forestry (New York State Department of Environmental Conservation, 2017). The New York State Department of Environmental Conservation is responsible for managing nine public regions with each containing multiple state forests. The state forest system totals 787,000 acres. This does not include the nearly 3 million acres of the Adirondack and Catskill Forest Preserves. The state has a sophisticated PILT system for industrial development. It also implements a PILT for certain conservation areas (i.e., the Delaware, Susquehanna, and St. Lawrence River basins; Vermont Legislature, 2014). There is no PILT for the vast forest preserves; instead local taxes are levied on the land (New York State Department of Taxation and Finance, 1996). However, the PILT system has not been extended to state-owned forestland. The Department of Environmental Conservation and the Division of Local Government and School Accountability within the Office of the State Comptroller did not respond to inquiries for this study.

**Review of states with state forest PILT legislation.** The Minnesota State Forest covers 4.2 million acres of land (Minnesota Department of Natural Resources, 2017a). The state implements a complicated PILT system that calculates different total payment amounts using different methods (e.g., acre and acquisition date criteria; appraised land values) for various classes of state-owned natural resource land (e.g., forests, parks, wildlife management areas; Minnesota Department of Natural Resources, 2017b). Their PILT system has undergone substantial revision from 1979-2011 with more than 20 major and minor legislative changes (Minnesota Department of Natural Resources, 2012). In 2012, the total PILT amount was \$25,827,999 for 8,474,871 acres, which was paid directly to the involved counties (Minnesota Department of Natural Resources, 2012). This equates to approximately

\$3.05 per acre. In 2016, the approximate payment per acre was \$3.74 (i.e., 8,507,615 total acres for \$31,856,865 total payment; Minnesota Department of Natural Resources, 2017b).

Michigan manages around 4 million acres of state-owned forestland. The state is heavily forested overall with private landowners accounting for 60 percent of total forest space in the state (Michigan Department of Natural Resources, 2017a). Michigan makes two types of PILT payments to county governments for state-owned conservation lands, forestland included. The first type is a flat per acre rate that only applies to lands purchased prior to 1933. According to statute, after 2014, \$4 per acre will be paid with an annual increase of 5 percent, or the inflation rate, whichever is less (Michigan Legislature, 1994). The second type applies to lands purchased after 1933 and fluctuates based on local millage rates – the payment is based on either “the current year’s total millage rate for the local unit or the total millage rate levied in 2004, whichever is less” (Michigan State Tax Commission, 2009). According to the Michigan Department of Treasury, in 2016 the state made a total payment of a little over \$26 million to county governments for state-owned natural resource land that totaled a little over 4.6 million acres. This equates to \$5.66 per acre. This was a sizable per-acre increase compared to 2013 when the per-acre average was \$3.87 (i.e., \$17.8 million for about the same 4.6 million acres; Michigan Department of Natural Resources, 2017b).

Vermont is around 78 percent forested (4,591,281 acres), however, most of that forestland is privately owned. Only 19 percent is publicly owned between the federal, state, and local governments (Vermont Agency of Natural Resources, 2017a). Vermont uses a PILT system for land owned by the state Agency of Natural Resources (ANR), including state forests, parks, and other public access recreation lands. Payments are made only to municipalities that possess state-owned ANR land. Since 2014, the Vermont PILT system has undergone legislative review and changes. Prior to undergoing changes, the PILT rates were “The lessor of [either] 1 percent of the appraised value of Agency of Natural Resources (ANR) land for the current year; or 1% of the current year use value of ANR land enrolled by the ANR in

the use value appraisal program” (Vermont Legislature, 2014). There are currently two different PILT calculations based on year of ANR acquisition of the land:

- (1) On parcels acquired before April 1, 2016, 0.60 percent of the fair market value as appraised by the Director of Property Valuation and Review as of April 1 of fiscal year 2015;
- (2) On parcels acquired on or after April 1, 2016, the municipal tax rate of the fair market value as assessed on April 1 in the year of acquisition by the municipality in which it is located (Vermont General Assembly, 2017)

The new PILT legislation also institutes that beginning in fiscal year 2022 the ANR Secretary is to recommend adjustments to the base PILT payments every 3 to 5 years. According to available PILT reports, in fiscal year 2016, Vermont paid 205 municipalities \$11,002, on average, for PILT-eligible land; or \$6.42 on average per acre. In fiscal year 2011, municipalities received \$10,300, on average, or \$6.10, on average, per acre (Vermont Agency of Natural Resources, 2017b).

The New Jersey Forest Service maintains 775,000 acres of state-owned forestland (New Jersey Department of Environmental Protection, 2017). The state implements a PILT for these lands and for other state-owned lands that are used for recreation and conservation purposes. The PILT is paid directly, and only, to municipalities that are affected. The PILT calculation process is multi-staged. For the first 13 years that the land is owned by the state, a sliding scale of percent of tax last assessed is used. After the 13<sup>th</sup> year, a sliding-scale flat per acre rate is assessed that is based on the percent of total land area of the municipality that the state-owned land encompasses: \$2 if the land constitutes less than 20 percent of the total land area of the municipality where the land is situated; \$5 per acre if use is at least 20 percent, but less than 40 percent; \$10 per acre if use is at least 40 percent, but less than 60 percent; \$20 per acre if use is at least 60 percent (New Jersey Revised Statutes, 2014). The research team was unable to find or obtain data on New Jersey PILT payments.

**Federal PILT legislation.** The original federal PILT law dates back to 1976, was rewritten in 1982, and was further detailed by the U.S. Department of the Interior in 2004, with the final regulation published in the Federal Register (U.S. Department of the Interior, 2017a). Federal PILT payments are

made for many different types of federal land located in county jurisdictions (e.g., military installations, parks, forests) and are only made to county governments. The PILT payments are not a flat price per acre. The formula to calculate the PILT payments made to a county are based on five factors:

“(1) the number of acres eligible for PILT payments, (2) the county’s population, (3) payments in prior years from other specified federal land payment programs, (4) state laws directing payments to a particular government purpose, and (5) the Consumer Price Index as calculated by the Bureau of Labor Statistics. If the appropriation for PILT funding is less than the full authorized amount, each county receives a prorated payment.” (Hoover 2017, p. 2)

Table 27 displays the 2017 Federal PILT payments made to Pennsylvania counties for the 513,727 PILT-eligible acres of U.S. Forest Service Land in Pennsylvania (U.S. Department of the Interior, 2017b). These acres are spread across five counties: Elk, Forest, McKean, Pike, and Warren. The small parcel of land in Pike county is Grey Towers (the homestead of Gifford Pinchot), and the Allegheny National Forest accounts for the large amounts of land in the other four counties.

*Table 28: 2017 Federal PILT Payment to Pennsylvania Counties for U.S. Forest Service Land*

<b>County</b>	<b>Payment</b>	<b>Acres</b>	<b>Payment by Acre</b>
Elk	\$199,051	111,679	\$1.78
Forest	\$44,037	119,361	\$0.37
Mckean	\$241,079	135,337	\$1.78
Pike	\$275	95	\$2.89
Warren	\$263,777	147,255	\$1.79
<b>TOTAL</b>	<b>\$747,522</b>	<b>513,727</b>	<b>\$1.71</b>

*Source: U.S. Department of the Interior (2017b).*

## Conclusions

Pennsylvania's state forest system provides numerous economic values that contribute to the well-being of Pennsylvanians. These values come in various forms, such as ecological services (e.g., air purification), forest goods (e.g., timber), and socio-cultural benefits (e.g., recreation). Defining and capturing the impact of all of the state forest system's values was beyond the scope of this study; as a result, it is unreliable to report a single figure that attempts to capture the entire value. However, the present study used multiple diverse research approaches – from both a market and nonmarket perspective – to provide insight into some of these values. Much was discovered about what was explored and what may require additional exploration. Specific conclusions related to the results of each research approach used in the study are discussed below.

The results of the market-based research approaches present several conclusions and future considerations. The data provided by the BOF to estimate the income derived from the state forest system demonstrate how marketable goods present as a value of the system. The income derived from the oil- and gas-related sales was the largest contributor in this respect. The royalties from the oil and gas leases alone accounted for 73 percent of the total income derived across the 5 years studied. However, the sales related to oil and gas activities also require substantial forestland. The average number of acres used for oil- and gas-related income a year across the five years studied was 368,545 acres. Based on this figure, an acre used for oil- and gas-related activities provided \$273, on average, per year. This amount does not consider the number of years that an acre may be used for such activities. Based on the data provided by the BOF, it is unclear how many years an acre used for oil and gas activities may be used. Determining this figure would provide a better estimate of the value of oil and gas activities. For example, if an acre of forestland can be used for oil and gas activities for 10 years, the amount per acre would increase to \$2,730. It is also important to note that the oil and gas figures do not account for the income received and acres used from pipeline right-of-ways (ROWs). Pipelines are a necessary aspect of oil and gas activities, but – according to many foresters interviewed – have the potential to damage the wild character of state

forests if they cut through the middle of state forest tracts. The data reviewed for this study did not detail the amount of income derived from ROWs used strictly for oil and gas pipelines (as opposed to those for power lines or other uses), nor did it include the number of acres required for such ROWs. It would be beneficial to couple this level of ROW detail with the oil and gas data to obtain a more accurate estimate of value per acre for oil and gas activities than what was able to be accomplished in this study.

Additional conclusions are made evident by the timber-related sales data. For example, when looking at the data across time the total amount of income for timber stumpage sales increased 19 percent from 2012 to 2016 (\$21.3 million to \$25.4 million); yet the average amount per acre decreased 22 percent from 2012 to 2016 (\$1,688 to \$1,324), with 2012 having the highest average amount per acre in all of the 5 years analyzed. This decrease does not appear to be a result of a lack of interested buyers. The average number of buyer bids per sale remained flat across each of the 5 years at about 4 bids per sale. This consistent level of average bids per sale suggests that the market for state forest timber has been stable for the 5 years analyzed. The state forest system has achieved the Forest Stewardship Council's Forest Management certification since 1998. This means that forest products "...come from responsibly managed forests that provide environmental, social, and economic benefits" (Forest Stewardship Council, 2017). The Forest Stewardship Council certification has undoubtedly assisted with keeping state forest timber desirable to logging companies. This desirability is also evidenced in the difference between the minimum bid prices and the sale amounts. As detailed earlier, the sales are consistently well above the minimum asking bid price, with one-third of the sales at least double the minimum bid price. The total timber stumpage sales totaled \$108.4 million across the 5 years studied, which is \$43.3 million more than if the sales had been made at the minimum bid price.

Although it is a very small part of the overall income derived from state forestland, the firewood sales data provides an additional insight into a value of state forest goods. According to the BOF, the firewood sales are primarily for domestic fuelwood consumption, which is a notable direct economic benefit for Pennsylvanians. While the cost of a cord of wood varies substantially, a split and seasoned

cord can average between \$120 and \$180 (Sielicki, 2017). In comparison, BOF sales average \$19 per cord, a substantial savings for individuals willing to remove and cut their own firewood. An estimated 91,859 rural households in Pennsylvania (7 percent of all rural households) used wood as their primary source of heating fuel in 2016 (U.S. Census Bureau, 2016b). In addition, an increasing number of households throughout Pennsylvania are also relying on wood as a secondary heating source (U.S. Energy and Information Administration, 2014). Technologically advanced wood stoves, furnaces, and fireplaces have made wood burning more efficient and environmentally friendly (Gulland, 2010). Allowing access to low-cost firewood on state forestland is a worthwhile value for many – and particularly rural – Pennsylvanians.

The IMPLAN analyses demonstrate that state forestland generates substantial economic value via tourism. While the two models in this study did not measure contribution and impact to local communities, it is likely that much of the economic contribution and impact estimated in the state-level models in the current study is delivered into communities and businesses (e.g., restaurants, food and beverage stores, hotels, gas stations) near state forests. Many forest managers during the interviews suggested that state forest visitation is continuing to increase, which will likely increase the economic impact of the state forest system. Potential increases in out-of-state visitation are particularly noteworthy – according to the out-of-state visitation model, \$1 of direct output associated with out-of-state visitation to the state forest system generates an additional \$1.25 in Pennsylvania’s economy. It would be worthwhile to conduct an updated out-of-state visitation model when the U.S. Fish and Wildlife Service release new survey results given that the current model relied on survey data from 2011 (although IMPLAN accounted for inflation). In addition, the results of the out-of-state visitation model relied heavily on a single estimate of state forest use for outdoor wildlife activities compared to other types of land (i.e., 16 percent of outdoor wildlife activities in Pennsylvania are conducted on state forestland). The current study was unable to corroborate this figure with other estimates. Changes in this estimated percentage would greatly affect the impact estimated.

The results of the nonmarket-based research approaches also present several conclusions and future considerations. For example, the results of the contingent valuation survey indicate little variation in how urban and rural Pennsylvanians in the sample surveyed value the state forest system. In terms of conservation-related attitudes assessed in the current study, rural and urban residents did not differ – large majorities of both types of residents were in agreement that it is important to protect and conserve state forestland; and that ensuring environmental improvements is worthy of government intervention. In addition, there were no statistically significant differences between rural and urban residents in terms of 1) the amount they would be willing to pay in extra state taxes to conserve and expand Pennsylvania’s state forest system; and 2) the number of days they spend recreating on state forestland in a typical year. Rural-urban county of residence was also not a significant predictor of whether a respondent would be willing to pay anything or not. Experience with the state forest, however, was a significant predictor of willingness-to-pay. This coincides with the perspective of many forest managers, who indicated that people who spend more time in the forest tend to value the forest more than those who are less familiar with the forest.

It is important to note that a limitation of the contingent valuation survey is the potential inability of some participants in differentiating state forestlands with state park and state game lands. This may have impacted their prior experience and valuation estimates. Interviews with forest managers confirmed (anecdotally) that many Pennsylvanians do not know the difference between these types of land and the mission behind the different government agencies that manage them.

In addition to the contingent valuation survey, the nonmarket-based bibliometric analysis demonstrated the extensive use of state forestland for research purposes and the impact of the research in the academic community. While the theses and dissertations discovered in the bibliometric analysis do not capture the entirety of graduate training conducted on state forestland, it is notable that at least three master’s students each year and two doctoral students every 2 years are using state forestland as the setting for their final research project. This training of future researchers illustrates a specific value of

public state forestland that benefits the academic community but also the resource itself as these young researchers may maintain a connection with state forestland throughout their research careers. The majority of all SFRA researchers came from Pennsylvania organizations and universities, particularly Penn State at University Park and Shippensburg University. Having state forestland open to public research is a demonstrated value.

Regarding state forest governance practices, similar themes emerged from the interviews with forest managers. These themes included how the multiple roles of the forest manager – while demanding – provide an array of value; how district personnel levels are dwindling and may ultimately affect the ability to govern the forest appropriately (and in turn may impact forest value); how increasing demands of multiple state forest user groups are, at times, at odds with one another; and how partnerships with individuals and organizations external to the Bureau of Forestry help to ensure the quality of the state forest system. The interviews also highlighted the fact that many forest managers were able to identify numerous aspects of the state forest system that were not planned to be addressed in this study; yet provide vast value to Pennsylvanians. Capturing all values that the state forest system provides to Pennsylvanians was beyond the scope of the current study. For example, the current study did not consider the value of carbon sequestration or water purification, which are forest services that are estimated at providing billions of dollars in value annually (e.g., Virginia Department of Forestry, 2006, 2015; National Association of State Foresters, 2017). Exploring these values in depth deserve further consideration.

During the interviews many districts expressed concern with the increasing demands of recreation. These demands include more trails and more types of trails (e.g., ATV trails), as well as increased requests for camping amenities that are more aligned with camping in parks than traditional camping in state forests. Many forest managers expressed concern that the increasing demands coupled with continued staffing restraints will ultimately lead to the cutting of certain tasks, which may damage district infrastructure. While these concerns are bleak, forest managers did express positivity regarding

public interest in the forest. With outdoor activities increasing in popularity, citizens are becoming more invested in the condition of the forest. Volunteerism and conservation remain steady and the forest sees more and more visitors each year. An increasing number of visitors to state forestlands may also mean increasing economic impact for local rural communities.

The state PILT research conducted in the current study provides several insights. First, several of the peer states reviewed are covered by a large percent of forestland but have relatively small state forest systems compared to Pennsylvania. This is particularly true for the peer states reviewed that do not have a PILT for state forestland (i.e., Virginia, West Virginia, South Carolina, North Carolina, Maryland). For example, Virginia is 60.7 percent forestland – compared to Pennsylvania’s 55.3 percent – yet has only 68,626 acres of state forestland – compared to Pennsylvania’s 2.2 million (U.S. Department of Agriculture, 2016a). On the other hand, New York has a sizable state forest system – 787,000 acres – but does not have a PILT for those lands. This may be due to compensating local governments through both a PILT on certain conservation areas and allowing local tax levying on the vast state forest preserves, which is separate from the state forest system. The fact that Pennsylvania has a PILT for state owned forestlands and that such a PILT is not standard across all states demonstrates Pennsylvania state government’s commitment to both ensuring that all Pennsylvanians are able to access forestland, and that local governments that are affected are compensated for ensuring this access. Second, from a payment perspective Pennsylvania’s flat-rate \$6.00 PILT per acre appears adequate compared to the PILT average-per-acre of peer states reviewed in this study (i.e., Minnesota, Michigan, Vermont, New Jersey). These states also have substantially more complicated PILT calculation systems than Pennsylvania’s but come up with relatively similar (or less sizable) payments. Third, it is clear that Pennsylvania has made a commitment to various stakeholder groups by ensuring that three different types of local governments receive PILT payments (i.e., county, local, and school districts). In comparison, the peer states with a PILT system make payments only to one local government level (i.e., municipality or county). Fourth, Pennsylvania’s PILT system for state forestland is substantially more generous to local governments than

that of the federal PILT system for U.S. Forest Service land. When comparing county payments only, the average federal PILT per-acre payment for U.S. Forest Service in Pennsylvania counties was 15 percent less than that of the Pennsylvania state forest PILT (i.e., \$1.71 versus \$2.00, respectively). Since the federal PILT only compensates county governments, the average federal PILT per-acre payment is actually 71.5 percent less than the total Pennsylvania PILT per-acre payment of \$6.00. Lastly, while not covered extensively in this study, it is important to note that additional services that the Bureau of Forestry provides on state forestland removes a level of burden from local governments that have state forest within their jurisdiction. For example, bureau rangers provide law enforcement services and bureau maintenance staff maintain roads (e.g., grading and plowing roads, cleaning and repairing culverts and bridges).

## **Policy Considerations**

The multiple research approaches in the current study provide different types of policy considerations that are all related to the value of the state forest system, whether market- or nonmarket-based values. The considerations are diverse and are not in order of importance.

- 1) Consider exploring economic impacts not covered in the current study

Capturing the entire economic impact of a complex social-ecological system such as Pennsylvania's state forest system is well beyond the scope of a single, year-long research study. As noted earlier, there are several economic benefits of the state forest system that were not explored in this study but that deserve further consideration. For example, the benefits provided by forest ecosystem services – such as carbon sequestration, storm water mitigation, and erosion prevention – have been traditionally difficult to quantify; however, new ecosystem accounting methods may make it possible to better quantify these services into monetary estimates. For example, the 2.5 million acres of forestland in Maryland have been estimated at providing \$5 billion annually in ecosystem services (Campbell & Tilley,

2014); and Virginia forests have been estimated at providing over \$900 million annually in air pollution abatement services alone (Virginia Department of Forestry, 2006).

The current study may also not have captured the total economic impact of recreational activity associated with the state forest system. The current study measured typical state forest visitation, but a closer examination of certain recreational activities may illuminate additional economic impacts. For example, large organized group events held on state forestland (e.g., trail-runs, equestrian rides) likely produce large concentrated economic impacts for local communities (DCNR, 2018a). In addition, the leased campsite program likely produces frequent recreational activity (DCNR, 2018b). There are 3,985 leased campsites on state forestland where individuals own and maintain a cabin but lease the land. These cabins are typically used as family camping cabins or group hunting cabins. They also create economic impact beyond that associated with recreational visits as the cabin owners must pay local property taxes and water and electric utilities (when available). The money spent on cabin improvements and maintenance may also create a notable economic impact.

In addition, the steward of the state forest system (i.e., the Bureau of Forestry) provides additional economic impact outside the scope of actual state forestland, particularly in terms of protecting all of Pennsylvania's forestland from invasive pests and wildfires and educating the public. For example, the Emerald Ash Borer Community Suppression program is a bureau program that assists Pennsylvania communities' in securing federal funding to protect high value ash trees. Nearly 1,500 ash trees from various communities were treated as part of the program. In addition, the bureau estimates that the costs of wildfire suppression across all of Pennsylvania (both state and non-state forestland) borne by the bureau was about \$4.5 million for the years 2012 through 2016. The bureau is also responsible for educating private forestland owners and the general public about fire prevention and proper forest stewardship. The bureau conducted about 900 forest fire prevention events per year from 2012 to 2016 across Pennsylvania, which equates to about 14 events per county per year. In terms of promoting proper forest stewardship, in 2016 the Bureau recorded over 11,000 service foresting outreach activities across

Pennsylvania (e.g., assisting with management and stewardship plans, planting and layout assistance, street tree recommendations). In addition, the Bureau outreach program called Project Learning Tree conducts educational sessions that teach Early Childhood and Pre-K to grade 12 educators about how to use trees and forests to increase their students' understanding of the environment and conservation. Approximately 400 educators a year undergo a session of the Project Learning Tree program.

- 2) Consider ways of increasing personal experience with a state forest among individuals who have not visited a state forest

The results of the contingent valuation survey suggest that overwhelming majorities of both urban and rural Pennsylvanians in the sample surveyed appreciate the importance of conserving state forestland. In addition, the results of the statistical modeling suggest that individuals who have experienced the state forest have higher odds of placing greater value in the forest (in terms of the willingness-to-pay valuation) than those who have not experienced the state forest. These results suggest that while individuals may have a great appreciation of state forest conservation, personally experiencing the state forest may increase their odds of placing greater value in the forest. In other words, encouraging recreational visitation to a state forest may improve personal value perceptions of the state forest system. It is unclear whether educating individuals about the state forest without actually visiting a state forest has the same impact. It may be beneficial to continue to support and expand partnerships with nonprofit agencies that promote outdoor activity and state forest volunteerism in Pennsylvania (e.g., Pennsylvania Parks and Forest Foundation, Keystone Trails Association, etc.).

- 3) Consider how revenue generated from recreational activity may help offset the increased burden of such activity

Increased recreational activity on state forestland has both favorable and unfavorable consequences: it produces local economic stimulation through visitation and may introduce a new group of individuals to the conservation mission of the bureau; but it also increases administrative, maintenance,

and safety burdens on state forest districts. The impact of increased recreation differs from district to district. It may be worthwhile to ensure that district resources directed at particular recreational activities and programs that are focused on small groups of people and not the general public (e.g., group events, leased campsite program) are somewhat comparable with the revenue these activities generate.

4) Consider placing additional emphasis on the state forest system as a resource for research

One-quarter of the research requests over the 7 years studied came from a single institution (i.e., Penn State University). The large number of requests from Penn State University is understandable given the size of the university, the number of programs at the university interested in forestland, and the location of the campus. However, the disparity in requests between Penn State and other Pennsylvania universities is larger than expected. The Bureau of Forestry has developed mutually beneficial relationships with Penn State researchers that have produced substantial academic results as well as useful applied knowledge (e.g., the Oak Regeneration project). It may be worthwhile for the bureau to place additional emphasis on their openness to conducting research on state forestland, perhaps by publicly highlighting some (or all) previous research. It is also important for the bureau, or individual districts, to continue connections with researchers after the research is approved to reap the benefits of the research (i.e., to obtain the results of the research) and to potentially partner with researchers to aid the bureau in researching solutions to unique district issues. The majority of researchers contacted in this study that have conducted research on state forestland were excited to share their research results, expressed interest in learning more about other research conducted on state forestland, and were very thankful for being able to use the state forest as a research resource.

5) Consider how to incorporate changes into PILT payments

Pennsylvania's flat-rate PILT system keeps complicated PILT calculations and potential issues that may arise from such calculations at a minimum. It also gives local governments a consistent revenue amount to include in budget calculations. However, the system does not take into consideration future

environmental or economic changes. Vermont's recent PILT legislation instituted a system of review providing that the Secretary of Natural Resources review the PILT payments every 3 to 5 years and provide adjustment recommendations to the legislature. Establishing a similar system of review may be beneficial for Pennsylvania's flat-rate PILT system.

6) Consider ways to reduce administrative burden through advances in technology

In times of having to do more with less, administrative organizations typically seek ways to reduce administrative burden. Many times, this involves relying on technology to either replace or improve the efficiency of administrative processes. Doing so typically gives personnel more time for matters that are more important than paperwork. Having a central office with 20 district offices, the Bureau of Forestry has the opportunity to centralize and streamline certain routine administrative tasks. For example, camping permits are distributed through each district office and campers looking for permits cannot check availability or book online. However, the bureau's sister agency – State Parks – operates a centralized, online reservation system for all state parks. Not only does this streamline the permitting process, but it gives campers the opportunity to check availability and to view all state park campsites online.

7) Consider ways to expand the leveraging of partnerships that support district operations

The interviews with forest managers revealed that districts collaborate with a large number and variety of organizations to support district operations and meet district goals. While some partnerships are common (e.g., State Parks), not all districts partner with the same organizations. Many times, the partnerships start as informal relationships that turn into mutually beneficially arrangements. Many partnerships are based on local context, but other districts may have similar organizations in their area (e.g., chamber of commerce). Also, some partnerships with statewide organizations are not used by all districts. Determining how to spread the use of beneficial partnerships may be of value. For example, it may be beneficial to create a centralized database of partnerships that detail the types and purpose of the

partnerships formed across the state. This database could be used by districts when they are seeking assistance with certain forest management goals.

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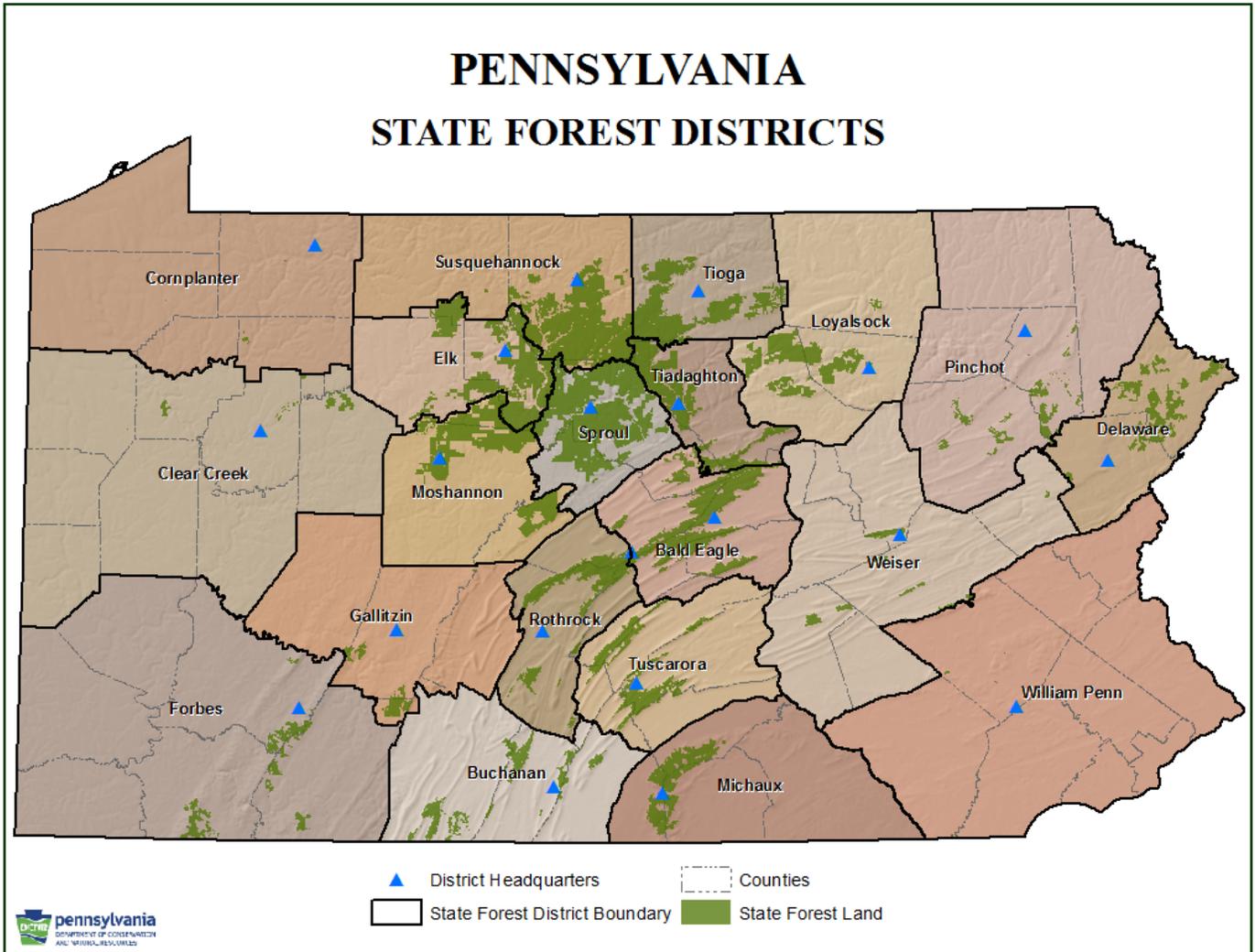
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## Appendices

### Appendix A: Map of Pennsylvania State Forest Districts



Source: Pennsylvania Bureau of Forestry Forest Products Statistical Report 2016.

## Appendix B: Out-of-State Trip Expenditures and IMPLAN Sectors

Trip Expenditures	IMPLAN SECTOR	Hunting Total Expenditures	Fishing Total Expenditures	WW Total Expenditures	State Forest Modifier	Hunting Total Modified	Fishing Total Modified	WW Total Modified	FINAL MODEL
Food and lodging - Food	400 Retail - Food and beverage stores	\$16,741,762	\$31,035,218	\$150,430,754	16%	\$2,678,682	\$4,965,635	\$24,068,921	<b>\$31,713,238</b>
Food and Lodging - Lodging	499 Hotels and motels, including casino hotels	\$996,238	\$7,865,782	\$32,636,246	16%	\$159,398	\$1,258,525	\$5,221,799	<b>\$6,639,722</b>
Transportation	402 Retail - Gasoline stores	\$15,182,000	\$29,142,000	\$30,471,000	16%	\$2,429,120	\$4,662,720	\$4,875,360	<b>\$11,967,200</b>
Boating costs	406 Retail - Miscellaneous store retailers	\$19,000	\$4,742,000	\$1,052,125	16%	\$3,040	\$758,720	\$168,340	<b>\$930,100</b>
Fee-Guide fees, package fees, privilege fees	464 Employment Services	\$1,237,937	\$5,908,353	\$1,488,432	16%	\$198,070	\$945,336	\$238,149	<b>\$1,381,555</b>
Fee-Public land use fee	531 * Employment and payroll of state govt, non-education	\$101,376	\$2,118,941	\$459,010	16%	\$16,220	\$339,031	\$73,442	<b>\$428,693</b>
Fee-Equipment rental	443 General and consumer goods rental except video tapes and discs	\$157,268	\$2,066,638	\$270,805	16%	\$25,163	\$330,662	\$43,329	<b>\$399,154</b>
Heating and cooking fuel	156 Petroleum refineries	\$830,879	\$1,690,258	\$196,228	16%	\$132,941	\$270,441	\$31,396	<b>\$434,778</b>
Bait	385 Sporting and athletic goods manufacturing	\$0	\$10,689,308	\$0	16%	\$0	\$1,710,289	\$0	<b>\$1,710,289</b>
Ice	107 Manufactured ice	\$0	\$3,632,241	\$0	16%	\$0	\$581,159	\$0	<b>\$581,159</b>
<b>Total Trip-Related Expenditures</b>		<b>\$35,266,460</b>	<b>\$98,890,739</b>	<b>\$217,004,600</b>		<b>\$5,642,634</b>	<b>\$15,822,518</b>	<b>\$34,720,736</b>	<b>\$56,185,888</b>

<b>Equipment Expenditures</b>	<b>IMPLAN SECTOR</b>	<b>Hunting Total Expenditures</b>	<b>Fishing Total Expenditures</b>	<b>WW Total Expenditures</b>	<b>State Forest Modifier</b>	<b>Hunting Total Modified</b>	<b>Fishing Total Modified</b>	<b>WW Total Modified</b>	<b>FINAL MODEL</b>
Rifles/firearms	259 Small arms, ordnance, and accessories manufacturing	\$10,517,035	\$0	\$0	16%	\$1,682,726	\$0	\$0	\$1,682,726
Short gun	259 Small arms, ordnance, and accessories manufacturing	\$6,730,880	\$0	\$0	16%	\$1,076,941	\$0	\$0	\$1,076,941
Muzzleloaders, pistols	259 Small arms, ordnance, and accessories manufacturing	\$898,082	\$0	\$0	16%	\$143,693	\$0	\$0	\$143,693
Pistols and handguns	259 Small arms, ordnance, and accessories manufacturing	\$4,301,978	\$0	\$0	16%	\$688,316	\$0	\$0	\$688,316
Bows, arrows, archery equipment	385 Sporting and athletic goods manufacturing	\$6,879,742	\$0	\$0	16%	\$1,100,759	\$0	\$0	\$1,100,759
Telescopic sights	385 Sporting and athletic goods manufacturing	\$3,905,205	\$0	\$0	16%	\$624,833	\$0	\$0	\$624,833
Decoys and game calls	385 Sporting and athletic goods manufacturing	\$2,222,447	\$0	\$0	16%	\$355,591	\$0	\$0	\$355,591
Ammunition	257 Small arms ammunition manufacturing	\$9,555,620	\$0	\$0	16%	\$1,528,899	\$0	\$0	\$1,528,899
Hand loading equipment	385 Sporting and athletic goods manufacturing	\$1,464,624	\$0	\$0	16%	\$234,340	\$0	\$0	\$234,340
Hunting dogs/associated costs	14 Animal production, except cattle and poultry and eggs	\$6,999,425	\$0	\$0	16%	\$1,119,908	\$0	\$0	\$1,119,908
Other hunting equipment	404 Retail - Sporting goods, hobby, musical instrument and book stores	\$3,472,962	\$0	\$0	16%	\$555,674	\$0	\$0	\$555,674
Reels, rods, and rod-making components	385 Sporting and athletic goods manufacturing	\$0	\$19,046,129	\$0	16%	\$0	\$3,047,381	\$0	\$3,047,381
Lines, hooks, sinkers, etc.	385 Sporting and athletic goods manufacturing	\$0	\$11,793,658	\$0	16%	\$0	\$1,886,985	\$0	\$1,886,985
Artificial lures and flies	385 Sporting and athletic goods manufacturing	\$0	\$9,502,472	\$0	16%	\$0	\$1,520,395	\$0	\$1,520,395
Creels, stringers, fish bags, landing nets, and gaff hooks	385 Sporting and athletic goods manufacturing	\$0	\$545,717	\$0	16%	\$0	\$87,315	\$0	\$87,315

Minnow sienes, traps, and bait containers	385 Sporting and athletic goods manufacturing	\$0	\$972,405	\$0	16%	\$0	\$155,585	\$0	\$155,585
Other fishing equipment	404 Retail - Sporting goods, hobby, musical instrument and book stores	\$0	\$5,132,620	\$0	16%	\$0	\$821,219	\$0	\$821,219
Binoculars, spotting scopes	385 Sporting and athletic goods manufacturing	\$0	\$0	\$3,024,727	16%	\$0	\$0	\$483,956	\$483,956
Film and photo processing	186 Photographic film and chemical manufacturing	\$0	\$0	\$1,738,826	16%	\$0	\$0	\$278,212	\$278,212
Cameras, special lenses, video cameras, and other photographic equipment, including memory cards	398 Retail - Electronics and appliance stores	\$0	\$0	\$8,785,227	16%	\$0	\$0	\$1,405,636	\$1,405,636
Day packs, carrying cases, and special clothing	121 Textile bag and canvas mills	\$0	\$0	\$3,885,481	16%	\$0	\$0	\$621,677	\$621,677
Bird food	66 Other animal food manufacturing	\$0	\$0	\$22,952,727	16%	\$0	\$0	\$3,672,436	\$3,672,436
Food for other wildlife	66 Other animal food manufacturing	\$0	\$0	\$6,839,597	16%	\$0	\$0	\$1,094,335	\$1,094,335
Nest boxes, bird houses, bird feeders, and bird baths	142 Wood container and pallet manufacturing	\$0	\$0	\$4,069,443	16%	\$0	\$0	\$651,111	\$651,111
Other WW equipment (including field guides)	385 Sporting and athletic goods manufacturing	\$0	\$0	\$562,904	16%	\$0	\$0	\$90,065	\$90,065
Auxiliary equipment (tents, camping)	121 Textile bag and canvas mills	\$0	\$0	\$11,197,697	16%	\$0	\$0	\$1,791,632	\$1,791,632
Special equipment (off road vehicles, trailers)	349 Travel trailer and camper manufacturing	\$0	\$0	\$65,750,371	16%	\$0	\$0	\$10,520,059	\$10,520,059
<b>Total Equipment-Related Expenditures</b>		\$56,948,000	\$46,993,000	\$128,807,000		\$9,111,680	\$7,518,880	\$20,609,119	\$37,239,679
<b>Total Trip &amp; Equipment-Related Expenditures</b>		<b>\$127,480,920</b>	<b>\$244,774,479</b>	<b>\$562,816,200</b>		<b>\$14,754,314</b>	<b>\$23,341,398</b>	<b>\$55,329,855</b>	<b>\$93,425,567</b>

Source: Expenditures (U.S. Census Bureau, 2015); IMPLAN sector and ID (IMPLAN Group LLC, 2015).

## Appendix C: Contingent Valuation Survey

**Introduction/transition:** Next, I would like to ask you a few questions about Pennsylvania state forests. The Pennsylvania state forest system makes up 13 percent of all forests in the state. The state forests provide many natural services that improve the quality of life for Pennsylvanians. These services include cleaning the water Pennsylvanians drink and the air they breathe. State forests also provide natural habitats for plants and animals.

**Question 1:** How much would you be willing to pay each year in extra state taxes to conserve and expand Pennsylvania's state forestlands?

- Open-ended numeric response: \_\_\_\_\_

**Question 2:** Please indicate your level of agreement with the following statement:

It is important to protect and conserve the state forestland.

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree
- Neither disagree nor agree (Do not read unless needed)
- Don't know (Do not read unless needed)
- Decline to answer (Do not read unless needed)

**Question 3:** Please indicate your level of agreement with the following statement: The government should require everyone to help pay for environmental improvements. Would you say you...

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree
- Neither disagree nor agree (Do not read unless needed)
- Don't know (Do not read unless needed)
- Decline to answer (Do not read unless needed)

**Question 4:**

In a typical year, how many days do you go to a Pennsylvania state forest for recreational activities?

- Open-ended numeric response: \_\_\_\_\_

## Appendix D: Rural and Urban Counties by Population Density

County	Population Density	Type
Adams	196	Rural
Allegheny	1,676	Urban
Armstrong	106	Rural
Beaver	392	Urban
Bedford	49	Rural
Berks	480	Urban
Blair	242	Rural
Bradford	55	Rural
Bucks	1,035	Urban
Butler	233	Rural
Cambria	209	Rural
Cameron	13	Rural
Carbon	171	Rural
Centre	139	Rural
Chester	665	Urban
Clarion	67	Rural
Clearfield	71	Rural
Clinton	44	Rural
Columbia	139	Rural
Crawford	88	Rural
Cumberland	432	Urban
Dauphin	511	Urban
Delaware	3,041	Urban
Elk	39	Rural
Erie	351	Urban
Fayette	173	Rural
Forest	18	Rural
Franklin	194	Rural
Fulton	34	Rural
Greene	67	Rural
Huntingdon	52	Rural
Indiana	107	Rural
Jefferson	69	Rural
Juniata	63	Rural
Lackawanna	467	Urban
Lancaster	550	Urban

County	Population Density	Type
Lawrence	254	Rural
Lebanon	369	Urban
Lehigh	1,013	Urban
Luzerne	360	Urban
Lycoming	95	Rural
McKean	44	Rural
Mercer	173	Rural
Mifflin	114	Rural
Monroe	279	Rural
Montgomery	1,656	Urban
Montour	140	Rural
Northampton	805	Urban
Northumberland	206	Rural
Perry	83	Rural
Philadelphia	11,379	Urban
Pike	105	Rural
Potter	16	Rural
Schuylkill	190	Rural
Snyder	121	Rural
Somerset	72	Rural
Sullivan	14	Rural
Susquehanna	53	Rural
Tioga	37	Rural
Union	142	Rural
Venango	82	Rural
Warren	47	Rural
Washington	243	Rural
Wayne	73	Rural
Westmoreland	355	Urban
Wyoming	71	Rural
York	481	Urban

*Source: The Center for Rural Pennsylvania.*

## **Appendix E: Grand Tour Questions for Qualitative Interviews**

- What are the biggest challenges facing your district? What about the challenges facing the entire state forest system?
- Tell me about your job at the BOF and what it's like to work there.
- How do you handle difficult forest management situations that arise at work? Describe an example.
- How does interacting with individuals outside of BOF and DCNR impact your job? Describe an example.
- What are the biggest challenges facing your district and the BOF in general?
- What aspect(s) of the state forest do you believe the general public values most? Why?
- How have demands placed on the BOF and the state forest system changed over time?
- What do you think the state forest system will look like in 10-20 years?



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