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The Growing Importance of the Environmental Horticulture Industry in the Agricultural Economy of the Northeastern United States

Martin Shields and Fern K. Willits

This study examines several aspects of the Environmental Horticulture Industry (EHI) in the northeastern United States. First, the EHI is compared to other agricultural sectors in the region. The sector's growth is found to far outpace growth in traditionally important crops and commodities. The study then takes a closer look at the EHI in Pennsylvania, utilizing survey data and the IMPLAN input-output model to estimate the overall economic contributions of the industry to the state's economy. Results suggest that the EHI generates nearly \$3.3 billion in value-added and more than 107,000 state jobs through direct, indirect, and induced effects. Finally, survey data are used to identify and discuss important issues that land grant universities throughout the Northeast can address as they seek to strengthen the sector.

Key Words: agricultural development, economic contribution, environmental horticulture

Fueled by a strong national economy in the 1990s, the Environmental Horticulture Industry¹ (EHI) has become one of the fastest growing segments of production agriculture in the United States. Between 1992 and 1997, the *U.S. Census of Agriculture* shows the number of U.S. farms growing nursery and greenhouse crops increased by 43%, to a total of 67,816 establishments [U.S. Department of Agriculture/National Agricultural Statistics Service (USDA/NASS)].

Sales have also exhibited strong growth. Correcting for inflation, producer sales of floriculture and greenhouse products rose by more than 18% from 1991 to 2000, exceeding \$13.2 billion [USDA/

Economic Research Service (ERS)]. While data are not yet available for analysis from the 2002 agricultural census, it appears likely the industry has continued to expand. Moreover, this growth has not been limited to the production of plants and trees. An analysis of *County Business Patterns* (U.S. Bureau of the Census, 2000) data shows that an increased demand for EHI products and services had led to growth in a number of related sectors, such as landscaping goods, wholesale and retail trade operations, and the landscape service industry. Thus, EHI growth has not only created jobs in agriculture, but has also helped affiliated businesses prosper.

The increasing importance of the EHI in the Northeast relative to other agricultural sectors suggests this sector may offer new opportunities to strengthen the region's agricultural economy. First, because many growers ship their products out of the region, the industry provides a stimulus for increasing regional agricultural exports, injecting new monies into the regional economy. Second, the industry's production practices foster opportunities to maintain a strong agricultural base in an ever-changing economy. Specifically, nursery and green-

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¹ The term "Environmental Horticulture Industry" refers to all businesses engaged in the production, retail, wholesale, re-wholesale, and/or installation or maintenance of green goods (plants, trees, sod, cut flowers, etc.) and related hard goods (tools, mulch, pavers, fertilizers, plant containers, etc.).

house production generally requires less land than most agricultural activities—likely a desirable attribute in an increasingly urbanized region. Indeed, Heimlich and Barnard (1992) identified “adaptive farms” (defined by high values per acre, and including EHI producers) as an important component of the future of agriculture in the Northeast, noting adaptive farms are “likely to survive and increase because they can better compete economically with urban land uses” (p. 59).

Given the increasing importance of the sector, an improved understanding of the nature and extent of the EHI and its wider economic contribution is needed.² For individual businesses, basic industry information provides a needed perspective in planning for growth and marketing. As an expanding presence in the agricultural economy, the industry can use this information to further its objectives with regard to market growth, competitiveness, and government assistance. Lacking clear information, political leaders, government agencies, educators, researchers, and the public may overlook or downplay the industry’s importance and its contributions to the region’s economic and social well-being.

While it is generally recognized that the U.S. EHI has expanded to meet the increasing demand for its products, careful economic analysis of the industry’s scope and contribution has been limited. At the national level, Turner and Kriesel (1995) used the IMPLAN input-output (IO) model to examine the role of the EHI in the U.S. economy. Using IMPLAN-provided data from 1990, they constructed employment and output multipliers, concluding that the industry was the second leading employer in production agriculture and the sixth-ranked production agriculture sector in terms of output in the United States.

Several researchers have also examined the industry within individual states in the South and West, including Arizona (Cox, Leones, and Hollyer, 1995), Louisiana (Hughes and Hinson, 2000), and Florida (Hodges and Haydu, 2000). These state-level analyses also employed the IMPLAN model, supplemented by survey data, to examine issues such as linkages between producers and service industries (Arizona) and broadly defined industry contributions (Louisiana and Florida).

Little is known, however, about the role of the EHI in the agricultural economy of the North-

east.³ To our knowledge, only one peer-reviewed research study examining the economic contribution of the EHI in a northeastern state (New Jersey) has been published (Tavernier, Li, and Thatch, 1995). These researchers used base IMPLAN data to assess the industry’s production side and reported a total contribution of \$144 million in employee compensation spread over 10,308 jobs.

A similar analysis has been conducted in Delaware (Tanjukio, Madiraju, and Hastings, 1997). These authors also use the base IMPLAN model, but expand the definition of the industry to include landscape and garden services, and retail and wholesale trade, in addition to production. For 1993, they found the industry generated 4,032 jobs and \$102 million in value-added.

While both of the above studies help improve our understanding of the industry, they are subject to scrutiny because they rely on the national coefficients (i.e., nonsurvey) that underlie the IMPLAN database. The national data may not accurately reflect what is happening in the Northeast. Consequently, a survey-based approach can enhance the accuracy of such estimates.

Recently, Perry and Berg Stack (2000) conducted such a survey of the industry in New England to document sales and growth. While their study provides a good overview of select industry trends, it does not offer a detailed economic analysis of the industry; especially notable is the absence of an analysis of the industry’s multiplier contributions.

Although a clearer picture of the growth of the EHI in the region is emerging, additional analysis is needed to document both its historic growth and its overall economic contribution. Because of weather differences, evidence from California and the southern states (where the industry is driven largely by exports) may provide little insight into the northeastern situation where it is largely seasonal and locally focused. Moreover, slower population growth in the Northeast relative to these other areas may affect the nature and rapidity of the industry’s future development.

This research provides information on the EHI in the northeastern United States by examining three types of data. First, extant secondary data from U.S. government sources are analyzed to provide a general overview of the industry’s scope. Second, information from a survey of industry businesses in

² In a series of industry meetings in the early 1990s, an increased understanding of the economic and employment aspects of the industry was identified among six emerging issues (Johnson and Christensen, 1995).

³ The northeastern United States is defined to include: Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia.

one northeastern state (Pennsylvania) is analyzed using the IMPLAN input-output model to provide estimates of the direct and secondary economic contributions of the industry in that state. Finally, information from the same survey is utilized to explore the views of participants concerning important issues facing the industry now and in the future.

Environmental Horticulture Trends in the Northeast

As noted in the introduction, the EHI has experienced strong growth relative to other agricultural sectors. In this section we describe recent trends in the industry, drawing on several data sources.

Floriculture and Nursery Crops

The *U.S. Census of Agriculture* (USDA/NASS) and the *Floriculture and Nursery Crops Yearbook* (USDA/ERS) provide data documenting the growth of EHI production in the northeastern United States. Table 1 describes some important industry trends over the past 10 years. Highlights include:

- According to the most recent information from the *U.S. Census of Agriculture*, the number of farms growing nursery and greenhouse crops in the Northeast increased by 65% between 1992 and 1997, to a total of 16,786 operations. This was considerably greater than the corresponding increase of 43% for the nation as a whole.
- According to the USDA/ERS, Northeast sales of floriculture and nursery crops totaled more than \$1.6 billion in 2000, representing an inflation-adjusted increase of 4% since 1991. In the United States, the overall increase in adjusted sales was 18%.
- On a per capita basis for the period 1991–2000, inflation-adjusted sales of nursery and greenhouse crops have remained steady in the Northeast (about \$25 per person), while U.S. per capita sales have increased 9%, to about \$48 per person.
- *U.S. Census of Agriculture* data show the number of farms producing landscape and nursery crops increased in every northeast state between 1992 and 1997. However, the USDA/ERS data show that several of these states saw a decline in total sales once inflation was accounted for.

The 12 northeastern states combined accounted for about 12% of the nation's farm gate receipts from floriculture and nursery crops in 2000. The modest growth of the industry in the Northeast, coupled with the overall strong growth in the nation, is particularly impressive when one considers that the total cash receipts for all commodities, adjusted for inflation, declined by about 3.7% between 1991 and 2000.

Environmental Horticulture Retail and Services

U.S. Bureau of the Census secondary data from the *1997 U.S. Economic Census of Retail Trade* and the year 2000 report of *County Business Patterns* provide information for a limited examination of the magnitude of the retail sales and service components of the EHI in the region (table 2). Sales figures were available only from the *1997 U.S. Economic Census of Retail Trade*, but data on the number of establishments, employment, and payrolls were included in the 2000 *County Business Patterns* data. However, the recent change from Standard Industrial Classification (SIC) codes to North American Industrial Classification System (NAICS) codes for classifying data means that long-term trend analysis of these measures is not possible.⁴

- Retail establishments in the Northeast which were primarily engaged in nursery and garden sales (NAICS sector 44422) reported \$2.9 billion in sales receipts in 1997. This figure excluded both lawn and garden power equipment sales/service (NAICS sector 44421) and sales of green and related hard goods by home centers, convenience stores, groceries, and general merchandise outlets. The latter likely account for billions more in sales.
- In 2000, there were a total of 2,560 retail establishments in the Northeast primarily engaged in nursery and garden sales (NAICS sector 44422). These businesses employed 21,575 workers, with an annual payroll of nearly \$500 million.

⁴ Prior to 1997, the government used the SIC to classify businesses. In 1997 the *U.S. Economic Census of Retail Trade*, and in 1998 the *County Business Patterns* (U.S. Bureau of the Census) data changed to the NAICS coding procedure to make consistent the organization of economic data throughout North America. Although for some industrial groups NAICS and SIC are comparable (or nearly so), this was not true for the categories relevant to the EHI.

Table 1. Recent Trends in State-by-State Landscape and Nursery Production in the Northeast United States

Region	Number of Farms in 1997 ^a	Growth, 1992–1997 (%)	Sales, 2000 (\$000s) ^b	Inflation-Adjusted Growth Since 1991 (%)
U.S.	67,816	43	13,270,842	18
Northeast	16,786	65	1,647,557	4
Connecticut	1,133	78	176,735	46
Delaware	176	50	30,300	! 27
Massachusetts	1,375	49	25,285	9
Maryland	1,009	29	269,356	11
Maine	926	63	134,175	! 4
New Hampshire	619	92	56,920	44
New Jersey	2,826	59	297,392	18
New York	3,346	62	295,072	3
Pennsylvania	3,877	72	311,902	! 11
Rhode Island	276	75	31,030	! 37
Vermont	665	117	19,390	! 30
West Virginia	558	105	not reported	

^a Source: 1997 U.S. Census of Agriculture (USDA/NASS).^b Source: Floriculture and Nursery Crops Yearbook (USDA/ERS, 2000).**Table 2. State-by-State Employment in Select Environmental Horticulture Industry Sectors in the Northeast United States, 2000**

Region	Nursery and Garden Centers			Landscape Services		
	No. of Establishments	Employment (No. of Jobs)	Payroll (\$000s)	No. of Establishments	Employment (No. of Jobs)	Payroll (\$000s)
U.S.	16,459	151,539	3,350,291	67,053	415,873	9,770,825
Northeast	2,560	21,575	499,289	17,591	77,239	2,176,033
Connecticut	175	2,062	51,228	1,580	5,809	188,990
Delaware	51	407	8,178	215	1,291	30,142
Massachusetts	208	1,608	46,618	2,155	8,663	268,978
Maryland	228	2,580	53,197	1,421	11,057	278,082
Maine	65	467	8,955	377	1,452	38,161
New Hampshire	79	55	13,935	428	1,576	43,134
New Jersey	331	2,639	63,717	3,225	12,832	371,698
New York	620	4,903	125,414	4,218	14,934	452,608
Pennsylvania	609	5,259	106,809	3,085	16,281	421,809
Rhode Island	33	NA	NA	454	1,314	37,560
Vermont	63	469	9,973	227	667	17,913
West Virginia	98	627	11,265	206	1,363	26,958

Source: County Business Patterns (U.S. Bureau of the Census, 2000).

- Landscaping services (NAICS 56173), with 17,591 establishments, employed more than 77,239 workers in the Northeast in 2000 (as of March 12), and had a total annual payroll of \$2.2 billion.

The importance of sales and services underscores the fact that the EHI is more than plant production. Landscaping services, including design, installation, and maintenance, contribute in important ways to the size and effect of the industry on the region's economy.

An Economic Analysis of Pennsylvania's Environmental Horticulture

As documented in the previous section, the EHI represents an important part of the agricultural economy in the Northeast. The industry generates jobs in a variety of sectors, and farm-level sales have been growing faster than the overall regional average. To date, however, the economic contributions of the industry are not well understood; research on the broader contributions of the industry in both the Northeast region and its individual states is needed.

To partially address this void, an economic analysis of Pennsylvania's EHI is carried out using the Pennsylvania IMPLAN IO model, which is extensively modified using data collected in a statewide survey of industry participants. This survey was necessary because data sets such as those described above are marked by several problems. First, they individually consider only certain aspects of the industry, such as production and retail. Second, even in instances where data are gathered, the information is categorized in ways that are not amenable to a study focusing specifically on the EHI. For example, at the retail level, stores such as Home Depot and Wal-Mart are important sellers; yet sales data for these nonspecialized stores are often reported in other categories. Thus, secondary data fail to provide sufficient information for obtaining an adequate picture of the EHI.

The Survey

To obtain information for analyzing Pennsylvania's EHI, a sample of 4,015 units was drawn from the year 2000 listing of all 7,435 certified nursery growers and dealers in the state. The Pennsylvania Department of Agriculture (PDA) requires certifi-

cation for all businesses, organizations, and individuals who sell (retail or wholesale) living plants or parts of plants. Of the total sample, 1,044 units were retail establishments which were part of larger "chain stores," 2,909 were independent dealers or growers, and 62 were not businesses (e.g., youth and school groups, community organizations, conservation districts, and charitable agencies). These "nonbusinesses" were removed from the sample.

Survey forms were mailed to the 2,909 "non-chains" in October 2000, requesting information on their involvement in the EHI, including their major sources of income (sales of green goods and related hard goods, landscape design, installation, and maintenance), gross income, number of employees, total payroll, taxes, and other business characteristics. Participants were also asked their opinions about various issues related to the EHI. In an effort to increase response rates, a postcard reminder followed the initial mailing and, several weeks later, a duplicate survey along with a second request for participation was mailed. Of the 2,909 survey forms mailed to members of the sample, 183 establishments were no longer in business, and 96 were not at the listed address and the materials could not be forwarded. A total of 842 of the 2,630 independent businesses contacted returned usable questionnaires (yielding a 36% response rate).

For this analysis, information available from the certification records was used to classify each establishment into one of four type-of-business categories: growers, landscape contractors, garden centers, and distribution/mail order.⁵ A comparison (table 3) of the distribution of the various "types" in the sample with the total population of "nonchain" businesses on the PDA list of certified nursery dealers and growers revealed the sample contained disproportionately fewer garden centers (18%) than did the total population of certified dealers and growers (24%), and somewhat more landscape contractors (32%) and growers or nursery production establishments (48%) than did the population (29% and 45%, respectively).

In developing population estimates from the survey data, a three-step procedure was used. First, we determined the averages of employment, wages, sales, and other relevant information (call this y) for each type of business (j). Recognizing the potential for scale economies, we compiled an "average-by-

⁵ This four-category system of classification was a condensed version of the 11 categories used by the Bureau of Plant Industry, PDA, to classify certified dealers and growers in its records.

Table 3. Population and Sample Distribution of Environmental Horticulture Industry Business Types

Type of Operation	Total Population	% of Total Population	Sample Responses	% of Sample
Non-Chains:				
Growers	2,414	45	407	48
Landscape Contractors	1,554	29	270	32
Garden Centers	1,290	24	150	18
Distribution and Mail Order	96	2	15	2
Subtotal	5,354	100	842	100
Chains:				
Grocery Stores	763	44	126	47
Convenience Stores	446	26	44	17
Home Centers/Hardware Stores	286	17	27	10
General Merchandise Stores	183	11	69	26
Specialty Stores	35	2	0	0
Subtotal	1,713	100	266	100

sales” for each of 11 sales ranges (i) for each business type, i.e.,

$$E(y_j) = \sum_{i=1}^{11} \frac{y_{i,j}}{n_{i,j}}, \quad j = 1, 2, 3, 4,$$

where n is the number of businesses in a category, and

$$\sum_{j=1}^4 \sum_{i=1}^{11} n_{i,j} = N.$$

In the second step, a typical “business profile” was developed for each of the four types of businesses. To produce this profile (S_j), the average-by-sales was weighted by the sample’s distribution-by-sales (i.e., $S_j = E(y_j) (n_j/N_j)$).

In the third step, the sample was expanded to the population for each type of business (p_j) by multiplying assorted facets of the business profile by the type-of-business population in order to derive a category total (T_j) (i.e., $T_j = S_j (p_j)$). The effect was a relative weighting to reflect the population distribution,

$$\sum_{j=1}^4 p_j = P.$$

The 1,044 chain outlets in the sample represented 64 separate companies. Because we anticipated that the individual stores would be unable or unwilling to provide the needed data, we telephoned regional or national offices directly. Information was obtained for 266 establishments, representing 26 different chains. Citing company policy, two major

retailers—Wal-Mart and K-Mart—refused to participate in the study. For the economic analysis, estimated values for these stores, based on national data sources including those published in *Nursery Retailer Magazine*, were utilized.

Further, recognizing there are differences among the stores, we classified chain outlets into the following categories: grocery stores, convenience stores, home centers and hardware stores, general merchandise stores, and stores specializing in EHI plants and products. Similar to the procedure outlined above, the sample data were weighted by these categories to match the distribution of chain outlets in the population listing (table 3).

Economic Impacts

The first goal of the state-level analysis which follows is to highlight the industry’s *direct* contributions to the state’s economy, focusing on sales, employment, payroll, value-added, and taxes. The second goal is to quantify the industry’s *secondary* contributions to the state’s economy by documenting the multiplier effects of business and employee spending using the 1999 IMPLAN model.

Direct Contributions

Generally, an industry’s economic contribution is reported in terms of total sales, employment (expressed as jobs or wages and salaries), and value-added. Value-added represents the portion of total

sales directed to employee income, taxes, rent, and profit.⁶ Estimates of the direct contribution of the EHI on the state's economy obtained using the survey data showed the industry generated more than \$3.3 billion in total sales in 1999. Highlights include:

- Sales by growers, landscapers, retail garden centers, and distributors totaled about \$3.1 billion.
- Chain stores sales were estimated at nearly \$200 million.
- Value-added totaled almost \$1.5 billion for the industry.

The EHI is an important employer in Pennsylvania. Based on the survey results, industry employment in 2000 was estimated at more than 73,000 workers. Findings of note include:

- The industry employed approximately 35,000 full-time workers.
- Part-time employment exceeded 12,000 workers.
- The industry employed more than 25,000 seasonal workers.
- Total industry compensation and payroll exceeded \$1 billion.

The survey results further suggest the EHI is a major source of federal, state, and local tax revenues. Growers, landscapers, retail garden centers, and distributors reported paying more than \$18.6 million in EHI related taxes. While the data do not allow for quantification of the tax payments of EHI chain stores, they likely are substantial. Furthermore, based on the sales data shown above, the EHI is also clearly an important contributor to state sales tax revenues (currently at 6% of sales). However, an examination of this contribution is beyond the scope of this study.

Indirect and Induced Contributions

Quantifying the direct economic contribution of an industry—as was done above—is the first step in conducting an economic analysis. But an industry's

economic contribution is much more substantial when one considers its multiplier effects. These effects are both indirect (the local economic activity created by business purchases) and induced (the local economic activity driven by employee household spending).

The IMPLAN model is especially helpful at quantifying the relationships among local industries, as it allows users to examine how the demand for locally produced goods and services affects the output decisions of all local producers. The IMPLAN software and database (described more fully online at www.IMPLAN.com) establishes the characteristics of economic activity in terms of 10 broad industrial groups, involving as many as 528 sectors. In practice, IMPLAN is used in every state and hundreds of communities across the nation to catalog economic activity and predict the effects of alternative policies and various economic changes.⁷

The IMPLAN model is based on national surveys of industry and household purchasing patterns. A key feature of the model is that it allows users to estimate the extent to which industries locally purchase those inputs necessary to produce their products. Fully capturing these local inter-industry relationships is an integral function of the model because changes in local industry output are essential to determining the widespread industry contribution of local economic activity. IMPLAN provides information on a number of important aspects of economic change including employment, earnings, income, value-added, and output.

Modifications to the Pennsylvania IMPLAN Model

Although the basic IMPLAN model offers a comprehensive picture of a state economy, the model is not disaggregated enough to examine some key individual sectors in the EHI. In particular, basic data provided for many of the important retail channels through which EHI products are sold (e.g., home centers and discount stores) are just too aggregated to use, with industry sales lumped in with other sales such as hardware or building supplies. Thus, without a survey such as ours, it is not possible to adequately assess the industry's economic contribution. Fortunately, the basic IMPLAN model

⁶ Technically, adding total sales from any two sectors can involve some double-counting, where one sector's output becomes another sector's input. For example, in Pennsylvania, there are a number of wholesale nurseries that sell to local retail garden centers. If the sales of both the intermediate and final sellers were simply added, it would overstate the true economic contribution of the final sale. Value-added excludes the cost of intermediate inputs, and as such, is a better measure of the net economic gain to the region.

⁷ In addition to the studies previously cited, Tanjuakio, Hastings, and Tytus (1996) show how the IMPLAN model can be used to estimate the role of agriculture in a state economy (Delaware). These authors do a good job of discussing the fundamentals of the IMPLAN model, database, and software.

is quite flexible, allowing users to alter both the basic data set as well as a number of parameters, and in this study we modified the Pennsylvania model using the survey data to describe the specific character of the state's EHI. A brief summary of the key changes is given below.

The essence of our modeling effort was to introduce what amounts to a "hybrid" IMPLAN industry, which we call the EHI sector. As noted above, this industry is comprised of IMPLAN's Greenhouse and Nursery Products and Landscape and Horticultural Services, and portions of the model's Wholesale Trade, Building Materials and Gardening Centers, General Merchandise Stores, Grocery Stores, and Miscellaneous Retail sectors.

In building this hybrid industry, most of our efforts were aimed at refining the value-added and total industry output measures of the basic Pennsylvania model. Using our survey data on industry sales, employment (part- and full-time), and business expenditures on wages and benefits, taxes, and other operating expenses, we were able to construct a detailed expenditure profile for each sector of the hybrid industry. Our survey also asked respondents to report on the extent to which their EHI business plant sales were derived from plants they grew and propagated themselves, versus those they purchased. This was a necessary step, especially at the retail level, because it allowed us to avoid double-counting by focusing exclusively on value-added business activity.

Another adaptation worth noting is our recognition that some sectors of the state's EHI purchase inputs from out-of-state suppliers, and our data were further modified so as to separate local and out-of-state purchases. This approach allowed us to modify the regional purchase coefficients (RPCs) of the basic IMPLAN model. For several sectors, these modifications were fairly important. For example, in the basic model, the (average) default RPC for Greenhouse and Nursery Products is 0.55; based on our survey, the (average) RPC for this sector was estimated at 0.81. Similarly, other notable changes in the RPCs occurred for Landscape and Horticultural Services (default average = 0.59; adjusted average = 0.33) and Building Materials and Gardening (default average = 0.95; adjusted average = 0.45).⁸

⁸ Users can also modify the production functions in IMPLAN. While we generally found no need to do so, the production function was slightly altered for one industry (wholesale trade). In an IMPLAN-based study of Minnesota's poultry industry, Lazarus, Platas, and Morse (2001) note that the magnitudes of impacts are more sensitive to changes in RPCs than they are to changes in the parameters of the Leontief production function.

After making these adjustments, we were outfitted with newly constructed measures of value-added, which served as the basis for editing the base IMPLAN data on value-added, output, and employment in the sectors of interest.

While the alterations occurred across the board, the primary change worth mentioning is our revision of the Greenhouse and Nursery Products sector. In the 1999 IMPLAN database, this sector was reported to provide about 9,500 jobs, with about \$68,000 in output per worker and \$15,546 in earnings per worker. Our survey data, however, showed there were far more workers employed in this sector in Pennsylvania (about 29,000), but output per worker (\$40,190) and earnings per worker (\$10,809) were substantially lower than the IMPLAN database. When discussing these discrepancies with industry experts, our modifications to the IMPLAN model seemed more consistent with their view of the industry, in terms of both size and compensation.

Implementing the Modified Pennsylvania IMPLAN Model

After tailoring the model to Pennsylvania's EHI, IMPLAN was used to estimate the secondary economic contributions of the EHI, employing the three-step procedure outlined in "IMPLAN Pro Case Studies" (Minnesota IMPLAN Group, 1997). For the first step, we created the type II multipliers for the state model. For the second step, we took the hybrid industry's value of production for the year, and divided it by the type I (direct and indirect) multiplier. (This procedure avoids double-counting when examining entire industries, and ensures the direct and indirect effects will sum to the total value of production.) For the third step, this (lower) value was then entered as a new event to "shock" the hybrid EHI sector of the IMPLAN model. For the retail trade sectors, the default margins in IMPLAN were applied to the total sales figures so as not to overestimate the contributions of this sector.

The results of the IMPLAN analysis are presented in tables 4 and 5, showing both the direct and secondary contributions. It is important to note these estimates are based on the assumption that Pennsylvania residents' current expenditures on EHI products are considered import substitutes. In other words, if these goods and services were not available in the state, residents would choose to import them, rather than spending their money on other in-state activities. In this case, then, the local

Table 4. The Environmental Horticulture Industry's Contribution to Pennsylvania Value-Added: Direct and Secondary Effects, 2000 (\$ millions)

Industry	Direct Impacts (\$ mil.)	Secondary Impacts (\$ mil.)	Total Impacts (\$ mil.)	State Total (\$ mil.)	Contribution to State Total (%)
Agriculture (excluding Green Industry)		18.2	18.2	4,511.4	0.4
Greenhouse & Nursery Products	375.3	NA	375.3	375.3	100.0
Landscape & Horticultural Services	425.0	NA	425.0	425.0	100.0
Mining		6.7	6.7	5,604.3	0.1
Construction		81.0	81.0	40,941.9	0.2
Manufacturing		137.8	137.8	204,512.9	0.1
Transportation, Communication & Utilities		266.1	266.1	53,340.4	0.5
Wholesale & Retail Trade (excl. Green Industry)		192.8	192.8	77,497.9	0.2
Green Industry Retail Sales	688.3	NA	688.3	688.3	100.0
Finance, Insurance & Real Estate		449.0	449.0	89,735.3	0.5
Services		605.6	605.6	127,453.3	0.5
Government		31.9	31.9	39,757.1	0.1
Other		2.3	2.3	865.7	0.3
Total	1,488.6	1,791.4	3,280.0	649,532.0	0.5

Table 5. The Environmental Horticulture Industry's Contribution to Pennsylvania Employment: Direct and Secondary Effects, 2000 (number of jobs)

Industry	Direct Impacts (no. of jobs)	Secondary Impacts (no. of jobs)	Total Impacts (no. of jobs)	State Total (no. of jobs)	% of State Total Employment
Agriculture (excluding Green Industry)		1,269	1,269	48,269	2.6
Greenhouse & Nursery Products	28,889	NA	28,889	28,889	100.0
Landscape & Horticultural Services	18,583	NA	18,583	18,583	100.0
Mining		77	77	28,689	0.3
Construction		1,984	1,984	411,832	0.5
Manufacturing		2,028	2,028	976,484	0.2
Transportation, Communication & Utilities		2,056	2,056	307,997	0.7
Wholesale & Retail Trade (excl. Green Industry)		6,719	6,719	1,408,295	0.5
Green Industry Retail Sales	25,736	NA	25,736	25,736	100.0
Finance, Insurance & Real Estate		3,527	3,527	467,793	0.8
Services		15,542	15,542	2,277,092	0.7
Government		556	556	791,700	0.1
Other		223	223	35,119	0.6
Total	73,208	33,981	107,189	6,826,477	1.6

industry is preventing money from leaking out of the state, and the results can be seen as the additional contribution to the state's economy.⁹ Still, because this assumption is strong, the estimates of the secondary effects should be viewed as an upper bound, as some EHI goods and services would

surely be imported, but other monies might be spent on substitutes (albeit with a likely loss in consumer surplus).

Table 4 reports the industry's contribution to value-added. (Note that the indirect and induced contributions within the industry itself are included as a direct contribution.) In the right-hand column of the table, we show the percentage share of the respective industry totals.

⁹ This is a common assumption in EHI studies (e.g., Rathwell et al., 1995; Hughes and Hinson, 2000).

- The industry generated nearly \$3.3 billion in value-added economic activity, representing about 0.5% of the total Gross State Product.
- Of this amount, about \$1.5 billion is contributed directly, and \$1.8 billion is contributed through indirect and induced effects.

Overall, the results indicate the industry has a value-added multiplier of 2.2. This means that for every dollar the EHI generated in value-added, \$1.20 is generated in secondary (multiplier) contributions.¹⁰

The secondary contribution is largest in the Services and the Finance, Insurance, and Real Estate (FIRE) sectors, which largely reflects industry demand for business and real estate services and employees spending their wages and salaries.

Table 5 reports the employment contribution of the industry, as derived from the survey and the IMPLAN model. Here, it can be seen that the industry is an important contributor to state employment. Key findings include:

- The Environmental Horticulture Industry supported more than 107,000 jobs, representing about 1.6% of total state employment.
- Of these jobs, 73,208 were created directly by the industry, while an additional 33,981 jobs were created as the secondary effect.
- The employment effects of the industry generated more than \$2.2 billion in proprietors' and employees' income (including wages and benefits).

Overall, results indicate an employment multiplier of 1.5. Alternatively, for every job generated by the EHI, an additional 0.5 job was created by secondary (multiplier) effects, mostly in trade and services.¹¹ In the aggregate, the total employment contribution represents about 1.5% of the state's total employment.

¹⁰ It is interesting to note how our results compare to the base IMPLAN model. While we describe above an example of how our estimates of employment and output differ substantially from the base data set (for example, with Greenhouses and Nurseries we found more employment but less earnings per worker), our "adjusted multipliers" were slightly higher than those supplied in the base IMPLAN model for comparable sectors. In our hybrid model, the type II value-added multipliers are 2.8 and 2.1 for Greenhouse and Nursery Products and Landscape and Horticulture Services, respectively. By comparison, the default multipliers in the base IMPLAN model are 2.5 and 1.8 for the respective sectors.

¹¹ Like the value-added multipliers, our employment multipliers for comparable sectors were close to those provided in the base IMPLAN model. In our hybrid model, the type II employment multipliers for Greenhouse and Nursery Products and Landscape and Horticulture Services were 1.5 and 1.7, respectively. In the base IMPLAN model, the default multipliers are 1.7 and 1.4, respectively.

A Few Words About Industry Exports

As noted above, the analysis provided here rests on the assumption that Pennsylvania residents would choose to allocate their EHI expenditures on out-of-state purchases if the industry was not present in the state. Recognizing this is a strong assumption, we briefly turn our attention to the export side of the industry in order to gain a better understanding of the economic contributions of the industry's out-of-state sales. This analysis is possible because we asked survey respondents to indicate the portion of their sales to out-of-state buyers. Because it was mostly growers who reported any significant amount of out-of-state sales, we limit our analysis to this category. This information is useful when assessing the potential effects of stepped-up efforts to market EHI products as part of the state's economic development strategy.

According to our survey, 41% of all grower sales were made out-of-state (by comparison, garden centers and landscape contractors reported out-of-state sales of 5% and 4%, respectively). Using IMPLAN, growers are estimated to contribute, through out-of-state exports, 10,641 direct jobs and 5,638 indirect and induced jobs to the state's economy. In terms of value-added, this represents \$140.7 million in direct contributions and \$264.5 million in indirect and induced contributions. Translating these contributions into multipliers, we find a type II employment multiplier of 1.5 and a type II value-added multiplier of 1.9.

Emerging Industry Issues

The EHI today faces challenges related to its rapid expansion and unique needs, and an understanding of these can contribute to enhancing the viability of the industry in the future. In our survey, participants were asked to indicate what priority they felt should be given various issues facing the industry. Given similarities in business and industry structure (e.g., size and sales), their responses may be suggestive of general concerns of participants across the Northeast.

Respondents were requested to indicate whether each of 12 issues was "not a priority," "low priority," "high priority," or "highest priority." The list was developed in consultation with representatives of the Pennsylvania Landscape and Nursery Association (PLNA). To explore differences in responses by different types of industry participants, the answers were tallied separately for

Table 6. Emerging Issues in the Pennsylvania Environmental Horticulture Industry

Issue No. / Description	Respondents Suggesting This Issue Is “Highest” or “High” Priority (%)		
	Growers	Landscape Contractors	Garden Centers
1. Educating policy makers about economic importance of the industry	77	74	70
2. Increasing research in insect and disease management *	81	70	69
3. Enhancing public awareness of industry contributions	66	62	62
4. Education on advances in horticultural technology	64	60	58
5. Farm/business management education to increase profitability *	60	51	45
6. Developing industrywide promotion	57	59	50
7. Increased industry worker training *	52	72	53
8. Developing professional standards *	32	59	32
9. Establishing/strengthening licensing requirements *	21	45	22
10. Developing new plant varieties	48	47	53
11. Providing marketing assistance to individual businesses	40	37	41
12. Relaxing government regulations regarding chemical usage *	40	31	37

Note: An asterisk (*) denotes statistically significant difference among the categories of respondents at the 5% level based on a χ^2 test.

growers ($n = 407$), landscape contractors ($n = 270$), and garden centers ($n = 150$).

In table 6, the 12 issues are ranked from highest to lowest importance, sorting responses by industry category. The table also reports statistically significant differences among respondent groups. Ranking among the top issues of concern were those dealing with increasing the understanding of policy makers and the public concerning the contributions of the EHI. More than 70% of the growers, landscape contractors, and garden center representatives gave at least high priority to educating legislators and government officials about the importance of the industry to the economy (issue 1); and more than 60% reported that increasing public awareness of the industry (issue 3) should be an item of high priority. Developing industrywide promotion of the industry (issue 6) also was supported by more than half of the respondents. Agricultural economists and cooperative extension staff can assist in achieving these goals by providing detailed industry analyses and educational programming. The publication and use of research directed toward understanding its contributions can bring attention to the current and growing economic and social contributions of the EHI to the region.

Another issue receiving a large percentage of high priority ratings concerned the development of improved pest management procedures (issue 2). As this is generally a production-level issue, it was especially important to growers, with more than 80%

of the growers viewing it as an important area. Support of this issue was also high (approximately 70%) for the other two respondent groups. Development of new plant varieties (issue 10) is considered important by a somewhat smaller proportion of the respondents, but nearly half reported that this should also be an issue of high priority. New and strengthened partnerships among state and federal departments of agriculture and the land grant institutions can explore new pest management strategies for the industry, and contribute to the development of new varieties of plants.

Responses to several other issues suggest opportunities for cooperative extension educational programming. A majority of all three industry groups gave high priority to educating industry members concerning advances in horticultural technologies (issue 4). Most growers and landscape contractors were also interested in education targeted to improving farm and business management skills (issue 5). More than 7 out of 10 landscape contractors gave high priority to increasing programs to train EHI workers (issue 7), suggesting the opportunity for workforce development programming.

The survey provided some insight into industry views of government regulation. With respect to business operations, establishing professional standards and strengthening licensing requirements (issues 8 and 9) received lukewarm support from growers and garden centers, but were viewed as deserving of high priority by most landscape

contractors. Based on personal discussions with industry experts, there seems to be a common feeling among contractors that "unqualified" businesses are: (a) damaging the profession's reputation, and (b) taking away business. The issue of relaxing government regulations concerning chemical usage in the EHI (issue 12) received support from only a minority of the industry participants.

Summary and Conclusions

Far outpacing the average growth of production agriculture in the Northeast, the Environmental Horticulture Industry has emerged as an important driver of the region's agricultural economy. The industry is an important employer in the region, generating hundreds of thousands of jobs and billions of dollars in employee compensation. This remarkable growth has been driven, in part, by the rapid economic expansion of the 1990s, as homeowners and businesses increased purchases of EHI products and services.

The fact that the industry has shown inflation-adjusted growth suggests an area of opportunity for agricultural economic development. Given the increased prominence of land use as an important policy topic in the Northeast, the apparent profitability of the sector, coupled with its relatively concentrated production activities, suggests the industry could help maintain the viability of production agriculture at the urban-rural interface.

Beyond documenting industry trends, this study also demonstrates the economic importance of the myriad industry activities related to the industry in one northeastern state. Using a modified IMPLAN input-output model, our research shows that the industry contributes to Pennsylvania's economy through more than \$3.3 billion in total sales. These sales translate directly into nearly \$1.5 billion in value-added income, providing more than 73,000 jobs with total employee compensation exceeding \$1 billion. Millions of additional dollars are generated in tax revenues. But the contribution is even more widespread. Our estimates show the industry's secondary effects contribute an additional \$1.8 billion in value-added and nearly 34,000 additional jobs to the state economy. Furthermore, the industry brings substantial jobs to the state via exports, with nearly 15% of direct industry employment generated by out-of-state sales.

The growth of this industry offers policy makers, state and federal agencies, and land grant institutions a number of promising opportunities for promoting

agricultural economic development. In this study several key issues have been identified that are critical to industry members, including outreach to policy makers and the general public, as well as working directly with growers on emerging research issues. In the Northeast, most land grants are seemingly well positioned to deliver research and extension programs that address grower, contractor, and retail needs.

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