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Assessing Economic Impacts and Benefits of Commercial Horticulture Extension Programs[1]

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Introduction and Background

The extension education mission of a land-grant university system is to provide information that will lead to improvements in the economic and social conditions of individuals and industry groups in the state. As fiscal pressures increase from federal and state government agencies to spend public dollars more effectively, it is imperative that the outcomes from educational efforts be clearly documented in terms of measurable changes in knowledge and behavior of clientele or stakeholders. Traditionally, impacts of extension programs have been evaluated in a rather unsystematic fashion, with extension professionals separately developing ad hoc methods that are suited to their particular programs. Often, these impact assessments are very qualitative and subjective, and do not make a compelling linkage between increased knowledge and positive behavioral change. Even more rarely do such assessments attempt to account for impacts on the broader economy and social well-being of the citizens.

The objective of this document is to develop a standardized approach for evaluating the economic impacts of extension educational programs in commercial horticulture in Florida that were identified by County Extension Agents. Where possible, these impacts should be quantified in terms of measurable changes in revenues, income, or employment (jobs).

Approach

In evaluating the effects of extension programs, it is important to distinguish between economic impacts and economic benefits, and between gross and net benefits. Economic ***impacts*** represent a change in industry revenues, income, or employment resulting from a change in final demand by local consumers, institutions, or export markets. On the other hand, economic ***benefits*** represent the change in overall social welfare for producers or consumers arising from a change in prices or supply/demand conditions. So, there can be changes in regional economic impacts when there may be no change in social welfare and, conversely, there may be economic benefits even when there is no change in economic activity. For example, consider a hypothetical case of a plant disease that infects and kills a local population of a popular ornamental tree species. Typically, such an event would generate a great deal of economic activity in the way of pest control treatments, and the removal and replacement of dead trees. These activities could represent a significant increase in local economic

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impact. However, the social welfare (economic benefit) for local residents may be decreased because they are deprived of the amenities associated with the tree, such as shade, temperature moderation, erosion control, aesthetic beauty, etc.

A list of common problems encountered by UF/IFAS commercial horticultural extension agents in the South Central Extension District (Tampa Bay area) was compiled from a recent survey. A majority of these problems were addressed through one-on-one consultations and were generally outside the bounds of traditional extension programming. Some of these issues included the following:

- Saving high-value landscape trees, as opposed to losing and resetting trees, including diagnosis of diseases
- Identification and correction of pest or nutritional problems for greenhouse and nursery producers through on-site visits and laboratory analyses
- Pesticide applicator training and licensing
- Adding new crops to the product mix for producers
- Developing entirely new crops or products for the industry
- Consultations to clients via telephone, email, and/or site visits

Recommended techniques for valuation or impact analysis in each of these problems are discussed below.

Protecting Landscape Trees

The most direct method for assessing the value of trees in the landscape is to calculate the replacement cost for a tree of equivalent size and quality, including equipment and labor for removal, installation, and establishment. Prices for trees of various species and sizes can usually be obtained from local wholesale nurseries. Labor rates and time requirements for various landscape service tasks are available from landscape estimating guides such as that of R.S. Means Company (http://rsmeans.reedconstructiondata.com/).

The *in situ* value of landscape trees may also include estimated benefits for shade, air quality improvement, storm-water runoff control, carbon sequestration, and contribution to property values. Several online tools have been developed for this purpose. The National Tree Benefit Calculator (http://www.treebenefits.com) was developed by Davey Tree Expert Company and Casey Trees. This tool will estimate values for many of the most popular ornamental trees (identified by common name), situated on properties that are single- or multi-family residential, small commercial businesses, industrial or large commercial businesses, parks or vacant land. The tree location can be specified for a particular zip code, or chosen from a map of agroclimatic zones. For example, a ten-inch diameter Bald Cypress (*Taxodium distichum*) tree located near a single-family residence in the U.S. southeast coastal plain region is estimated to provide $53 annually in benefits, including enhanced property value ($35.24), storm-water runoff control ($7.15), electricity savings for reduced cooling requirements due to shade and evapotranspiration ($6.29), natural gas savings for heating due to reduced wintertime wind velocity ($1.41), carbon dioxide uptake through photosynthesis ($1.52), and air quality improvement through pollutant and particulate removal ($1.24).

The USDA Forest Service has also developed a spreadsheet-based tool for calculating benefits of urban landscape trees. Additional resources, background information, and methodologies for valuation of urban trees are available at http://www.itreetools.org.

Identification and Correction of Pest or Nutrition Problems for Greenhouse and Nursery Crops

Consulting with commercial greenhouse and nursery growers regarding pest or nutrition problems for ornamental crops is a common activity of university horticulture extension faculty. Again, the most straightforward way to place a value on this service is the market price of the commercial crop(s) at stake. This can be simply calculated as the quantity of plants multiplied by the average wholesale price per unit. The average price should reflect the list or advertised price less any discounts typically offered by the producer for volume purchases or advance payment.

For example, a new grower of "xyz" plant called about a problem with a crop of cuttings. The problem was new and the grower's losses were dramatic. When questioned on how many cuttings he had left, he said about 800. Samples sent to the UF/IFAS laboratory showed no disease or insect issues. Through e-mailed pictures and extensive questioning, it was determined that the plant losses were caused by the air conditioner in the screenhouse drying out the cuttings. A remedy was suggested to cover the plants with plastic to increase the humidity. The result was that the remaining plants survived. The economic benefit of the intervention by the extension agent was approximately $360

(800 cuttings at $0.45 each). In this case, it is appropriate to claim the entire value of the crop, since it clearly would have been a complete loss without the intervention.

In many other cases where extension expertise contributes partially but not exclusively to the protection or preservation of a crop, we should describe the economic impact as protecting the value at risk.

Pesticide Applicator Training and Licensing

Training of nursery and landscape workers on the proper application of pesticides is important for effective and economic use, protection of worker health, and reduction of impacts on non-target organisms. The benefit of training and licensing to the trainee can be estimated in terms of increased wages and career earnings. Data on average hourly wages for various occupational titles in Florida and its metropolitan areas are available from the Florida Agency for Workforce Innovation (http://www.labormarketinfo.com/Library/OES.htm). For example, the average hourly wage in Florida in 2009 for pesticide handlers, sprayers and applicators, and pest control workers was $14.91, which was substantially higher than for regular landscaping and groundskeeping workers ($11.29) and for all other agricultural workers ($10.57) (Table 1). The wage difference also exists for entry-level and experienced workers. Assuming an average of 2,000 hours worked yearly, the average wage differential would represent about $6,400 greater annual income for the licensed pesticide applicators, compared to the regular landscaping workers. This earnings benefit could be applied to the number of people who receive training resulting in a pesticide applicator license.

The benefits and economic impacts of pesticide training in terms of more effective application of pesticides, protection of worker health, and reduced environmental contamination are definitely real, but are more difficult to measure.

New Crops or Production Systems for Greenhouse and Nursery Producers

Development of new crops for nursery and greenhouse producers is another longstanding role of university agricultural research and extension programs. In this arena, economic benefits may arise in two forms: 1) adding crops or new production systems to a producer's product portfolio, and 2) developing entirely new crops or products for the industry.

In the case of adding a new crop to an existing operation, the economic benefit comes about in terms of increased productivity, reduced costs, and higher profits for the new crop or product relative to the crop/product that it replaces. This assumes that the business is a going concern and is at full production capacity, such that introduction of a new product requires the reduction of other product(s). The direct economic benefit would be calculated as the difference in net income between the new crop and whatever crop it replaces.

In the case of developing entirely new crops or products for the industry, this represents new final demand, and it is reasonable to claim the entire amount of sales and income generated by the new crop as a benefit attributable to extension programs.

Consultations via Telephone, E-mail, or Site Visits

Informal consultation with clients by telephone, e-mail, or on-site visits is one of the most common services provided by university extension programs. Unfortunately, it is also one of the most difficult to value because there is no market transaction involved, and the consultation does not necessarily lead to a measurable change in behavior. A reasonable approach to estimate the value of this service would be based upon the value of an equivalent service provided by a private-sector consultant. Hourly or daily rates for horticultural consultants may be obtained by quotation from the consultants themselves, or from clients who have used these services in the past.

Economic Multiplier Effects of Extension Horticulture

The economic impacts of university extension programs are not limited to the direct impacts on client businesses, but extend throughout the local economy through multiplier or "spin-off" effects. Economic multipliers apply in cases where changes to final demand are involved, including sales of greenhouse and nursery products for export (shipments out of state) or to new home landscapes. This would not apply, however, for sales of products or services to customers within the local area for whom the purchase represents discretionary spending because this represents simply a transfer of spending from some other discretionary item.

Regional economic multipliers can be estimated using a technique known as input–output analysis, which accounts for the composition and linkages in a local or state economy. Multipliers for the state of Florida and its counties or

metro areas are routinely prepared by the UF Economic Impact Analysis Program (http://economicimpact.ifas.ufl.edu) using the *IMPLAN Professional* software and regional database. Typical multipliers for selected sectors of the environmental horticulture industry in Florida are shown in Table 2.

These multipliers represent the original change in final demand or sales (direct effects), changes in activity in supply-chain businesses serving the selected industry sectors (indirect effects), and changes in employee household spending (induced effects). The multipliers are used to multiply against changes in output or sales revenues. For example, say that UF/IFAS Research and Extension develops a new crop for nursery and greenhouse producers that results in $10 million of new sales to the export market or to the landscape industry for new construction. The total economic activity in the state generated by this would be $23.8 million ($10M x 2.38). The employment multiplier represents the number of jobs (full-time and part-time) per million dollars of output or sales. Value added is a measure of net income, both personal and property based, such as rents and interest. Labor income represents employee wages, salaries, and benefits, and business owner (proprietor) income. Indirect business taxes represent all forms of taxes paid to local, state, and federal governments, except income taxes.

Economic multipliers are also available for individual counties, where it may be important to estimate impacts for local areas.

Conclusions

Measurements that estimate an economic return from taxpayer investments into extension services are needed by decision makers if the cooperative extension service is to continue to receive public dollars. Future funding of governmental programs, such as extension, are dependent upon our ability to transform the services and educational programming into meaningful, positive outcomes that can be measured. In order to provide this type of data to stakeholders, standards of measure that are concrete, uniform, and transparent are required for assessing the economic, social, and environmental impacts and benefits provided by commercial horticulture extension programs. Consistent statewide standards and assessments can be compiled to show the extent and benefit of extension programs to stakeholders and society at large. These standards can also be used to compare the effectiveness of programs individually and to highlight and expand programs that are most effective and impactful.

Table 1. Employment and average hourly wages for selected occupational titles in agriculture and horticulture in Florida, 2009

			Hourly Wages ($)		
Occupational Code	Occupational Title	Employment (2008)	Average	Entry-level Workers	Experienced Workers
37-2021	Pest Control Workers	9,720	14.49	10.29	16.60
37-3012	Pesticide Handlers, Sprayers, and Applicators (Vegetation)	2,000	14.91	10.88	16.92
37-3011	Landscaping and Groundskeeping Workers	85,990	11.29	8.52	12.68
45-2099	Agricultural Workers; All Others	100	10.57	7.61	12.06
Source: Florida Agency for Workforce Innovation, Occupational Employment Statistics					

Table 2. Economic multipliers for environmental horticulture industry sectors in Florida (2007)

Multiplier Type	Greenhouse and Nursery Production	Retail Lawn-and-Garden Centers	Landscape and Pest Control Services
Output or Sales Revenue (dollars per dollar)	2.38	2.63	2.34
Employment: Full-time & part-time positions (jobs per million dollars output)	22.9	26.5	29.3
Value Added: Personal and property income (dollars per dollar output)	1.54	1.70	1.31
Labor Income: Employee wages, salaries, and benefits, and business owner income (dollars per dollar output)	0.85	1.07	0.93
Indirect Business Taxes: Paid to local, state, and federal governments, excluding income taxes (dollars per dollar output)	0.08	0.23	0.09
Source: *IMPLAN Pro* Software, Florida dataset (MIG, Inc. 2008)			