Economics and Marketing

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Section Editor
An Economic Dashboard for Assisting Green Industry Managers in Making Strategic Decisions

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Index words: dashboard, economic indicators, strategy

Nature of Work: In management information systems, a dashboard is "an easy to read, often single page, real-time user interface, showing a graphical presentation of the current status (snapshot) and historical trends of an organization’s key performance indicators to enable instantaneous and informed decisions to be made at a glance." In this paper, an economic dashboard is described that encompasses the most pertinent economic indicators affecting the green industry. The economic dashboard is not a predictive or market timing tool. The dashboard is intended as a tool for green industry owners and managers to set context and perspective when evaluating the current state of the economy. It is not meant to serve as a direct prediction regarding the future performance of any economic or financial market. It is not intended to predict or guarantee future investment performance of any sort.

Objectives: An economic indicator is simply any economic statistic, such as the unemployment rate, GDP, or the inflation rate, which indicate how well the economy is doing and how well the economy is going to do in the future. If a set of economic indicators suggests that the economy is going to do better or worse in the future than businesses had previously expected, they may decide to change their strategy. Unfortunately, the population of possible indicators for managers to consider is voluminous. The objective of this research was to provide a subset of indicators that owners and managers could track to develop a representative snapshot on the nature of the economy in the short run.

Procedure: To understand economic indicators, we must understand the ways in which economic indicators differ. Economic Indicators can have one of three different relationships to the economy:

- A procyclic (or procyclical) economic indicator is one that moves in the same direction as the economy. So if the economy is doing well, this number is usually increasing, whereas if we're in a recession this indicator is decreasing. The Gross Domestic Product (GDP) is an example of a procyclic economic indicator.

- A countercyclic (or countercyclical) economic indicator is one that moves in the opposite direction as the economy. The unemployment rate gets larger as the economy gets worse so it is a countercyclic economic indicator.
An *acyclic* economic indicator is one that has little or no relation to the health of the economy. Acyclic indicators are rare and generally of little use.

Economic Indicators can be leading, lagging, or coincident which indicates the timing of their changes relative to how the economy as a whole changes.

- **Leading** economic indicators are indicators of change before the economy changes. Stock market returns are a leading indicator, as the stock market usually begins to decline before the economy declines and they improve before the economy begins to pull out of a recession. Leading economic indicators are the most important type for investors as they help predict what the economy will be like in the future.

- **A lagged** economic indicator is one that does not change direction until a few quarters after the economy does. The unemployment rate is a lagged economic indicator, as unemployment tends to increase for 2 or 3 quarters after the economy starts to improve.

- **A coincident** economic indicator is one that moves at the same time as the economy does. The Gross Domestic Product is a coincident indicator.

From a procedural standpoint, any economic dashboard needs to contain a mix of each type of indicator in order to be most useful to green industry owners and operators.

**Results and Discussion:**

The list of indicators (and their source) that we have selected is presented below. They reflect the underlying economic and financial conditions that have the greatest potential for reflecting changes in economic variables that will likely affecting the green industry.

a. Leading Economic Index (Conference Board)
b. Chicago Fed National Activity Index (FRB Chicago)
c. Bloomberg Financial Conditions Index
d. Daily Consumer Leading Indicators (Consumer Metrics Institute)
e. Conference Board Consumer Confidence Index
f. Real Personal Income Levels (Bureau of Economic Analysis)
g. Employment Trends Index (Conference Board)
h. Unemployment Claims (U.S. Department of Labor)
i. Existing Homes Sales and Inventory Months of Supply (Nat. Assoc. of Home Builders)
j. New Residential Homes Sales and Inventory Months of Supply (U.S. Census Bureau)
k. Residential Investment (Bureau of Economic Analysis)
l. Buildfax Residential Remodeling Index
m. Architectural Billings Index (American Institute of Architects)
n. Real GDP (Bureau of Economic Analysis)
o. Industrial Production (FRB St. Louis)
p. ATA Truck Tonnage Index (American Trucking Association)
Notice that the indicators to be included in the dashboard are related to general economic conditions, employment, housing, and productive capacity of businesses. All of these are reflective of factors that affect the green industry directly and represent all of the types of indicators aforementioned. Each of the indicators is defined in Table 1, with implications also provided.

**Conclusions:** Economic reports and indicators are often-voluminous statistics put out by government agencies, non-profit organizations and even private companies. They provide measurements for evaluating the health of our economy, the latest business cycles, and how consumers are spending and generally faring. Various economic indicators are released daily, weekly, monthly and/or quarterly.

For business owners and executives (and investors), being able to understand the economy’s “health” and direction can help guide business and investment decisions. Economic indicators are not perfect crystal balls, but they are certainly better than winging it.

While it is important to keep a pulse on the economy, few analysts or economists wade through all of these massive volumes of data. Which reports are worth the effort to track on a regular basis and why? This paper has presented a short list of economic indicators that the authors feel are particularly correlated with key driving forces and trends that directly impact green industry businesses today.

It is anticipated that green industry business leaders can utilize this information to make better hiring decisions, match inventories to the business cycle (businesses that are sensitive to the economic cycle need larger inventories during periods of economic growth than during recessions), improve business forecasts, and evaluate new business opportunities based on current economic conditions.

**References:**

Table 1. Summary of economic indicators serving as a green industry dashboard.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Definition &amp; Implications</th>
</tr>
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<tbody>
<tr>
<td>Leading Economic Index (Conference Board)</td>
<td>This leading indicator is intended to forecast future economic activity. The 10 components of the Conference Board Leading Economic Index® for the U.S. include: Average weekly manufacturing hours, Average weekly initial claims for unemployment insurance, Manufacturers’ new orders of consumer goods and materials, ISM Index of New Orders, Manufacturers’ new orders of nondefense capital goods excluding aircraft orders, Building permits of new private housing units, Stock prices, 500 common stocks, Leading Credit Index™, Interest rate spread of 10-year Treasury bonds less federal funds, and Average consumer expectations for business conditions.</td>
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<tr>
<td>Chicago Fed National Activity Index (FRB Chicago)</td>
<td>The Federal Reserve Bank of Chicago combines 85 different indicators into one number to give a sense of whether the overall U.S. economy is growing faster than its historical trend (numbers above zero) or slower (numbers below zero). If you average the last three months' index values, you get the CFNAI-MA3 (“moving average 3 months”). When the CFNAI-MA3 value moves below -0.70 following a period of economic expansion, there is an increasing likelihood that a recession has begun. Conversely, when the CFNAI-MA3 value moves above -0.70 following a period of economic contraction, there is an increasing likelihood that a recession has ended.</td>
</tr>
<tr>
<td>Bloomberg Financial Conditions Index</td>
<td>Monitors the level of stress in the U.S. financial markets. The Bloomberg Financial Conditions Index combines yield spreads and indices from the Money Markets, Equity Markets, and Bond Markets into a normalized index. When this index is high (good), it means that money is probably flowing well between banks and businesses or consumers. When it goes lower (worse), it means that credit is probably tough to get, so many businesses and people cannot get a hold of the money they need to take care of their needs (hiring workers, buying inventory, buying machinery, etc.)</td>
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<tr>
<td>Consumer Leading Indicators (Consumer Metrics Institute)</td>
<td>Consumer spending accounts for a significant portion of the overall U.S. economy. This indicator measures the consumer’s interest in items that are discretionary, meaning that they are not necessary for survival like</td>
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</table>
food, gas or water. The data is tracked every day and posted only a day or two later, so this is one of those rare almost real-time indicators.

<p>| Conference Board Consumer Confidence Index | The Conference Board Consumer Confidence Index® (CCI) is a barometer of the health of the U.S. economy from the perspective of the consumer. The index is based on consumers’ perceptions of current business and employment conditions, as well as their expectations for six months hence regarding business conditions, employment, and income. The Consumer Confidence Index and its related series are among the earliest sets of economic indicators available each month and are closely watched as leading indicators for the U.S. economy. |
| Real Personal Income Levels (Bureau of Economic Analysis) | Personal income levels are important for the health of the economy. When people have more income, they spend more, which helps business grow and employ more people. The NBER (who officially decides whether the economy is growing or shrinking) looks at real personal income less transfer payments (government benefits). The “real” refers to the fact that this statistic is adjusted for inflation. |
| Employment Trends Index (Conference Board) | The Employment Trends Index aggregates eight labor-market indicators, each of which has proven accurate in its own area. Aggregating individual indicators into a composite index filters out “noise” to show underlying trends more clearly. The eight labor-market indicators aggregated into the Employment Trends Index include: Percentage of Respondents Who Say They Find “Jobs Hard to Get” (The Conference Board Consumer Confidence Survey®); Initial Claims for Unemployment Insurance (U.S. Department of Labor); Percentage of Firms With Positions Not Able to Fill Right Now (© National Federation of Independent Business Research Foundation); Number of Employees Hired by the Temporary-Help Industry (U.S. Bureau of Labor Statistics); Ratio of Involuntarily Part-time to All Part-time Workers (BLS); Job Openings (BLS); Industrial Production (Federal Reserve Board); and Real Manufacturing and Trade Sales (U.S. Bureau of Economic Analysis). |
| Unemployment Claims (U.S. Department of | Weekly initial unemployment claims is one of the most important jobs indicators because, of all the jobs-related indicators, it is the closest to being a leading indicator of |</p>
<table>
<thead>
<tr>
<th>Labor</th>
<th>any kind. Typically, changes in the labor market are lagging the changes in the general economy, but initial weekly unemployment claims are about synchronous with the general economy. As long as the 4-week moving average of unemployment claims stays down below 400,000 we probably are not in a recession.</th>
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<tr>
<td><strong>Existing Homes Sales and Inventory Months of Supply (National Association of Home Builders)</strong></td>
<td>You can get a sense for whether there are too many existing homes still on sale (inventory) by taking the total inventory and dividing it by the pace of sales. The result is “months of supply,” which means that if existing homes were to continue selling at the same rate as the most recent month of data, the current inventory of homes would be sold by that many months. A normal reading is around 6 months – a higher number means too much inventory, and if supply is greater than demand, that usually means prices will drop.</td>
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<tr>
<td><strong>New Residential Homes Sales and Inventory Months of Supply</strong></td>
<td>When there are too many new homes still left unsold (inventory) on the market, it usually means that prices will be dropping because supply is greater than demand. The opposite is also generally true. A good way of measuring the inventory is to calculate how long it would take that inventory to sell at the current pace of sales. The normal level for this is around 6 months.</td>
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<tr>
<td><strong>Residential Investment (Bureau of Economic Analysis)</strong></td>
<td>Residential investment is one of the best leading indicators for the general economy, meaning that what happens to residential investment typically ends up happening to the general economy a few months later. Investment in residential structures consists of new construction of permanent-site single-family and multi-family units, improvements (additions, alterations, and major structural replacements) to housing units, expenditures on manufactured homes, brokers’ commissions on the sale of residential property, and net purchases of used structures from government agencies. Residential structures also include some types of equipment such as heating and air-conditioning equipment. In other words, residential investment refers to money that people spend on buying homes (either to live in or to rent out), home improvements and money people make on the sale of homes.</td>
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<tr>
<td><strong>Buildfax Residential Remodeling Index</strong></td>
<td>The BuildFax Remodeling Index (BFRI) is based on construction permits for residential remodeling projects filed with local building departments across the country. The index estimates the number of properties permitted.</td>
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<td>Index Name</td>
<td>Description</td>
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<tr>
<td>Architectural Billings Index (American Institute of Architects)</td>
<td>A leading economic indicator of demand for commercial and industrial building activity. The ABI is based on responses to the monthly Work-on-the-Boards survey that asks the principals and partners of architecture firms (that are American Institute of Architects members), whether their billing activity for the previous month grew, declined or remained flat. The change in billing activity tells us about the level of demand for design services from architecture firms; in other words, it tells us about the level of interest in constructing new buildings. When the index is above 50, demand is increasing; when it is below 50, demand is falling.</td>
</tr>
<tr>
<td>Real GDP (Bureau of Economic Analysis)</td>
<td>GDP is the broadest and most comprehensive measure of the economy that is widely accepted. It basically measures the value of all goods and services produced in the country, regardless of industry. GDP is the monetary value of all the finished goods and services produced within a country's borders in a specific time period, though GDP is usually calculated on an annual basis. It includes all of private and public consumption, government outlays, investments and exports less imports that occur within a defined territory. GDP = C + G + I + NX where: &quot;C&quot; is equal to all private consumption, or consumer spending, in a nation's economy; &quot;G&quot; is the sum of government spending; &quot;I&quot; is the sum of all the country's businesses spending on capital; &quot;NX&quot; is the nation's total net exports, calculated as total exports minus total imports. (NX = Exports - Imports)</td>
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<tr>
<td>Industrial Production (FRB St. Louis)</td>
<td>The index of industrial production shows how much factories, mines and utilities are producing. The manufacturing sector accounts for less than 20 percent of the economy, but most of its cyclical variation. Consequently, this report has a big influence on market behavior. In any given month, one can see whether capital goods or consumer goods are growing more rapidly. Because it relates to manufacturing, and manufacturing is only about 20 percent of our economy, at first glance one might consider this indicator not important. But the changes in the manufacturing sector track the changes in the economy extremely well; the</td>
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<td>ATA Truck Tonnage Index (American Trucking Association)</td>
<td>Each month, ATA asks its membership the amount of tonnage each carrier hauled, including all types of freight. The indexes are calculated based on those responses. The sample includes an array of trucking companies, ranging from small fleets to multi-billion dollar carriers. Trucking serves as a barometer of the U.S. economy, representing 67% of tonnage carried by all modes of domestic freight transportation, including manufactured and retail goods.</td>
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<td>cycles of the two are well matched, making IP important to track.</td>
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Opportunities for Social Media Marketing in Retail Garden Centers

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Index Words: Facebook, Twitter, Pinterest, landscape, nursery, employee training, customer engagement

Significance to Industry: Small family enterprises are an important part of the rural economy. Green industry businesses (nurseries, garden centers, lawn care, etc.) operate in these small, rural communities, often locally growing their products and later passing the business on to family. These small businesses frequently struggle to be profitable with a small customer base. However, with the advent of social media (Facebook, Twitter, Pinterest, YouTube, blogs), reaching a larger audience for little to no cost is easier than ever, though business owners often do not know how or why they should use these tools. Evaluating social media use for garden centers has the potential to enhance the financial sustainability of nursery businesses by enlarging their customer bases and bringing new customers into the store throughout the entire calendar year.

Nature of Work: Word-of-mouth advertising is one of the most effective means available (Ekanem et al., 2000) and can encourage people to travel from a great distance (whether across rural areas or across large urban metropolitan areas) to shop at garden centers. It can be difficult to generate word-of-mouth traffic in today’s world if the business does not have a website, and increasingly, a Facebook page. However, many business owners do not understand how to use social media (what to post, how often, etc.) or why they should spend time on it.

Determining how the most successful businesses use social media and sharing how to effectively implement these techniques at the grassroots level can make a significant difference in rural and urban communities. As the pace of technology advances, it will be increasingly important to train garden center businesses to navigate the flow of information and marketing opportunities available to them. To date, no studies have measured the existing use of social media by garden centers and nurseries in the U.S., though anecdotal information suggests only a small portion use social media for marketing and of those an even smaller portion use it to the greatest extent possible.
Recent data on the demographics of social media use show young adults are more likely than older adults to use social media (Fig. 1; Duggan and Brenner, 2013). This demographic will be key to the sustainability and longevity of garden centers which indicate their primary demographic segment consists of older, well educated, high income patrons. Data from the same report indicated that women, African-Americans, and Latinos show high interest in sites such as Twitter (micro blogging in 140 characters or less), Instagram (user-generated photo sharing site), and Pinterest (online pin-board for photos of project ideas). While Facebook was used by 67% of the participants in the study, marketing to minority audiences can be increased with the addition of Twitter and Instagram to a social media marketing strategy. Pinterest will continue to attract the traditional garden center customer and perhaps inspire them to make larger purchases based off of sample landscape photos.

A 2011 study showed that two-thirds of online adults (66%) use social media platforms such as Facebook, Twitter, MySpace or LinkedIn (Smith, 2011). Most users were focused on improving connections with family members and friends. However, 14% of users said that connecting around a shared hobby or interest is a major reason they use social media. In particular, middle-aged and older adults placed a higher value on social media use for a shared hobby. Men were also more likely than women to use these sites to connect around a hobby or interest.

Garden center business is quite seasonal (Fig. 2). In fact, most of the profits driving the business are obtained in the spring and fall gardening seasons. If social media marketing techniques can be used to increase traffic and customer interaction during low profit times, it may increase the viability of the business as a whole while also increasing community engagement and development.

A pilot study was conducted in early December 2012 with an established garden center in a medium-sized community in Kansas in order to determine if and how existing customers used Facebook, why they were in the store, and whether they made a purchase. This was in conjunction with a coordinated photography event with a photographer whose business has been entirely built on Facebook and Instagram. Our hypothesis was that bringing the two businesses together for an event could result in mutually gaining new customers. However, no intervention with marketing suggestions was provided so that baseline data on the interactions that occurred could be gathered.

The event was scheduled for the first two Saturdays in December, where the photographer offered a family photography sitting in the seasonally decorated garden center. Prior to the event, Facebook analytics access from the garden center was granted in order to gather data. Throughout the two event days, we conducted a brief customer intercept survey to collect basic information on purchasing history at the garden center, familiarity with Facebook pages of the businesses (garden center and the photographer), and demographics. A total of 47 responses were collected between the two days. After the event, two primary employees at the garden center and the photographer were interviewed.
Results and Discussion: Most shoppers were female (79%) while 17% were male and 4% did not answer. The largest age demographic was 25 to 34 years of age (23%). For 24% of the visitors, it was their first time to visit the nursery. Visitors who had primarily come for the photography event comprised 36% of the population while 49% came to look for something specific and 15% came to browse. Fifty-three percent of the visitors had a facebook account, however, only 19% had visited Blueville’s Facebook page and “liked” it. Slightly more of the visitors had visited and “liked” the photographer’s Facebook page (34%). Fortunately, 55% of visitors made a purchase and 70% indicated that they planned to visit the nursery again in the next 6 months (an additional 13% said “maybe”).

While garden center employees thought they had done an excellent job promoting the event, in reality it had resulted in very little Facebook customer interaction and few garden center Facebook fans took advantage of the family photo opportunities. Photography customers were excited to take advantage of the opportunity, but without adequate motivation (gift certificate, holiday gift ideas, etc.) they did not stay in the store for very long or make purchases, though some came back later in the year after having visited the store for the first time at the photography event (personal communication with store manager). Some customers (many were from the non-photography event group) came into the store looking for a specific item and were unable to locate it.

Developing relationships with customers via social media can help garden centers stay in the forefront of customer’s minds in any economic condition. Additionally, providing events in collaboration with other local businesses and organizations at the garden center will keep them returning to the store along with new customers. In early April 2013, suggestions and ideas for social media posts were provided to the nursery. Since then, customer actions have improved significantly over the same time period in 2012 (Fig. 3), indicating that employee training in social media marketing has the potential to increase customer interaction, resulting in a more consistent, loyal customer base and higher profits.

Challenges to future work in this area include gaining the trust and approval of “gatekeepers” at participating garden centers. Access to sales data, social media analytics, garden center staff and their attitudes towards social media will be significant components of successful social media marketing adoption for each business. From a research standpoint, it will be important to maintain relationships with participating garden centers in a way that does not disrupt normal business operations (Minahan et al., 2013) and provide reporting that demonstrates the viability of social media marketing for each business.

Data are currently lacking to determine opportunities and challenges of adoption and continued use of social media for nursery and garden center marketing. Subsequent training opportunities will be helpful for businesses across the U.S. as they seek to remain profitable in difficult economic climates.
Literature Cited

The Landscape of Social Media Users

<table>
<thead>
<tr>
<th>Use Any Social Networking Site</th>
<th>% of internet users who....</th>
<th>The service is especially appealing to...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Facebook</td>
<td>67</td>
<td>Adults ages 18-29, women</td>
</tr>
<tr>
<td>Use Twitter</td>
<td>16</td>
<td>Adults ages 18-29, African-Americans, urban residents</td>
</tr>
<tr>
<td>Use Pinterest</td>
<td>15</td>
<td>Women, adults under 50, whites, those with some college education</td>
</tr>
<tr>
<td>Use Instagram</td>
<td>13</td>
<td>Adults ages 18-29, African-Americans, Latinos, women, urban residents</td>
</tr>
<tr>
<td>Use Tumblr</td>
<td>6</td>
<td>Adults ages 18-29</td>
</tr>
</tbody>
</table>

Source: Pew Research Center’s Internet & American Life Project Post-Election Survey, November 14 – December 09, 2012. N=1,802 internet users. Interviews were conducted in English and Spanish and on landline and cell phones. Margin of error is +/- 2.6 percentage points for results based on internet users. Facebook figures are based on Pew Research Center’s Internet & American Life Project Omnibus Survey, December 13-16, 2012. Margin of error for Facebook data is +/- 2.9 percentage points for results based on internet users (n=860).

Fig. 1. The landscape of social media users.
Fig. 2. “Heatmap” of weekly sales totals (5 year average imposed onto a current calendar) for a garden center in a medium sized urban market in Kansas. This graphic demonstrates the seasonality of garden center sales with darker colors denoting higher sales.
Fig. 3. Facebook visits to Blueville Nursery, Inc. in 2012 and 2013 (late February to late May). Researcher intervention (suggestions, ideas for Facebook posts) began on April 3, 2013.
Challenges, Opportunities and Skill Needs of Tennessee Nursery Growers

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Index Words: Nursery industry, challenges, skill needs

Nature of Work: The nursery industry is an important sub-sector of agriculture, particularly in cash crop in the United States including Tennessee. It is reported that nursery cash receipt in the United States was $16.9 billion in 2006 (Jerardo, 2007). Nursery and Greenhouse industry lands nearly 2 Million jobs in the country (Hall et al., 2006). On average, nursery and greenhouse farms in the U.S. have 56.70 % more cash receipts than all farms (Muhammed et. al, 2000). This number increases to 307% for the state of Tennessee. With economic hardships and other challenges, the nursery industry faces some unique challenges in the state. The objective of this study is to focus on the challenges and problems that nursery businesses face in the state of Tennessee. A short survey of nursery businesses was conducted in 2012 to gather information about possible effects of economic downturn, high energy costs, market competition, production issues and need of skilled labor requirements.

Results and Discussions: A state-wide survey of 46 randomly surveyed nurseries suggested that 93 percent of the nurseries were negatively affected by the economic downturn over the last five years. Table 1 shows the demographic characteristics of the nursery operators. One out of four has a graduate degree. Four out of five nursery growers are above the age of 45. Figure 1 shows that high energy cost affected 28 nurseries out of the 46 in last five years. Almost all of the nursery growers have a high school diploma or higher with nearly half (46%) of the growers have a college degree or higher. Marketing is another challenge faced by nursery growers as more than 60% ranked marketing as the second top challenge. Another major component in the survey was the requirements of skilled labor for the nursery business. The surveys indicate that nearly half the businesses need some or more skilled personnel for their businesses, with sales requiring the most (figure 2). In terms of net income and future growth opportunities, it was found that majority of the nursery growers expect their business to either stay the same or slow down. Even the 3 growers (out of 46) making more than $500,000 expected a slowdown in the future (figure 3). The majority of nursery growers in the survey, mostly over 45, need help to expand the industry in Tennessee.

Significance to the industry: Economic hardships affect every area of a business e.g. income, expenditure, costs, production inputs etc. With the problem of stiff competition, where high costs reduce the profit margin, small businesses like nurseries find it hard to compete. This study will help policy makers understand the trends, hardships and needs of the industry to make better policies that will help nursery growers to be more
efficient in their use of resources. Energy efficient, cost-effective management practices can help overcome some of the challenges. Further research can help the nursery industry.

**Literature Cited**


Table 1. Characteristics of Nursery Operators in Tennessee

<table>
<thead>
<tr>
<th>Age</th>
<th>Percent of Nursery Growers</th>
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<tbody>
<tr>
<td>31-45</td>
<td>15</td>
</tr>
<tr>
<td>46-60</td>
<td>39</td>
</tr>
<tr>
<td>Over 60</td>
<td>41</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Education Category</th>
<th>Percent of Nursery Growers</th>
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</thead>
<tbody>
<tr>
<td>High school /GED</td>
<td>28</td>
</tr>
<tr>
<td>Some college</td>
<td>22</td>
</tr>
<tr>
<td>Undergraduate degree</td>
<td>22</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>24</td>
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</table>
Figure 1. Challenges faced by nursery growers.

Figure 2. Skilled labor requirement.
Figure 3. Income and future opportunities.
Measuring the Economic Carbon Footprint of a Golf Course

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Index Words: greenhouse gas emissions, CO2e, life cycle assessment, sustainability

Significance to Industry: In Georgia, nearly 500 recreational golf courses utilize turf grass for fairways, greens, tee boxes, and rough, plus nursery plants (annuals and perennials) for aesthetic landscaping and erosion control. Resource intense recreational activities, such as golf, impact the environment and greenhouse gas emissions (primarily CO2) from its operations and maintenance strategies, facility and equipment utilization, and pedestrian traffic densities. To achieve carbon neutrality and sustainability, the life cycle assessment (LCA) of a golf course must be evaluated and revisions to the current operations and maintenance strategies must be developed. So what does a golf course carbon footprint have to do with the nursery industry? Do annuals and perennials increase the carbon contribution (and how) or the carbon sequestration (and how) to influence the net carbon footprint of a golf course?

Nature of Work: The definition of sustainability goes beyond the concern of just 'going green' (environmental impact), or being environmentally friendly, organic, natural, reducing greenhouse gas emissions, minimizing global warming, reducing the carbon dioxide equivalents, and so forth. There are three components to sustainability: economic (profitability) effects, societal or community effects, and environmental effects. The challenges to developing a business investment case for sustainability are two-fold: forecasting and calculating the benefits and costs long term and planning well beyond the one-to-five year time horizon typical of most investment frameworks; and gauging the system-wide effects (peripheral businesses and industries, including neighboring activities) of sustainability investments in a life cycle assessment.

What is a life cycle assessment? The US Environmental Protection Agency defines a LCA as “….a tool to evaluate the environmental consequences of a product or activity holistically across its entire life,” from conception and development through to maturity and demise. A life cycle assessment is system-oriented because it attempts to integrate environmental requirements into each stage of the golf course development and operations/maintenance process, including landscaping, so that total impacts caused by the entire system can be reduced. A life cycle assessment normally follows three distinct steps:

- An inventory analysis that identifies materials and energy resources and their flow patterns;
- An impact analysis of qualitative and quantitative assessments of the consequences to the environment; and
• An improvement analysis that contemplates actions that can be taken to improve upon current conditions.

The lack of relevant and verifiable and quantifiable inventory data from all participants is the biggest hindrance to completing a life cycle assessment for a golf course. After all, the participant list includes golf course designers and developers, heavy machinery equipment manufacturers and operators, sod farms and production nurseries, turf maintenance equipment manufacturers/operators and pesticide product manufacturers and application equipment manufacturers/operators, plus the employees of the golf course superintendent. What’s missing is a common understanding of determining value, the multiplier effects, job creation, increases in revenues or lowering of costs, the environmental impacts, the quality of the golfing experience, any improved health (reduced pollution, cleaner water, etc.), the book value and costs of operating inventory items such as equipment, and the efficiency factors of equipment and labor in reducing carbon dioxide emissions.

Numerous assessment factors indicators are integral for calculations of a golf course life cycle assessment. A glimpse of the assessment indicators factors for the establishment and installation of golf course is shown below:
If the on-course operations of a golf course, including the indoor efficiency issues of the clubhouse, concessions, offices, changing rooms and bathrooms, pro shop, maintenance compound, hvac units, roof and wall installation, windows and window treatments, plumbing and electrical connections, are evaluated, vast data is necessary to calculate the life cycle assessment.

The methodologies employed for calculating the carbon footprint and life cycle assessment of six collaborating Georgia golf courses were nonlinear regression analysis for determining a price-based carbon footprint, an energy-based carbon footprint, carbon sequestration by forest and vegetation type, carbon sequestration of the soil profile, and carbon sequestration of golf course turf grasses, all from a limited sample size of six. The six course in the study represented two private, two public municipal, and two state-run (public) courses in three distinct geographical areas (two in Atlanta metro area, two in the interior Piedmont, and two coastal) with varying management and operational practices, and a variety of resources (labor, money, equipment, management skills and strategies, etc.). Carbon emission totals were calculated by event, resource use, turf quality, and time, and then converted into total carbon dioxide equivalents, CO2e.

Results and Discussion: Selected findings from the six golf courses are presented below (in MT CO2e/year):

<table>
<thead>
<tr>
<th>Course</th>
<th>Carbon Contribution</th>
<th>Carbon Sequestered</th>
<th>Net Annual Carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,337</td>
<td>157</td>
<td>1,181</td>
</tr>
<tr>
<td>2</td>
<td>416</td>
<td>130</td>
<td>286</td>
</tr>
<tr>
<td>3</td>
<td>465</td>
<td>113</td>
<td>353</td>
</tr>
<tr>
<td>4</td>
<td>739</td>
<td>133</td>
<td>606</td>
</tr>
<tr>
<td>5</td>
<td>1,017</td>
<td>141</td>
<td>876</td>
</tr>
<tr>
<td>6</td>
<td>848</td>
<td>125</td>
<td>723</td>
</tr>
<tr>
<td>Average</td>
<td>681</td>
<td>133</td>
<td>548</td>
</tr>
</tbody>
</table>

The data shows that golf courses could be managed in a way that would approach carbon neutrality. For instance, courses #2 and #3 had net annual carbon emission rates that could be offset with relatively small management adjustments, such as switching from petroleum diesel to local biodiesel, or reducing the amount of municipal water used for watering waste areas to reduce evapo-transpiration rates, and/or by implementing better fertilization and pest management regimes and using more annual and perennial vegetative plants, without knowingly reducing turf quality.

Due to the small number of participants, this study does not offer sufficient data to be representative of the region or all golf courses. The outcomes cited offer a conservative assessment of carbon emissions from operations and maintenance resource use and the imbedded CO2 sequestration potential to offset these emissions for these particular courses, but does suggest golf course operations and maintenance, if optimized, could approach carbon neutrality.
Few life cycle and carbon cycle assessments of recreational activities have been conducted. This may be due to the limited economic incentive to make recreational venues such as golf courses more efficient, or it could be a social dynamic that does not view these activities as having negative environmental impact or potential. Regardless, the good news for the environmental horticulture sector is that environmental horticulture vegetation is treated as a carbon sink (reduced the greenhouse gas emissions), while other inventor items are sources of greenhouse gas emissions and carbon contributions.

Literature Cited
Pre and Post Perceptions of Sustainable Landscape Demonstration Garden

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Index Words; Sustainable landscapes; educational garden; demonstration garden; perception survey; environmental stewardship; native plants

Significance to Industry: The Sustainable Landscape Demonstration Garden was created to address both consumer perception and the resulting green industry marketing challenge related to environmental gardens and native plants. Consumer perception of native plant gardens is often negative due to perceptions of garden untidiness or lack of maintenance (4). These perceptions result in reduced commercial viability of native plant species. This project is intended to increase the potential for environmental stewardship through the installation of a sustainable landscape demonstration garden. This garden contains native plants and is well-tended (mulched, weeded and watered) yet low-maintenance (no fertilizer or pest control applications). Environmental benefits are communicated in a variety of ways to passersby including both participatory (such as in-person surveys) and passive (such as educational signage and QR codes) mechanisms to enhance access to garden information.

Nature of Work; Environmental education demonstration gardens are typically located in botanical gardens or edges of public parks. These discrete sites may be chosen due to the experimental nature of the installation and/or the assumption that the gardens are not as aesthetically pleasing as traditional landscape beds. Our project takes a different approach acknowledging that 1) environmental educational displays are needed in the busiest, hectic urban environments in order to reach and influence greater numbers and diverse people; 2) the display should be aesthetically pleasing as well as educational so as to generate sales and production of these less common, but environmentally beneficial plants; and 3) the experimental nature of the garden should include a participatory role for passersby to share their opinion and judgment of the display. Participation is engaged learning and often results in greater knowledge retention and continued involvement.

People tend to consider attractive landscapes as ones that appear visually cared for or those that are relatively neat and tidy in appearance (4). Therefore, to enhance acceptance and appreciation of educational display gardens, the garden needs to be professionally maintained, just as any ornamental display garden would be. By locating the environmental display garden in a busy intersection and by partnering with the Clemson University Landscape Services Department to provide installation and
maintenance supervision, we are addressing this need for aesthetic tending.

Hester (2) suggested that by “championing everyday beauty” (p. 109) in an urban environment, knowledge, pride, and pleasure may result. By surveying passersby for their preference ratings of the site before and after installation and by surveying people’s preference for native plants, we are inviting passersby and the community at large to actively participate in the project. This engaged learning has the potential to result in increased interest in native plants as well as a stimulus for “ambassador” acts (when people offer positive explanations concerning the project to others).

Changing behaviors, even to protect the environment for future generations, is never easy. Employers who hire college students frequently do so to capture new knowledge and practices. Strategies being learned by the students include how to design and install a native plant demonstration garden; how to successfully work in interdisciplinary teams; and how to measure environmental and perceptual effects of the installation. These are skills needed to create sustainable solutions to the environmental problems in the world today.

Efforts to promote environmental stewardship through the installation of a sustainable garden on the Clemson campus began in 2011. Two adjacent garden locations were identified in a public space bordered by sidewalks. Each location was in a relative stage of decline. One 1,800 square foot area contained weeds, Bermudagrass, liriope, and juniper and was bordered on two sides by sidewalks and one side by the wall of a brick building (Figure 1A). The other 1,400 square foot bed did not have any ornamental plants and was bordered on all sides by sidewalk (Figure 1C). This latter spot had housed a pecan tree, which had been removed from the space due to a combination of decline and high target pedestrian population. All that remained were the roots of the pecan and a vegetative mulch layer on top of the soil.

Clemson University’s Landscape Services Director served as the client for students in the sustainable landscape design class offered by the horticulture department. Her criteria for the proposed landscape were that the landscape plantings be low-maintenance, well tended, and aesthetically pleasing to passersby. Class criteria were that the landscape would promote environmental sustainability through biodiversity and include native plants. Horticulture students from three separate classes (Horticulture Inquiry and Discovery, Hort 408; Sustainable Landscape Design, Hort 308/309; and Landscapes and Health, Hort 400) collected human preference and behavior survey data; created landscape designs of the existing space; or submitted soil samples for laboratory analysis.

The concept of sustainability stems from the historical definition developed by The World Commission on Environmental and Development Report to the United Nations, *Our Common Future*, also known as The Brundtland Report. Sustainable development, according to the Brundtland Report, meets the needs of the present without compromising the ability of future generations to meet their own needs (8). The
Brundtland Report identifies healthy environment, economic development, and social justice as the three issue areas that must be present in order for sustainable development to occur. Current perspectives and practices conveyed to students are inspired by EPA GreenScapes materials (7), the Sustainable Sites Initiative Benchmarks and Guidelines (6), and the publication Cradle to Cradle: Remaking the Way We Make Things (3).

To assess people’s preferences, a survey was designed using the Dillman Tailored Design Method (1). After obtaining Institutional Review Board (IRB) approval for the survey, identical preference and demographic questions were administered by student interviewers to passersby in the garden area. Pre-installation surveys were conducted in spring 2012 \((n = 171)\) prior to any disturbance of the space. The demonstration garden was installed in June 2012; and post installation surveys \((n = 86)\) were conducted 4-5 months later in the autumn of 2012 after the first growing season. Quantitative survey responses evaluating garden aesthetics and perception of maintenance pre and post-installation were analyzed using a Least Squares analysis of fit, and means were separated using the Student’s t test in JMP v 10.0 (SAS Institute, Cary NC).

Soil samples were submitted for analysis both pre installation in November 2011 and three months after installation in September 2012. Garden installation occurred in June of 2012 with a student working alongside the Landscape Services crew. The existing plants were physically removed from the larger space and the roots were removed from the smaller area; the spaces were tilled with a rototiller and 6” of leaf compost, obtained from the South Carolina Botanical Garden, was incorporated into the soil to a depth of 8”. Twenty different native plant species and cultivars were installed. A three-inch layer of double ground vegetative mulch was applied to the soil surface immediately after planting. Plants were watered deeply by hand whenever the soil felt dry to the touch 1-2” below the soil surface.

Signs (4” x 6”) with the plant botanical and common names were installed in the garden at time of planting, and a larger sign introducing “Sustainable Landscape Demonstration” (Figure 2) that contained a QR code link to the garden’s website (5) was installed during the summer. The garden website (5) went live in late April of 2013, and contains information about the Garden’s purpose; the designs; the planning, design, installation and maintenance team; and the plants. Each plant is featured on a plant profile sheet that contains descriptive details about its mature size, environmental preferences, and environmental benefits. All plant profile information is cited to source and the sources are listed in the profile.

**Results and Discussion:** Results from the pre and post surveys of passersby on campus indicate that aesthetics and maintenance of the installed gardens were significantly higher. The survey enabled participants to rate the pre- and post-installation space on a scale of 1 to 10, with 1 being the poorest and 10 being the best. Pre-installation respondents rated the space as a 4.3 in aesthetic appearance, while post-installation respondents rated the Sustainable Landscape Demonstration Garden
as a 6.9 in aesthetic appearance ($P < 0.0001$). Respondents in the pre-installation survey perceived the quality of maintenance as a 4.8, while respondents in the post-installation survey rated the quality of maintenance as a 6.8 ($P < 0.0001$). These positive changes in perception of aesthetics and the quality of maintenance are encouraging, considering that perennial plants generally require two complete growing seasons to reach peak performance and the post-installation survey was conducted after only one growing season.

The pre-installation soil test (analyzed at Clemson University Agricultural Service Laboratory) for the larger garden that is bordered by sidewalks and a building documented in 2011 that phosphorus (P) was high, calcium (Ca) and magnesium (Mg) were sufficient to high, and potassium (K), zinc (Zn), manganese (Mn), and boron (B) were medium to sufficient. Cation exchange capacity was 7.2 meq per 100 g soil$^{-1}$ with 3.3% organic matter. With the exception of less P (medium), and more B (sufficient), the 2012 soil test was very similar to pre-planting soil conditions. The initial soil test for the smaller garden documented that Ca was excessive, K and B were high, and P, Mg, Zn, and Mn were sufficient. Cation exchange capacity was 15.8 meq per 100 g soil$^{-1}$ with 5.6% organic matter. With the exception of less P (medium), and B (sufficient to high), the 2012 soil test was very similar to pre-planting soil conditions. To date, no fertilizers have been applied to either garden since the removal of the original existing vegetation and roots. This pattern of minimal change in minerals, organic matter, and CEC suggest that although plants were establishing, which is thought to be a period of elevated nutrient requirement, a depletion of most minerals did not occur. Locating the demonstration garden in a busy thoroughfare has resulted in high sample sizes for surveys, increased time spent in the area, and increased interactions between student garden workers and passersby.

Our next steps include invitations to green industry professionals, Master Gardeners, and Master Naturalists to visit the Sustainable Landscape Demonstration Garden to rate the individual plants. These plant preference ratings will be posted on the website as indicators of potential promise for native plants and will hopefully be used by producers and retailers when considering introduction of native plants into their production line or garden center stock. During fall 2013, preference surveys of passersby will be administered by students, and additional soil samples will be collected and analyzed.

**Literature Cited**


Fig. 1. Pre-installation (A) and post-installation (B) perspective of 1,800 ft$^2$ bed bordered by sidewalks and brick building. Pre-installation (C) and post-installation (D) perspective of 1,400 ft$^2$ bed bordered by sidewalks. Post-installation (E) view of both gardens.
Fig. 2. Signage installed within the Sustainable Landscape Demonstration Garden to increase awareness of the gardens’ purpose and components, and to enhance educational opportunities for passersby who interact with the garden.
Green Industry Supply Chains

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Index Words: supply chain management, green industry, economic and market linkages

Significance to Industry: The supply chain of a firm in the green industry consists of the business entities from raw material or input supplier to customer. The supply chain is the firm’s lifeblood – delivering product to customers to generate revenue, as well as procuring components, inputs or services at competitive prices, plus shepherding new products and information from thought, design or research and development to delivery to enable sustained competitiveness. For an individual firm, the supply chain includes both its upstream supplier network of input and service providers and its downstream distribution channel, a series of linked suppliers or distributors and customers. Materials and information flow both up and down the supply chain. For an industry such as the green industry, the focus is on supply chain relationships and organizational dynamics, which lead to profitable businesses and satisfied customers.

Nature of Work: Because of the dynamics of not only different competing firms within a defined business as well as integrating both upstream and downstream suppliers and providers of goods and services in yet other defined business functions, a backlash or bullwhip effect is not uncommon. To avoid the sting of the bullwhip, the four causes of the bullwhip effect should be identified and evaluated: demand forecasts need constant updating; most container and field nursery and greenhouse production resembles order batching; spatial and marketing firm price fluctuations; and an inherent rationing within the supply chain. Perhaps a look at a food product (cereal) supply chain will highlight the various bullwhip effects:

If the basic supply chain model is expanded to reflect an integrated supply chain with materials and information and financial flows depicted as flowing in both directions, the purpose of a supply chain is well documented. The supply chain is to provide end
customers and supply chain member organizations and firms with the materials required, in the proper quantities, in the desired form, with the appropriate documentation, at the desired location at the right time, and at the lowest possible cost.
Results and Discussion: The basic green industry crop supply chain encompasses three sectors: inputs (goods and services suppliers), production (growers), and marketing (customer).

The basic green industry crop supply chain: inputs → production → customer
Planting or Potting from Seed or Stock
Growing in Field, Container, Greenhouse
Harvesting for Market
Storage & Shipping
Distribution & Sales

Distribution
Marketing
Customer
Ancillary Services
There are numerous economic linkages observed via supply chains:
• Jobs: employment, labor and wages
• Tax revenues to state, county, community and federal governments
• Business and personal taxes to local and state and federal governments
• Purchased inputs and services (indirect effects)
• Local consumption and intermediate demand
• Imports (leakages)
• Consumer household spending (induced effects)
• Multiplier effects (output, employment, value-added for production and manufacturing, service and trade sectors).

Several challenges are on the horizon for supply chain management of green industry firms:
✓ Sharing the risks in inter-organizational relationships
  o Confidentiality
  o Research and development
  o Increased service expectations
  o Leverage
  o Mass customization
  o Shared responsibility
✓ Managing the global supply chain
✓ The ‘greening’ of the supply chain and sustainability
  o CO2e (carbon contribution, carbon sequestration, net carbon)
  o Reverse logistics
  o Recycling
  o Supplier selection and evaluation
  o Surplus and scrap disposition
  o Carrier selection and transportation
  o Product design, packaging, and labeling
✓ Design for supply chain management
✓ Intelligent information systems
✓ When things go wrong.

Literature Cited: