2. Research Methodology

Industry Sector Classification

The economic sectors associated with the environmental horticulture or "Green" Industry were identified, based on their primary product or service activity as described in the North American Industry Classification System (Office of the President, 1997) as indicated in Table 2-1. Production and manufacturing includes the sectors for nursery and greenhouse, lawn and garden equipment manufacturers, and greenhouse manufacturers (prefabricated metal buildings). The horticultural services sector includes landscaping and landscape architecture. Wholesale and retail trade of horticultural goods includes sectors for flower, nursery stock and florist supplies wholesalers, lawn and garden stores, and florists. In addition, building material and supplies dealers, food and beverage stores, general merchandise stores, and farm and garden equipment wholesalers all have significant sales of horticultural merchandise as port of their overall business.

Table 2-1. Classification of Economic Sectors Associated with the Green Industry

Industry Sector	NAICS Code
Nursery & Greenhouse	1114
Lawn & Garden Equipment Mfg	333112
Greenhouse Manufacturing (Prefab. Metal Buildings)*	332311
Landscaping Services	56173
Landscape Architectural Services	54132
Flower, Nursery Stock And Florist Supplies Wholesalers	42493
Lawn & Garden Equipment & Supplies Stores	4442
Florists	4531
Building Material & Supplies Dealers*	4441
Food & Beverage Stores*	445
General Merchandise Stores*	452
Farm & Garden Machinery & Equipment Wholesalers*	421820

* Merchandise or product line sales of horticultural goods represents a portion of overall business.
Source: Executive Office of the President, Office of Management and Budget. North American Industry Classification System, United States, 1997.

Information Sources

Economic information on the Green Industry in the United States was compiled from a variety of sources. For the nursery and greenhouse sector, national and state information on number of farms and value of sales were taken from the Census of Agriculture for 2002 (USDA, 2004). For the various services and trade sectors, information on number of establishments, employment, and sales (receipts) were taken from the 2002 Economic Census Industry Report Series for U.S. totals, while state-level information on number of firms, employment and payroll in 2002 were taken from County Business Patterns (US Census Bureau, 2004, 2005). For the sectors whose primary business is not in horticulture (such as general merchandise stores), employment and payroll were estimated in proportion to horticulture merchandise or product line sales as a share of total sales. Also, state-level information on number of firms, employment and payroll were adjusted to match the U.S. totals. The Census of Agriculture and Economic Census were considered to be the most reliable information sources available, since they have well-established statistical methodologies, with adjustment for small or non-responding firms, and provide published confidence parameters. For some states in which employment and wages were non-disclosed because of a small number of firms reporting, employment was estimated at the midpoint of the range indicated, and payroll was estimated at the national average annual wages per employee.

According to Census Bureau data, the number of establishments, employment, payroll, and sales receipts for sectors of the Green Industry in the United States in 2002 are shown in Table 2-2. There were a total of 255,389 business establishments involved in the industry, including 56,233 nursery producers or manufacturers, 82,683 horticultural services firms, and 116,473 wholesale/retail trade firms. Total reported employment was 1.085 million employees, and total payroll was $46 billion (Bn), excluding the nursery and greenhouse sector. Total sales receipts in 2002 were $147.1 Bn, including $23 Bn for producers, $38.8 Bn for horticultural services, and $85.3 Bn for wholesale/retail trade.

Table 2-2. Sales and Employment in the U.S. Green Industry, 2002

Sector (NAICS code)	Establish-ments	Paid Employees	Annual Payroll ($Mn)	Sales Receipts ($Mn)
Production/Manufacturing	**56,233**	**173,403**	**26,896**	**23,000**
Nursery & Greenhouse (1114)	56,070	150,543	4,459	16,362
Lawn & Garden Equipment Manufacturing (33311)	145	22,201	681	6,517
Prefabricated metal buildings (332311) (Greenhouses)*	18	659	21,756	121
Horticultural Services	**82,683**	**551,641**	**12,839**	**38,804**
Landscaping Services (56173)	76,458	514,962	11,509	35,235
Landscape Architectural Services (54132)	6,225	36,679	1,330	3,569
Wholesale & Retail Trade Horticulture Products	**116,473**	**510,512**	**10,676**	**85,305**
Flower, Nursery Stock and Florist Supplies Wholesalers (42493)	4,816	60,010	1,580	10,022
Lawn & Garden Equipment & Supplies Stores (4442)	21,065	171,149	3,769	30,953
Florists (4531)	22,753	113,929	1,489	6,597
Building Material & Supplies Dealers (4441)*	18,623	60,450	1,608	13,201
Food & Beverage Stores (445)*	22,465	19,222	330	3,090
General Merchandise Stores (452)*	22,710	56,651	955	9,898
Farm & Garden Equipment Wholesalers (42382)*	4,041	29,102	945	11,541
Total All Sectors	**255,389**	**1,235,557**	**50,410**	**147,109**

* Payroll and employment estimated proportional to merchandise line sales of total sales.

Sources: 2002 Economic Census, 2002 Census of Agriculture (USDA/NASS), 2001 *Implan* data for the US (nursery & greenhouse employment, payroll)

Primary market research data regarding the structure and performance of the nursery industry were generated by the Fourth National Nursery Industry survey conducted by the S290 Multi-state Regional Research Committee, a group of agricultural economists and horticulturists from 24 land-grant institutions across the country (including the principal investigators of this project). A total of 44 states participated in this survey. It is through the S290 survey efforts conducted in early 2004 that detailed data regarding sales of urban forest tree species were collected. For the first time in the survey's history, a standard methodology of obtaining a sample frame was used. The population lists for each state were assembled from the respective Department of Agriculture offices responsible for licensing nursery producers. A master file of all certified/licensed nursery operations was compiled at the University of Florida. Two states that had recently completed nursery surveys were excluded (AL and AZ) in addition to four other states that had extremely small nursery numbers (AK, KS, MD, and WI). The remaining 44 states resulted in a combined listing of 38,269 certified/licensed nursery operations. Based on considerations of budget and statistical reliability, a sample of 15,888 firms was selected for the survey, with sampling in each state based on its proportion of the overall nursery population. Where information was available on nursery production area, inventory or sales volume, sampling was stratified for three size classes: small (less than five acres), medium (5 to 19 acres), and large (20 or more acres). Sampling was weighted on larger firms, with 100 percent of the large nurseries, 60 percent of the medium nurseries, and 25 percent of the small nurseries. In several states, the nursery acreage values were not available, or not available for all certified or licensed operations, and in these states 40 percent of the identified firms were sampled. The final sample included 3,476 large nurseries, 3,778 in the medium category, 5,996 of the small firms, and 2,338 of unknown size. There were a total of 2,485 usable returned questionnaires returned, representing an overall response rate 15.9 percent. The number of respondents from individual states ranged from as few as 10 in Nevada to 476 in Florida.

Economic Impact Analysis

To evaluate the broad regional economic impacts of the Green Industry in the United States, regional economic models were developed for each state using the *Implan* software system and associated state datasets (MIG, Inc., 2004). The *Implan* system includes over 500 distinct industry sectors. The sectors pertinent to the Green Industry are indicated in Table 2-3 and Figure 2-1. The information for these models was derived from the U.S. National Income and Product Accounts, together with regional economic data collected by the U.S. Department of Commerce, Bureau of Economic Analysis. Input-output models represent the structure of a regional economy in terms of transactions between industries, employees, households, and government institutions (Miller & Blair, 1985). The *Implan* data used for this analysis was based on fiscal year 2001.

Economic multipliers derived from the models were used to estimate the total economic activity generated in each state by sales (or output) to final demand or exports. This includes the effects of intermediate purchases by industry firms from other economic sectors (indirect effects) and the effects of industry employee household consumer spending (induced effects), in addition to direct sales by industry firms. The regional *Implan* models were constructed as fully closed models, with all household, government, and capital accounts treated as endogenous, to derive Social Accounting Matrix (SAM) type multipliers, which represent transfer payments as well as earned income. Separate multipliers are provided for output (sales), employment, value added, labor income, and business taxes. The output total effects multipliers for each industry sector and state are shown in Table 2-4. The direct, indirect, and induced effects multipliers for output, value added and employment for each industry sector are shown in the Appendix Tables. The multipliers for output, value added, labor income, and indirect business taxes are expressed in units of dollars per dollar output, while the employment multiplier is expressed in jobs per million dollars output. The total output multipliers generally range from 1.8 to 2.8, meaning that for each dollar of sales to final demand, total output generated in the region (state) is $1.80 to $2.80. Differences in values of the multipliers reflect the structure of industry sectors and regional mix of supplier industries. The multipliers were applied to estimated industry sales or output in order to estimate total economic impacts. For the producer and service sectors, total economic impacts were estimated as:

$$I_{hij} = S_{hi} \times [\, A_{hij} + E_{hi} \times (B_{hij} + C_{hij})];$$

and for the wholesale trade sectors, impacts were estimated as:

$$I_{hij} = S_{hi} \times G_i [\, A_{hij} + E_{hi} \times (B_{hij} + C_{hij})];$$

and for the retail trade sectors, impacts were estimated as:

$$I_{hij} = S_{hi} \times G_i [\, A_{hij} + B_{hij} + C_{hij}],$$

where

I_{hij} is total impact for measures (j) of output, employment, value added, labor income, or indirect business. taxes, in each sector (i), and state (h).
S_{hi} is industry sales in sector i and state h.
E_{hi} is the proportion of industry sales exported or shipped outside the state, by sector i in state h.
A_{hij} is the direct effects multiplier for measure j in sector i and state h.
B_{hij} is the indirect effects multiplier for measure j in sector i and state h.
C_{hij} is the induced effects multiplier for measure j in sector i and state h.
G_i is the gross margin on retail sales for sector i.

The calculation for the producer, wholesale, and service sectors assumes that only the export portion of output is sold to final demand, and therefore is subject to the indirect and induced effects multipliers, while the remainder of in-state sales is subject to intermediate demand from other business sectors and to direct effects multipliers. Data on exports were taken from the *Implan* database for 2001 or 1999, except in the case of the nursery and greenhouse sector, where information for some states was taken from the 2003 National Nursery Survey. The calculation for retail and wholesale sectors assumed output is reduced to reflect only the gross margin on sales according to national averages: 20.1 percent for flower and nursery stock wholesalers, 24.7 percent for general merchandise stores, 26.5 percent for lawn and garden equipment wholesalers, 28.5 percent for food and beverage stores, 29.5 percent for lawn and garden stores, 29.5 percent for building materials and supply stores, 42.3 percent for florists (miscellaneous retailers) [Census Bureau, Annual Benchmark Reports for Retail Trade & Food

Services, and for Wholesale Trade]. All results were stated in 2004 dollars by adusting values using the Gross Domestic Product (GDP) Implicit Price Deflator (U.S. Department of Commerce).

Table 2-3. *Implan* Sectors Used for Economic Impact Analysis of the Green Industry

Implan Sector Name (Number)	Horticulture Industry Sector Covered
Nursery & Greenhouse (6)	Nursery & Greenhouse
Lawn & Garden Equipment Mfg (258)	Lawn & Garden Equipment Mfg
Prefabricated Metal Building & Component Mfg. (232)	Greenhouse Manufacturing
Services To Buildings And Dwellings (458)	Landscaping Services
Architectural And Engineering Services (439)	Landscape Architectural Services
Wholesale Trade (390)	Flower, Nursery Stock & Florist Supplies Wholesalers Farm & Garden Machinery & Equipment Wholesalers
Building Material And Garden Supply Stores (404)	Lawn & Garden Equipment & Supplies Stores Building Material & Supplies Dealers
Miscellaneous Store Retailers (411)	Florists
Food And Beverage Stores (405)	Food & Beverage Stores
General Merchandise Stores (410)	General Merchandise Stores

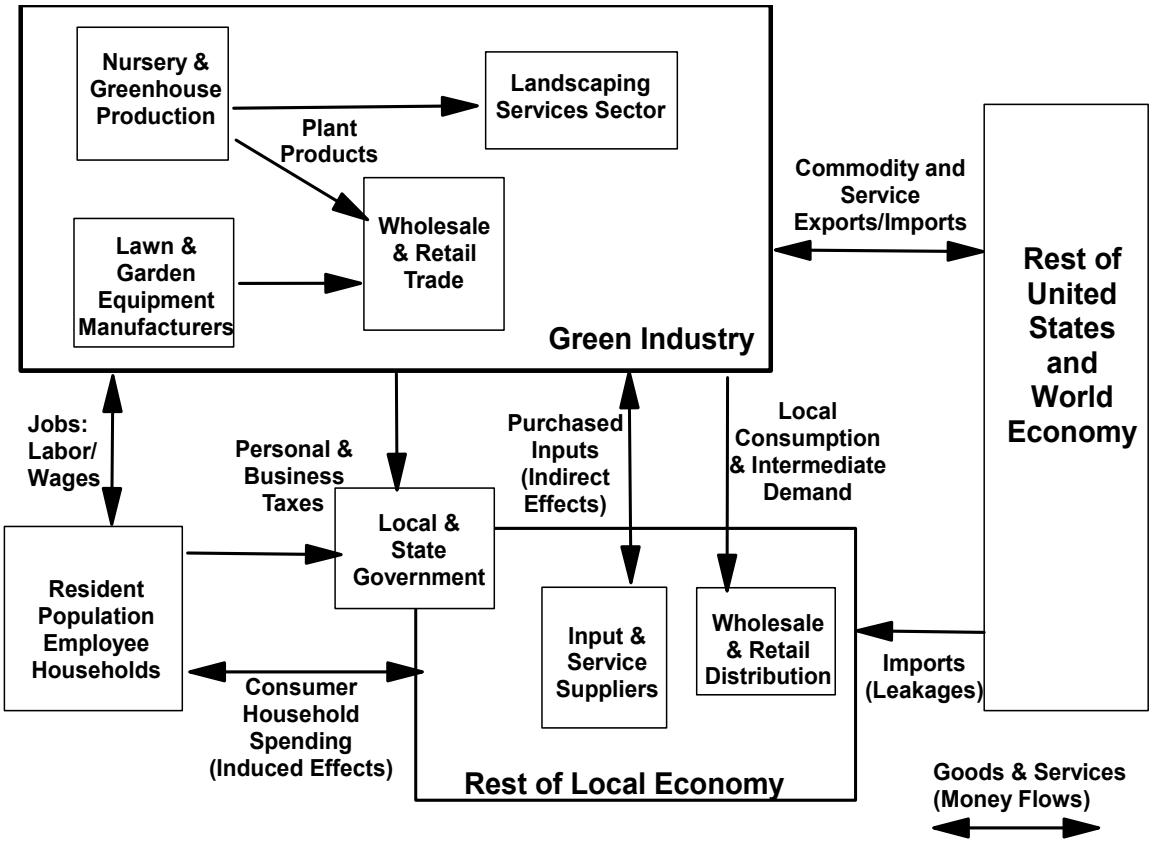

Figure 2-1. Market Structure and Economic Linkages of the Green Industry

Table 2-4. Output Total Effects Multipliers for the Green Industry, by Sector and State (2001)

State	Nursery & Greenhouse	Lawn & Garden Equipment Mfg	Landscaping Services	Landscape Architecture	Wholesale Trade (Hort. Goods, Equip.)	Lawn & Garden Stores (Bldg. Mat./Supl)	Florists (Misc. Retailers)	Food & beverage stores	General merchan-dise stores
Alabama	1.976	1.932	2.186	2.104	2.166	2.157	2.143	2.156	2.156
Alaska	1.877	0.000	1.991	2.017	1.997	2.024	2.030	2.026	2.019
Arizona	2.213	1.929	2.368	2.390	2.438	2.436	2.483	2.456	2.433
Arkansas	1.922	1.768	2.051	1.997	2.051	2.063	2.065	2.069	2.062
California	2.480	2.180	2.687	2.666	2.722	2.711	2.790	2.743	2.712
Colorado	2.434	2.222	2.613	2.635	2.714	2.703	2.768	2.725	2.700
Connecticut	2.011	0.000	2.289	2.258	2.318	2.318	2.414	2.361	2.321
Delaware	1.873	0.000	2.020	1.976	2.025	2.040	2.033	2.041	2.037
Florida	2.370	2.001	2.572	2.548	2.603	2.600	2.661	2.636	2.597
Georgia	2.258	2.157	2.547	2.530	2.580	2.580	2.646	2.618	2.582
Hawaii	2.303	0.000	2.419	2.388	2.392	2.412	2.401	2.411	2.410
Idaho	2.052	0.000	2.190	2.147	2.164	2.175	2.200	2.191	2.176
Illinois	2.387	2.435	2.627	2.643	2.690	2.693	2.782	2.736	2.696
Indiana	2.092	2.096	2.232	2.187	2.261	2.275	2.298	2.291	2.274
Iowa	1.955	1.903	2.116	2.066	2.133	2.122	2.113	2.122	2.119
Kansas	2.119	1.876	2.268	2.218	2.286	2.292	2.309	2.305	2.291
Kentucky	1.916	1.874	2.071	2.021	2.018	2.037	2.048	2.046	2.039
Louisiana	2.061	1.736	2.193	2.184	2.226	2.220	2.228	2.228	2.215
Maine	2.010	1.672	2.128	2.098	2.136	2.122	2.067	2.105	2.117
Maryland	2.393	2.128	2.603	2.629	2.622	2.623	2.634	2.633	2.622
Massachusetts	2.205	2.023	2.423	2.430	2.453	2.453	2.527	2.495	2.456
Michigan	2.140	2.060	2.305	2.269	2.322	2.343	2.405	2.376	2.345
Minnesota	2.317	2.091	2.552	2.545	2.605	2.607	2.688	2.645	2.607
Mississippi	1.908	1.822	2.063	1.985	2.049	2.043	2.018	2.036	2.039
Missouri	2.255	2.182	2.455	2.411	2.495	2.505	2.588	2.544	2.507
Montana	1.888	0.000	2.021	2.041	2.013	2.016	1.952	1.997	2.014
Nebraska	1.978	1.905	2.249	2.242	2.315	2.299	2.303	2.306	2.295
Nevada	2.156	0.000	2.193	2.201	2.192	2.215	2.237	2.225	2.216
New Hampshire	2.150	0.000	2.303	2.247	2.301	2.305	2.327	2.319	2.303
New Jersey	1.996	1.894	2.299	2.262	2.321	2.318	2.419	2.368	2.320
New Mexico	2.078	0.000	2.198	2.194	2.255	2.241	2.247	2.246	2.235
New York	1.979	2.053	2.207	2.238	2.276	2.276	2.378	2.334	2.278
North Carolina	2.095	2.034	2.348	2.268	2.325	2.318	2.319	2.320	2.317
North Dakota	1.768	1.587	1.960	1.934	1.957	1.959	1.942	1.952	1.957
Ohio	2.016	1.862	2.205	2.185	2.156	2.217	2.287	2.254	2.220
Oklahoma	2.276	1.985	2.387	2.304	2.357	2.361	2.362	2.369	2.362
Oregon	2.307	1.934	2.386	2.318	2.321	2.340	2.438	2.382	2.341
Pennsylvania	2.292	2.166	2.481	2.479	2.493	2.509	2.601	2.550	2.512
Rhode Island	1.884	0.000	2.024	1.991	1.998	2.007	1.964	1.992	2.005
South Carolina	1.986	1.871	2.164	2.088	2.134	2.134	2.109	2.126	2.130
South Dakota	1.870	1.798	2.090	2.065	2.128	2.110	2.053	2.082	2.105
Tennessee	2.289	2.089	2.409	2.337	2.387	2.384	2.414	2.403	2.384
Texas	2.490	2.142	2.593	2.534	2.588	2.551	2.600	2.576	2.548
Utah	2.424	2.201	2.595	2.560	2.618	2.621	2.654	2.640	2.621
Vermont	1.985	1.745	2.133	2.109	2.159	2.159	2.165	2.167	2.158
Virginia	2.213	1.929	2.423	2.405	2.463	2.481	2.523	2.503	2.480
Washington	2.161	1.796	2.306	2.251	2.231	2.254	2.309	2.279	2.259
West Virginia	1.921	0.000	1.939	1.878	1.853	1.870	1.853	1.869	1.872
Wisconsin	2.090	2.083	2.251	2.223	2.274	2.278	2.312	2.298	2.278
Wyoming	1.881	0.000	1.935	1.931	1.942	1.940	1.934	1.939	1.936

Source: *Implan* 50 state data package, 2001 (MIG, Inc. 2004)