Trade Flows within the U.S. Nursery Industry[1]

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Abstract

This study summarizes regional trade flows in the U.S. nursery industry by incorporating origin and destination (OD) sales data from a national survey of ornamental plant growers and dealers conducted in 2014. Specifically, we discuss: 1) regional annual sales reported by the green industry firms in 2013, 2) percentage distribution of OD trade flows by regions and states, and 3) differences in the percentage distribution of OD trade flows during the 5-year period by region. Of 32,000 questionnaires sent via mail and email, a total of 2,657 usable observations were received and used in the analysis. The OD trade flow results were then compared with those of 2008 estimates by eight United States regions. The highest proportion of inter-regional sales were reported by firms in the Appalachian (35.7%), followed by Mountain (25.4%), and Southeast (19.1%) regions, and the lowest inter-regional sales were in the Midwest (2.2%) and Great Plains (0.9%) regions. The results show considerable changes in both *intra-state* (within home state) and *inter-regional* (between states) trade flows from 2008 to 2013. Overall, intra-regional trade in the Great Plains, Midwest, Pacific, and Southeast regions increased by 9.9, 3.7, 1.6, and 7.8% from 2008 to 2013, respectively. However, the proportion of sales within Appalachian, Mountain, Northeast and Southcentral regions, decreased by 11.1, 8.3, 3.8 and 0.2%, respectively. Implications for relevant green industry stakeholders are discussed.

Index words: nursery sales, ornamental plants, horticulture, wholesale trade, regional demand.

Significance to the Horticulture Industry

The nursery or 'green' industry in the United States experienced significant structural changes due to the economic losses during the Great Recession from 2007 to 2009 and during the ongoing slow recovery (Hall 2010). In order to effectively manage production risks and adjust business strategy according to dynamic consumer preferences, green industry firms need reliable information about general economic trends, regional trade, marketing channels, consumer preferences, real estate markets, and production issues (i.e., proper product mix, irrigation technology, integrated pest management, etc.). Of special importance is the information about inter-regional trade flows, since it informs on spatial distribution of demand and may help industry stakeholders with strategic decisions about emerging market locations. In order to address that research gap, the current report summarizes the trade flows in the industry in 2013 and provides a 5-year comparative analysis of inter-regional trade in the U.S. green industry.

Introduction

The *Green Industry Research Consortium* has regularly conducted national surveys to analyze production and marketing practices within the U.S. green industry in a series of reports since 1989 (Brooker et al. 1990, 1995, 2000, 2005; Hodges et al. 2010; Hodges et al. 2015a). The central objective of those reports was to consistently document changes in the key practices over time and across regions, thus providing practical information to growers and allied industry professionals. In addition to industry stakeholders, the information is also utilized by university Extension communities and researchers in communicating the relevance and economic impacts of the green industry at county, state and regional levels. The key data provided in the reports were related to the production efforts (plant types and forms grown, irrigation methods and water sources, and pest management), marketing practices (market distribution channels, selling methods, and advertising forms) and a range of factors affecting pricing strategies and overall business growth and opportunities. The reports also summarized regional trade flows of finished products and propagation materials for each U.S. region and reporting period.

The geographic dispersion of the industry has changed over the past several decades and regional trade flow analysis may provide further insights about consolidation trends and competitive displacement in the industry. Although there are a number of factors that affect the OD trade within the green industry, part of the demand is absorbed by regional real estate markets, such as new construction starts, and re-landscaping of existing homes. Thus, changes in trade flows can be associated with the housing market dynamics in respective regions. Due to the cyclical nature of the housing market, year-over-year changes are expected in trade flows within the nursery industry. In addition, we argue that changes in the trade flows (that are influenced by the dynamics in the real estate markets) are also spatially disproportionate. The results are consistent with earlier findings (Abraham and Hendershott 1996) that regions react to economic shocks differently, which could translate into spatially-variable demand for green industry products. Overall, the results showed that 85.6% of trade was comprised of intra-regional sales, 12.8% inter-regional sales, followed by 1% international and 0.6% sales to other (unidentified) regions.

Understanding regional trade dynamics is particularly important, since it provides insights about the geographic distribution of product demand and may help industry

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stakeholders with strategic trade and production expansion decisions. In order to address that research gap, this research was conducted with the following objectives: 1) summarize regional annual sales reported by green industry firms in 2013; 2) examine percentage distribution of OD trade flows by regions and states; and 3) discuss differences in the percentage distribution of OD trade flows during the 5-year period by region.

Materials and Methods

The research team compiled a list of 110,000 registered growers and plant dealer firms in all 50 states of the U.S. A random sample of 32,000 firms was developed for the survey with 15,000 firms selected for mail and 17,000 firms for email questionnaires. The survey was administered during July to August, 2014 (soliciting end-of-year 2013 data), with the first set of questionnaires distributed after an introductory letter sent to selected firms. Following survey research recommendations in Dillman et al. (2008), reminder postcards followed both mailings of the survey questionnaire. The email survey was conducted in parallel and followed a similar methodology and timeline. After screening out duplicate responses and outlier values, the number of survey respondents totaled 2,657 firms, representing an 8% response rate of firms contacted.

The previous survey conducted during June to August, 2009 (soliciting end-of-year 2008 data), included 38,000 certified nursery operations. A total of 3,044 usable questionnaires were returned from a stratified sample of 17,019 firms contacted, representing a 17% response rate. Detailed methodology and sample summary statistics for both surveys are provided in Hall et al. (2011) and Hodges et al. (2015b). Questionnaires for both surveys included questions about annual sales, employment characteristics, plant types produced, native plants, product forms, market distribution channels, selling methods, advertising forms, irrigation water sources and application methods, integrated pest management practices, interstate and international trade flows of finished products and propagation materials, year of business establishment, and factors affecting business growth and pricing. The state-level survey data were assigned to eight regions of the U.S. defined to reflect agroclimatic characteristics, similar to the USDA Farm Production Regions.

Results and Discussion

The results of the study are organized as follows. The first subsection provides a summary of nursery industry sales by region and type of destination (i.e., inter-regional, intra-regional, or international). The second subsection discusses the percentage distribution of OD trade flows at state and region levels. The final subsection provides an overview of changes in OD trade flows from 2008 to 2013.

Trade flows by OD region. The respondent firms provided information on total annual sales and the percentage distribution by destination state or country, which was then categorized as inter-regional (sales to outside home region), intra-regional (sales within home region), or international (Table 1). A small percentage [0.58%, $17 million (M)] of total sales were indicated as 'other/U.S.' without further specification of the exact destination. The total reported sales across all U.S. regions were $2.972 billion (B), with the top-four highest regional sales reported by firms in Southeast ($761 M), Midwest ($660 M), Pacific ($449 M) and Northeast ($395 M) (Table 1). Firms in the Appalachian region reported $388 M in total sales, while Mountain, Southcentral and Great Plains had $110 M, $108 M, and $98 M, respectively.

The majority of trade in the industry was intra-regional, accounting for 85.6% of total sales (Table 1). Firms in Midwest, Southeast, Pacific and Northeast regions reported the largest intra-regional sales in dollar terms, amounting to $646 M, $616 M, $403 M and $357 M, respectively. Firms in the Appalachian region traded $250 M worth of production within the region, while the Great Plains, Southcentral and Mountain regions reported below $100 M in sales intra-regionally. Inter-regional trade within the U.S. accounted for 12.8% of total sales, with firms in the Appalachian and Southeast regions reporting $136 M and $123 M in sales to outside home regions, respectively, while the Pacific, Northeast and Northeast regions reported sales in the $20 M to $41 M range, and the lowest intra-regional trade was reported for the Southcentral and Midwest regions ($13 M for each). Trade flows to international destinations accounted for only 1% of the total trade volume or $28 M. Among 19 reported international destinations, Thailand ($13 M), Japan ($4 M), Taiwan ($4 M), Russian Federation ($2 M) and Canada ($2 M) were among the top 5 purchasing countries. The top ori-

Table 1. Summary of trade flows by origin region and destination geography in 2013, reported by respondents to a national green industry survey[z].

	Destination geography				
Origin regions	**Inter-regional**	**Intra-regional**	**Other/U.S.**	**International**	**Grand total**
	Sales in millions dollars				
Appalachian	136.5	249.6	2.2	0.0	388.21
Great Plains	0.9	97.1	0.0	0.0	98.01
Midwest	12.7	646.1	2.1	0.0	660.90
Mountain	22.0	82.3	5.9	0.1	110.41
Northeast	33.1	356.6	2.2	3.4	395.28
Pacific	40.9	402.6	4.5	1.8	449.71
Southcentral	13.0	95.0	0.0	0.3	108.31
Southeast	122.7	615.8	0.4	22.6	761.56
Grand Total	**381.9**	**2545.0**	**17.2**	**28.2**	**2972.4**

[z]The National Green Industry Consortium conducted the survey. Responses from 2,657 firms were used in the analyses.

Table 2. Summary of origin-destination trade flows by region in 2013, reported by respondents to a national green industry survey.

	Destination regions										
Origin regions	**Appalachian**	**Great Plains**	**Midwest**	**Mountain**	**Northeast**	**Pacific**	**Southcentral**	**Southeast**	**Other US**	**International**	**Grand Total**
	Sales in millions dollars										
Appalachian	249.6	2.1	18.3	0.0	48.9	0.7	16.8	49.7	2.2	0.0	388.2
Great Plains	0.0	97.1	0.6	0.1	0.0	0.0	0.2	0.0	0.0	0.0	98.0
Midwest	5.8	1.3	646.1	0.1	2.5	0.1	0.1	2.9	2.1	0.0	660.9
Mountain	0.0	0.1	0.1	82.3	0.0	2.3	13.7	5.9	5.9	0.1	110.4
Northeast	4.1	0.0	26.9	0.0	356.6	0.9	0.0	1.1	2.2	3.4	395.3
Pacific	0.1	0.0	0.2	28.8	2.3	402.6	1.9	7.6	4.5	1.8	449.7
Southcentral	2.1	0.4	0.4	0.0	0.0	0.2	95.0	9.8	0.0	0.3	108.3
Southeast	33.5	0.2	4.3	1.3	43.1	17.0	23.3	615.8	0.4	22.6	761.6
Grand total	**295.2**	**101.1**	**697.0**	**112.6**	**453.4**	**423.8**	**151.0**	**692.7**	**17.2**	**28.2**	**2972.4**

gin region for international shipments was the Southeast with $23 M sales, followed by the Northeast and Pacific regions with $3 M and $2 M sales, respectively (Table 1).

The largest proportion of inter-regional trade flows from the Appalachian region was to the Southeast ($50 M) and Northeast ($49 M) regions (Table 2). Sales from the Appalachian region to destinations in Midwest and Southcentral were $18 M and $17 M, respectively. The Southeast and Pacific were the only two regions shipping to all other U.S. regions and internationally. The top destination regions for sales originating from the Southeast included the Northeast ($43 M), Appalachian ($34 M), Southcentral ($23 M), and international ($23 M) destinations. Southeast to Pacific sales reached $16 M, while sales to the Midwest were under $5 M. The top destination for sales originating from the Pacific region was the Mountain region ($29 M), while the Southeast, Northeast and Southcentral regions purchased in the amount of $8 M, $2 M, and $2 M, respectively. Sales from the Pacific region to international markets were $2 M. The top destination for sales originating from the Northeast region was the Midwest ($27 M), followed by the Appalachian, International, Southeast, and Pacific regions ($4 M, $3 M, $2 M, and $1 M, respectively).

Percentage distribution of OD trade flows. Analysis of the share of total sales to destinations outside home regions shows that there is a large spatial variation in the distribution of trade flows across states (Table 3). As shown in Table 3 and Fig. 1, states with the largest percentages of out-of-state sales included Alaska (93.8%), Delaware (55.9%), Arkansas (47.8%), Virginia (45.8%), North Carolina (41.6%), Tennessee (40.4%), New Mexico (39.5%), Missouri (37.0%), and Colorado (36.7%). The largest proportion of inter-regional sales were reported by the firms in the Appalachian region (35.7%), with the most products sold to the Northeast (12.6%) and Southeast (12.8%) regions, and a lower share to the Midwest (4.7%) and Southcentral (4.3%) regions (Table 3). Figure 2 shows the geographic distribution of sales from the Appalachian region at the state-level, with Ohio, Pennsylvania, South Carolina, Georgia, Texas, and Florida among the largest purchasing states (ranging from 10 to 16% of outside-of-region sales). Among the 5 states in the Appalachian region, the largest contributions to inter-regional trade were by Virginia (45.8%), North Carolina (41.6%) and Tennessee (40.4%), then followed by West Virginia (21.7%), and almost all sales by Kentucky firms were within the state.

The second largest proportion of out-of-home region sales was by nursery firms in the Mountain region (24.5%) (Table 3). As shown in Fig. 3, Texas, Louisiana, and Georgia were among the largest purchasing states (ranging from 10 to 45% of outside-of-region sales). The Southcentral region was the greatest purchasing region (12.4%), followed by the Southeast (5.3%) and Pacific (2.1%) regions. At the state level, the greatest proportion of inter-regional sales were by firms in Colorado (36.7%), Arizona (26.8%), and Idaho (12.8%). The states of Nevada and Utah sold only 5.7 and 3.2% of their production to other regions, and Montana and Wyoming traded exclusively within the state.

The Southeast region had the third largest out-of-region sales (19.1%). Four regions received about 2–5% of the output shipped out of the Southeast, while the Great Plains, Midwest and Mountain regions each purchased lower than 1% (Table 3). As shown in Fig. 4, North Carolina, Maryland, New York, Texas and California were among the top purchasing states (ranging from 10 to 22% of outside-of-region sales). Among the five states in the Southeast, those with the largest inter-regional shipments were South Carolina (31.1%) and Florida (19.4%), while firms in Georgia and Mississippi contributed about 15% of their output, and Alabama shipped 11% to other regions. With 3% of total sales, this region had the largest proportion of sales to international destinations.

The fourth largest proportion of inter-regional sales originated from the Southcentral region, representing 12.3% of total region output (Table 3). The biggest proportion of out-of-home region sales was shipped to destinations in the Southeast region (9.0%), while about 2% of shipments were to the Appalachian region, and the rest of the regions combined purchased only 1% of the output produced by the Southcentral nurseries. As shown in Fig. 5, the top proportion of sales from the Southcentral region were shipped to destinations in Tennessee, Mississippi, Alabama, Georgia and Florida (ranging from 10 to 40% of outside-of-region sales). Among the five states in this (Southcentral) region, Arkansas, New Mexico and Louisiana shipped more than

Table 3. Percentage distribution of origin-destination trade flows by region and state in, reported by respondents to a national green industry survey.

Origin regions/ states	Destination regions: Appalachian	Great Plains	Midwest	Mountain	Northeast	Pacific	Southcentral	Southeast	Other U.S. (unspecified)	Foreign	Percent of sales outside home region
	Percentage of total sales in each region										
Appalachian	**64.28**	**0.53**	**4.72**	**—**	**12.59**	**0.19**	**4.33**	**12.80**	**0.56**	**—**	**35.72**
KY	99.01	—	0.97	—	—	—	—	0.02	—	—	0.99
NC	58.36	0.87	5.28	—	10.40	0.03	4.48	19.59	0.98	—	41.64
TN	59.56	0.25	8.35	0.01	8.96	0.05	11.65	11.14	0.03	—	40.44
VA	54.16	—	1.08	—	44.71	0.05	—	—	—	—	45.84
WV	78.30	—	9.80	—	0.81	8.34	—	2.61	0.15	—	21.70
Great Plains	**0.01**	**99.05**	**0.59**	**0.12**	**0.01**	**0.01**	**0.21**	**—**	**—**	**—**	**0.95**
KS	—	97.96	1.30	—	—	—	0.73	—	—	—	2.04
ND	—	99.72	0.28	—	—	—	—	—	—	—	0.28
NE	0.01	99.25	0.43	0.13	0.01	0.01	0.15	—	—	—	0.75
SD	—	95.86	4.14	—	—	—	—	—	—	—	4.14
Midwest	**0.87**	**0.20**	**97.76**	**0.01**	**0.37**	**0.02**	**0.01**	**0.43**	**0.31**	**—**	**2.24**
IA	0.73	0.14	97.31	—	0.36	1.46	—	—	—	—	2.69
IL	0.63	0.07	99.21	—	—	0.07	—	—	0.01	—	0.79
IN	1.08	—	98.92	—	—	—	—	—	—	—	1.08
MI	1.18	—	98.47	—	0.15	—	—	0.03	0.18	—	1.53
MN	—	1.04	98.66	0.13	0.03	0.02	0.12	—	—	—	1.34
MO	3.79	3.82	62.97	—	—	—	—	19.04	10.38	—	37.03
OH	3.36	—	90.90	—	5.09	—	—	0.04	0.61	—	9.10
WI	—	—	99.95	—	0.05	—	—	—	—	—	0.05
Mountain	**0.01**	**0.05**	**0.13**	**74.55**	**0.01**	**2.05**	**12.41**	**5.30**	**5.37**	**0.12**	**25.45**
AZ	—	—	—	73.21	—	10.14	16.65	—	—	—	26.79
CO	—	0.09	0.06	63.26	—	0.06	17.56	9.48	9.48	—	36.74
ID	—	0.02	0.09	87.25	—	9.05	1.30	—	—	2.29	12.75
MT	—	—	—	100.00	—	—	—	—	—	—	—
NV	—	—	—	94.33	—	2.83	2.83	—	—	—	5.67
UT	0.11	—	1.62	96.78	0.22	0.04	0.02	—	1.22	—	3.22
WY	—	—	—	100.00	—	—	—	—	—	—	—
Northeast	**1.04**	**—**	**6.81**	**0.01**	**90.22**	**0.23**	**—**	**0.29**	**0.55**	**0.85**	**9.78**
CT	—	—	—	—	99.26	—	—	—	0.74	—	0.74
DE	—	—	51.26	—	44.08	—	—	—	—	4.66	55.92
MA	—	—	0.02	—	92.52	—	—	—	7.47	—	7.48
MD	8.13	—	—	—	91.78	0.08	—	—	—	—	8.22
ME	—	—	11.42	—	88.58	—	—	—	—	—	11.42
NH	—	—	—	—	100.00	—	—	—	—	—	—
NJ	0.26	—	1.06	—	95.20	1.32	—	0.01	0.14	2.02	4.80
NY	0.03	—	0.37	—	99.59	0.01	—	—	—	—	0.41
PA	1.87	—	0.04	0.01	95.38	0.17	—	1.44	1.09	—	4.62
RI	—	—	23.43	0.39	76.18	—	—	—	—	—	23.82
VT	—	—	—	—	99.98	—	—	0.02	—	—	0.02
Pacific	**0.02**	**—**	**0.05**	**6.40**	**0.50**	**89.51**	**0.43**	**1.69**	**0.99**	**0.40**	**10.49**
AK	—	—	—	—	81.25	6.25	—	—	—	12.50	93.75
CA	0.03	—	0.02	9.45	0.04	85.39	0.68	2.66	1.57	0.17	14.61
HI	—	—	0.53	—	0.26	94.30	—	0.26	—	4.65	5.70
OR	—	—	—	2.49	9.08	88.43	—	—	—	—	11.57
WA	—	—	—	1.21	—	98.79	—	—	—	—	1.21
Southcentral	**1.96**	**0.37**	**0.41**	**0.01**	**—**	**0.21**	**87.71**	**9.04**	**0.02**	**0.27**	**12.29**
AR	3.64	23.18	20.45	—	—	—	52.18	—	0.55	—	47.82
LA	11.73	—	0.99	—	—	0.37	66.75	20.15	—	—	33.25
NM	—	—	—	0.66	—	—	60.47	—	—	38.87	39.53
OK	—	0.71	—	—	—	2.38	96.90	—	—	—	3.10
TX	0.20	0.08	—	—	—	0.16	92.20	7.34	0.01	—	7.80
Southeast	**4.40**	**0.03**	**0.57**	**0.17**	**5.66**	**2.23**	**3.05**	**80.86**	**0.06**	**2.97**	**19.14**
AL	3.31	—	—	—	1.41	—	6.09	89.19	—	—	10.81
FL	4.49	0.05	0.85	0.27	4.20	0.44	4.12	80.63	0.09	4.87	19.37
GA	2.47	—	0.05	—	9.47	5.48	0.01	82.51	—	—	17.49
MS	6.62	—	2.20	—	—	—	7.11	84.07	—	—	15.93
SC	14.82	—	0.07	—	4.53	6.34	5.53	68.69	0.02	—	31.31
Grand total	**9.93**	**3.40**	**23.45**	**3.79**	**15.25**	**14.26**	**5.08**	**23.30**	**0.58**	**0.95**	**—**

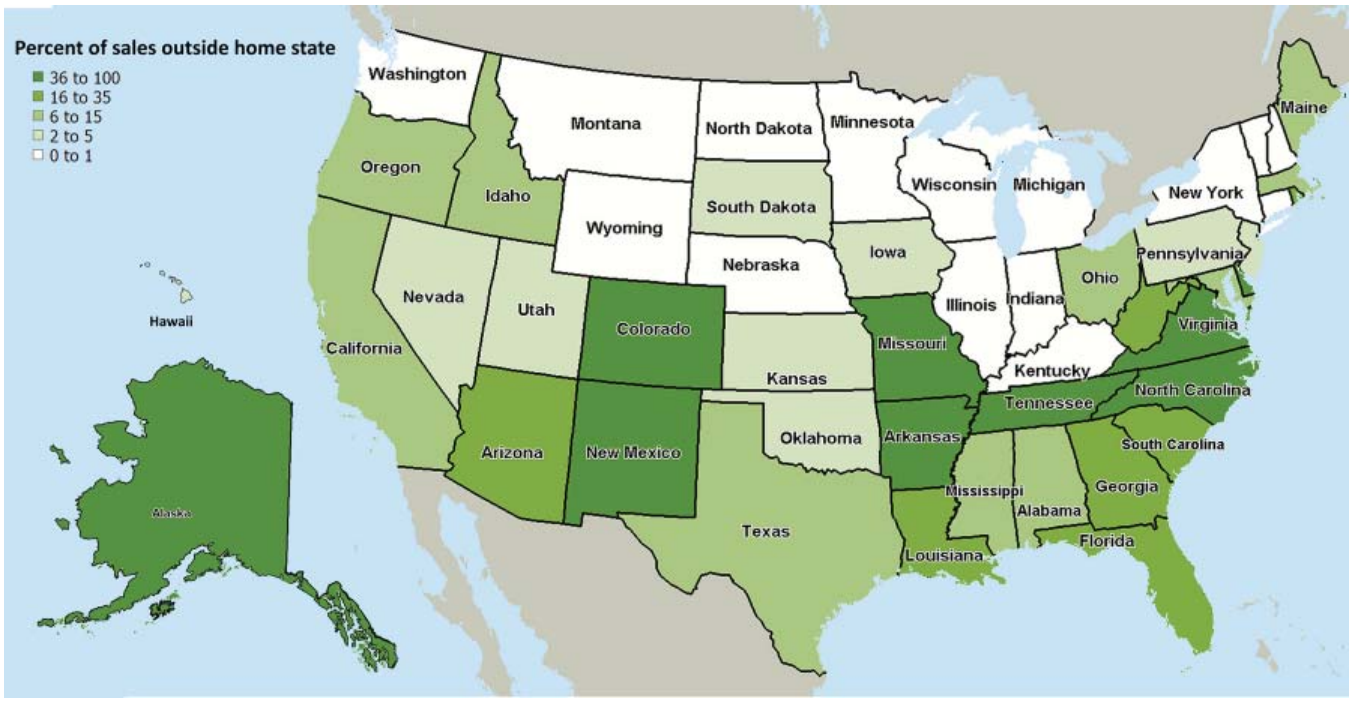

Fig. 1. Map of the geographic distribution of sales proportions outside home states in 2013, reported by respondents to a national green industry survey.

one third of their production to out-of-home regions (47.8, 39.5 and 33.3%, respectively), while Oklahoma and Texas sold less than 10% outside of the region.

Relatively lower proportion of output in the Pacific and Northeast regions were sold to out-of-region destinations (10.5 and 9.8%, respectively) (Table 3). The largest purchasing region for the shipments from the Pacific region was the Mountain (6.4%), followed by the Southeast (1.7%) region. The rest of the regions (Appalachian, Midwest, Northeast, and Southcentral) combined purchased 1% of the Pacific

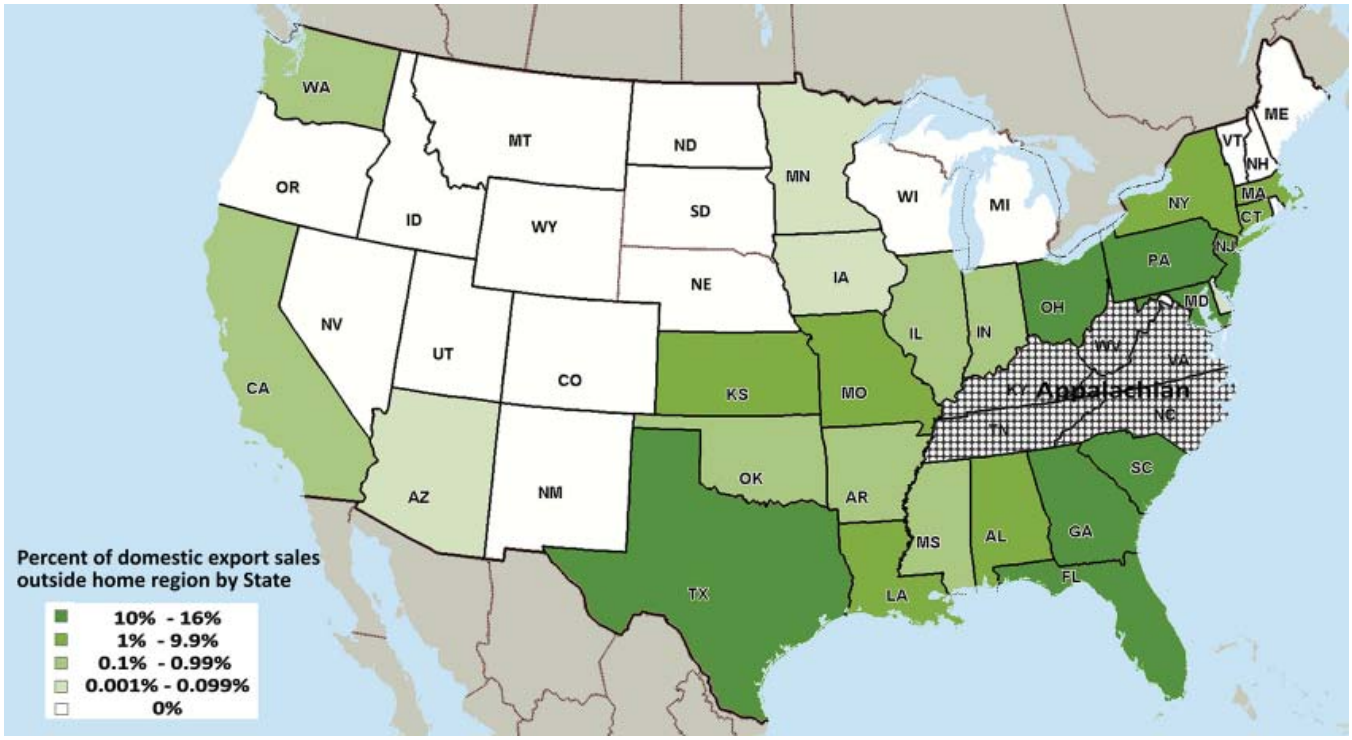

Fig. 2. Map of the geographic distribution of sales proportions outside of the Appalachian region in 2013, reported by respondents to a national green industry survey.

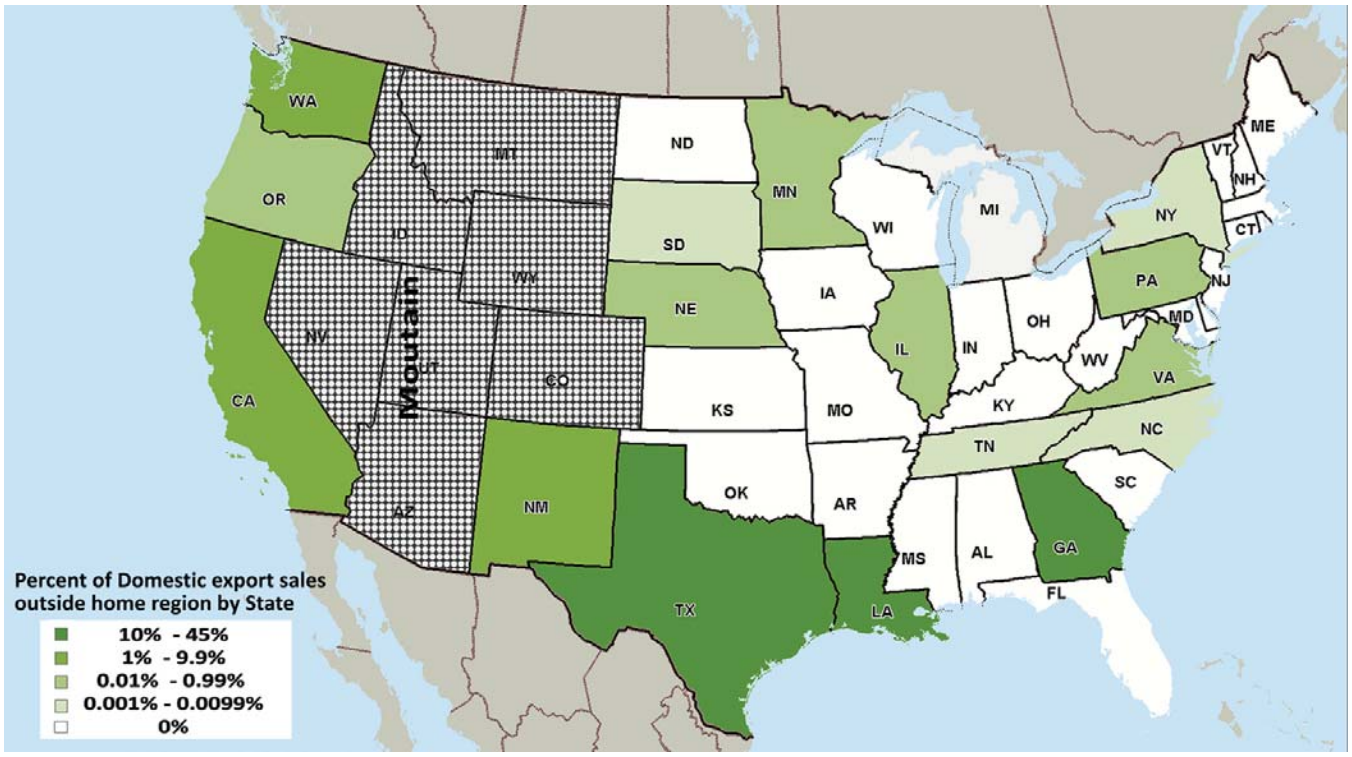

Fig. 3. Map of the geographic distribution sales proportions outside of the Mountain region in 2013, reported by respondents to a national green industry survey.

region output. As shown in Fig. 6, the largest proportion of sales from the Pacific region was shipped to Nevada, Arizona, and Florida (ranging from 10 to 40% of outside-of-region sales). The Midwest was the largest purchasing region for the Northeast (6.8%). At the state level within the Northeast, the biggest proportion of inter-regional sales were

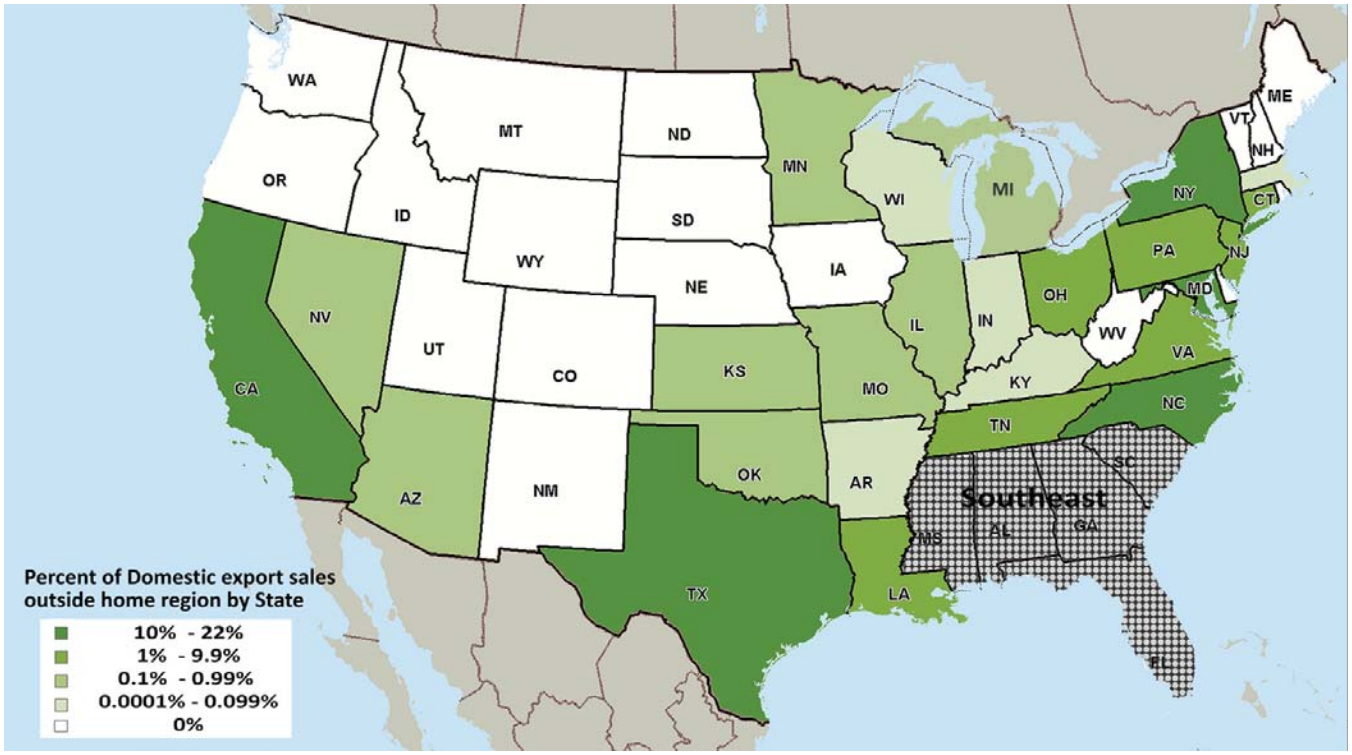

Fig. 4. Map of the geographic distribution of sales proportions outside of the Southeast region in 2013, reported by respondents to a national green industry survey.

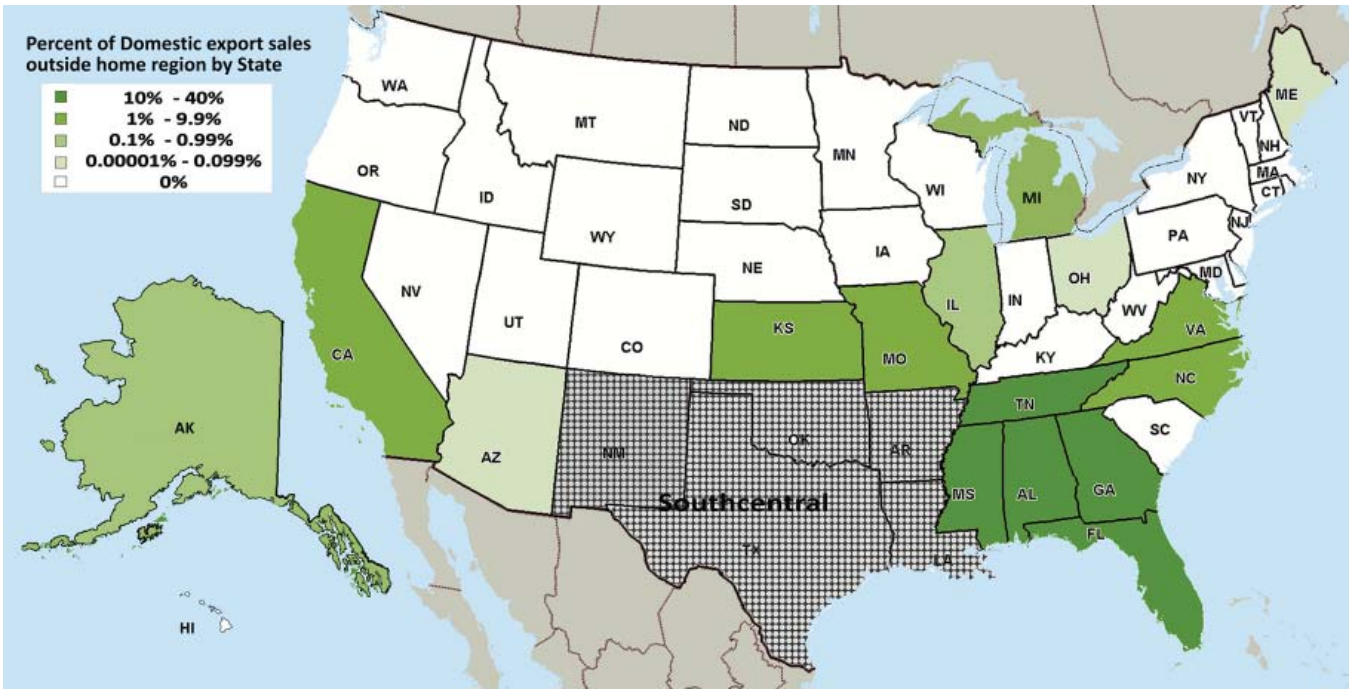

Fig. 5. Map of the geographic distribution of sales proportions outside of the Southcentral region in 2013, reported by respondents to a national green industry survey.

from Delaware (55.9%), followed by Rhode Island (23.8%), Maine (11.4%), Maryland (8.2%) and Massachusetts (7.5%). A shown in Fig. 7, Ohio and Michigan were among the top sales destinations from Northeast, with sales proportions ranging from 10 to 45 percent. As shown in Fig. 8, out-of-region sales from Midwest were mostly shipped to destinations in New York, Kentucky, Tennessee and Mississippi (10 to 24% of outside-of-region sales). The largest proportions

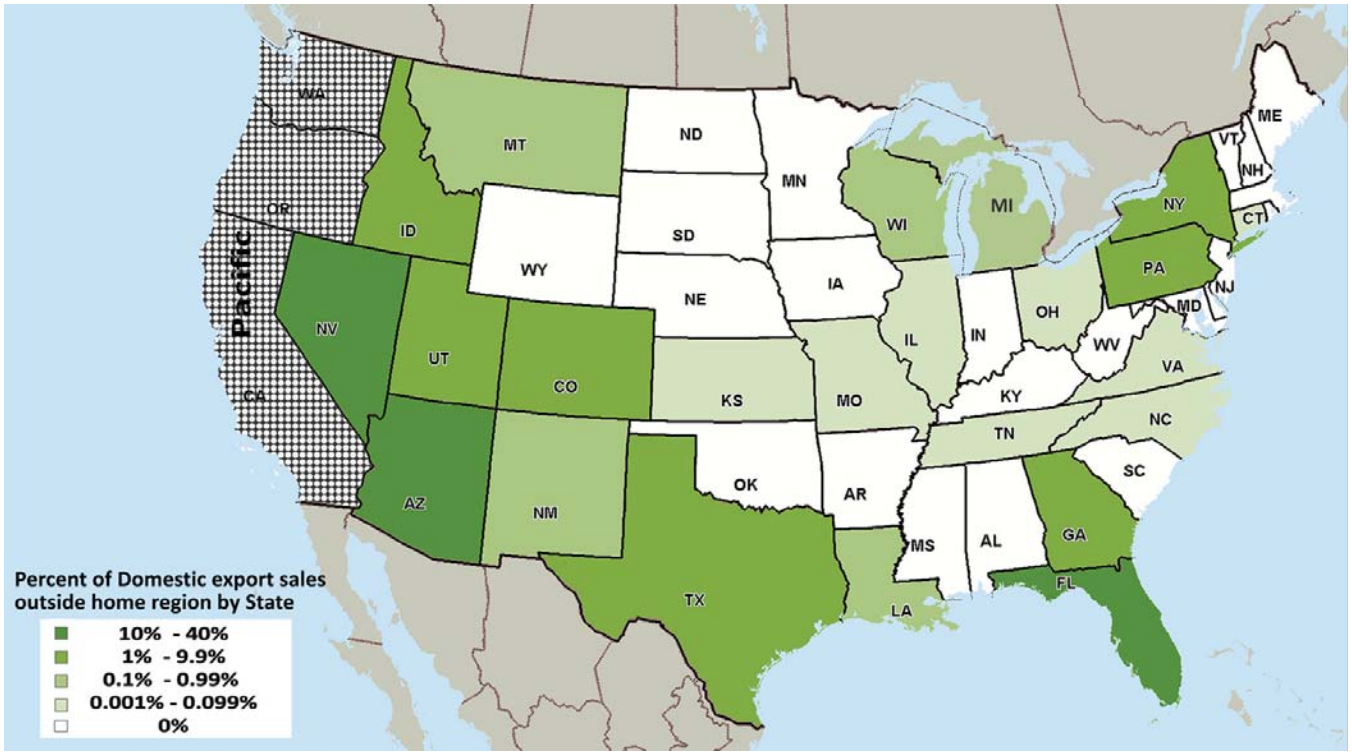

Fig. 6. Map of the geographic distribution of sales proportions outside of the Pacific region in 2013, reported by respondents to a national green industry survey.

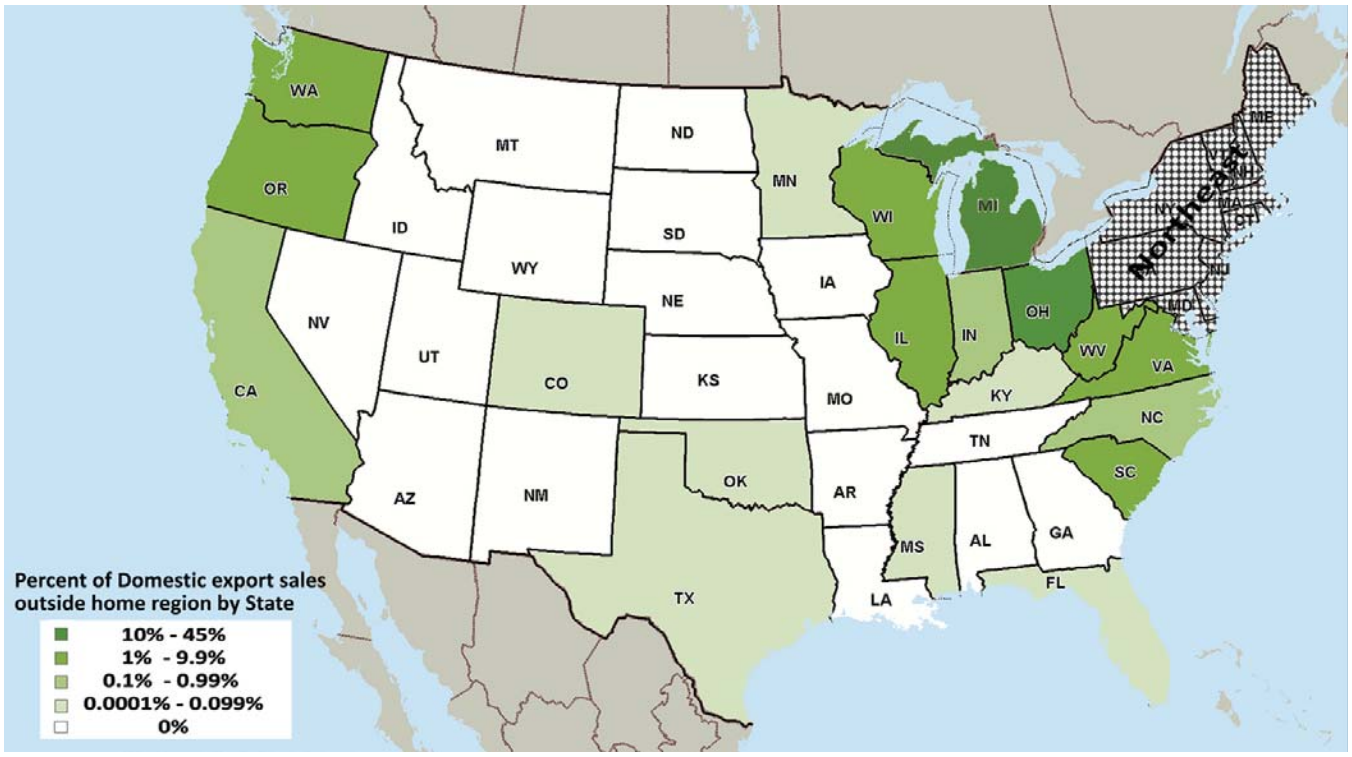

Fig. 7. Map of the geographic distribution of sales proportions outside of the Northeast region in 2013, reported by respondents to a national green industry survey.

of out-of-region sales from the Great Plains regions were shipped to Iowa, Missouri, New Mexico, and Utah (10 to 35% of outside-of-region sales) (Fig. 9).

Changes in OD trade flows from 2008 to 2013. Comparing OD trade flow proportions from the 2008 and 2013 survey datasets, the results show a reallocation of trade occurring

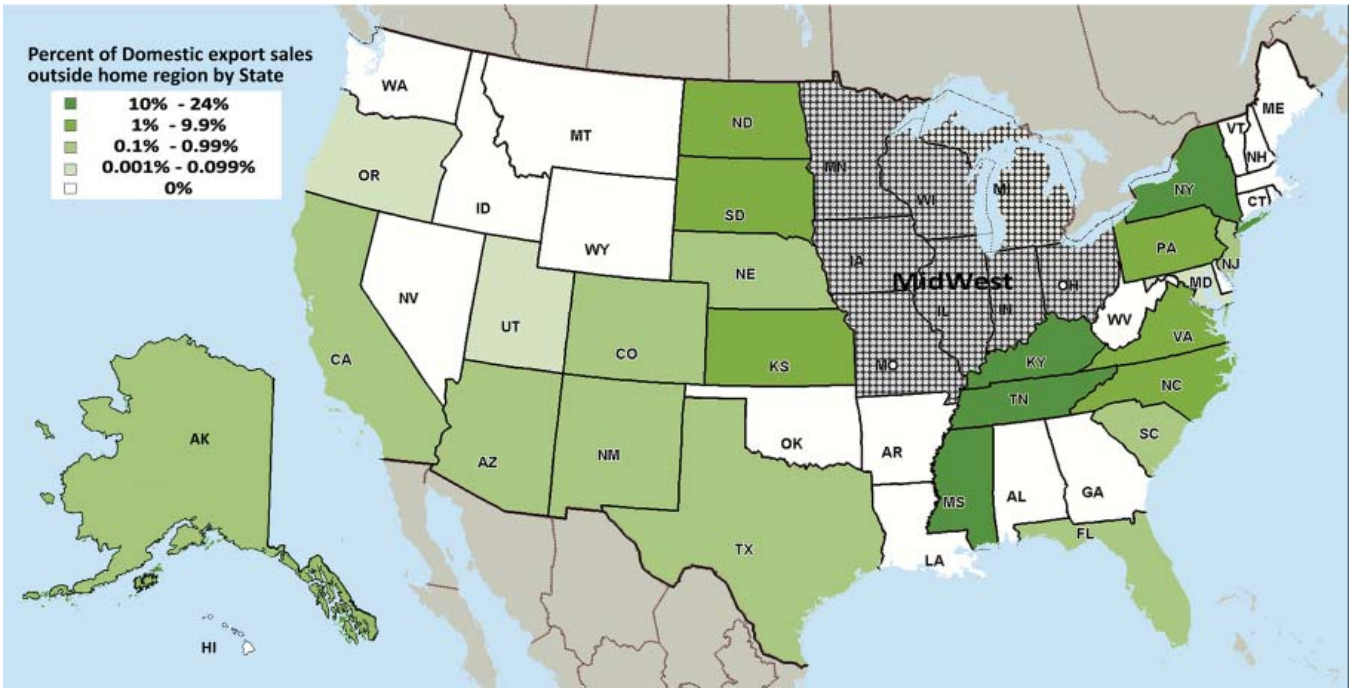

Fig. 8. Map of the geographic distribution of sales proportions outside of the Midwest region in 2013, reported by respondents to a national green industry survey.

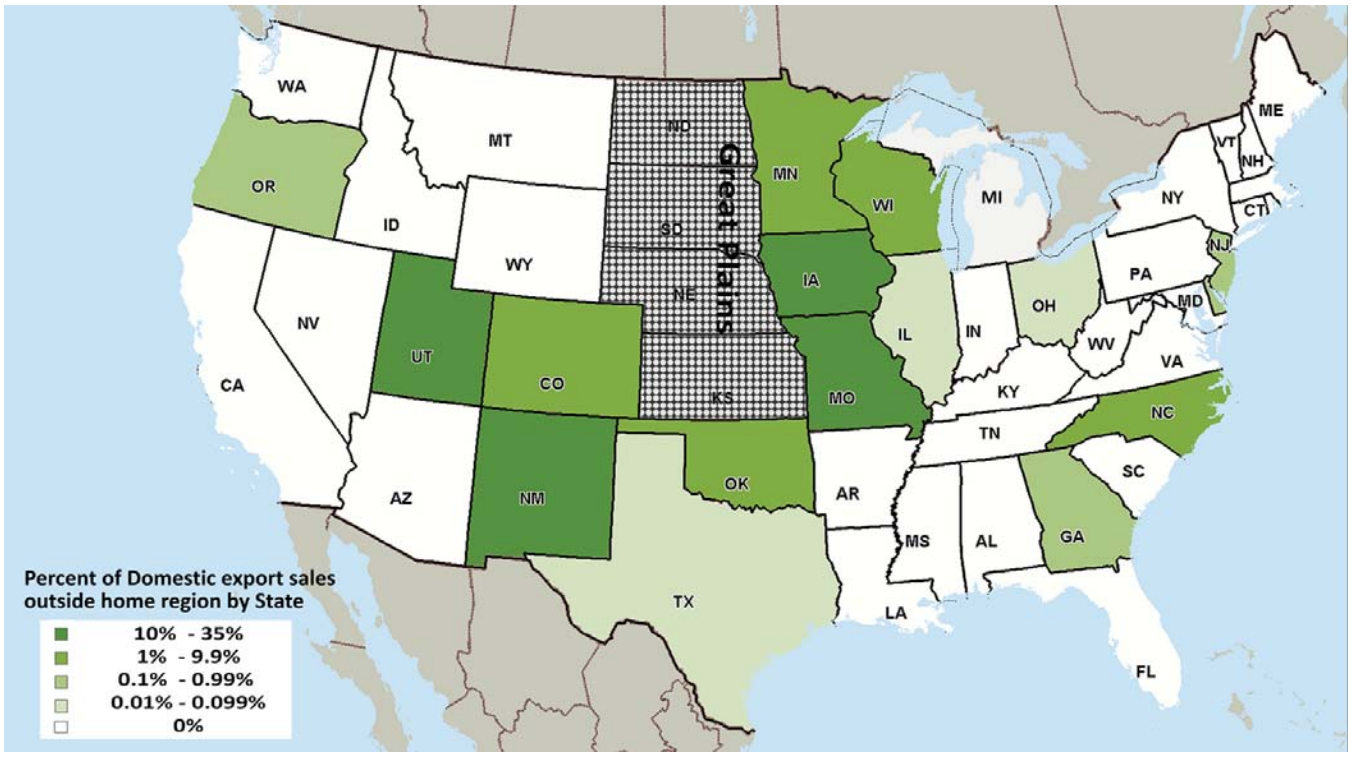

Fig. 9. Map of the geographic distribution of sales proportions outside of the Great Plains region in 2013, reported by respondents to a national green industry survey.

between intra- and inter-regional trade flows (Table 4). Sales within the Appalachian, Mountain, Northeast and Southcentral regions decreased by 11.1, 8.3, 3.8 and 0.2%, respectively. Because the results are given in percentages, the change in sales within regions can be viewed as corresponding opposite change in inter-regional sales. Those changes, as shown in Table 4, are usually disproportionate across the other seven regions, suggesting that industry managers are targeting specific other states for development of inter-state markets. For example, considering the Appalachian region, sales to the Southeast increased by as high as 9.5%, while sales to the Midwest, Northeast, Southcentral and Pacific regions increased by only 1.8, 0.8, 0.2, and 0.1%, respectively. The only negative change from 2008 to 2013 in sales from the Appalachian region was to destinations in the Mountain region.

The negative change in sales within the Mountain region (by 8.3%) is translated into increased sales to the Southeast (5.6%), Southcentral (2.8%), and Pacific regions (1.1%), and decreased sales to the Great Plains (0.6%) and Northeast (0.5%) regions (Table 4). Likewise, although within-region sales decreased by 3.8% in the Northeast from 2008 to 2013, sales to other regions increased, including the Midwest (2.6%), Appalachian (0.3%), Pacific (0.2%), and Southeast (0.1%). The Southcentral region also had a negative change (by 0.2%) in home region sales, with a 5.5% increase in sales to the Southeast region, while sales to the Midwest, Mountain, and Northeast regions declined marginally.

Table 4. Changes in the regional proportion of origin-destination trade flows from 2008 to 2013, reported by respondents to a national green industry survey.

	Destination regions								
Origin regions	**Appalachian**	**Great Plains**	**Midwest**	**Mountain**	**Northeast**	**Pacific**	**Southcentral**	**Southeast**	**Foreign**
	Percentage changes of total sales in each region								
Appalachian	–11.06	0.13	1.85	–1.20	0.76	0.09	0.16	9.47	–0.20
Great Plains	–1.09	9.85	–7.01	0.12	0.01	0.01	–1.79	–0.10	0.00
Midwest	0.48	–1.50	3.67	–0.59	–2.22	0.02	0.01	0.14	0.00
Mountain	0.01	–0.64	0.04	–8.32	–0.49	1.07	2.77	5.60	–0.07
Northeast	0.35	0.00	2.65	0.01	–3.78	0.23	–0.20	0.09	0.66
Pacific	–1.08	–0.30	–2.05	2.87	–0.99	1.61	–0.96	1.11	–0.09
Southcentral	1.36	0.17	–2.39	–0.39	–0.10	–4.29	–0.17	5.54	0.27
Southeast	–10.09	–0.17	–1.83	–3.23	2.77	1.43	0.76	7.80	2.57
Grand total	**–1.41**	**1.32**	**5.69**	**–2.39**	**–0.86**	**–4.26**	**–4.69**	**5.94**	**0.76**

Table 5. Changes in the proportion of origin-destination trade flows from 2008 to 2013 by region and state, reported by respondents to a national green industry survey.

	Destination regions								
Origin regions	**Appalachian**	**Great Plains**	**Midwest**	**Mountain**	**Northeast**	**Pacific**	**Southcentral**	**Southeast**	**Foreign**
Appalachian	**–11.4**	**0.1**	**1.8**	**–1.2**	**0.7**	**0.1**	**0.1**	**9.4**	**–0.2**
KY	18.2	0	–18.2	0	0	0	0	0	0
NC	–27.8	0.9	4.8	–1.7	5.5	–0.2	4.4	13.2	0
TN	–11.9	–1.1	4.8	0	4.3	0	–2.2	6.7	–0.7
VA	–13.6	0	–0.7	–2.1	16.5	0.1	0	0	0
WV	–5.1	0	8.7	0	–14.7	8.3	0	2.6	0
Great Plains	**–1.1**	**9.9**	**–7.0**	**0.1**	**0**	**0**	**–1.8**	**–0.1**	**0**
KS	0	38.5	–27.2	0	0	0	–11.2	0	0
ND	–59.4	65	–2.5	0	0	0	0	–3.1	0
NE	0	2.4	–2.8	0.1	0	0	0.1	0	0
SD	0	–0.5	0.5	0	0	0	0	0	0
Midwest	**0.5**	**–1.5**	**3.4**	**–0.6**	**–2.2**	**0**	**0**	**0.1**	**0**
IA	0.7	–17.5	15.3	0	–0.1	1.5	0	0	0
IL	0.6	–0.8	0.5	–0.4	0	0.1	0	0	0
IN	–0.2	0	2.4	0	0	0	0	–2.2	0
MI	0.3	0	–0.6	0	0.1	0	0	0	0
MN	0	–1.6	1.4	0.1	0	0	0.1	0	0
MO	3.8	3.4	–36.6	0	0	0	0	19	0
OH	2.9	0	5.2	–2.3	–6.4	0	0	0	0
WI	0	–11.1	13.2	0	–1.7	–0.3	0	–0.1	0
Mountain	**0**	**–0.6**	**0**	**–12.5**	**–0.5**	**1**	**2.06**	**5.3**	**–0.1**
AZ	0	0	0	6	0	4.1	–10	–0.1	0
CO	0	–1.3	–0.1	–17.3	0	0.1	–0.2	9.5	0
ID	0	0	–0.2	–5.7	0	4	1.3	0	0.6
MT	0	0	0	0	0	0	0	0	0
NV	0	0	0	6.8	–9.9	2.3	0.7	0	0
UT	0.1	0	1.6	–2.3	0.2	–0.9	0	0	0
WY	0	–1.9	0	2	–0.2	0	0	0	0
Northeast	**0.3**	**0**	**2.6**	**0**	**–4.3**	**0.2**	**–0.2**	**0.1**	**0.7**
CT	0	0	0	–86.4	85.7	0	0	0	0
DE	0	0	51.3	0	–55.9	0	0	0	4.7
MA	0	0	0	–3.3	–4.2	0	0	0	0
MD	1.8	0	0	–2	0.2	0	0	0	0
ME	0	0	11.4	–3.2	–8.2	0	0	0	0
NH	0	0	0	0	0	0	0	0	0
NJ	0.1	0	–9.7	–1	7.2	1.3	0	0	2
NY	–0.8	0	–2.5	–3.2	8.3	0	–0.9	–0.8	–0.2
PA	1.9	0	–4.4	–5.6	6	0.2	0	1.3	–0.5
RI	0	0	17.9	–8.6	–9.2	0	0	0	0
VT	0	0	–0.1	–7.1	7.1	0	0	0	0
Pacific	**–1.1**	**–0.3**	**–2.1**	**2.8**	**–1**	**0.7**	**–1**	**1.1**	**–0.1**
AK	0	0	–0.3	0	81	–92.3	0	–0.7	12.5
CA	–1	–0.3	–0.6	6.7	–1.5	–6.4	–0.8	2.3	0
HI	0	0	–4.4	–0.6	–0.2	3.4	–1.4	–1.4	4.6
OR	–3.1	0	–21.5	–8.9	6	36.4	–1.5	–2.9	–4.7
WA	–0.1	–0.6	–0.1	–5.7	0	6.8	0	–0.1	–0.2
Southcentral	**1.4**	**0.2**	**–2.4**	**–0.4**	**–0.1**	**–4.3**	**–0.2**	**5.5**	**0.3**
AR	3.6	21.6	18.7	0	–0.2	0	–42.7	–1.5	0
LA	9.7	0	0.7	0	0	0.3	–25.8	15.1	0
NM	0	0	0	–1	0	0	–37.7	0	38.9
OK	0	0.4	0	0	0	2.4	–2.8	0	0
TX	0.1	0.1	–6.7	–0.1	–0.2	–11.6	16	2.4	0
Southeast	**–10.1**	**–0.2**	**–1.8**	**–3.2**	**2.8**	**1.4**	**0.8**	**7.8**	**2.6**
AL	–48.8	0	–1.4	0	1.1	0	4.9	44.1	0
FL	–8	–0.1	–2.5	–4.7	0.7	–0.8	1.4	9.5	4.4
GA	–9.2	–0.4	–0.3	0	8.7	5.5	–0.6	–3.6	0
MS	–6.3	0	1.2	0	–4	0	–4.1	13.2	0
SC	–15.1	–0.1	–0.3	0	–10.9	6.3	5.5	14.6	0
Grand total	**–1.5**	**1.3**	**5.5**	**–2.4**	**–0.9**	**–4.3**	**–4.7**	**5.8**	**0.8**

Regions with increased intra-regional trade included the Great Plains, Midwest, Pacific, and Southeast, with 9.9, 3.7, 1.6, and 7.8% increases from 2008 to 2013, respectively (Table 4). Sales from the Great Plains region were reduced to the Midwest by 7.0%, followed by the Southcentral, Appalachian, and Southeast regions (1.8, 1.1, and 0.1%, respectively). Changes in inter-regional trade originating from the Pacific region ranged from a 2.9% increase to the Mountain region to a 2.1% decrease to the Midwest. The largest change in inter-regional trade was from the Southeast to the Appalachian region (a 10.1% reduction). The second largest reduction in sales originating from the Southeast was to the Mountain region (3.2%), followed by Midwest (1.8%) and Great Plains (0.2%). Sales originating from Southeast increased to the Northeast, Pacific and Southcentral regions by 2.8, 1.4, and 0.8%, respectively.

Similar to the results in 2008, firms in the Great Plains and Midwest regions did not report international sales in 2013 (Table 4). Sales originating from the Appalachian, Mountain, and Pacific regions to international destinations decreased by less than 0.1%. The largest increase in international trade from 2008 to 2013 was from the Southeast (2.57%), followed by Northeast (0.66%) and Southcentral (0.27%) regions. Comparison of the 2008 and 2013 datasets also revealed sub-regional or state-level variation in OD trade flows. Detailed results on state-level percentage changes in OD trade flow can be found in Table 5.

Although nationwide industry surveys are restrictive in terms of capturing the entire industry capacity, our investigation of the OD trade flow patterns reveals several important findings. First, most of the output by the green industry firms is sold to destinations within the home region (85.6%), which underscores costs associated with long-haul transportation and the perishable nature of the live product. Second, while there is some evidence that regions with high home sales also maintain relatively high inter-regional trade volume (e.g., Southeast; Table 1), there were at least two regions with relatively lower within-home-region sales and a higher proportion of inter-regional sales (e.g., Appalachian and Mountain; Table 3). This implies that inter-regional trade is not directly proportional to the total output by the firms in the region. Third, the origin and destination linkages and trade volumes can be determined by both proximity of markets (i.e., transportation distance/cost) and population density, which is positively correlated with economic activity in the region. Consider the Appalachian region, which had the largest inter-regional trade in 2013 (Table 1), and shipped most of its production to Southeast and Northeast destinations (Table 2). Although, the Midwest is also a contiguous region, only 4.7% of Appalachian shipments were purchased in this region, compared with 12.8 and 12.6% purchased in the Southeast and Northeast regions (Table 3). This is also true for the Southeast region, which had the second largest inter-regional sales in 2013. Although the Southcentral and Appalachian regions are contiguous to the Southeast, the Northeast, Midwest and Pacific regions purchased more of the output originating from the Southeast. Among the top four regions in inter-regional trade volume (Appalachian, Southeast, Pacific, and Northeast), the Southeast is the only region that had more than 2% of inter-regional trade with a third-order neighbor region (i.e., separated by two regions in between) such as the Pacific region. Finally, considering the total OD trade flows (both intra- and inter-regional), the Southeast and Midwest are the largest purchasing regions, accounting over 46% of the purchases nationwide. Compared with 2008, these two regions had a 5.9 and 5.7% increase, respectively, in purchase volume across all regions, including intra-regional sales.

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