

Trade Flows within the United States Nursery Industry in 2018¹

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Abstract

This study is a continuation of the series of summaries by the Green Industry Research Consortium examining the regional trade flows in the U.S. nursery industry. This detailed analysis of green industry regional trade flows in eight U.S. regions compares 2018 data with those of the 2008 and 2013 national survey estimates of origin and destination (OD) information to sales data. Specifically, we discuss: 1) regional annual sales reported by the green industry firms in 2018, 2) the percentage distribution of OD trade flows by regions and states, 3) differences in the percentage distribution of OD trade flows during the 5-year period by region (2013 to 2018), and 4) differences in the percentage distribution of OD trade flows during the 10-year period by region (2008 to 2018) for both intra-state (within home state) and inter-regional (between states) trade flows. The OD trade flow results were compared with those of 2008 and 2013. The results show considerable changes in intra-state and inter-regional trade flows from 2013 to 2018. From 2008 to 2018, only the Southcentral region increased in the proportion of sales within the region. Implications for relevant green industry stakeholders are discussed.

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

Significance to the Horticulture Industry

After the slow recovery from the Great Recession in 2008, the green industry has been experiencing a stronger recovery in recent years (Hall et al. 2020). With an ever changing and evolving business environment, up to date information regarding 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.) is critical for nursery managers and business owners to adjust business strategies and effectively manage production risks. This current report provides information regarding the inter-regional and intra-regional trade flows

and provides a 5-year and 10-year comparative analysis of inter-regional trade in the U.S. green industry. This information may help inform industry members of the geographical trends of demand and assist in developing strategic decisions about emerging (or evolving) markets.

Introduction

The Green Industry Research Consortium has regularly conducted national surveys to analyze production and marketing practices within the U.S. green industry. Through a series of reports, beginning in 1989, the consortium has consistently documented changes in the key practices over time and across regions (Brooker et al. 1990, 1995, 2000, 2005, Hodges et al. 2010, Hodges et al. 2015a, Khachatryan et al. 2016). These surveys provide empirical evidence that can be used by horticulture industry stakeholders, growers, and university extension faculty and staff, and researchers to convey the importance and impacts of the green industry at county, state, and regional levels.

The key data provided in previous reports were related to the production efforts (plant types and forms grown, irrigation methods and water sources, pest management), marketing practices (market distribution channels, selling methods, 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 (Brooker et al. 1990, 1995, 2000, 2005, Hodges et al. 2010, Hodges et al. 2015a, Khachatryan et al. 2016).

These periodic regional trade flow analyses provide further insight into firm consolidation trends and competitive displacement in the industry. Additionally, regional changes in trade flow patterns can be attributed to changes in the portion of demand that is absorbed by regional real estate markets (i.e., new construction starts and re-landscaping of existing homes). Combined with the

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Table 1. Summary of trade flows by origin region and destination geography in 2018, reported by respondents to a national green industry survey^z.

Origin Regions	Destination Region Type			Grand Total
	Inter-regional	Intra-regional	International	
	<i>Sales in Millions</i>			
Appalachian	22.1	22.2	12.9	57.23
Great Plains	1.7	4.3	0.0	5.98
Midwest	18.7	185.7	19.2	223.59
Mountain	10.0	47.4	0.0	57.42
Northeast	22.5	111.6	11.6	145.75
Pacific	15.2	94.4	37.8	147.35
Southcentral	0.6	59.8	3.0	63.33
Southeast	28.0	130.7	23.4	182.10
Grand Total	118.8	656.0	107.9	882.7

^zThe National Green Industry Consortium conducted the survey. Responses from 2,657 firms were used in the analyses.

cyclical nature of the housing market, changes in trade flows can be associated with the respective regional housing market dynamics and may result in changes year-over-year within the green industry. Regions react to economic shocks differently, which could translate into spatially variable demand for green industry products (Abraham and Hendershott 1996).

This article addresses the changes in regional dynamics that occurred from 2008 to 2018 and 2013 to 2018. This is important information to communicate to stakeholders because understanding the geographic distribution of product demand can ultimately affect production expansion policies and strategic geographic market emphasis. Therefore, in this article, we seek to: 1) summarize regional annual sales reported by the green industry firms in 2018, 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 from 2013 to 2018, 4) discuss differences in the percentage distribution of OD trade flows during the 10-year period by region from 2008 to 2018.

Materials and Methods

The research team compiled a list of 52,000 registered growers and plant dealer firms in all 50 states of the U.S. We developed a random sample of 32,000 firms 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 2019 (soliciting end-of-year 2018 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 2,172 firms, representing an 8 percent response rate of firms contacted.

The previous survey conducted during July to August 2014 (soliciting end-of-year 2013 data), included 38,000 certified nursery operations. A total of 2,657 usable questionnaires were returned from a stratified sample of 33,000 firms contacted, representing an 8 percent response rate. See Hall et al. (2011) for detailed methodology and sample summary statistics for both online and mail surveys and Hodges et al. (2010, 2015a, 2015b). All survey questionnaires included sections on employment, categories of plants sold, annual sales, product forms, marketing and advertising methods, and production practices (irrigation, pest management, etc.). Additionally, the data were evaluated by U.S. region, Southeast (587 respondents), Northeast (337 respondents), Midwest (453 respondents), Appalachian (218 respondents), Pacific (264 respondents), Southcentral (173 respondents), Great Plains (44 respondents), and Mountain (94 respondents), which is defined by the USDA Farm Production Regions (Heimlich 2000).

Results and Discussion

The results and discussion section is organized by regional sales and type of destination (i.e., inter-regional, intra-regional, or international) followed by state and regional distribution of OD trade flows, and, lastly, by the changes in OD trade flows from 2013 to 2018 and from 2008 to 2018.

Trade flows by OD region. Table 1 presents the total annual sales and percentage of distribution by destination (state or country) of the surveyed firms in 2018. These sales are organized in three categories: inter-regional (sales to outside home region), intra-regional (sales within home region), or international. The total reported sales across all

Table 2. Summary of origin-destination trade flows by region in 2018, reported by respondents to a national green industry survey.

Origin Regions	Destination Regions									Grand Total
	Appalachian	Great Plains	Midwest	Mountain	Northeast	Pacific	Southcentral	Southeast	International	
	<i>Sales in million dollars</i>									
Appalachian	22.2	0.0	2.9	4.6	12.0	0.1	0.5	2.0	12.9	57.2
Great Plains	0.0	4.3	1.3	0.0	0.0	0.0	0.4	0.0	0.0	6.0
Midwest	7.9	0.7	185.7	0.0	9.5	0.0	0.0	0.6	19.2	223.6
Mountain	0.0	0.0	0.0	47.4	0.1	9.4	0.5	0.0	0.0	57.4
Northeast	1.7	0.1	3.0	0.0	111.6	0.0	3.6	14.0	11.6	145.8
Pacific	0.0	7.0	0.8	2.8	3.0	94.4	1.0	0.5	37.8	147.3
Southcentral	0.0	0.0	0.0	0.1	0.0	0.1	59.8	0.4	3.0	63.3
Southeast	21.2	0.0	0.8	0.0	3.5	0.4	1.9	130.7	23.4	182.1
Grand Total	53.1	12.1	194.7	54.9	139.8	104.3	67.7	148.2	107.9	882.7

Table 3. Percentage distribution of origin-destination trade flows by region and state in 2018, reported by respondents to a national green industry survey.

Origin Regions / States	Destination Regions									Percent of sales outside home region
	Appalachian	Great Plains	Midwest	Mountain	Northeast	Pacific	Southcentral	Southeast	International	
	<i>Percentage of total sales in each region</i>									
Appalachian	38.80	—	5.11	8.08	20.95	0.19	0.93	3.44	22.50	61.20
KY	78.04	—	20.71	—	1.11	—	—	0.14	—	21.96
NC	57.52	—	0.94	19.36	13.54	0.16	1.58	6.90	—	42.48
TN	18.87	—	0.88	—	7.67	0.83	1.89	3.84	66.02	81.13
VA	2.81	—	0.23	—	50.12	—	—	—	46.84	97.19
WV	58.03	—	40.88	—	1.09	—	—	—	—	41.97
Great Plains	—	71.37	22.32	0.03	—	—	6.28	—	—	28.63
KS	—	50.78	24.61	—	—	—	24.61	—	—	49.22
ND	—	99.63	—	0.37	—	—	—	—	—	0.37
NE	—	64.60	35.40	—	—	—	—	—	—	35.40
SD	—	95.25	4.75	—	—	—	—	—	—	4.75
Midwest	3.54	0.32	83.05	—	4.23	—	—	0.28	8.57	16.95
IA	—	1.97	98.03	—	—	—	—	—	—	1.97
IL	0.67	—	99.33	—	—	—	—	—	—	0.67
IN	19.97	—	71.10	—	—	—	—	—	8.93	28.90
MI	1.72	—	92.49	—	1.73	—	—	0.48	3.59	7.51
MN	—	18.06	81.94	—	0.00	—	—	—	—	18.06
MO	—	0.91	39.53	—	59.56	—	—	—	—	60.47
OH	6.10	—	83.25	—	10.17	—	—	—	0.48	16.75
WI	—	—	49.30	—	—	—	—	—	50.69	50.70
Mountain	—	0.02	—	82.52	0.23	16.33	0.89	—	—	17.48
AZ	—	—	—	64.13	—	34.03	1.84	—	—	35.87
CO	—	0.14	—	99.71	—	—	0.14	—	—	0.29
ID	—	—	—	97.79	—	2.21	—	—	—	2.21
MT	—	—	—	99.33	0.67	—	—	—	—	0.67
NV	—	—	—	100.00	—	—	—	—	—	—
UT	—	—	—	99.03	0.97	—	—	—	—	0.97
WY	—	—	—	100.00	—	—	—	—	—	—
Northeast	1.18	0.04	2.08	0.02	76.59	0.03	2.49	9.61	7.98	23.41
CT	—	—	—	—	100.00	—	—	—	—	—
DE	—	—	—	—	4.77	—	—	—	95.23	95.23
MA	—	—	—	—	100.00	—	—	—	—	—
MD	2.74	—	—	—	52.34	—	—	—	44.92	47.66
ME	—	11.76	—	—	88.24	—	—	—	—	11.76
NH	—	—	—	—	100.00	—	—	—	—	—
NJ	—	—	0.03	—	92.65	—	—	—	7.32	7.35
NY	—	—	0.08	0.18	98.40	0.30	1.01	0.02	—	1.60
PA	1.70	—	3.77	—	70.72	—	4.76	19.05	—	29.28
RI	—	—	9.28	—	90.72	—	—	—	—	9.28
VT	—	—	—	—	100.00	—	—	—	—	—
Pacific	0.01	4.76	0.57	1.91	2.06	64.03	0.66	0.33	25.67	35.97
AK	—	—	—	—	—	100.00	—	—	—	—
CA	—	—	0.06	0.24	0.04	73.90	0.99	0.45	24.32	26.10
HI	—	—	—	—	—	12.37	—	—	87.63	87.63
OR	0.04	19.52	2.17	6.27	8.34	37.73	—	—	25.93	62.27
WA	—	—	—	3.88	—	94.15	—	0.48	1.49	5.85
Southcentral	0.03	—	—	0.10	—	0.13	94.39	0.61	4.74	5.61
AR	—	—	—	—	—	—	100.00	—	—	—
LA	—	—	—	—	—	0.03	92.14	0.89	6.94	7.86
NM	—	—	—	7.20	—	—	92.80	—	—	7.20
OK	—	—	—	—	—	—	100.00	—	—	—
TX	0.11	—	0.01	—	0.01	0.39	99.48	0.01	—	0.52
Southeast	11.67	0.01	0.46	—	1.95	0.22	1.05	71.80	12.85	28.20
AL	10.61	—	—	—	—	—	2.19	87.20	—	12.80
FL	7.58	—	0.71	—	1.55	0.34	1.22	68.76	19.83	31.24
GA	18.94	0.03	0.05	—	3.01	—	0.67	77.27	0.03	22.73
MS	—	—	—	—	—	—	—	100.00	—	—
SC	25.34	—	0.04	—	—	0.03	—	52.16	22.42	47.84
Grand Total	6.02	1.37	22.05	6.22	15.84	11.82	7.67	16.79	12.22	—

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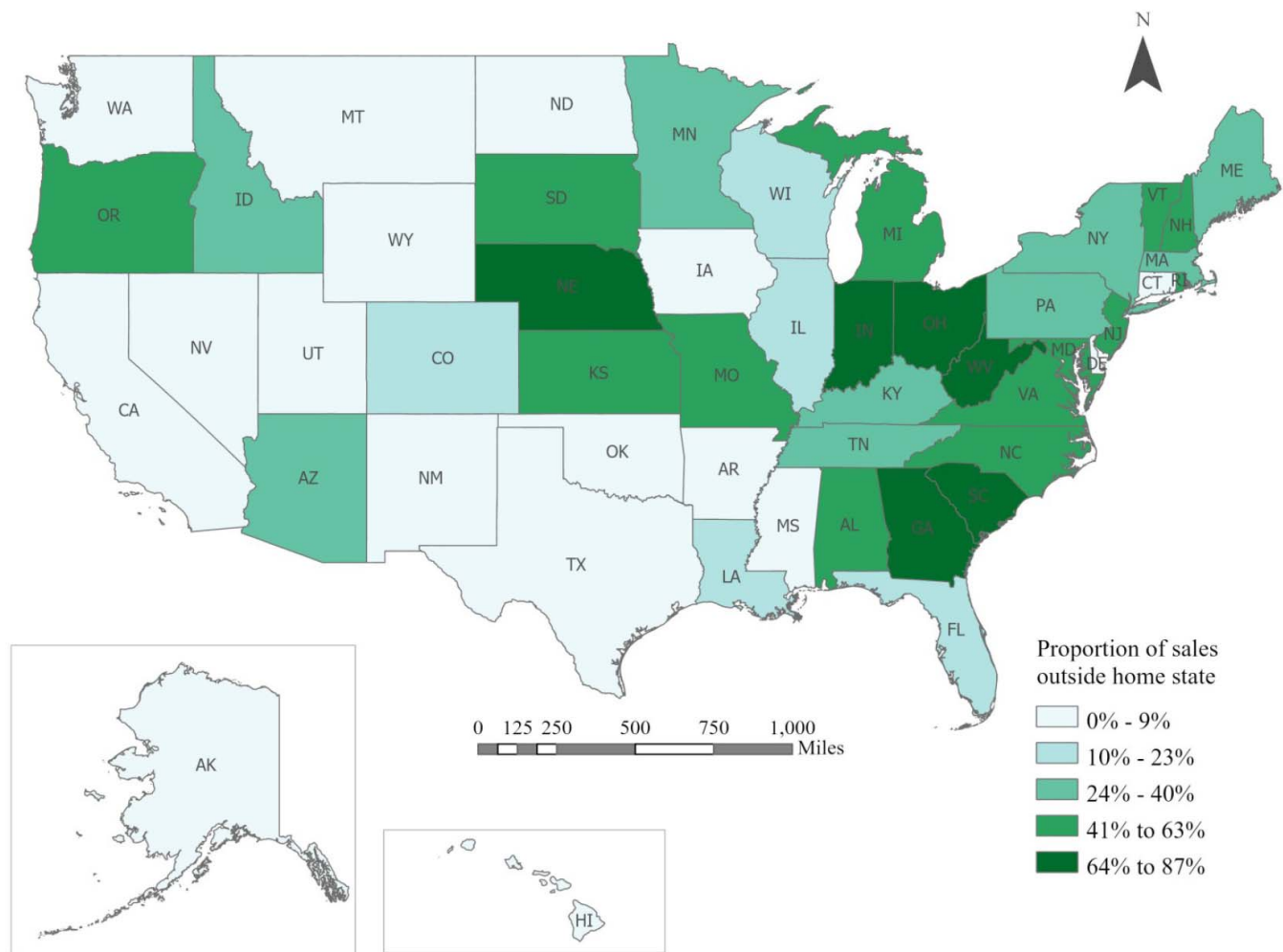


Fig. 1. Map of geographic distribution of sales proportions outside home state in 2018, reported by respondents to a national green industry survey.

U.S. regions were \$882.7 million (M), with the total regional sales reported by firms in the Midwest (\$223.59 M), Southeast (\$182.10 M), Pacific (\$147.35 M) and Northeast (\$145.75 M), respectively (Table 1). Firms in the Appalachian region reported \$57.23 M in total sales, while firms in the Mountain, Southcentral and Great Plains had \$57.42 M, \$63.33 M, and \$5.98 M in total sales, respectively.

Most trade in the industry in 2018 was intra-regional, accounting for 74.4 percent of total sales (Table 1). Firms in the Midwest, Southeast, Northeast and Pacific regions reported the largest intra-regional sales in dollar terms, amounting to \$185.7 M, \$130.7 M, \$111.6 M and \$94.4 M, respectively. Firms in the Appalachian region traded \$22.2 M worth of production within the region, while the Great Plains, Southcentral and Mountain regions reported below \$60 M in sales intra-regionally. Inter-regional trade within the U.S. accounted for 13.5 percent of total sales, with firms in the Southeast and Northeast regions reporting \$28.0 M and \$22.5 M in sales to outside their home regions, respectively, while the Midwest, Mountain, Pacific, and Appalachian regions reported inter-regional sales in the \$10 M to \$22 M range, and the lowest intra-regional trade was reported for the Southcentral and Great Plains regions (\$0.6 M and \$1.7 M, respectively). Trade

flows to international destinations accounted for 12 percent of the total trade volume or \$107.9 M. Among 30 reported international destinations, the top purchasing countries, in alphabetical order, were Canada, China, Colombia, Japan, Mexico, Peru, The Netherlands, and the United Kingdom. The top origin region for international shipments was the Pacific with \$37.8 M sales, followed by the Southeast and Midwest regions with \$23.4 M and \$19.2 M sales, respectively (Table 1).

The largest proportion of inter-regional trade flows from the Appalachian region was to the International (\$12.9 M), Northeast (\$12.0 M), Mountain (\$4.6 M), Midwest (\$2.9 M), and Southeast (\$2.0 M) regions (Table 2). The Great Plains traded primarily in the Midwest (\$1.3 M) and Southcentral regions (\$0.4 M). The top destination regions for sales originating from the Midwest included international (\$19.2 M), Northeast (\$9.5 M), Appalachian (\$7.9 M), and Great Plains (\$0.7 M) destinations. The Mountain interregional sales were to the Pacific (\$9.4 M), Southcentral (\$0.5 M), and Northeast (\$0.1 M) regions. The inter-regional trade flows from the Northeast includes the Southeast (\$14.0 M), Southcentral (\$3.6 M), Midwest (\$3.0 M), and Appalachian regions (\$1.7 M). International sales from each of the regions were \$37.8M from the Pacific region, \$7.0M from the Great Plains region, \$3.0 M from

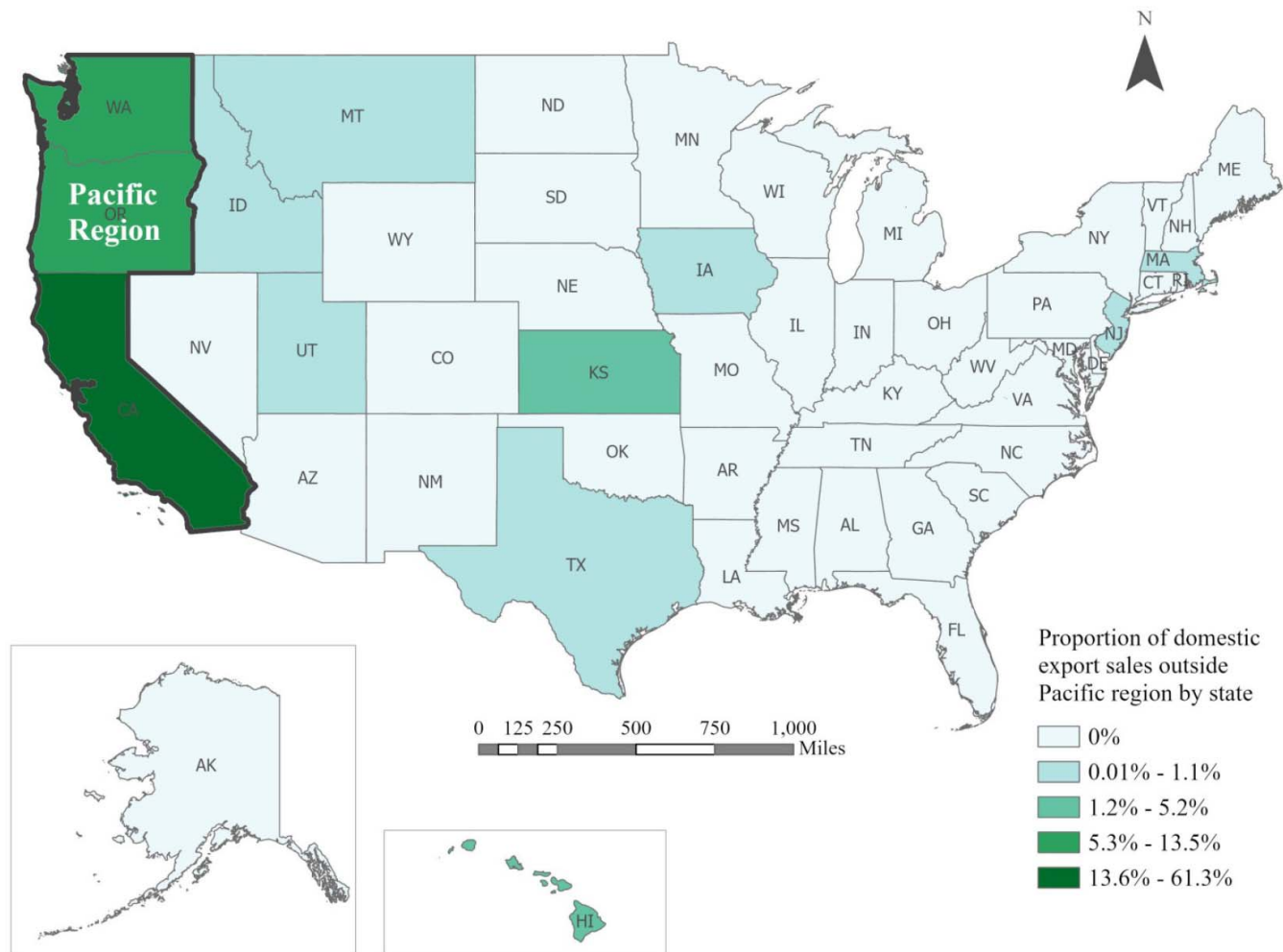


Fig. 3. Map of geographic distribution of sales proportions outside of the Pacific region in 2018, reported by respondents to a national green industry survey.

Texas, Iowa, New Jersey, and Massachusetts (ranging from 1.2% to 5.2%). The regions that purchased the most from the Pacific region were the Great Plains region (4.76%), followed by the Northeast (2.06%) and Mountain (1.91%) regions. At the state level, the greatest proportion of inter-regional sales were by firms in Hawaii (87.63%), Oregon (62.27%), California (26.10%), and Washington (5.85%). Alaska did not sell any of their production to other regions.

The Great Plains region had the third largest out-of-region sales (28.63%). Three regions received output shipped out of the Great Plains: Midwest (22.32%), Southcentral (6.28%), and Mountain (0.03%) (Table 3). As shown in Figure 4, Iowa was the top purchaser (sales ranging from 6.4% to 15.2%) followed by Missouri and Oklahoma (ranging from 0.8% to 6.3% of outside-of-region sales). Among the four states in the Great Plains, those with the largest inter-regional shipments were Kansas (49.22%) and Nebraska (35.40%), while firms with the lowest inter-regional shipments were from North and South Dakota, selling under 5 percent of their output to other regions.

The fourth largest proportion of inter-regional sales originated from the Southeast region, representing 28.2 percent of total region output (Table 3). The biggest

proportion of out-of-home region sales was shipped to destinations in the Appalachian region (11.67%), while about 2 percent of shipments were to the Northeast region, and the rest of the regions combined purchased only 2 percent of the output produced by the Southeast nurseries. As shown in Figure 5, the top proportion of sales from the Southeast region were shipped to destinations in North Carolina, Tennessee, and Texas (ranging from 4% to 56% of outside-of-region sales). Among the five states in this (Southeast) region, each shipped less than 50 percent of their production outside the region: South Carolina (47.84%), Florida (31.24%), Georgia (22.73%), Alabama (12.80%), and Mississippi (0%).

The lowest proportion of output in the Southcentral region was sold to out-of-region destinations (5.61%, respectively) (Table 3). The largest purchasing region for the shipments from the Southcentral region was international (4.74%). Less than one percent of output was sold in the other regions. As shown in Figure 6, the proportion of sales from the Southcentral region was relatively low, due to the small percentages reported in Table 3, and were shipped to California, Alaska, Arizona, Colorado, Missouri, Mississippi, Alabama, Florida, Indiana, Michigan, North Carolina, Pennsylvania, and New York (ranging from

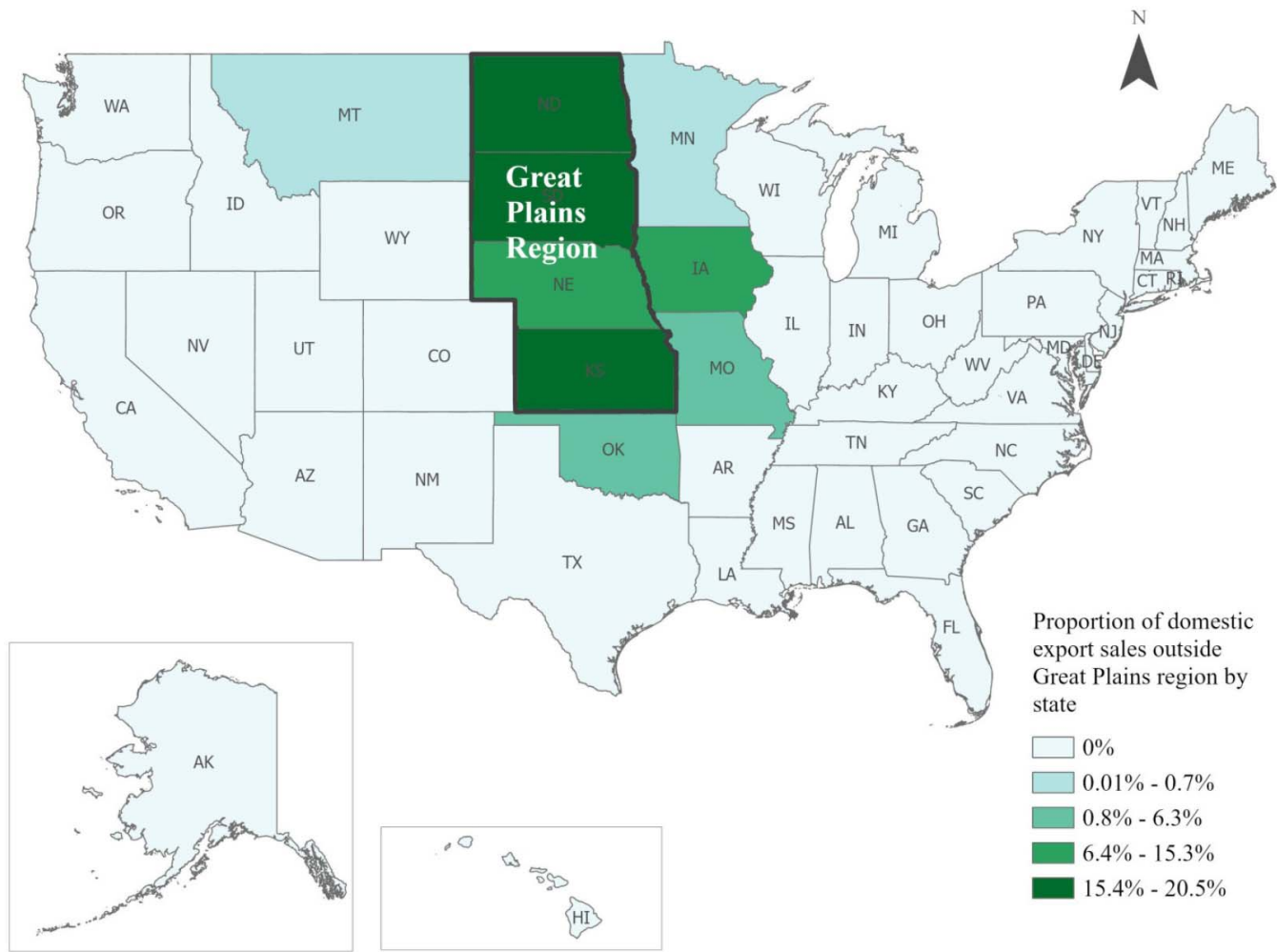


Fig. 4. Map of geographic distribution of sales proportions outside of the Great Plains region in 2018, reported by respondents to a national green industry survey.

0.01% to 1.4% of outside-of-region sales). Among the five states in the Southcentral region, those with the largest inter-regional shipments were Louisiana (7.86%), New Mexico (7.20%) and Texas (0.52%), while firms in Arkansas and Oklahoma contributed none of their output to other regions.

Relatively lower proportion of inter-regional sales originated from the Midwest region. The sales from the Midwest region were to the Northeast (4.23%), Appalachian (3.54%), Great Plains (0.32%), and Southeast regions (0.28%), respectively. At the state level within the Midwest, the biggest proportion of inter-regional sales were from Missouri (60.47%), followed by Wisconsin (50.70%), Indiana (28.9%), Minnesota (18.06%), Ohio (16.75%), Michigan (7.51%), Iowa (1.97%), and Illinois (0.67%). As shown in Figure 7, Kentucky and Maryland were among the top sales destinations from the Midwest, with sales proportions ranging from 6.8 to 33.9 percent.

The Mountain region sold approximately 17.48 percent of their nursery stock to other regions. As shown in Figure 8, out-of-region sales from the Mountain region were mostly shipped to destinations in California (16.01% to 29.9% of outside-of-region sales). The largest proportions of out-of-region sales were to the Pacific (16.33%)

followed by much smaller proportions to the Southcentral (0.89%), Northeast (0.23%), and Great Plains (0.02%) regions. At the state level within the Mountain region, the biggest proportion of inter-regional sales were from Arizona (35.87%) followed by Idaho (2.21%), Utah (0.97%), Montana (0.67%), and Colorado (0.29%). No inter-regional sales came from Nevada or Wyoming.

Changes in OD trade flows from 2013 to 2018. Comparing OD trade flow proportions from the 2013 and 2018 survey datasets, the results show a reallocation of trade occurring between intra- and inter-regional trade flows (Table 4). Sales within the Appalachian, Great Plains, Midwest, Northeast, Pacific, and Southeast regions decreased by 25.8, 27.7, 15, 14, 26.4, and 9 percent, respectively. Because the results are given in percentages, the change in sales within regions can be viewed as corresponding to opposite changes 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 states out of their region for development of inter-state markets. For example, considering the Appalachian region, sales to the Northeast increased by as high as 8.28 percent between 2013 and 2018, while sales to the Midwest, Mountain, and Pacific

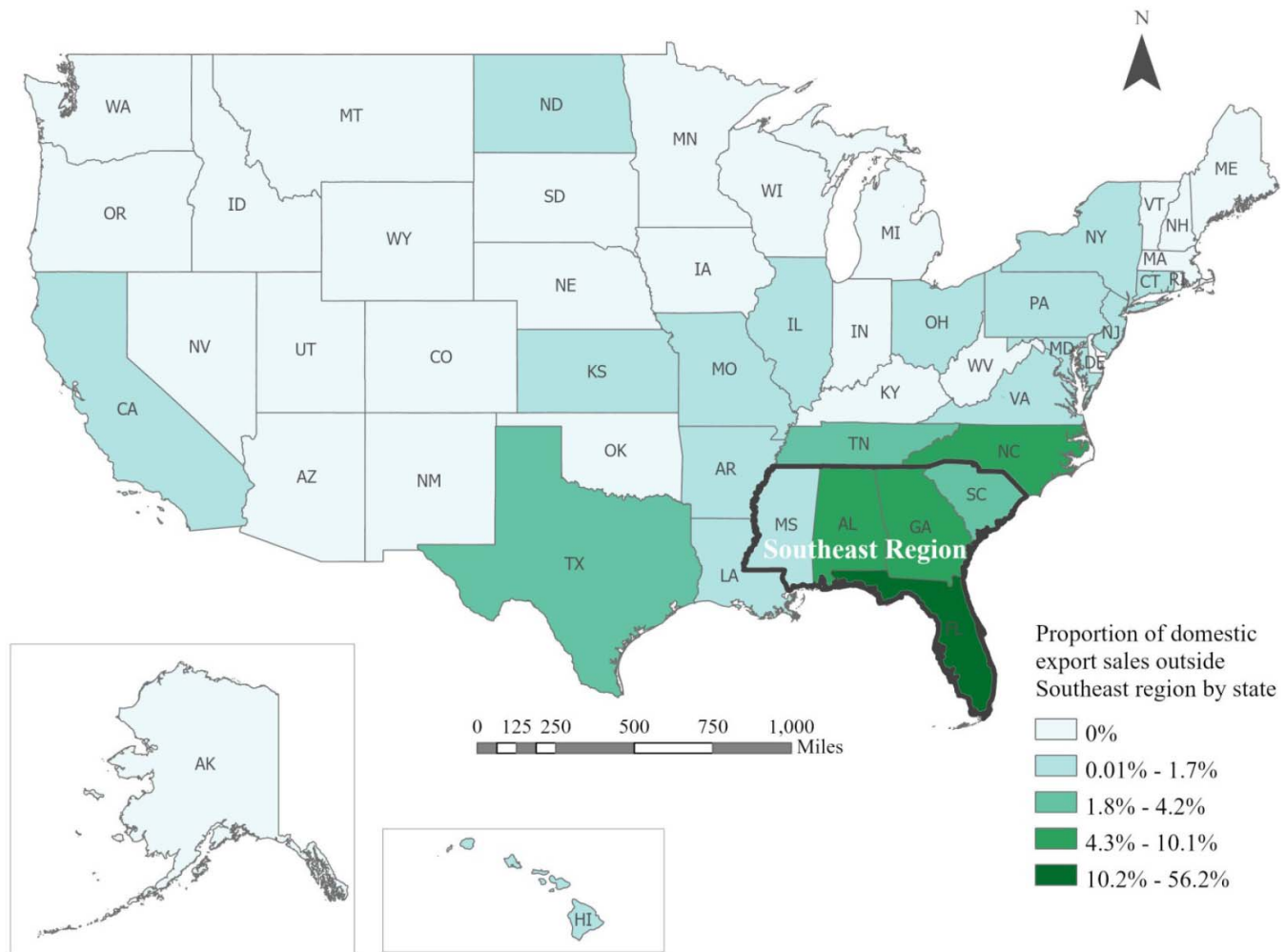


Fig. 5. Map of geographic distribution of sales proportions outside of the Southeast region in 2018, reported by respondents to a national green industry survey.

regions increased by 0.36, 8.08, and 0 percent, respectively. The negative changes from 2013 to 2018 in sales from the Appalachian region were to destinations in the Great Plains, Southcentral, and Southeast regions.

The negative change in sales within the Great Plains region (by 27.7%) is translated into increased sales to the Midwest (21.73%) and Southcentral (6.07%) regions, and decreased sales to the Appalachian (0.01%), Mountain

(0.08%), Northeast (0.01%), and Pacific (0.01%) regions (Table 4). Likewise, although within-region sales decreased by 15.01 percent in the Midwest from 2013 to 2018, sales to other regions increased, including the Northeast (3.85%), Appalachian (2.66%), and Great Plains (0.12%) regions. The Northeast region also had a negative change (by 14.14%) in home region sales, with a 9.32 percent increase in sales to the Southeast region and 2.49

Table 4. Changes in the regional proportion of origin-destination trade flows from 2013 to 2018, reported by respondents to a national green industry survey.

Origin Regions	Destination Regions								
	Appalachian	Great Plains	Midwest	Mountain	Northeast	Pacific	Southcentral	Southeast	International
<i>Percentage changes of total sales in each region</i>									
Appalachian	-25.84	-0.53	0.36	8.08	8.28	0.00	-3.43	-9.42	22.50
Great Plains	-0.01	-27.68	21.73	-0.08	-0.01	-0.01	6.07	0.00	0.00
Midwest	2.66	0.12	-15.01	-0.01	3.85	-0.02	-0.01	-0.16	8.57
Mountain	-0.01	-0.03	-0.14	3.74	0.22	14.17	-12.22	-5.60	-0.13
Northeast	0.13	0.04	-4.76	0.01	-14.14	-0.20	2.49	9.32	7.13
Pacific	-0.01	4.76	0.52	-4.56	1.55	-26.38	0.22	-1.38	25.26
Southcentral	-1.93	-0.37	-0.41	0.09	0.00	-0.08	6.66	-8.43	4.46
Southeast	7.26	-0.02	-0.11	-0.17	-3.72	-2.02	-2.01	-9.11	9.88
Grand Total	-4.0	-2.1	-1.5	2.4	0.5	-2.5	2.6	-6.7	11.3

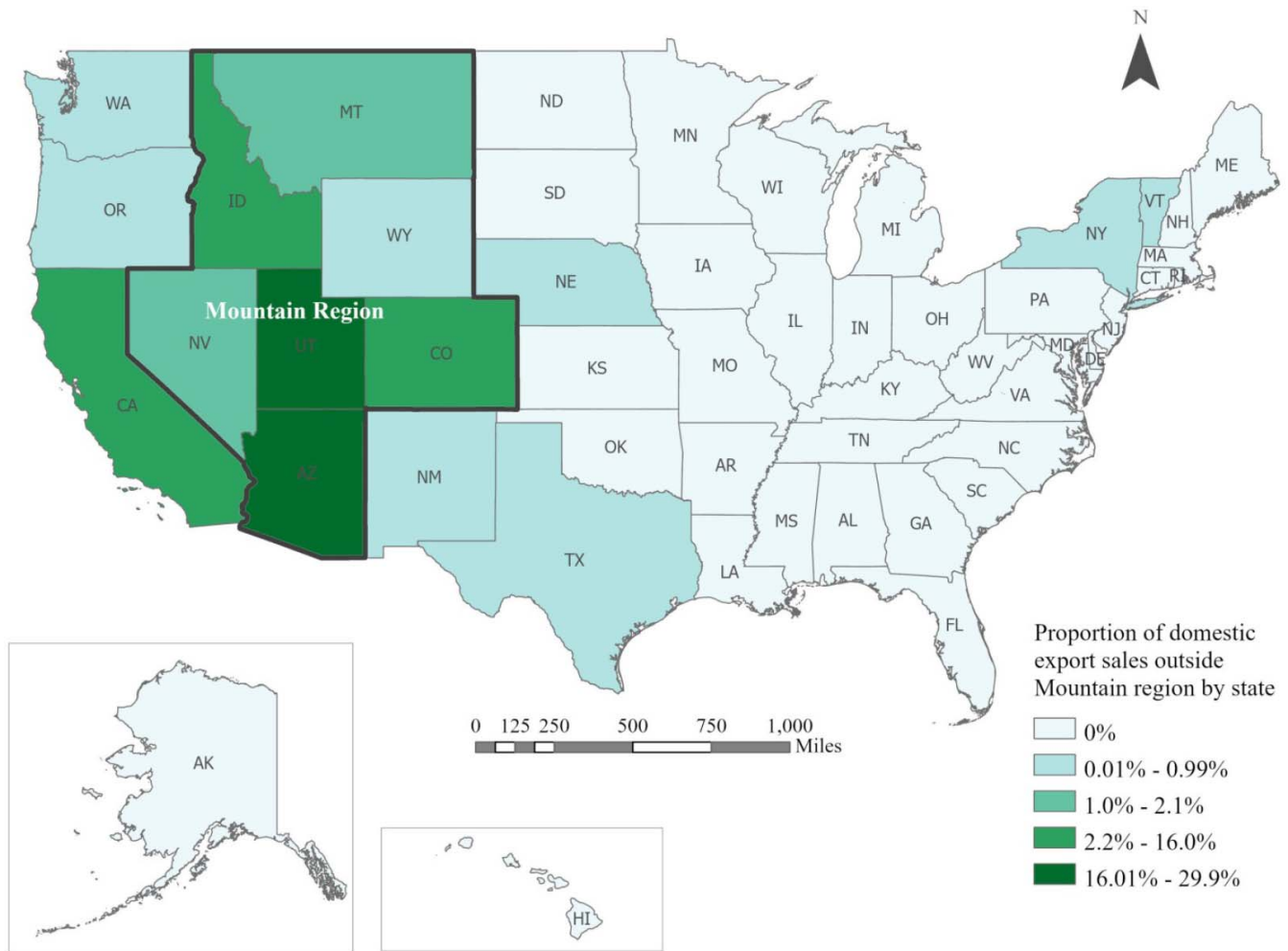


Fig. 6. Map of geographic distribution sales proportions outside of the Mountain region in 2018, reported by respondents to a national green industry survey.

percent increase in sales to the Southcentral region, while sales to the Appalachian, Great Plains, and Mountain regions increased marginally. The Pacific region had a significant decrease (by 26.38%) in sales done within their home region with most of the change resulting not from other regions but increased sales internationally (25.26%). The Southeast region had a marginal decrease in sales within-region (9.11%) with an increase in sales to the Appalachian region (7.26%).

Regions with increased intra-regional trade included the Mountain and Southcentral, with 3.74 and 6.66 percent increases from 2013 to 2018, respectively (Table 4). Sales from the Mountain region were reduced to the Southcentral region by 12.22 percent, followed by the Southeast, Midwest, and Appalachian regions (5.60%, 0.14%, and 0.1%, respectively). Changes in inter-regional trade originating from the Southcentral region ranged from an 8.43 percent decrease to the Southeast region to a 0.08 percent decrease to the Pacific region. The largest change in inter-regional trade was from the Great Plains region to the Midwest region (a 21.73% increase). The second largest change in sales originating from the Mountain region was to the Pacific region (14.17%).

Sales originating from all of the regions except the Great Plains (0%) and Mountain (0.13%) regions showed an increase in international sales (Table 4). The largest increase in international trade from 2013 to 2018 was from the Pacific (25.26%), followed by Appalachian (22.50%) and Southeast (9.88%) regions. Comparison of the 2013 and 2018 datasets also revealed sub-regional or state-level variation in OD trade flows (Table 5).

Changes in OD trade flows from 2008 to 2018. Comparing OD trade flow proportions from the 2008 and 2018 survey datasets, the results show a reallocation of trade occurring between intra- and inter-regional trade flows (Table 6). Sales within the Appalachian, Great Plains, Midwest, Mountain, Northeast, Pacific, and Southeast regions decreased by 36.9, 17.8, 11.3, 4.6, 17.9, 24.8, and 1.3 percent, respectively.

The negative changes from 2008 to 2018 in sales from the Appalachian region were to destinations in the Midwest and Southcentral regions. The negative change in sales within the Great Plains region (by 17.8%) was due to increased sales to the Midwest (14.7%) and Southcentral (4.3%) regions, and decreased sales to the Appalachian (1.1%) and Southeast (0.1%) regions (Table 4). Likewise, although within-region sales decreased by 11.3 percent in

Table 5. Changes in the proportion of origin-destination trade flows from 2013 to 2018 by region and state, reported by respondents to a national green industry survey.

Origin Regions	Destination Regions								
	Appalachian	Great Plains	Midwest	Mountain	Northeast	Pacific	Southcentral	Southeast	International
Appalachian	-25.8	-0.5	0.4	8.1	8.3	0.0	-3.4	-9.4	22.5
KY	-21.0	0.0	19.7	0.0	1.1	0.0	0.0	0.1	0.0
NC	-1.4	-0.9	-4.4	19.4	3.0	0.1	-2.9	-12.9	0.0
TN	-40.7	-0.3	-7.5	0.0	-1.3	0.8	-9.8	-7.3	66.0
VA	-51.3	0.0	-0.8	0.0	5.4	-0.1	0.0	0.0	46.8
WV	-20.4	0.0	31.1	0.0	0.3	-8.4	0.0	-2.6	0.0
Great Plains	0.0	-27.7	21.7	-0.1	0.0	0.0	6.1	0.0	0.0
KS	0.0	-47.2	23.3	0.0	0.0	0.0	23.9	0.0	0.0
ND	0.0	-0.1	-0.3	0.4	0.0	0.0	0.0	0.0	0.0
NE	0.0	-34.6	35.0	-0.1	0.0	0.0	-0.1	0.0	0.0
SD	0.0	-0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Midwest	2.7	0.1	-15.0	0.0	3.9	0.0	0.0	-0.2	8.6
IA	-0.7	1.8	0.7	0.0	-0.4	-1.5	0.0	0.0	0.0
IL	0.0	-0.1	0.1	0.0	0.0	-0.1	0.0	0.0	0.0
IN	18.9	0.0	-27.8	0.0	0.0	0.0	0.0	0.0	8.9
MI	0.5	0.0	-6.2	0.0	1.6	0.0	0.0	0.5	3.6
MN	0.0	17.0	-16.7	-0.1	0.0	0.0	-0.1	0.0	0.0
MO	-4.2	-3.4	-30.7	0.0	59.6	0.0	0.0	-21.2	0.0
OH	2.7	0.0	-8.2	0.0	5.0	0.0	0.0	0.0	0.5
WI	0.0	0.0	-50.7	0.0	0.0	0.0	0.0	0.0	50.7
Mountain	0.0	0.0	-0.1	3.7	0.2	14.2	-12.2	-5.6	-0.1
AZ	0.0	0.0	0.0	-9.1	0.0	23.9	-14.8	0.0	0.0
CO	0.0	0.0	-0.1	29.8	0.0	-0.1	-19.3	-10.5	0.0
ID	0.0	0.0	-0.1	10.5	0.0	-6.8	-1.3	0.0	-2.3
MT	0.0	0.0	0.0	-0.7	0.7	0.0	0.0	0.0	0.0
NV	0.0	0.0	0.0	5.7	0.0	-2.8	-2.8	0.0	0.0
UT	-0.1	0.0	-1.6	1.1	0.8	0.0	0.0	0.0	0.0
WY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northeast	0.1	0.0	-4.8	0.0	-14.1	-0.2	2.5	9.3	7.1
CT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DE	0.0	0.0	-51.3	0.0	-39.3	0.0	0.0	0.0	90.6
MA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MD	-5.4	0.0	0.0	0.0	-39.4	-0.1	0.0	0.0	44.9
ME	0.0	11.8	-11.4	0.0	-0.3	0.0	0.0	0.0	0.0
NH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NJ	-0.3	0.0	-1.0	0.0	-2.7	-1.3	0.0	0.0	5.3
NY	0.0	0.0	-0.3	0.2	-1.2	0.3	1.0	0.0	0.0
PA	-0.2	0.0	3.7	0.0	-25.7	-0.2	4.8	17.6	0.0
RI	0.0	0.0	-14.1	-0.4	14.5	0.0	0.0	0.0	0.0
VT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pacific	0.0	4.8	0.5	-4.6	1.6	-26.4	0.2	-1.4	25.3
AK	0.0	0.0	0.0	0.0	-81.3	93.8	0.0	0.0	-12.5
CA	0.0	0.0	0.0	-9.4	0.0	-12.8	0.3	-2.2	24.1
HI	0.0	0.0	-0.5	0.0	-0.3	-81.9	0.0	-0.3	83.0
OR	0.0	19.5	2.2	3.8	-0.7	-50.7	0.0	0.0	25.9
WA	0.0	0.0	0.0	2.7	0.0	-4.6	0.0	0.5	1.5
Southcentral	-1.9	-0.4	-0.4	0.1	0.0	-0.1	6.7	-8.4	4.5
AR	-3.7	-23.3	-20.6	0.0	0.0	0.0	47.5	0.0	0.0
LA	-11.7	0.0	-1.0	0.0	0.0	-0.3	25.4	-19.3	6.9
NM	0.0	0.0	0.0	6.5	0.0	0.0	32.3	0.0	-38.9
OK	0.0	-0.7	0.0	0.0	0.0	-2.4	3.1	0.0	0.0
TX	-0.1	-0.1	0.0	0.0	0.0	0.2	7.3	-7.3	0.0
Southeast	7.3	0.0	-0.1	-0.2	-3.7	-2.0	-2.0	-9.1	9.9
AL	7.3	0.0	0.0	0.0	-1.4	0.0	-3.9	-2.0	0.0
FL	3.1	0.0	-0.1	-0.3	-2.6	-0.1	-2.9	-11.9	15.0
GA	16.5	0.0	0.0	0.0	-6.5	-5.5	0.7	-5.2	0.0
MS	-6.6	0.0	-2.2	0.0	0.0	0.0	-7.1	15.9	0.0
SC	10.5	0.0	0.0	0.0	-4.5	-6.3	-5.5	-16.5	22.4
Grant Total	-4.0	-2.1	-1.5	2.4	0.5	-2.5	2.6	-6.7	11.3

the Midwest region from 2008 to 2018, the sales to the Great Plains (1.4%) and Mountain (0.6%) regions also decreased. The Mountain region also had a negative change (by 4.6%) in home region sales, with a 15.2 percent increase in sales to the Pacific region and 9.4 percent

decrease in sales to the Southcentral region. The Northeast region had a decrease (by 17.9%) in sales done within their home region, with most of the change resulting from increased sales to the Southeast (9.4%) and Southcentral (2.3%) regions. The Pacific region had a substantial

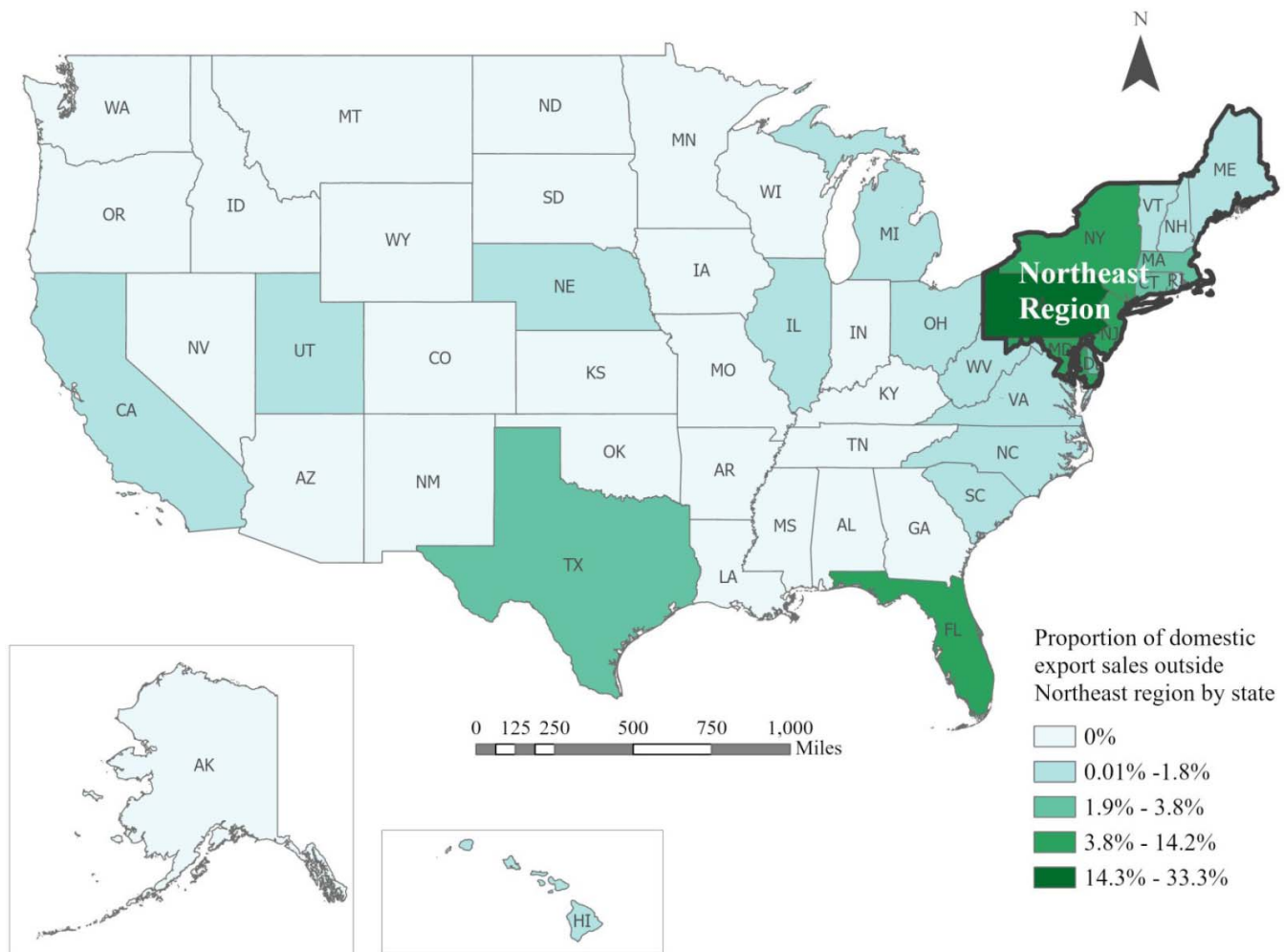


Fig. 7. Map of geographic distribution of sales proportions outside of the Northeast region in 2018, reported by respondents to a national green industry survey.

decrease in sales within-region (24.8%) and an increase in sales to the Great Plains region (4.5%). The Southeast had a decrease in intra-regional sales (by 9.11%), with decreased sales to each region except the Appalachian region.

The region with increased intra-regional trade was the Southcentral, with 6.5 percent increases from 2008 to 2018 (Table 6). Inter-regional sales from the Southcentral region were reduced for every region, with the largest reduction

from the Pacific region (4.4%). The largest change in inter-regional trade was from the Mountain region to the Pacific region (a 15.2% increase). The second largest increase in sales originating from the Great Plains region to the Midwest region (14.7%).

International sales originating from all the regions except the Great Plains (0%) and Mountain (-0.2%) regions showed an increase in international sales (Table 6). The largest increase in international trade from 2008 to

Table 6. Changes in the distribution of origin-destination trade flows from 2008 to 2018 by region.

Origin Regions	Destination Regions								
	Appalachian	Great Plains	Midwest	Mountain	Northeast	Pacific	Southcentral	Southeast	International
	<i>Percentage of total sales in each state or region</i>								
Appalachian	-36.9	-0.4	2.2	6.9	9.0	0.1	-3.3	0.0	22.3
Great Plains	-1.1	-17.8	14.7	0.0	0.0	0.0	4.3	-0.1	0.0
Midwest	3.1	-1.4	-11.3	-0.6	1.6	0.0	0.0	0.0	8.6
Mountain	0.0	-0.7	-0.1	-4.6	-0.3	15.2	-9.4	0.0	-0.2
Northeast	0.5	0.0	-2.1	0.0	-17.9	0.0	2.3	9.4	7.8
Pacific	-1.1	4.5	-1.5	-1.7	0.6	-24.8	-0.7	-0.3	25.2
Southcentral	-0.6	-0.2	-2.8	-0.3	-0.1	-4.4	6.5	-2.9	4.7
Southeast	-2.8	-0.2	-1.9	-3.4	-1.0	-0.6	-1.3	-1.3	12.5
Grand Total	-5.4	-0.7	4.2	0.0	-0.4	-6.8	-2.1	-0.7	12.0

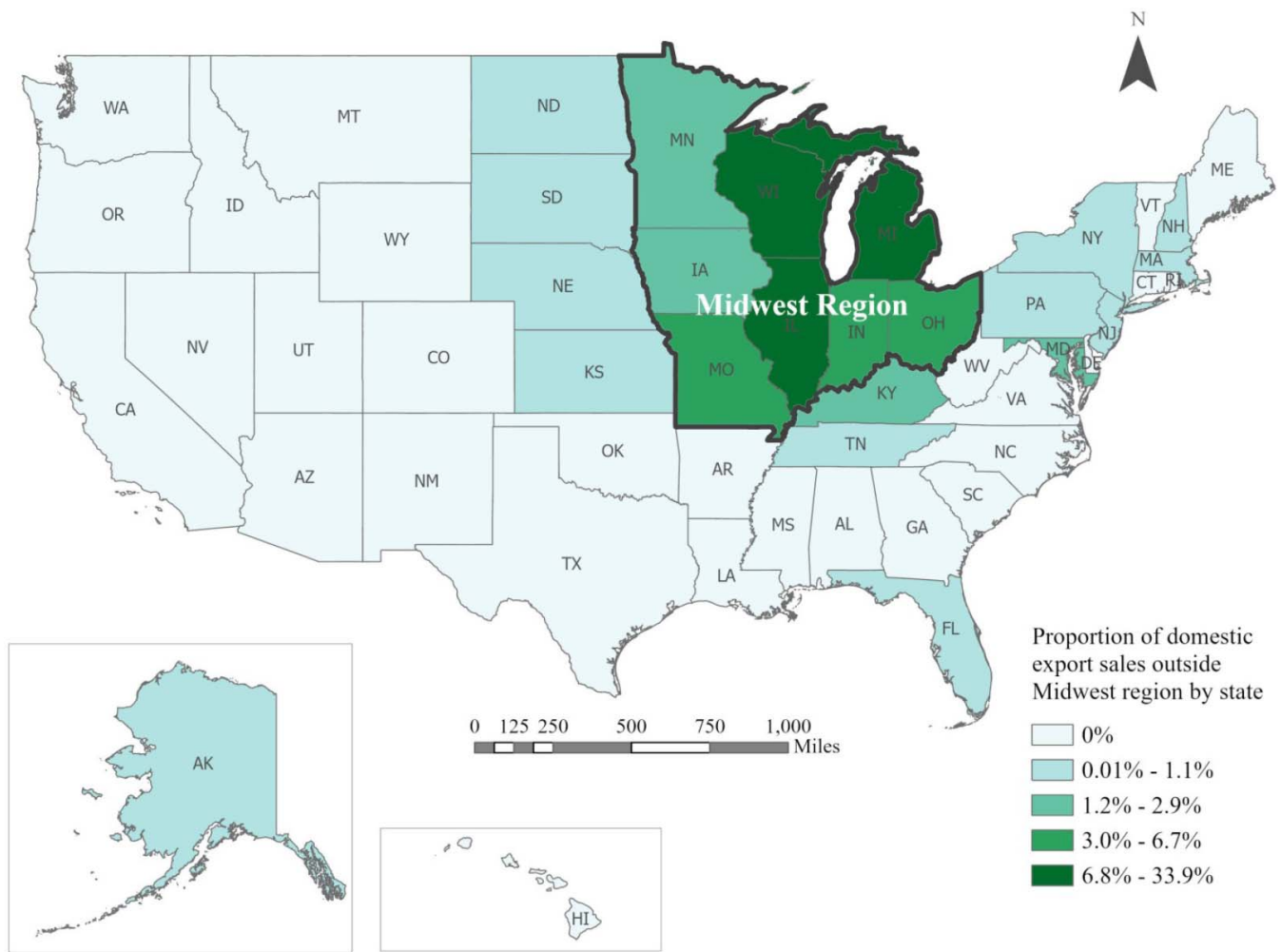


Fig. 8. Map of geographic distribution of sales proportions outside of the Midwest region in 2018, reported by respondents to a national green industry survey.

2018 was from the Mountain (25.2%), followed by Appalachian (22.3%) and Southeast (12.5%) regions. Comparison of the 2008 and 2018 datasets also revealed sub-regional or state-level variation in OD trade flows (Table 7).

Summary and conclusions. The results of this report are similar to the 2013 report, but not identical. As before, most of the output by the green industry firms was sold to destinations within their home region (74%), which underscores costs associated with long-haul transportation and the perishable nature of the live product. While there is some evidence that regions with high home sales also maintain relatively high inter-regional trade volume (e.g., Southeast, Table 1), at least two regions had relatively lower within-home-region sales and a higher proportion of inter-regional sales (e.g., Appalachian and Pacific regions; Table 3). This, as before, implies that inter-regional trade is not directly proportional to the total output by the firms in the region. Second, 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 Southeast region, which had the largest inter-regional trade in 2018 (Table 1) and shipped most of its production to Appalachian destinations (Table 2). Among the top four regions in inter-regional trade volume (Southeast, Northeast, Appalachian, and Midwest), the Appalachian region had the most, 8 percent, of inter-regional trade with third-order neighbor regions (i.e., separated by two regions in between) (Table 3). International trade has spiked both in the 5-year and 10-year time span for nearly all the regions, accounting for a total of 11.3 percent growth since 2013 and 12.0 since 2008 (Table 4). Finally, considering the total OD trade flows (both intra- and inter-regional), the Great Plains and Pacific are the largest purchasing regions, accounting for over 54.1 percent of the purchases nationwide. Compared with 2008, these two regions had a 9.9 and 1.5 percent increase, respectively, in purchase volume across all regions, including intra-regional sales. From 2008 to 2018, intra-region sales decreased in most regions except for South-central (Table 6). This could be because business owners

Table 7. Changes in the proportion of origin-destination trade flows from 2008 to 2018 by region and state.

Origin Regions	Destination Regions								
	Appalachian	Great Plains	Midwest	Mountain	Northeast	Pacific	Southcentral	Southeast	International
Appalachian	-36.9	-0.4	2.2	6.9	9.0	0.1	-3.3	0.0	22.3
KY	-2.8	0.0	1.5	0.0	1.1	0.0	0.0	0.1	0.0
NC	-28.7	0.0	0.4	17.7	8.6	0.0	1.5	0.5	0.0
TN	-52.6	-1.4	-2.6	0.0	3.0	0.8	-12.0	-0.6	65.3
VA	-65.0	0.0	-1.6	-2.1	21.9	0.0	0.0	0.0	46.8
WV	-25.4	0.0	39.8	0.0	-14.4	0.0	0.0	0.0	0.0
Great Plains	-1.1	-17.8	14.7	0.0	0.0	0.0	4.3	-0.1	0.0
KS	0.0	-8.7	-3.9	0.0	0.0	0.0	12.7	0.0	0.0
ND	-59.4	64.9	-2.8	0.4	0.0	0.0	0.0	-3.1	0.0
NE	0.0	-32.2	32.2	0.0	0.0	0.0	0.0	0.0	0.0
SD	0.0	-1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Midwest	3.1	-1.4	-11.3	-0.6	1.6	0.0	0.0	0.0	8.6
IA	0.0	-15.6	16.0	0.0	-0.5	0.0	0.0	0.0	0.0
IL	0.7	-0.9	0.6	-0.4	0.0	0.0	0.0	0.0	0.0
IN	18.7	0.0	-25.4	0.0	0.0	0.0	0.0	-2.2	8.9
MI	0.8	0.0	-6.6	0.0	1.7	0.0	0.0	0.5	3.6
MN	0.0	15.5	-15.4	0.0	0.0	0.0	0.0	0.0	0.0
MO	0.0	0.5	-60.1	0.0	59.6	0.0	0.0	0.0	0.0
OH	5.6	0.0	-2.4	-2.3	-1.3	0.0	0.0	0.0	0.5
WI	0.0	-11.1	-37.5	0.0	-1.7	-0.3	0.0	-0.1	50.7
Mountain	0.0	-0.7	-0.1	-4.6	-0.3	15.2	-9.4	0.0	-0.2
AZ	0.0	0.0	0.0	-3.1	0.0	28.0	-24.9	-0.1	0.0
CO	0.0	-1.3	-0.2	19.1	0.0	0.0	-17.7	0.0	0.0
ID	0.0	0.0	-0.3	4.8	0.0	-2.8	0.0	0.0	-1.7
MT	0.0	0.0	0.0	-0.7	0.7	0.0	0.0	0.0	0.0
NV	0.0	0.0	0.0	12.5	-9.9	-0.5	-2.1	0.0	0.0
UT	0.0	0.0	0.0	-0.1	1.0	-0.9	0.0	0.0	0.0
WY	0.0	-1.9	0.0	2.0	-0.2	0.0	0.0	0.0	0.0
Northeast	0.5	0.0	-2.1	0.0	-17.9	0.0	2.3	9.4	7.8
CT	0.0	0.0	0.0	-86.4	86.4	0.0	0.0	0.0	0.0
DE	0.0	0.0	0.0	0.0	-95.2	0.0	0.0	0.0	95.2
MA	0.0	0.0	0.0	-3.3	3.3	0.0	0.0	0.0	0.0
MD	-3.6	0.0	0.0	-2.0	-39.3	-0.1	0.0	0.0	44.9
ME	0.0	11.8	0.0	-3.2	-8.6	0.0	0.0	0.0	0.0
NH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NJ	-0.2	0.0	-10.8	-1.0	4.6	0.0	0.0	0.0	7.3
NY	-0.8	0.0	-2.8	-3.0	7.1	0.3	0.1	-0.8	-0.2
PA	1.7	0.0	-0.6	-5.6	-18.7	0.0	4.8	19.0	-0.5
RI	0.0	0.0	3.8	-9.0	5.3	0.0	0.0	0.0	0.0
VT	0.0	0.0	-0.1	-7.1	7.1	0.0	0.0	0.0	0.0
Pacific	-1.1	4.5	-1.5	-1.7	0.6	-24.8	-0.7	-0.3	25.2
AK	0.0	0.0	-0.3	0.0	-0.3	1.4	0.0	-0.7	0.0
CA	-1.0	-0.3	-0.5	-2.6	-1.5	-17.9	-0.5	0.1	24.1
HI	0.0	0.0	-4.9	-0.6	-0.5	-78.5	-1.4	-1.7	87.6
OR	-3.1	19.5	-19.3	-5.1	5.2	-14.3	-1.5	-2.9	21.2
WA	-0.1	-0.6	-0.1	-3.0	0.0	2.2	0.0	0.4	1.3
Southcentral	-0.6	-0.2	-2.8	-0.3	-0.1	-4.4	6.5	-2.9	4.7
AR	0.0	-1.6	-1.8	0.0	-0.2	0.0	5.1	-1.5	0.0
LA	-2.0	0.0	-0.3	0.0	0.0	-0.1	-0.5	-4.2	6.9
NM	0.0	0.0	0.0	5.5	0.0	0.0	-5.4	0.0	0.0
OK	0.0	-0.3	0.0	0.0	0.0	0.0	0.3	0.0	0.0
TX	0.0	0.0	-6.7	-0.1	-0.2	-11.4	23.3	-4.9	0.0
Southeast	-2.8	-0.2	-1.9	-3.4	-1.0	-0.6	-1.3	-1.3	12.5
AL	-41.5	0.0	-1.4	0.0	-0.3	0.0	1.0	42.1	0.0
FL	-4.9	-0.1	-2.7	-5.0	-1.9	-0.9	-1.5	-2.3	19.3
GA	7.2	-0.4	-0.3	0.0	2.2	0.0	0.1	-8.8	0.0
MS	-12.9	0.0	-1.0	0.0	-4.0	0.0	-11.2	29.1	0.0
SC	-4.6	-0.1	-0.4	0.0	-15.4	0.0	0.0	-1.9	22.4
Grand Total	-5.4	-0.7	4.2	0.0	-0.4	-6.8	-2.1	-0.7	12.0

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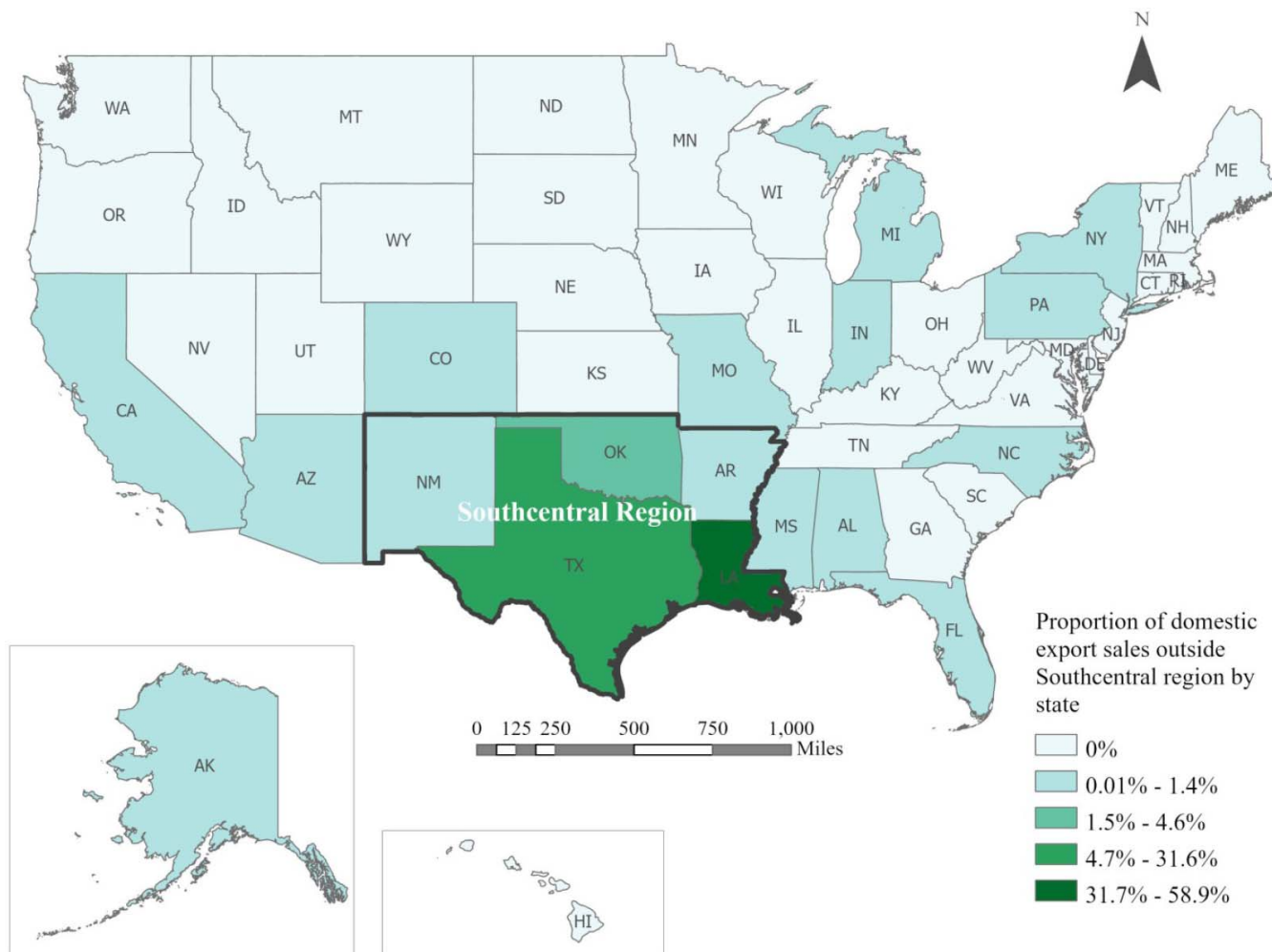


Fig. 9. Map of geographic distribution of sales proportions outside of the Southcentral region in 2018, reported by respondents to a national green industry survey.

are adapting to demand changes and drawing from markets where demand for their products exists.

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