The Regional Economic Development Potential and Constraints to Local Foods Development in the Midwest*

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Abstract: There are no standard definitions of what constitutes "local" food amidst a burgeoning local food promotion and policy-development movement. Nonetheless, government policies are rapidly evolving to promote local food production. For most states, anything produced or processed in-state is considered local. In other instances, a 250 or even a 500 mile perimeter constitutes an acceptable boundary justifying a local food territory for policy making purposes or purchasing preferences. The absence of clean definitions of what constitutes local food as well as the ostensible regional economic gains to be expected from local food promotion and increased production have led to a common situation in U.S. rural development initiatives: substantive policy initiatives pre-date validating research.

This paper looks at practical limits to local foods production and consumption in the Upper Midwest. It presumes that local foods production makes the most sense, and has the greatest profit potential, in relatively close proximity to dense urban demand. The research demonstrates methods for determining county-level fresh fruit and vegetable production potentials for the states of Minnesota, Wisconsin, Illinois, Michigan, Indian, and Iowa in light of the distribution of metropolitan areas with 250,000 residents or more within or nearby the region. It also estimates the farm production-related total economic values that would accumulate were local foods production goals achieved in the region using input-output modeling tools. A state-only analysis was also conducted for Iowa using smaller metropolitan areas and a shorter viable distance-to-market threshold to apply the larger study's insights in a manner that might guide state-level decision making. The research can be useful for helping to inform state policy developments as well as the location and extent of Cooperative Extension and other types of state and local services and production assistance designed to bolster or further investigate this emerging rural development topic.

Local Foods Impact Research: A Selective Self-Evaluation

The desirability of producing and procuring locally-grown foods is frequently justified along four fronts (Hughes et al, 2007). They are perceived to be of higher quality (see Davis et al. 2004); to be more environmentally friendly with fewer energy or chemical inputs (Weber and Matthews 2008, Mariola 2008); to reinforce social relationships among food consumers and producers, as exemplified by the USDA's Know Your Farmer – Know Your Food program, as just one example; and to retain local dollars by minimizing import demands (Swenson 2006, Hughes 2008). All of these assertions are testable, and

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should probably be investigated more extensively than has been the case to date. But in a more general and practical sense for rural development policy, the last motivating assumption prevails. It is presumed that the re-establishment of local foods production in the U.S. will have a positive impact on rural-area jobs and income generation and introduce stability into persistently struggling rural areas.

The U.S. is very efficient at producing foods, processing them, and distributing them. These efficiencies are well documented and well-known, and specific regions of the U.S. dominate the production of particular food commodities for the rest of the U.S. It of course must be acknowledged at the outset that "local foods" in the main would substitute for foods produced somewhere else in the U.S. So, regional income enhancements associated with local food growth would come at the expense of production and realized incomes elsewhere.[1] The parochial nature of the local foods movement reinforces a bias in favor of local versus foreign, neighbor versus alien, small farm versus large farm, and the perceived environmentally sensitive versus the perceived environmentally indifferent. Much of the discussion about local foods revolves around and extrapolates from the growing popularity of farmers markets, increases in community supported agriculture (CSA) operations over time, diverse horticultural and niche animal production initiatives, and the re-establishment of farmer-owned and operated direct sales capacities (see Martinez et al. 2010).

Earlier analysis by this writer studying Iowa found that producing a quarter of Iowa's actual annual demand for 32 fresh fruits and vegetables only required the equivalent of 434 jobs when on-farm and all indirect activities were counted (Swenson 2006). The land to produce those commodities, however, had to be taken from conventional crops, so those gains came at the expense of 71 jobs attributable to that kind of farming, which netted farm-level gains of 363 jobs. The sponsors of that research next supposed that half of that production could potentially be marketed directly to consumers in actual fruit and vegetable markets. In constructing that scenario, literally, as these markets did not physically exist, and in calculating offsets in existing retail grocery establishments (as was also considered in Hughes 2008), those retailers might link to 1,900 relatively seasonal retail and pre-processing jobs. The largest job numbers associated with the hypothesized expansion were in fresh food and fruit retail activity, not from the farming activities. In all, that research determined that import substitutes considering all offsets and acknowledging that there would be within-state shifts could potentially result in $54 million in labor incomes to 2,030 jobs, but would have involved the development of new farm production and food retailing configurations for which there were no feasibility analyses to bolster their suppositions.[2]

[1] U.S. fresh fruit and vegetable imports were roughly twice as great as U.S. exports in 2009. Those imports, however, provided supplies that major U.S. producers do not maintain during portions of the year. As the preponderance of those imports comes from the very warm climates of Mexico and Central America, local fresh fruit and vegetable production would not change our overall propensity to import those foods.

[2] This scenario supposed actual physical structures that would be regional fruit and vegetable marketing centers. Two decades ago Iowa state government controlled all liquor and wine sales through state-owned outlets distributed rationally across the state. This study assumed a similar fruit and vegetable retail and wholesale distribution territory – you'd of course drive just as far to get fresh tomatoes as a bottle of wine – and building configuration (Morton building with loading dock, produce shelves, refrigeration, etc., but otherwise an austere structure that would not operate year-round).

That analysis resulted in this writer questioning the viability of the assumptions specified by the research sponsors as the research did not or could not provide insights into

- The farm-level production feasibility among the selected fruits and vegetables that were specified,
- The constraints against the introduction or re-introduction of farmer-direct marketing establishments among the counties and the cities given the highly competitive and highly efficient food markets in the state, and
- The location of production given settlement concentrations in the state – an initial analysis of the data indicated that a substantial fraction of the state's counties would not have sufficient demand to warrant either production or retail investments.

Subsequent sponsored project research verified that job development potentials of local foods production were meager in areas with comparatively sparse populations – areas in the greatest need of rural development opportunities. One regional study of local foods production coupled with residential nutrition goals (Swenson 2007) found that total job gains in farming and food processing could be as high as 408 for a seven county region were the local nutrition and local food production objectives met, but the feasibility of the objectives was not evaluated by the project participants. In another analysis for a different region that did not have nutrition goals but evaluated 22 fruits and vegetables the research sponsors thought could be competitively produced in their region, 50 jobs were generated from the analysis, which included direct marketing half of the crops to consumers after all appropriate offsets to conventional farming and grocery stores were considered (Swenson 2009).

The last regional assessment in Iowa (Swenson 2010) looked primarily at the potential of farmers to produce for nearby metropolitan centers, which aligns with Hughes's (2007) supposing that success will be highest in rural-urban fringe areas. That investigation looked at a 12 county region that had the Omaha-Council Bluffs MSA on its western boundary and the Des Moines metropolitan area on its eastern edge. That research contained three important distinctions from the previous local foods assessments in Iowa:

- Local foods production was evaluated in terms of satisfying nearby and dense metropolitan demand, not just local, residential demand,
- The propensity to actually produce local foods was considered, albeit indirectly, using USDA data on nonconventional farms as well as cropland acres, and
- The disincentives of distance were factored into the analysis

That study did not presuppose the establishment of farmer-direct markets, so all produce would have entered existing wholesale systems. Accordingly, total job impacts were only modest, but they were based on crop production not the supposition of a new food retailing structure. In satisfying regional demand on an import-substitution basis and in satisfying a portion of the demand of the 1.4 million metropolitan residents on its borders (which would technically be considered regional exports), 45 total jobs and $2.7 million in labor incomes would have been sustained. The research demonstrated what should be quite obvious to policy makers: if distance-to-market is an important factor in the success of local foods initiatives, nearby counties are better situated to satisfy regional demand. The combination of sparse local population and increased distances to their export market decreased the likelihood of fruit and vegetable production for the fringe metros among the more remote counties.

Introduction to the Upper Midwest Study

The Upper Midwest Study (Swenson 2010a) relied on many of the analytical assumptions, techniques, and insights developed in the several previous Iowa regional studies. The participant states were Illinois, Indiana, Iowa, Michigan, Minnesota, and Wisconsin. There were two dimensions to the research. The first scenario in the original technical report described economic activity associated with fruit and vegetable production with an assumption that statewide demands for fresh fruits and vegetables were to be met solely by each state's producers only. That initial analysis provided a state-bounded local production and consumption summary that was geared towards single-state marketing and promotion interests to bolster state-specific policy initiatives.[3]

The second scenario of the research is described here and was more realistic in that state boundaries were not a delimiting factor in determining potential local food production among the six states. That evaluation began at the county level and estimated the potential farm level sales that could be made from any county in the region to any metropolitan areas within the region or that was within 150 miles of the region's boundaries that had populations of 250,000 or more. Further, it used distance from metropolitan markets to discount the farmers' likelihoods of producing for the metro markets, while taking into account a measure of the proclivity of farmers to actually produce fruits and vegetables, along with the amount of available cropland in each county as a final production consideration.

There were several standard and specialized data sources utilized for this analysis. Among them were

- Detailed national, state and county level agricultural production characteristics derived from USDA Agricultural Census data for 2007.
- Information on farm and retail level fruit and vegetable prices obtained from the Economic Research Service (ERS) of the USDA.
- Data on expected resident population fruit and vegetable consumption from the USDA and from data imbedded within the Iowa Produce Market Calculator.[4]
- Economic impact modeling data were purchased from Minnesota Implan for each state so that input-output models could be constructed to evaluate each participating state's full range of linked economic outcomes associated with the study scenarios.

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[3] This paper does not describe the first scenario in detail. The in-state sponsors were more interested in sets of insular conclusions from the standpoint of lobbying legislators to support local food policies even though there would be large areas in their states where local food production was clearly infeasible either due to topography or settlement. Readers can obtain the original technical report at http://www.leopold.iastate.edu/research/marketing_files/Midwest_032910.pdf

[4] The underlying proprietary database of the Iowa Produce Market Calculator was used in part in this analysis. It is an on-line tool to assist in determining regional market demand and production potential for an array of foods. Most of its crop or production data come from the 2007 Agricultural Census. It can be accessed here: http://www.leopold.iastate.edu/research/calculator/home.htm.

The research produced summaries of the total economic value of such activity, but the real economic impacts to the states in terms of defensible projected net new economic activity were not attempted. The Upper Midwest report was not intended to isolate all of the net new production to the states or the region; and hence, the economic impacts. Instead, it identified the total value of production given the scenarios employed to demonstrate the potential gains that might accumulate to a state or a region were a bundle of fresh fruits and vegetables produced in amounts sufficient to substitute for imported foods. Additional research is necessary to discern the state-by-state and regional productivity gains that might have accrued after completely accounting for existing regional production of the studied commodities.

Vegetable and Fruit Production in the Upper Midwest

Interest has grown nationally in recent years in re-introducing fresh fruit and vegetable production in many regions of the U.S. that had long ceded production to other areas. Table 1 informs us that the vegetable agricultural sector required 2.82 million acres in 2007, which represented less than .7 percent of all U.S. crop land. A third of those acres were dedicated to sweet corn and potatoes, and just 15 vegetables accounted for 80 percent of the acres dedicated to fresh vegetable production nationally, with six accounting for just over half of all acres. Our collective preferences in terms of consumption and production are well-articulated and quickly discerned.

Table 1

Selected Examples of U.S. Vegetables Harvested For Sale (2007): Top 15	Acres	Percent of Total	Cumulative Percent of Total	Acres Per 1,000 Persons
Total	2,820,130	100.0%		9.34
Potatoes	595,804	21.1%	21.1%	1.97
Sweet Corn	294,004	10.4%	31.6%	0.97
Lettuce	166,967	5.9%	37.5%	0.55
Watermelons	151,135	5.4%	42.8%	0.50
Onions	130,925	4.6%	47.5%	0.43
Tomatoes in the Open	126,926	4.5%	52.0%	0.42
Broccoli	124,362	4.4%	56.4%	0.41
Beans, Snap	111,448	4.0%	60.3%	0.37
Pumpkins	101,010	3.6%	63.9%	0.33
Lettuce, Romaine	87,735	3.1%	67.0%	0.29
Cantaloupes	87,430	3.1%	70.1%	0.29
Sweet Potatoes	84,004	3.0%	73.1%	0.28
Cabbage	76,411	2.7%	75.8%	0.25
Carrots	68,058	2.4%	78.2%	0.23
Cucumbers and Pickles	61,992	2.2%	80.4%	0.21

Source: 2007 Agricultural Census

It takes comparatively small parcels of land to meet large fractions of statewide or regional fresh vegetable consumption. Given national averages, 93.4 vegetable acres could produce the annual needs of a small city of 10,000 persons. By specific crop, the U.S. allotted just 4.2 acres per 10,000 persons in fresh tomato crops and 2.5 acres for cabbages.

The six states in this analysis had widely varying total vegetable production levels as evidenced by Figure 1. Where the previous table indicated a mere 9.3 acres produced the fresh fruit and vegetables of 1,000 persons, the overall regional weighted average was 4.6 acres – half the national allocation of acres, yield per acre notwithstanding. The lowest amount was found in Illinois at 1.4 acres in production per 1,000 persons in 2007, followed by Iowa with 1.6 acres. Both Michigan and Minnesota scored higher at over 6.0 acres per 1,000 persons, and Wisconsin exceeds the national average at 9.9 acres.

While the region appears to be producing substantial portions of regional demand, a closer scrutiny of, for example, the very high Wisconsin score found that 75 percent of its acres produced potatoes and sweet corn. Michigan and Minnesota also demonstrated similarly strong potato and sweet corn production, so the heavy dominance by just those two vegetables would mean, region wide, much fewer acres in other vegetables and suggests an absence of production diversity.

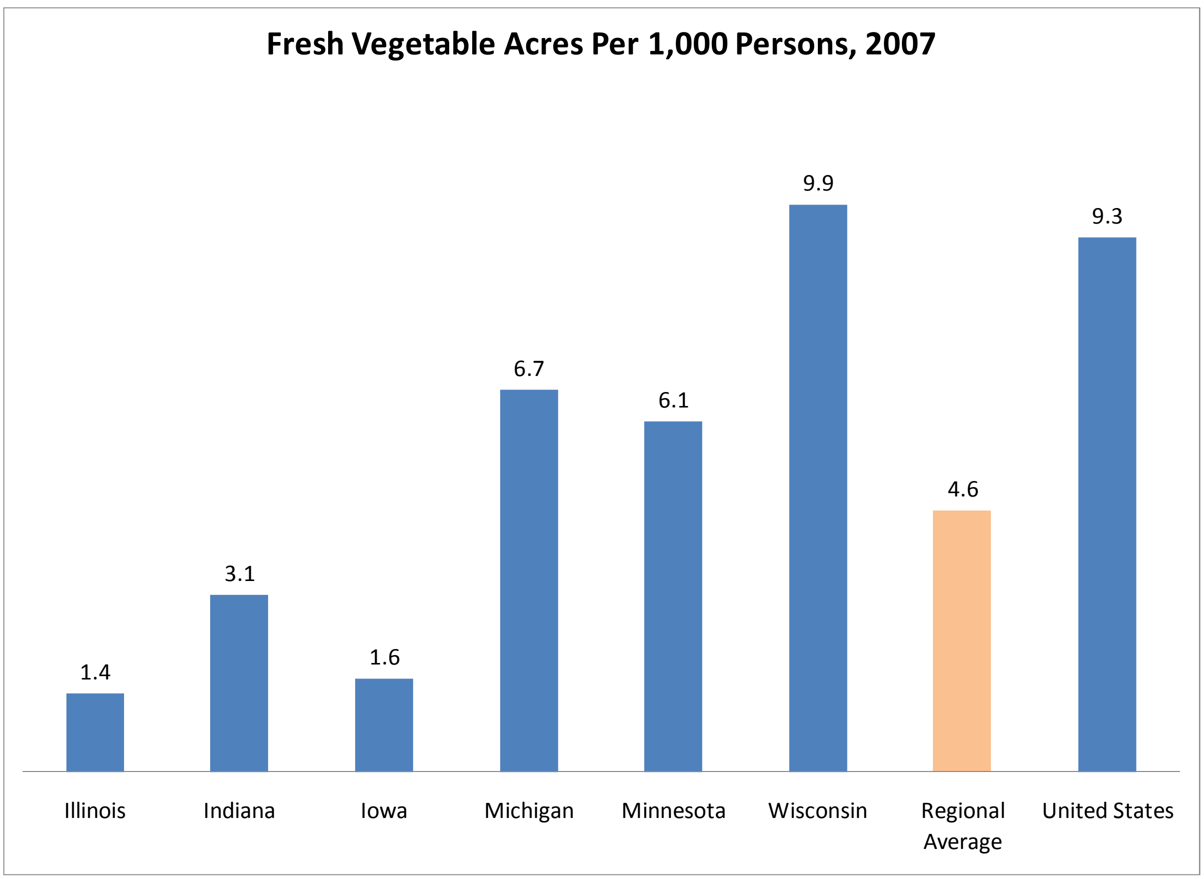

Figure 1. Source: 2007 Census of Agriculture

There were wide variances in the regional production of non-citrus fruits, too. Figure 2 indicates there were 6.4 fruit bearing acres of this type per 1,000 persons in the U.S. in 2007, but the regional weighted average was 2.7. Five of the six states had very low values, but Michigan's per capita acres exceeded the national average by 50 percent. Michigan has a diversified fruit production system featuring apples, peaches, cherries, and grapes, and is a major U.S. fruit producer. Indeed, the region demonstrated not just a strong regional prominence but also a national prominence among these items owing primarily to Michigan's production among several categories.

Figure 3 gives the same type of estimates for all berry production in the multi-state region. Nationally, just 7/10th of an acre produced the annual berry needs of 1,000 persons. The region, however, exceeded the national average at 1.0 acre per 1,000 persons. There were extremely low levels of berry production in Illinois, Iowa, Indiana, and Wisconsin. Michigan and Wisconsin were exceptions. Berry acres were three times the national average in Michigan and five times the national average in Wisconsin.

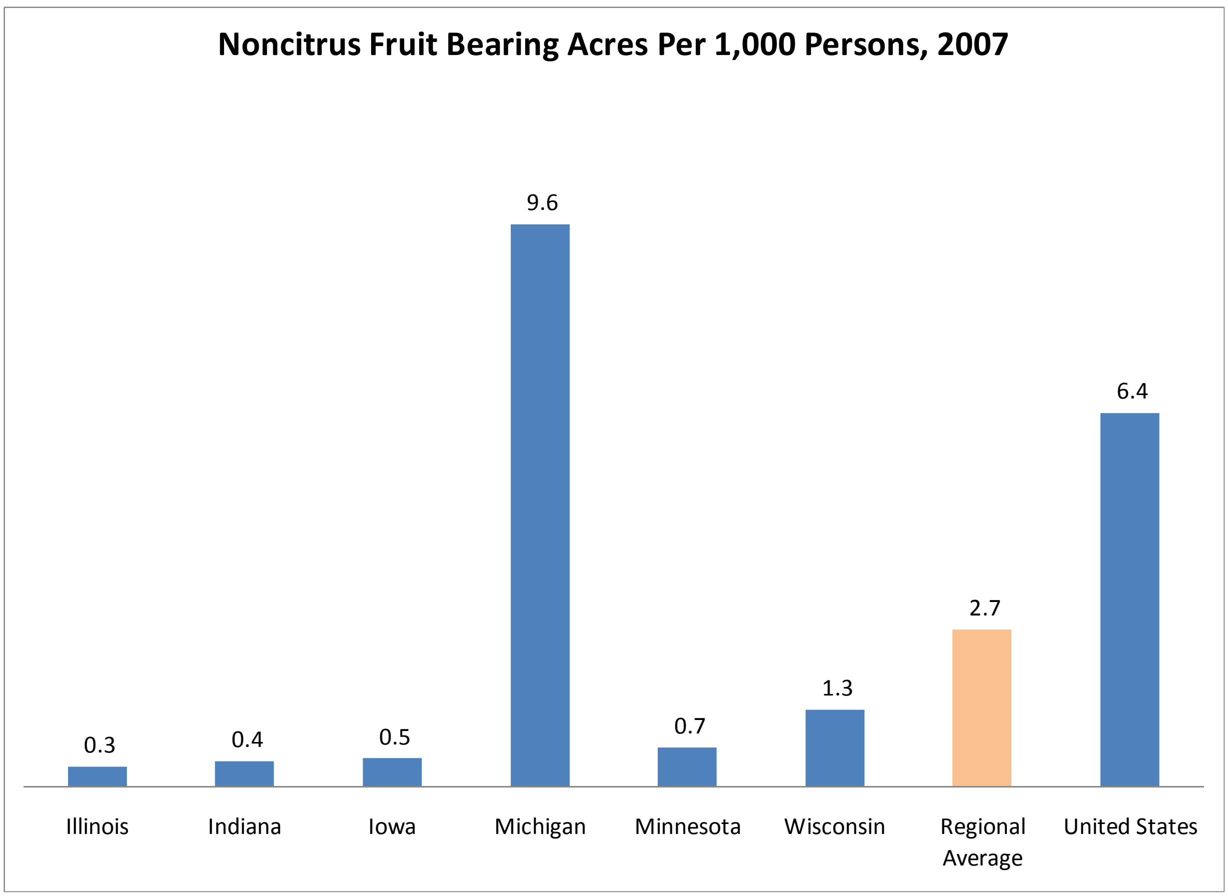

Figure 2. Source: 2007 Census of Agriculture

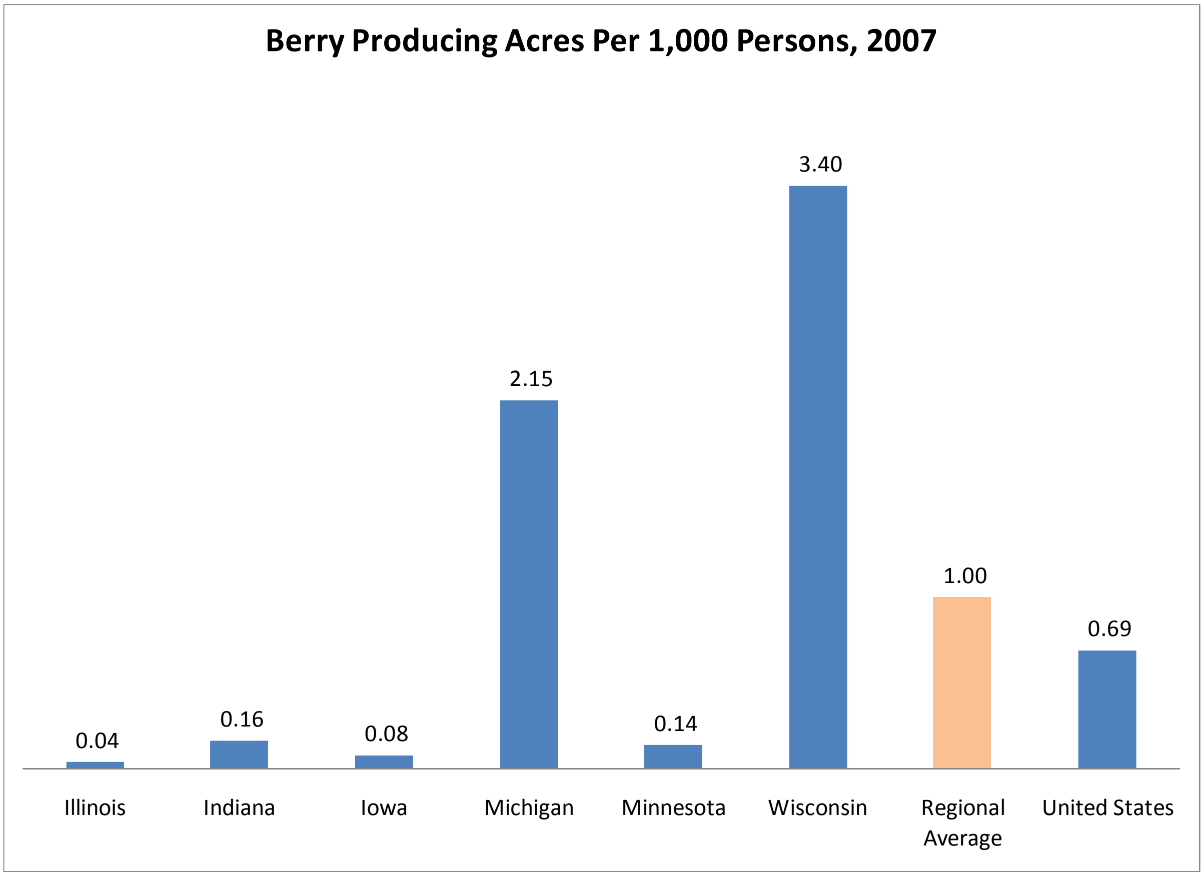

Figure 3. Source: 2007 Census of Agriculture

Table 2 gives an acre-based measure of the overall competitiveness of the states regarding fresh vegetable, fruit bearing, and berry bearing acres as compared to the national average. These estimates reflected the number of acres (not the productivity of the acres) per capita given each state's average compared to the national value. An expected value of 1.0 meant a state was, on an acreage basis for any of the categories, producing at the national average. Values greater than 1.0 indicated a capacity to produce for export, and values less than 1.0 indicated a need to import those agricultural commodities. Values relatively close to 1.0 were evidence of regional or state level self-sufficiency in production.

While the experiences of the states were mixed across the different categories, Illinois, Indiana, and Iowa ranked consistently low or very low on all measures. Minnesota demonstrated minor competitiveness in fresh vegetables, as does Michigan. Michigan demonstrated very strong competitiveness in berry production and a competitive advantage in fruit bearing acres. Lastly, Wisconsin was, on an acres basis, considered self sufficient in fresh vegetable production, but was very prominent in berry production. Overall, given the strong Michigan and Wisconsin scores, the region combined was considered self sufficient in berry production and deficient in fresh vegetable and fruit bearing acres.

Table 2. Source: 2007 Census of Agriculture

Indicators of Regional Production Competitiveness

	Fresh Vegetables	Fruit Bearing Acres	Berries
Illinois	0.15	0.05	0.06
Indiana	0.33	0.07	0.24
Iowa	0.17	0.08	0.11
Michigan	0.71	1.50	3.11
Minnesota	0.66	0.10	0.20
Wisconsin	1.06	0.21	4.92
Regional Average	0.49	0.42	1.45
United States	1.00	1.00	1.00

The values in this simple competitiveness index only looked at acres relative to the population. They did not take into account overall productivity or the mix of crops, nor did they factor in growing season length, yield differentials, or other indicators of actual capacity. They did, however, show that there was an inadequate current supply of acres producing fresh vegetables and fruits to support potential local demand were that demand measured as the national average. While the region was a very strong producer of, as examples, potatoes, sweet corn, pumpkins, apples, cherries, and cranberries, it was deficient in many other categories of annually demanded vegetables, fruits, and berries.

Estimating Regional Demand and Regional Production Potential

Our annual demand for fresh fruits and vegetables is met on a year-round basis from a combination of local, regional, national, and international suppliers. The supply that can be generated by local producers, however, is constrained primarily by the length of the growing season and the storability of the fruits and vegetables that are produced.

Per capita consumption

The potential purchased farm weights per capita for this evaluation were derived from Iowa Produce Market Calculator tables, which were constructed originally from USDA estimates of production per acre or per capita in the U.S. Table 3 provides the estimated farm level production required per capita for an abbreviated assortment of fruits and vegetables through the retail level to show the shrinkage that occurs between farm and store. These values across the entire range of potential fruits and vegetables were applied uniformly to all of the study states to provide determinants of the total pounds of each crop that would be required to satisfy the residents of the metropolitan areas in the Upper Midwest with populations of 250,000 or more.

Table 3

Example Farm and Retail Weight Assumptions, Selected Fruits and Vegetables

Item	Farmed Weight (Pounds/Capita)	Retailed Weight (Pounds/Capita)
Apples	16.4	14.4
Apricots	0.2	0.1
Asparagus	1.1	0.9
Bell Peppers	6.8	5.7
Blueberries	0.6	0.5
Broccoli	6.0	4.9
Cabbage	8.6	6.9
Cantaloupe	9.9	8.0
Carrots	9.0	8.2
Cauliflower	1.7	1.4
Cherries	1.2	1.1
Collard Greens	0.6	0.3

Required Acre Estimates

Once the total fresh fruit and vegetable commodity demand was known, the next requirement was to determine the acreage requirements. Crop productivity assumptions contained within the Iowa Produce Market Calculator per commodity were relied on to establish a crop yield baseline. The Iowa Produce Market Calculator produces an extensive array of yield values for fruits and vegetables, and it was used to project the production potential in Iowa counties in light of existing fruit and vegetable production. Those values had been reviewed by Iowa State University horticulturalists to provide "best estimates" of the state's yield potentials for these crops. Because many of the crops contained in this research are not grown commercially in Iowa, there are no standardized agricultural statistics on average yields over time or for specific regions of the state. In addition, there was very little in-state research on production practices, yield variances, or other production-related outcomes for most of the crops. The yields for Iowa were considered, therefore, reasonable in the eyes of ISU scientists given their knowledge of overall horticultural production in the state and the state's climate and other production attributes.

Table 4 lists examples of production estimates for Iowa for a selection of fruits and vegetables, and those values were used to identify the number of acres required to produce the whole range of fresh fruits and vegetables that were initially assessed. Before those factors could be used, however, adjustments had to be made for overall average productivity differences across the states.

Table 4

Selected Crop Yields in Iowa

Item	Yield (Pounds Per Acre)
Apples	13,000
Apricots	9,000
Asparagus	2,500
Bell Peppers	8,500
Blueberries	6,000
Broccoli	11,000
Cantaloupe	21,000
Carrots	30,000

Differences in average state grain crop productivity were used to adjust the values in Table 4 to arrive at yield expectations per acre across our six states, as indexed to the Iowa values.[5] Table 5 shows the yield adjustments. They were applied uniformly across all crops, and when combined with the values in Table 4 and multiplied by the appropriate demand populations determine the total acres needed to produce for the measured demand. The yield values were estimates of the capacity of the land to produce horticultural output using grain output as the major criterion

Table 5

Example Yield Assumptions (Pounds Per Acre)

	Broccoli	Cantaloupe	Carrots
Illinois	11,045	21,086	30,123
Indiana	9,539	18,211	26,016
Iowa	***11,000***	***21,000***	***30,000***
Michigan	7,903	15,087	21,553
Minnesota	8,978	17,140	24,485
Wisconsin	9,557	18,245	26,064

[5] The adjustments were the averages of the separately weighted values of the other states' 2008 yields per acre compared to Iowa for corn, soybeans, and oats.

The Amount of Regional Demand That Can Be Supplied

An Upper Midwestern growing season is shorter than the national average, and it is certainly far shorter than most areas of the U.S. that have demonstrable competitive advantages in fruits and vegetable production. In the earlier Iowa and regional studies, fruit and vegetable production for local demand was constrained to 25 percent of annual demand. That assumption was somewhat too limiting for subsequent research for two important reasons. There are fruits and vegetables that store well and are therefore available for an extended period after harvest time. Plus, we tend to consume higher quantities of some fruits and vegetables precisely because they are in season, and when they are not in season we do not consume them as much. Fresh tomatoes are an easy example, as also would be sweet corn and cantaloupes. Absent research that demonstrated the actual amounts of annual fruits and vegetables consumed during particular months among the study states, the entire array of fresh fruits or vegetables that could be produced for our Midwestern large metro populations was limited to either 25 percent of annual consumption or 50 percent of annual consumption.

Table 6 displays examples of the assigned percentages. More perishable items or items that we consume in relatively constant amounts monthly are scored 25 percent. Those we consume more of during their season or that store well are scored 50 percent. While it may be the case that more than 50 percent of a particular crop can be and in fact is produced annually, this analysis set the upper limit at 50 percent.

Table 6

Local Supply Potential Weights Per Crop

Apples	50%	Lima Beans	25%
Apricots	25%	Mustard Greens	25%
Asparagus	50%	Okra	25%
Bell Peppers	50%	Onions	50%
Blueberries	25%	Peaches	50%
Broccoli	25%	Pears	50%
Cabbage	25%	Plums	50%
Cantaloupe	50%	Potatoes	50%
Carrots	25%	Pumpkin	50%
Cauliflower	25%	Radishes	50%
Cherries	50%	Raspberries	50%
Collard Greens	50%	Snap Beans	50%
Cucumbers	25%	Spinach	25%
Eggplant	50%	Squash	50%
Garlic	50%	Strawberries	50%
Grapes	25%	Sweet Corn	50%
Kale	25%	Sweet Potatoes	25%
Lettuce (Head)	25%	Tomatoes	50%
Lettuce (Leaf)	25%	Watermelon	50%

Realistic Local Production Potential

As a penultimate step to this initial estimation process, the number of fruits and vegetables measured for local production and local consumption was limited by three factors. The first took into account the region's existing overall production of the entire array of fruits and vegetables and excluded those that the region already unarguably produced in excess of estimated regional demand. That step removed the production of potatoes, sweet corn, pumpkin, apples, grapes, cranberries, and cherries, as examples. The second limiting factor was actual evidence of production. For example, no acres of artichokes, celery, or other more tender crops are recorded in the USDA data set for our study region. Third, there were categories for which no prices for 2008, the base year for this analysis, were available from USDA data summaries, so those crops were not analyzed.

Table 7 has the final list of fresh vegetables and fruits for which a realistic increase in local production could be made to satisfy significant portions of regional demand and for which prices were either obtained or reliably estimated.

Table 7

Fruit and Fresh Vegetables Analyzed

Apricots	Lettuce (Leaf)
Asparagus	Mustard Greens
Bell Peppers	Onions
Broccoli	Peaches
Cabbage	Pears
Cantaloupe	Plums
Carrots	Raspberries
Cauliflower	Snap Beans
(Collard) Greens	Spinach
Cucumbers	Squash
Eggplant	Strawberries
Garlic	Sweet Potatoes
Kale	Tomatoes
Lettuce (Head)	Watermelon

There is one last point to make here. Subsequent economic analysis did not control for the amount of regional demand that was already met by existing regional production of the chosen crops. The impact summaries project the farming values for those 28 commodities as if the demand values displayed in Table 6 were completely met by regional farmers irrespective of whether portions of those demands were already met. The analysis was intended to be indicative of the potential value of a bundle of fresh fruit and vegetable gains over and above what are supplied across the entire range of fresh foods that we consume. No net increments to regional productivity were calculated, as there were no region-wide summaries of the actual local production / local consumption relationships. Except for the instances described previously where the acres in production were far in excess of the acres required to satisfy the entire region's needs, there were no other estimates of existing local production employed.

Study Scenario – Producing for Regional Metropolitan Markets

A typical Michigan fruit or vegetable farmer would likely sell to strong market demand in Michigan, Illinois, Indiana, as well as other Midwestern states owing to their well-established specializations in fruit and vegetable production. The situation assessed in this paper assumes that the large and concentrated metropolitan populations create opportunities for production efficiencies and intra-regional advantages that could be capitalized on by producers in the other states. Large population centers send a powerful and consistent signal to producers interested in developing their locally grown enterprises. That signal is strongest and most consistent to growers nearer the metropolitan areas than for those that are distant.

It also assumes for consistencies sake that adjacent and relatively nearby metropolitan areas are included in the subsequent measures. This allows for sales outside of the region to Omaha, NE, or St. Louis, MO, as examples. Last, a particular county can be expected to produce primarily for one or even multiple metropolitan areas, provided distances are feasible. Other counties, owing to much greater distances will be assumed to not produce for any metropolitan market. There will therefore be some counties, given the assumptions that are used, that will not be candidates for enhanced fruit and vegetable production in this scenario.

The Metropolitan Areas

This region can produce enough fresh fruits and vegetables, of the 28 measured, for 160 persons from each acre of land, given our existing consumption preferences, and given the region's weighted productivity averages and the fraction of demand that could be met. When considering a significant boost to regional fruit and vegetable production, the most consistent regional demand will be generated from larger metropolitan areas, and those larger areas would require a concentrated level of regional production – production levels that could stimulate beneficial economies of scale internal to the producers as well as economies external to the producers, such as shared marketing, warehousing, transportation, coordination, and other production-benefitting activities down-stream from the farm.

In this assessment, the metropolitan markets are 250,000 in population or larger. There has always been and there will always be elements of local fruit and vegetable production near all metropolitan areas, but if the local foods emphasis is on boosting the most production to serve the most concentrated demand, then focusing on the region's largest metropolitan areas offers the most potential consumption volume relative to the average distance a producer might be from any given major market. Smaller metropolitan markets are important, but this multi-state analysis considered the major metropolitan areas as the primary drivers of local foods production potential.

The metropolitan areas were measured in terms of all the counties that comprised the metropolitan or the combined metropolitan areas in 2008. Table 8 lists the 28 primary metropolitan markets. They ranged from a low of 252,472 persons in the Cedar Rapids, IA, metro to a high of 9.5 million in the Chicago region. The average size was 1.27 million persons, although the average was skewed sharply by the larger places – just seven were larger than the weighted average, and 21 are smaller.

Table 8

Metropolitan Area	2008 Population	Metropolitan Area	2008 Population
Ann Arbor, MI	347,969	Holland-Grand Haven, MI	258,461
Cedar Rapids, IA	252,472	Indianapolis, IN	1,692,737
Chicago-Naperville-Joliet, IL-IN-WI	9,496,853	Kalamazoo-Portage, MI	322,340
Cincinnati-Middletown, OH-KY-IN	2,143,824	Lansing-East Lansing, MI	455,071
Davenport-Moline-Rock Island, IA-IL	375,638	Louisville, KY-IN	1,232,304
Dayton, OH	838,828	Madison, WI	554,267
Des Moines, IA	545,669	Milwaukee-Waukesha-West Allis, WI	1,543,378
Detroit-Warren-Livonia, MI	4,457,523	Minneapolis-St. Paul-Bloomington, MN-WI	3,197,620
Duluth, MN-WI	273,757	Omaha-Council Bluffs, NE-IA	827,666
Evansville, IN-KY	349,723	Peoria, IL	370,793
Flint, MI	434,027	Rockford, IL	351,260
Fort Wayne, IN	409,177	South Bend-Mishawaka, IN-MI	316,233
Grand Rapids-Wyoming, MI	774,931	St. Louis, MO-IL	2,805,465
Green Bay, WI	301,056	Toledo, OH	650,770
		Total Population	35,579,812

The table included several metropolitan markets that were on the edges or outside of the six states. The Omaha, St. Louis, Toledo, Cincinnati, Dayton, Evansville, and Louisville metropolitan areas were not part of our six state totals, but were within marketing reach of many of the states' producers.

Determining the Propensity and the Capacity to Produce

Research recently completed at Iowa State University provided a procedural template for the next step in the estimation process (Swenson 2010). That research consisted of a 12 county, but primarily rural and sparsely populated area , and the sponsors were interested in the farmer income and job impact potential of expanding production for the metropolitan markets of Omaha on the western edge and Des Moines on the eastern edge.

There were three factors used to determine the propensity or capacity to produce for those nearby markets:

- Factor 1. The number of farms smaller than 50 acres in size. Small farms in the Upper Midwest are more likely to produce fruits and vegetables than standard farms. The incidence of small farms was also greater in more urban counties.[6]

- Factor 2. The amount of harvested cropland in 2007. This was simply the supply of land that was being farmed for any purpose in 2007.

- Factor 3. Distance. The probability of either Factor 1 or Factor 2 playing a role in contributing to any of the several metropolitan areas' local foods demand was delimited by the sheer miles that farm produce must be transported. In the subsequent analysis, a threshold distance of 150 miles was established. Distance to a market need not be limited, but for the purposes of identifying primary potential production areas, the 150 mile limit seemed reasonable.[7]

Considering all three, then, Factor 1 is the propensity to produce, Factor 2 is the capacity to produce, and Factor 3 is a countervailing limit on production for a particular market due to distance and the impacts of transportation costs on farmer returns.

Calculating Distances

A matrix of distances was calculated for each of the 535 counties in the six states to each of the 28 metropolitan markets within 150 miles. This 535 X 28 matrix of values represented the right-angled distance between all points considering the population weighted midpoint of the county and the population weighted midpoint of the entire metropolitan area that was to be served. Each metropolitan area's population-weighted midpoint represented the point on a plane that considered the densely populated central cities and the less dense suburban place compositions. Each county's midpoint in the six-state region was the weighted value of all places within the county.

This process provided all of the potential to-metropolitan supply opportunities and provided the distances that were used to adjust the production propensity and production capacity factors above.

Calculating Weights

All counties under Factor 1 and Factor 2 above generated a score representing the propensity or the capacity of the county to produce for the metropolitan regions given their sums of distances from all of them. By dividing those factors by the sum of all scores for all counties, the share of that factor's

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[6] In previous research the duplicated number of farms that grew vegetables, orchard farms, organic farms and farms being converted to organic, goat farms with sales, sheep and lamb farms with sales, poultry farms, meat chicken farms, and layer chicken farms were used to weight the counties. Changing that multiple-variable consideration to the number of farms with fewer than 50 acres did not alter the results and was much easier to compile.

[7] Research on a 12 county region of southwestern Iowa considered the probability of selling to metropolitan markets on their eastern and western borders. That research demonstrated, using the methods employed here, that the probability of producing for a metropolitan area was relatively low for counties as many as 100 or so miles distance from that metro area. To be somewhat more inclusive, then, the 150 mile threshold was chosen to allow as much possible and realistic production as seemed practical given the emphasis on "local food" production, not national markets. That ISU report can be found at: http://www.leopold.iastate.edu/research/marketing_files/swiowa.pdf .

contribution to the total value for each metropolitan candidate was obtained weighted by either the propensity to produce (the small farms factor) or the capacity to produce (the cropland factor).

Calculating Regional and Extra-Regional Demand

It was assumed that all of the metropolitan areas completely contained within the six-state region could have a substantial portion of their fresh fruit and vegetable consumption produced by regional farmers, given the production assumption limits in Table 6 (either 25 percent or 50 percent of the demand, given the fruit or vegetable type). For all metropolitan areas that bordered the six states, just 50 percent of their population demand was used. The argument there was that the other side of that metropolitan region, the portion in states outside of the region, was just as capable of producing for that metropolitan area as the counties within the region. The same assumption was used for the metropolitan areas in Ohio that were somewhat distant from the regional boundaries, but still potential markets. The 50 percent limit was applied to them, but the extra distance also limited the overall propensity to produce for that region. As those three Ohio metropolitan midpoints were a scant one-county's distance from the regional boundaries, no other adjustments were made for them.[8]

Applying the Weights to Metropolitan Demands

The allocation values in each county for Factor 1 and for Factor 2 were applied to the estimated demand for each metropolitan area, to the extent the county was within the 150 mile limit. This produced two values for each county. The first would be the sum of all metropolitan demands weighted by the number of small farms, as limited by distance. The second would be the sum of all metropolitan demands weighted by the amount of harvested cropland, as limited by distance. Those two factors were averaged to estimate the average amount of demand for each metropolitan area that would be met by each county in the region. That value was then divided by the statewide productivity values per county in those states to estimate the number of acres that would be producing for the metropolitan areas.[9]

Table 9 provides the aggregate outcomes. Within the six states, 195,669 acres would have been required to produce $637.4 million in fruit and vegetable sales in 2008.

Table 9

Production Outcomes for the Metropolitan Markets

Acres Required	195,669
Farm Value	$637,441,980

[8] This method did not allow nor adjust for the likelihood that out-of-region counties could be producing for within-region metros using the same distance-limiting assumptions. That was an oversight. Accordingly, the analysis over-estimates regional production in part.

[9] To be methodologically consistent, it would have been preferable to calculate the crop acre weights considering their expected yields. Not doing so was an oversight that was remedied in part here.

The visual outcomes reflect the much higher concentrations of production that would be expected for counties that were close to metropolitan areas or were serving more than one major market. Figure 4 shows the allocation of acres for the entire region. The population midpoints of the 28 metropolitan areas are also displayed on the map as well. It is immediately evident that, given the 150 mile production threshold, 54 counties would be too far away to produce for any of our large metropolitan areas. These areas were, logically, most of the western two-to-three tiers of counties in Minnesota extending into northwest Iowa, plus much of northern Wisconsin, the Upper Peninsula of Michigan along with other northern Michigan counties, plus a few counties in extreme southern Illinois. The lightest values represented 5 to 249 acre intervals, with the implicit understanding that value approaches 249 acres the closer to a metro and 5 acres the farther away. The amount of acre potential per county grows to over 1,000 in the two more darkly-colored categories.

Figure 5 provides the same type of information translated into estimated farm sales value gradients. The lightest county values were less than $1 million, with those at the most distance from the metropolitan areas approaching values that were less than $15,000 per county. The two darker categories indicated total fruit and vegetable farm sales potentials in excess of $5 million.

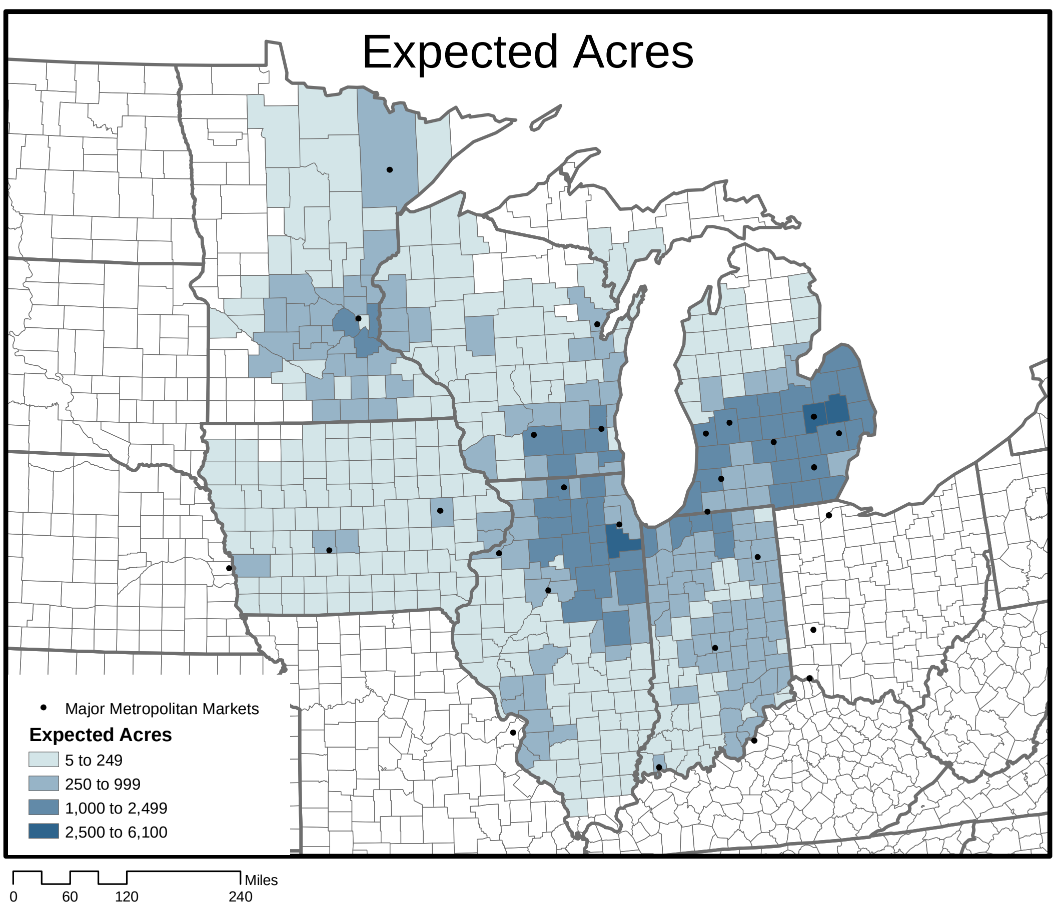


Figure 4

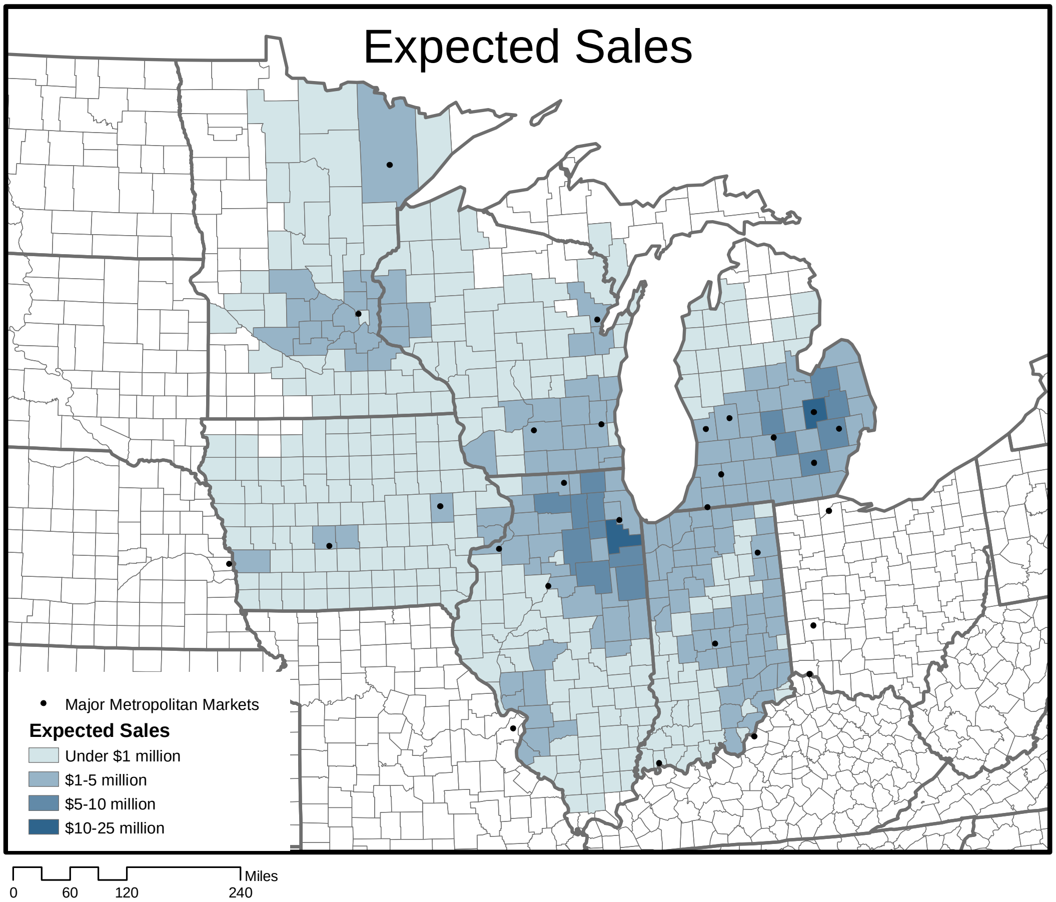


Figure 5 (Farm Sales)

The Regional Economic Outcomes

Table 10 lists the distributions that result from the acreage and sales allocation processes that were just described. There would be fewer than 250 acres of production in 53 percent of the counties and just 10.5 percent had the potential of 1,000 acres or more. Over 57 percent of the counties would have had gross farm-level sales under $1 million, and only 3.2 percent would have had sales in excess of $5 million. The higher productivity intervals of 250 to 999 acres and $1million to $4,999,999 in sales are the categories where the most intermediate level production and sales would occur and would represent areas where state agencies or land-grant universities would target development resources.

Table 10

Distribution of Counties by Acres and Total Farm-Level Sales

Acres	Counties	Sales	Counties
None	54	None	54
1 to 249	283	Under $ 1 M	306
250 to 999	141	$1M to 4.999 M	158
1,000 to 2,499	54	$5 M to $9.999 M	15
2,500 or more	2	$10 M or more	2

Table 11 summarizes the acreage values, farm sales, and the estimated sales per acre for our metropolitan production scenario. Strong advantages accumulated to Illinois in total sales by virtue of its metropolitan populations and its higher crop production scores. More acres would be required of Michigan's cropland than any other state due to the productivity adjustment that was described in Table 5. More distant and less populous Iowa has the lowest farm sales and contributing acre values notwithstanding its comparatively high yield values.

Table 11

Farm Sales and Acreage Requirements to Selected Metropolitan Areas by State

	Farm Sales	Acres
Illinois	188,664,354	49,596
Indiana	130,774,296	39,804
Iowa	34,048,702	8,987
Michigan	155,960,538	57,300
Minnesota	55,875,658	18,071
Wisconsin	72,118,432	21,911
Region	$637,441,980	195,669

Understanding Economic Impact Analysis Process

The total economic value of a specific type of productivity was measured using an input-output (IO) model of the area of scrutiny. For this study, state level data bases were purchased so that each state's industrial characteristics were analyzed uniquely, which in turn allowed for the compiling of separate state level summaries.

The tables produced in IO models display the amount and the types of economic activities that are generated when fruits and vegetable production increase in a state. There are four categories of economic information that were produced in subsequent tables:

- Total industrial output. This is the value of what is produced in the industries are evaluated.
- Total value added. Value added is composed of wages and salaries to workers, returns to management to sole proprietors, incomes from properties and other investments and indirect tax payments that are part of the industrial production processes. Value added is the same thing as Gross Regional Product, and it is the standard manner in which we gauge the size of an economic activity, especially on a comparative basis with other regions or states.
- Labor income. Labor income is a subset of value added. It is composed of the payments to workers and the proprietors' incomes. Labor incomes are useful for regional analysis because large fractions accumulate to resident workers, whereas incomes from investments, for example, may accumulate out of the region of scrutiny.
- Jobs. Jobs are not the same as employed persons as many people have more than one job. There are, therefore, more jobs in an economy than employed persons. In addition, no jobs are created equal. Some are seasonal, others are part-time. The modeling system provides an annualized value of the jobs associated with some level of industrial output even if the jobs only occur during a short period of time, which would be the case for fruit and vegetable production jobs or many other crop production jobs.

There were three levels of economic activity summarized.

- Direct activity. This refers to all of the economic values listed above in the industry that we are assessing. In subsequent analyses, for example, all fresh fruit and vegetable production is the direct activity.
- Indirect activity. All firms require inputs into production such as raw commodities, chemicals, services, wholesale goods, transportation, banking services, and utilities. When levels increase or decrease in the direct sector, that influences the demand for inputs.
- Induced activity. This occurs when workers in the direct firm and workers in the indirect, the supplying, sectors convert their labor incomes in to household consumption. This stimulates another round of regional economic activity that, in turn, stimulates jobs and pays incomes.

We sum these values to arrive at an estimate of the total economic value of a particular kind of industrial production.

The phrase *economic value* is used instead of *economic impact* when describing the subsequent findings. In this kind of analysis, the term *economic impact* is reserved for occasions in which we can document net increases in regional productivity. Those increases would happen if a region were expanding export sales or, as is the case here, reducing imports by substituting locally grown foods for imported foods.

The degree to which an economic activity is indeed producing incremental export or import substituting gains constitutes the regional economic impact. This study, however, identifies the full value of the economic activity, here fruit and vegetable farming, but it does not estimate how much of that production would be considered new production in the state or regional economies given existing within-region production. That declaration is even harder to discern when one assumes that there are substantial imports into, say, Illinois or Indiana from Michigan, a major fresh fruit and vegetable producer within the region. Were Illinois to effectively substitute for imports, for example, it would favor Illinois production over Michigan imports. The accounting of all of this complexity was not possible in this study.

Input Output Model Adjustments and Other Considerations

Data were obtained to build IO models for each of the participating states. Assuming the region, on net, had deficits in its overall production of vegetables and fruits, those two separate agricultural sectors in the modeling system were modified in all of the states so that they approximated national averages, as a significantly-expanded local production scenario logically presupposed the attainment of production efficiencies and labor to output ratios that would be competitive with the average national producer. This involved re-stating the fruit and vegetable production sectors in each state so that they made payments to workers and producers similar to national averages, with payments to labor adjusted for the state's average per job relative to the national average. This allowed the modeling system to suppose efficient and to-scale production on a statewide basis of fruits and vegetables and eliminated the distortions that occurred in the original data because of a predominance of one type or another of production in states like Iowa and Minnesota where production might be highly concentrated in just a few crops like potatoes or sweet corn, and the jobs per output values were very low.

Next, cropland in the region was treated as fixed. For there to be an increase in fresh fruit and vegetable production in the Upper Midwest, that land must come from existing conventional crop production. As corn and soybean are dominant crops in these states, comparisons were made to an equivalent amount of corn and soybean farming on the same acres to demonstrate the potential net shifts in regional jobs, incomes, etc., from trading one form of crop production for another. As, comparatively, the amount of land needed to satisfy regional fruit and vegetable demand was relatively small, the overall production consequences to the total corn and soybean industry was comparatively nominal, but still important to acknowledge and document.

Impact Modeling Outcomes

Table 12 uses the state-by-state farm sales values in Table 11 to estimate the direct, indirect and induced, and the total economic values that would be expected from this scenario. For the region, the total economic output would be $1.027 billion, with 6,694 jobs requiring $284.61 million in labor income producing $519.4 million in value added (or GDP) based on the value of the fruit and vegetable sales and concomitant indirect and induced activity that would support. Nearly three-quarters of the jobs would be concentrated in Illinois, Indiana, and Michigan. The fewest would be in Iowa.

Table 12

Fruit and Vegetable Farm Level Results

Direct Values

	Output $	Value Added $	Labor Income $	Jobs
Illinois	188,664,354	91,175,021	49,435,544	1,111
Indiana	130,774,296	63,240,659	34,294,034	771
Iowa	34,048,702	16,439,654	8,912,040	198
Michigan	155,960,538	75,478,868	40,937,223	920
Minnesota	55,875,658	27,009,967	14,645,735	329
Wisconsin	72,118,432	34,902,847	18,930,142	425
Region	637,441,980	308,247,017	167,154,718	3,754

Indirect and Induced Values

	Output $	Value Added $	Labor Income $	Jobs
Illinois	122,716,312	67,031,835	36,713,439	747
Indiana	81,262,343	41,293,344	22,058,730	578
Iowa	19,748,210	10,282,162	5,679,181	166
Michigan	89,462,343	50,113,254	28,069,225	764
Minnesota	34,325,656	19,320,099	11,035,700	281
Wisconsin	42,701,094	23,133,842	13,896,048	403
Region	390,215,959	211,174,536	117,452,323	2,940

Total Values

	Output $	Value Added $	Labor Income $	Jobs
Illinois	311,380,666	158,206,856	86,148,983	1,859
Indiana	212,036,639	104,534,003	56,352,764	1,349
Iowa	53,796,912	26,721,816	14,591,221	364
Michigan	245,422,881	125,592,122	69,006,449	1,684
Minnesota	90,201,314	46,330,066	25,681,435	610
Wisconsin	114,819,526	58,036,689	32,826,190	828
Region	1,027,657,939	519,421,553	284,607,041	6,694

Table 13 gives the total economic values that could be produced in the regions were the acres in Table 11 used to produce conventional row crops. It also serves as an estimate of the offsets that would accrue in the state economies when land is converted from one productive use to another. Here, considering the scenario of producing for the major metropolitan markets, the land required for fruits and vegetable production would generate, had it been used for corn and soybean production, $317.9 million in industrial output, $150.6 million in value added, $42.5 million in labor income, and would support 1,892 jobs considering all farm level, indirect, and induced activity.

Table 13

Corn and Soybean Farming Offsets

	Output $	Value Added $	Labor Income $	Jobs
Direct Values				
Illinois	61,574,744	27,883,084	4,726,596	307
Indiana	47,690,123	22,038,187	3,256,936	324
Iowa	10,966,853	4,695,550	1,080,582	39
Michigan	59,982,268	26,928,511	4,898,643	383
Minnesota	20,481,757	9,239,324	1,669,923	115
Wisconsin	21,456,183	9,234,699	1,752,288	137
Region	222,151,927	100,019,354	17,384,968	1,304
Indirect and Induced Values				
	Output $	Value Added $	Labor Income $	Jobs
Illinois	28,431,094	15,287,820	7,545,769	147
Indiana	19,808,370	9,790,491	4,653,696	122
Iowa	4,513,634	2,326,200	1,183,854	34
Michigan	25,821,695	13,728,725	6,877,241	165
Minnesota	8,439,364	4,742,400	2,406,746	61
Wisconsin	8,688,507	4,709,400	2,460,049	59
Region	95,702,663	50,585,035	25,127,355	588
Total Values				
	Output $	Value Added $	Labor Income $	Jobs
Illinois	90,005,838	43,170,903	12,272,366	454
Indiana	67,498,493	31,828,678	7,910,632	446
Iowa	15,480,487	7,021,749	2,264,437	72
Michigan	85,803,963	40,657,236	11,775,884	548
Minnesota	28,921,120	13,981,724	4,076,668	176
Wisconsin	30,144,690	13,944,100	4,212,337	196
Region	317,854,591	150,604,390	42,512,324	1,892

Differencing the two tables gives the values in Table 14. Given the production scenario and all offsets, growing the fruits and vegetables described in this analysis would support a net gain of 4,802 jobs making $242.1 million in labor incomes. Total value added would be $368.82 million.

Table 14

Total with Conventional Crop Offsets	Output $	Value Added $	Labor Income $	Jobs
Illinois	221,374,828	115,035,953	73,876,618	1,405
Indiana	144,538,146	72,705,325	48,442,133	903
Iowa	38,316,426	19,700,067	12,326,784	292
Michigan	159,618,918	84,934,886	57,230,564	1,136
Minnesota	61,280,194	32,348,342	21,604,767	434
Wisconsin	84,674,836	44,092,589	28,613,852	632
Region	709,803,348	368,817,163	242,094,718	4,802

Applying the Same Techniques to Iowa Considering Its Metropolitan Areas – A Within-State Evaluation

Lessons learned from the foregoing analysis were applied to the state of Iowa considering all within-state and nearby metropolitan areas using the same bundle of fruits and vegetables utilized in the multi-state study. This analysis, given the smaller average size of the metropolitan areas, reduced the viable distance to 100 miles for all of Iowa's counties.

Calculating In-State and Out-of-State Metropolitan Demand

Table 15 indicates that Iowa metropolitan or combined metropolitan areas could have from 100 percent of their seasonal fresh fruits and vegetable consumption (either 25 percent or 50 percent of annual amounts) produced by Iowa farmers, as in the case of Ames, IA, to a low of 40 percent in the case of the Omaha-Council all given all of the fruit and vegetable production levels specified in Table 6. The percentages are less than 100 percent for eight of the nine Iowa metropolitan areas because there are non-Iowa counties within 100 miles of those metropolitan areas that would also compete for those metropolitan sales. To maintain consistency in this analysis, those out-of-Iowa counties were allowed to produce for Iowa metropolitan market, as well.

Table 15

Iowa Metropolitan Areas	Percentage of Demand Met by Iowa Farmers	Nearby Metropolitan Areas	Percentage of Demand Met by Iowa Farmers
Ames, IA	100%	Janesville, WI	5%
Cedar Rapids, IA	90%	La Crosse, WI-MN	20%
Davenport-Moline-Rock Island, IA-IL	50%	Lincoln, NE	10%
Des Moines-West Des Moines, IA	95%	Mankato-North Mankato, MN	10%
Dubuque, IA	60%	Peoria, IL	3%
Iowa City, IA	85%	Rochester, MN	10%
Omaha-Council Bluffs, NE-IA	40%	Rockford, IL	5%
Sioux City, IA-NE-SD	60%	Sioux Falls, SD	20%
Waterloo-Cedar Falls, IA	90%	St. Joseph, MO-KS	5%

Iowa's ability to produce for the out-of-state metros ranged from 20 percent in Sioux Falls, SD, and La Cross, WI, to a low of 3 percent for Peoria, IL. In these cases, Iowa farmers are competing with significantly more out-of-state farmers who are located closer to those metros.

Applying the County Weights to Metropolitan Demands

As before in the multi-state example, the allocation values in each county (number of small farms and cropland) were applied to the estimated demand for each metropolitan area, to the extent the Iowa county was within the 100 mile limit. This produced two values for each county. The first would be the sum of all metropolitan demands weighted by the number of small farms, as delimited by distance. The second would be the sum of all metropolitan demands weighted by the amount of harvested cropland, as delimited by distance. Those two factors were averaged to estimate the amount of demand for each metropolitan area that would be met by each county in the region considering both factors and the number of acres necessary to meet that production.

Table 16 lists the acreage requirements and the expected farm sales. Iowa farmers would have needed 10,548 acres of total production to satisfy the metropolitan demands.[10] In marketing those fruits and vegetables, Iowa farmers would have received $39.96 million in sales.

Table 16

Production Outcomes for the Metropolitan Markets
Served by Iowa Producers

Acres Required	10,548
Farm Value	$39,960,374

The visual outcomes are more dramatic and reflect the much higher concentrations of production in metro counties, those counties close to metropolitan areas, or those that were serving more than one major market. Figure 6 shows the estimated allocation of acres for Iowa. Given the 100 mile production threshold, Appanoose, Clay, Davis, Palo Alto, and Pocahontas County would not be expected to competitively produce for the in-state and out-of-state metropolitan areas.[11] The density of dots increases markedly within and around metropolitan areas and for those areas that are spatially fortunate to fall between more than one metro.

Figure 7 provides the same type of information translated into estimated farm sales value gradients. The darkest county values represent farm sales opportunities in excess of $1 million. Pottawattamie County near Omaha-Council Bluffs would be expected to require 809 acres to meet the needs of their

[10] The average Iowa county has slightly fewer than 240,000 acres of cropland. This scenario would have required, then, less than 5 percent of the cropland in a typical county, and less than .05 percent of all cropland in the state.
[11] The northwestern counties of Clay, Palo Alto, and Pocahontas have high numbers of animal feeding operations and a substantial number of the state's ethanol plants are located. They also posted some of the highest rates of population decline over the past decade. The southeastern areas of Appanoose and Davis County have much poorer overall agricultural productivity and much lower levels of economic activity in general.

metropolitan region and neighbors, followed by Polk County at 425 acres. In contrast, Emmett and Humboldt County would only be expected to devote 6 acres each.

Figure 6

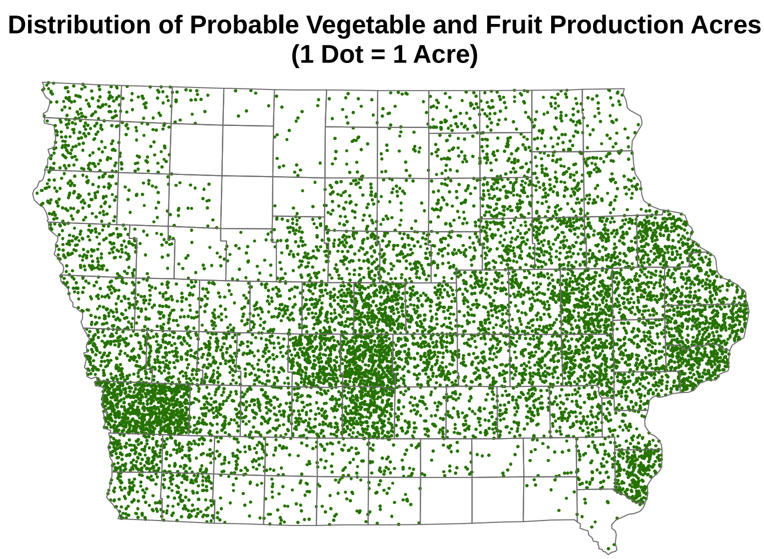
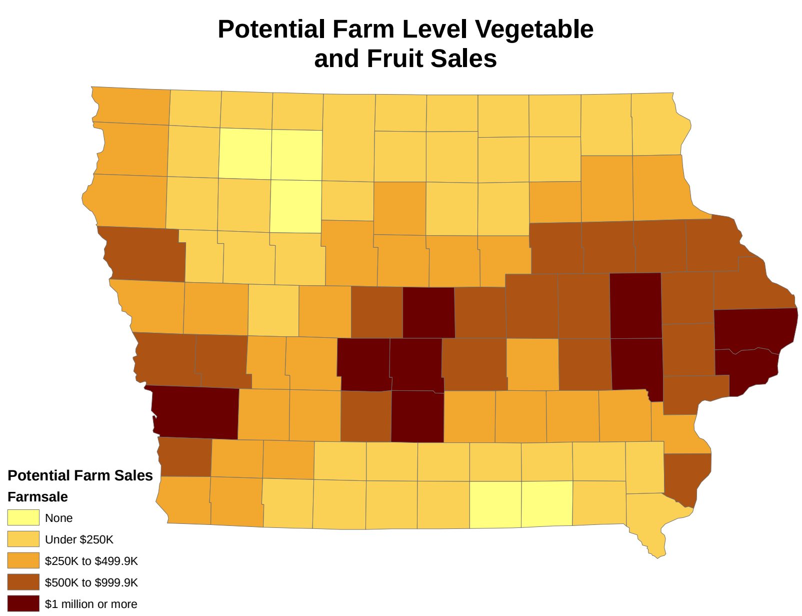


Figure 7 (Farm Sales)



Iowa Economic Outcomes

Table 17 lists the acreage and farm sales allocation intervals. There would be fewer than 50 acres of production in 36 counties and only 9 posted production potentials of, given regional metropolitan demand, 250 acres or more. Those nine counties would see potential gross farm-level sales in excess of $1 million. The higher productivity intervals of 50 to 249 acres and $250,000 to $999,999 in sales were the counties categories where the higher incidences of comparatively higher-valued production would occur.

Table 17

Distribution of Counties by Acres and Total Farm-Level Sales

Acre Intervals	Counties	Farm Sales Intervals	Counties
None	5	None	5
1 to 49	31	Under $250,000	38
50 to 99	18	$250,000 to $499,999	28
100 to 249	36	$500,000 to $999,999	19
250 or more	9	$1 million or more	9

Table 18 has the results obtained by running $39.96 million in fruit and vegetable sales through the adjusted IO modeling system for Iowa. In producing those farm level sales for metropolitan consumption, Iowa would have required the annual equivalent of 232 direct jobs making $10.5 million in combined labor income (which includes payments to all workers and to the farmers). In so doing, Iowa farmers would have required $12.83 million in inputs, which would further need 97 jobs making $3.6 million in labor income. When the workers in the farm and the supplying sector spent their earnings, they induced $10.35 million in additional Iowa output, which further required 98 jobs making $3.08 million in labor income. All combined, farm level production considering all linkages and household spending would link to $63.14 million in output, 428 jobs, and $17.1 million in statewide labor income.

Table 18

State of Iowa Farm-Level Economic Values of Fruit and Vegetable Production

	Direct	Indirect	Induced	Total	Multiplier
Output $	39,960,374	12,828,397	10,348,576	63,137,347	1.58
Value Added $	19,293,973	6,311,187	5,756,206	31,361,365	1.63
Labor Income $	10,459,384	3,577,569	3,087,654	17,124,606	1.64
Jobs	232.4	96.8	98.4	427.6	1.84

The previous table also lists state-level total impact multipliers for the scenario. These were obtained by dividing the total value by the direct value in each category. The output multiplier of 1.58 means that for each $1 in output, $.58 in output was sustained in the supplying and induced sectors. The multiplier of 1.64 for labor income means that for each $1 in labor income at the farm level, $.64 in labor income was supported in the rest of the economy. The jobs multiplier of 1.84 means that for every farm job, another 84/100th of a job was sustained in the rest of the Iowa economy.

Table 19 shows the total economic values that would be produced in Iowa were those same acres used to produce conventional row crops.   The land required for fruits and vegetable production would generate, were it used for corn and soybean production, $18.2 million in total statewide economic output when considering direct, indirect, and induced linkages, which would yield 85 total jobs and $2.7 million in labor income. The multipliers in the table are to be interpreted in precisely the same manner as the previous example.

Table 19

State of Iowa Farm-Level Economic Values of Corn and Soybean Production

	Direct	Indirect	Induced	Total	Multiplier
Output $	12,870,962	3,650,180	1,647,129	18,168,271	1.41
Value Added $	5,510,810	1,813,065	917,019	8,240,893	1.50
Labor Income $	1,268,197	898,877	490,522	2,657,597	2.10
Jobs	45.5	23.7	15.7	84.9	1.87

Differencing the two, this scenario would support 343 more jobs making $14.5 million in labor incomes on this cropland, with the preponderance of those accumulations located nearer the metropolitan areas.

The previous two tables described the maximum gains and the concomitant offsets that could result if land were shifted from corn and soybean production to fruit and vegetable production as described in this report.   As a consequence, there is net productivity growth in Iowa to the extent that a locally produced agricultural commodity replaces one that was imported. That is called import substitution, and it is a standard mechanism to develop regional economies by achieving greater levels of production self-sufficiency. To the extent that Iowa producers would be able to satisfy demands beyond the state’s borders also has the potential of increasing the state’s next exports of agricultural commodities, which also boosts in-state productivity. The degree to which economic impacts actually accumulate, given the corn and soybean production offsets due to the fixed cropland assumption, depends on the extent to which Iowa producers in fact significantly substitute locally grown foods for imported foods – a propensity that is yet to reveal itself. Additionally, sales to metropolitan areas that are outside of the state constitute exports and are thus considered economic impacts from an in-state accounting perspective.

Conclusions and Cautions

The results of this report were projections based an extended set of successive assumptions. The longer the string of assumptions, the more tenuous one’s affection for the results. Owing to the linear and linked nature of the modeling process, early assumptions may carry great weight by the time final results are determined. Average fruit and vegetable yields among our states were indexed to variations in grain yields per acre as a proxy for production. That was the basis for the variation across the states and the initial productivity driver for the states in the Midwestern study. In addition, those variations were applied to estimates of fruit and vegetable production potentials in Iowa for many crops that have not produced in large amounts commercially. Those estimates have been reviewed by ISU horticulturalists, but they remain estimates with precious little farm enterprise budget research to refine the modeling processes. One is left to wonder whether, at the scale supposed, whether the necessary acres required in the Midwest or in Iowa were properly estimated.

This is an important limitation of current local foods research. The larger market is already telling us where local foods, as historically evolved, have succeeded. Evidence of emerging successes is primarily anecdotal and not based on Cooperative Extension farm or survey research. According to the USDA (Martinez 2010)

> … future research will need to examine relationships between farm size and location, land and operator characteristics, mix of products and marketing outlets, and relative costs and returns associated with local food marketing. Understanding these relationships will help uncover the incentives and disincentives that exist for participating in local food markets, how they vary across the farm landscape, and how policies can encourage participation (p. 50)

Until that basic research has been conducted, input-output modelers can only guess at adjustments to existing modeling systems needed to realistically project likely regional gains from local food production and sales improvements. This study made states that were significantly deficient in vegetable and fruit production align with national averages in those modeling categories as they were reported in the Implan data for the U.S. Those industrial values were improvements over the state amounts, most especially for Iowa, Illinois, and Indiana which had very little comparative fruit and vegetable production. Using state-specific research would be a marked improvement in the estimation process and model configuration.

The scenarios presented here were a more realistic depiction of a potential producer-to-consumer relationship in space and in overall farm values than estimates for a single state or residential demand in a particular sub-region as if they were insular entities. Dense metropolitan demand will likely induce production proximate to that demand. Suppliers at greater distances will incur higher costs and will be less inclined towards this type of production. Those dynamics are captured with the production limits used in this evaluation. As local food expansion does not at its early stages of description entail high levels of specialization and other beneficial agglomerations, one must assume that transport costs are significant as (or if) production systems evolve.

This research used either 150 miles in the regional case or 100 miles for Iowa as the cut-off for production. Using a fixed value is not necessary as the formulae would reduce participation probabilities for outlying counties to very low amounts nonetheless. Still, this raises an analytic point that again must rely on good regional farm level research to discern for future studies: the reduction formula used in this analysis a constant (distance) in the denominator. There is really no reliable research as of yet to determine the appropriate average value of that distance-decay function given different types of fruits and vegetable production re-introductions.

This has been a modeling process to produce sets of reasonable results, given the chosen assumptions and the limits to the data. The job and income projections presuppose the ability to produce at much higher levels than currently exists among these states, excepting Michigan, which has extensive fruit and vegetable production experience. It is reasonable to ask just where the labor that would staff this emerging capacity might emanate from. It could be the case that enhanced rural-urban heterogeneity might be adding labor force members who would eagerly staff such operations. Given the array of job opportunities near urban areas, however, one is hard-pressed to assume an efficient reverse-migration to fringe area farms. Again, more research is needed.

The logic used in this research indicates that the majority of income and job gains from expanding local foods production capacities among the various states will disproportionately accrue in and near metropolitan areas – areas that already are likely beneficiaries of metropolitan economic spread effects. More outlying rural areas, areas that are experiencing more community-level deterioration are unlikely beneficiaries.

This research also demonstrates that with the use of very optimistic production scenarios, the total number of jobs that could be added from increased farm production is relatively small. In the Iowa example, a total of 343 jobs would be linked with supplying the fruits and vegetables to the metropolitan populations. By way of comparison, Iowa lost an average of 2,300 farmer proprietors per year between 2000 and 2009.

One must also not forget that very high levels of fresh fruit and vegetable consumption in the study states are currently not met by regional producers or directly-distributed by farmer retailers regardless of the assumptions and methods employed in this research. There are sound and powerful market antecedents for those facts that, despite this research and much of the efforts to date, cannot be simply assumed away.

Finally, if state land-grant universities and state agencies are charged with addressing local foods implementation and programming, it is incumbent upon them to conduct farm-level and regional-level research that more adequately advises policy development so that scarce public resources are used wisely and with the greatest economic and desired social outcomes. The worth of potential outcomes should come from an accumulation of research, not from an accumulation of promotional voices.

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