**The role of US organic certifiers in organic hotspot formation**

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*The views expressed here are those of the authors and not necessarily those of the U.S. Food and Drug Administration.

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## Objectives

The purpose of this paper is to investigate the **formation of hotspots of organic operations** (geographically close areas that have positively correlated high numbers of organic operations), paying particular attention to the role of the **organic certifying agent.** We analyze **the association of county-level factors related to policy, economics, demographics and organic certifiers with the probability that a county is in a hotspot or coldspot** (geographically close areas that have positively correlated low numbers of organic operations) of organic operations.

## Methodology

### Step 1: Identify hotspots and coldspots of organic operations:

**Local Moran's I** (Anselin, 1995)

$$I_i = (x_i - \bar{X})\Sigma_{j \neq i} w_{ij}(x_j - \bar{X})$$

A permutation method is used to test the null hypothesis of spatial autocorrelation and identify whether a county belongs to a hotspot or coldspot

### Step 2: Identify county-level factors associated with the presence of hotspots and coldspots of organic operations:

**Logit** (Cameron and Trivedi 2005 ):

When F is the cdf for $\varepsilon_i$,

$\Pr[y_i = 1] = \mathrm{F}[\boldsymbol{x}, \boldsymbol{\beta}]$.

**Where $y_i$ takes on a value of 1 if the county belongs to a hotspot (coldspot)**, identified in Step 1. The **x matrix represents county-level variables** associated with the presence of hotspots and coldspots. When $\varepsilon_i$ follows a logistic distribution, the model is a logit.

## What are the characteristics of Organic Certifiers?

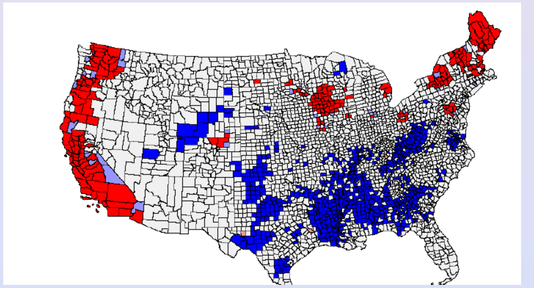
### List of organic certifiers with more than 100 certified operations

| Certifying agent | Provides outreach | Government | Number of operations certified |
|---|---|---|---|
| California Certified Organic Farmers Certification Services | Yes | No | 2146 |
| Quality Assurance International | No | No | 1317 |
| Midwest Organic Services Association, Inc. | Yes | No | 1284 |
| Oregon Tilth | Yes | No | 1227 |
| Washington State Department of Agriculture | No | Yes | 1165 |
| Organic Crop Improvement Association International | Yes | No | 1031 |
| Ohio Ecological Food and Farm Administration | Yes | No | 700 |
| Northeast Organic Farming Association of New York | Yes | No | 662 |
| Global Organic Alliance | No | No | 631 |
| Vermont Organic Farmers, LLC | Yes | No | 551 |
| Pennsylvania Certified Organic | Yes | No | 532 |
| Quality Certification Services | Yes | No | 484 |
| Guaranteed Organic Certification Agency | No | No | 426 |
| Indiana Certified Organic | No | No | 408 |
| Organic Certifiers | No | No | 395 |
| Maine Organic Farmers and Gardeners Certification Services, LLC | No | No | 385 |
| Texas Department of Agriculture | No | Yes | 346 |
| Iowa Department of Agriculture and Land Stewardship | No | Yes | 326 |
| Idaho State Department of Agriculture | No | Yes | 298 |
| OneCert | No | No | 241 |
| Kentucky | No | Yes | 237 |
| Baystate Organic Certifiers | No | No | 215 |
| Colorado Department of Agriculture | No | Yes | 196 |
| Hawaii Organic Farmers Association | Yes | No | 155 |
| New Mexico Organic Commodity Commission | No | No | 143 |
| Nature's International Certification Services | No | No | 141 |
| Stellar Certification Services | No | No | 140 |
| NH Department of Agriculture, Division of Regulatory Services | No | Yes | 139 |
| Montana Department of Agriculture | No | Yes | 120 |
| Global Culture | No | No | 115 |
| Maryland Department of Agriculture | No | Yes | 106 |

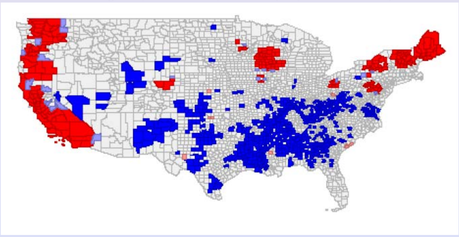
**The Data:**
Data on location of organic operations and the names of their certifiers come from the National Organic Program's list of certified and exempt organic operations. Information on the services provided by certifiers come from the certifiers' websites. Data on other county level characteristics come from publicly available sources, such as the U.S. Census and USDA's Census of Agriculture.

## Results: Where are hotspots and coldspots of organic operations located in the United States?

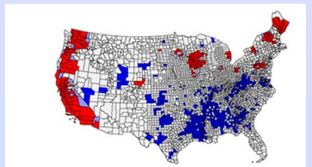
All organic operations



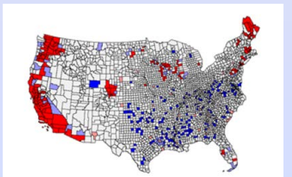
Organic production operations (crops and livestock)



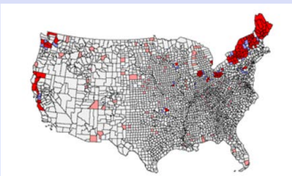
Organic operations with crops as the primary scope



Organic operations with handling as the primary scope



Organic operations with livestock as the primary scope



*Notes: Grey = not significant; red = hotspot, blue = cold-spot, purple = low-high, pink = high-low

## Results: What county-level factors, especially those relate to the certifier, are associated with the presence of hotspots and coldspots?

| Level for certifiers ($x$%) | 30% | | 50% | | 70% | |
|---|---|---|---|---|---|---|
| | Logit | Marginal effects | Logit | Marginal effects | Logit | Marginal effects |
| *Hotspots all organic* | | | | | | |
| cert_priv_outreach_xpct_09 | 2.0506876*** | 0.10997533*** | 2.4484397*** | 0.12803699*** | 1.6538889*** | 0.08995825*** |
| cert_govt_xpct_09 | 0.57637459** | 0.03091011** | 1.2527395*** | 0.06550988*** | 0.61077437** | 0.03322121** |
| avg_farm_income_0 | 0.0000168*** | $9.011 \times 10^{-7}$*** | 0.00001835*** | $9.594 \times 10^{-7}$*** | 0.0000204*** | $1.110 \times 10^{-6}$*** |
| indus_entropy_indx_00 | 0.06909786 | 0.00370562 | 0.13602558 | 0.00711323 | 0.2126942 | 0.01156885 |
| distance_to_interstate_07 | −0.01630735** | −0.00087454** | −0.01221967* | −0.00063901* | −0.01247575* | −0.00067858* |
| pop_density_07 | −0.00061764** | −0.00003312** | −0.00046259* | −0.00002419* | −0.00029177 | −0.00001587 |
| natural_amenities_scale | 0.07901324** | 0.00423736** | 0.08483505** | 0.0044363** | 0.07825644** | 0.00425652** |
| land_values_07 | 0.00005815** | $3.118 \times 10^{-6}$*** | 0.00005902*** | $3.086 \times 10^{-6}$*** | 0.00004158* | $2.262 \times 10^{-7}$* |
| property_tax_per_cap_02 | −0.00019619 | −0.00001052 | −0.0001431 | $-7.48 \times 10^{-6}$ | −0.00017712 | $-9.63 \times 10^{-6}$ |
| politics_green_00 | 0.43408016*** | 0.02327907*** | 0.39416464*** | 0.02061217*** | 0.40255062*** | 0.02189552*** |
| urban_influence_code_03 | −0.08590914** | −0.00460718** | −0.08515574** | −0.00445307** | −0.09995603*** | −0.0054368*** |
| _cons | −4.9395405*** | | −5.2409713*** | | −4.6645635*** | |
| *Hotspots organic production* | | | | | | |
| cert_priv_outreach_xpct_09 | 2.0910975*** | 0.11127704*** | 2.5567506*** | 0.13241269*** | 1.795269*** | 0.09625132*** |
| cert_govt_xpct_09 | 0.42921287* | 0.02284042* | 1.2511224*** | 0.06479494*** | 0.64608177** | 0.03463894** |
| avg_farm_income_07 | 0.0000122** | $6.494 \times 10^{-7}$** | 0.00001336** | $6.917 \times 10^{-7}$** | 0.00001595*** | $8.551 \times 10^{-7}$*** |
| indus_entropy_indx_00 | 0.15406506 | 0.00819852 | 0.21586338 | 0.01117944 | 0.28386556 | 0.01521913 |
| distance_to_interstate_07 | −0.02304809*** | −0.0012265*** | −0.0190983*** | −0.00098909*** | −0.01907071*** | −0.00102245*** |
| pop_density_07 | −0.00089284*** | −0.00004751*** | −0.00075387** | −0.00003904** | −0.00053943* | −0.00002892* |
| natural_amenities_scale | 0.07824539** | 0.0041638** | 0.08072009** | 0.00418045** | 0.074589** | 0.003999** |
| land_values_07 | 0.00006124** | $3.259 \times 10^{-6}$** | 0.00006327** | $3.277 \times 10^{-6}$** | 0.00004529* | $2.428 \times 10^{-6}$* |
| property_tax_per_cap_02 | −0.00022622 | −0.00001204 | −0.00016778 | $-8.69 \times 10^{-6}$ | −0.00021374 | $-1.15 \times 10^{-5}$ |
| politics_green_00 | 0.47499887*** | 0.0252769*** | 0.43593914*** | 0.02257705*** | 0.44158415*** | 0.02367503*** |
| urban_influence_code_03 | −0.0468722 | −0.00249429 | −0.04459721 | −0.00230966 | −0.0607423* | −0.00325663* |
| _cons | −5.264064*** | | −5.6297886*** | | −5.0252791*** | |
| *Hotspots organic handling* | | | | | | |
| cert_priv_outreach_xpct_09 | 1.5995048*** | 0.0625253*** | 1.6484843*** | 0.06439556*** | 1.2461322*** | 0.04955507*** |
| cert_govt_xpct_09 | 0.62164821** | 0.02430329** | 0.88211955*** | 0.03448568*** | 0.52192658* | 0.02075551* |
| avg_farm_income_07 | 0.0000166*** | $6.489 \times 10^{-7}$*** | 0.00001779*** | $6.950 \times 10^{-7}$*** | 0.00001977*** | $7.864 \times 10^{-7}$*** |
| indus_entropy_indx_00 | −0.57380691** | −0.02243294** | −0.49904455** | −0.01949443** | −0.42356637* | −0.01684401* |
| distance_to_interstate_07 | −0.01795963** | −0.00070213** | −0.01499933* | −0.00058593* | −0.01583061* | −0.00062954* |
| pop_density_07 | 0.00010962 | $4.29 \times 10^{-6}$ | 0.00020745 | $8.10 \times 10^{-6}$ | 0.00032045 | $1.27 \times 10^{-5}$ |
| natural_amenities_scale | 0.14805029*** | 0.00578802*** | 0.15146439*** | 0.00591673*** | 0.15927494*** | 0.0063339*** |
| land_values_07 | 0.00010143*** | $3.965 \times 10^{-6}$*** | 0.00010513*** | $4.107 \times 10^{-6}$*** | 0.00009283*** | $3.692 \times 10^{-6}$*** |
| property_tax_per_cap_02 | −0.00024062 | $-9.41 \times 10^{-6}$ | −0.00020711 | $-8.09 \times 10^{-6}$ | −0.00022462 | $-8.93 \times 10^{-6}$ |
| politics_green_00 | 0.36714606*** | 0.01435355*** | 0.33329496*** | 0.01301967*** | 0.34058072*** | 0.01354391*** |
| urban_influence_code_03 | −0.16696988*** | −0.00652768*** | −0.1674223*** | −0.0065401*** | −0.17533963*** | −0.00697275*** |
| _cons | −3.1841352*** | | −3.2569409*** | | −3.079473*** | |

## Conclusions

- A high presence of private organic certifying agents who are associated with **outreach opportunities** and a high presence that are **state or local-government agents** are **consistently positively associated with the presence of hotspots, and negatively associated with the presence of coldspots.**
- Results hold no matter whether the hotspots are defined as all organic operations or as some subset of production or handling operations.
- Results hold no matter whether the threshold for an outreach presence (or a government-certifier presence) is 30, 50 or 70% of all operations in a county.
- Supplemental analyses suggest that these associations may be stronger in the Midwest and West than in the Northeast

## What factors are associated with the presence of hotspots of organic operations (the variables that make up the x matrix in our logit model)?

| Factors affecting organic | Description |
|---|---|
| cert_govt_30pct_09 (*cert_govt_50pct_09 and cert_govt_70pct_09 refer to 50% and 70% cutoffs, respectively) | takes a value of 1 if 30% or more of the organic operations in the county are certified by a government agency |
| cert_outreach_30pct_09 (*cert_outreach_50pct_09 and cert_outreach_70pct_09 refer to 50% and 70% cutoffs, respectively) | takes a value of 1 if 30% or more of the organic operations in the county are certified by a private agency (non-governmental) which provides outreach (e.g., conferences, workshops, education, networking) |
| avg_farm_income_07 | receipts of income and farm related totals measured in dollars per operation, 2007 |
| indus_entropy_indx_00 | industry entropy index, which measures economic diversity in 2000: High IE means higher diversity |
| urban_influence_code_03 | urban influence code in 2003: Lower UIC means higher level of urban influence |
| pop_density_07 | population density in 2007 |
| natural_amenities_scale | natural amenities scale |
| land_values_07 | value of land and buildings per acre, 2007 |
| property_tax_per_cap_02 | property tax per capita in 2002 |
| politics_green_00 | number of people who voted for Nader or the green party in 2000 |
| distance_to_interstate_07 | distance of the county from an interstate highway measured in kilometers |
| Hotspots and Coldspots | |
| hh_09 | takes a value of 1 if the county is an organic hotspot, and 0 otherwise |
| hh_prod_09 | 1 if the county is an organic production hotspot |
| hh_hand_09 | 1 if the county is an organic handling hotspot |
| hh_crop_09 | 1 if the county is an organic crop hotspot |
| hh_live_09 | 1 if the county is an organic livestock hotspot |
| ll | 1 if the county is an organic coldspot |

| Rationale | Variables | Expected Effect on number of organic operations | Source for Rationale |
|---|---|---|---|
| Certifiers | cert_priv_outreach_xpct_09 (* x=30, 50, 70) | positive: private certifiers who provide outreach may indicate the level of communication between organic operations | Hypothesis |
| | cert_govt_xpct_09 (* x=30, 50, 70) | positive: the diversity of activities that government certifiers participate in may be another indicator of communication; however, a high government presence in certification may also imply the need for it | |
| Policy | property_tax_per_cap_02 | ambiguous: state level fiscal policies have been found to negatively affect the formation of clusters; however, higher taxes may also imply higher amenities | Goetz (1997), Glaeser (1996) |
| Work-force heterogeneity | indus_entropy_indx_00 | ambiguous: this indicates economic diversification and clustering is driven by workforce heterogeneity and diversity of a region; however, organic has been found to need more specialized labor | Davis and Schulter (2005), Duranton and Puga (2003), Delgado et al. (2012) |
| Resources/Supply | land_values_07 | positive: This may indicate presence of resources | Kamath et al. (2012), Brown et al. (2012) |
| | pop_density_07 | ambiguous: This variable may capture labor supply, which would imply a positive effect given the fact that organic operations tend to be more labor intensive; however, farms, specifically may fare better if they are removed from population centers. | |
| | natural_amenities_scale | positive: a higher natural amenities scale may imply availability of better resources | |
| Demand conditions | avg_farm_income_07 | positive: may indicate high demand for agricultural goods | Kamath et al. (2012), Schmidtner et al., (2012), Brown et al. (2012) |
| | urban_influence_code_03/ distance_to_interstate_07/ pop_density_07/ indus_entropy_indx_00 | ambiguous: being closer to a highway or being in an urban area may provide market access, which encourages the development of farms; however, farms may also fare better if they are protected from sprawling development | |
| | politics_green_00 | positive: liberal areas are generally associated with more receptiveness of organic | |
| Opportunity Cost | land_values_07/ natural_amenities_scale | negative: high land values and amenities may also indicate that the opportunity cost of using them for farming is high | Brown et al. (2012), Mishra and Goodwin (1997) |