

An aerial photograph of a coastal landscape in Ventura County, California. The image shows a mix of agricultural fields in various shades of green and brown, interspersed with roads and infrastructure. In the foreground, a sandy beach meets the ocean, with waves breaking onto the shore. The sky is a clear, pale blue.

*Landscape Capacity Analysis
For Ventura County*

Who, what, where , when , why?

- Ventura County AFA
- Later
- Ventura County
- Analysis conducted 2007,
 - data from 2003
- Why



The Vivid Picture Project

Foundations put in \$2.4 million over 3 years:

- 1) Overhead for the Council
- 2) The Vivid Picture Project
- 3) 2 Leadership Development projects
 - one at a county level
 - one at a state level

Now raising \$10 million for implementation

The Vivid Picture Project

An 18 month research project was conducted.

QUANTITATIVE ANALYSIS

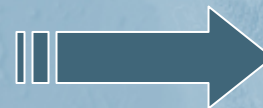
- 700 data sets for projecting 2030 scenarios
- 4 GIS analysis tools

QUALITATIVE ANALYSIS

- 159 interviews with food system leaders
- 2 Roots of Change Council workgroups

RESEARCH

- Indicators data collection



The New Mainstream

- A vision for sustainable food system
- An agenda for change
- Indicators to track progress

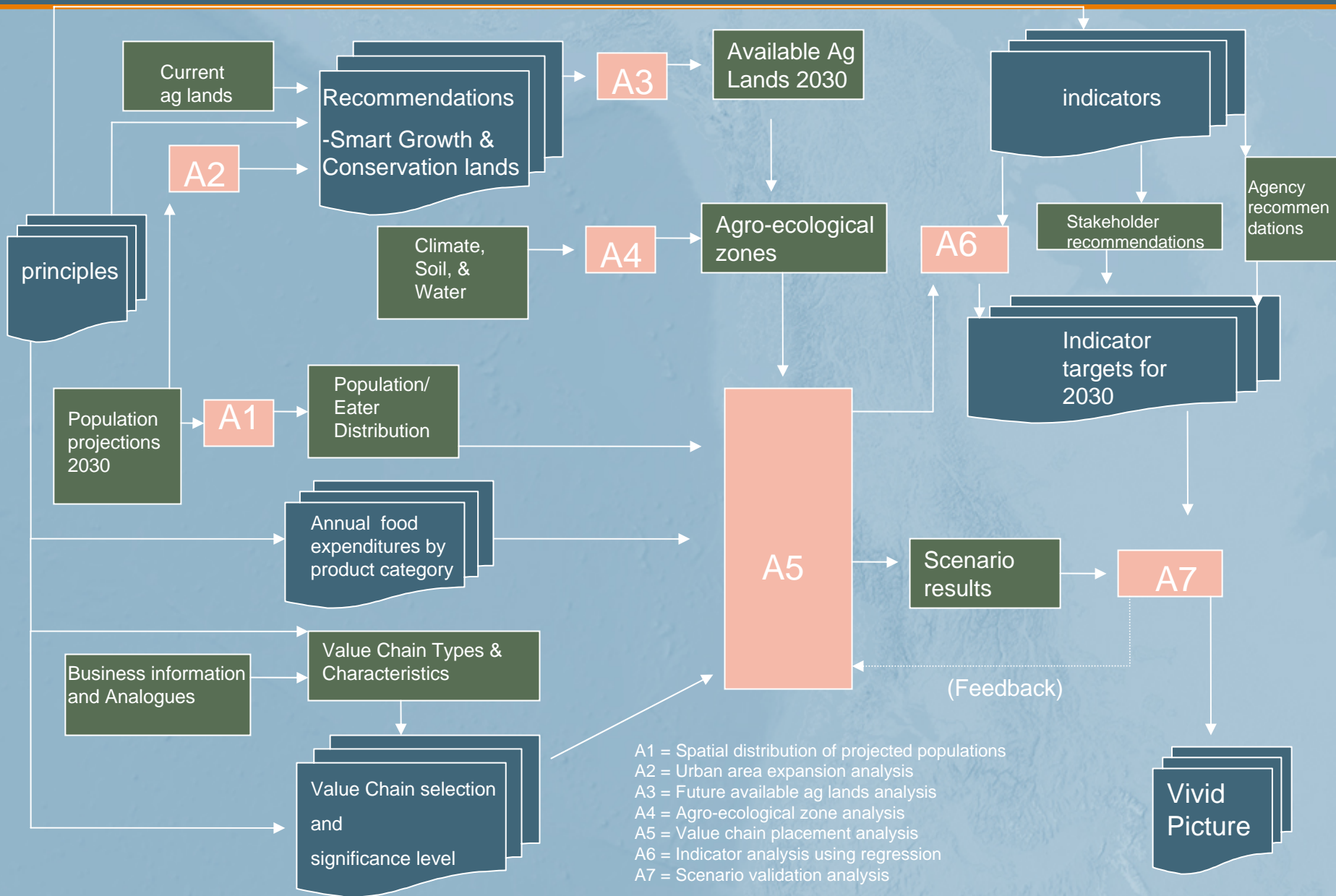
Quantitative Analysis

What's the underlying question we designed the toolset to answer?

How do you
organize eaters,
producers,
distribution,
manufacturing,
food outlets



to produce positive
social,
environmental
and local
economic impacts
(see goals)?



Vivid picture toolset (SEED Tools)

- A1 = Spatial distribution of projected populations
- A2 = Urban area expansion analysis
- A3 = Future available ag lands analysis
- A4 = Agro-ecological zone analysis
- A5 = Value chain placement analysis
- A6 = Indicator analysis using regression
- A7 = Scenario validation analysis

So, why were you going to answer the question “Why”?



Ag Innovations working in Ventura County

- Ag futures alliance
- Local level leadership initiative

Visioning process to help initiate change.

What would a diversified agricultural landscape look like; What would some of the implications be?

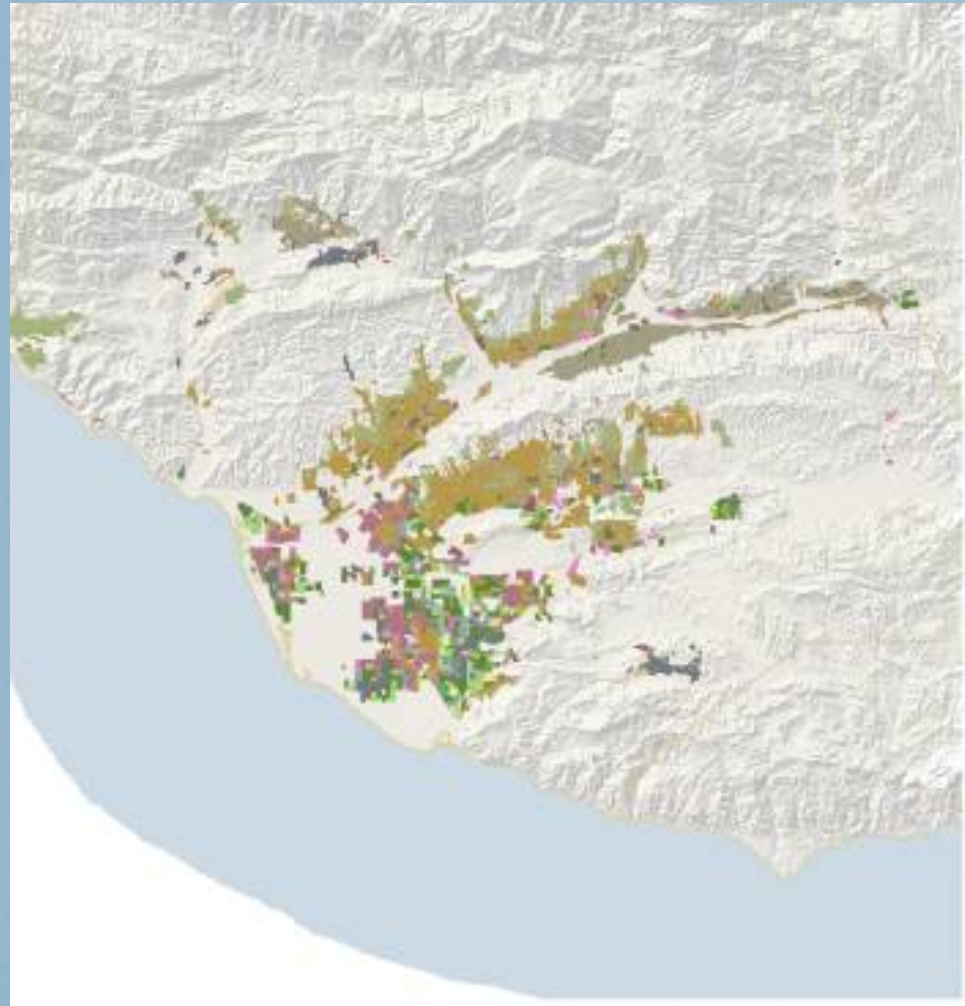
- How many people can Ventura County feed

Existing crops in Ventura County

Table 1: Ventura crops by acres and value

| Commodity | Acres | Value |
|-------------------------------|--------|---------------|
| Strawberries | 8,685 | \$300,746,000 |
| Oranges | 15,667 | \$21,023,000 |
| Grapefruit | 325 | \$229,000 |
| Lemons | 31,092 | \$148,634,000 |
| Peppers | 3,176 | \$22,964,000 |
| Fruits and Nuts | 1,920 | \$49,145,000 |
| Avacados | 18,069 | \$100,760,000 |
| Beans (Dry) | 705 | \$2,239,000 |
| Broccoli | 742 | \$13,188,000 |
| Cabbage | 605 | \$9,690,000 |
| Celery | 3,343 | \$113,381,000 |
| Corn | 680 | \$1,382,000 |
| Lettuce | 1,516 | \$11,237,000 |
| Onions & Garlic | 1,553 | \$4,244,000 |
| Melons, Squash, and Cucumbers | 878 | \$1,354,000 |
| Misc. Vegetable | 9,811 | \$44,695,000 |
| Flowers & Nursery | 3,820 | \$217,777,000 |

Source: Crop mix and associated acres, California dept of water resources, 2002
commodity values, California Dept. of Food and Agriculture, 2003



Methods

4 step Process

- Determine potential productivity

$$P_{tz} = P_{tc} * ((D_{tz} / (D_{tz} + D_{ctz})) + P_{tc} * ((D_{ctz} / (D_{tz} + D_{ctz}))$$

$$D_{tz} = \frac{A_{tcz}}{\sum_{c=1}^C A_{tz}}$$
$$D_{ctz} = \frac{A_{tcz}}{\sum_{z=1}^Z A_{tc}}$$

- Determine consumption
- Define relationship between consumption and crop types
- Use fancy tools to optimize location of crops on the landscape

Agro-ecologic zone analysis

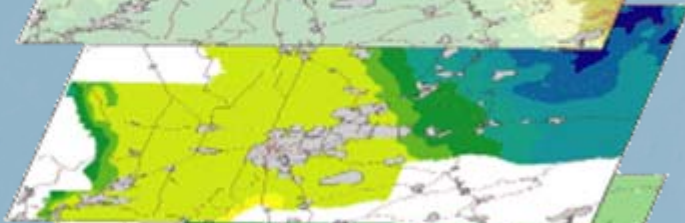
Soils data



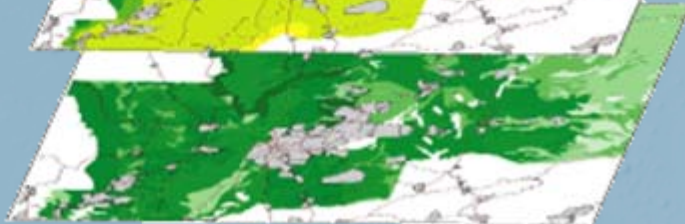
Elevation data



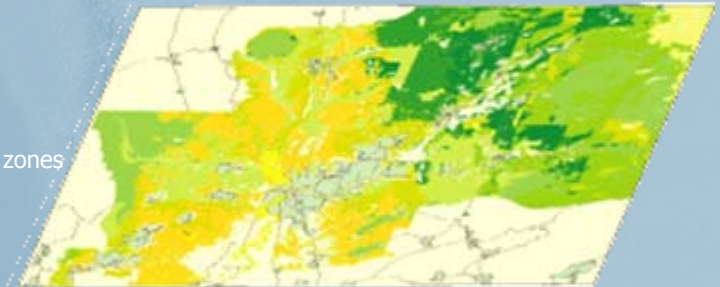
Climate data



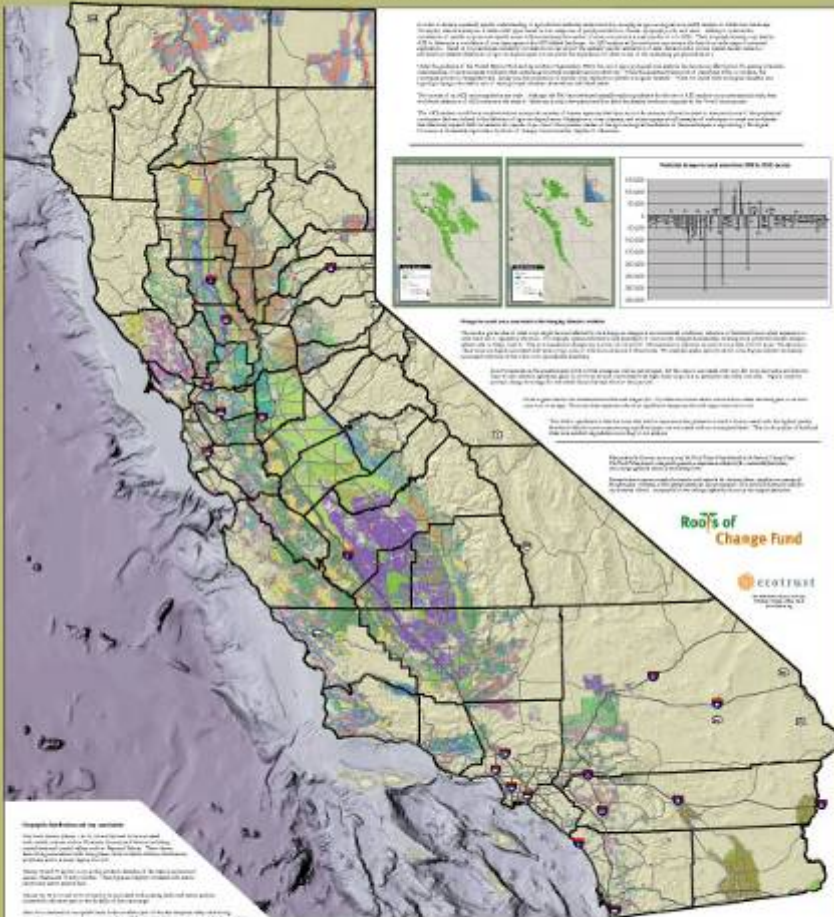
Land cover



Agro-ecologic zones



Agro-Ecologic Zones and Crop Correlations in California



Coastal - Temperate highly productive

- 1A, 4A, 6A, 8A, 9A, 11A
- 14A, 15A, 15A, 20A, 21A, 24A

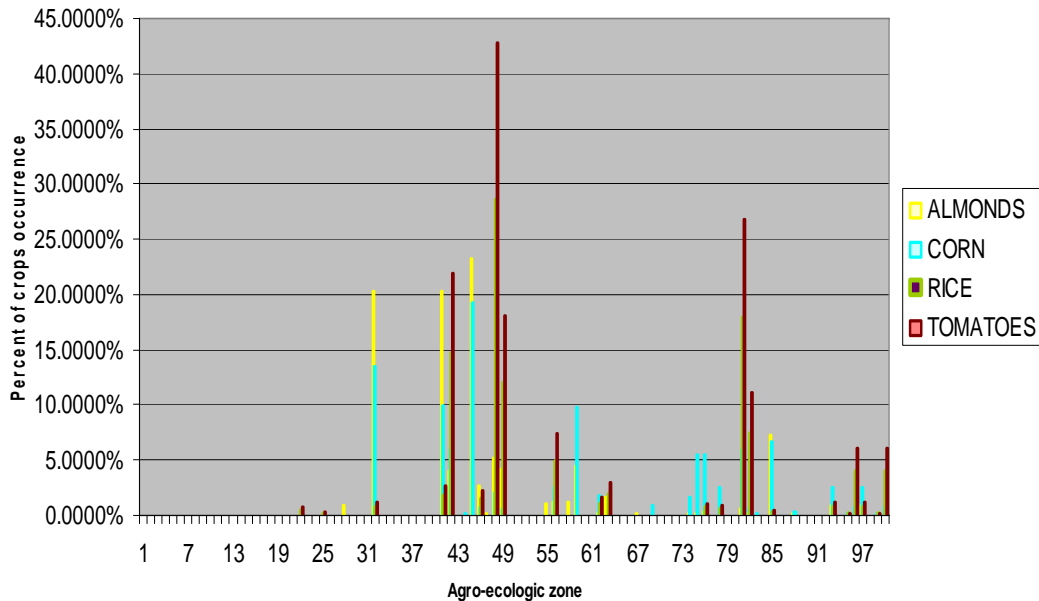
Native Pasture - foothills

- 31C, 39C, 40C, 44C
- 51P, 54P, 57P, 64P

Foothills - marginal

- 75H, 86J, 92E
- 92

AEZ Crop associations of 5 commonly occurring crops



| ID | Crop Type | Potential Maximum Production (in tons) |
|----|---------------------------|--|
| 1 | Alfalfa Mixtures | 699,713 |
| 2 | Apples | 1,388,982 |
| 3 | Avocados | 256,183 |
| 4 | Barley | 117,519 |
| | Beans | 108,101 |
| 6 | Broccoli | 632,093 |
| 7 | Bush Berries | 514,450 |
| 8 | Cabbage | 1,768,603 |
| 9 | Carrots | 1,644,038 |
| | Celery | 2,885,795 |
| 11 | Corn | 706,945 |
| 12 | Grain | 368,549 |
| 13 | Grapefruit | 923,304 |
| 14 | Kiwis | 389,670 |
| | Lemons | 1,429,261 |
| 16 | Lettuce | 1,364,385 |
| 17 | Melons, Squash, Cucumbers | 1,221,234 |
| 18 | Misc Grasses | 154,418 |
| 19 | Misc Subtropical | 555,032 |
| | Misc Vegetables | 6,929,382 |
| 21 | Oats | 114,885 |
| 22 | Olives | 285,423 |
| 23 | Onions, Garlic | 1,479,774 |
| 24 | Oranges | 1,153,032 |
| | Peaches, Nectarines | 1,222,025 |
| 26 | Pears | 864,729 |
| 27 | Peas | 190,147 |
| 28 | Peppers | 1,580,676 |
| 29 | Pistachios | 55,052 |
| | Potatoes | 1,308,898 |
| 31 | Rice | 303,763 |
| 32 | Spinach | 427,180 |
| 33 | Strawberries | 2,034,462 |
| 34 | Sugar Beets | 2,313,069 |
| | Sweet Potatoes | 376,871 |
| 36 | Table Grapes | 4,352 |
| 37 | Tomatoes | 3,796,632 |
| 38 | Walnuts | 130,439 |
| 39 | Almonds | 656,748 |
| | Corn silage | 2,408,671 |
| 41 | Silage | 1,090,175 |
| 42 | Grazing Land | n/a |

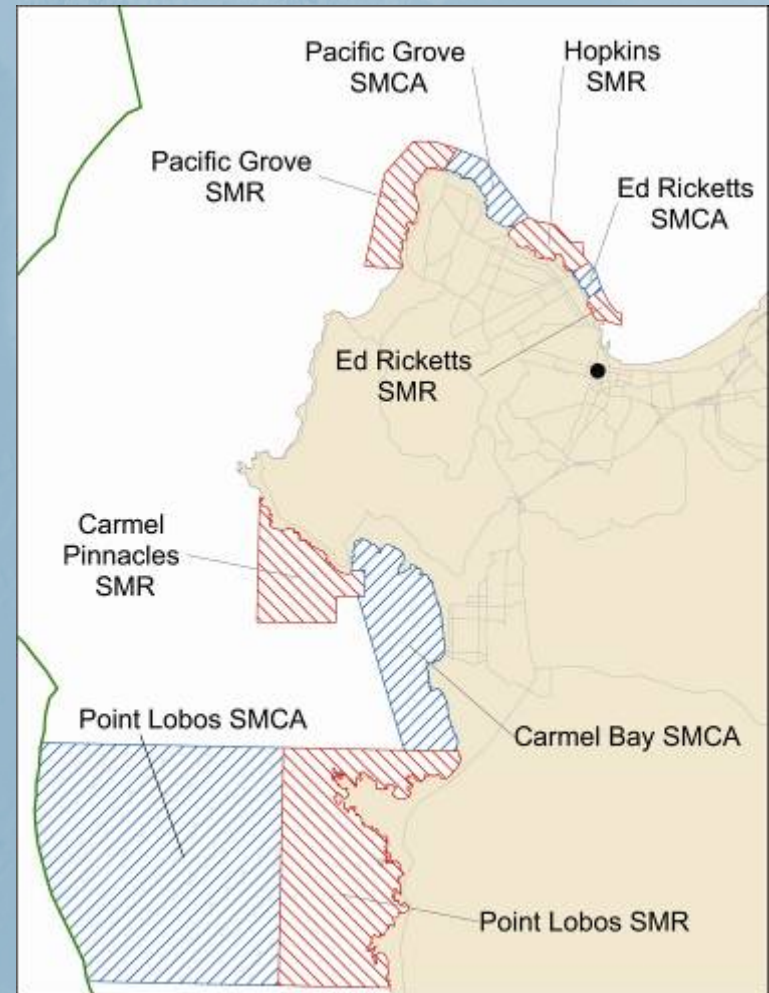
Consumption

USDA – ERS, 2003

- 🍌 Per capita consumption of specific products
- 🍌 Translated to specific demand for consistent volume that can be expressed on the landscape.
 - E.g. How do you grow milk on the landscape

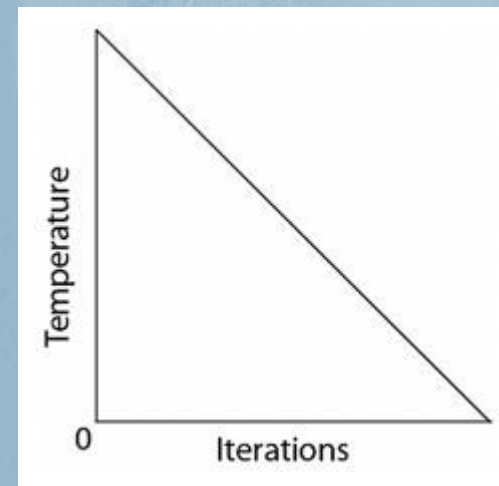
Placing farms on the landscape: MarZone

- **Multiple Zones & Costs**
 - Marine Reserve
 - Cost – All commercial and recreational fishing
 - Marine Park
 - Cost – All commercial and some recreational fishing, enforcement
 - Conservation Area
 - Cost - some commercial and some recreational fishing, enforcement
 - Available (Unreserved)



Simulated Annealing

- **Objective Function = Cost + Penalty + Boundary**
- **Number of iterations**
- **Temperature**
- **Number of runs**



Spatial optimization

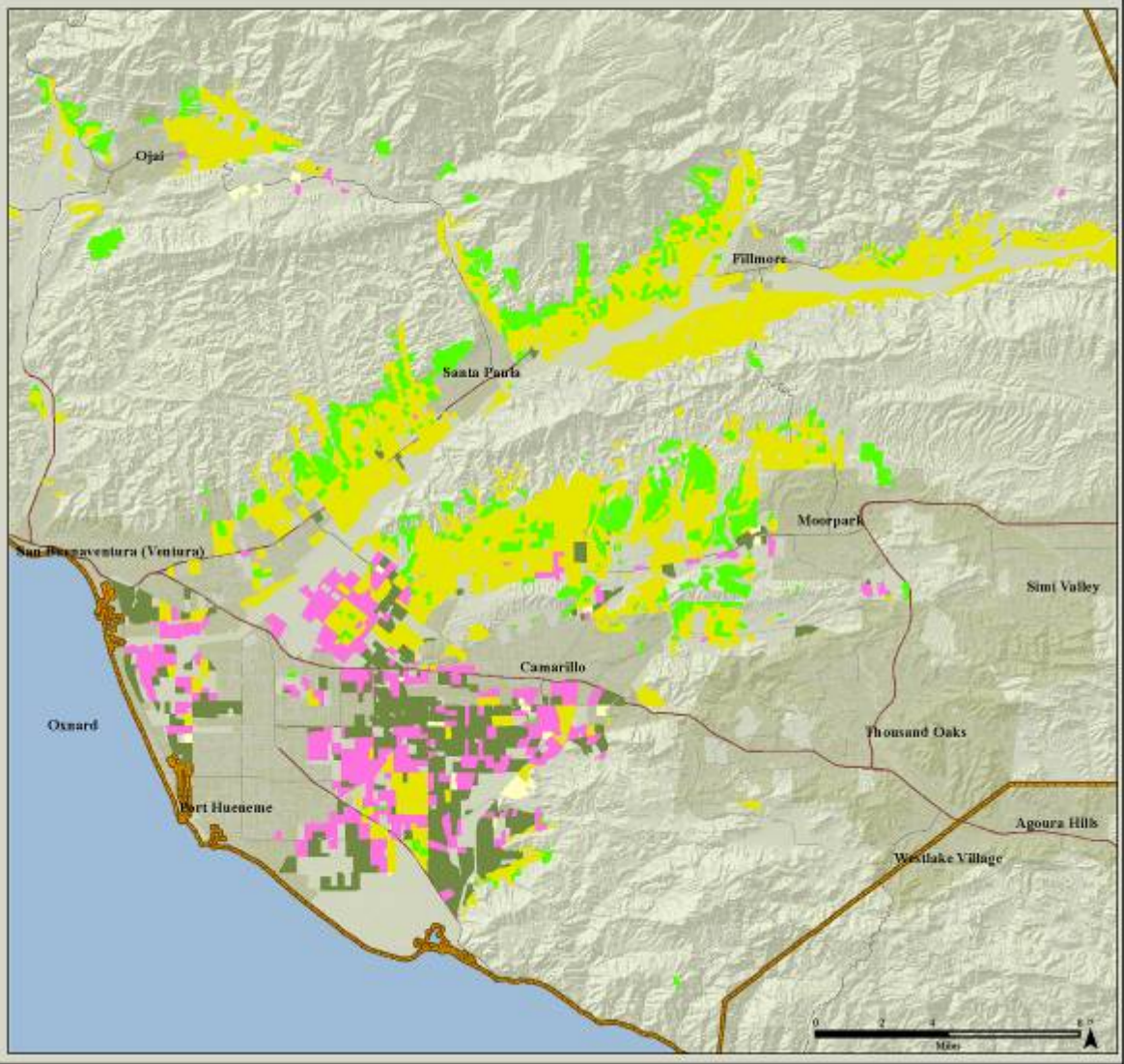
- Use consumption to drive demand or targets
- Associate specific crops with specific zones.
 - i.e. you can only grow corn in a corn zone.
- Transform data for crops where demand surpasses what's available.
- Apply penalties for crops that don't meet demand

Map 1: Existing crop distribution (2002)

Existing Crops

- Avocados
- Citrus
- Fruits and Nuts
- Grain
- Vegetables

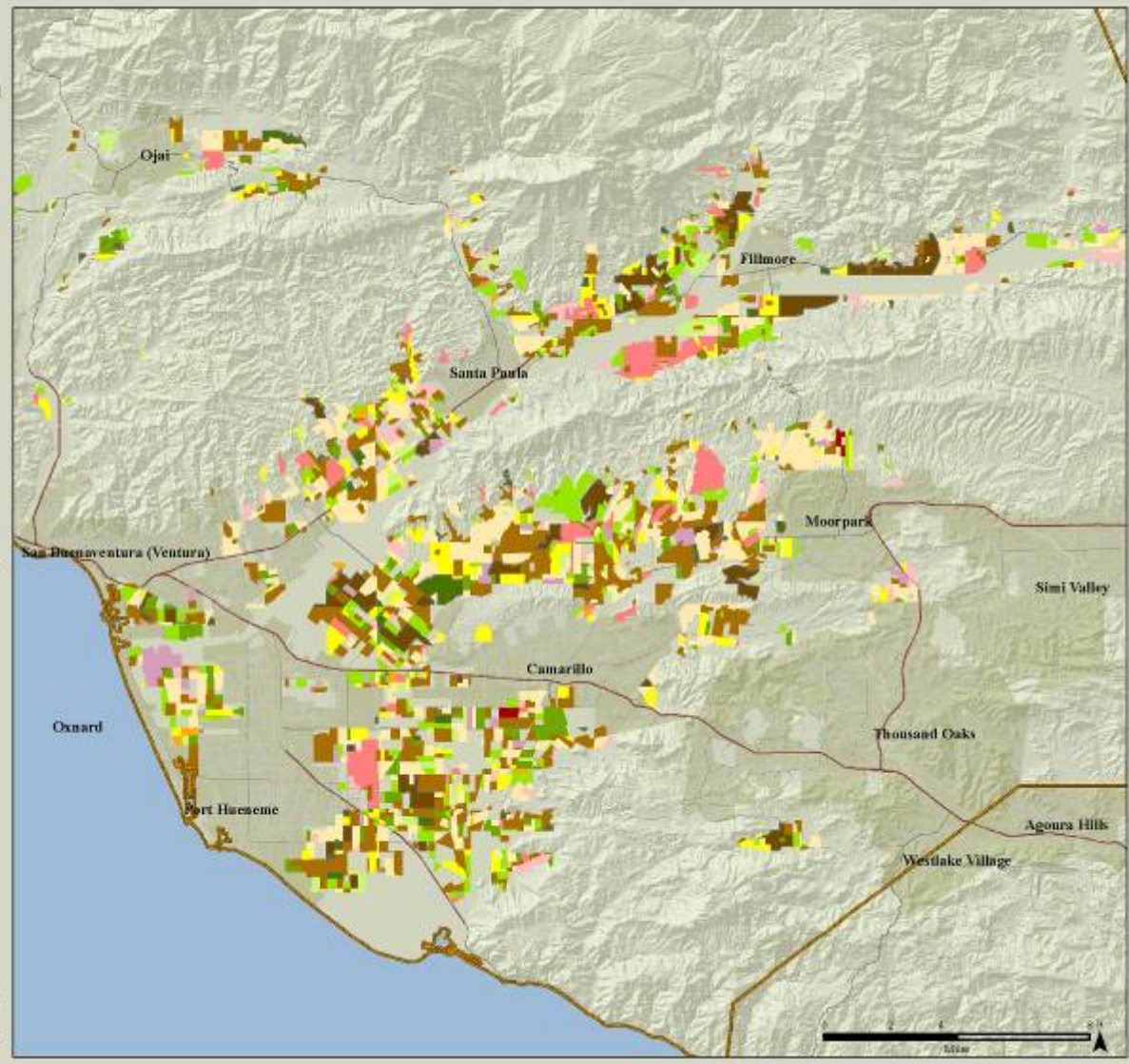
- Artichokes
- Beans (Green)
- Cabbage
- Cauliflower
- Celery
- Cole Crops
- Corn
- Lettuce
- Peppers
- Spinach



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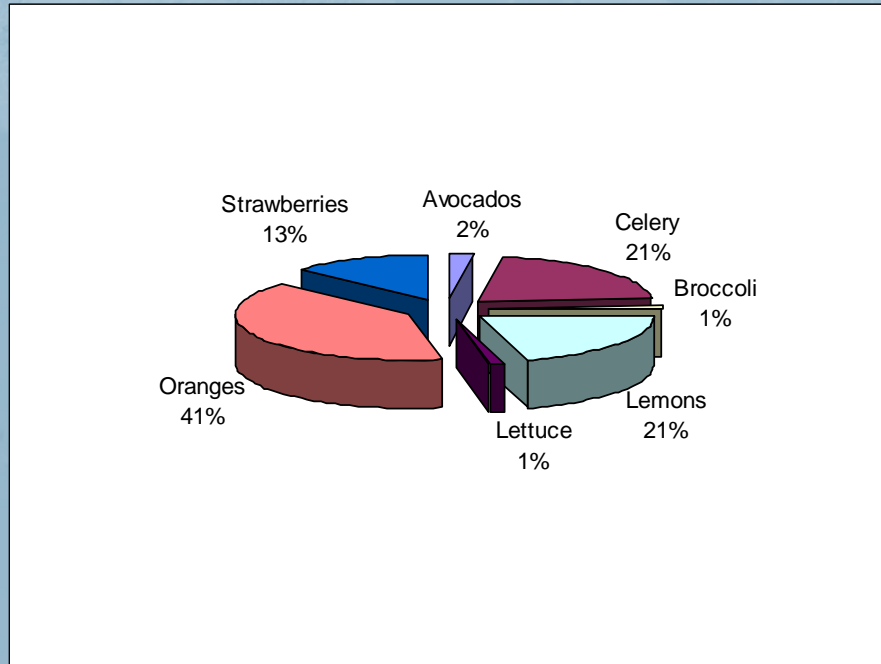
Map 2: Potential crop distribution to meet demand for a population of five million people

- Grain
 - Berries
 - Legumes
 - Nuts
 - Fruit (General)
 - Tree Fruit & Crops
 - Citrus
 - Root Crops & Potatoes
 - Leafy Greens
 - Melons, Squash, Cucumbers
 - Peppers
 - Tomatoes
 - Vegetables (General)
- Beans Dry
 - Broccoli
 - Cabbage
 - Carrots
 - Celery
 - Corn
 - Lettuce
 - Peas
 - Peppers
 - Spinach



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| ID | Crop Type | Production (in tons) | Acres |
|----|---------------------------|----------------------|---------|
| | Alfalfa Mixtures | - | - |
| | Apples | - | - |
| | Avocados | 48,024 | 17,545 |
| | Barley | - | - |
| | Beans | - | - |
| | Broccoli | 21,646 | 2,775 |
| | Bush Berries | 2,777 | 372 |
| | Cabbage | 54,465 | 2,134 |
| | Carrots | - | - |
| | Celery | 438,359 | 11,030 |
| | Corn | 4,114 | 677 |
| | Grain | - | - |
| | Grapefruit | 827 | 103 |
| | Kiwis | - | - |
| | Lemons | 422,898 | 23,865 |
| | Lettuce | 24,554 | 2,199 |
| | Melons, Squash, Cucumbers | 1,589 | 149 |
| | Misc Grasses | - | - |
| | Misc Subtropical | - | - |
| | Misc Vegetables | 3,936,726 | 1,895 |
| | Oats | - | - |
| | Olives | - | - |
| | Onions, Garlic | 9,202 | 699 |
| | Oranges | 81,552 | 6,070 |
| | Peaches, Nectarines | - | - |
| | Pears | - | - |
| | Peas | - | - |
| | Peppers | 43,119 | 1,647 |
| | Pistachios | - | - |
| | Potatoes | - | - |
| | Rice | - | - |
| | Spinach | 8,509 | 1,041 |
| | Strawberries | 268,041 | 8,794 |
| | Sugar Beets | - | - |
| | Sweet Potatoes | - | - |
| | Table Grapes | - | - |
| | Tomatoes | 26,222 | 167 |
| | Walnuts | - | - |
| | Almonds | - | - |
| | Corn silage | - | - |
| | Silage | - | - |
| | Grazing Land | n/a | 135,195 |



| Product | Percent of Demand met |
|--------------|-----------------------|
| Avocados | 6025.60% |
| Celery | 19517.32% |
| Broccoli | 756.32% |
| Lemons | 18828.94% |
| Lettuce | 120.81% |
| Oranges | 2635.91% |
| Strawberries | 12542.86% |

Capacity to meet Ventura County Demand

| ID | Crop Type | Demand (in tons) | Production (in tons) | Demand Satisfied |
|----|---------------------------|------------------|----------------------|------------------|
| 1 | Alfalfa Mixtures | 25,363 | 25,363 | 100% |
| 2 | Apples | 15,723 | 15,718 | 100% |
| 3 | Avocados | 797 | 800 | 100% |
| 4 | Barley | 254 | 276 | 109% |
| 5 | Beans | 3,333 | 3,339 | 100% |
| 6 | Broccoli | 2,862 | 2,880 | 101% |
| 7 | Bush Berries | 2,572 | 2,680 | 104% |
| 8 | Cabbage | 3,840 | 3,872 | 101% |
| 9 | Carrots | 5,507 | 5,598 | 102% |
| 10 | Celery | 2,246 | 2,274 | 101% |
| 11 | Corn | 42,894 | 42,928 | 100% |
| 12 | Grain | 59,160 | 59,157 | 100% |
| 13 | Grapefruit | 1,848 | 1,842 | 100% |
| 14 | Kiwis | 217 | 272 | 125% |
| 15 | Lemons | 2,246 | 2,472 | 110% |
| 16 | Lettuce | 20,324 | 20,289 | 100% |
| 17 | Melons, Squash, Cucumbers | 15,433 | 15,494 | 100% |
| 18 | Misc Grasses | 4,673 | 4,662 | 100% |
| 19 | Misc Subtropical | 54,125 | 54,050 | 100% |
| 20 | Misc Vegetables | 13,730 | 19,329 | 141% |
| 21 | Oats | 1,558 | 1,551 | 100% |
| 22 | Olives | 326 | 322 | 99% |
| 23 | Onions, Garlic | 7,680 | 7,890 | 103% |
| 24 | Oranges | 30,939 | 31,019 | 100% |
| 25 | Peaches, Nectarines | 3,333 | 3,452 | 104% |
| 26 | Pears | 1,014 | 1,472 | 145% |
| 27 | Peas | 1,340 | 1,395 | 104% |
| 28 | Peppers | 2,862 | 3,033 | 106% |
| 29 | Pistachios | 322 | 324 | 101% |
| 30 | Potatoes | 50,248 | 50,265 | 100% |
| 31 | Rice | 7,137 | 7,195 | 101% |
| 32 | Spinach | 978 | 1,014 | 104% |
| 33 | Strawberries | 2,137 | 2,973 | 139% |
| 34 | Sugar Beets | 23,766 | 24,032 | 101% |
| 35 | Sweet Potatoes | 1,558 | 1,648 | 106% |
| 36 | Table Grapes | 2,645 | 2,644 | 100% |
| 37 | Tomatoes | 31,591 | 31,580 | 100% |
| 38 | Walnuts | 645 | 684 | 106% |
| 39 | Almonds | 645 | 854 | 132% |
| 40 | Corn silage | 6,999 | 7,155 | 102% |
| 41 | Silage | 6,999 | 7,391 | 106% |
| 42 | Grazing Land | n/a | n/a | 205% |

Capacity to meet Demand of a population of 5 million

| ID | Crop Type | Demand (in tons) | Production (in tons) | Demand Satisfied |
|----|---------------------------|------------------|----------------------|------------------|
| 1 | Alfalfa Mixtures | 175,025 | 10,138 | 6% |
| 2 | Apples | 108,500 | 87,379 | 81% |
| 3 | Avocados | 5,500 | 5,504 | 100% |
| 4 | Barley | 1,750 | 1,782 | 102% |
| 5 | Beans | 23,000 | 2,761 | 12% |
| 6 | Broccoli | 19,750 | 19,364 | 98% |
| 7 | Bush Berries | 17,750 | 17,519 | 99% |
| 8 | Cabbage | 28,500 | 25,387 | 96% |
| 9 | Carrots | 38,000 | 34,619 | 91% |
| 10 | Celery | 15,500 | 15,314 | 99% |
| 11 | Corn | 296,000 | 10,256 | 3% |
| 12 | Grain | 408,250 | 28,464 | 7% |
| 13 | Grapefruit | 12,750 | 13,350 | 105% |
| 14 | Kiwis | 1,500 | 1,536 | 102% |
| 15 | Lemons | 15,500 | 15,314 | 99% |
| 16 | Lettuce | 140,250 | 120,038 | 86% |
| 17 | Melons, Squash, Cucumbers | 108,500 | 92,511 | 87% |
| 18 | Misc Grasses | 32,250 | 4,034 | 13% |
| 19 | Misc Subtropical | 373,500 | 15,336 | 4% |
| 20 | Misc Vegetables | 94,750 | 42,514 | 45% |
| 21 | Oats | 10,750 | 10,785 | 100% |
| 22 | Olives | 2,250 | 2,256 | 100% |
| 23 | Onions, Garlic | 53,000 | 46,362 | 87% |
| 24 | Oranges | 213,500 | 74,162 | 35% |
| 25 | Peaches, Nectarines | 23,000 | 20,984 | 91% |
| 26 | Pears | 7,000 | 7,075 | 101% |
| 27 | Peas | 9,250 | 9,278 | 100% |
| 28 | Peppers | 19,750 | 19,493 | 99% |
| 29 | Pistachios | 2,225 | 2,227 | 100% |
| 30 | Potatoes | 346,750 | 853 | 0% |
| 31 | Rice | 49,250 | 4,446 | 9% |
| 32 | Spinach | 6,750 | 7,039 | 104% |
| 33 | Strawberries | 14,750 | 15,719 | 107% |
| 34 | Sugar Beets | 164,000 | 113,491 | 69% |
| 35 | Sweet Potatoes | 10,750 | 10,761 | 100% |
| 36 | Table Grapes | 18,250 | 1,301 | 7% |
| 37 | Tomatoes | 218,000 | 100,500 | 46% |
| 38 | Walnuts | 4,450 | 4,467 | 100% |
| 39 | Almonds | 4,450 | 4,470 | 100% |
| 40 | Corn silage | 48,300 | 35,325 | 73% |
| 41 | Silage | 48,300 | 42,818 | 89% |
| 42 | Grazing Land* | n/a | n/a | 92% |

Next steps?

- 🍷 Ground truth results
- 🍷 Work with AFA to adjust targets to represent reality
- 🍷 Constrain optimization with “costs”
- 🍷 Build tools

The Analytic Framework

- Database driven with spatial components (GIS)
- Spatial data gives as inputs
- User defined assumptions that represent potential policy/planning decisions

- Employment characteristics
- Value of land
- Geographic

Food Systems Community Visioning Tool: Outlet parameter inputs

| Characteristic | Description | Farmers' Market | Small Grocery | Medium Grocery | Large Grocery |
|--|--|--|--|--|--|
| Outlet placement | Outlet placement parameter | 10 | 10 | 19 | 10 |
| Maximum sales capacity (annual) | The maximum sales capacity (annual) (usually based on square footage of the outlet type) | \$20,000,000 | \$1,000,000 | \$10,000,000 | \$50,000,000 |
| Minimum sales | Minimum sales for business to be profitable | \$500,000 | \$200,000 | \$1,000,000 | \$10,000,000 |
| Secondary trade area radius | Maximum distance from business | 4 Miles | 2 miles | 3 miles | 4 miles |
| Main trade area radius | Radius of area in which business commands its full market share (defined below) | 6 Miles | 0.5 miles | 1 mile | 1 miles |
| Proportions of product types | Proportions of total food sales from vegetables, fruits and nuts, meat, poultry, dairy products and manufactured goods | 5% Vegetables, 30% Fruit, 10% Meat, 10% Dairy, 10% Other | 5% Vegetables, 5% Fruits and Nuts, 10% Dairy, 7% Meat, 6% Poultry, 67% Other | 5% Vegetables, 5% Fruits and Nuts, 10% Dairy, 7% Meat, 6% Poultry, 67% Other | 5% Vegetables, 5% Fruits and Nuts, 10% Dairy, 7% Meat, 6% Poultry, 62% Other |
| Proportion of product type purchased through direct channel | For example, proportion of vegetable products a given outlet purchases through the direct channel | 100% Direct for all products | 0% Direct for all products | 0% National, 30% Regional, 70% local | 100% National |
| Margin of each product type when purchased through each channel type | These values represent the combined margins of the outlet and distribution channel for each product types. The value remaining after applying these margins is the proportion of eater dollars reaching producers. | 5% for all products | 0% for all products | 0% for all products | 10% for all products |
| Employees | Number of employees, receiving wages | 2 | 1 | 1 | 100 (100,000) |
| Average wage | Average wage in dollars per hour | \$10.00 | \$10.00 | \$10.00 | \$9.00 |
| Ownership type | Structure of business ownership | Individual | Individual/ operator | Individual | Corporate |

- Proximity to markets
- Elevation data
- Climate data
- Land cover

Farmer