The Impact of Water on Crop Planting and Prices
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California is entering the fourth year of what many consider a historic drought. According to the U.S. Department of Agriculture (USDA), in October of 2015, 46-percent of California is in an exceptional drought (though this has decreased from 58-percent of California a year ago). Currently, only 0.14-percent of California is not experiencing any drought conditions.

Figure 1. U.S. Drought Monitor

This has massive implications for the farm sector. According to the California Department of Food and Agriculture, California contains nearly half of the total acreage of U.S.-grown fruits, nuts, and vegetables (including producing virtually all almonds, walnuts, and pistachios); California agricultural exports amount to $21.24 billion in value, which would be a larger value than the gross domestic product (GDP) of many African and Latin American countries.

The San Joaquin Valley is one of the most fertile areas in all of California; it accounts for more than 65-percent of total fruit and nut crop production value, and produces nearly 33-percent of California’s vegetables. But, because much of the land is irrigated, water scarcity (and rising water prices) are leading to changes in acreage planted and in the prices of the products being produced, squeezing both farmers and consumers during a time of stagnant national wage growth.

Production volume of most crops grown in California has decreased, dramatically. As shown in the table below, as the drought has progressed, crop production (in 1,000 tons) has fallen, from the average from 2011 to 2013, to 2014.

<table>
<thead>
<tr>
<th>Crop</th>
<th>2011 – 2013 Average (1,000 tons)</th>
<th>2014 (1,000 tons)</th>
<th>Percent Change</th>
<th>California Production (Fraction of Total U.S. Production)</th>
<th>Gallons of Water per LB of Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oranges</td>
<td>2,333</td>
<td>2,000</td>
<td>-14.3</td>
<td>.29</td>
<td>74</td>
</tr>
<tr>
<td>Lemons</td>
<td>827</td>
<td>760</td>
<td>-8.1</td>
<td>.91</td>
<td>85</td>
</tr>
<tr>
<td>Grapes</td>
<td>7,079</td>
<td>6,819</td>
<td>-3.7</td>
<td>.88</td>
<td>80</td>
</tr>
<tr>
<td>Peaches</td>
<td>711</td>
<td>616</td>
<td>-13.4</td>
<td>.73</td>
<td>120</td>
</tr>
<tr>
<td>Strawberries</td>
<td>1,351</td>
<td>1,379</td>
<td>2.1</td>
<td>.91</td>
<td>46</td>
</tr>
<tr>
<td>Almonds</td>
<td>1,697</td>
<td>1,546</td>
<td>-8.9</td>
<td>1</td>
<td>2,126</td>
</tr>
</tbody>
</table>

Source: The National Drought Mitigation Center
As we see in Table 1 above, with the exception of several nut crops and strawberries, crop production has fallen. However, this production hides the substitution towards less water intensive crops (per pound of food). Whereas nuts, peaches, oranges, lemons, and grapes are all high- to moderate-intensive foods, in terms of water usage (according to Mekonnen and Hoekstra, 2011), strawberries, broccoli, tomatoes, and carrots are some of the least water intensive foodstuffs to produce. This means that, regardless of price changes in the crops produced, the drought has already altered crop-planting patterns, beyond leaving cropland fallowed.

These patterns in crop production have also altered the prices of these commodities on the market. According to the USDA Economic Research Service, about $0.40 of every $1.00 in cost for fresh fruits is due to the farm sector. This means that changes in farm costs will affect the price of fresh fruits quite significantly. With the drought increasing the price of water and increasing the price of many inputs used in the production process for farming, it is likely that the retail price of foodstuffs will increase as well. Figure 2 shows the correlation between the fraction of California that is exhibiting at least moderate drought conditions and the consumer price index (CPI). We see that there is a sizable positive correlation between the two. More recently, since 2012, the price of fresh fruits and vegetables has increased as more and more of California enters an unprecedented drought. We also notice that there is a lag between experiencing a drought and price changes; typically, it may take almost a year for prices to respond.

**Figure 2. California Drought Severity and Change in Consumer Price Index (CPI)**

Source: USDA Economic Research Service
These price increases of fresh fruit and vegetables have two impacts: the first is that they put a tighter squeeze on the average budget of the consumer. Since 2012, the price of fresh fruits has increased by 12-percent. The price of vegetables has increased by half that, a little over 6-percent. As Social Security has calculated, since 2012, wages have increased (on average) by less than 3-percent per year (in 2013, increased by only 1-percent), meaning that food price increases have largely outpaced income increases.

The second (and often most pernicious impact) is that as people face higher prices of fresh fruits and vegetables, they substitute towards less nutritious (and relatively more inexpensive) fast foods, processed foods, or pre-made meals. Though this often eases the immediate pressure on the budgets of individuals, it ultimately leads to higher costs for families in the long-run, largely because of more ill health and higher healthcare expenditures.

This brings us to the potential impact of the potential (and large scale) El Nino event that is anticipated to start this year, and continue into next year. Though this event may help to alleviate immediate drought conditions, if enough snowpack is not accumulated in the Sierra Nevada Mountains, the potential to mitigate the effects of the long-term drought are limited. This means that it may be unlikely that, if farmers do not anticipate the conditions remaining, they will switch back to more water dependent crops. But, another outcome may occur; food prices may actually continue to rise. Analysts are worried about the impact of higher precipitation totals on crops that are ruined by large-scale rainfalls; maize, corn, wheat, etc. Because of the switch towards crops that consume less water, farmers may set themselves up to lose more of their crops from this large-scale rain event. This could potentially increase food prices again, again straining the budgets of the typical middle-class American.

Sources:


U.S. Department of Agriculture Economic Research Service:


U.S. Social Security Administration Average Wage Index:

http://www.ssa.gov/oact/cola/awidevelop.html