

# *Introduction to Human Geography Using ArcGIS Online*

## Chapter 6 Exercises

### Exercise 6.1: The Columbian exchange—origins of agricultural globalization

#### Introduction

The Columbian exchange initiated a radical transformation of global agricultural landscapes, as crops were transplanted between the Old and New Worlds. This has transformed economies and culinary traditions across the globe. In this exercise, you will explore how different crops have diffused from their hemisphere of origin to their current distribution of production and consider how your diet has changed as a result.

#### Objectives

- Identify crops by hemisphere of origin.
- Compare your diet to one how it would be without the Columbian Exchange.
- Quantify the tons of crops produced in the Old World and the New World.

#### **1. Open the Chapter 6 FAO Crop Production map and sign in to your account:**

- **<https://arcg.is/1PjL5L>**

The map opens showing countries divided into Old World and New World. The Chapter 6 FOA Crop Production layer includes 2014 United Nations Food and Agriculture data on crop production in tons for the year 2014.

**2. Begin by identifying the hemisphere of origin for selected crops.**

This information can be found in Table 6.1.

**3. Write “Old World” or “New World” in the second column of the table (question 6.1.1).**

Information for grapes is already filled in as an example.

**4. Think about how your diet would be different without any Old World crops. Give examples in the third column of the table.**

**Question 6.1.1**

Crop	Hemisphere of Origin (Old World or New World). Use Table 6.1 as a guide.	For Old World crops, give an example of how your diet would be different without them. Would you miss out on any of your favorite dishes?	Tons produced in Old World vs tons in New World.	Put an “X” in the cells below if more tons are produced outside of the hemisphere of origin.
Grapes	Old World	I could not eat my favorite fruit or drink wine. I would only have New World fruits, such as possibly pineapple.	Old World: 59,576,347  New World: 14,841,089	(No “X” in this case, since grapes are from the Old World and there is more production there.)
Cocoa/cacao beans			Old World:  New World:	
Wheat			Old World:  New World:	

<b>Rice</b>			Old World:  New World:	
<b>Potatoes</b>			Old World:  New World:	
<b>Apples</b>			Old World:  New World:	
<b>Tomatoes</b>			Old World:  New World:	
<b>Coffee</b>			Old World:  New World:	
<b>Barley</b>			Old World:  New World:	

- 5. Analyze where crops are produced by ton to see how their distribution has changed since the Columbian exchange.**
  
- 6. Hover the pointer over the Chapter 6 FAO Crop Production layer name and select Filter.**

You are going to filter each crop in the following table by Old World and New World to get statistics on crop production for each hemisphere.

- 7. Set the first filter expression so that Region is New World, as in the image below. If you select the Unique radio button, you can select rather than type New World.**

This will filter for all countries in the New World.

- 8. Click Add another expression at the top of the filter window.**

- 9. Set the second expression so that Cocoa\_beans is at least 1.**

This will filter for only countries that produced at least 1 ton of cocoa beans.

- 10. Click Apply Filter.**

Create

+ Add another expression  Add a set

Display features in the layer that match **All** of the following expressions

Region is New World  Value  Field  Unique  Ask for values

Cocoa\_beans is at least 1  Value  Field  Unique  Ask for values

APPLY FILTER APPLY FILTER AND ZOOM TO CLOSE

The map now shows only countries in the New World that produce cocoa beans.

- 11. Hover the pointer over the Chapter 6 FAO Crop Production layer name and select Show Table.**
- 12. Scroll the table to the right until you see Cocoa\_beans, and then click the field heading and select Statistics.**
- 13. From the statistics window, write down the Sum of Values number in the table (question 6.1.1), next to New World in the Cocoa/cacao beans row.**
- 14. Change the filter to show Old World cocoa production.**
- 15. Hover the pointer over the Chapter 6 FAO Crop Production layer name and select Filter.**
- 16. In the Filter Window, select Edit.**
- 17. Set the filter expression to Region is Old World. Leave the Cocoa\_beans expression the same.**
- 18. Click Apply Filter.**
- 19. Repeat the preceding steps and write down the Sum of Values for cocoa beans production in the Old World.**
- 20. Follow the same process for each of the crops in the table.**
- 21. In the right column, put an "X" in the cells if more tons are produced outside of the hemisphere of origin.**

## Conclusion

In this exercise you have seen how the Columbian exchange has altered your own diet. You have also seen how the Columbian exchange initiated a global transformation of the world's agricultural systems, as crops taken to new lands have come to provide vast amounts of our food supply.

## Exercise 6.2: Agriculture and development

### Introduction

There is a strong relationship between a country's level of economic development and its reliance on agriculture for employment and revenue. In this exercise you will analyze economic and employment data to determine what this relationship is for affluent and poor countries. You will also argue why this pattern is commonly found around the world.

### Objectives

- Identify countries with economies that are highly dependent on agriculture and others that are not.
- Determine the relationship between level of economic development and importance of the agricultural sector.
- Explain why these patterns occur.

**1. Open the map Chapter 6 Agriculture and Development and sign in to your account:**

- **<https://arcg.is/14rqOP>**

The map opens showing agricultural value added as a percentage of GDP for 2015. Countries with higher values have economies more dependent on agriculture. Countries with lower values have economies that are more dependent on industry or services.

**2. Use the Filter tool to identify countries in the top quintile of agricultural dependence, then identify countries in the bottom quintile, based on the following steps.**

- **Hover the pointer over the layer name Chapter 6 Agriculture and Development, then click the Show Legend button.**

This shows that the top quintile is from 20.8 to 60%, while the bottom quintile is 0 to 2.3%.

- **Hover the pointer over the layer name Chapter 6 Agriculture and Development, then click the Filter button.**
- **Set the expression so that Ag\_Pct\_GDP\_2015 is at least 20.8, as in the next image, and then Click Apply Filter.**

The screenshot shows the 'Create' tab of a filter tool. At the top right, there are links for '+ Add another expression' and 'Add a set'. Below this, the text reads 'Display features in the layer that match the following expression'. The main expression field contains 'Ag\_Pct\_GDP\_2015' in a dropdown, followed by 'is at least' in another dropdown, and '20.8' in a text input field. Below the expression field, there are radio buttons for 'Value' (selected), 'Field', and 'Unique'. There is also a checkbox for 'Ask for values' which is currently unchecked. At the bottom, there are three buttons: 'APPLY FILTER', 'APPLY FILTER AND ZOOM TO', and 'CLOSE'.

This selects the top fifth of countries with economies that are the most dependent on agriculture.

3. **Looking at the map, consider if these appear to be richer countries or poorer ones.**
4. **Hover the pointer over the layer name Chapter 6 Agriculture and Development, then click Show Table.**
5. **Find the average GDP per capita (PPP) for countries in the top quintile of most agriculturally dependent.**
6. **In the table, click on the GDP\_Per\_Cap\_PPP\_2015 field heading and select Statistics.**
7. **In the following table, write down the Average value in column two next to Top Quintile.**
8. **Repeat the step above with the Pct\_in\_ag\_2015 (Percent of workers in agriculture) and Ag\_Value\_Per\_Capita (Agricultural value per capita).**
9. **Write the average values in the table.**

#### Question 6.2.1

	<b>GDP Per Capita PPP</b>	<b>Percent of workers in agriculture</b>	<b>Agricultural value per capita</b>
<b>Top Quintile</b>			
<b>Bottom Quintile</b>			

10. **Filter for the countries that are least dependent on agriculture.**

**11. Hover the pointer over the layer name Chapter 6 Agriculture and Development, then click the Filter button.**

**12. Click the Edit tab. Set the expression so that Ag\_Pct\_GDP\_2015 is at most 2.3.**

**13. Click Apply Filter.**

This selects the bottom fifth of countries with economies agricultural dependency.

These countries have economies more geared toward industry or services.

**14. Looking at the map, consider if these appear to be richer countries or poorer ones.**

**15. As you did previously, use the table in ArcGIS Online to find the average values for GDP Per Capita PPP, Percent of workers in agriculture, and Agricultural value per capita.**

**16. Write the values in the previous table.**

#### **Question 6.2.2**

Which quintile of countries is richer (i.e., a higher GDP per capita PPP) and which has a larger percentage of workers in agriculture?

#### **Question 6.2.3**

Note that one group of countries produces slightly more agricultural value per capita but with a vastly different percent of workers in the agricultural sector. Based on the textbook, why is this?

### Question 6.2.4

If most people in a country do not have to work as (generally low wage) farm workers, what are they freed up to do? Give examples of jobs people in the bottom quintile countries do that pay higher wages.

### Conclusion

As you have discovered some countries are much more efficient at producing agricultural output than others. This allows more people to pursue other economic activities that create more wealth for themselves, and in turn, their countries.

## Exercise 6.3: Farmers' markets: Consumption patterns of buying locally

### Introduction

Farmers' markets are often described by proponents of the "local food" movement as healthier and more environmentally friendly alternatives to globally produced foods typically found in supermarkets. Some critics, however, argue that a great disadvantage of farmers' markets is that they cost more. In this exercise, you will determine the income level of neighborhoods surrounding farmers' markets in a city of your choice and discuss the pros and cons of globally and locally produced food.

### Objectives

- Identify farmers' markets in a city of your choice.
- Analyze the income level of neighborhoods within walking distance.
- Evaluate the pros and cons of global and local food production.

**1. Open the map Chapter 6 USDA Farmers Markets and sign in to your account:**

- <https://arcg.is/KSDr1>

The map opens showing these layers:

- a. **USA Census Populated Places. These typically reflect city boundaries.**
- b. **USA Counties (Generalized).**
- c. **Chapter 6 USDA Farmers Markets. This includes all farmers' markets as identified by the US Department of Agriculture.**

**2. Zoom to a place of your choice in the United States.**

Most, but not all, farmers' markets are located within populated places (e.g., cities).

**3. If the area you are studying has a farmers' market that is not in a populated place, turn off the Populated Place layer and turn on the Counties layer.**

**4. Click the County or Census Populated Place you will be studying and write down the Feature ID (FID): \_\_\_\_\_.**

**5. Filter the county or place.**

- **Hover your cursor over the Populated Places or Counties layer you are using for your analysis.**
- **Click the Filter icon.**
- **In the Filter window, set the expression so that FID is <FID from previous step>.**

Create

+ Add another expression  Add a set

Display features in the layer that match the following expression

---

FID  is

Value  Field  Unique

Ask for values ▼

**6. Click Apply Filter.**

**7. Find farmers' markets within your filtered Populated Place or County.**

- **Hover over the Chapter 6 USDA Farmers Markets layer and click the Perform Analysis icon.**
- **Select Find Locations, Find Existing Locations.**
- **In the Find Existing Locations window, click Add Expression.**
- **Set the expression so that Chapter\_6\_USDA\_Farmers\_Markets, completely within, either Populated Places or Counties (whichever you filtered previously). Click Add.**
- **For Result layer name, create a unique name.**
- **Zoom in so that you see the entire boundary of the county or place, but not much more.**
- **Show credits: should be less than 1 credit.**
- **Click Run Analysis.**

This creates a new layer with just the farmers' markets within your selected place or county.

**8. Enrich farmers' market layer to obtain socioeconomic data on people within ¼ mile of each farmers' market.**

- **Hover your cursor over the new Find Locations layer you just created.**
- **Click the Perform Analysis icon.**
- **Then click Data Enrichment, Enrich Layer.**
- **In step 2 of the Enrich Layer window, click Select Variables.**
- **In the Data Browser window, select Income, then Median Household Income.**
- **Click Back, then click Tapestry, Dominant Tapestry Segment Name.**
- **Apply.**
- **In step 3 of the Enrich Layer window, set Walking Distance. 0.25 miles and Return as bounding areas.**

**3 Define areas to enrich**

 Walking Distance ▼

0.25      Miles ▼

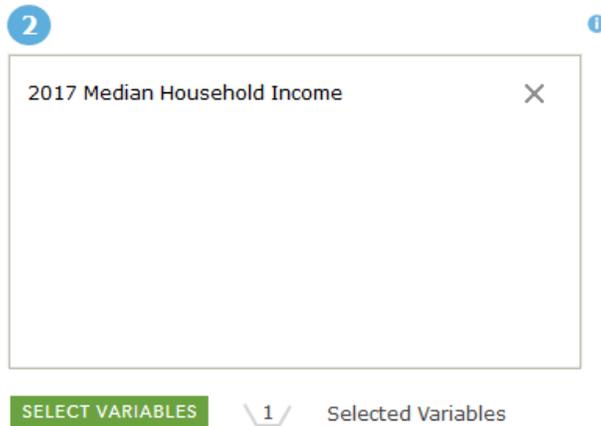
Return result as bounding areas

- **Show Credits:** The number of credits used should be about the same as the number of selected farmers' markets in your area. Make sure they are less than about 10, so as to not use too many credits. If you have more than ten, zoom in and make sure the Use current map extent is checked. Look at Show credits again to see if there are less than about 10.

- **Run Analysis.**

**9. Get median household income for your filtered place or county.**

- **Hover your cursor over the name of the layer you previously filtered: USA Census Populated Places or USA Counties (Generalized).**
- **Click the Perform Analysis button.**
- **Select Data Enrichment, then Enrich layer.**
- **In the Enrich Layer window, under number 2, click Select Variables.**
- **In the Data Browser window, select Income.**
- **Check Median Household Income, then Apply.**



- **Give your layer a unique name.**
- **Click Show Credits. You should use less than one credit. If it is more, make sure you have filtered for just one place or county.**
- **Run Analysis.**

A new Enriched layer will be added to your map that contains the median household income for your filtered place or county.

**10. Hover your cursor over the layer name and Show Table.**

**11. In the table, scroll until you see the median household income field. Make note of the value: \_\_\_\_.**

**12. Next, Show Table for your enriched Chapter 6 USDA Farmers' markets layer.**

- **Hover your cursor over the layer name and Show Table.**
- **In the table, scroll until you see the median household income field and dominant tapestry segment name.**

- **Make note of the values and segments for the ¼ mile walking distance around each farmers' market:**

#### **Question 6.3.1**

Do farmers' markets appear to be in areas with higher incomes or lower incomes than the city/county as a whole? Give examples using the median household income data.

#### **Question 6.3.2**

Open this link and click on the tapestry segment names that correspond to those in your table: <https://doc.arcgis.com/en/esri-demographics/data/tapestry-segmentation.htm>. List the segments and give a brief description.

#### **Question 6.3.3**

Based on the tapestry descriptions, are there similarities in terms of income, education, or other characteristics that make these places desirable for locating farmers' markets? Describe them.

#### **Question 6.3.4**

Based on the income and tapestry data, as well as your personal experience, which is cheaper, locally grown foods at a farmers' market, or globally produced foods at the supermarket? Include examples from the data and your own experience to support your answer.

### **Question 6.3.5**

Based on the Von Thunen model, which crops are grown closest to market and thus would be expected in a local farmers' market?

### **Question 6.3.6**

Based on the textbook, which do you think is better for you and society at large, globally or locally produced food? Explain why.

## **Conclusion**

Farmers' markets are often located in neighborhoods with specific income and lifestyle characteristics. In this exercise you have evaluated these patterns to see if certain types of places have better access to them, and, in contrast, if other types of places have lower access.

## **Exercise 6.4: Food deserts and racial disparities**

### **Introduction**

In developed countries food insecurity is due less to insufficient calories and more to poor nutrition. In some urban and rural communities there is a lack of supermarkets with fresh and affordable fruits and vegetables. In these so-called "food deserts" people too often rely on nearby convenience stores and fast food restaurants for food—places where fresh fruits and vegetables are less commonly sold. In this exercise you will identify food deserts in a city of your choice in the United States. You will also analyze the spatial relationship between food deserts and race/ethnicity and evaluate if there are disparities in which groups are impacted.

### **Objectives**

- Observe spatial patterns of food deserts in a selected county.

- Calculate racial/ethnic proportions for a selected county and its food deserts.
- Evaluate the degree of racial/ethnic disparity in food deserts.
- Hypothesize as to why some people face problems of poor nutrition.

**1. Open the map Chapter 6 Food Deserts Exercise and sign in to your account:**

- **<https://arcg.is/1C81u8>**

The map opens showing these layers:

- a. **Food Deserts. This includes census tracts where 500 people or 1/3 of the tract population lives 0.5 (urban) or 10 (rural) miles from a supermarket.**
- b. **2017 USA Diversity Index. This layer includes data on race/ethnicity at a variety of scales.**

**2. Zoom to a county of your choice in the United States.**

The food desert tracts are divided into two groups, colored blue and rust. The blue tracts represent areas that are not only food deserts, but where access to supermarkets is even more severe. These tracts are those where a significant number of households do not have a vehicle, or in the case of rural areas, where people live 20 miles or more from a supermarket.

**3. Zoom in and look at the food desert tracts. Based on what you already know about these areas, think about their socioeconomic characteristics.**

Next you will compare the racial/ethnic makeup of food desert census tracts with the overall racial/ethnic makeup of the wider county to see if there are racial disparities.

**4. Calculate the proportion of racial/ethnic groups for the county as a whole.**

- **Click one of the food desert census tracts in your study area. The popup will show the name of the county and its State/County ID code. Write down this number: \_\_\_\_\_.**
- **Expand the 2017 USA Diversity Index layer.**
- **In the expanded layer, click Filter for the County scale (not the State, Zip Code, Tract, or Block Group).**

▲  2017 USA Diversity Index

Country

State

County

County

County  
    | ...

ZIP Code

Tract

Block Group

- **Set the filter expression for Filter: 2017 USA Diversity Index-County so that ID is <enter the ID code you wrote down previously>.**

- **Click Apply Filter**

Filter: 2017 USA Diversity Index - County

Create
+ Add another expression  Add a set

Display features in the layer that match the following expression

ID

is

Value
  Field
  Unique

Ask for values ▼

- **In the expanded layer, click Show Table for the County scale (not the State, Zip Code, Tract, or Block Group).**
- **From the County table, fill in column B. For column C, all rows will have the same value, taken from the 2017 Total Population field.**
- **Calculate D so that  $D = A/B$ . This will give you the proportion of each race/ethnicity in the county.**

**Question 6.4.1**

(A) Race/ Ethnicity	(B) Sum of Values from Diversity Index table	(C) 2017 Total Population (Sum of Values)	(D) Percent of Total (Sum of Values/ Total Population)	(E) Sum of Values from Food Deserts table	(F) POPULATION	(G) Proportion of each race/ ethnicity in the food desert tracts  (G = E/F)
White						
Black/African American		(same as above)			(same as above)	

<b>American Indian/ Alaska Native</b>		(same as above)			(same as above)	
<b>Asian</b>		(same as above)			(same as above)	
<b>Pacific Islander</b>		(same as above)			(same as above)	
<b>Hispanic</b>		(same as above)			(same as above)	

5. Next, calculate the racial/ethnic proportions found in food deserts for your selected county.

- **Hover your cursor over the Food Deserts layer and select the Filter icon.**
- **Set the expression in Filter: Food Deserts so that STCOFIPS is <use the same ID number you used previously>.**

### Filter: Food Deserts

Create
+ Add another expression
 Add a set

Display features in the layer that match the following expression

STCOFIPS

▼

is

▼

Ask for values ▼
 

Value
  Field
  Unique

- **Click Apply Filter.**

This selects only the food desert census tracts within your chosen county.

- **Hover your cursor over the Food Deserts layer and select the Show Table icon.**

Unlike with the filtered county table, the filtered food deserts table contains multiple rows of information (one for each food desert tract). Because of this, you must use the Statistics function to get the Sum of Values.

- **In the table, click the WHITE field heading, then select Statistics.**
- **In the preceding table, write down the Sum of Values in column E. Repeat this process for the other racial/ethnic groups.**
- **Do the same for the POPULATION field, and write down the Sum of Values in column F.**

The value is the same for all rows.

- **Calculate G so that  $G = E/F$ .**

This will give you the proportion of each race/ethnicity in the food desert tracts.

#### **Question 6.4.2**

Are there racial disparities in food desert populations? In other words, are the proportions of some groups in food deserts substantially higher than their overall county proportions?

#### **Question 6.4.3**

If so, what may account for these disparities? Why may grocery stores be avoiding these places?

#### **Question 6.4.4**

From what you know of your selected city, do food deserts really exist in the identified tracts, or are there other sources of healthy foods in those areas?

#### **Question 6.4.5**

What do you think is the best way to convince people to eat healthier foods? Is better access the solution, or are other solutions needed as well?

### **Conclusion**

As show in this exercise, access to nutritious foods can depend on where one lives. In some cases, racial disparities in access exist. But oftentimes access is not the only barrier to eating well, as other sociocultural forces can also play a role.

## **Exercise 6.5: Undernourishment and development**

### **Introduction**

A global decline in undernourishment is one of humanity's great achievements. One of the most successful means of reducing undernourishment has come from economic growth. As economies grow, they typically create wealth that can be used for investment in agricultural production and food imports. Yet the benefits of economic growth also depend on income distributions. When growth only benefits a small elite, declines in undernourishment can fail to materialize. In this exercise you will calculate the percent change in undernourishment and then compare these changes to economic growth since the year 2000.

### **Objectives**

- Calculate the percent change in undernourishment between 2000 and 2015.

- Compare changes in undernourishment to changes in GDP per capita.
- Explain the relationship between undernourishment, economic growth, and social policies.

**1. Open the map Chapter 6 Food Deserts Exercise and sign in to your account:**

- <https://arcg.is/1Hi914>

The map opens showing these layers:

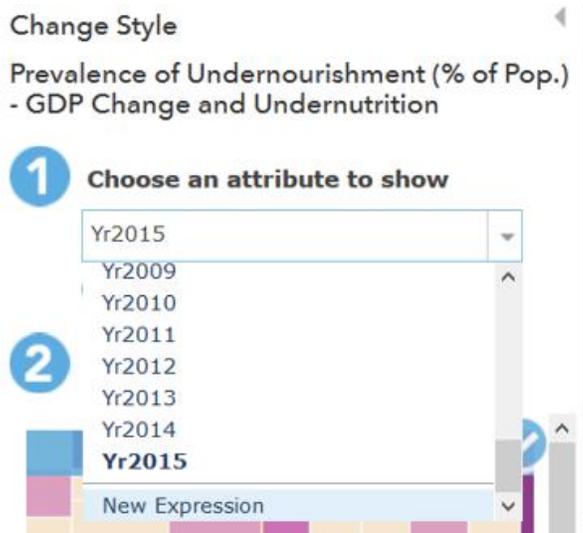
- a. Prevalence of Undernourishment (% of Pop.). This shows the proportion of people who were undernourished for the years 2000 through 2015.**
- b. GDP Per Capita (PPP) Change 2000-15. This shows the percent change in per capita GDP between the years 2000 and 2015, accounting for purchasing power parity, or the difference in cost of living between countries.**

The initial map shows undernourishment for the year 2015. Data is missing for a handful of countries.

**2. Calculate percent change in undernourishment between the years 2000 and 2015.**

- **Hover your cursor over the Prevalence of Undernourishment (% of Pop.) layer and click the Change Style icon.**

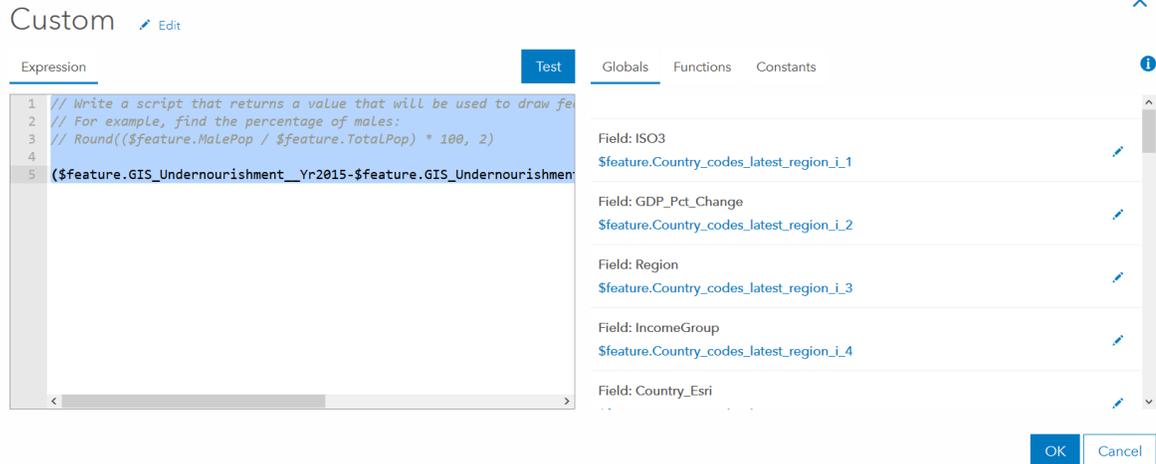
- **Choose an attribute to show: click the dropdown arrow and scroll to the very boom. Select New Expression.**



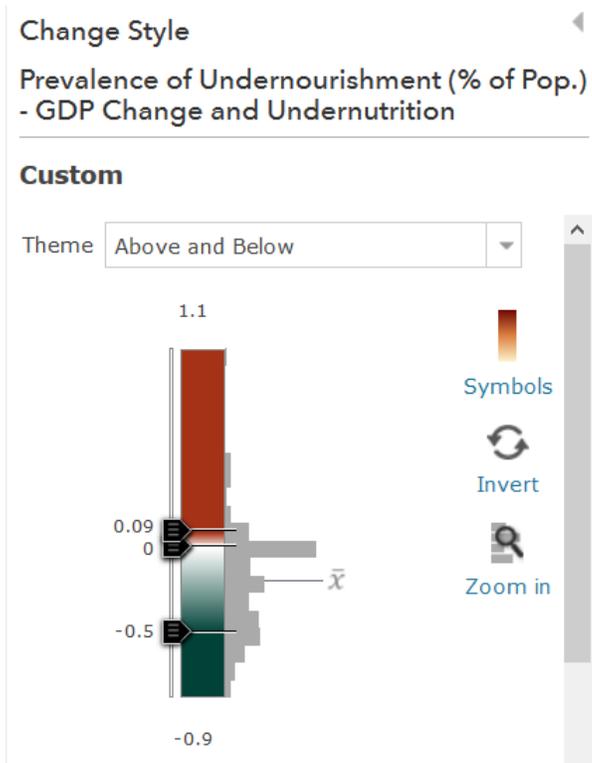
The formula for percent change is:  $(\text{New value} - \text{Old value}) / \text{Old value}$ .

- **In the Custom window Expression box, type the following (you can click the fields in the Global box on the right side of the Custom window):**  

$$\frac{(\$feature.GIS\_Undernourishment\_Yr2015 - \$feature.GIS\_Undernourishment\_Yr2000)}{\$feature.GIS\_Undernourishment\_Yr2000}$$



- **Click OK.**
- **Select a drawing style. Change the graduated circles to a choropleth map by clicking Select under Counts and Amounts (Color).**
- **Click Options under Counts and Amounts (Color).**
  - **Set the Theme to Above and Below.**
  - **Click on the middle value of the scale and change it to zero (0). This will show where undernourishment increased, decreased, and remained about the same.**



- **Click OK, then Done.**
  - **Hover over the Prevalence of Undernourishment (% of Pop.) layer and click Show Legend to see the legend.**
- 3. Identify countries with large declines in undernourishment and make note of their change in GDP per capita.**
- **Click on five countries that show large declines in undernourishment. In the popup window, look at the GDP\_Pct\_Change value.**
  - **In the next table, write the country name, then mark an X in the cell that corresponds to the GDP\_Pct\_Change value.**

If you like you can view the map with GDP Per Capita (PPP) Change 2000-15 and Show

Legend.

### Question 6.5.1

GDP per capita Change:	Country 1:	Country 2:	Country 3:	Country 4:	Country 5:
1. 160 to 452%					
2. 109 to 160%					
3. 75 to 109%					
4. 55 to 75%					
5. -19 to 55%					

### Question 6.5.2

Based on the preceding table, describe the relationship you see between a decline in undernourishment and growth in GDP per capita. Does undernourishment decline only in high growth economies?

### Question 6.5.3

Explain how economic growth can reduce undernourishment. Consider how changes in capital investment can help improve agricultural productivity and the role of trade.

- 4. Identify countries with high economic growth, but with limited declines in undernourishment.**

- **Hover your cursor over the Prevalence of Undernourishment (% of Pop.) layer and click Filter.**
- **In the filter window, set the expression so that GDP\_Pct\_Change is at least 109. This will filter for countries in the top two quintiles of growth (top 40%).**

Filter: Prevalence of Undernourishment (% of Pop.)

Create
+ Add another expression  Add a set

Display features in the layer that match the following expression

GDP\_Pct\_Change

▼

is at least

▼

109

Ask for values ▼
 

Value
  Field
  Unique

- **Click Apply Filter.**

#### Question 6.5.4

Of the countries with high economic growth, identify two that did not see declines in undernourishment. Write their names. Explain how income inequality can negate the benefits of economic growth. If instructed by your professor, research why undernourishment did not decline in your selected countries.

- 5. Identify countries with low economic growth but with significant declines in undernourishment.**

- **Hover your cursor over the Prevalence of Undernourishment (% of Pop.) layer and click Filter.**
- **In the filter window, edit the expression so that GDP\_Pct\_Change is at most 75.**

This will filter for countries in the bottom two quintiles of growth (bottom 40%).

- **Click Apply Filter.**

#### **Question 6.5.5**

Of the countries with low economic growth, identify two that did see declines in undernourishment. Write their names. How can economic resources be redistributed to help reduce undernourishment? Think about national and international programs that could help poor farmers and urban consumers.

#### **Conclusion**

Undernourishment is most easily reduced when economies grow and offer greater resources to farmers and urban consumers. However, the relationship does not have a perfect correlation. Inequality can limit the benefits of economic growth, while national and international programs that target undernourishment can benefit people even when economic growth is limited.