# Capstone Project Stage 2: Water, soils and crops

(Modules 4-6)

The diagram below summarizes the topics you will explore in Stage 2 for your assigned region. In Stage 2 of the capstone, you will engage in ***spatial thinking*** and ***geographic facility*** to interpret spatial data (for example annual precipitation, evapotranspiration and soils data) and interpret how multiple regional factors contribute to determining which crops are produced in your region.

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## What to do for Stage 2?

* Complete the Stage 2 worksheet table that contains a table summarizing the data you’ll need to collect to complete this stage. Remember, you need to think deeply about each response and write responses that reflect the depth of your thought as informed by your research.
* Add relevant visual figures (i.e. maps, tables, graphics, diagrams) to your power point.
* Add questions and continue to research the questions in your worksheets.
* Continue building a CHNS diagram to illustrate the connections between the natural system and the human food systems of the region. You may decide that you need multiple diagrams.

## Capstone Project Overview: Where do you stand?

At this stage, you should have started to investigate your assigned region and have added information, maps and data to your worksheets and PowerPoint file for Stages 1 and 2.

Upon completion of stage 2, you should have at this point:

1. Continued research and data compilation in the Stages 1 and 2 tables in the associated Stages 1 and 2 worksheets.
	1. Stage 1: Regional food setting, history of regional food systems, diet/nutrition
	2. Stage 2: Water resources, soils and crops
2. Added to your powerpoint file containing the data that you are collecting about the food system of your assigned region. Information you may have:
	1. Labeled map of your region
	2. Soil map of your region
	3. Precipitation and temperature map of your region
	4. Major crops and crop families grown in your region
3. Continued to record citations for all references and resources you are using in your research. This is a critical step. Every figure, map, piece of data and bit of information you collect from the web, a book, a person, a journal or any other source must be attributed to the source.
4. Added to your list of questions you have about your region related to key course topics and initiated significant efforts to answer.
5. Revised your CHNS diagram and/or create a new one incorporating topics from Modules 4, 5 and 6.

# CHNS Diagram

Continue to populate the CHNS diagram with information from Modules 4-6. Add new lines and boxes and connections to the diagram to illustrate other components of the human-natural system and their relationships. *Put your CHNS diagram(s) both here and in the powerpoint file.*

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| Stage 2: Water, soils and crops |
| **Region Name** | **Country** | **State/Province** |
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| Questions to Explore | Information about your regional food system(include a citation for everything you put here!) |
| Water Resources and PrecipitationDescribe the water resources available in your region and if irrigation is necessary.* What is the average annual precipitation in your assigned region?
* Is irrigation necessary in your assigned region? (Learning goal 1)
* What other water resources does your region have to support agriculture?

*Tips to Start** The regional climate data centers of the National Oceanic and Atmospheric Administration (NOAA) might provide precipitation data for regions in the US. Particularly, for western US, the [Western Regional Climate Center](https://wrcc.dri.edu/) is a good place to start.
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| Questions to Explore | Information about your regional food system(include a citation for everything you put here!) |
| Virtual WaterRefer back to summative assessment for Module 4 to speak to the amount of virtual water embedded in the food products of your assigned region.* How much virtual water is embedded in the food products from this region? You won’t be able to come up with an exact number, but just consider food production in your region in refence to food items listed in virtual water estimates that describe foods that range from high to low amounts of water required to produce.

*Tips to Start** Search your region on google scholar with “virtual water.” What other terms do you think will be helpful?
* Check out [National water footprint accounts: the green, blue and grey water footprint of production and consumption](https://research.utwente.nl/en/publications/national-water-footprint-accounts-the-green-blue-and-grey-water-f) report for national water data. This might be beneficial for those researching small states and also how to conceptualize virtual water trade.
* For those researching particular states in the US, this [article](https://doi.org/10.1002/2014WR015919) titled, Agricultural virtual water flows within the United States, might be a good place to start thinking about subnational flows.
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| Water PollutionAssess water pollution issues associated with food systems in your region.* Are any waterways impaired by excess nutrients (or other agricultural related pollutants?) (Learning goal 2)

*Tips to Start** If your region is in the US, EPA’s surf your watershed [website](http://cfpub.epa.gov/surf/locate/index.cfm) is a great resource.
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| Soil Types**Describe the soil types present in your region including soil fertility.*** What soil types are present in your region, at the level of detail presented in module 5.1, i.e., age, climate that formed them, rough soil order from the USDA?
* What kind of topography (level or sloping) is in your region?
* Are the soils generally deep or shallow?
* Are the soils typically well drained or poorly drained?
* Do they tend to have high or low pH and/or fertility?

*Tips to Start** Employ ***spatial thinking*** and start with the information provided in Module 5.1, particularly in the Formative Assessment 5.1.
* The Natural Resource Conservation Service (NRCS) global map of phosphorus retention in soils that was described in module 3.1 can be found in a high resolution version at: <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/?cid=nrcs142p2_054014>
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| Soil Impacts**Describe the effects that the regional food system has on the soil including erosion issues and fertilizer application.** * What affect does the food system in your assigned region have on soil?
	+ Topography and drainage?
	+ Erosion issues?
	+ Excess or shortage of fertility and organic matter amendments?
* Pollution of soils or waterways by industries or by agriculture itself?

*Tips to Start** Search your region on google scholar with varying combination of the words: “soil” and/or “impacts.” What other key words do you think might be helpful? Think about the particular context of your region. Is there urbanization, mining, or other industries that might impact your soil?
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| Crops and their characteristics**Describe the main crops grown in your region and their plant families.** Crops do not include animals; however, they can be a feed crop for livestock productions (i.e. silage, hay, corn, etc). Please identify the five plant species, this might involve additional research if you find that hay is a top crop, as hay is not a species, so you can’t answer the questions below based this term. *You will want to identify botanical names for these crops to determine their characteristics.*Questions to answer for each of the five species:* What is their botanical name?
* What are the top five crops in your region?
* Is each crop an annual or perennials?
* In what plant family is each crop?
* Is each crop a cool season or warm season crop, a C3 or C4 plant?

*Tips to Start** If your region is the US, you should use the USDA CropScape [website](http://nassgeodata.gmu.edu/CropScape/). You can also use the [USDA National Agricultural Statistics Service](http://www.nass.usda.gov/). Go to the section labeled “**Find Data and Reports**” Begin by selecting your state, then select the link labeled the name of your State Agricultural Overview., for example “Colorado Agricultural Overview”. You can also get data by counties, which is in the link at the left of the page that says “**County Profiles**” under “**More State Features**”. The county profile will give the rank of the county in the state for production of the different crops so that you can assess its importance in producing that crop, in addition to its ranking within the region. The county profile also gives information on the range of farm sizes and farm incomes in the region, which is useful socioeconomic information in characterizing agriculture for your capstone.
* If your region is outside the US, [FAOSTAT](http://www.fao.org/faostat/en/) is a great resource for country level data; however, if you are research a subnational region, which many of you are, you will need to find more localized data sources. I understand that you might have to guess what are major local crops but please provide good data sources to back up these inferences.
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| Crops, climate, soilDiscuss the possible relationships between crops, soils and climate of this region* Would you classify the soils and climate of your region as a high resource of low resource environment?
* How might climate and soils in your region explain why these crops are produced in that region?

*Tips to Start** You may find complementary information on crops, climate, and soil at a regional level in the NRCS Major Land Use Areas publication at <http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050898.pdf>
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| Crops & Socioeconomic FactorsPlease include at least 2 peer reviewed academic sources.* What socio-economic factors might explain why these crops are produced in that region?

*Tips to Start** Think about how markets and the ability to transport the products either locally or to other areas of the U.S. or other region. Another might be the economic level and ability to invest in production by residents of the region or companies producing food there.
* For US regions, note that the “County Profiles” on the NASS site listed above gives farm sizes and incomes. There is also the transportation networks and geographic location you characterized in the first capstone assignment. National census data can also be used to compare the median income of your region with that nationally., google your counties with U.S. census data and try to find this data; your instructors may have other suggestions.
* For all regions, search your region with combination of terms: “agriculture,” “development,” “market,” “socio-economic,” “farming,” “technology,” “knowledge.” What other terms might be used more specific to the context of your region.
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| Questions about your region? What additional information do you still need to find? Where might you find this information (add future references below)? |
| Future References and Key ResourcesInclude citations to newspaper articles, primary literature, databases, personal communications, etc. to information that might be useful in the future and aren’t already cited below.  |
| References Remember to use APA Format. |