**Getting students to hypotheses**

Below, we list several possible ways to get students practiced at hypothesis-making. They range from highly structured, guided prompts to more open-ended processes. Use the methods you need – or add your own – to help scaffold students as they work toward a testable hypothesis.

A hypothesis should generally have the format:

“If \_\_\_\_\_\_, then \_\_\_\_\_, because\_\_\_\_\_.”

Or, alternatively:

“If X is related to Y in the following manner (manner explained), then as X changes in a specified way, Y will change in this other specified way.”

**Where to start?**

**Start with questions**

1. I see, I wonder, I think

Site conditions: Look at your site, or sites. Have your students write observations or draw a detailed picture of the site (or each site). While in the field use the following prompt:

“What is at this site that would affect snow depth?” Walking around your study area asking that question where ever you stop and then asking if someone mentions a variable, “Is that the same as at the last site (or site x, y or z)?”]

Have your students put marks on their drawing of what might affect snowpack.

Once back in the classroom share the drawings with the same prompt.

Using the structure

“If\_\_\_\_, then \_\_\_ because\_\_\_.” Have students explain to each other how one variable from the sites might affect the other (snowpack, snow water equivalent, or the profile of snow).

1. Weather conditions: If thinking about how different weather may affect snowpack have your students write down all of the different types of snow events or snowstorms they have experienced in their lives. Use the prompt: “How would each of those events affect snow depth and/or snow water equivalent?”

Using the structure

“If\_\_\_\_, then \_\_\_ because\_\_\_.” Have students explain to each other how one variable from the sites might affect the other (snowpack, snow water equivalent, or the profile of snow).

1. Regional differences: Look at the spread of sampling sites for the project. Use the prompt: “How would location of these sites affect snowpack?” Ask students to use their own knowledge of the State and where these locations are to list some variables (hilly, flat, near shore, away from the coast).

Using the structure

“If\_\_\_\_, then \_\_\_ because\_\_\_.” Have students explain to each other how one variable from their list might affect the other (snowpack, snow water equivalent, or the profile of snow).

**Start with variables.**

As a warm-up, create a guided data exploration. Note: tailor the
"pick list” to variables you have measured at your site.

Select a variable from the list to explore and relate to snowpack depth in your study watershed:

* Air temperature
* Forest type
* Forest cover (open or covered)
* Forest location (deep in the woods or at the edge)
* Time (e.g., number of days since first snowfall)
* Site elevations
* Site aspect (which way is the site facing)
* Soil temperature

For each variable picked ask students to explain how snowpack could be related to that variable.

Using the structure

“If\_\_\_\_, then \_\_\_ because\_\_\_.” Have students explain to each other how one variable from their list might affect the other (snowpack, snow water equivalent, or the profile of snow).

 **Table of Field Variables (variation on the Start with variables, above)**

Using the Table of Field Variables, have students write down different types of conditions for each of the variables on the list (aspect: north, south, east, west; topography: hilly, flat; etc.). From that list of different conditions and using the “If, Then, Because” format, have students explain to one another how one variable would affect snow depth or snowpack. Encourage students to be specific, to add the ‘because’ statement – i.e., instead of saying “If temperature changes, it will affect snowpack because it has to be cold enough for snow”, have students explain the direction of change and specify what kind of driver would be needed. In this example, “If air temperature becomes warmer as we go from February to March, the snowpack will get progressively shallower because it will begin to melt”.

**A multiple-hypothesis brainstorming approach.**

To allow students more flexibility to decide what variables they are interested in try a brainstorming approach, where students rapidly develop several hypotheses then work with one testable one to create a final research focus:

Either from a site visit or from prior personal knowledge have students write a list of all of the variables they’ve noticed. Next to each variable, have students write whether it is a dependent or independent variable. “Snowpack depth” would be dependent in most cases, whereas “forest type”, “site elevation” and “air temperature” would be independent (they are the variables we think have an influence on snowpack).

Then, have students choose three of the independent variables they’ve listed, and write a hypothesis for each (or start with a question and progress to a hypothesis). The goal here is to practice, so encourage them not to spend too much time on any one of these just yet.

Have students look at the three hypotheses they developed and ask them to define how they would test each of the hypotheses. Some might be quite feasible to test; for example, if you are measuring air temperature and snowpack depth, then a hypothesis aimed at determining the effect of temperature on snowpack depth is testable. Some hypotheses won’t be testable with the sites or data you will have. For example, if you have two study sites at the same altitude, then a hypothesis about the effect of altitude (elevation) on snow won’t be testable. With the data you are collecting in mind, have students choose one of their three hypotheses that is testable, and work on adding some details and finessing the hypothesis to become the student’s final version to test.