How many people can the aquifer support?

Groundwater, Drought, and Natural Resource Management

Task 4: Final Models and Justification

Task Overview

In this last task, students are using their data to draw conclusions in order to answer the unit's essential question: How many people can the aquifer support? Students will justify their conclusions with evidence, and communicate their findings to the class.

Task Level NGSS Practices and Crosscutting Concepts

Disciplinary Core Ideas:

ESS2.A, ESS3.A, ESS3.B, ESS3.C

Science & Engineering Practices:

Analyzing and interpreting data
Engaging in argument from evidence
Obtaining, evaluating, and communicating information

Crosscutting Concepts:

Cause and effect

Materials:

Access to computers and Internet
Poster Paper
Printer (optional)

Safety Concerns:

None

I. How Many People Can the Aquifer Support?

Using their data from previous class periods, students make claims as to how many people they believe the aquifer can support. They can use their own collected data to make this claim, or other data they observed within the simulation.

Note: There are several ways the students can come to a conclusion about how many people the aquifer can support. Look for justifications that include data and evidence.

For instance, if there are 5 city wells pumping at their maximum rate and 3 farm wells when the aquifer is in drought, we see red appear on the map as early as Month 14. This indicates that too much water is being removed and that the aquifer is not stable. Students could conclude

that the city is removing 75,000 gallons of water each day (5 wells each pumping 15,000 gallons daily), and that the average American household of four needs 400 gallons of water a day. This works out 187.5 households of four, or 750 people. This population is too big for this aquifer.

Students can make a rough estimate of a stable population by determining the maximum water they believe the aquifer can sustainably have pumped out each day. Dividing that by 400 gallons will the number of four person households that the aquifer can support.

Student groups finalize their posters that explain the population that they believe the aquifer can support. Posters should include graphs and a written explanation that support their reasoning. Evidence should be cited on the posters (e.g. data collected in the simulation, facts given in the readings such as the amount of water an American household uses each day, etc). Groups must make recommendations for how to best manage an aquifer.

II. Presentations

Student groups present their findings and posters to the class. When all groups have presented, allow time for gallery walk and class discussion to synthesize results. Discuss similarities and differences. How did the groups differ in their approach to this task? Ask students how very large discrepancies in population size can be accounted for between the models.

Discuss the farm with students. Ask students who addressed the farm in their data collection or in their final presentation to share more about how they viewed the farm compared to the city. Ask all students their thoughts about the farm as the city population grows. During a drought, what farming practices should be considered? Students should address the farm, numerically or in words, as to how they believe it affects their model.

Ask students if they see similarities to the Dust Bowl of the 1930s in the trends in their data, or in current event news articles.

Discuss with students the limitations of models, even those based on data. At best, models accurately predict phenomena or generate data to support explanations. At worst, they provide inaccurate information. Ask students how they can evaluate their models (answers may include: compare outcomes with other models from other student groups, observe if predictions are correct, collect more data).

III. Revisions

Allow student groups to meet and review their findings in light of what they know about their classmates' findings. Students should make any changes to their models based on feedback from peers and class discussion. Allow student groups to use information presented by another group, so long as they cite that group's work when writing their final project for submission.

IV. Final Written Response

Student groups should submit a copy of their group's final computational model (spreadsheet with labeled columns and rows, relevant graphs for drought and no-drought with extrapolations if appropriate, and final poster).

Each student should independently submit their handouts and the final written response that includes:

- A brief explanation and justification for their chosen Indicators of Aquifer Sustainability
- A description of the method they used for collecting data
- Conclusions based on their finalized computational model
- Recommendations or an explanation for responsible aquifer management based on their collected data and observations, and historical knowledge
- An explanation of the merits and limits of their model