

Unit 6.1

Water on the Move: The Water Cycle

Public Preview

Unit Summary

In this unit, students explore the water cycle (hydrologic cycle) and how human activity can alter this cycle but not stop it. Students work to describe why a local community is having flooding problems and evaluate proposed solutions to address this problem.

To help students discover why flooding is occurring they investigate the multiple pathways water can take when moving through the water cycle and particularly how the cycle is a natural system which is driven by energy from the sun and gravity (MS-ESS2-4). As students learn about the water cycle, they work to accurately define the criteria and constraints of a successful solution (MS-ETS1-1) based on the needs and wants of the local community members.

Unit Challenge Questions

- How does human development affect how water moves through our community?

Unit Big Ideas

- Water is continuously cycling from one earth reservoir to another through multiple pathways and changes in state, due to the effects of gravity and thermal energy on water particles.
- Solutions to water quantity related issues should take into account the scientific phenomenon dictating the water cycle and how human activity affects the pathway water molecules take.

Connection to 21st Century Issues

One of the greatest challenges facing humanity in the future is ensuring that communities have sufficient water as well as mitigating the effects that climate change. One projected change is an increase in severe weather in some regions. This severe weather combines with land use changes as a result of human development, to cause river flow to become variable. Rivers that were previously stable throughout the year, may regularly breach their banks or dry up depending on the season. Students work to evaluate different development scenarios, to identify scenarios that may reduce the likelihood of flooding.

Unit Challenge

Unit Challenge Summary

The students work to explain if and how well different solutions to address a flooding problem meet the chosen criteria and constraints. The students are asked to present to the mayor/town council several products: 1) a revised list of criteria and constraints that must be taken into account when addressing a problem, 2) a brief presentation explaining how well a specific solution from list of proposed development solutions meets the criteria and constraints.

In order to accomplish this goal, the class and student Unit Challenge Groups slowly develop two models of the water cycle throughout the first 7 lessons- one model of the underutilized lot in present day and a second of what the lot might have looked like in the past when it was in a more natural form. Students use these models to evaluate the proposed development options (e.g. skate park, rain garden, soccer field) and use their models to determine what influences each option has on runoff, infiltration, and transpiration. Finally, students create an informational presentation that describes how well a given development option meets the criteria and constraints.

Unit Challenge Scenario

Our community used to be a forest surrounding a river connected to many smaller streams. The river and streams did not flood during storms and made a good home for fish, ducks and other wildlife. In the past, locals and tourists would visit the area to enjoy the forest and river. The local businesses made money from tourists visiting their shops.

As our community grew, much of the forest was logged. The forest was replaced with homes, stores, farms, and parking lots.

Today, the community has a problem with the river. The river floods when the snow melts and sometimes after large rainstorms. Now there are fewer recreation opportunities for people to enjoy. The local businesses are concerned because less people are visiting and shopping in the community. A local environmental group is concerned with the loss of trees and wildlife and would like to restore the river so that the river always has water for wildlife.

Here is where we need your help. Not far from your school there is piece of land with a small stream flows between a concrete parking lot and old field. This land is no longer used and the owner is worried the lot might be part of the water problem. If the planning committee can show how the land can used to improve the environmental, economic and social conditions of the community the landowner will donate the land to the community.

Unfortunately, the planning committee does not know what causes the stream to flood in the spring and dry up in the summer. They think this problem has something to do with how the land in our community has changed from forest to homes, stores, farms and parking lots.

Unit Challenge Student Products & Teacher Resources

Exemplary Student Products and Other Teacher Resources:

- 6.1_UnitChallenge_Teacher_BaseMap_ExampleCompletedModels
- 6.1_UnitChallenge_Teacher_ScenarioAnswerKey - summary of how well each proposed solution meets the criteria and constraints
- 6.1_UnitChallenge_Teacher_ProposedModel&PredictionsAnswerKey - contains the answers students will develop for each proposed solution
- 6.1_UnitSummaryTable_TeacherVersion
- Unit Challenge Student Product Checklist

Unit Challenge Student Resources

- 6.1_UnitChallenge_Student_BaseMapSideView_ForestedLot
- 6.1_UnitChallenge_Student_BaseMapSideView_PresentDayLot
- 6.1_UnitChallenge_Student_PlanningCommittee - students revise criteria and constraints initially developed by the planning committee.
- 6.1_UnitChallenge_Student_ProposedModel&Predictions - unit challenge teams are assigned to one of these proposed solutions, and predict how the solution will affect the movement of water

- 6.1_UnitChallenge_Student_CriteriaConstraintChecklist - students determine if their assigned proposed solution meets their revised criteria and constraints.
- 6.1_UnitChallenge_Student_ProposedDevelopmentScenarioCards - fact sheets that students use to determine the impact of the proposed solution.
- 6.1_UnitSummaryTable_StudentVersion

Lesson Sequencing Table			
Lesson #	Lesson Questions	What students do...	# days
1 (opener)	<ul style="list-style-type: none"> How does understanding the ways that water moves using system models help us determine the best solutions to water related challenges in the community? 	Students identify and communicate prior knowledge about the location and use of water within their community and how humans might impact a natural water system.	1.5-2
2	<ul style="list-style-type: none"> How and why does water flow from one place to another? 	Students investigate the cause and effect relationship between gravity, the movement of water from one place to another in a community and type of surface material and landforms over which water moves.	2.5
3	<ul style="list-style-type: none"> Where does the water in precipitation come from? 	Students explain how precipitation forms through evaporation, transpiration, and condensation.	3-4
4	<ul style="list-style-type: none"> What makes liquid water, ice and water vapor different? 	Students explore what happens to water at the molecular scale when it is a solid, liquid, and gas	2
5	<ul style="list-style-type: none"> How does water change state, from solid to liquid to gas? How does this affect the water system? 	Students explore how exactly matter, in this case water, changes state.	2-3
6	<ul style="list-style-type: none"> Where does water in our community come from and where does it go? How can humans change the way that water moves? 	Students use the information they previously learned consider how water moves on a global scale through the water cycle.	3
7	<ul style="list-style-type: none"> How can we make sure we have a good solution to a problem? 	Students experience importance of clearly defining the criteria, and constraints in order to have a successful solution.	1.5-2
8	<ul style="list-style-type: none"> How can scientific knowledge and well-defined criteria and constraints be used to choose successful solutions? 	Students use their models and revised criteria and constraints to make recommendations about the solutions proposed by the planning committee.	3-4
9 (closer)	<ul style="list-style-type: none"> How does understanding the ways that water moves using system models help us determine the best solutions to water related challenges in the community? 	Students present their findings to the class, critique each other's arguments, and reach a group consensus on how to address the problem of streamflow in their community.	2

Select Assessment Tools

The tools below are just **some** of the assessment opportunities that are available in this unit. The tools in this section have undergone more formal review.

Performance Expectations Coverage Matrix: 6.1_PE_Coverage Matrix

Pre-Post Assessment:

- Unit 6.1 Pre-Post Assessment- Student Version
- Unit 6.1 Pre-Post Assessment- Teacher Version

Embedded Assessment:

- Lesson 03 Check Your Progress
 - 6.1_L03_Check_Teacher_EA_InstructionsAndRubric
 - 6.1_L03_Check_Student_EA_StudentCopy
 - 6.1_L03_Check_Teacher_EA_StudentExemplar
- Lesson 05 Check Your Progress
 - 6.1_L05_Check_Teacher_EmbeddedAssessment_Instructions&Rubric
 - 6.1_L05_Check_Student_EA_StudentCopy
 - 6.1_L05_Check_Teacher_EA_StudentExemplar

Unit Challenge Student Product Proficiency Rubrics:

- 6.1_L09_Check_InvasiveSpeciesPriorityMatrix_Teacher_InstructionsRubric

Unit Content Resources:

- [NGSS Connections](#)
- [Prior and Future Knowledge](#)
- [Unit Materials List](#)
- [Unit Synopsis Video](#)
- Teacher Background Content Resources*
- Compiled Gotta Have Checklist*
- Unit External Web Links*

*Available to teachers who have completed the Unit Primer as part of the Mi-STAR Professional Learning Program

Unit Advance Preparation:

- Consult the Unit Materials Shopping List
- Complete the Unit Graphic Organizer & Resource List

