



TEACHER GUIDE | 45 MINUTES

Glaciers climate change and water access

English C1 | Ages 15–18 | EU4Blue

Students evaluate how hydrological evidence informs decisions about water security. They reconstruct an argument, expose unstated assumptions and negotiate a defensible policy under uncertainty.

Learning outcomes

Students can synthesise a complex argument, distinguish empirical claims from value judgements, and qualify causal inferences. They can negotiate competing priorities and respond spontaneously to objections in a formal register.

Lesson sequence

Time	Activity	Outcome
0–5 min	Discuss: “Until causation is certain, water restrictions are unjustified.” Identify the assumption behind this position.	Initial interpretation
5–17 min	Read p. 2. In pairs, write the synthesis in task 1 and discuss task 2. Discuss the author’s reasoning.	Critical reading
17–23 min	Analyse the fictional case on p. 3. Calculate the shortfall and identify missing evidence.	Evidence and inference
23–36 min	In groups of three, compare packages and prepare a council recommendation.	Reasoned negotiation
36–42 min	Two groups deliver a 90-second briefing. Each responds to one unprepared challenge from peers.	Argument and response
42–45 min	Revisit the opening claim. Agree on a qualified conclusion and distinguish adaptation from mitigation.	Shared conclusion

Preparation and teaching notes

Print pp. 2–3. Keep p. 4 as the answer key. Students need pens, paper for notes and, if useful, calculators. No internet access is required.

Use paired discussion to support complex reasoning without simplifying the text. Ask students to distinguish causal attribution from the justification for action. Assess how precisely they qualify claims and respond to objections, rather than rewarding specialised vocabulary alone.

Ocean Literacy: climate–ocean interactions and the relationship between people and the ocean (principles 3 and 6). EU4Blue themes: Climate Change & Water; Water, Health & Society.



STUDENT WORKSHEET 1

Glacier retreat and water security

Name _____ Date _____

Read and evaluate

Glacier retreat presents an apparent paradox: the depletion of a freshwater reserve may initially increase the flow available downstream. Interpreting this temporary gain as improved water security, however, confuses the liquidation of a stock with the sustainable provision of a resource. Mountain catchments receive water from rainfall, seasonal snow and glacier melt in varying proportions; dependence on each source is therefore geographically and seasonally uneven. [1, 2]

Where ice losses persistently exceed accumulation, accelerated melting draws down the reserve that sustains runoff. Beyond peak water, diminishing ice volume can outweigh the effect of intensified melting, resulting in lower annual glacier runoff. The timing varies between catchments. Moreover, glacier runoff and total river discharge are not interchangeable: precipitation and seasonal snowmelt can modify the relationship. Uncertainty about the scale or timing of local impacts should consequently not be mistaken for the absence of a physical mechanism. [2]

Water insecurity nevertheless cannot be reduced to a hydrological variable. Infrastructure, demand and the distribution of resources mediate the consequences of changing flows. Irrigation, hydropower and aquatic ecosystems may compete for increasingly constrained supplies, while communities differ in their capacity to adapt. Continued loss of land ice also contributes to sea-level rise, linking mountain processes to coastal exposure. The implications thus extend beyond the catchment in which the ice is lost. [1, 2]

For a council facing an immediate shortage, establishing its precise causes and deciding how to respond are related but distinct tasks. Incomplete attribution need not justify inaction; equally, urgency does not make every restriction proportionate. Leak repairs and demand management address impacts through adaptation, whereas mitigation tackles the causes of warming by reducing emissions. Choosing between local measures also involves a normative judgement: whose essential needs should be protected, and who should bear the costs? Evidence can constrain that choice without determining it. A defensible recommendation must therefore make its assumptions explicit and remain open to revision.

Technical terms: catchment = area draining to a river; discharge = volume of flow per unit of time; attribution = identifying causes; normative = concerning what ought to be done.

1 Synthesise the argument

In 60–80 words, connect the stock–flow distinction to the case for acting under uncertainty. Preserve the author's qualifications and reformulate the reasoning rather than copying phrases. Write on separate paper.

2 Evaluate assumptions and language

Discuss the opening statement from the lesson: does uncertain attribution invalidate restrictions? Distinguish an empirical claim from a normative judgement. Analyse the stock–flow metaphor and one concession in the text: how do they shape the argument?

Conclude with one condition under which temporary restrictions would be defensible and one reason they should be reconsidered.



STUDENT WORKSHEET 2

The valley water council

A fictional valley's usable water supply falls from 100 to 70 units per week during a dry summer. Demand remains 100 units. A minimum ecological river flow has already been reserved and cannot be reassigned. All figures below are invented for this classroom scenario.

3 Separate evidence from inference

Calculate the shortfall and percentage fall in supply. Explain why these figures cannot attribute the decline to glacier retreat. Identify two alternative explanations and specify evidence that would help distinguish them.

4 Negotiate a recommendation

Your budget is 8 tokens. Compare at least two packages that save 30 or more units per week. Each measure may be selected once. For the initial calculation, treat projected savings as independent and additive.

Measure	Cost	Saving	Limitation
A Repair leaking pipes	5	20 units	Disruption during repairs; trained staff required.
B Improve irrigation	4	15 units	Equipment and training costs fall on farmers.
C Restrict non-essential use	2	10 units	Some businesses and households bear more of the burden.
D Information campaign	1	5 units	Participation and savings are uncertain.

Roles: the water officer prioritises reliable savings; the community representative challenges unequal burdens; the ecosystem adviser defends the reserved river flow. Agree on a package without ignoring these tensions.

Negotiate a 90-second council briefing. Compare two feasible packages, justify your preferred balance of reliability and fairness, and concede one weakness. Set a measurable review trigger. Propose a separate mitigation action with a responsible actor. Respond to an unprepared objection after presenting.

Stress test before committing funds: D saves only 2 units. Recalculate and revise your package if necessary. Explain whether the result establishes overall reliability or tests only one assumption.

Challenge: if improved irrigation encourages farmers to expand the irrigated area, how would this affect the council's interpretation of projected savings?



TEACHER ANSWERS AND SOURCES

Solutions and assessment

Reading tasks

1 Model synthesis (64 words): Accelerated melting can temporarily increase runoff while depleting the ice reserve that sustains it. After peak water, glacier runoff may decline, although rainfall and snowmelt complicate local outcomes. Uncertain attribution does not remove the need to address shortages, but neither does scarcity justify any restriction. Councils must weigh essential needs, unequal burdens and the limits of their evidence, keeping their decisions open to revision.

2 The opening claim assumes complete attribution is a prerequisite for justified action. A measured shortage is empirical; prioritising essential needs is normative. "Liquidation of a stock" frames extra runoff as depletion rather than renewable income. "Equally, urgency does not ..." concedes a limit to the case for action. Restrictions may be justified if necessary and proportionate, with essential needs protected; easing the shortage or evidence of disproportionate harm warrants review.

Council task

3 Shortfall: 30 units/week; decline: 30%. Possible explanations include lower precipitation (test rainfall/snow records) and infrastructure losses (compare upstream flows with delivered volumes and leak records). Glacier measurements would help estimate its contribution. A before–after difference alone cannot isolate causes. Rising demand can intensify scarcity but does not itself demonstrate reduced natural supply.

4 Feasible initial packages: A + C costs 7, saves 30; A + C + D costs 8, saves 35; B + C + D costs 7, saves 30. With D saving only 2, the totals become 30, 32 and 27 respectively. B + C + D would leave a 3-unit gap; switching to either A + C or A + C + D remains within budget. No package is automatically fairest.

Model briefing: We favour A + C + D: eight tokens buy a projected saving of 35 units, leaving a buffer absent from B + C + D. Even if D saves only two, the total remains 32. This tests campaign participation, not the reliability of repairs. We concede that restrictions impose uneven costs; essential household needs should be protected and affected businesses consulted. The water officer should review the package if measured weekly savings fall below 30 units. Separately, the council should cut heating emissions from public buildings. Objection: why fund D? Its additional margin may justify the cost, but A + C is defensible if the remaining token has greater value elsewhere.

Efficiency challenge: expanding irrigated land may offset savings per hectare. Measure total withdrawals against a defined baseline. Passing one stress test does not establish robustness to delays, overlapping savings or other implementation failures.

Assessment

Assess four criteria, 0–2 each: faithful synthesis and inference; evaluation of assumptions and evidence; negotiated justification and spontaneous response; precise vocabulary, qualification and coherent formal register. 0 = absent/substantially inaccurate; 1 = partly effective; 2 = precise and developed. Total: 8. This classroom rubric is not a formal CEFR assessment.

Sources

[1] UNESCO. UN World Water Development Report 2025: Mountains and Glaciers, Water Towers.
<https://www.unesco.org/en/reports/wwdr/2025>

[2] WMO. Glacier melt will unleash avalanche of cascading impacts (2025).
<https://wmo.int/news/media-centre/glacier-melt-will-unleash-avalanche-of-cascading-impacts>

Last visited: 13 October 2026.