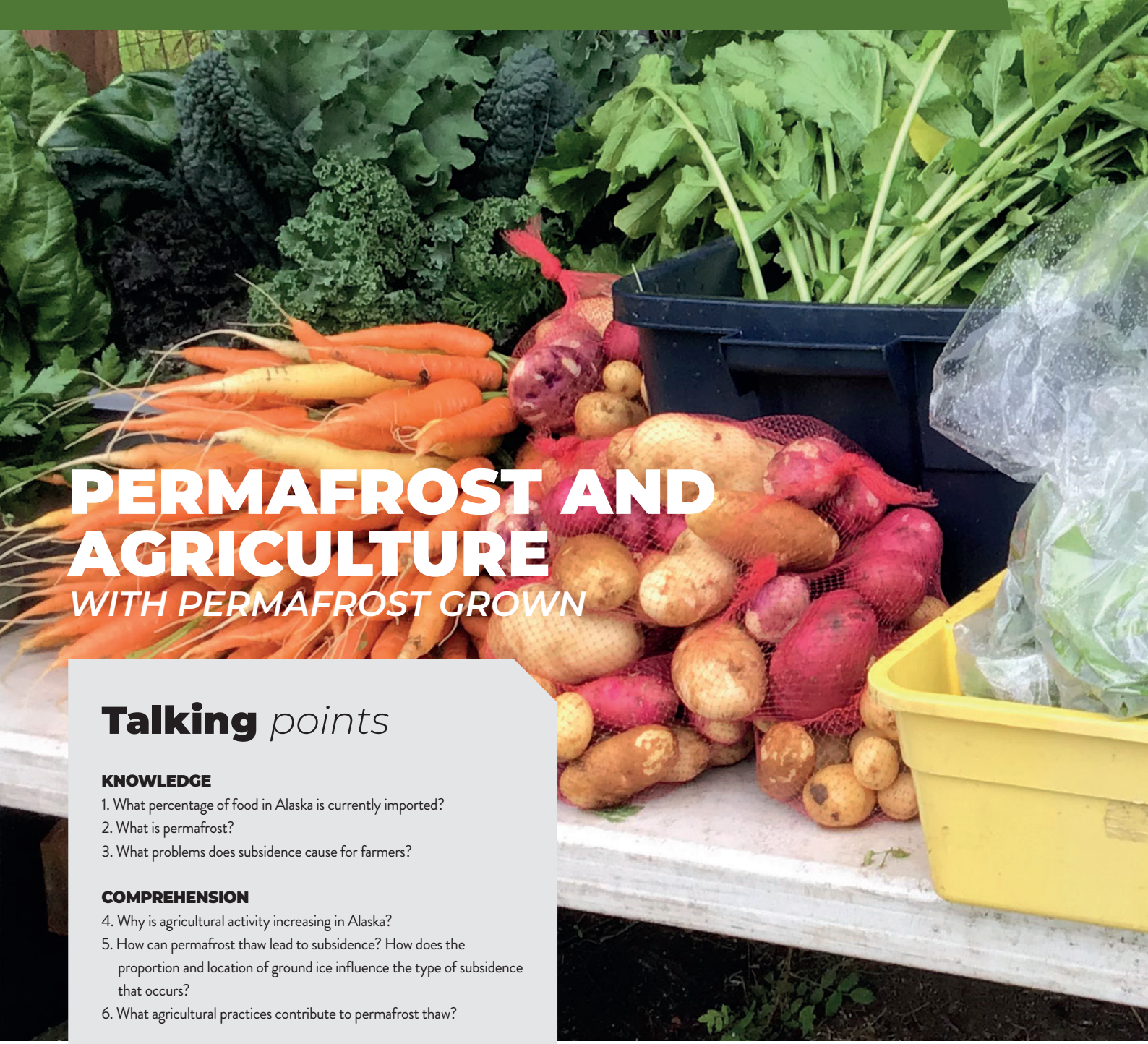

PERMAFROST AND AGRICULTURE
WITH PERMAFROST GROWN

Talking *points*

KNOWLEDGE

1. What percentage of food in Alaska is currently imported?
2. What is permafrost?
3. What problems does subsidence cause for farmers?

COMPREHENSION

4. Why is agricultural activity increasing in Alaska?
5. How can permafrost thaw lead to subsidence? How does the proportion and location of ground ice influence the type of subsidence that occurs?
6. What agricultural practices contribute to permafrost thaw?

ANALYSIS

7. Why does Permafrost Grown require a permafrost geomorphologist, a ground ice specialist, a remote sensing specialist, a sustainable food systems researcher and a natural resource economist? How do you think each team member contributes to the project?
8. Why is it essential that Alaskan farmers are involved in Permafrost Grown?

Evaluation

9. What environmental and social issues do you think might arise from increased farming in northern high latitude regions?
10. As climate change continues, do you believe that expanding agriculture into high latitude regions is the best solution to ensuring global food security? Why, or why not?

CREATIVITY

11. How would you design an experiment to test the impact of different crop types on soil temperature?
12. What farming practices can you think of that might avoid thawing the ground in permafrost regions?

Activity

Make your own permafrost!

You will need a freezer, four plastic containers (labelled A, B, C, D), soil or sand, water and ice cubes.

Making your permafrost

1. Fill container A with dry soil/sand and place it in the freezer.
2. Add some water to the remaining soil/sand. You want to create a mixture that is damp but not wet (it should still retain its structure as a solid).
3. Fill container B with the damp soil/sand and place it in the freezer.
4. Half-fill container C with damp soil/sand and place it in the freezer.
5. Fill container D with a mixture of the damp soil/sand and ice cubes.
6. After a couple of hours, pour a 1-2 cm thick layer of water over the frozen soil/sand in container C and return it to the freezer.
7. After a couple more hours, fill the rest of container C with damp soil sand and return it to the freezer.
8. Leave your permafrost samples in the freezer for several hours or overnight.

Thawing your permafrost

1. Remove your permafrost samples from the freezer leave them to thaw.
2. Take photos of the samples at regular intervals to record how they respond to thawing.

Questions to consider:

- What type of permafrost is represented by each of your samples?
- Why are the contents of your containers not technically permafrost?
- What happens to each sample as it thaws? Why?
- How does the proportion and location of ground ice in the sample influence the stability of the ground surface?
- What challenges would a farmer in each of these four situations face as the permafrost below their fields thawed?
- How could the farmer mitigate these challenges?
- How could a remote sensing specialist use your series of images to investigate permafrost thaw?

Visit the Permafrost Grown Futurum webpage for an animation about the team's work:
www.futurumcareers.com/farming-on-permafrost

More *resources*

- Visit the Permafrost Grown website to learn more about the project: **www.permafrostgrown.org**
- Read more about Permafrost Grown: **www.arcus.org/witness-the-arctic/2021/2/article/32639**
- Dr Benjamin Jones has used remote sensing to observe coastal erosion in Alaska. Watch this timelapse video of thawing permafrost coastline collapsing into the sea: **www.washingtonpost.com/energy-environment/2018/11/14/watch-warming-ocean-devour-alaskas-coast-this-striking-time-lapse-video/**
- Learn more about permafrost and explore a range of educational resources from The Permafrost Tunnel: **www.permafrosttunnel.org/index.html**
- The University of Alaska Fairbanks Cooperative Extension Service has resources covering a range of topics about living in Alaska, including gardening: **cespubs.uaf.edu**
- *It Grows in Alaska* is a gardening blog run by Heidi Rader, Associate Professor of Extension at the University of Alaska Fairbanks Cooperative Extension Service: **itgrowsinalaska.community.uaf.edu**
- Frozen Ground Cartoons produces educational cartoons, games and videos about permafrost: **www.frozengroundcartoon.com**
- The International Permafrost Association (**www.permafrost.org/group/education-and-outreach**) and the US Permafrost Association (**www.uspermafrost.org/resources-for-kids**) have educational resources about permafrost, the Arctic and climate change.