DRONES ON THE DELTA
In Ghana's Volta River delta, the remotely-operated aerial vehicles are going where researchers can't to help study coastal erosion, flooding and migration

River deltas are among some of the most densely populated places on Earth, especially in some developing African and Asian nations. They're also some of the areas most vulnerable to climate change, with rising seas and increasingly powerful storms driving flooding and erosion.

So how do the people who live in these regions adapt to the changes that are occurring there? That's what Kwasi Appeaning Addo, an associate professor in the department of marine and fisheries sciences at the University of Ghana, is trying to help determine. He's part of an International Development Research Centre-supported project that's gathering information on the changes affecting three major river deltas around the world — the Ganges-Brahmaputra-Meghna delta in Bangladesh and India, the Mahanadi delta in India and the Volta delta in Ghana — and how migration can be an adaptive option for the people who live there. The project looks at a variety of factors using different techniques, including hydrology and economic studies, and surveys of migrants both within the deltas and at their final destinations.

In some of these countries, though, studying deltas can be tricky, as the terrain is difficult or variable and there are sometimes security concerns. Cost can also be an issue, with the expense of using advanced remote-sensing systems or traditional aerial photography not something developing countries can usually afford. With these costs in mind, Appeaning Addo has been experimenting with using drones to monitor coastal erosion and flooding, and studying how those processes affect the people of the Volta delta.

The drones take pictures and record video of coastal areas, collecting a visual record that's used to build a database to quantify the changes seen in the most vulnerable areas. "The people in the communities keep us updated, and we move in to capture what is going on," says Appeaning Addo. (Watch this video to see footage of flooding and Appeaning Addo explaining his work.)

The drone project is focusing on two communities in particular, both just to the east of the capital, Accra: Fuvemeh, a low-lying coastal town that has suffered from severe floods in recent years, and Keta, a bigger town on a narrow spit of land between a large lagoon and the sea, which has recently experienced erosion rates of up to eight metres per year.

Around Fuvemeh, the drones have allowed Appeaning Addo and his colleagues to better quantify the damage caused by the floods. "About 50 houses have been lost and almost 250 people have been displaced in the last two years," he says. In Keta, his team is monitoring the effectiveness of major engineering projects, such as huge breakwaters intended to help reclaim land and build beaches. Appeaning Addo says that these structures have trapped some sediment but notes that it's too soon to say whether the solution will be a long-term one.

Waves wash ashore at Fuvemeh, a town in Ghana's Volta River delta that's threatened by coastal erosion and flooding. (Photo: Appeaning-Addo et al. 2015)

Nevertheless, Appeaning Addo believes the data the drones have gathered is already having an effect. He recently showed some footage to a local member of parliament who immediately saw the need for action and arranged a meeting between the researchers and the local district assembly. "We can show them what's going on and offer solutions," he says. "It can help them decide whether to try and solve the problem with engineering or by relocating people."

Drones have not been used in the deltas in India and Bangladesh yet, but Michele Leone, the IDRC project manager overseeing the delta research, says the potential to do so exists. "I'd like to see how useful it is before committing to a larger scale, but we will often use the same techniques adapted to different regions."

Leone hopes that the data from the project will be used to improve countries' long-term plans for managing their river deltas. He cites Bangladesh's multi-million-dollar plan to manage its side of the Ganges delta until 2100 as an example. "It does not explicitly take into account migration as a complex process that needs to be understood far better while planning for the next century," he says. "If we don't know where people are going, where they want to go and what allows them to go," he adds, "there is no chance for these plans to succeed."

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READING AS THINKING

Answer the following in complete sentences.

1. Before you read the article, reflect upon the title, the picture and its caption. What are some keywords that come to mind that give you an idea of the article's subject matter?

    _____

    _____

    _____

After reading the article:

2. Circle the keywords and underline the main ideas in the article. Use this information to summarize the article in point form with five to ten points.

    _____

    _____

    _____

    _____

    _____

3. We tend to glance over pictures without realizing that they play a key role in communicating ideas. Take a closer look at the picture in the article and answer the questions below.

What do you see in the picture? (Who? What?)	
What does it remind you of? What personal connections can you make to the picture?	
How does the picture relate to the article? Why do you think this picture was chosen for the article?	

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4. Who might be affected by the changes to the three major river deltas in the article, both directly and indirectly? How can they be part of a solution?

5. Why are densely populated places some of the most vulnerable to climate change? Elaborate on the reasons given in the text and add your own ideas.

6. Explain the difficulties associated with studying deltas.

7. Michele Leone is quoted as saying, "If we don't know where people are going, where they want to go and what allows them to go, there is no chance for these plans to succeed." Explain the challenges that would impede success.

8. In the article, it is mentioned that drones are being used to take pictures and videos as a way to study the coastal areas. What are some concerns people might have about using drones?

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Think-Pair-Share

9. *Think*
    Imagine that you live in a densely populated region that has experienced erosion rates similar to that of Keta's 8 metres per year. The local government has decided that the population must migrate elsewhere. What would be some challenges that you and your family might face?

	Before the migration	During the migration	After the migration
Challenges			

10. *Pair*
    Compare your answers with a partner or your team.
    a. Discuss why certain challenges might be unique to some people.
    b. Think of ways to diminish the challenges and to reduce the impact of the migration.

11. *Share*
    As a class, share the ways you have proposed to diminish the challenges and to reduce the impact of migration. Brainstorm ways in which Canadians could help.

ONLINE

1. Using Google Maps, locate Ghana and explore the country by using Street View and the satellite and map modes. Using the quick facts section and other research tools find the following:
    a. The population
    b. The neighboring countries
    c. The major bodies of water
    d. The capital city
    e. The Volta delta. Describe its location relative to the location of the capital, Accra.

2. Using Google Maps Street View or a general picture search, compare the landscape of the Volta delta in Ghana, the Ganges-Brahmaputra-Meghna delta in Bangladesh and India and the Mahanadi delta in India.

3. Read through this presentation about the DECCMA project.

4. Watch this video to learn how out-migration affects women who are left behind in the Mahanadi delta.

5. Learn more about how DECCMA Northern is using drones to monitor coasts.

6. Read more about how Prince Edward Island is using drones to monitor its coast. What other places around the world are using drones to monitor erosion?

7. Read this article about the new ways that we use drones and be sure to watch the videos.

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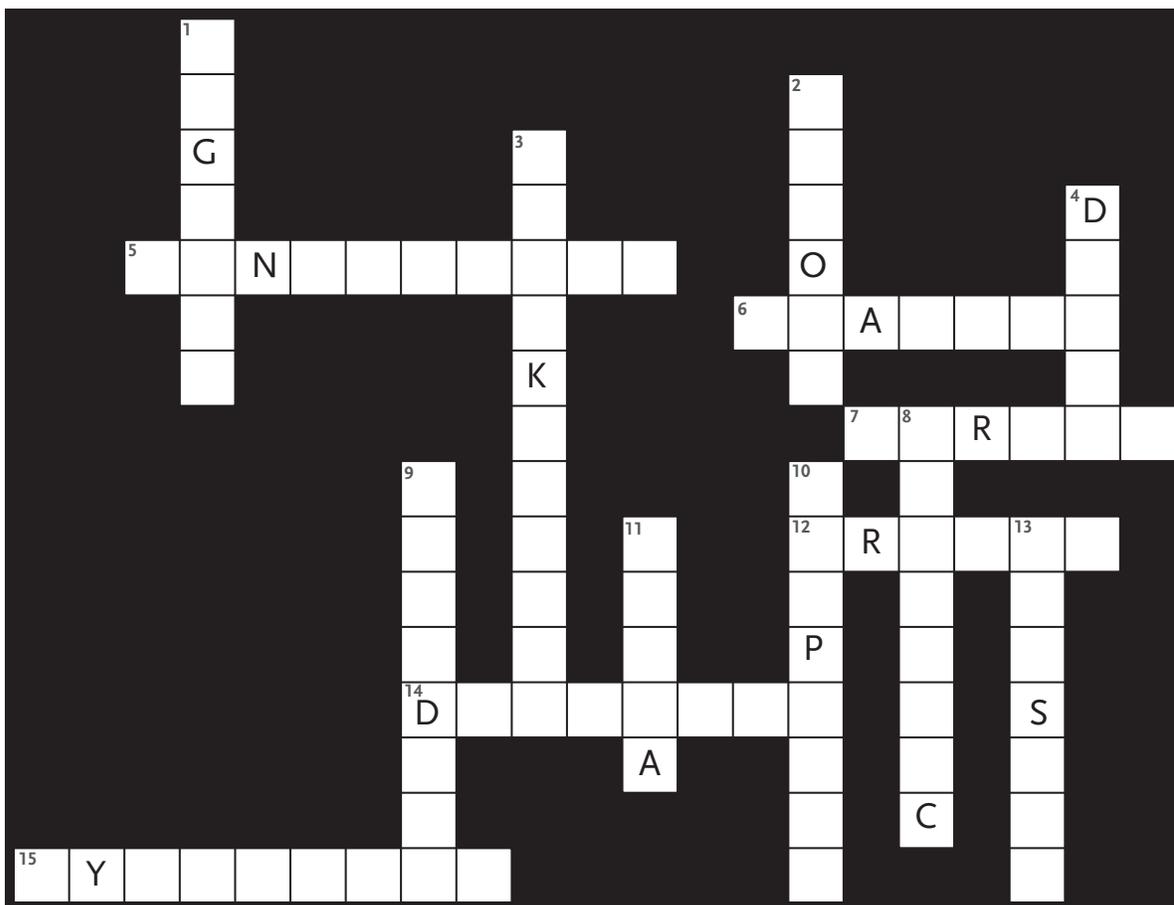
CROSSWORD:

Across
5. One of the world's most densely populated countries in Asia
6. Seaside
7. Happens in the air
12. Pilotless flying vehicles
14. A way to divide up a territory
15. The study of water

Down
1. Someone who relocates
2. A body of water detached from a larger body of water by a sandbank or a reef
3. Used to protect an anchorage
4. A landform, usually triangular, that forms when the river current slows down and deposits sediment
8. Fiscal
9. Inundation
10. Flexible
11. The capital of Ghana
13. Slow disintegration

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