Cutting the cow burps activity sheet

39 Ways to Save the Planet

Royal Geographical Society with IBG

Advancing geography and geographical learning

Methane

The following activity is based on the BBC Radio 4 series 39 Ways to Save the Planet. In order to complete this worksheet, listen to the 13-minute episode Cutting the Cow Burps.

Methane (CH_4) is 28 times more powerful than carbon dioxide (CO_2) at warming the planet and might rise to being 80 times more powerful in the next 20 years. This radio episode explains how methane is linked to cattle farming.

There is over a billion head of cattle throughout the world, with each cow emitting methane equivalent to around 1 tonne of carbon dioxide per year.

What is the problem with cattle farming?

Cattle farming is the agricultural business of raising cows and bulls, oxen or calves for the dairy or beef or leather industries. As awareness grows about the rising threat of climate change attention is turning to the issue of cow flatulence releasing a potent greenhouse called methane. However, the real problem is not flatulence but rather cow burps that are the real problem.

The reasons cow burps are so damaging to the environment is because cows are ruminants. Ruminants are mammals which are herbivores with multichambered stomachs for digesting grass. Cows are unable to break down cellulose in the cell walls of plants, therefore they are unable to digest plants directly. Instead, they chew food more than once. Grass is first exposed to bacteria in the Rumen (Go to the Memorial University Biology Faculty to see a Figure of ruminant digestion). This allows the cow to regurgitate and reprocess the grass, described by the phrase *to chew one's cud* — when a bolus of food is brought back into the cow's mouth to rechew and reswallow. This first chamber of the stomach is significant because the cow's powerful stomach muscles churn the grass with microbes which start fermentation and generate methane and carbon dioxide in the process. These gases are then burped out.

The possible solutions

However, not all cows emit the same level of methane. Eileen Wall from Scotland's Rural College (SRUC) says that genetic control is a possible solution for controlling methane emissions from cows.

> One of the things that I'm looking at is understanding the genetic control of methane emissions from the animal. Our work has shown there is a 25% variation between animals that is down the genetics of the animal in terms of the methane they emit, per unit of feed intake (and you can look at that per unit of meat output).
>
> Eileen Wall

This essentially means that farmers in the future will be able to identify which animals they want to retain in a herd to limit their greenhouse gas emissions by breeding out the most gaseous cows.

Alternatively, certain types of grass produce less methane in a cow's stomach.

Another option is the cultivation of a red seaweed called asparagopsis taxiformis which has a key chemical in it to prevent the production of methane escaping from cattle (show in Figure 2).

The breakdown of complex carbohydrates in the Rumen of the cow generates volatile fatty acids. If red asparagopsis could be used as feed the bromide-based compound in the seaweed, called bromoform (CHBr3), will block carbon and hydrogen atoms from forming methane thereby lowering

emissions. Unfortunately, asparagopsis is yet to be farmed at scale and a wild harvest is unlikely to support global uptake in the cattle industry.

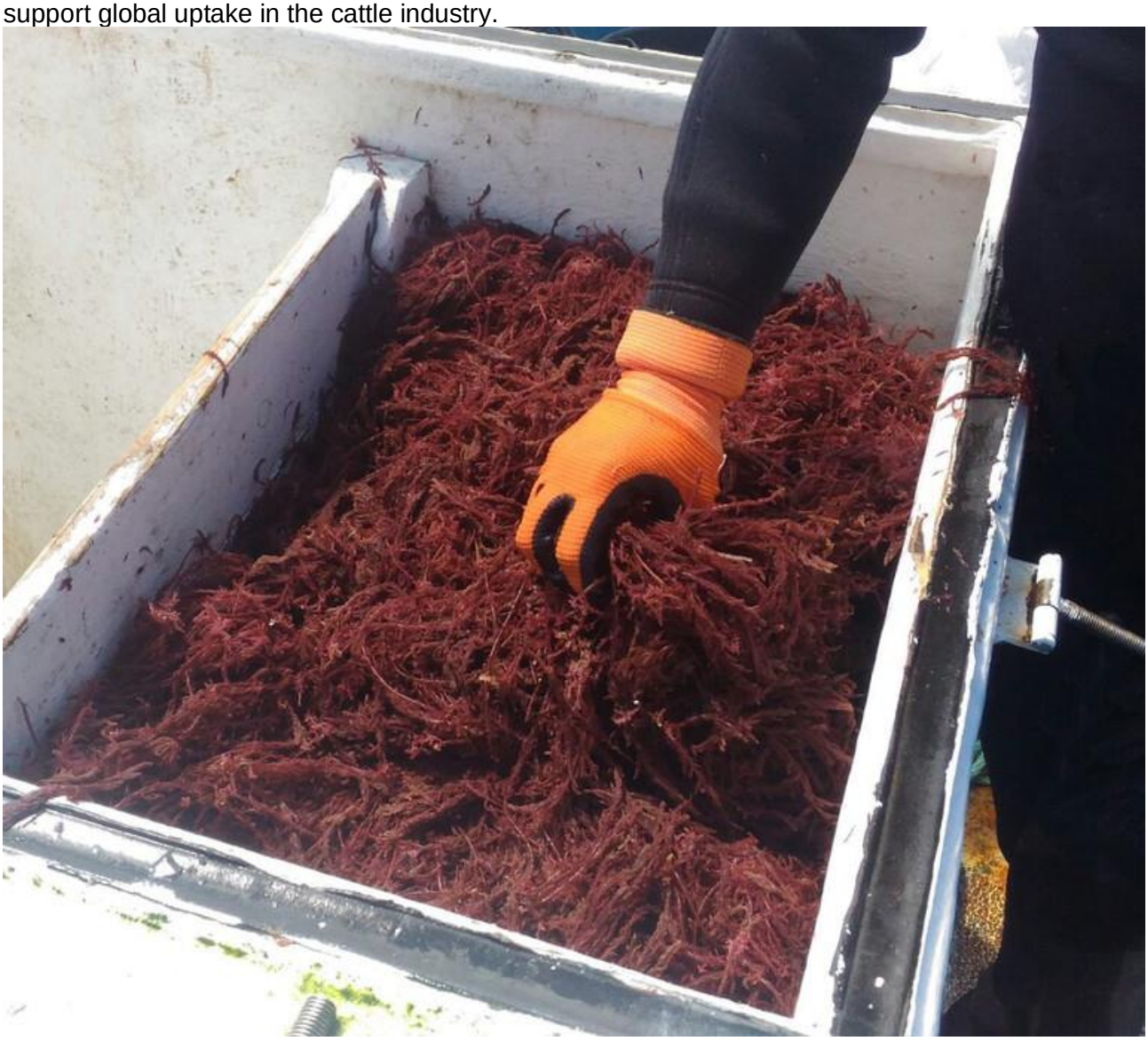

Figure 2 Asparagopsis taxiformis, red seaweed © Penn State University, HRISTOV research group

Finally, methane capture is also being researched either directly from a cow's muzzle or, if the cattle are indoors, from the building. It is hoped it could be stored and converted into biogas from new and evolving engineering solutions.

Slurry

Slurry is cow waste and is another problem as it gives off ammonia, nitrous oxide, carbon dioxide and methane. It is commonly known as manure. The solution to this is to store the slurry in concrete tanks with a lid. Downward injection rather than spraying muck (slurry) on fields would also mean less air movement and less exposed slurry surface area.

Further reading

- Cow digestion www.mun.ca/biology/scarr/Ruminant_Digestion.html

- Pearson diagram www.qualifications.pearson.com/content/dam/pdf/BTEC-Nationals/Animal-Management/2016/specification-and-sample-assessments/Additional-Sample-Assessment-Material-Unit-2-Animal-Biology.pdf

- Are my hamburgers hurting the planet? www.washingtonpost.com/climate-solutions/2019/11/18/are-my-hamburgers-hurting-planet/

- 'Are a cow's farts the worst for the planet?' Children's climate questions answered www.theguardian.com/environment/2019/jun/29/cows-farts-children-climate-questions-answered

- Methane explained www.nationalgeographic.com/environment/article/methane

- Phys www.phys.org/news/2019-06-seaweed-additive-livestock-methane-poses.html

- Why dairy farmers are looking to the sea www.theguardian.com/dairy-australia-green-solutions/2021/jan/22/why-dairy-farmers-are-looking-to-the-sea-to-reduce-methane-emissions

- Feeding seaweed to reduce emissions www.jofnm.com/article-76-Feeding-seaweed-to-reduce-emissions.html

Suggested questions for Cutting the Cow Burps

a. How many cows are there in the world?

b. Tom Heap says ‘there are certainly plenty of solutions on offer’ what list of ideas is offered?

c. For the genetic control idea, once you have identified your best cattle, how long does it take to breed out the high emitters?

d. What is asparagopsis? How much could this reduce emissions from cattle?

An RGS-IBG expert

Go to What our expert say to hear further analysis from Dr Tamsin Edwards, Eileen Wall from Scotland’s Rural College, Dr Michelle Cain from Cranfield University (shown below) and Professor Vincent Gauci from the University of Birmingham.