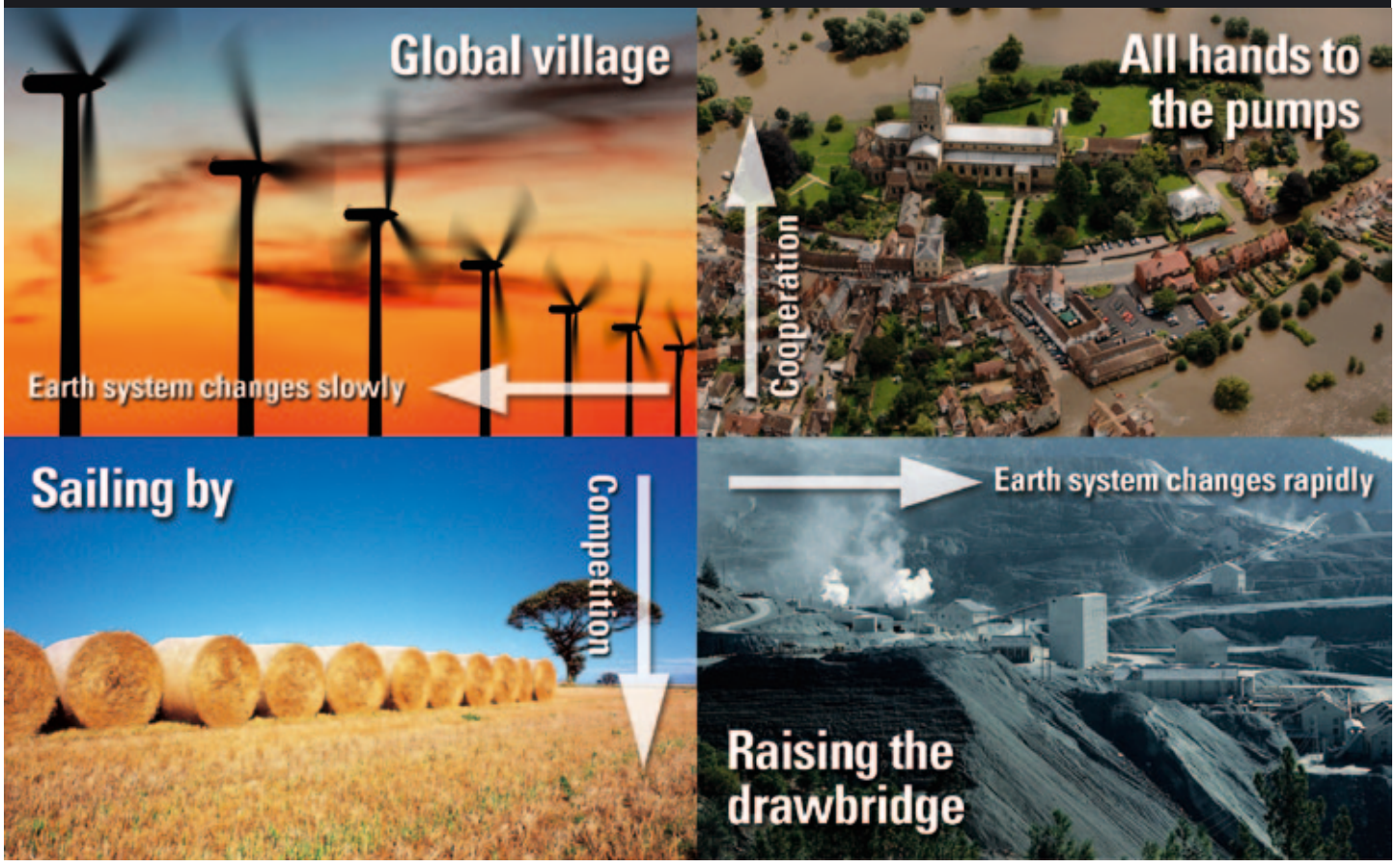
The future's bright... if you have the resources

The global population is growing incredibly quickly, and the UN estimates it could reach nine billion by 2030. This will put huge pressures on the environment and use up natural resources ever more quickly. Kathryn Goodenough and Daren Gooddy argue that the geosciences are essential to making sure the world's population can support itself while minimising environmental damage.

We rely on natural resources from the ground – aggregates for roads and buildings; oil and coal for transport and energy; rare metals for new technologies like electric vehicles and solar panels; and water, the basis of life on Earth. But what will we need in the future? And how will our needs change in response to developments in politics, technology and social and economic growth? How can we make sure our natural resources are used sustainably? To try to answer some of these questions, and understand the priorities for the geosciences in the future, BGS has put together a Science Futures Team.

The team developed a set of four possible, contrasting future scenarios, based on two important variables: how fast the Earth system changes and whether nations are cooperating or competing. The scenarios are based on our current knowledge of the most important issues likely to affect people's lives over the next 20 to 30 years. To illustrate them, let's look at some graduate scientists of the future and see how their lives might look under each scenario.

The four scenarios were developed by considering two contrasting factors – the rate of change in the Earth system and the degree of cooperation between countries.



Global village

Significant international agreements on climate change were finally signed following the droughts and pan-European heatwave of 2012, with richer countries recognising that they must work with developing nations. For Emma, graduating in Environmental Science and Economics in 2030, it's an exciting time. She can expect to work in a truly global industry, perhaps studying the effects on biodiversity of the new renewable energy power stations now spread across the world, or joining one of the green finance companies that trade globally in carbon credits and water stocks rather than money.

Travel is no problem; massive increases in duty on oil and gas after incidents like the 2010 Gulf of Mexico oil spill led to rapid development of hybrid and electric engines for cars, and much more efficient jet engines for planes. Oil is now largely the domain of the aviation industry, with almost all other transport powered by electricity from a network of power stations harnessing renewable energy sources, nuclear and coal with carbon capture. Some people complain about the pylons and power lines that now march alongside new roads across every country in the world, but in Emma's view, progress is necessary. The only thing she misses is meat – in the global push to feed the growing population, meat has become ever more expensive, as more and more land is turned over to growing genetically-modified food crops alongside biofuels.

All hands to the pumps

Climate change accelerated rapidly after 2010, with floods in Pakistan, droughts that devastated China's food production, and heatwaves across the Americas triggering a push for global emissions agreements. But despite the G20's efforts to cooperate, it seemed there was no way to slow environmental change. Attention turned to ways to adapt to a rapidly changing world.

For Hannah, a new graduate in Demographic and Technical Engineering, there are many opportunities. Across the UK, new infrastructure projects include the massive pipeline that brings water from the Scottish Highlands to south-eastern England, and building New Letchworth, a semi-underground city on the South Downs that will shelter hundreds of thousands of people who have lost their homes to flooding. Further afield, the Global Key Resources Programme is an international effort to identify new sources of critical raw materials, such as gallium for the arrays of solar panels spreading across the ever-widening Sahara Desert.

Sailing by

The slow rate of progress seen in Copenhagen in 2009 continued, with no global agreement on environmental change ever being reached. Disparate national and regional initiatives took the place of global ideas. In the UK, policy-makers chose to ignore the effects of climate change beyond their borders, instead planning for the UK environment as an isolated unit, balancing the need for natural resources with the requirement to protect the wealth of habitats and biodiversity. By the time Daniel graduates in Modern Landscapes and Geography in 2030, cheap travel is a thing of the past, and most British people work and holiday in the British Isles.

Imported oil and gas have become very expensive, so public transport is again many people's main method of travel. British coal and renewable energy keep the country running, and new techniques for deep mining have advanced rapidly. Although National Parks and other key countryside areas are fiercely protected, much of the land between is taken up by mines, quarries and factories, or by huge farms that now grow much of Britain's food. Daniel aims to work in one of the large government bodies that run much of the country's infrastructure, managing resources for UK PLC.

Raising the drawbridge

The world has changed a great deal. An international climate change agreement was never achieved, and developing countries' emissions kept growing. The effects were rapidly seen, with droughts and desertification advancing across southern Europe, Australia and Africa, while flooding and extreme weather affected northern Europe, North America and southern Asia. China developed a policy of preserving its own natural resources – and buying up those of poorer countries – and other nations followed. Eventually, the European Union splintered, with richer countries no longer able to support poorer ones.

By the time Andy graduates in Georesources in 2030, Britain is beleaguered, trying to fight off flooding and sea-level rises while dealing with summertime water shortages. Nearly all natural resources must come from within the UK, and some more abundant commodities have to be defended fiercely. Large swathes of the country have been industrialised; in the south the priorities are huge water-storage tanks, industrial-scale agriculture and new inland housing for those threatened by rising seas. Elsewhere, open-cast coal pits and giant quarries compete with enormous wind farms. Despite all this, Britain still depends on hugely expensive imported oil and gas. Andy would love to do research on Icelandic volcanoes, but he knows that he is most likely to get a job with one of the companies prospecting for oil, gas and other raw materials in ever more difficult and dangerous parts of the UK's continental shelf.

Where next?

The BGS Science Futures Team is using these scenarios to try to understand what the priorities might be for geoscience research in 20 years' time. The results will help us start thinking now about the questions that will be most important in future.

We need to prioritise our skills to ensure that as a nation we are equipped for the challenges ahead. This will probably include higher levels of numeracy and better computer modelling, as well as improving our ability to measure and monitor the environment.

Some topics prove important in all the scenarios – these will probably be vital whatever happens. For example, in any foreseeable future Britain will need to use its domestic mineral and energy resources, such as coal. This has big implications for geoscientists. We won't just need geologists to help us mine efficiently; we will also need people with expertise in capturing carbon dioxide emissions underground, or using other methods to reduce coal's environmental impact.

How can we ensure we have enough water? Understanding how water moves through the landscape is essential to help choose the best ways to protect it. If we build new nuclear plants to generate clean electricity, how will we store the radioactive waste they produce safely and permanently in underground repositories? Geoscientists are already working on the problem, and this research will only become more important.

Of course, these scenarios are extreme – the real 2030 will probably lie somewhere in between. We would be very interested to hear what *Planet Earth* readers think of any of the scenarios, or which they see as most likely!

MORE INFORMATION

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The BGS Science Futures Team comprises Jon Chambers, Daren Gooddy, Kathryn Goodenough, John Laxton, Jon Naden, Simon Price, Barry Rawlins, Helen Reeves and Dave Schofield. You can give feedback on which scenario you think is most likely on the BGS Science Futures web page: www.bgs.ac.uk/sciencefutures