RSC Sustainability

ROYAL SOCIETY OF CHEMISTRY

ESSAY

View Article Online
View Journal | View Issue

Open Access Article. Published on 05 October 2023. Downloaded on 3/16/2026 10:07:47 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

Check for updates

Cite this: *RSC Sustainability*, 2023, **1**, 1588

DOI: 10.1039/d3su90042h

rsc.li/rscsus

"We didn't start the fire": how the chemical sciences can steward the use of our Earth's chemical resources

Eleanor R. Newton

Three over-arching approaches are needed to manage resources sustainably: encouraging innovation (advancing upcycling and recycling technologies), promoting education and awareness (chemistry practice; greater scientific literacy in society), and advocating for better regulations (government policy).

Humans have been extracting natural resources from the earth for centuries and using them to create useful products. For example, as early as 200 000 BC, humans discovered that they could use fuel, such as wood, to create controlled fires for warmth and cooking.[1] These resources, which are extracted from the air, water, and land, can contain common chemicals like aluminium, copper, and indium,[2] as well as rare-earth elements like cerium, which are used for a variety of purposes such as tinting glass and ceramics.[3]

However, as demand for these chemicals increases, the speed at which they are depleted also increases. This has led to some resources, such as indium, being classified as "critical minerals" as demand for technologies like TVs and mobile phones that use it increases.[2] Copper, which is used in some batteries, is another example of a resource whose demand has risen with the growth in technology.[4] As this process continues, it is unlikely that these resources will last.

Therefore, it is our responsibility to manage these resources in a sustainable way to prevent their depletion. This is the goal of stewardship, which is particularly important for those in the chemical sciences. The chemical sciences encompass various chemistry subdivisions like organic, inorganic, physical, and analytical, as well as biochemistry. They also play a key role in environmental stewardship, which combines knowledge from the chemical, biological, and physical sciences with social sciences such as sociology and politics to plan and manage these resources.

In summary, as the demand for natural resources increases, it is essential that we manage them responsibly to prevent their depletion. This is the responsibility of everyone, but particularly those in the chemical sciences, who play a critical role in environmental stewardship. As such, this essay aims to list three over-arching ways in which those in the chemical sciences can ensure that these resources are able to be used for many years to come. These methods are encouraging innovation, promoting education and awareness, and advocating for better government regulations.

One way in which those in the chemical sciences can continue to support the conservation of the Earth's chemical resources is through encouraging innovation. Everyone has heard of 'reduce, reuse, and recycle', however the global recycling rate was only 32% in 2022.[5]

School of Chemistry, College of Health and Science, University of Lincoln, Brayford Pool Campus, Lincoln, LN6 7TS, UK. E-mail: enewton1618@gmail.com

Eleanor Newton was born and raised in the USA and now lives in the UK. She has just finished her master's degree in Chemistry with Education and the University of Lincoln. Her work focuses on sustainable chemistry practices and issues with science education in the UK. She would like to continue her research in a similar field through PhD study, or she would like to support the improvement of science education in the UK through teaching.

© 2023 The Author(s). Published by the Royal Society of Chemistry

Open Access Article. Published on 05 October 2023. Downloaded on 3/16/2026 10:07:47 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

Additionally, a staggering 91% of all plastic waste has not been recycled, leaving it to end up in landfills or – even worse – in our oceans.[5] Therefore, it is imperative that everyone does their part for environmental stewardship by correctly recycling their paper, plastic, glass, and metal products where possible. By doing so, we are able to ensure that the useful chemical resources from these products do not go to waste. Additionally, we save energy, as more energy is needed to extract these materials again and make another product than is used to recycle a product.[2]

However, while recycling is a useful way to ensure that these products stay out of landfill, there are hurdles that chemical scientists are tackling to ensure that these resources are recycled more effectively. For example, chemical scientists have been innovating new methods of recycling and reusing resources such as through chemical upcycling,[6] bio-based recycling,[7] solvent-based recycling,[8] and thermal recycling.[9]

As mentioned, chemical upcycling – the conversion of products such as waste plastic into higher value products[6] – has been perceived as an ideal approach to conserving our resources. This method involves the chemical conversion (through catalytic pyrolysis) of used plastics into useful gas or liquid products that can be used for a wide array of uses such as fuels and new plastics. With help from chemical upcycling, it has been proposed that 50% of plastic waste will be recycled in the EU by 2025.[10] Combined with the use of the other recycling techniques listed, the goal of 100% circular recycling seems more obtainable.

Another way in which chemical scientists can promote the better use and management of the Earth's chemical resources is through promoting education and awareness. By improving society's scientific literacy, for example, we can encourage more people to carry out sustainable practices. For example, through the collaboration of professional bodies and institutions to produce resources to help educate the public on pressing environmental issues.

Chemists can participate in public outreach programs to help educate the public about the importance of sustainability in chemistry and their day-to-day lives. This can include giving talks, participating in community events, and creating educational materials such as brochures and videos. Additionally, chemists can support the integration of sustainability topics and concepts into chemistry courses at all levels, from introductory to advanced. This will help students understand the importance of sustainability in chemistry and its impact on society. Lastly, chemists can set an example by practicing sustainable chemistry in their own work and personal lives. This can include reducing waste, conserving energy, and using environmentally friendly materials and practices in the laboratory. By leading by example and sharing their practices with society through useful tools such as social media, they can ensure that more people understand their message.

Lastly, and probably most importantly, chemical scientists can support the stewardship of our Earth's chemical resources by advocating for better governmental regulations. As it stands, governments around the world continue regulatory practices that hinder sustainability. For example, the UN Development Programme have stated that governments around the world have pledged over $420 billion each year to subsidise the fossil fuel industry.[11] These production subsidies make producing these fuels artificially cheap, which leads to complacency and discourages the development of more sustainable and renewable fuels. Additionally, these governments have regulations and policies for companies that limit the liability for environmental damages,[12] which ultimately encourages risky or unsustainable practices.

Therefore, chemical scientists can ensure that they advocate for better government policies through actions such as lobbying (the act of lawfully attempting to influence government policy).[13] Despite a UK 'anti-lobbying' clause, scientists who provide expert opinions to the government are still allowed to voice their displeasure of regulations and may lobby against them.[14] Additionally, independently funded scientists are free to express their views. Through lobbying, these scientists are able to correct politicians and government institutions when they misinterpret or ignore sound scientific findings and conclusions. For example, in recent news there has been a debate over the Willow Project – a project that seeks to build new oil drilling sites in remote Alaska.[15] This project has been proposed by the Biden administration in the US, and by the administration's own estimates it could see enough oil generated to increase carbon emissions by 9.2 million metric tonnes a year.[16] While the debate continues, as this project would increase jobs for remote Alaskans and may improve their economy, scientists can recognise the climate impact of this project. Therefore, this has led to lobbying through petitions and talks to inform the policymakers on these views.

As stated, the extraction and use of natural resources from the earth have been crucial to human survival and the creation of useful products. However, with increasing demand, the depletion of these resources is becoming a critical issue. To manage these resources responsibly and prevent depletion, everyone must contribute, particularly those in the chemical sciences, who play a critical role in environmental stewardship. This essay suggests that chemical scientists can promote sustainability through encouraging innovation, promoting education and awareness, and advocating for better government regulations. With chemical upcycling, improving scientific literacy, and lobbying for better policies, chemical scientists can ensure that these resources are used in a sustainable manner for years to come. Because after all, as Billy Joel once said, "We didn't start the fire… no, we didn't light it… we just tried to fight it".[17]

References

1 *Energy sources through time – timeline*, Science Learning Hub, University of Waikato, Hamilton, New Zealand, 2018, available at: **https://www.sciencelearn.org.nz/resources/1636-energy-sources-through-time-timeline**.

2 *Resources from the Earth*, BBC, London, 2023, available at: **https://**

Open Access Article. Published on 05 October 2023. Downloaded on 3/16/2026 10:07:47 PM.
This article is licensed under a Creative Commons Attribution 3.0 Unported Licence.

www.bbc.co.uk/bitesize/topics/z3fv4wx/articles/zsgkdp3.

3 MMTA, *Cerium*, available at: https://mmta.co.uk/metals/ce/.

4 N. Bennett, *The looming copper crunch and why recycling can't fix it*, available at: https://www.mining.com/the-looming-copper-crunch-and-why-recycling-cant-fix-it/.

5 R. Peysakhovich, *How Many People Recycle in the World?*, 2022 Stats, available at: https://www.getonedesk.com/recycling-statistics.

6 X. Chen, Y. Wang and L. Zhang, Recent progress in the chemical upcycling of plastic wastes, *ChemSusChem*, 2021, **14**, 4137, DOI: 10.1002/cssc.202100868.

7 W. Cornwall, *The Plastic Eaters*, 2021, available at https://www.science.org/content/article/could-plastic-eating-microbes-take-bite-out-recycling-problem, DOI: 10.1126/science.abk1723.

8 Y.-B. Zhao, X.-D. Lv and H.-G. Ni, Solvent-based separation and recycling of waste plastics: A review, *Chemosphere*, 2018, **209**, 707, DOI: 10.1016/j.chemosphere.2018.06.095.

9 A. Kijo-Kleczkowska and A. Gnatowski, Recycling of plastic waste, with particular emphasis on thermal methods—Review, *Energies*, 2022, **15**, 2114, DOI: 10.3390/en15062114.

10 *Chemical recycling*, Plastics Europe, available at: https://plasticseurope.org/sustainability/circularity/recycling/recycling-technologies/chemical-recycling/.

11 *COP26: How much is spent supporting fossil fuels and green energy?*, BBC News, 15 November 2021, available at: https://www.bbc.co.uk/news/59233799.

12 M. Greenstone, *Liability and Financial Responsibility for Oil Spills Under the Oil Pollution Act of 1990 and Related Statutes*, 2010, available at: https://www.brookings.edu/testimonies/liability-and-financial-responsibility-for-oil-spills-under-the-oil-pollution-act-of-1990-and-related-statutes/.

13 *What is lobbying? A brief guide*, BBC News, 5 November 2021, available at: https://www.bbc.co.uk/news/uk-politics-56733456.

14 K. G. Orphanides, *Publicly funded scientists won't be gagged by anti-lobbying law*, Wired, 20 April 2016, available at: https://www.wired.co.uk/article/publicly-funded-scientists-wont-be-gagged-by-lobbying-law.

15 A. Phillips, *What is the Willow Project? Biden's Alaska oil plan faces growing backlash*, Newsweek, 3 March 2023, available at: https://www.newsweek.com/what-willow-project-alaska-oil-drilling-backlash-1785420.

16 E. Nilsen, *What to know about the controversial Willow oil drilling project in Alaska*, CNN, 2023, available at: https://edition.cnn.com/2023/03/07/politics/willow-project-alaska-oil-explained-climate/index.html.

17 B. Joel, *We didn't start the fire*, available at: https://genius.com/Billy-joel-we-didnt-start-the-fire-lyrics.

 © 2023 The Author(s). Published by the Royal Society of Chemistry