

Chemistry: Meeting the World's Needs?



by *Natalia Tarasova*

“The International Union of Pure and Applied Chemistry (IUPAC) serves to advance the worldwide aspects of the chemical sciences and to contribute to the application of chemistry in the service of Humankind. As a scientific, international, non-governmental and objec-

tive body, IUPAC can address many global issues involving the chemical sciences.” These words meet the visitors of the Union website. If IUPAC wants to be visible outside the community of chemists and really intends to help meeting the world's needs, a broad picture of these needs is to be understood by all. A short overview of the “state-of-art” in this field is given below.

Origin of the Millennium Development Goals

At the turn of the millennium human development on Earth calls for a structured approach. In September, 2000, 189 states agreed upon key areas of global cooperation to ensure well-being for all. These key areas translated into eight Millennium Development Goals (MDGs), each split into several targets dealing with poverty, education, gender equality, health and environmental sustainability. For 15 years these have been the ultimate goals of the United Nations member states. While there has been progress on many targets, the condition of the environment has been consistently deteriorating. Although the MDGs have not yet expired, it has become obvious that, despite some progress, some of the targets within the eight goals will not be met. It is worth noting that, although the goals and targets were set on the global scale, the progress towards the goals has been uneven. Some countries achieved many goals, while others are not on track to realize any, especially in Sub-Saharan Africa. Despite significant progress in China, the number of people suffering from hunger globally has remained practically constant since 1992. While some progress was made to reduce hunger up to the mid-2000s, increasing food prices have left more people without sufficient access to food, especially in sub-Saharan Africa and South Asia. Biodiversity, as measured in mean species abundance, has continuously declined since 1992, mostly due to habitat loss, but also to increasing environmental pressures and disturbance.

Admittedly, the MDGs were simply goals, agreed upon by world leaders in an effort to rid the future of the most topical obstacles to human well-being. The goals brought together public, private and nonprofit actors working both in concert and independently to achieve the targets set. Before the MDGs were crafted there was no common framework for promoting global development and well-being. This fact alone makes the MDGs a notable landmark in the history of humanity as a global society. Nevertheless, in the light of the unachieved targets and the pressing issues of both environmental and social natures, the global community must take a further step. The MDGs are recognized to have been a bold, sharp set of goals, but not a system, focusing on individual goals while neglecting the system these goals exist in.

There were a number of criticisms of the MDGs. Lack of participation, for one thing, has been mentioned as a considerable drawback. Since the MDGs emerged from a closed-door UN process and did not involve wide consultation with the civil society groups and other stakeholders in the countries whose policies were decided upon, the feedback from civil society and local governments was weaker than it could have been had they been called upon during the formulation process. Another weak point is that the MDGs were more of a statement of what was desired to be achieved rather than a step-by-step plan of how to achieve that. Priority was given to tackling symptoms rather than causes. Sustainable development comprises three areas: social, economic, and environmental. MDGs were distorted toward several aspects of the first two areas, completely disregarding the importance of tackling increasing environmental issues. Barriers to the achievement of targets also included the debatable accuracy of gathered statistics and a focus on external financing rather than on the interaction between local governments and community initiatives. The 7th Goal, ensuring environmental sustainability, made scarce mention of the environmental issues themselves. The targets included improving the lives of slum dwellers and providing access to safe drinking water and sanitation, whereas pressing issues like the transition to renewable sources of energy, tackling deforestation and habitat destruction, climate change and ocean acidification, waste and pollution management were completely left out of the picture. These factors play a key role in providing healthy drinking water and improving people's lives in general. In a world of interconnection and precautionary principle, it is no longer possible to leave such an inalienable part of the system behind. A lack of understanding of the complex links between

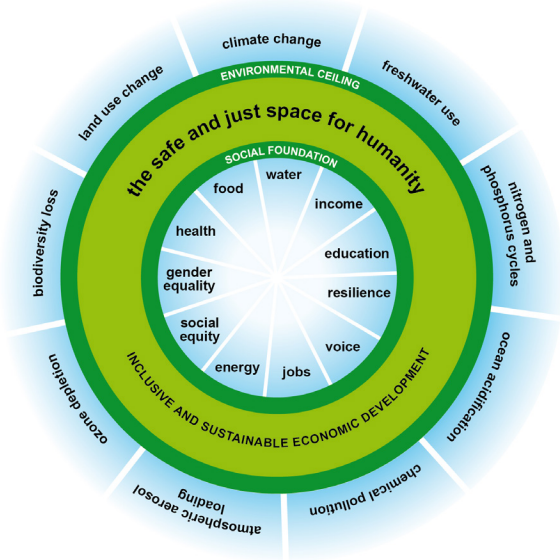


Figure 1: K. Raworth describes humanity's twenty-first century challenge as a doughnut of planetary and social boundaries (Image: K Raworth)

the environment and human well-being results in an attempt to treat the symptoms of a disease rather than getting to the root cause: human activities "...push the Earth system outside the stable environmental state of the Holocene, with consequences that are detrimental or even catastrophic for large parts of the world." (Rockström et al. 2009).

Planetary and Social Boundaries

A concept of planetary boundaries was introduced in 2009 by J. Rockström in *Nature* (Rockström et al. 2009), which defines nine planetary systems and the status of human disturbance within them. Thresholds have been identified that cannot be transgressed if we want to maintain the stability of the Holocene state in which human civilizations have developed. If crossed, these thresholds can generate unacceptable environmental change. The nine processes for which such thresholds were defined are climate change, biodiversity loss, nitrogen and phosphorus load, stratospheric ozone depletion, ocean acidification, change in land use, chemical pollution, and atmospheric aerosol loading. The boundaries in three of the systems (rate of biodiversity loss, climate change and human interference with the nitrogen cycle) have already been exceeded and will bring consequences. (see also Sala and Saouter, *Chemistry International* November-December, 2014)

K. Raworth adds a social dimension to this picture and describes humanity's twenty-first century challenge as a doughnut of planetary and social boundaries (Raworth, 2012). The environmental ceiling consists of the nine planetary boundaries set out by Rockström et al, beyond which lie environmental degradation and crises in Earth systems. The social foundation, introduced by K. Raworth, consists of eleven top social priorities identified by the world's governments in the run-up to Rio+20. Below this foundation lies unacceptable human deprivation such as hunger, poor health and poverty, as shown in Figure 1. The quest for humankind is to recognize the interconnection between these two layers and find a way to live inside this so-called doughnut.

The emergence of the Sustainable Development Goals

After the 2012 Rio+20 Conference on Sustainable Development, its outcome document, *The Future We Want* (futurewewant.org), initiated a process to develop a set of sustainable development goals. Countries agreed that both dimensions need to come together in a single framework. An intergovernmental 30-member Open Working Group was established to develop a set of Sustainable Development Goals (SDGs) for consideration and discussion at the General Assembly's 69th session in September 2014. The objective was to produce a set of universally applicable goals by the end of 2015 that balance the three dimensions of sustainable development (environmental, social, and economic), and are consistent with both the MDGs and the principles of sustainable development formulated by the Rio+20 outcome document. Once approved and adopted, the SDGs will constitute the framework of international development until their expiration in 2030.

The Open Working Group went on to formulate a proposal to be the main basis for integrating SDGs into the post-2015 development agenda. This proposal was discussed and adopted at the UN General Assembly's 69th session. It describes 17 SDGs with about 10 targets each, including Means of Implementation. (See <http://sustainabledevelopment.un.org/sdgsproposal.html>) One aspect of the SDGs is in stark contrast to the MDG approach. Eight goals out of the 17 are dedicated to tackling environmental issues: water management (Goal 6), access to modern and sustainable energy (Goal 7), sustainable cities and infrastructure (Goals 9 and 11), sustainable consumption and production patterns (Goal 12), urgent action to combat climate change (Goal 13), sustainable man-

Chemistry: Meeting the World's Needs?

GOAL 6

ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal

Goal 6. Ensure availability and sustainable management of water and sanitation for all

6.3 by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse globally

GOAL 7

ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL

SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal

Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all

7.4 by 2030 enhance international cooperation to facilitate access to clean energy research and technologies, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote investment in energy infrastructure and clean energy technologies

GOAL 9

BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION

SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal

Goal 9. Build resilient infrastructure, promote inclusive & sustainable industrialization and foster innovation

9.4 by 2030 upgrade infrastructure and retrofit industries to make them sustainable, with increased resource use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, all countries taking action in accordance with their respective capabilities

GOAL 11

MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE

SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

11.6 by 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management

GOAL 12

ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS

SUSTAINABLE DEVELOPMENT GOALS
More at sustainabledevelopment.un.org/sdgsproposal

Goal 12. Ensure sustainable consumption and production patterns

12.6 by 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment
12.7 by 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse

Chemistry: Meeting the World's Needs?

agement of marine and terrestrial resources and ecosystems (Goals 14 and 15). Chemistry and chemical technology might be considered as a means to achieve these strategic goals. Several examples are shown in the table on the facing page.

Apart from basic research into approaches and methods to tackle SDGs, there are certain practical steps already being undertaken. One of these steps has a very perceptible effect on the condition of the environment and, consequently, the entire 'doughnut' we strive to live in: the assessment of the chemical footprint, which presents an increasing interest for both scientific and political communities and the field of green chemistry. Green chemistry's task is to assess the intensity of a chemical's pressure when released into the environment and the potential harm it does in a life cycle perspective. Even though the standards and methodology in this field, and, importantly, the incentives offered to industry, need to be further developed, the advent of this area of knowledge is indicative of the journey of transformation we as a society of chemists have embarked on. 🏛️

Natalia Tarasova <tarasnp@muctr.edu.ru> is IUPAC Vice President and has been a member of the IUPAC Bureau since 2008 and the Executive Committee since 2010. She is a professor at the D. I. Mendeleev University of Chemical Technology of Russia, a Member of the Russian Academy of Sciences, Director of the Institute of Chemistry and Problems of Sustainable Development, a Chairholder of the UNESCO Chair of Green Chemistry for Sustainable Development.

Why the SDGs are big on Science - Jeffrey Sachs Interview

Web site *SciDev.net* sat down with Jeffrey Sachs, director of the UN's Sustainable Development Solutions Network (4 July 2014).

[SciDev.Net] How can it be ensured that negotiations on the SDG targets are based on scientific evidence and are not reduced to political horse trading?

[Jeffrey Sachs] I hope the scientists are outspoken at this point, and many of them are. For example, the concept of limiting global warming to two degrees Celsius not only arose from the scientific community, but it has generated a good, robust debate within the scientific community on whether two degrees Celsius is, in fact, too high. That goal was adopted under the UN Framework Convention on Climate Change in 2010 and one of the things that I am fighting for is for that goal to be taken seriously both within the SDGs and within the context of the current climate negotiations.

In biodiversity, the message from the ecologists is over-

References

1. Raworth, K. (2012) "A Safe and Just Space for Humanity: Can We Live Within the Doughnut?" Oxfam Discussion Paper. Available at <http://go.nature.com/HrU9hi>
2. Raworth, K. (2012) "Living in the doughnut." Interview by Gaia Vince. *Nature Climate Change*, **2**:225-226; doi: 10.1038/nclimate1457
3. Rockström, J. et al (2009). "A safe operating space for humanity." *Nature*, **461**: 472-475; doi:10.1038/461472a
4. Sala, S. and E. Saouter (2014). Planetary boundaries and chemical pollution: A Grail quest? *Chemistry International* **36**(6):2-4, doi: 10.1515/ci-2014-0603

Road to Dignity

The UN's Sustainable Development Knowledge Platform (<http://sustainabledevelopment.un.org>) released "The Road to Dignity by 2030" on 4 December 2014. This 47-page long report presents a universal call to action to transform our world beyond 2015. It includes a synthesis of what was learned from decades of development experience, from the post-2015 process, and describes shared ambitions for a shared future.

While framing the new agenda, mobilizing the means to implement the agenda, the report provides details on how it is a shared responsibility to deliver that agenda. Ban Ki-Moon concludes by emphasizing the urgency to deliver on the UN's promise to "to take the world forward to a sustainable future."

The full report is available at http://sustainabledevelopment.un.org/content/documents/5527SR_advance%20unedited_final.pdf

whelming: we are in the midst of the sixth great planetary extinction, which has many fundamental drivers, and this is of major concern for humanity. That has been strongly represented in the draft as well.

Partly because this is a noisy world, scientists need to find ways to make sure they are heard, whether it's through Future Earth or SDSN, or the many statements from national science academies or the Intergovernmental Panel on Climate Change. This is a world that has every capacity to ignore the scientific evidence, especially in my own country, the United States, so this is not simply about taking an article in the draft and expecting it to be the basis of global action, this is a major fight for public awareness, understanding, attention and resolve.

I know that behind the scenes and in the corridors there are plenty of attacks on the scientific evidence base — climate change being the most important of these — and this is where the scientific community absolutely has to raise its voice.

The full interview is available at www.scidev.net/global/mdgs/feature/jeffrey-sachs-sdgs-big-science.html