# UN Environment FRONTIERS 2017 Briefing for Committee of Permanent Representatives

UN Environment Frontiers 2017 covers 6 emerging issues: Environmental Dimension of Antimicrobial Resistance; Subduing Sand and Dust Storms; Environmental Displacement; Marine Protected Areas at the heart of Sustainable Development; Off-grid Solar solutions; and Nanomaterials.

**Understanding the Environmental Dimension of Antimicrobial Resistance**

Antibiotic resistance is a serious and growing phenomenon which has emerged as one of the biggest public health concerns of the 21st century. Whilst genes for antibiotic resistance have been around for millions of years, the persistent and often unnecessary administration of antibiotics over the last 70 years, combined with sub-lethal levels of antibiotics and resistant bacterial species in effluents from hospital, households and agricultural run-off, has led to antimicrobial resistance spreading across bacterial populations and the emergence of multi-strain resistant bacteria, known as superbugs.

Antimicrobial resistance is acquired through DNA mutations or horizontal gene transfer between resistant forms into human and animal pathogens. Unsurprisingly, wastewater treatment plants are known to be a source of resistance. Solving the problem will require tackling the use and disposal of antibiotic pharmaceuticals and implementing infection controls over extended faecal –oral transmission pathways. This way we may be able to reduce the rate at which new resistance mechanisms emerge. Most of all, however, we need to understand more about the evolution and transmission of resistance in natural environments, to determine the best policies on usage and waste management.

**Subduing Sand and Dust Storms**

Sand and dust storm deposits are the advance guard of desertification. They result from strong turbulent winds eroding sand and silt particles from arid landscapes. Sand storms move relatively close to the ground and the density of the particles constrains the distance the storms travel. Dust storms raise large quantities of fine silt particles and smaller clay particles high into the air.

Dust storms can travel thousands of kilometres across continents and oceans, entraining other pollutants on the way and depositing particles far from their origin. Mineral dust deposition provides nutrients such as iron and other trace elements to terrestrial and marine ecosystems, boosting primary productivity and phytoplankton growth. Saharan dust is a natural fertilizer of the Amazon rainforest, providing phosphorus inputs that balance losses through river discharge. Hawaiian rain forests receive nutrients from the dust of Central Asia, whilst dust from Africa and Asia may damage Caribbean coral reefs.

Dust also harms animals and humans, especially in arid and semi-arid regions. For humans, inhaling fine particles can generate and aggravate asthma, bronchitis, emphysema, and silicosis. Finer dust also can also deliver a range of pollutants, spores, bacteria, fungi and allergens. Other common problems include eye infections, skin irritations and Valley Fever. In countries of the Sahel, dust loads arriving from the Sahara correlate strongly with meningitis outbreaks.[i] Chronic exposure to fine dust contributes to premature death from respiratory and cardiovascular diseases, lung cancer and acute lower respiratory infections.

The anthropogenic causes result from land use changes that include unsustainable agricultural practices, excessive water extraction, water diversion for irrigation, artificial changes to water bodies, and deforestation. These are all forms of land degradation. Sand and dust storms are thus inter-connected with a range of environmental and development issues that extend across national, regional, and continental bounds. Anthropogenic climate change will further exacerbate decades of unsustainable land and water resource management in regions that generate sand and dust storms. This threat can be diminished by quick and effective action.

In the longer term, reducing the threat from sand and dust storms will focus on strategies that promote sustainable land and water management in landscapes including cropland, rangelands, deserts, and urban areas, integrated with measures addressing climate change mitigation and adaptation. In many regions, such integrated strategies are currently lacking and need to be formulated based on co-ordination of policies to improve land management, early warning systems and emergency procedures and widespread education.

**Exodus: humans in the Anthropocene**

We live in an era of unprecedented mobility: movement of ideas, goods, money and, increasingly, of people. Two hundred and fifty million people live and work outside the country of their birth. Another 750 million migrate within their own countries. Migration is a hugely important driver of development, and when it comes to understanding the root causes of displacement, definitions matter. The lack of an adequate definition for environment-driven population movements means that they are often invisible. No single international institution is responsible for collecting data on their numbers, let alone providing them with basic services, and so they fall through the cracks in international humanitarian law. This chapter uses the term "environmental displacement" accepting that it is not a universally accepted term but in the hope that it conveys a reasonably accurate impression of the increasing phenomenon of forced population displacement linked to environmental degradation and climate change.

Analysis of civil wars over the past 70 years indicate that at least 40 per cent are linked to the contested control or use of natural resources such as land, water, minerals or oil. By the end of 2016, more than 65 million people were refugees or internally displaced – a number greater than at any time since the end of the Second World War, and 125 million people required humanitarian assistance. The African continent has more countries affected by displacement than any other continent or region, and in 2015 was hosting more than 15 million people who had been displaced within their own country for a number of reasons, including those linked to the environment.

The interlacing trends of climate change, population growth, rising consumption, and environmental degradation are likely to lead to even greater numbers of people being displaced in the future. This will be particularly true for Africa, which has a future potentially blighted by droughts, floods and food scarcity and more than half the world's fragile states.

The international community is now putting in place institutions and plans to try to tackle migration and forced displacement and respond to irregular refugee flows. If the experience of refugees from recent extremes of climate-related events is any indication, we will need to do more than simply respond each time to recurring crises. The next few years will be critical for the development of a more effective, compassionate and rights-based approach to human displacement. We will need to work more proactively to reduce risks and avoid merely reactive responses. We need, in other words, to do more fire prevention and less fire-fighting.

**Marine Protected Areas: flowing through the heart of sustainable development**

Our oceans have been under too much stress, for too many years. Overfishing, extractive activities, tourism, recreation, coastal development and pollution are damaging habitats and reducing populations of marine species at an incredible rate. We have lost half of the world's coral reefs, with a 400 mile stretch of the Great Barrier Reef dying in 2016 alone. We are consuming 31 per cent of fish stocks at unsustainable levels, with a 49 per cent drop in marine populations between 1970 and 2012.In short, we are using the ocean's resources faster than they can naturally recover. And yet we cannot live without healthy oceans.

Oceans provide more than half the oxygen we breathe and remove nearly half the carbon dioxide we create. They sustain the fish that provide the major source of protein for nearly three billion people. They support 850 million people living within 100km of a coral reef and many more who rely on the ocean for their livelihoods, food and flood defences. Our oceans are worth at least $24 trillion, equivalent to the seventh largest economy in the world.
Marine protected areas provide a commonly agreed solution. Over 15 years *t*he area of ocean covered has increased by 5.1 per cent (18.5million $km^2$) and 12.7 per cent of coastal and marine areas under national jurisdiction. However, physical extent is not enough. Just 40 of the 15,320 designated zones account for more than 60 per cent of the protected marine area. What is needed is effective conservation and equitable sharing of costs and benefits, but today 40 per cent of marine protected areas have major deficiencies, with weak and ineffective governance. The economic and social stakes are high: latest estimates show that a network of protected areas covering 20-30 per cent of our oceans, could cost $5-19 billion per year but provide ecosystem services with a gross value of $4.5-6.7 trillion each year and provide around 1 million jobs.

**Off-grid solar solution**

Nearly 1.1 billion people worldwide live without electricity. While significant progress has been made in recent years, it is projected that nearly 780 million people could still remain off-grid in 2030. Solar energy became one of the first among several renewable energy technologies to be adopted globally to meet basic electricity needs of off-grid populations mostly in rural areas. The use of solar photovoltaics for decentralized rural electrification has become important for powering public services supporting rural communities, such as school lighting and power, information exchange and communications, community pumping and vaccine refrigeration. With its low operational and maintenance costs, the solar photovoltaic technology has become the energy source of choice in providing decentralized rural electrification at the community level in developing countries.

Solar technologies are also relevant in the urban context. About 48 per cent of the developing region's population now resides in cities, with the number likely to rise to 63 per cent by 2050. Around a quarter of the urban population, or about 881 million people, live in informal settlements. Provision of basic services for informal settlements presents a unique challenge, with its root in how the "formal city", i.e. the government and governance structures of the municipal area, define eligibility for formal urban services. In the case of electricity access, it involves issues such as land right, lack of recognition by authorities, reluctance to engage by stakeholders involved, un/affordability of services, return of investment by the electricity/utility company, and proximity to existing grid and other necessary infrastructure.

Recent years have seen an unprecedented penetration of small distributed solar energy systems in the market of low-income customers in Africa and Asia, where at least 95 per cent of the off-grid population reside. An estimated 86 million people have gained access to basic energy services through off-grid solar market initiatives. There have been successful roll-outs of solar products, with improved batteries, lower capital costs, affordable financing and easy access to pay-as-you-go schemes. Access to energy has created opportunities for innovative interventions, such as the **iShack**, and ways to improve insulation and water harvesting. But there are still many countries where without additional policies that recognize the need to electrify informal and rural settlements, electricity will remain a luxury for many millions of the poorest.

**Nano-X: a risk to society and the environment or a growing opportunity?**

Along with synthetic biology and artificial intelligence, a new urgency is being given to nanomaterials because of resource shortages here on earth and the expansion of exploration into space. People want to know more about them and what they can do. But they also want to know if engineered or natural nanomaterials pose a threat to our world or presage a future full of opportunities and innovative products.

Despite many more nanomaterials being developed, there is a serious risk that we do not know enough about the long-term effects of these materials on human health or the environment to use them without greater safeguards being put in place. The question is what lessons can we learn from the past about dealing with exposure to materials, such as asbestos, that have had a deadly aftermath when managing and assuring the safety of nanomaterials in the future?

Nanomaterials occur everywhere in the natural world and are now being engineered for their amazing properties. One of the most interesting is the carbon nanotube. Nanotubes are the stiffest and strongest human-made material, they are better conductors than copper and have higher thermal conductivity than diamonds. However, changing the properties of a material by nanoizing it, can also change its environmental and health impacts. In building novel nanoworlds we will need to develop a much deeper understanding of the potential toxicity and risks to immunity in humans and the natural world. We must try to learn from the lessons of the past that *no evidence of harm* is not the same as *evidence of no harm*.