TOPICS

Subduing Sand and Dust Storms

Understanding the Environmental Dimension of Antimicrobial Resistance

Exodus: humans in the Anthropocene

Marine Protected Areas: flowing through the heart of sustainable development

Off-grid solar solution

Nano-X: a risk to society and the environment or a growing opportunity?
Sources and impacts of sand and dust storms

25% of dust emissions are a result of human activities, e.g., unsustainable use of land and water, agricultural intensification, deforestation, water diversion for irrigation, human intervention in the hydrological cycle.

Sand and dust storms usually develop in arid and semi-arid regions, which are accounted to 33% of the global land area.

Sandstorms are dominated by particles larger than 60 microns in diameter.

There is evidence to support positive impacts of improved land management on reducing dust events. Preventive measures are key to avoiding soil degradation and reducing soil exposure to wind erosion.

Climate change, especially increasing climate variability and frequency of extreme events, is an important risk factor for increased sand and dust storms.

Dust storms are the result of surface winds raising large quantities of dust into the air, reducing visibility at eye level to less than 1,000 m. Dominant particles are smaller than 60 microns.

Infections by airborne fungi, such as Aspergillosis, Valley Fever, and bacteria such as Meningitis are found to correlate with dust events.

Dust storms damage crops, kill livestock and erode fertile soil.

Dusty regions are likely to become drier and face greater risk of dust storms, such as most of the Mediterranean areas of Europe and Africa, northern Sahara, central and west Asia, southwest USA, and southern Australia.

US$ 964 million of economic losses due to dust storms in China from 2010-2013.

A dust storm in northwest China in 1993 killed nearly 120,000 livestock, destroyed 373,333 million hectares of crops, and buried over 2,000 km of irrigation ditches.

Particles smaller than 10 microns are of significant health concern as they cause respiratory and cardiovascular illnesses when inhaled.

Typical concentration of particulate matter during dust storms in hundreds of μg/m³.

Over 10,000 μg/m³ detected in a dust event over Iran in January 2017.

Air quality guideline set by the World Health Organization is below 50 μg/m³.
Antimicrobial resistance and the environment

The environment is key to antibiotic resistance. Bacteria in soil, rivers and seawater can develop resistance through contact with resistant bacteria, antibiotics, and disinfectant agents released by human activity. People and livestock can then be exposed to more resistant bacteria through food, water, and air.

- **Human antibiotic use**: By 2000s, up to 75% of antibiotics used in aquaculture may be lost into the surrounding environment.
- **Antibiotics in livestock**: Manure fertilizers cause antibiotic contamination in surface runoff, groundwater and drainage networks.
- **Antimicrobial use**: For livestock, antibiotic use will jump 67% by 2030.
- **Wastewater treatment**: Plants cannot remove all antibiotics and resistant bacteria.
- **Antibiotics in crops**: 30% of antibiotics are used by plants and crops.
- **Antibiotics in humans**: Up to 80% of consumed antibiotics are excreted through urine and feces.
- **Industrial estate**: Indian industrial estate was found to release enough antibiotics to treat 44,000 people.
- **Solid waste**: More than 50% of municipal solid waste ends up in landfills and open dumps. This can include unused or expired drugs.
- **Antibiotic resistance**: Man-made antibiotic resistant bacteria have been found in fish, sea mammals and sea birds.
Environmental Displacement

Land Degradation, Desertification and Drought
Drought, a prolonged period of dryness with deficiency in precipitation, leads to water and food shortages, and causes long-term economic, environmental and health impact on population. It often forces people to leave their lands in search of water, pasture, or better economic and social opportunities. Drought is projected to become longer and more intense due to climate change.

By 2020, between 75 and 250 million Africans are likely to be exposed to increased water stress. Since 2016, insufficient rainfall and ongoing severe drought has led to crop failure, loss of livestock, and food insecurity in Somalia. At least 192,000 people have been displaced since November 2016 as a result.

Infrastructure and Land grabbing
Infrastructure and Land Grabbing. Large scale infrastructure projects such as dams and roads can result in massive displacement of populations. Meanwhile, large-scale land purchases in developing countries by agribusiness for biofuels, food crops and palm oil plantations has become a highly contentious issue, often labelled land grabbing. It is difficult to determine how many people are displaced by these land purchases, but this is likely to more prominent cause of displacement in future.

Construction of the Three Gorges Dam on the Yangtze river in China is estimated to have displaced 1.3 million people. In the 1980s and 1990s, 10 million people worldwide were displaced such year by development projects, such as construction of large dams and transportation systems, transformation of urban areas.

Competition over Natural Resources
Forced dispossession of lands is increasingly common in Latin America due to the legal and illegal extraction of resources, e.g. oil palm plantation, crops for bioterror, logging. In many cases, tensions and conflicts among users. Over the past 60 years, at least 40 per cent of all conflicts within national borders are associated with natural resources. In many cases, tensions can lead to violent conflicts and large-scale forced displacement. If unresolved, non-violent conflicts can also trigger forced displacement.

Sea Level Rise
Sea level rise threatens coastal cities, coastlines and livelihoods of hundreds of millions of people living in low-lying areas. Most of the world’s megacities are located in the coastal zone including large deltas, and they continue grow. A study of migration patterns in developing countries suggests that from 1970 to 2000 people tended to move out of marginal drylands and drought-prone areas towards the coastal zone. Coastal population and infrastructure are vulnerable to flooding, inundation, coastal erosion and shoreline transformation and saltwater intrusion as a result of sea level rise.

Natural disasters
Over the past few decades, there is a marked increase in the number of weather-related disasters and the scale of impacts on societies, infrastructure, economies and the environment. Extreme weather events may make areas temporarily uninhabitable, and displace populations temporarily or permanently. Climate change has continued to influence the likelihood, frequency and intensity of extreme hydro-meteorological events, such as storms, floods, and extreme temperatures. Changes in the incidence of extreme events will amplify the challenges and risks of displacement.

Nearly 940 million people or 11% of the global population are projected to live in the low-lying coastal zone by 2050, and three quarters of them are in Asia and the Pacific. From 2013-2015, 52.4 million people were displaced due to weather related disasters.

Industrial accidents
Serious industrial accidents can leave large areas so polluted that people are forced to abandon their homes and resettle elsewhere. Long-term health, social, economic and environmental impacts of industrial accidents often have implications for the permanent return and resettlement of residents. In Ukraine, the 1986 Chernobyl nuclear meltdown forced the resettlement of 350,000 people, while 150,000 were evacuated following the 2011 Fukushima meltdown following a devastating tsunami in Japan.
850 million people benefit from living within 100 km of coral reefs.

3 billion people rely on fish as a source of protein.

Oceans are worth US$ 24 trillion as a total asset.

Each year 121 million people participate in marine recreational activities, generating US$ 47 billion in expenditures.

31% of fish stocks are overfished.

50% of coral reefs have disappeared.

Over a 40-year period, 49% of marine species have been lost.
Good Governance of Marine Protected Areas

Top-down governance
Laws and regulations by the state needed to protect diversity of natural resources from degradation

Bottom-up governance
People and local community are involved in decision-making

Market-brand governance
Laws and regulations by the state needed to protect diversity of natural resources from degradation

Chumbe Island Coral Park
Tanzania

Bluefield Bay
Jamaica

Great Barrier Reef
Australia

Local community ____ and manages its own restrictions on how to use resources

Did you know?
- Oceans are worth 24 trillion as a total
- It is estimated that if 20-30% of our oceans are protected areas, costing $5-19 billion, Gross Value
Marine protected areas contribute to:

- Participatory decision-making
- Equal rights to economic resources
- Sustainable management of marine and coastal ecosystems
- Safeguard the world's natural heritage
- Sustainable tourism
- Reduced pollution
The Rise of Off-grid Solar

Solar or Photovoltaic (PV) systems are becoming mainstream among off-grid populations in rural and urban settings particularly in Africa and Asia.

- **Solar home systems** are stand-alone photovoltaic systems that supply direct current electricity to power household lighting, electrical appliances or battery recharge.
  - Common sizes vary from a single solar lantern to a large system that can power TVs, small fridges and other household appliances.

- **Pico-solar or pico-PV** is a small solar home system of up to 10 watt-peak, supporting household lighting and mobile phone charging.
  - Pico-solar is increasingly replacing traditional lighting sources.

- **Kerosene** burning emits black carbon, causing household air pollution and global warming.
  - 25 billion litres of kerosene is used for lighting each year.
  - 1 kg of black carbon causes as much warming as having 700 kg of CO₂ circulating in the atmosphere for 100 years.

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**TRENDS**

- **Prices are dropping**
  - Manufacturing cost of a pico solar lantern:
    - 2010: US$19.7
    - 2015: US$4.4
    - 2020: US$3.1

- **Sales are rising**
  - Cumulative global sale of small-scale solar products over 5 years (million units):
    - 2011-2016: Steady increase

- **Battery costs are falling**
  - Lithium-ion battery prices (US$/kWh):
    - 2010-2025: Decreasing trend

- **Innovative business is emerging**
  - Pay-as-you-go
  - Payment schemes
  - To be added
The Rise of Off-grid Solar

**ACCESS TO ELECTRICITY**

- Nearly 1.1 billion people worldwide have no access to electricity
  - Southeast Asia: 60 million
  - South Asia: 360 million
  - Sub-Saharan Africa: 575 million
  - The rest of the world: 76 million

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**Kerosene burning** emits black carbon, causing household air pollution and global warming. 25 billion litres of kerosene is used for lighting each year, resulting in 270,000 tons of black carbon emitted.

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NANO-X