

**Forum:** Environment Sub-Commission 1  
**Issue:** Increasing Consumer Awareness to Achieve Better Resource Efficiency  
**Student Officer:** Samuel Holmes  
**Position:** Deputy President

---

## Introduction

“If the global population reaches 9.6 billion by 2050, the equivalent of almost three planets will be required to sustain current lifestyles,” according to the United Nations Environment Program’s Sustainable Development Goals.

This is not solely a problem with the population of humans on Earth. Instead, it also encompasses how we as humans use the Earth and its resources. If we as a collective are more aware of the resources that we use in our everyday lives, work to cut back on our usage of resources, and only use resources that are environmentally sustainable, then we will be able to live on the Earth with our currently rising population. With the human population predicted to rise to 9.7 billion by 2050, we have no choice but to change our way of living and use the resources provided to us by our planet more efficiently.

In today’s world, nearly one third of all food produced ends up rotting in the trash bins of consumers, retailers, or shipping companies. Almost 2 billion people worldwide are either obese or overweight, while another 1 billion go hungry. Less than 3 percent of the world’s water is drinkable and only 0.5 percent is available to human use. This leads to more than 1 billion people not having access to fresh water. Despite the enhanced technologies that have helped provide better efficiency in regard to the use of energy, the energy consumption of countries in The Organisation for Economic Co-operation and Development, which includes much of Europe, North American, Japan, Chile, Australia, as well as other more economically developed countries, is expected to grow 35% by the year 2020. Out of all of the land on Earth, only 71 percent is defined as habitable. Of that 71 percent, our human “footprint” can be seen on 83 percent.

Despite these obvious problems with consumption, and in many cases, overconsumption, of our natural resources, few steps have been taken to achieve better resource efficiency. The United Nations Environment Program (2011a) estimates that the amount of materials extracted and used has octupled between 1900 and 2005 while material productivity has stayed practically constant and even declined since 2000. As a world, we cannot continue this trend if we hope to be able to save the environment and natural resources for the next generations. Yet, the only way for change to truly begin, is for the consumers of the world to be aware of the grave problems that are affecting other humans and how their actions and purchases contribute to the problem. If we, as a world, hope to solve any of the major environmental problems that are plaguing billions of people around the world, consumers must increase their awareness and be able to purchase products from the companies that use green marketing and sustainability to develop their products.

## Definition of Key Terms

### Resource Efficiency

The “term resource efficiency” is used to describe a number of important ideas, the technical efficiency of resource use measured by the amount of useful energy output per energy input, the resource productivity, or the economic value added from the resource, and the extent the resource impacts the environment.

### Sustainability

Sustainability is a fashion of living which will allow humans alive today to use the resources they need without depriving future generations of the same access to those resources.

### Green Marketing

Green Marketing is the process of selling products and/or services based on the environmental benefits. For example, the clothing company Timberland is famous for their form of green marketing through their “Earthkeepers” campaign, which marketed a line of clothes made with recycled materials, and through their “Virtual Forest”, where customers could build a virtual forest and the company would then create it by planting trees in Haiti.

### Overconsumption

Overconsumption is the situation where a resource is being used at a rate where the ecosystem is not able to replenish the resource before each use and leads to environmental degradation and eventual loss of the resource.

## Background Information

The Earth stands at a crossroads due to the threats of global warming, climate change, an exponentially increasing human population, and the finite ability of the planet to support humans and all its other life forms. To each of these environmental problems and the many other problems that plague the Earth, there is one seemingly simple, but truly very complicated solution can be done to help alleviate the burden. Human kind must increase the awareness of consumers and mobilize the entire population of the Earth to work towards this solution, increasing resource efficiency. Unfortunately, having consumers buy only products from companies that promise to be cruelty free and “green” is not enough to solve these major issues. Instead, there must be a push to change more than just the buying and selling of products. We must convince consumers on every continent to work together to change the way that natural resources are used each and every day.

The crops that humans grow, the water that is taken from aqueducts and used by humans for sewage and consumption, the energy that is produced by fossil fuels, and the land that humans live on and use to produce food are all resources that need to be used more efficiently if humans have a chance of helping the Earth through the many problems that we have created. But before the use of these resources can begin to become more efficient, consumers must first be educated about the effects of their lives on planet Earth. Consumers must understand the problems that Earth is experiencing and know how they can help alleviate these problems through the principles of increasing resource efficiency in all aspects of their lives.

### Agriculture

Agriculture uses many different natural resources and can be sustainable or not in a multitude of fashions. Agriculture requires vast swaths of land to meet the growing human wants and needs for different foods. According to the Food and Agriculture Organization of the United Nations (FAO), close to 11 percent of the world's land is used to grow crops and another 22 percent is permanent pastures. Even though only about 71 percent of Earth is considered habitable, one third of the total land on Earth is used for agricultural purposes. The amount of agricultural land has increased about 11 percent from 1961 to 2013 and globally humans consume about 25 percent of the total biomass produced by the Earth every year. As agricultural land increases, it replaces biodiversity-rich areas such as forests in South America and South-East Asia with very low biodiversity fields of single crops or with grazing pastures for animals.

Even though the amount of land used to produce food has steadily been on the rise, many people still are malnourished while others are obese. In 2015, 11 percent of the world's population was undernourished, with many of these people living in Asia and Saharan Africa. This, combined with the two billion people that are currently overweight or obese, signals a significant problem with the distribution of the world's agricultural products. According to the World Hunger Series, about 16 percent of rural populations in developing countries lack convenient access to markets, causing many farmers to be unable sell their products. In fact, throughout the entire world, it is estimated that only about 40% of all crops produced are marketed and only two-thirds of all farmers sell their crops to any form of market. There are also problems with farmers not having passable roads available over which to move their products to the public in many parts of the world. It is estimated that 25 to 50 percent of all food produced is wasted in some fashion, either due to contamination by disease or pest, lack of proper storage, or malformations in its physical appearance which cause many consumers in more developed markets to not want to buy the product.

## Water

Although 71 percent of the Earth is covered by water, the majority of that water is not usable by humans for drinking, farming, or industrial work. In fact 97.5 percent of all water on Earth is salty and out of the remaining 2.5 percent of water that is fresh, 66 percent of that is locked up in the poles or in glaciers and is unable to be used by humans. Also, due to pollution, water quality is under threat and only 0.007 percent of all water on Earth is safe for human consumption according to the World Health Organization (WHO). This amount of water that is consumable has been fairly constant across human history yet over the last 100 years as the human population has tripled (3 times larger), the overall consumption of water by humans has sextupled (6 times larger). One of the largest reasons that consumption has increased by so much is the growing middle class around the world. As the middle class grows, more and more people have the money to buy better foods and the consumption of meat rises. Meat requires a much higher amount of water to produce than fruits, vegetables, and grains and the amount of meat consumption is projected to double by 2050. Additionally, there is a problem within cities with the transportation of water. Growing cities need to rapidly expand their water delivery infrastructure and many existing systems growing quite old and leaking up to 30% of transported water. Overall, more than 70% of consumed water is used by to agriculture, 20% by industrial, and only 10 percent for drinking and sanitation.

## Energy

Energy, the production of it, and the effects of its production are topics that have been discussed extensively on a global scale. With the Paris Agreement still working to carry out its tasks of achieving specific climate targets related to the emission of greenhouse gasses through the production of energy, increased resource efficiency can greatly help. Energy is created through either the burning of fossil fuels or from renewable resources. Fossil fuels, which are the result of decomposed plants that over millions of years have been compressed together into either coal, natural gas, or oil, provide over 85 percent of the energy that is consumed by the world today. It is predicted that the world will run out of fossil fuels within the next 100 to 200 years, and already humans have had to resort to obtaining these fuels through more and more environmentally unfriendly tactics, such as tar sands and fracking, making fossil fuels a very non-sustainable resource. The burning of fossil fuels, which is required to harness their energy, also releases greenhouse gases in the form of carbon dioxide. These gases trap heat on the Earth and assist in the creation of global warming. Therefore, there has been a push to limit the use of fossil fuels to create energy and instead invest in renewable energy either in the forms of wind, hydroelectric, solar, biomass, or geothermal. There are problems to be solved around collecting and storing renewable energy and a massive amount of infrastructure will be needed to the harness level of renewable energy needed to eliminate the use of fossil fuels altogether. In 2013, only 20 percent of the world's energy consumption was from renewable sources. Overall more than a billion people lack access to electricity, while 3 billion rely on dirty fuels like charcoal and animal wastes for cooking and heating. Additionally, the use of these unsustainable forms of energy is expected to grow around the world, with the number of kilometres driven in cars expected to increase 40 percent and global air travel projected to triple.

## UN Sustainable Development Goals

On January 1<sup>st</sup>, 2016, the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development came into force. These goals are meant to create a framework for all countries to mobilize their efforts towards the shared goal of creating a better world for future generations. These efforts will focus on ending all forms of poverty and inequality and on tackling climate change across the globe. Building off of the Millennium Development Goals (MDGs), the SDGs aim to call into action all countries, no matter their social, economic, or developmental positions. Responsible Consumption and Production was chosen as one of these goals for the next 15 years and aims to bind together many of the more environment focused goals with ending poverty and creating a better tomorrow through sustainable development. Although these goals are not legally binding, all governments are expected to take ownership of working towards each and every one of the goals as well as creating programs to help achieve these goals and review their work.

## Consumer Awareness

Consumer Awareness is how businesses have used advertisements to convince consumers to buy products throughout history and this resolution also needs to be persuasive with an emphasis on solving the issue of increasing resource efficiency. Businesses do three basic things to convince consumers to buy their product: 1) They teach the public that they have a need or problem, even if the

public didn't know about it before hand, then 2) They teach the public the basic solution to the problem and, finally 3) They convince the public that their product or idea is by far the best one to solve this problem. Many times, companies will give a face or a name to the problem so that the everyday consumer feels more tied to the issue. The United Nations Environment Program (UNEP) and many other UNO's also use this strategy to get their solutions out to the consumer and convince them that their issues need attention and support.

## Major Countries and Organizations Involved

### OECD (The Organisation for Economic Co-Operation and Development)

The Organisation for Economic Co-Operation and Development (OECD) was established in 1961, is currently comprised of 35 member countries and the European Commission, and works with emerging economies in China, India, and Brazil. Through its work with the Business and Industry Advisory Committee (BIAC) and the Trade Union Advisory Committee (TUAC), the OECD has a commitment to market economies backed by democratic institutions and is focused on the well being of all citizens and the protection of the environment.

### EC (The European Commission)

The European Commission is the European Union's Executive Arm, which takes on the role of making decisions in regard to the European Union's (EU) political and strategic direction. It is made up of one commissioner from each EU country, whose job is to defend the interest of the EU as a whole and not to solely defend the interests of their home country. The EC created The Roadmap to a Resource Efficient Europe (COM(2011) 571), which established the European 2020 Strategy, aimed at creating a "smart, sustainable, and inclusive economy". This "Roadmap" includes a vision for the structural and technological changes needed for their 2050 goal with a milestone in 2020 of putting Europe on a path to resource efficiency and sustainable growth.

### Interreg Europe

Interreg Europe is the follow-up program of Interreg IVC that set interregional cooperation in motion within Europe and gathered information about the situation in Europe. This program aims to help local and regional governments in Europe by creating an environment where governments share possible solutions to issues to ensure an integrated and sustainable result for all people and places. Its resource efficiency policies place an emphasis on providing opportunities for regional growth, job creation, and increase in regional attractiveness due to the protection of ecosystems and landscapes. It can also bring down unit costs for manufacturers and buyers to encourage efficient use of resources.

### UNCED (The United Nations Conference on Environment and Development)

The United Nations Conference on Environment and Development (UNCED), informally called the Earth Summit, was held in Brazil between the 3<sup>rd</sup> and 14<sup>th</sup> of June 1992. 172 governments, including 108 heads of state attended the conference. At the same time, a parallel NGO forum was attended by

over 2,400 NGO's and 17,000 individuals. The conference created the Commission on Sustainable Development, an Inter-Agency Committee on Sustainable Development, and a High-level Advisory Board on Sustainable Development. It also created Agenda 21 (one of the first sustainable development goals of the United Nations), the United Nations convention on Biological Diversity, and the Rio Declaration on Environment and Development.

### UNEP (The United Nations Environment Program)

The United Nations Environment Program (UNEP) has many programs that work towards the creation of sustainable production, and protection of the environment. The Sustainable Consumption and Production Brand works to promote and sustain resource management in a life cycle perspective for goods and services produced and used by countries, businesses, and people. The UNEP also works on Developing the Global Initiative for Resource Efficient Cities to enhance the quality of life in growing cities and in developing countries while decreasing resources extraction and non-sustainable use. Overall, the UNEP wants to provide leadership and teachings to all people in order to improve their quality of life without compromising the environment for future generations.

### The Netherlands

The Netherlands is one of the countries leading the way to increase resource efficiency. The National Raw Materials Agreement was signed by more than 180 parties in the Netherlands including many parts of the Dutch government, innovative start-up companies, financial institutions, trade unions, and environmental organizations within the nation. The goal of this agreement is to work towards a circular economy by 2023, which will both have high resource efficiency and will add 7.3 billion euros a year and 54,000 jobs to the Netherlands. In January 1<sup>st</sup>, 2011, the Netherlands also banned free distribution of plastic to consumers and required payment for the use of the bags. This new regulation has driven plastic bag usage down by 71 percent in the Netherlands.

### Germany

Germany is another leader in increasing resource efficiency. The German Resource Efficiency Program II (ProgRess II) focuses on sustainable building, urban development, product information, and communication technology with a goal of permanently reducing overall consumption of resources. The second part of the program was adopted in March 2, 2017 after the original version, which worked to specifically protect natural resources, expired. The new program led to the completion of a comprehensive public participation process including online discussions, five workshops open to the public, and a final report that was used to compile a citizen's advice document featuring 12 recommendations to build consumer involvement in increasing resource efficiency.

### The Republic of Korea

The Republic of Korea (South Korea) has been working to build on the principles of green growth. The Seoul Initiative was created to address major policy issues for Green Growth that began to arise in 2005. The Initiative takes into account economic, social, cultural, and geographic features of the region and creates networking and policy consultants for the promotion of Green Growth at all levels

within the nation. Right now, the Seoul Initiative is in its third phase activities where it aims to specifically promote the environment as an opportunity for economic growth and development. The Seoul Initiative does not only work to create Green Growth opportunities within the Republic of Korea, but has also provided assistance and funding to projects in many East Asian countries.

## India

With the help of the National Development and Reform Commission (NDRC), India has been able to work on many fronts to strengthen their society through the use of better resource efficiency. In the past decade, India has created comprehensive laws on the creation of energy efficient buildings in the state of Andhra Pradesh and Telangana. India is working to achieve 175 gigawatts of renewable energy by 2022, which would create upwards of 1 million jobs for the country. India and the NDRC have also partnered with women's group to increase off-grid energy access to clean water in the Gujarat desert by powering water pumps with solar energy instead of diesel. The Indian resource efficiency and recycling governmental body, Adelphi, is also working to strengthen the public's and decision-maker's awareness and protection of biodiversity in their country.

## Timeline of Events

Date	Description of event
June 4 <sup>th</sup> , 1992	At the United Nations Conference on Environment and Development, the Convention on Biological Diversity is approved by 168 signatures.
September 4 <sup>th</sup> , 2002	Signed at the World Summit on Sustainable Development, and encourages the development of the 10-year Framework of Programs to move towards sustainable consumption and production.
September 1 <sup>st</sup> , 2013	The Copenhagen Centre on Energy Efficiency was created as a joint taskforce between the UNEP and the Danish Government with the goal of creating programs to help the uptake of energy efficiency programs on a global scale.
January 1 <sup>st</sup> , 2016	The 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development were adopted to assist all people's prosperity while protecting the planet
October 5 <sup>th</sup> , 2016	The Paris Agreement achieved the threshold necessary for entry into force and stressed the role of resource efficiency in achieving its climate target goals
March 17 <sup>th</sup> , 2017	The G20 Workshop on Resource Efficiency under the German G20 Presidency in Berlin was formed of governmental delegations and invited guest speakers created a G20 Resource Efficiency dialogue to more closely deal with the efficiency and sustainable use of resources

## Relevant UN Treaties and Events

- 10-year Framework of Programs on Sustainable Consumption and Production Patterns (**A/CONF.216/5**)

- The Convention on Biological Diversity (*Treaty Series*, vol. 1760, No. 30619)
- The United Nations' 2030 Agenda for Sustainable Development
- Johannesburg Declaration on Sustainable Development (A/CONF.199/20)
- The Roadmap to a Resource Efficient Europe (COM(2011) 571)
- COP21 Climate Summit in Paris

## Previous Attempts to solve the Issue

- The Roadmap to a Resource Efficient Europe (COM(2011) 571) which created the Europe 2020 Strategy for establishing a smart, sustainable, and inclusive economy
- The Convention on Biological Diversity (CBD)
- Sustainable Development Goals: 17 Goals to Transform our World

## Possible Solutions

The issue of resource efficiency is very complicated and will not be solved with just one press conference or through only a month of sustained work. Instead, for resource efficiency to be significantly increased, it will take many, many years of sustained commitment. The average consumer must first understand the true effects of low resource efficiency before any work to increase resource efficiency can begin. Once the masses feel a strong enough connection to this problem to be willing to work on it for no matter how long it takes, then the true work can begin. This work can take multiple forms, as new technologies can be implemented into areas of agriculture, water, and energy to increase each of their respective efficiencies.

Increasing consumer awareness is something done by businesses, NGO's, UNO's, and countries around the world every day for multitudes of products and issues. Therefore, to focus consumer attention on the issue of resource efficiency, many strategies could be taken. From the more basic, press releases, word of mouth, blogging, and interviews with local media, to more high-tech ways of getting the word out such as social media campaigns, using images that will create an emotional connection to consumers in different parts of the globe, and creating television and radio advertisements, there are many ways to teach people about the issue. Convincing local celebrities to go on television, social media, and radio, or to talk about the issues at their concerts, sporting events, or charity events is a useful way to increase consumer interest. Another way to show the severity of this issue is to use data in the form of charts and visuals that show how bad things are. No matter which method is utilized to spread the reasons for these problems, it is important that the message is not simply "we need better resource efficiency". The message must also convey to consumers how they can personally effect the issue and provide concrete examples and next steps of what they can do to help.

Once the consumer base is behind the issue of resource efficiency, there are countless solutions that can be implemented over the years. There are things that each and every consumer can do to decrease the amount of resources that they waste, from using in home or city-wide composters instead of throwing away food waste, to using reusable shopping bags, straws, and plastic bottles to decrease the amount of plastic wasted. People can also show solidarity through an international "Day Without Electricity", because if people can go for even one day without using electricity, they will better

understand their ability to decrease their energy usage each day. Another idea is to have an international “No Elevators Day” to show people how little things and have a big impact on the amount of energy used. Consumers can also be thoughtful about what they buy and chose sustainable options, from local business and farmers markets, instead of unsustainable bigger businesses.

Different technologies can also be implemented to increase the resource efficiency of the production of food, water and energy. Micro drip irrigation can be used in agriculture, as it can decrease the amount of water used by 70 to 80 percent while still producing the same crop yield. Investing in increased desalination technologies, such as membrane desalination using seawater reverse osmosis and thermal desalinization using waste heat from refineries and power plants to evaporate water and separate it from the salt can save resources. Developing new technologies to find and fix leaks in pipes will help. Implementation of solar power in areas with high levels of sunshine and low levels of population, such as deserts, creation of batteries can store the electricity created, and then transportation of this energy to areas with more humans can decrease fossil fuel consumption. Overall, consumers applying pressure to businesses and governments to increase resource efficiency is the best way to convince governments to follow the lead of the EU, Germany, and the Netherlands to increase their resource efficiency.

## Bibliography

*Advancing Resource Efficiency in the Supply Chain – Observations and Opportunities for Action*. 14 Sept. 2016, [www.oecd.org/environment/ministerial/whatsnew/2016-ENV-Ministerial-United-States-Report-Resource-Efficiency-G7-US-Workshop.pdf](http://www.oecd.org/environment/ministerial/whatsnew/2016-ENV-Ministerial-United-States-Report-Resource-Efficiency-G7-US-Workshop.pdf).

BMUB, Internetseite des Bundesumweltministeriums -. “Overview of German Resource Efficiency Programme (ProgRess).” *German Resource Efficiency Programme (ProgRess)*, [www.bmub.bund.de/en/topics/economy-products-resources-tourism/resource-efficiency/german-resource-efficiency-programme/overview/](http://www.bmub.bund.de/en/topics/economy-products-resources-tourism/resource-efficiency/german-resource-efficiency-programme/overview/).

*CONSUMER EDUCATION Policy Recommendations of the OECD’S Committee on Consumer Policy*. [www.oecd.org/sti/consumer/44110333.pdf](http://www.oecd.org/sti/consumer/44110333.pdf).

“Definition of ‘Consumer Awareness’ - English Dictionary.” *Consumer Awareness Definition in the Cambridge English Dictionary*, [www.dictionary.cambridge.org/us/dictionary/english/consumer-awareness](http://www.dictionary.cambridge.org/us/dictionary/english/consumer-awareness).

“Environment and Resource Efficiency.” *Interreg Europe*, [www.interregeurope.eu/policy-learning-platform-old/environment-and-resource-efficiency/](http://www.interregeurope.eu/policy-learning-platform-old/environment-and-resource-efficiency/).

*The Future of European Sustainable Consumption and Production* . [www.erscp2017.eu/pdfs/glavic\\_ab.pdf](http://www.erscp2017.eu/pdfs/glavic_ab.pdf).

“Home.” *Food and Agriculture Organization of the United Nations*, [www.fao.org/home/en](http://www.fao.org/home/en).

“Inadequate Food Distribution Systems.” *Inadequate Food Distribution Systems | Mission 2014: Feeding the World*, [www.12.000.scripts.mit.edu/mission2014/problems/inadequate-food-distribution-system](http://www.12.000.scripts.mit.edu/mission2014/problems/inadequate-food-distribution-system).

“India.” *NRDC*, 24 Jan. 2017, [www.nrdc.org/india](http://www.nrdc.org/india).

Kennell, Brian. “Environmental Concern Empowers the People.” *The Huffington Post*, TheHuffingtonPost.com, 10 Sept. 2015, [www.huffingtonpost.com/brian-kennell/environmental-concern-emp\\_b\\_8105580.html](http://www.huffingtonpost.com/brian-kennell/environmental-concern-emp_b_8105580.html).

“The Lazy Person’s Guide to Saving the World - United Nations Sustainable Development.” *United Nations*, United Nations, [www.un.org/sustainabledevelopment/takeaction/](http://www.un.org/sustainabledevelopment/takeaction/).

Magyari, Kristin. “5 Ways to Build Customer Awareness Through Marketing.” *Syncshow - Inbound Marketing Agency for Manufacturing*, [www.syncshow.com/blog/5-marketing-tactics-for-building-customer-awareness](http://www.syncshow.com/blog/5-marketing-tactics-for-building-customer-awareness).

NGO International Sport and Culture Association ISCA Vester Voldgade 100, 2DK-1552 Copenhagen Denmark [www.isca-web.org](http://www.isca-web.org) [info@isca-web.org](mailto:info@isca-web.org). "ISCA - International Sport and Culture Association / Burn Calories, Not Electricity: Organisations across Europe Support Third No Elevators Day." *ISCA - International Sport and Culture Association*, [www.isca-web.org/english/news/burncaloriesnotelectricityorganisationsacrosseuropesupportthirdnoelevatorsday](http://www.isca-web.org/english/news/burncaloriesnotelectricityorganisationsacrosseuropesupportthirdnoelevatorsday).

*OVERCONSUMPTION? Our Use of the World's Natural Resources*. [www.foe.co.uk/sites/default/files/downloads/overconsumption.pdf](http://www.foe.co.uk/sites/default/files/downloads/overconsumption.pdf).

Perlman, USGS Howard. "How Much Water Is There on, in, and above the Earth?" *How Much Water Is There on Earth, from the USGS Water Science School*, [www.water.usgs.gov/edu/earthhowmuch.html](http://www.water.usgs.gov/edu/earthhowmuch.html).

"Pilot Projects." *Seoul Initiative Network on Green Growth*, [www.singg.org/en/main/index.do](http://www.singg.org/en/main/index.do).

*RESPONSIBLE CONSUMPTION & PRODUCTION: WHY IT MATTERS*. [www.un.org/sustainabledevelopment/wp-content/uploads/2016/08/16-00055L\\_Why-it-Matters\\_Goal-12\\_Consumption\\_2p.pdf](http://www.un.org/sustainabledevelopment/wp-content/uploads/2016/08/16-00055L_Why-it-Matters_Goal-12_Consumption_2p.pdf).

*Resource Efficiency: Potential and Economic Implications*. United Nations Environment Program, <https://www.env.go.jp/press/files/jp/102839.pdf>.

"Resource Efficiency." *Resource Efficiency - Environment - European Commission*, [www.ec.europa.eu/environment/resource\\_efficiency/about/roadmap/index\\_en.htm](http://www.ec.europa.eu/environment/resource_efficiency/about/roadmap/index_en.htm).

"Resource Efficiency." *The United Nations Environment Program*, [www.unep.org/resourceefficiency/](http://www.unep.org/resourceefficiency/).

"Resources." *Adelphi*, [www.adelphi.de/en/topics/resources](http://www.adelphi.de/en/topics/resources).

RobecoWebTV. "WATER Our Most Precious Resource." *YouTube*, YouTube, 24 Apr. 2014, [www.youtube.com/watch?v=Vlaw5mCjHPI](http://www.youtube.com/watch?v=Vlaw5mCjHPI).

*Strategy Paper on Resource Efficiency*. June 2017, [www.niti.gov.in/writereaddata/files/document\\_publication/Strategy%20Paper%20on%20Resource%20Efficiency.pdf](http://www.niti.gov.in/writereaddata/files/document_publication/Strategy%20Paper%20on%20Resource%20Efficiency.pdf).

"Sustainable Consumption and Production." *United Nations*, United Nations, [www.un.org/sustainabledevelopment/sustainable-consumption-production/](http://www.un.org/sustainabledevelopment/sustainable-consumption-production/).

"UNBISnet - UN Bibliographic Information System." *United Nations*, United Nations, [www.unbisnet.un.org/](http://www.unbisnet.un.org/).

"United Nations Sustainable Development Agenda." *United Nations*, United Nations, [www.un.org/sustainabledevelopment/development-agenda/](http://www.un.org/sustainabledevelopment/development-agenda/).

“Various Facts About Fossil Fuels.” *Conserve Energy Future*, 24 Dec. 2016, [www.conserve-energy-future.com/various-fossil-fuels-facts.php](http://www.conserve-energy-future.com/various-fossil-fuels-facts.php).

Waterstaat, Ministerie van Infrastructuur en. “Study: Shopkeepers See Substantial Reduction in Use of Plastic Bags.” *News Item | Government.nl*, Ministerie Van Algemene Zaken, 24 Apr. 2017, [www.government.nl/topics/environment/news/2017/04/24/study-shopkeepers-see-substantial-reduction-in-use-of-plastic-bags](http://www.government.nl/topics/environment/news/2017/04/24/study-shopkeepers-see-substantial-reduction-in-use-of-plastic-bags).

“What Is Interreg Europe?” *Interreg Europe*, [www.interregeurope.eu/about-us/what-is-interreg-europe/](http://www.interregeurope.eu/about-us/what-is-interreg-europe/),

“Your Water Partners.” *IDE Technologies*, [www.ide-tech.com/](http://www.ide-tech.com/) .

**Forum:** Environment Sub-Commission 1

**Issue:** Improving water purification methods to increase access to clean water

**Student Officer:** M. Zirdi Syukur

**Position:** President

---

## Introduction

Consumption of contaminated water may lead to the transmission of diseases and other health risks. A lack of clean water causes unsanitary practices in sanitation and hand hygiene which further intensifies the health risks. In addition to health effects, some people take long and risky journeys to resolve their basic need of water. The time they spend looking for water can be productive in other fields. Improving the safety of water will also reduce the medical costs brought by water-related disease. These factors call for water to become available on an on need basis, be safe, and be close.

Water is the resource of life, humanity uses it in cooking, cleaning, growing, and drinking. As of 2015, 2.1 billion people did not have access to these standards of water. Of which, 1.3 billion can find basic clean water within 30 minutes away, 423 million access unprotected wells and springs, 263 million have limited services (more than 30 minutes to collect water), and 158 million collect untreated surface water from lakes, ponds, rivers, and streams. While this may seem like a vast improvement in the scope of humanity, it still does not meet our sustainable development goal 6.1 which states “By 2030, achieve universal and equitable access to safe and affordable drinking water for all”. Water is a basic right for anyone to have and despite our progress, many people in the world still do not have this basic right. Thus our goal is to focus on the 2.1 billion people who need national and international attention.

Several obstacles face this problem for example: many efficient water purification methods are too expensive for LEDCs. This brings in the topic of concern which is improving these water purification methods to increase access to clean water. Today’s current methods are either too expensive, inefficient, or unavailable to a country to use. So in an effort to reach our goal of sustainable development goal 6, we must make strides to make the methods less expensive, more efficient, and more available.

## Definition of Key Terms

### Improved drinking water source

An improved drinking water source is defined as a water source that is protected from being contaminated. Examples of unimproved drinking water sources include: surface water from rivers, lakes, dams, springs, or unprotected dug wells.

### Water purification and treatment

Water purification refers to the removal of undesired chemicals and contaminants in water. The process is usually to make water safe for human consumption. Water treatment is more general in

the sense that it treats water so that it is usable for any use like cleaning wastewater and returning it to the environment.

### Water security and scarcity

IX Powers defines water security/scarcity as the ability to access sufficient quantities of clean water to maintain adequate standards of food and goods production, proper sanitation, and sustainable health care.

### Drinking-water quality standards

Many different countries set their own standards of drinking water quality. For example Europe has the European Drinking Water Directive and the United States had the Environmental Protection Agency's monitoring (EPA). In countries without specific guidelines, the World Health Organization (WHO) and their Guides for Drinking Water Quality (GDWQ) helps establish basic framework and implements their own list of chemical concentrations in water in national law.

## Background Information

### Problems with Access to water

Freshwater is defined as containing a concentration of less than two parts per thousand (<0.2%) of dissolved salts. It is the water that we consume and use through everyday life. 71% of the earth's surface is covered with water, however, only 3% of which is a fresh water supply—with mostly all being lakes, rivers, vapour, clouds, precipitation, ground water, and polar ice caps or glaciers. Because not all of these resource can be used by humanity (like vapour), in reality, only 0.5% of the freshwater is available for humans and other forms of life. While the fresh water is a good supply for many communities, the journal Nature predicts that 3.4 billion people worldwide are in danger of freshwater supply shortages. This figure is further strained by a 10-20% increase in demand for freshwater due to a rising population.

#### *Africa*

This problem is most severe in Africa. Tens of millions of rural inhabitants in Africa rely on simple hand pumps as their primary water supply, one-third of which are estimated to be broken at the same time. In the Water Security and scarcity graph below, it is clear that sub-Saharan Africa is whether most of economic water scarcity is demonstrated. This calls for specific attention to be focused on this region and to find the root causes of this problem.

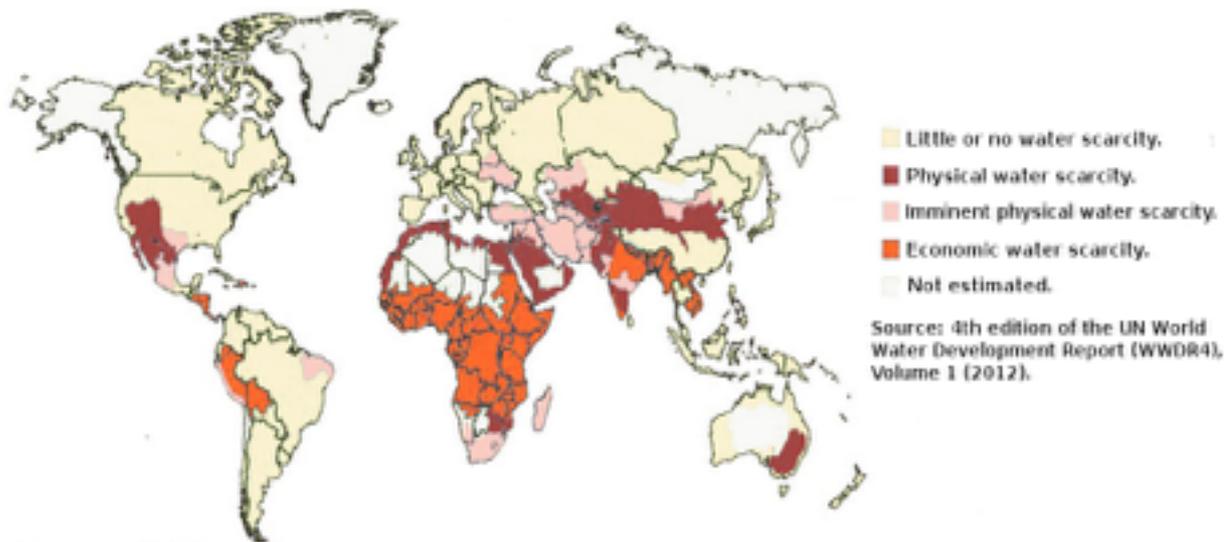


figure 1.1 4th edition of the UN World Water Development Report (WWDR4) Volume 1 (2012)

### *Waterborne Diseases*

The World Health Organization (WHO) estimates that Water-related diseases kill 1.5 million people each year. This problem is most severe in developing nations whose water sanitation systems are not fully developed and their surface water being contaminated with waterborne diseases. That is not to say that the problem does not exist in the developed world as well. These diseases are not from a common root, they come from a multitude of pathogens like bacteria, viruses, parasites, protozoa, or other disease-causing organisms. In the past, there has been numerous waterborne disease outbreaks. Even the country that is ranked number one with improved water sources, Denmark, suffered a gastroenteritis outbreak in 2007. Studies have shown that an investment in addressing this problem will result in lower death rates and a 300-400% return investment, which could help developing nations reduce deaths and tackle poverty.

### *Rural Communities*

Figure 1.1 above only shows the regional average. What we see when we zoom in is that many rural communities are struggling with water scarcity more than urban communities. The UNESCO sites four out of five rural inhabitants as being water insecure. The roots of this problem is an over focusing on urban communities and a lack of proper transportation of water from urban pipelines to the rural communities.

### *Water Consistency*

In the past, because the problem of providing water was such a daunting task, some areas may have received instant but not self-sustaining relief. Many projects involve providing short term water facilities but has since degraded and left communities dry. If it is still running, the infrastructure still struggles with intermittency problems. The IWA (International Water Association) describes an intermittent water supply (IWS) as a piped water supply that is available less than 24 hours a day.

### *Different Water Treatment Methods*

### *Community Water Treatment*

The first step of this method is coagulation and flocculation where the water is treated by adding chemicals that have a positive charge. This allows for negatively charged particles of dirt and others to bind together to create larger particles known as floc.

Sedimentation is the period in which floc settles in the bottom of a water supply, as it does not float in water. Once separated, filtration takes the clear water on top and passes it through a series of filters like sand, gravel, and charcoal. This removes the dust, parasites, bacteria, viruses, and chemicals, and other components of waterborne diseases.

The last phase of this process is disinfection, where the water is subject to disinfectants like chlorine or chloramine to kill any remaining parasites, bacteria, or viruses so that the water is protected from germs when being piped to its destination.

While this method of water treatment is very efficient, the amount of infrastructure required is a complex task for LEDCs to complete.

### *Desalination*

Unlike community water treatment, desalination allows the cleansing of Salt water, not fresh water. The process is called reverse osmosis. Infrastructure will extract water from the ocean using wells or intake structures in the ocean or shoreline. The sea water is first filtered of particles like sand, twigs, or seaweed, so that the particles don't clog up a semipermeable membrane. This is accomplished through multimedia filters like anthracite, gravel, or sand. A second stage of filtration called cartridge filter is used. This process removes even finer particles like fine sand or clay.

By applying pressure to water next to a semi-permeable membrane, we can allow the freshwater molecules to pass through and not the salt or other pollutants thanks to a membrane with a small pore size. Lastly, calcium carbonate ( $\text{CaCO}_3$ ) is added to give the water taste and bring back the Ph to a neutral range (7) so that it is not too acidic or basic. Lastly the water is then sent out to homes, businesses, or storage for consumption or irrigation.

This process is a useful tool in bringing freshwater to coastal communities. Household reverse osmosis setups tend to be unreliable and only return about 5-15% of the intake water. However industrial size desalination plants can return up to 90% of the feed water. One of the largest of such plants was built in Sorek, Israel in 2013. The plant is capable of producing an output of 165 million U.S. gallons every day. Thanks to this, it is possible for the plant to sell water at a very cheap price. However once again, this process is only available to developed countries as the infrastructure required for large scale plants are unrealistic for developing communities.

Additionally, inland countries cannot benefit from desalination plants seeing as they are not in contact with large salt bodies and further infrastructure would be needed to irrigate the salt water inland.

### *Point of Use Technologies*

Point of use technologies (POUs) are water treatment and storage systems that may improve the water quality on site. These technologies have virtually no cost and effectively reduce the likeliness of waterborne diseases. The only drawback is that since they are meant on an

individual scale, the treatment process can be slow and is not suitable for large scale water production. An example of such technologies is using diluted sodium hypochlorite to disinfect water. Users add the mixture, wait 30 minutes, and the water is suitable for drinking. However simple it is, the process is less efficient with more turbid waters and there are certain parasites that sometimes pass through like Cryptosporidium.

Another POU technology is the use of solar disinfection. The treatment was initiated by the Swiss Federal Institute for Environmental Science and Technology in 1991. The process involves putting water in plastic water bottles, shaking, and hanging them on a roof or rack for six hours in sunny weather. It works because of the ultraviolet (UV) lights and temperature from the sun. Again, this process is less efficient against turbid waters and suffers from long treatment times. Other private firms have developed technologies such as instant filtering water bottles. The main challenge with these are distributing the technologies and ensuring their affordability/long-term durability.

## Challenges Facing Water Treatment

### *Cost limitations*

There are many expensive means of addressing freshwater shortages like aqueducts, dams, canals, pipelines, and pumping systems but these methods are out of reach for developing populations.

### *Drinking Water Quality Standards*

Like previously stated, many countries have their own framework for water quality. Those without one have WHO and their Guides for Drinking Water Quality (GDWQ) that guide national legislation. The scope of operation is the limiting factor. With the millions of people around the globe without access to water, their water quality needs to be assessed first. Many rural communities have not gotten the assessment that they need to determine the most suitable water treatment for them.

## Major Countries and Organizations Involved

### JMP (Joint Monitoring Programme for Water Supply and Sanitation)

The JMP is a collaborative effort between WHO and UNESCO that was established in 1990. They were the ones who were tasked with the millennium development goal (MDGs) of drinking water and sanitation. The MDGs mandate lasts until 2015 and despite the JMP's 25 years of experience, they concluded that too many people still lack regular and safe water access. Thus, the JMP persists under the mandate of the sustainable development goals (SDGs) and acts as the only drinking water monitoring system that spans international borders. They continue to publish reports on their progress on an annual basis

### WHO (World Health Organization)

WHO is an organization that directs health related matters as a specialized agency of the United Nations. They regulate public health worldwide and specifically inspects water quality to eradicate

waterborne diseases. They have set standards with guidelines for water quality (GDWQ) to help nations provide clean water access.

### UNICEF (United Nations International Children's Emergency Fund)

UNICEF is a United Nations Program that sets out to provide humanitarian aid to children and mothers internationally. This includes providing water access to developing children. UNICEF's Water, Sanitation, and Hygiene (WASH) team works with 100 countries to bring clean water access, appropriate sanitation, and healthy hygiene. In the past they have brought 14 million people clean access to water in order to reduce the amount of child deaths because of water and sanitation related health risks.

### UN Water

UN Water is the UN's mechanism to coordinate Water and Sanitation projects. Their reach spans over 30 UN organizations and are heavily involved with the Joint Monitoring Programme for Water Supply and Sanitation (JMP). Other programs include the UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) and GEMI. In addition to the monitoring tasks of the JMP, they work in international fora to develop water and sanitation policies as well as launch campaigns to raise awareness such as World Water Day.

### Denmark

Denmark has the highest score in improved water source (percent of population with access) with a 100%. Their water source comes almost entirely from ground water and consumes about 1000 million m<sup>3</sup> every year. Some attributes of their water supply and sanitation program include a voluntary benchmarking system and research and development towards efficiency and cost saving technologies.

### Somalia

Somalia has the lowest value in the world in improved water source (percent of population with access) with a score about 31.70%. Somalia suffers unpredictable rainfall patterns, conflict, and lack of water infrastructure. Because of this, water borne diseases causes 23 percent of children to die before reaching five years old, and only 31.70% of the population is able to have a steady source of clean water.

### Paraguay

Paraguay started 2000 with only 51.6% of its rural population having access to safe water. Since, that statistic has risen to 94.9% in 2015. Paraguay claims the number one spot for rising improved rural water access with a rise of 43.3% despite being 10<sup>th</sup> out of 12 in South American Countries by their GDP per capita. Some of the policies they have expressed include: Reorganizing their water agency under public health, a focusing on sustainability, and communication to rural communities. The policies can be modeled for other LEDCs.

### OECD (Organization for Economic Cooperation and Development)

The OECD's 35 member countries have provided numerous financial aid to numerous developing country's water supplies. As of 2011, the annual donated aid was about 7.6 billion USD, with Japan committing the most (\$1.8 billion) in the OECD and globally, followed by Germany (\$868 million), and the United States (\$442 million).

## Timeline of Events

Date	Description of event
September 30 1990	A large gathering of world leaders for the World Summit for Children where the lack of clean water is one of the causes limiting child development
September 2, 2003	Establishment of UN-Water
July 28th, 2010	Human Right to Water and Sanitation (HRWS)
2013	United Nations General Assembly designates 2013 as the UN international year of water Cooperation and recognizes World Water Day on March 22nd
18 January 2018	International Water Summit held in Abu Dhabi

## Relevant UN Treaties and Events

- The Human Right to Water and Sanitation, July 28<sup>th</sup> 2010, (A/RES/64/292)
- The Right to Development, 15 February 2000, (A/RES/54/175)
- International Decade for Action, "Water for Life", 2005-2015, 23 December, 2003, (A/RES/58/217)

## Previous Attempts to solve the Issue

### UN Water

UN Water is continuing in their mission of providing clean access to water globally. Yearly they make publications on the after status of the world and work with management systems around the globe. The UN World Water Development Report (WWDR) is that report and analyses the worlds' freshwater supply. It examines how the resources are being managed, how different regions are affected by this problem, and other useful data. They also sponsor the world water day every year in an effort to bring more attention towards the cause.

### The Water Project

The Water Project is an organization that works on clean water projects in Rwanda, Sierra Leone, Uganda, Sudan, and Kenya. Thus far they have helped over 125,000 people gain access to clean water and sanitation.

### ACP-EU Water Facility

This program was established in 2004 from the European Development Fund to help finance water purification projects in advice in water management policy in Africa, the Caribbean, and Pacific countries.

## Possible Solutions

### Localized vs Networked Water Treatment

Earlier in this report, different water purification methods were recognized and gauged on their pros and cons. One of which included their effectiveness as a large scale operation or for a household. The distribution of these types of treatment are key in finding a solution to the water scarcity. Rural areas will need to be networked to larger clean water facilities via pipe line projects and developing countries will need to become aware of household (localized) methods of water treatment. These methods could also be given as a response to disaster situations like after a hurricane where resources like water are scarce.

### Subsidizing, Investment, and Training

It is clear that R&D is needed in the sector, thus one possible way of arriving there is through subsidizing and investing in the industry. National governments would need to realize the importance of achieving this basic right and allocate funds towards those projects. International states or NGOs can be swayed into investing in the industry because of fast growing technologies. Patents on water technologies may be lifted or cheapened to be more available. And lastly, in order to keep infrastructure running, training and higher education on the topic is necessary so that a country or region may be able to be self-reliant on their water supply. This is especially pertinent to LEDCs that don't have the economy to support big research projects. Such countries may require international expertise to train their own government agencies and water-experts.

### Protecting the freshwater supply

Seeing as only a miniscule percentage of earth's water is fresh water we mustn't further limit the options. Decades of pollution following the industrial revolution calls for the pollution of our water supply to come to a halt. This can be accomplished by identifying contaminated water supplies—lakes, rivers, wetlands, ground water, creating effective policies that are region exclusive but are monitored by international organizations such as the JMP, and then establishing measures to prevent further pollution done to these ecosystems by implementing laws with consequences like imprisonment or heavy fines that deter such actions.

### Overcoming poverty and conflict

The building of water facilities, systems, and policies is in fact the easier part of the problem. The obstacles is getting these technologies to impoverished and conflicted communities. Extreme poverty and high density of population leads to a daunting problem in some communities. Poverty and water is a self-sustaining problem that will perpetually grow. A Lack of water will cause poverty to worsen and that in turn will make water less available. Overcoming this aspect might be plausible with the upbringing of cheaper and more sustainable water technologies, international aid and relief, and possibly a tackling of corruption among the officials responsible. In addition, like any resource, water becomes scarce during times of conflict. When violence breaks out, instant relief provided by international communities won't

last for nations with ongoing conflict. Water infrastructure including plants, pipelines, and reservoirs must be guarded and ensured to be kept running despite conflict so that localized water treatment does not get shut down.

## Bibliography

- Purvis, Katherine. "Access to Clean Water and Sanitation around the World – Mapped." *The Guardian*, Guardian News and Media, 1 July 2015, [www.theguardian.com/global-development-professionals-network/2015/jul/01/global-access-clean-water-sanitation-mapped](http://www.theguardian.com/global-development-professionals-network/2015/jul/01/global-access-clean-water-sanitation-mapped).
- Bain, Tom Slaymaker and Robert. "Access to Drinking Water around the World – in Five Infographics." *The Guardian*, Guardian News and Media, 17 Mar. 2017, [www.theguardian.com/global-development-professionals-network/2017/mar/17/access-to-drinking-water-world-six-infographics](http://www.theguardian.com/global-development-professionals-network/2017/mar/17/access-to-drinking-water-world-six-infographics).
- "Quality and Wastewater." *UN-Water*, [www.unwater.org/water-facts/quality-and-wastewater/](http://www.unwater.org/water-facts/quality-and-wastewater/).
- Slaughter, Sarah. "Improving the Sustainability of Water Treatment Systems: Opportunities for Innovation." *The Solutions Journal*, May 2010, [www.thesolutionsjournal.com/article/improving-the-sustainability-of-water-treatment-systems-opportunities-for-innovation/](http://www.thesolutionsjournal.com/article/improving-the-sustainability-of-water-treatment-systems-opportunities-for-innovation/).
- Shankleman, Jessica. "What Are the Latest Advances in Water Treatment and Management?" *The Guardian*, Guardian News and Media, 18 Oct. 2011, [www.theguardian.com/sustainable-business/sustainable-water-treatment-management](http://www.theguardian.com/sustainable-business/sustainable-water-treatment-management).
- McGrath, Matt. "'Huge' Water Resource Exists under Africa." *BBC News*, BBC, 20 Apr. 2012, [www.bbc.com/news/science-environment-17775211](http://www.bbc.com/news/science-environment-17775211).
- International Hydrological Programme. "Water Security." *PROPOSAL FOR THE ESTABLISHMENT OF A CATEGORY II WATER RELATED CENTRE ON*.
- Robeson, Michael D. "Providing Clean Water to the Developing World." *Water Technology Online*, 15 July 2015, [www.watertechnonline.com/providing-clean-water-to-the-developing-world/](http://www.watertechnonline.com/providing-clean-water-to-the-developing-world/).

## Appendices

- I. <https://www.theguardian.com/global-development-professionals-network/2015/jul/01/global-access-clean-water-sanitation-mapped>  
Purvis, Katherine. "Access to Clean Water and Sanitation around the World – Mapped." *The Guardian*, Guardian News and Media, 1 July 2015, [www.theguardian.com/global-development-professionals-network/2015/jul/01/global-access-clean-water-sanitation-mapped](http://www.theguardian.com/global-development-professionals-network/2015/jul/01/global-access-clean-water-sanitation-mapped).
- II. <https://www.theguardian.com/global-development-professionals-network/2017/mar/17/access-to-drinking-water-world-six-infographics>  
Bain, Tom Slaymaker and Robert. "Access to Drinking Water around the World – in Five Infographics." *The Guardian*, Guardian News and Media, 17 Mar. 2017, [www.theguardian.com/global-development-professionals-network/2017/mar/17/access-to-drinking-water-world-six-infographics](http://www.theguardian.com/global-development-professionals-network/2017/mar/17/access-to-drinking-water-world-six-infographics).

III. <https://www.thesolutionsjournal.com/article/improving-the-sustainability-of-water-treatment-systems-opportunities-for-innovation/>

Slaughter, Sarah. "Improving the Sustainability of Water Treatment Systems: Opportunities for Innovation." *The Solutions Journal*, May 2010, [www.thesolutionsjournal.com/article/improving-the-sustainability-of-water-treatment-systems-opportunities-for-innovation/](http://www.thesolutionsjournal.com/article/improving-the-sustainability-of-water-treatment-systems-opportunities-for-innovation/).

IV. <https://www.theguardian.com/sustainable-business/sustainable-water-treatment-management>

Shankleman, Jessica. "What Are the Latest Advances in Water Treatment and Management?" *The Guardian*, Guardian News and Media, 18 Oct. 2011, [www.theguardian.com/sustainable-business/sustainable-water-treatment-management](http://www.theguardian.com/sustainable-business/sustainable-water-treatment-management).

V. <http://www.bbc.com/news/science-environment-17775211>

McGrath, Matt. "'Huge' Water Resource Exists under Africa." *BBC News*, BBC, 20 Apr. 2012, [www.bbc.com/news/science-environment-17775211](http://www.bbc.com/news/science-environment-17775211).



used. The pH scale measures the concentrations of hydrogen ions (H<sup>+</sup>) and hydroxide ions (OH<sup>-</sup>). The more hydrogen ions (H<sup>+</sup>) there are in a solution the more acidic and lower the Ph is. However, the more hydroxide ions (OH<sup>+</sup>) there are the more basic the solution is. Something that is very important to keep in mind is that this scale is not linear but it is a logarithmic scale which means that each whole pH value higher or lower than another pH value has a ten times higher or lower concentration of H<sup>+</sup>. Each step is a factor of ten.

## Geo-engineering

Geo-engineering is the use of scientific methods to counteract the effects of global warming. The removal of carbon dioxide or controlling sunlight before reaching the planet are two examples of geo-engineering. Although this may seem the solution to all of our problems concerning global warming, the consequences of these methods are not fully known and they are irreversible.

## Ecosystems

Ecosystems are the complex interaction between all of the living things in a given area, with each other, and also with their non-living environments (weather, earth, sun, soil, climate, atmosphere, rocks).

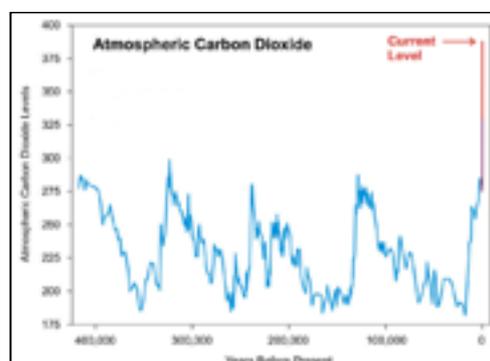
Ex: Tropical rainforest ecosystem

## Background Information

### Acidification chemistry

Ocean acidification is governed by simple chemistry. The carbon dioxide, or CO<sub>2</sub>, is naturally in the air, but due to human activity, the CO<sub>2</sub> level has increased greatly. But the CO<sub>2</sub> doesn't just stay in the atmosphere. About a third of it is absorbed by the ocean which leads to a drastic change in the basic chemistry of the oceans.

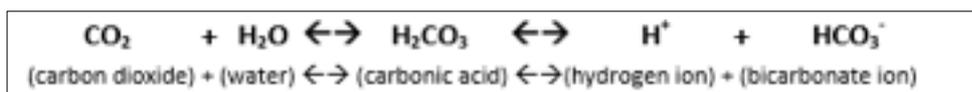
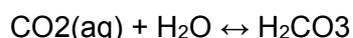
#### Evolution of the atmospheric carbon dioxide levels throughout time



When carbon dioxide dissolves in water, it forms carbonic acid (H<sub>2</sub>CO<sub>3</sub>). Carbonic acid rapidly splits apart to produce bicarbonate ions (HCO<sub>3</sub><sup>-</sup>). In turn, bicarbonate ions can also dissociate into carbonate

ions (CO<sub>3</sub><sup>2-</sup>). Both of these reactions also release ions (H<sup>+</sup>) which stated before, lowers the pH of the solution and makes the solution more acidic.

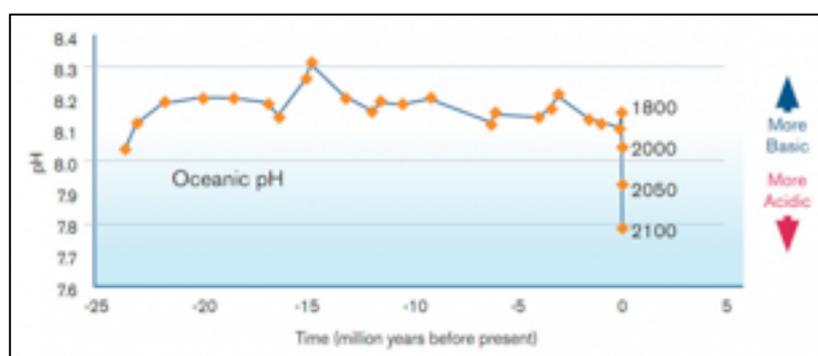
Chemical reactions:



### Projections of future changes

It is expected that later this century, if CO<sub>2</sub> emissions continue at the current rate, the average pH of the ocean will drop to 7.8. In 1885, the average pH level was around 8.2, in 2005 only 8.1 and it is predicted it should drop to 7.8 in 2094. This relatively small decrease in pH may not seem significant but it is important to remember that the pH scale is not a linear scale but a logarithmic scale. This means that, by the end of this century, the surface waters of the ocean could be nearly 150 percent more acidic than before the industrial revolution.

#### Historic Ocean pH levels



This chart shows us the evolution of pH levels throughout time and highlights the drastic decrease of the pH level in the ocean and the predictions for the next hundred years.

### Why acidity matters

Many chemical reactions, including those that are essential for life, are sensitive to small changes in pH. Even the human body is sensitive to those changes. In our body the pH level ranges between 7.35 and 7.45. A decrease in pH of 0.2-0.3 in our blood could cause seizures, comas and in certain cases death. Similarly, a small change in the pH of seawater can lead to harmful consequences on the marine life. For example, it could impact chemical communication, reproduction and or growth between marine species. A more acidic environment has a dramatic effect on some species including oysters,

clams, sea urchins, shallow water corals, deep sea corals, and calcareous plankton. We also know that when even a small part of the food chain is at risk, the entire food web might collapse. To put into perspective of human need, more than a billion people worldwide rely on food from the ocean as their primary source of protein. Furthermore, many economies around the world depend directly or indirectly on marine life.

### Impact on ecosystems

Ecosystems are defined by the complex interactions among organisms and also between organisms and their environment. Any disturbance may lead to dramatic effects throughout the system. To understand how ocean acidification may affect ecosystems, scientists use ecosystem and try to predict these consequences.

The pH level has fluctuated over the years within limits as a result of natural processes but the sudden and extreme rise in seawater acidity is disturbing the marine ecosystems in ways we can't even imagine. Today we already perceive a few of the consequences this modification in the marine chemistry has led to. A more acidic ocean won't destroy all marine life in the sea, but it is already affecting some ocean organisms.

Many marine organisms that produce calcium carbonate ( $\text{CaCO}_3$ ) shells or skeletons are negatively impacted by increasing  $\text{CO}_2$  levels and decreasing pH in seawater. The more carbon dioxide is dissolved in the ocean, the less free carbonate ions are accessible for forming calcium carbonate shells/skeletons. Since reef-building corals need carbonate to build their skeletons, decreasing carbonate ion concentrations will likely lead to weaker, and slower coral growth rates. Ocean acidification is therefore making it harder for many marine animals to build their calcium carbonate shells and skeletons. It could also cause in the future coral reefs to erode faster than they can calcify. Furthermore, massive coral reef structures, composed primarily of calcium carbonate, offer important habitats to numerous marine organisms thus impacting a great number of other species living in these reefs.

**Example:** We could take as an example the Great Barrier Reef in Australia which is the world's largest coral reef system. The reef covers 344,400 km<sup>2</sup> in area, and was listed by UNESCO in 1981 as a World heritage site. But in the past thirty years the Great Barrier reef has lost half of its coral cover and ocean acidification contributed among other factors to this decrease because ocean acidity has the potential to slow growth of coral and it may also encourage the growth of seaweeds, which compete for space with corals.

Another organism that shows us that even the little organisms are threatened by the changes is the pteropod, also called "sea butterfly", which is a tiny marine creature that looks like a snail and uses his feet as wings for swimming. Pteropods are a major food source for many marine creatures such as the salmon. A study made by the National Oceanic and Atmospheric Administration shows the evolution of the shells of pteropods when placed in sea water with pH and carbonate levels projected for the year 2100. The results are shocking and terrifying because after only 45 days the shell slowly dissolved. These pictures show the different stages of dissolution.



Shellfish, such as oyster, clams, crabs and scallop, are also endangered by the rapid change in the ocean's chemistry. Shellfish make their shells from calcium carbonate, which contains carbonate ion as a building block. The process of ocean acidification also decreases the concentration of carbonate ion and makes building and maintaining calcium carbonate structures difficult for marine organisms such as shellfish. Thus, makes their survival, growth and reproduction harder.

While fish don't have shells, like crabs or oysters may have, they will still be affected by the acidification of the oceans. The ability to adapt to higher acidity will vary from species to species but it will still be a challenge. Ocean acidification also alters fish populations indirectly through habitat modification since coral reefs are in danger of eroding, their habitat is also in danger. The important matter, now is finding out, specifically how different species react to these dramatic changes and how we can help.

Finally, regardless of the ecosystem, there is a concern that ocean acidification, along with other stressors, will reduce the biodiversity of marine ecosystems through species extinctions, with potentially important consequences. And, along with destroying marine life, it may also reduce the ability of the ocean to absorb CO<sub>2</sub>, leaving more CO<sub>2</sub> in the atmosphere and worsening its impact on the climate. Ocean acidification will therefore not only have an immense impact on our marine ecosystems but also on all other ecosystems.

### Impact on our society

Today, more than a billion people worldwide rely on food from the ocean as their primary source of protein. Approximately 20 percent of the world's population derives at least one-fifth of its animal protein intake from fish. Many jobs and economies around the world depend on the fish and shellfish that live in the ocean. The impact on our environment is a great concern but it isn't the only concern since these changes will not only affect the marine biodiversity but every society and country since their populations either eat or catch and sell fish and shellfish, have a coral reef tourism industry or depend on coral reefs for other goods and services. While some countries will be able to respond to the impacts of ocean acidification by for example replacing fish and seafood with other types of protein, other states will find it more difficult to adapt. As the oceans diminish in diversity, the countless goods and services our ocean provides for us, ocean acidification will force millions of people to find new food sources, and new sources of income.

## Major Countries and Organizations Involved

### Main emitters of carbon dioxide

The top ten countries with the highest carbon dioxide emissions are China, United States, Russia, India, Japan, Germany, Iran, South Korea, Canada and Saudi Arabia. These countries are involved in this issue since they are the main producers of the carbon dioxide which is known to be the cause of the increase in acidity of the oceans.

### Countries most vulnerable to ocean acidification

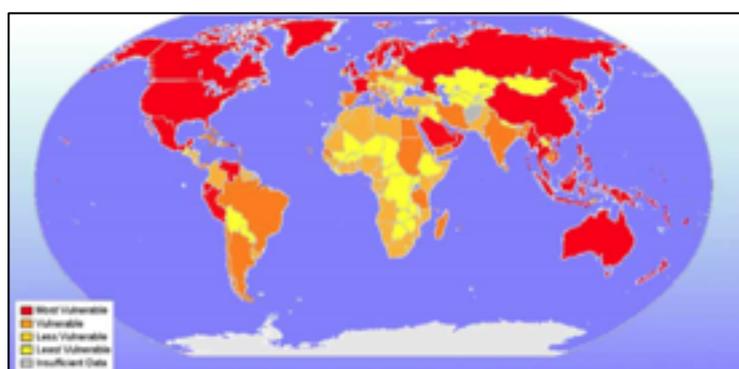
According to a research report of an international organization called Oceana, six of the ten biggest CO<sub>2</sub> polluters are likely to suffer most from the impacts of ocean acidification by 2050. This means that the countries producing the large amounts of carbon dioxide and benefiting from the marine life as an income are the first victims and responsible of these changes.

#### Top 25 Most Vulnerable Nations to Acidification:

Japan, France, United Kingdom, Netherlands, Australia, New Zealand, Republic of the Philippines, United States, Malaysia, Republic of Indonesia, Taiwan, Kingdom of Thailand, China, Iceland, Mexico, Norway, Greenland, Republic of Korea, United Arab Emirates, Socialist Republic of Vietnam, Republic of Singapore, Canada, Belize, Papua New Guinea, Republic of Maldives

These results are based on four criteria including their fish and shellfish catch, their consumption of seafood per capita, the importance of coral reefs within their exclusive economic zones (EEZ) and the projected level of ocean acidification in their coastal waters in 2050.

Acidification Vulnerability Rank	Country	Carbon Dioxide Emissions Rank	GDP Rank
1	Japan	5	2
2	France*	16	6
3	United Kingdom*	8	5
4	Netherlands*	24	16
5	Australia	12	14
6	New Zealand*	65	58
7	Philippines, Republic of the	45	47
8	United States*	2	1
9	Malaysia	31	41
10	Indonesia, Republic of	20	22
11	Taiwan, Province of China	21	23
12	Thailand, Kingdom of	25	26
13	China	1	4
14	Iceland	134	94
15	Mexico	13	15
16	Norway	96	25
17	Greenland	180	112
18	Korea, Republic of	9	13
19	United Arab Emirates	28	30
20	Vietnam, Socialist Republic of	44	60
21	Singapore, Republic of	32	45
22	Canada	7	9
23	Belize	170	158
24	Papua New Guinea	126	133
25	Maldives, Republic of	173	161



Most vulnerable to least vulnerable Nations to Ocean Acidification

## Japan

According to the same study mentioned before, Japan is the most vulnerable country to these changes of the ocean chemistry since Japan is among the ten largest consumers of fish and is also one of the top ten countries catching fish and shellfish within its EEZ.

## UNESCO-IOC

UNESCO-IOC (The Intergovernmental Oceanographic Commission of UNESCO) established in 1960 as a body with functional autonomy within UNESCO, is an organization within the UN system focused on marine science.

They are co-founder of the Ocean Acidification network. This network is an essential source of information for ocean researchers since they are co-hosts of the main international symposium on this issue. This symposium is called "The Ocean in a high CO<sub>2</sub> World" and takes place every four years. The first one was in 2004 and the last one was in 2016.

UNESCO's Intergovernmental Oceanographic Commission was also a partner of the Tara Oceans expedition which was a 3-year mission (2009-2012) around the world aiming to understand how the nature and diversity of planktonic life will be affected by climate change and acidification. Their main goal was to study plankton in marine ecosystems because they represent around 80 percent of single-celled organisms on Earth and play an essential role in our planets life.

The global Ocean Observing system (GOOS), is also programme executed by UNESCO-IOC and serves as a governance model and a project office, facilitating collaboration between different governance bodies. Finally, UNESCO-IOC and the Scientific Committee on Oceanic Research (SCOR) are sponsors of the International Ocean Carbon Coordination Project (IOCCP).

## IOCCP

IOCCP focuses their research on the effects the increasing levels of carbon dioxide on our ocean and especially on calcifying organisms. Their aim is to "develop an international ocean carbon observation network and to establish international agreements on observation methods, standards, data management, and data sharing for ocean carbon research."

## GOA-ON

The global Ocean Acidification Observing Network is a "collaborative international approach" to document the status and advancement of ocean acidification, and to provide data to optimize modelling for ocean acidification. Their most recent activity was in October 2017 with the first Latin-American Ocean Acidification Symposium in Buenos Aires.

## EPOCA

The European Project on Ocean Acidification was launched in June 2008 and ended four years after. Their goal was to further investigate on the biological and societal implication of ocean acidification.

To do so they brought together more than 160 researchers from 32 institutes and 10 European countries. They devoted much of their efforts to quantifying the impact of ocean acidification on marine organisms and ecosystems and they carried out experiments and documented the changes in the oceans chemistry throughout time.

### BIOACID (Biological Impacts of Ocean Acidification)

BIOACID (Biological impacts of Ocean Acidification) is one of the largest research programs on ocean acidification. They are supported by the German Federal Ministry of Education and Research, and coordinate projects trying to quantify the effects of ocean acidification on marine organisms and their habitat.

### NOAA

The NOAA Ocean Acidification Program (OAP) was established in May 2011, an organization trying to improve our understanding of our ocean's chemistry. They play an important role in maintaining long-term ocean acidification monitoring and they have a number of fisheries science centers, where they are able to study the response of marine organisms to the chemistry conditions expected. Not only concerning themselves with the environmental damages they also started economic modeling to find out the economic impacts of these changes in fisheries harvest. And finally, they take into consideration that education is one of the key elements to finding solutions, by starting projects to improve public awareness.

### UNDP

The United Nations Development Programme (UNDP) is the United Nations' global development network. The organization operates in 177 countries, and focuses on poverty reduction, HIV/AIDS, democratic governance, energy and environment, social development, and crisis prevention and recovery. They work internationally to help countries achieve the Millennium Development Goals which also includes to ensure environmental sustainability.

## Relevant UN Treaties and Events

- Oceans and the law of the sea, 4 December 2009 (**A/RES/64/71**), paragraph 113
- Oceans and the law of the sea, 4 December 2009 (**A/RES/64/71**), paragraph 159
- United Nations Convention on the Law of the Sea, 1982
- Intergovernmental conference on oceanographic research, 1960, Copenhagen

## Previous Attempts to solve the Issue

### Paris Agreement

In a way the Paris agreement is a solid attempt to combat ocean acidification since it is combating the global warming by trying to limit the emissions of carbon dioxide (CO<sub>2</sub>). 169 parties have

already ratified the agreement, of 197 Parties to the Convention. The Paris Agreement entered into force on 4 November 2016.

### United Nations Conference on Sustainable Development (Earth Summit 2012)

In June 2012, the UN Conference on Sustainable Development (Rio+20) recognized ocean acidification as a threat economically and ecologically. It may not seem that big of an accomplishment but this recognition at such a wide scale is the first step to solve this issue.

### Intergovernmental Conference on Oceanographic Research

The intergovernmental conference on oceanographic research was held in 1960 in Copenhagen and is referred to as the first oceanographic conference. This conference was the first step into recognizing that global issues like climate change, can only be addressed through international and intergovernmental cooperation such as this conference. Along with starting an international debate on the matter of our ocean, they created the "Intergovernmental Oceanographic Commission" (UNESCO-IOC).

## Possible Solutions

Various solutions can be suggested and put into action to combat ocean acidification and its impacts on ecosystems. Here are a few examples of solutions that could help you with your own research on solutions. This is just a guideline, so feel free to come up with new and effective solutions of your own directed specifically at your country's interests.

- Emphasize on the importance for the parties who haven't signed the Paris agreement to ratify it since it is one of the biggest steps in international diplomacy for a better agreement on how to combat global warming.
- Coordinate project, activities, events or research to avoid overlaps, and to be cost-effective. This may seem simple but it is one of the most effective ways to fasten the research and the process of finding better ways to combat ocean acidification.
- Supporting already existing projects or organisations focused on ocean acidification can be extremely helpful, because creating new ones when the already existing ones don't have enough support is counterproductive.
- Raise awareness among young people and insist on the importance of the issue. Young people are the future leaders and politicians of our world, and should be aware of the different aspects of global warming since they are the ones that have to live in that world.
- Integrate this issue in the curriculum of secondary schools to further educate people of the importance of ocean acidification and the impacts on the environment.
- However, knowledge of natural scientific facts on sea and climate alone do not trigger in most cases sufficient motivation in society to do something about it therefore we also have to consider

solutions on national and international levels with policies and directives aiming to counteract the negative effects of human activities.

- Reducing the consumption of carbon-oriented energy sources such as fossil fuels by transitioning to cleaner energy sources.
- Promoting offshore wind energy. An efficient way to transition to clean energy is to promote offshore wind energy and to minimize offshore drilling which is especially damaging to marine life and ecosystems. To do so, possible solutions are demanding policies that increase the supply of renewable energies or maybe tax credits for investments in wind technologies.
- Reduce personal carbon footprints, which can be taught at school or other education facilities with the help of governmental directives that could inform the teachers themselves.
- Geoengineering can also be considered a solution to ocean acidification and global warming in general, but it is not the safest of the solutions since we know little about the effect of geoengineering on our ecosystems.

## Bibliography

"What is ocean acidification", *National Oceanic and Atmospheric Administration (NOAA)*, <<https://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F>>

"Ocean acidification", *National Geographic*, 27<sup>th</sup> of April 2017 <<https://www.nationalgeographic.com/environment/oceans/critical-issues-ocean-acidification/>>

"Ocean acidification", *Wikipedia the free encyclopedia*, 22 October 2017 <[https://en.wikipedia.org/wiki/Ocean\\_acidification](https://en.wikipedia.org/wiki/Ocean_acidification)>

Jennifer Bennett. "Ocean acidification", *The ocean Portal*, <<http://ocean.si.edu/ocean-acidification>>

"What is ocean acidification", *European Project on OC acidification (EPOCA)*, <<http://www.epoca-project.eu/index.php/what-is-ocean-acidification.html>>

Stephen Barker & Andy Ridgwell. "Ocean acidification", *Nature Education Knowledge*, 2012 <<http://www.nature.com/scitable/knowledge/library/ocean-acidification-25822734>>

"An Introduction to Ocean Acidification", *National Environment Satellite, Data, and Information Service (NESDIS)*, <[https://coralreefwatch.noaa.gov/satellite/oa/description/oaps\\_intro\\_oa.php](https://coralreefwatch.noaa.gov/satellite/oa/description/oaps_intro_oa.php)>

"pH scale definition", *Business Dictionary*, <<http://www.businessdictionary.com/definition/pH-scale.html>>

"Acids, bases & the pH scale", *Science Buddies*, <<https://www.sciencebuddies.org/science-fair-projects/references/acids-bases-the-ph-scale#acidicorbasic>>

"pH scale", *Virtual Chembook*, <<http://chemistry.elmhurst.edu/vchembook/184ph.html>>

"Climate change: how do we know?", NASA, October 17, 2017 <<https://climate.nasa.gov/evidence/>>

"Effects of Ocean acidification on Marine Ecosystems", *The National Academies of Sciences Engineering Medicine*, 2010 <<https://www.nap.edu/read/12904/chapter/6>>

"Ocean acidification", UNESCO, <<http://www.unesco.org/new/en/natural-sciences/ioc-oceans/focus-areas/rio-20-ocean/blueprint-for-the-future-we-want/ocean-acidification/>>

Andrew Hudson. "Ocean acidification – what it means and how to stop it", *United Nations Development Programme*, 14 mars 2017 <<http://www.undp.org/content/undp/en/home/blog/2017/3/14/Ocean-Acidification-What-it-means-and-how-to-stop-it.html>>

"United Nations Development Programme", *Wikipedia*, <[https://en.wikipedia.org/wiki/United\\_Nations\\_Development\\_Programme](https://en.wikipedia.org/wiki/United_Nations_Development_Programme)>

"Paris Agreement - Status of Ratification", *United Nations Framework Convention on Climate Change*, <<http://unfccc.int/2860.php>>

"What is ocean acidification", *Conserve Energy Future*, <<https://www.conserve-energy-future.com/causes-effects-solutions-of-ocean-acidification.php>>

"Major CO<sub>2</sub> –Emitting Nations Vulnerable to Ocean Acidification", *Oceana Protecting the World's oceans*, December 2009 <<http://oceana.org/press-center/press-releases/major-co2-%E2%80%93emitting-nations-vulnerable-ocean-acidification>>

"Each Country's Share of CO<sub>2</sub> Emissions", *Union of concerned Scientists*, November 18, 2014 <[http://www.ucsusa.org/global\\_warming/science\\_and\\_impacts/science/each-countrys-share-of-co2.html#.WgclLele5D8](http://www.ucsusa.org/global_warming/science_and_impacts/science/each-countrys-share-of-co2.html#.WgclLele5D8)>

Ellycia Harrould-Kolieba and Dorothee Herr. "Climate Change and Ocean Acidification", *Oceana*, <[http://www.google.nl/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0ahUKEwiyy7ym5LbXAhWE2KQKHSnXC2MQFgg2MAI&url=http%3A%2F%2Foceana.org%2Fsites%2Fdefault%2Ffiles%2FClimate\\_change\\_and\\_Ocean\\_acidification\\_-\\_Synergies\\_and\\_opportunities\\_under\\_the\\_UNFCCC\\_Dec\\_2\\_0\\_0.pdf&usg=AOvVaw2jcTmw-8ZAByOfNVfBKE71](http://www.google.nl/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0ahUKEwiyy7ym5LbXAhWE2KQKHSnXC2MQFgg2MAI&url=http%3A%2F%2Foceana.org%2Fsites%2Fdefault%2Ffiles%2FClimate_change_and_Ocean_acidification_-_Synergies_and_opportunities_under_the_UNFCCC_Dec_2_0_0.pdf&usg=AOvVaw2jcTmw-8ZAByOfNVfBKE71)>

"Pteropod", *Encyclopaedia Britannica*, <<https://www.britannica.com/animal/pteropod>>

Matt McGrath. "Increasing ocean acidity could impact fish spawning", BBC News, 27 July 2016 <<http://www.bbc.com/news/science-environment-36895071>>

"United Nations Conference on Sustainable Development", *Wikipedia*, <[https://en.wikipedia.org/wiki/United\\_Nations\\_Conference\\_on\\_Sustainable\\_Development](https://en.wikipedia.org/wiki/United_Nations_Conference_on_Sustainable_Development)>

"Ocean acidification", *ocean acidification portal*, March 20, 2014 <<http://ocean-acidification.net/2014/03/20/mitigation-and-adaptation-policy-considerations/>>

"Great Barrier Reef", *Wikipedia*, <[https://en.wikipedia.org/wiki/Great\\_Barrier\\_Reef](https://en.wikipedia.org/wiki/Great_Barrier_Reef)>

"IOCCP", *ioc-unesco*, <[http://www.ioc-unesco.org/index.php?option=com\\_content&view=article&id=7:international-ocean-carbon-coordination-project&catid=5&Itemid=112](http://www.ioc-unesco.org/index.php?option=com_content&view=article&id=7:international-ocean-carbon-coordination-project&catid=5&Itemid=112)>

"GOA-ON Recent Activities", *GAO-ON*, <[http://www.goa-on.org/GOA-ON\\_Activities.php](http://www.goa-on.org/GOA-ON_Activities.php)>

"Exploring Ocean change", *BIOACID*, <<https://www.oceanacidification.de/bioacid-biological-impacts-of-ocean-acidification/?lang=en>>

"Press release Tara Oceans", *Tara expedition*, <<http://oceans.taraexpeditions.org/en/m/science/news/tara-oceans-expedition-scientific-results-a-second-year-of-discovery/>>

"Noaa's ocean acidification program", *OAP*, <<http://oceanacidification.noaa.gov/WhoWeAre.aspx>>

"Who we are", *The Global Ocean Observing System*, <[http://www.goosocean.org/index.php?option=com\\_content&view=article&id=119&Itemid=120](http://www.goosocean.org/index.php?option=com_content&view=article&id=119&Itemid=120)>

### Images and Graphs:

"The acid- Alkaline PH scale", *Abundant Health center*, April 10th, 2011 <<http://www.abundanthealthcenter.com/blog/the-acid-alkaline-ph-scale>>

"Are CO2 levels increasing?", *Skeptical Science*, <<https://www.skepticalscience.com/co2-levels-airborne-fraction-increasing.htm>>

"Ranking of 25 Countries Most Vulnerable to Ocean Acidification", *Oceana*, <<http://oceana.org/press-center/press-releases/major-co2-%E2%80%93emitting-nations-vulnerable-ocean-acidification>>

"Most vulnerable to least vulnerable Nations to Ocean Acidification", *Oceana*, <[http://www.google.nl/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwi2nciL1bbXAhWR6KQKHfAGDGkQFgg0MAE&url=http%3A%2F%2Foceana.org%2Fsites%2Fdefault%2Ffiles%2F%2FAcidity\\_Vulnerability\\_Risk\\_report\\_EU\\_embargoed\\_low\\_res\\_0.pdf&usg=AOvVaw0HC7GtIHLvliOrfhE2QJzG](http://www.google.nl/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwi2nciL1bbXAhWR6KQKHfAGDGkQFgg0MAE&url=http%3A%2F%2Foceana.org%2Fsites%2Fdefault%2Ffiles%2F%2FAcidity_Vulnerability_Risk_report_EU_embargoed_low_res_0.pdf&usg=AOvVaw0HC7GtIHLvliOrfhE2QJzG)>

## Appendix or Appendices

- I. UN Resolution containing two paragraphs concerning ocean acidification → <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N09/466/09/PDF/N0946609.pdf?OpenElement>
- II. European Project on ocean acidification → <http://www.epoca-project.eu/>

**Forum:** Environment Sub-Commission 1

**Issue:** Improving the monitoring of cross border environmental impact

**Student Officer:** Meriam Holmström

**Position:** Deputy President

---

## Introduction

History has shown that environmental neglect and mismanagement increase the probability of conflict, thereby posing a risk to human, as well as, national security. Thus it is important that the monitoring of cross border environmental impact is improved. Transnational environmental impact includes issues, such as cross border environmental crime and cross border pollution.

Cross border pollution is one of the main causes of global atmospheric change, making it a major part of cross border environmental impact. It includes issues, such as incorrect mining practices that can cause hazardous waste spills, which may seep across national borders. Cross border pollution may cause major complications between nations if no actions are taken to against it. This is due to emissions being carried away from a heavy emitter and that are then conveyed into the atmosphere of another close-by nation, whose own emissions may be relatively low. The pollution usually travels via air or water, causing the environment of not just one nation, but that of its surrounding nations to become tainted. This inevitably causes tension between nations.

The effects of cross border pollution have increased due to rapid industrial and urban growth. This puts weight on human relations, since the actions countries take concerning the environment, have a direct negative effect on nations nearby, thus increasing the probability of violent conflict. Environmental crime generally refers to any kind of violation of a national or international environmental law that exists to ensure the protection and sustainability of the world's environment. It is important to tackle transnational environmental crime because some of the consequences of environmental crime are permanent. In addition to significant harm done to the environment, environmental crime can impact the economy, due to illegal trade, which is a considerable part of the issue.

Issues related to shared water bodies, such as the building of dams and overfishing may have an exceedingly negative impact on the environment and people. They harm the biodiversity of water bodies, which may negatively affect the livelihoods of the people living and working nearby. Not only does it harm the people, but it can also disrupts the food chain of the species living in or close to the water, causing the declination of not just one population, but many that are apart of the same food chain. In the case of transboundary waters, tension between nations is likely to emerge.

## Definition of Key Terms

### Cross border environmental impact

The effects that one nation's activities can have on another nation's environment. For example when pollution spreads across borders either by natural or unnatural causes.

### Transnational environmental impact

Environmental issues that involve several nations. Essentially means the same as cross border environmental impact.

### Cross border pollution

Pollution that has been generated in one nation harming the environment of another nation by spreading through, for example, air, water and even pollutant smuggling.

### Cross border environmental crime

Criminal activities managed by persons acting across national borders. These activities include acts, such as, poaching, illegal logging, timber smuggling, species smuggling, the illegal movement of toxic and hazardous waste and other prohibited chemicals.

### Biodiversity

Biodiversity is a measure of the variety of organisms present in different ecosystems. This can refer to genetic variation, ecosystem variation, or species variation (number of different species) within a region.

### Poaching

Catching and killing animals without permission, usually on foreign land. For example the black rhinoceros, being a popular target for poachers due to its valuable horn, greatly suffers from poaching.

## Background Information

### Cross border pollution

Cross border pollution has a direct impact on the quality of air and water. As the production of goods increases around the globe, the potential for pollution to spill from one country to another increases, because cross border pollution is usually caused by industrial discharge. Long term cross border pollution may cause food supply reduction, habitat deterioration and climate change.

For instance, marine pollution is a serious problem that involves many nations. Transboundary marine pollution usually results from activities, such as oil drilling and waste disposal. Offshore oil drilling creates various forms of pollution that have substantial negative effects on marine wildlife. Especially oil spills can have various negative effects on the wildlife of the ocean, as well as the oil platform workers. For example, the biodiversity of oceans could decrease significantly because of large oil spills, due to oil being toxic to various organisms.

Air pollution is defined as the presence of often toxic chemicals or compounds in the air at levels that pose a health risk. These substances may, for example, damage the ozone layer or cause global warming. Air pollution knows no boundaries, thus it can travel from one nation to another. A country that is a heavy emitter of harmful chemicals and compounds, such as greenhouse gases, is very likely to harm the atmosphere of countries nearby. However, it is also very likely for air patterns to change very abruptly, making it harder to monitor from where the pollutants have come from. Acid rain can be used as a clear example of one nation's actions on the environment affecting another nation. One way of creating acid rain is by burning fossil fuels. The residuals of the substance combined with water vapor in the atmosphere turns into acid rain. The rain is very damaging to water bodies, forests and even buildings. Many industrialized nations produce harmful substances that, when mixed with water vapor, turn into acid rain. Often the pollution then rains down on developing countries, thus harming the environment. Though acid rain is still a serious problem, there has been a significant reduction in the amount of acid rain during recent years, due to various international agreements.

Cross border environmental pollution has become a common phenomenon in Asia, one of the biggest emitters being China. Many large cities in the People's Republic of China suffer from smog and a lot of pollution has spread to, for example the Republic of Korea and Japan. However, though air and water pollution has become an increasingly difficult problem in Asia, transboundary haze pollution largely from Indonesia, has caused an abundance of discussion between the members of the Association of Southeast Asian Nations (ASEAN). Haze pollution is caused mainly by land and forest fires. It has been a major problem for the members of ASEAN, especially in the 1990s, due to a crisis that was predominantly caused by land clearing for agricultural purposes on the island of Sumatra, Indonesia. Land was cleared via open burning, causing large amounts of haze. Malaysia, Singapore, and especially Thailand and Brunei Darussalam were affected by it. The haze is nearly an annual occurrence for some ASEAN members, which is why the ASEAN Agreement on Transboundary Haze Pollution was created. According to the agreement the ASEAN members should, for instance, collaborate in developing and implementing measures to prevent, monitor and reduce transboundary haze pollution, by for example controlling sources of land and forest fires

### Cross border environmental crime

Cross border environmental crime includes, for example, the illegal trade of wildlife, poaching, illegal logging and timber trade, smuggling of pollutants, including ozone depleting substances, and illegal disposal of toxic waste. This sort of crime attracts a large amount of attention because it negatively affects the conservation and sustainability of the environment, in addition to possibly fueling conflict between nations. A common reason for conflict caused by cross border environmental crime is,

for example, the unsustainable use of shared water bodies by the means of disrupting water flow or discarding waste. Illicit trade that strongly affects the economy, as well as, being a security and an environmental threat is also a major problem caused by cross border environmental crime.

For instance, Illegal logging and timber trade contributes to deforestation, causes ecological problems, such as flooding, and has a considerable effect on climate change, thus cross border illegal trade can damage economies and ecosystems all over the world. Resources could become more sparse in the future due to illegal trade not being monitored. This could widely affect the international community, since, for example, transnational illegal logging contributes to soil erosion, global warming due to the risen amount of greenhouse gases, extinction of species, which will result in the loss of biodiversity, flooding and drought

Further harm done by transnational environmental crime include illegitimate trade in ozone depleting substances and the illicit disposal of toxic waste. Ozone depleting substances cause thinning of the ozone layer, thus increasing the vulnerability of organisms, including humans, to problems such as skin cancer, since the ozone acts as protection against the harmful ultraviolet radiation of the sun. Many plant species are vulnerable to strong UV radiation. Overexposure to UV rays may lead to decrease in growth and photosynthesis. Crop plants vulnerable to ultraviolet radiation are, for example barley, corn and wheat. Ozone depletion is also one of the primary reasons for global warming. The illicit disposal of toxic waste, on the other hand, contaminates the soil and water, thus also making it a source of harm to organisms. It may very likely damage ecosystems and human health. In addition, illegal disposal of hazardous toxic waste undermines the legitimate waste treatment and disposal industries, causing economic loss for these industries.

Poaching, on the other hand, reduces the amount of animal populations in the wild and could even result in the extinction of a species, a result that is very permanent. For example, ploughshare tortoise, black rhino and Asian elephant populations are today threatened with extinction due to poaching and illegal trade. Poaching is often conducted by multinational crime syndicates that operate in cells spread throughout the world. These crime syndicates exploit limits of national laws and borders in order to evade national authorities, thus preventing poaching can be extremely difficult and resource consuming.

### Other cross border environmental issues

Issues related to shared water bodies, such as the building of dams and overfishing may have an exceedingly negative impact on the environment. In the mid 2000s, the governments of Laos, Cambodia, Thailand, and Vietnam revived plans from the 1950s to build dams on Mekong River, which flows through six nations in Asia: China, Myanmar, Laos, Thailand, Cambodia and Vietnam. The river is essential for over 60 million people living near it, since Mekong is the world's largest inland fishery and thus is a vital source of food and income. China has already built dams on Upper Mekong in the 1990s, however the negative effects on the people around the river were unknown at the time. The purpose of new dams would be to generate electricity. These dams would be built on Lower Mekong, posing a serious risk for the biodiversity of the river, as well as the wellbeing of the people around it.

Overfishing, on the other hand, has become an increasingly common phenomenon. The United Nations Food and Agricultural Organization (FAO) describes over 70% of the world's fisheries as either "fully exploited," "over exploited" or "significantly depleted." Overfishing can lead to dramatic decline in the population of fish and perhaps even extinction. Many endangered fish species and marine mammals are often unintentionally captured, due to getting tangled in large fishing nets. All in all, overfishing may have a vastly negative effect on marine biodiversity, since overfishing also disrupts the food chain, causing the declination of not just one population, but many that are a part of the same food chain.

## Major Countries and Organisations Involved

### People's Republic of China

The People's Republic of China is one of the biggest economies in the world, making the nation's industrial discharge one of the highest, at 30% of global carbon dioxide (CO<sub>2</sub>) emissions. Cross border pollution emitted by China is causing serious environmental problems for surrounding states, such as, Japan, the Republic of Korea and other neighboring countries. The industrial actions of the People's Republic of China have caused acid rainfall in surrounding nations, which threatens the health of the citizens of the nations at hand, as well as, seeming to have an effect on the ecosystems. This has even taken a toll on the amount of tourism. The People's Republic of China is currently expanding its economy further, making the possibility of the possibility of higher pollution rates more likely.

### United States of America

Much like the People's Republic of China, the United States of America is one of the largest economies in the world. As such, the country is one of the world's top polluters. According to the United States Environmental Protection Agency (EPA), in 2014 the United States of America accounted for around 15% of the world's carbon dioxide (CO<sub>2</sub>) emissions. This, in addition to the United States of America recently withdrawing from the Paris Agreement, caused the United States to be, and remain to be, one of the largest contributors to climate change.

### Greenpeace

Greenpeace is an independent global campaigning organisation that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace. They strive to tackle large environmental problems, such as use of toxins in manufacturing, unsustainable use of oceans and forest, and unsustainable energy production. Greenpeace also combats climate change in general. While Greenpeace doesn't necessarily devote its efforts strictly toward cross border environmental impact, the issues it tackles are highly related to cross border environmental issues. Energy production, use of oceans, forests and toxins, as well as combating environmental crime, are all areas that are related to cross border environmental impact.

### INTERPOL

INTERPOL leads global and regional operations to dismantle the criminal networks behind environmental crime, using intelligence-driven investigations and development of protection against environmental crime. For example, the organization provides environmental law enforcement agencies

with access to INTERPOL tools and services by enhancing their links with INTERPOL National Central Bureaus. An important part of INTERPOL's mission is working with the Environmental Compliance and Enforcement Committee, which brings together senior officials and decision makers from all INTERPOL member countries, to shape strategy and direction. In general, INTERPOL coordinates and develops international law enforcement practice manuals, guides and other resources for national officials.

### European Union

When seen as a unified economic zone, the European Union is up there, with the People's Republic of China and the United States of America, as one of the largest economies in the world. Thus environmental impact is also notable, with the European Union contributing to around 9% of global carbon dioxide (CO<sub>2</sub>) emissions. This issue is actively being tackled by the EU, as its member nations have adopted several goals of slowing down climate change and preventing cross-border environmental impact, the main principle being to prevent and rectify cross-border problems at their source.

### United Nations Development Programme

The United Nations Development Programme (UNDP) is the largest implementer of climate action in the United Nations -system. UNDP works with countries to develop their climate goals and to implement them into action. In its climate agenda, the organisation is especially focused on the Paris Agreement, helping committed nations put the agreement's words into action and supporting dialogue on global environmental issues.

## Timeline of Events

<b>Date</b>	<b>Description of event</b>
1966	United Nations Development Programme is established
June 5th-16th, 1972	United Nations Conference on the Human Environment, which addressed issues concerning the environment and sustainable development.
September 16th, 1987	The Montreal Protocol on Substances that Deplete the Ozone Layer, which was designed to reduce the production and consumption of ozone depleting substances in order to reduce their abundance in the atmosphere.
1991	Convention on Environmental Impact Assessment in a Transboundary Context, which sets out the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning.
1991	UNDP and the World Bank partner to create the Global Environmental Facility (GEF), a \$2 billion fund that helps developing countries protect the global environment.

March 17th, 1992	The Convention on the Protection and Use of Transboundary Watercourses and International Lakes, which strengthens cross-border water cooperation.
December 11th, 1997	The Kyoto protocol, which saw signatory nations commit to cut the emissions of greenhouse gases by 5.2% by the year 2012
April 22nd, 2016	The Paris Agreement, which had the main aim to prevent further climate change and to keep global temperature rise below 2 degrees celsius above pre-industrial levels.

## Relevant UN Treaties and Events

- **United Nations Conference on the Human Environment (UNCHE), 1972 in Stockholm, Sweden (A/CONF.48/14/Rev.1)**
  - <http://undocs.org/A/CONF.48/14/Rev.1>
  - The conference addressed issues concerning the environment and sustainable development. Environmental protection was linked with sustainable development and concrete ideas were produced on how governments could work together to preserve the environment. The concepts and plans developed by the conference have shaped every international conference and treaty on the environment over the last 35 years.
- **The Convention on the Protection and Use of Transboundary Watercourses and International Lakes, 1992 in Helsinki, Finland**
  - [http://www.unece.org/fileadmin/DAM/env/documents/2013/wat/ECE\\_MP.WAT\\_41.pdf](http://www.unece.org/fileadmin/DAM/env/documents/2013/wat/ECE_MP.WAT_41.pdf)
  - The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (The Water Convention) strengthens cross border water cooperation, in order to ecologically manage and protect transnational surface waters and groundwaters. It requires nations involved to use transboundary waters sustainably. In 2003, the Water Convention was amended to allow access to countries outside the UNECE region and as of 2016, all United Nations Member States have been granted the opportunity to partake in the agreements of the Water Convention.
- **Kyoto Protocol, 1997 in Kyoto, Japan**
  - <http://unfccc.int/resource/docs/convkp/kpeng.pdf>

- Nations that have ratified the Kyoto Protocol have committed to cut the emissions of greenhouse gases, such as methane and nitrous oxide. The goal of the Kyoto Protocol was to collectively reduce greenhouse gas emissions by 5.2% by 2012.
- **Paris Agreement, 2016 in Paris, France**
  - [http://unfccc.int/files/essential\\_background/convention/application/pdf/english\\_paris\\_agreement.pdf](http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf)
  - The main aim of the Paris Agreement is to prevent further climate change. Global temperature rise should be kept below 2 degrees Celsius above pre-industrial levels. However, according to the agreement nations should strive to limit temperature increase to as little as 1.5 degrees Celsius. The Paris Agreement also pursues to strengthen the ability of countries to deal with the impacts of climate change.

## Previous Attempts to solve the Issue

### Cross border pollution

Canada and the United States launched three extensive projects that were designed to decrease the amount of cross border air pollution, by coordinating the management of air quality between the nations. The objective was to reduce smog conditions. The announcement for the projects was made on June 23, 2003 and the projects were included in the *Border Air Quality Strategy*. The Strategy has been added to the *1991 Canada-United States Air Quality Agreement* that built a framework for collaboration on the issues of science and emission reduction in both nations.

The People's Republic of China has taken actions in order to reduce air pollution. These actions include, for example, closing outdated factories, relocating heavily polluting facilities, promoting the use of renewable energy, and regulating the number of cars on the road in megacities. Regulating the number of cars reduced the number of vehicles on the road by about 40%.

### Cross border environmental crime

The United Nations Office on Drugs and Crime (UNODC) has fought transnational environmental crime by the means of coordinated support to national wildlife law enforcement agencies. In 2012 UNODC together with the members of the International Consortium on Combating Wildlife Crime (ICWC) developed the Wildlife and Forest Crime Analytic Toolkit. Its purpose is to assist governments in identifying strengths and weaknesses of their criminal justice responses to wildlife and forest crime. The UNODC also conducts extensive research, in order to guide nations to combat the trafficking of wildlife and illegal logging, thus encouraging nations to protect their environment. This involves working with authorities to improve laws and expand international cooperation.

## Possible Solutions

### Cross border pollution

Due to the problem originating from another country, improving the monitoring of cross border pollution becomes a matter of diplomacy and international relations, thus it should be solved by the means of strengthening the cooperation between nations, especially between those sharing borders. To minimize cross border environmental impact, the corresponding states should engage in dialogue, in order to reach an agreement to reduce cross border environmental impact that is hazardous for the environment and the health of all living organisms

As cross border pollution is a major issue, monitoring systems should be set up to ensure that the amount of emissions are reduced, and that pollution doesn't have an effect on its source's bordering nations. Restricting pollution problems to the country of origin is important, because it allows national officials to take more efficient measures against pollution. If pollutants, or any environmental problem for that matter, spread across borders, the issue would suddenly become more complex and multiple national, as well as, international parties would be needed to solve it. Thus the sharing of data between parties is paramount in order to achieve a complete picture of the problem and then restrict and combat it in unison.

The number of factories could also be restricted or a more sustainable way of energy production should be adopted. For instance, adding filtration and pressuring private firms into taking more responsibility in storing, processing and disposing waste safely would be ways to decrease the amount of cross border pollution and improve monitoring.

### Cross border environmental crime

International effort and cooperation is needed to curb transboundary environmental crime. This can be achieved through organisations, such as INTERPOL, which has multiple programmes and committees that focus on preventing international environmental crime, such as poaching and illegal dumping of waste. All in all, INTERPOL is a great platform for the international community to develop means of monitoring and preventing cross border environmental crime. It has the means of complementing national laws and authorities to better enable them to combat environmental criminals who act transnationally.

Aside from the role of international organisations, the role of the public is also vital. By reducing the demand for protected species, the amount of poaching can be reduced. This can be done by raising awareness of such issues through, for example, Non-Governmental Organisations. As poverty is one factor that is driving people towards cross border environmental crime, the amount of it can be decreased by providing alternative and sustainable livelihoods.

Large companies can prevent transboundary environmental crime as well by checking certificates to ensure that products are legal. This is especially important for companies dealing with timber, since illegal timber trade causes an immense amount of damage to the environment. By refusing to buy timber of illegal origin, traffickers will receive less revenue, making illegal logging and timber trade less common.

## Bibliography

- Actman, Jani. "Poaching May Drive These 7 Species to Extinction." *National Geographic*, National Geographic Society, 20 May 2016, [news.nationalgeographic.com/2016/05/160520-poachers-endangered-species-extinction/](https://news.nationalgeographic.com/2016/05/160520-poachers-endangered-species-extinction/);
- Kireeva, Anna. "Russia and Norway Make Progress on Cross-Border Environmental Problems." Translated by Charles Digges, *Bellona.org*, The Bellona Foundation, 9 Oct. 2017, [www.bellona.org/news/industrial-pollution/2017-10-russia-and-norway-make-progress-on-cross-border-environmental-problems/](http://www.bellona.org/news/industrial-pollution/2017-10-russia-and-norway-make-progress-on-cross-border-environmental-problems/);
- Lee, Yok-shiu F. "Tackling Cross-Border Environmental Problems in Hong Kong: Initial Responses and Institutional Constraints." *Cambridge Core*, Cambridge University Press, 1 Dec. 2002, [www.cambridge.org/core/journals/china-quarterly/article/tackling-crossborder-environmental-problems-in-hong-kong-initial-responses-and-institutional-constraints/7623E90A7C0B8ED1B5DEC938A057316D](http://www.cambridge.org/core/journals/china-quarterly/article/tackling-crossborder-environmental-problems-in-hong-kong-initial-responses-and-institutional-constraints/7623E90A7C0B8ED1B5DEC938A057316D);
- Sayed, Md. Abu. "A Growing International Problem." *The Daily Star*, The Daily Star, 18 Feb. 2011, [www.thedailystar.net/news-detail-174570](http://www.thedailystar.net/news-detail-174570);
- Reinhold, Robert. "CROSS-BORDER POLLUTION VEXES U.S. AND MEXICO." *The New York Times*, The New York Times, 13 Sept. 1983, [www.nytimes.com/1983/09/14/us/cross-border-pollution-vexes-us-and-mexico.html?pagewanted=all](http://www.nytimes.com/1983/09/14/us/cross-border-pollution-vexes-us-and-mexico.html?pagewanted=all);
- West, Larry. "Cross-Border Pollution: A Growing International Problem." *ThoughtCo*, ThoughtCo, 24 July 2017, [www.thoughtco.com/cross-border-pollution-1204093](http://www.thoughtco.com/cross-border-pollution-1204093);
- Waddilove, Hannah. "Cross-Border Resource Management: How Do the Nile Countries Fare?" *International Rivers*, International Rivers, 20 Nov. 2012, [www.internationalrivers.org/resources/cross-border-resource-management-how-do-the-nile-countries-fare-7736](http://www.internationalrivers.org/resources/cross-border-resource-management-how-do-the-nile-countries-fare-7736);
- Brabeck-Letmathe, Peter. "Conflict over Water in Cross-Border River Basins." *Future 500*, Nestlé, 21 Aug. 2013, [www.future500.org/conflict-over-water-in-cross-border-river-basins/](http://www.future500.org/conflict-over-water-in-cross-border-river-basins/);
- "International Environmental Issues (Article)." *Khan Academy*, Khan Academy, [www.khanacademy.org/economics-finance-domain/microeconomics/consumer-producer-surplus/environmental-regulation/a/international-environmental-issues-cnx](http://www.khanacademy.org/economics-finance-domain/microeconomics/consumer-producer-surplus/environmental-regulation/a/international-environmental-issues-cnx),
- Pereira, Joana Castro. "Environmental Issues and International Relations, a New Global (Dis)Order - the Role of International Relations in Promoting a Concerted International System." *Revista Brasileira De Política Internacional*, Instituto Brasileiro De Relações Internacionais, June 2015, [www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0034-73292015000100191](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0034-73292015000100191);
- Governing Council of the United Nations Environment programme. "Environment and Security: a Global Agenda for UNEP." United Nations, 21 - 25 February 2005, <http://www.un.org/en/events/environmentconflictday/pdf/GC23-INF21.pdf>;
- Hyder, Joseph P. "United Nations Conference on the Human Environment (1972)." *Environmental*

- Science: In Context*, Encyclopedia.com, 2009, [www.encyclopedia.com/environment/energy-government-and-defense-magazines/united-nations-conference-human-environment-1972](http://www.encyclopedia.com/environment/energy-government-and-defense-magazines/united-nations-conference-human-environment-1972);
- United Nations Framework Convention on Climate Change. “Kyoto Protocol.” *Kyoto Protocol*, United Nations, 30 May 2013, [http://unfccc.int/kyoto\\_protocol/items/2830.php](http://unfccc.int/kyoto_protocol/items/2830.php);
- United Nations Framework Convention on Climate Change. “The Paris Agreement.” *The Paris Agreement - Main Page*, United Nations, 12 Oct. 2017, [http://unfccc.int/paris\\_agreement/items/9485.php](http://unfccc.int/paris_agreement/items/9485.php);
- Fridgen, Cynthia. “Transboundary Pollution.” *Environmental Encyclopedia*, Encyclopedia.com, 2003, [www.encyclopedia.com/environment/encyclopedias-almanacs-transcripts-and-maps/transboundary-pollution](http://www.encyclopedia.com/environment/encyclopedias-almanacs-transcripts-and-maps/transboundary-pollution);
- United Nations. *THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEplete THE OZONE LAYER | OZONE SECRETARIAT*, United Nations Environment Programme, [ozone.unep.org/en/treaties-and-decisions/montreal-protocol-substances-deplete-ozone-layer](http://ozone.unep.org/en/treaties-and-decisions/montreal-protocol-substances-deplete-ozone-layer);
- United Nations Economic Commission for Europe. *Conventions and Protocols*, United Nations Economic Commission for Europe, 14 Dec. 2017, [www.unece.org/env/treaties/welcome.html](http://www.unece.org/env/treaties/welcome.html);
- United Nations Economic Commission for Europe. “A Common Framework for Transboundary Cooperation on Air Pollution.” *The Convention and Its Achievements - Air Pollution - Environmental Policy - UNECE*, United Nations Economic Commission for Europe, [www.unece.org/environmental-policy/conventions/envlrtapwelcome/the-air-convention-and-its-protocols/the-convention-and-its-achievements.html](http://www.unece.org/environmental-policy/conventions/envlrtapwelcome/the-air-convention-and-its-protocols/the-convention-and-its-achievements.html);
- United Nations Economic Commission for Europe. “Introduction to Espoo Convention.” *Introduction*, United Nations Economic Commission for Europe, [www.unece.org/env/eia/eia.html](http://www.unece.org/env/eia/eia.html);
- United Nations Economic Commission for Europe. “About the UNECE Water Convention.” *Introduction*, United Nations Economic Commission for Europe, [www.unece.org/env/water/text/text.html](http://www.unece.org/env/water/text/text.html);
- United Nations Economic Commission for Europe. “About the Convention.” *Introduction*, United Nations Economic Commission for Europe, [www.unece.org/env/teia/about.html](http://www.unece.org/env/teia/about.html);
- Oceana USA. “Impacts of Offshore Drilling.” *Oceana USA*, Oceana, 3 Dec. 2014, [usa.oceana.org/impacts-offshore-drilling](http://usa.oceana.org/impacts-offshore-drilling);
- DiGiovanni, Franco. Fellin, Philip. “TRANSBOUNDARY AIR POLLUTION.” *UNESCO - Encyclopedia Of Life Support Systems*, Encyclopedia Of Life Support Systems, <https://www.eolss.net/Sample-Chapters/C09/E6-38A-03-04.pdf>;
- INTERPOL. “Environmental Crime.” *Environmental Crime*, INTERPOL, [www.interpol.int/Crime-areas/Environmental-crime/Environmental-crime](http://www.interpol.int/Crime-areas/Environmental-crime/Environmental-crime);
- INTERPOL. “Committee and Working Groups.” *Committee and Working Groups*, INTERPOL, [www.interpol.int/Crime-areas/Environmental-crime/Committee-and-Working-Groups](http://www.interpol.int/Crime-areas/Environmental-crime/Committee-and-Working-Groups);
- “Hazing Rituals.” *The Economist*, The Economist Newspaper, 10 Sept. 2015, [www.economist.com/news/asia/21664231-after-all-meetings-and-promises-smog-south-east-asia-still-proves-ineradicable-hazing](http://www.economist.com/news/asia/21664231-after-all-meetings-and-promises-smog-south-east-asia-still-proves-ineradicable-hazing);
- Kahn, Matthew E. “Cross-Border Pollution in Asia: Can Coase Tame a Brown Cloud?” *Environmental*

and Urban Economics, Matthew E. Kahn, 16 Aug. 2005, <https://greeneconomics.blogspot.fi/2005/08/cross-border-pollution-in-asia-can.html>;

Asuka, Jusen. "Sino-Japan Collaboration [on] Air Pollution in China." *JFS Japan for Sustainability (not original source)*, Iwanami Shoten Publishers, July 2013, [www.japanfs.org/en/news/archives/news\\_id034262.html](http://www.japanfs.org/en/news/archives/news_id034262.html);

Association of Southeast Asian Nations. "ASEAN Agreement on Transboundary Haze Pollution." *ASEAN Haze Action Online*, Association of Southeast Asian Nations, 23 June 2016, [haze.asean.org/asean-agreement-on-transboundary-haze-pollution/](http://haze.asean.org/asean-agreement-on-transboundary-haze-pollution/);

United States Environmental Protection Agency. "Global Greenhouse Gas Emissions Data." *EPA*, Environmental Protection Agency, 13 Apr. 2017, [www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data](http://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data);

United Nations Development Programme. "ON ITS 50TH ANNIVERSARY, UNDP IS LOOKING TOWARDS THE FUTURE." *UNDP 50th Anniversary*, United Nations Development Programme, 2016, [50.undp.org/en/](http://50.undp.org/en/)

European Environment Agency. "An Overview of EU Environment Policy Targets and Objectives." *European Environment Agency*, European Environment Agency, 24 July 2013, [www.eea.europa.eu/highlights/an-overview-of-eu-environment](http://www.eea.europa.eu/highlights/an-overview-of-eu-environment);

European Union. "Environment and Climate Change." *EUR-Lex*, European Union, [eur-lex.europa.eu/summary/chapter/environment.html?root\\_default=SUM\\_1\\_CODED%3D20](http://eur-lex.europa.eu/summary/chapter/environment.html?root_default=SUM_1_CODED%3D20)

Lerch, Marika. "Human Rights." *EU Fact Sheets | European Parliament*, European Parliament, Sept. 2017, [www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuid=FTU\\_5.4.1.html](http://www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuid=FTU_5.4.1.html);

United Nations Office on Drugs and Crime. "Let's Put Organized Crime out of Business. What's Being Done and How You Can Help." *unodc.org*, United Nations Office on Drugs and Crime, [www.unodc.org/toc/en/whatsbeingdone.html](http://www.unodc.org/toc/en/whatsbeingdone.html);

Jetson, Krysten. "Impact of Overfishing On Human Lives." *Marine Science Today*, Marine Science Today LLC, 8 Apr. 2014, [marinesciencetoday.com/2014/04/09/impact-of-overfishing-on-human-lives/](http://marinesciencetoday.com/2014/04/09/impact-of-overfishing-on-human-lives/)