NHSMUN

Background Guide | *UNEA*

NHSMUN
National High School Model United Nations

Welcome to NHSMUN 2026 and to the United Nations Environmental Assembly!

My name is María Jesús Di Giosafat Bermúdez, but everyone calls me Chus, so please feel free to call me by my nickname. This is my third year at NHSMUN. First, I was a delegate for China in SPECPOL, and then I served as an assistant director for SOCHUM. These experiences were enriching and helped me determine my career path, and I couldn't be happier to return for NHSMUN 2026.

This will also be my fifth year in Model UN. I have attended multiple conferences in Venezuela's National Model UN and even served as the logistics director for my school's conference. My journey in MUN has been significant for my personal development and has allowed me to make many friends who were once my co-delegates. What I've liked most about the committee were the creative solutions, inventive speeches, and energetic delegates who are always willing to help.

I was born in Caracas, Venezuela, and I currently live here while studying law at the Universidad Católica Andrés Bello. I am entering my second year of law school. I truly enjoy my career and the friendships it has brought me. Despite the political circumstances in Venezuela, I love living here; however, I would cherish seeing my country flourish. In my free time, I like to spend time with my family and friends, listen to music, and I am a big fan of spinning classes. For me, the best movie in the world is The Notebook—I could watch it a million times!

As your director, I look forward to ensuring you have a great time. This is a memorable experience, and I hope you all have an engaging debate. Please don't hesitate to ask for any help you may need; I would be glad to assist!

See you in March!

Best,
María Jesús Di Giosafat Bermúdez
UNEA Director, Session I
nhsmun.unea@imuna.org

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Dear delegates,

My name is Julia Stephen, and I am very excited to be directing UNEA in Session I.

I started my NHSMUN journey as a delegate at UNICEF back in 2021, the year that the conference had to be held virtually. I loved the experience, so I came back to debate in person at UNESCO for my last high-school level conference. Throughout my time as a delegate, I fell in love with the NHSMUN way to run conferences, which is why I keep coming back as a staffer. I was Assistant Director for Legal in 2024 and Director for CSTD in 2025. Now, I am returning to direct UNEA alongside Maria Jesus, who will be chairing in Session II.

I was born and raised in Lima, Peru, and I now live and study in Glasgow, Scotland. I am a second-year student at the University of Glasgow, where I am majoring in Molecular and Cellular Biology with Biotechnology. I hope to one day get a PhD and carry out research in my field. Outside of academics, I love performing arts. I have trained as a stage, screen, and voice actor and even had the chance to produce a play before moving abroad. In my free time, I love going to the theater, making thread and bead bracelets, and crocheting plushies. I also do a lot of volunteer work in my community. I am currently a volunteer basketball coach for primary and secondary school kids in Glasgow, and it is always the highlight of my week.

During debate, I would like to encourage you to be the type of leader that uplifts others and ensures their voices are heard. This conference is the place to step out of your comfort zone and grow to become better speakers and negotiators. UNEA is one of the larger committees at NHSMUN, which can be daunting at first if you have not debated in larger committees. The best advice I can give you is to just go for it, though. As someone who has been in your shoes, if you have any questions, please let Maria Jesus and me know. We will be happy to answer them. Best of luck with your preparation, and see you in March!

Yours in diplomacy,
Julia Stephen
UNEA Director, Session II
nhsmun.unea@imuna.org

A NOTE ON RESEARCH AND PREPARATION

Delegate research and preparation is a critical element of attending NHSMUN and enjoying the debate experience. We have provided this Background Guide to introduce the topics that will be discussed in your committee. We encourage and expect each of you to critically explore the selected topics and be able to identify and analyze their intricacies upon arrival to the conference.

The task of preparing for the conference can be challenging, but to assist delegates, we have updated our Beginner Delegate Guide, Advanced Delegate Guide, Research Guide, and Rules of Procedure Guide. In particular, these guides contain more detailed instructions on how to prepare a position paper and excellent sources that delegates can use for research. Use these resources to your advantage. They can help transform a sometimes overwhelming task into what it should be: an engaging, interesting, and rewarding experience.

To accurately represent a country, delegates must be able to articulate its policies. Accordingly, NHSMUN requires each delegation (the one or two delegates representing a country in a committee) to write a position paper for each topic on the committee's agenda. In delegations with two students, we strongly encourage each student to research each topic to ensure that they are both prepared to debate throughout the committee. More information about how to write and format position papers can be found in the Research Guide. To summarize, position papers should be structured into three sections.

I: Topic Background – This section should describe the history of the topic as it would be described by the delegate's country. Delegates do not need to give an exhaustive account of the topic. It is best to focus on the details that are most important to the delegation's policy and proposed solutions.

II: Country Policy – This section should discuss the delegation's policy regarding the topic. Each paper should state the policy in plain terms and include the relevant statements, statistics, and research that support the effectiveness of the policy. Comparisons with other global issues are also appropriate.

III. Proposed Solutions – This section should detail the delegation's proposed solutions to address the topic. Descriptions of each solution should be thorough. Each idea should clearly connect to the specific problem it aims to solve and identify potential obstacles to implementation and how they can be avoided. The solution should be a natural extension of the country's policy.

Each topic's position paper should be **no more than 10 pages** long double-spaced with standard margins and 12 point font size. This is a maximum; **3–5 pages per topic is often a suitable length**. The paper must be written from the perspective of your assigned country and should articulate the policies you will espouse at the conference.

Each delegation is responsible for submitting position papers on or before **February 20, 2026**. If a delegate wishes to receive detailed feedback from the committee's dais, a position must be submitted on or before **January 30, 2026**. The papers received by this earlier deadline will be reviewed by the dais of each committee and returned prior to your arrival at the conference. Instructions on how to submit position papers will be shared directly with faculty advisors.

Complete instructions for how to submit position papers will be sent to faculty advisers via email. If delegations are unable to submit their position papers on time, please contact us at nhsmun@imuna.org.

Delegations that do not submit position papers will be ineligible for awards.

Committee History

The United Nations Environment Assembly (UNEA) was created in the 2012 UN Conference of Sustainable Development, in Rio de Janeiro, Brazil. It is the top decision-making body for the environment in the world. Its work is central to the 2030 Sustainable Development Agenda.[1] Since its creation, environmental issues have gained more importance. They are now seen as global concerns, at the same level as peace, security, and health.[2] UNEA is the main body of the United Nations Environment Programme (UNEP). It makes sure that all groups take part in decisions and that science connects with policy. It also works to promote environmental laws worldwide.[3]

UNEA has a universal membership. This means that all 193 UN member states can participate and vote. Its sessions take place every two years at UNEP headquarters in Nairobi, Kenya.[4] Major groups and stakeholders work at national and regional levels. This makes them ready to support UNEP's work.[5] At the sub-regional level, UNEP builds strong partnerships. The goal is to improve environmental management in a clear and effective way. UNEP works with governments, research groups, international organizations, and UN agencies. Together, they identify common and global problems and look for solutions.[6] UNEA's biggest achievements are in environmental governance. Environmental governance is how people and institutions manage the environment. It sets rules for decisions, uses science for guidance, and allows public participation. UNEA creates important resolutions and treaties. Examples are the Nairobi Declaration of 2017 and the Cartagena Protocol on Biosafety.[7]

Further, the Assembly has supported many other resolutions. These include issues such as illicit wildlife trade, waste, chemical management, and the use of natural solutions for sustainable development.[8] A main concern for UNEA is the triple planetary crisis. This includes climate change, pollution, and biodiversity loss. Climate change is caused mostly by human activity. Energy use, transport, agriculture, and industry all play a role. Its effects are clear in rising sea levels, extreme weather events, droughts, and biodiversity loss. Pollution is another thread. It is the largest cause of diseases and early death in the world. Every year, more than seven million lives are lost because of it.

Biodiversity loss adds to these problems. It weakens the natural systems that keep life on Earth. To secure a safe future, humanity must face all three challenges. UNEA has also faced many limits and problems. Its decision-making can be slow because it seeks agreement among the 193 member nations. The resolutions of UNEA are not legally binding. This means that they cannot be enforced by law. Each country decides if it has the ability and the will to follow them.[9] Economic resource limits and the complex nature of global issues also make the work hard. The triple crisis of pollution, biodiversity loss, and climate change adds even more pressure. Still, these challenges show the need for new ideas and stronger cooperation to make progress.[10]

1 "What is the UN Environment Assembly and why does it matter?" UN News, February 25, 2024, news.un.org/en/story/2024/02/1146932#:~:text=Set%20up%20as%20a%20sort,international%20legislation%20on%20the%20matter.
2 "About the United Nations Environment Assembly," UN Environment Programme, 2024, www.unep.org/environmentassembly/ about-united-nations-environment-assembly
3 "UN Environment Assembly 5 Resolutions," UN Environment Programme, March 2, 2022, www.unep.org/resources/resolutions-treaties-and-decisions/UN-Environment-Assembly-5-2
4 Rules of Procedure of the United Nations Environment Assembly of the United Nations Environment Programme, United Nations General Assembly, K1610826, 5. May, 2016. wedocs.unep.org/bitstream/handle/20.500.11822/14367/K1610826%20%281%29.pdf?sequence=1&isAllowed=y
5 "Regional Initiatives", UN Environment Programme, 2024, www.unep.org/regions/asia-and-pacific/regional-initiatives
6 Engaging in the Regions", UN Environment Programme, 2024, www.unep.org/civil-society-engagement/participation-and-engagement/engaging-regions
7 "Multilateral actions to safeguard the environment: A timeline", UN Environment Programme, 2024, www.unep.org/multilateral-actions-safeguard-environment-timeline
8 "What you need to know about the UN Environment Assembly", UN Environment Programme, February 18, 2022. www. unep.org/news-and-stories/story/what-you-need-know-about-un-environment-assembly
9 "What you need to know about the UN Environment Assembly", UN Environment Programme, February 18, 2022.
10 UN News, "What is the UN Environment Assembly and why does it matter?"

Environmental Impact of Artificial Intelligence

Photo Credit: Victor Grigas

Artificial intelligence (AI) is the technological revolution's newest development. It is revolutionizing various fields, including economics, healthcare, and climate science. As these technologies continue to grow, environmental impacts worsen. These include water consumption, e-waste production, gas emissions, and excessive energy consumption. For example, OpenAI's chatbot, ChatGPT, consumes about 500 ml per 10-50 prompts.[1] Data companies like Amazon, Microsoft, and Google have seen their water usage rise, sparking concerns about sustainability.[2] Water is essential for the environment and covers 70 percent of the Earth.[3]

AI also contributes to electronic waste (e-waste), which has been growing alarmingly fast. E-waste describes when tech equipment is thrown away. To develop and run AI, a lot of hardware is needed. Generative AI could generate five million metric tons of e-waste by 2030. This raises concerns about environmental impact. These disposals often contain hazardous components. If these hazardous components, like lead or mercury, are not disposed of correctly, they can harm human health and the environment. E-waste is growing, in part, due to quick advancements in technology. Computing devices have a life of 2 to 5 years, and then they need to be replaced.[4]

According to the International Energy Agency (IEA), a single ChatGPT request requires around 10 times more electricity than a Google search. Data centers, where AI is trained and developed, consume immense amounts of energy. The energy they consume mainly comes from fossil fuels, which are a non-renewable method to produce energy that contributes to greenhouse gas emissions. Data centers' energy consumption is growing extremely fast.

AI requires 24/7 energy. According to the IEA, global data centers consumed about 460 TWh of electricity in 2022 (just under 2 percent of world demand). Their consumption could exceed 1,000 TWh by 2026, roughly the amount of electricity Japan uses today. By 2030, IEA projects data centers will consume about 945 TWh annually (close to 3 percent of global demand).[5] Rapid AI growth presents an urgent challenge to tackle the environmental footprint. A consistent method is essential for developing efficient and targeted solutions. With this upgrade, policymakers and grid operators will be able to appropriately tackle the issue. Because a lack of precise data makes it difficult to plan effective solutions, global tech leaders and governments should work collaboratively to establish standardized measurements.

Topic Background

Evolution of Artificial Intelligence

Artificial intelligence (AI) is a computer system designed to achieve tasks typically performed by humans.[6] There is no single, exact definition for AI, as these systems can accomplish a wide range of tasks. AI is constantly adapting and expanding. It is considered to possess human-like qualities, such as the ability to recognize or create images, produce language with human insight, solve problems, and

1 Banerjee, Shamik. 2024. "ChatGPT Chugging Water? It 'Drinks' 500 ml Every Conversation — Here's How!" Times Now. October 4, 2024. www.timesnownews.com/world/chatgpt-chugging-water-it-drinks-500ml-every-conversation-heres-how-article-113952442.
2 Jennings, Charlotte. 2025. "The Cloud Is Drying Our Rivers: Water Usage of AI Data Centers | EthicalGEO." EthicalGEO. July 23, 2025. ethicalgeo.org/the-cloud-is-drying-our-rivers-water-usage-of-ai-data-centers/.
3 United Nations. 2025. "Artificial Intelligence: How Much Energy Does AI Use?" United Nations Western Europe. April 7, 2025. unric.org/en/artificial-intelligence-how-much-energy-does-ai-use/.
4 Crownhart, Casey. 2024. "AI Will Add to the E-Waste Problem. Here's What We Can Do About It." MIT Technology Review. October 28, 2024. www.technologyreview.com/2024/10/28/1106316/ai-e-waste/.
5 Jeans, Sam. 2025. "Power-Hungry AI Will Devour Japan-Sized Energy Supply by 2030 | DailyAI." DailyAI. April 10, 2025. dailyai.com/2025/04/power-hungry-ai-will-devour-japan-sized-energy-supply-by-2030/.
6 "What Is Artificial Intelligence? - NASA," NASA, www.nasa.gov/what-is-artificial-intelligence/.

Internal Data Center view(Credit: Daoducquan)

learn from data.[7] This suggests that AI is always growing.

AI development has involved several projects throughout history. The first-ever chatbot, named ELIZA, was created in 1966 by a MIT professor named Joseph Weizenbaum. This program could respond to a message on an electric typewriter.[8] ELIZA was designed to imitate a therapist, capable of responding to an unlimited number of questions. It operated by analyzing keywords or phrases from the input provided and producing a response using those keywords from pre-programmed replies.[9] This is a very early precursor to what we know today. Another significant contribution to AI development was the Lighthill Report in 1973.[10] This report implied advancements were not meeting the ambitious goals set for AI. This then motivated AI researchers, leading to multiple projects and breakthroughs.[11]

This era coincides with the beginnings of climate monitoring around the world. The United Nations Environment Programme (UNEP) was founded in 1972 to foster collaboration in efforts to monitor climate change.[12] Specific targets included climate change, nature loss, and pollution/waste. Notably, waste and pollution as a result of human development were, and continue to be, a concern. UNEP is the highest-level environmental decision-making body, giving all countries a voice and role in climate accountability.

Over the last 20 years, there have been major milestones with AI. For example, Siri, a voice-based virtual assistant, launched in 2011.[13] Another accomplishment is Google DeepMind's AlphaGo, a system that was coached to master the Chinese game of Go in 2015.[14] OpenAI has created various versions and updates of their ChatGPT chatbot since 2018 but publicly released ChatGPT in November 2022. ChatGPT is a common source of virtual assistance to generate human-like text and real-world problem-solving.[15]

The rapid development of AI has had an impact on the environment, notably through global greenhouse

7 "Artificial Intelligence," June 18, 2025, dictionary.cambridge.org/dictionary/english/artificial-intelligence#google_vignette.
8 "Weizenbaum's Nightmares: How the Inventor of the First Chatbot Turned against AI." *The Guardian*, July 25, 2023, sec. Technology. www.theguardian.com/technology/2023/jul/25/joseph-weizenbaum-inventor-eliza-chatbot-turned-against-artificial-intelligence-ai.
9 "Story of ELIZA, the First Chatbot Developed in 1966." Analytics India Magazine. October 5, 2016. analyticsindiamag.com/ai-features/story-eliza-first-chatbot-developed-1966/.
10 "The First AI Winter and What the Lighthill Report Said about AI Progress - Brightwork Research & Analysis." Brightwork Research & Analysis. March 10, 2020. www.brightworkresearch.com/first-ai-winter-and-what-the-lighthill-report-said-about-progress/.
11 "The Story of Backpropagation: How an Old Idea Transformed AI." Medium. December 11, 2024. medium.com/@pole.indraneel/the-story-of-backpropagation-how-an-old-idea-transformed-ai-48ba235c60bc.
12 United Nations Environment Programme (UNEP), *"Frequently Asked Questions,"* accessed July 20, 2025, https://www.unep.org/who-we-are/frequently-asked-questions.
13 "Here's How Siri Made It onto Your IPhone." CNBC. June 29, 2017. www.cnbc.com/2017/06/29/how-siri-got-on-the-iphone.html?mockid=2a9a6a22f19363a83d286589f0ff6278.
14 "AlphaGo." 2015. Google DeepMind. 2015. deepmind.google/research/projects/alphago/.
15 "ChatGPT Timeline: The Evolution of AI-Powered Conversations." Adogy. October 28, 2024. www.adogy.com/chatgpt-timeline-the-evolution-of-ai-powered-conversations/.

gas emissions.[16] Recently, Microsoft revealed that its own emissions have increased 29.1 percent since 2020, as it has recently invested in infrastructure for new technologies.[17] AI models can consume thousands of megawatt-hours of electricity and emit hundreds of tons of carbon into the environment. This will only worsen, since AI has continued to expand its reach throughout society and become more accessible.[18] Global data center capacity is expected to more than double by 2030.[19] On average, the usage of data centers will grow by 19 percent, an increase from 171 to 219 gigawatts (GW).[20] In comparison, a common nuclear reactor produces one gigawatt per plant.[21] On the upper end, some estimates say data center capacity by 2030 will reach 27 percent of its current capacity, demanding 298 GW.[22]

AI models must be trained and developed to complete tasks. This training occurs in data centers. This is a physical location of computing machines and hardware where AI models are hosted. Commonly, they develop and maintain applications and services.[23] Data centers consume a lot of energy. Extensions of AI, such as machine learning and deep learning, can independently digest data. This means they are meant to learn from data instead of being explicitly programmed. These algorithms must have the capacity to process data quickly, which consumes more energy than traditional data centers. Additionally, real-time data processing refers to applications that use current data, like autonomous vehicles, financial trading algorithms, and healthcare diagnostics.[24] Such systems have to work fast and give quick and efficient solutions, further increasing the pressure on data centers.

Amazon Web Services, Google Cloud, Microsoft Azure, and Baidu are particular companies with a high-consumption AI system.[25] This technology has immense repercussions in the environment. For example, before Chat GPT-3 was even publicly released, it generated over 552 tons of CO_2 and 1,287 megawatt hours of electricity.[26] This amount is equivalent to the CO_2 produced by 123 gasoline vehicles over a whole year.

E-Waste Crisis

Electronic waste, also known as e-waste, refers to electric and electronic equipment that is thrown away after it has fulfilled its life of use.[27] According to the World Health Organization, e-waste is growing alarmingly fast.[28] During 2022, 62 million tons of e-waste were produced globally. Only 22.3 percent was recycled and collected, meaning just 13 million tons of recycled e-waste.[29] E-waste also contains toxic chemicals, including metals like cadmium, mercury, and nickel. Manufactured materials also often contain substances called flame retardants. Flame retardants are typically persistent organic pollutants and hazardous chemicals

16 Jolindsay Walton, "Estimating AI's Carbon Cost" Medium.Com, 2025 medium.com/@jolindsaywalton/estimating-ais-carbon-cost-09327650bd77#:~:text=Future%20of%20AI-,Jo%20Lindsay%20Walton.
17 "AI's Impact on the Environment, Explained." Snopes. Snopes.com. January 15, 2025. www.snopes.com/news/2025/01/16/ai-environment-carbon-footprint/.
18 "The Uneven Distribution of AI's Environmental Impacts." Harvard Business Review. Harvard Business Publishing. July 15, 2024. hbr.org/2024/07/the-uneven-distribution-of-ais-environmental-impacts.
19 "The Uneven Distribution of AI's Environmental Impacts." Harvard Business Review.
20 "Is Generative AI Bad for the Environment?" Euronews.
21 "INFOGRAPHIC: How Much Power Does a Nuclear Reactor Produce?" Energy.gov. Office of Nuclear Energy. February 6, 2018. www.energy.gov/ne/articles/infographic-how-much-power-does-nuclear-reactor-produce.
22 "AI Power: Expanding Data Center Capacity to Meet Growing Demand." McKinsey & Company. October 29, 2024. www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/ai-power-expanding-data-center-capacity-to-meet-growing-demand.
23 "Data Centers." Ibm.com. September 4, 2024. www.ibm.com/think/topics/data-centers.
24 "LOGIX Fiber Networks." LOGIX. September 17, 2024. logix.com/blog/ai-impact-data-centers-bandwidth-fiber-networks/.
25 "AI Power: Expanding Data Center Capacity to Meet Growing Demand." McKinsey & Company. October 29, 2024. www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/ai-power-expanding-data-center-capacity-to-meet-growing-demand.
26 "Is Generative AI Bad for the Environment?" 2023. Euronews. May 24, 2023. www.euronews.com/next/2023/05/24/chatgpt-what-is-the-carbon-footprint-of-generative-ai-models.
27 "What Is E-Waste? Definition and Why It's Important." Great Lakes Electronics. Great Lakes Electronics Corporation. March 12, 2020. www.ewaste1.com/what-is-e-waste/.
28 "Electronic Waste (E-Waste)." Who.int. World Health Organization: WHO. October 1, 2024. www.who.int/news-room/fact-sheets/detail/electronic-waste-%28e-waste%29.
29 "Health Consequences of Exposure to E-Waste: An Updated Systematic Review." *The Lancet Planetary Health* 5

that have a dangerous effect on the environment and human health.[30]

Recycling discarded materials recovers valuable substances like iron, aluminum, copper, silver, and rare earth metals. However, the recycling process itself can also do environmental harm.[31] Transportation of e-waste materials to proper recycling facilities, as well as the sorting, cleaning, and recycling processes themselves, both require energy that may require fossil fuels. Recycling sorts and collects rubbish to treat it and produce useful materials that can be used again, but not all e-waste materials can be recycled.[32] The World Health Organization warns that e-waste is highly polluting. It can release toxic substances with compounds such as lead, mercury, and dioxins. All can pose severe risks to human health and can leach into the environment. For example, exposure to mercury can damage the nervous system during pregnancy, infancy, and adolescence. Also, toxic substances generated from e-waste can influence human lung development and function, affecting the human respiratory system over time.[33] All these substances also harm or kill natural flora and fauna.

When electric devices are improperly discarded, they pose an extreme risk to air, soil, water, and dust contamination. Disposal methods like landfilling with regular waste, burning or heating electronic devices, dumping on land or in water bodies, acid baths, and more can severely contaminate the environment.[34] Melting, dismantling, or shredding e-waste releases particles and chemicals into the air. Burning e-waste releases carcinogens and dioxins.[35] These methods produce fine particles that adhere to the atmosphere and can travel thousands of miles, causing air pollution and contributing to acid rain. According to the WHO, dioxins are persistent environmental pollutants that remain in the environment for a long time. They accumulate in the food chain, primarily in the fat reserves of animals. This accumulation can lead to toxic effects in wildlife and humans as they consume contaminated food.[36] Landfill disposal methods can cause flame retardants to seep into soil. Crops can be contaminated, making them unsafe for human and animal consumption. Pollutants also cause harm to microorganisms in the soil. Common methods of e-waste disposal also cause water contamination. Heavy metals and toxins may leak deeper into the earth and reach groundwater sources. This pollution can reach rivers, streams, ponds, and lakes, causing acidification and toxification.[37] This kills marine and freshwater organisms, causing irreversible damage to entire ecosystems.

E-waste processing tends to be carried out in the informal sector. Sorting these materials tends to be inefficient and incomplete since the process is carried out in uncontrolled work settings. Protective equipment and modern technology are required for processing, which the informal sector can lack.[38] A 2018 study in Cotonou, Benin, interviewed 45 e-waste recycler workers. Over 90 percent of the participants admitted to disposing of e-waste in natural sites. Only 46.7 percent believed that e-waste disposal could pollute water, and only 71.1 percent also thought these disposals tended to contaminate air and soil.[39] Many people in charge did not

30 Environment, UN. 2017. "Flame Retardants." UNEP - UN Environment Programme. 2017. www.unep.org/flame-retardants.
31 "Health Consequences of Exposure to E-Waste: An Updated Systematic Review." *The Lancet Planetary Health* 5 (12): e905–20. doi.org/10.1016/s2542-5196(21)00263-1.
32 "Recycle." @CambridgeWords. February 21, 2024. dictionary.cambridge.org/dictionary/english/recycle#google_vignette.
33 "Electronic Waste (E-Waste)." Who.int. World Health Organization: WHO.
34 "Electronic Waste (E-Waste)." Who.int. World Health Organization: WHO. October 1, 2024. www.who.int/news-room/fact-sheets/detail/electronic-waste-%28e-waste%29.
35 elytus. 2019. "E-Waste & Its Negative Effects on the Environment | Elytus." Elytus.com. 2019. elytus.com/blog/e-waste-and-its-negative-effects-on-the-environment.html.
36 World Health Organization. 2023. "Dioxins and Their Effects on Human Health." World Health Organization. November 29, 2023. www.who.int/news-room/fact-sheets/detail/dioxins-and-their-effects-on-human-health.
37 elytus. 2019. "E-Waste & Its Negative Effects on the Environment | Elytus." Elytus.com. 2019.
38 Clive D'Souza, Augustine A Acquah, Bernard J Martin, and Julius N Fobil. 2024. "SS36-01 E-WASTE PROCESSING in the INFORMAL WORK SECTOR: A GLOBAL PERSPECTIVE." *Occupational Medicine* 74 (Supplement_1). doi.org/10.1093/occmed/kqae023.0224.
39 Houessionon, M. G. Karel, Niladri Basu, Catherine Bouland, N. Marius Kedote, Benjamin Fayomi, N. Julius Fobil, and Edgard-Marius Ouendo. 2021. "Knowledge, Practices, and Environmental and Occupational Health Risks Associated with Electronic Waste Recycling in Cotonou, Benin." *Occupational Diseases and Environmental Medicine* 09 (02): 33–48. doi.org/10.4236/odem.2021.92004.

understand the consequences of improper disposal and thus did not always follow procedure. Thus, current e-waste recycling practices in Cotonou often contaminate the environment. Further, the study revealed that e-waste workers suffer from several illnesses, including respiratory, heart, eye, and kidney conditions. These illnesses might be related to their job and the lack of proper protective equipment. According to the WHO's Digital Dumpsites Report, millions of vulnerable people work at informal e-waste processing sites where they are exposed to hazardous chemicals. This includes children, adolescents, and women of childbearing age. E-waste disposal is responsible for 70 percent of hazardous toxins reported in the environment. Pollutants from electronic hardware have a profound effect on ecosystems and on humans.[40]

The global flow of e-waste is directed toward developing countries. There, workers do not always have proper access to adequate equipment for handling common e-waste disposal methods. Workers are exposed to harmful substances such as nickel, zinc, lead, chromium, barium, and flame retardants. All of these cause damage to human bodies. Workers can suffer from hypertension, skin disorders, asthma, respiratory decline, and more.[41] People who live near e-waste processing sites face a high risk of exposure to hazardous substances. Inhalation of toxic fumes and fine particles produced by common disposal methods is one risk. Contaminated soil and water pollute local crops and drinking water. This exposes citizens to environmental pollutants that affect their daily lives.[42] E-waste is a long-term issue, since heavy metals and toxins are not biodegradable and can remain in the environment for decades. This means that e-waste pollutants persist in all the places it contaminates, including water, soil, and air.[43]

Representation of E-Waste (Credit: US EPA)

New technology may be very harmful to the environment.[44] According to a Nature Computational Science study, e-waste could reach up to 1.20 to 5.0 million metric tons by 2030. This is equivalent to 1,000 times more e-waste than what was produced in 2023. Asaf Tzachor, a professional in sustainable development at Reichman University in Israel and co-author of the Nature Computational Science study, argues that "e-waste generated by generative AI, particularly large language models, could increase… up to 2.5 million tons per year by 2030 if no waste reduction measures

40 "E-Waste | Children's Environmental Health Collaborative." Ceh.unicef.org. February 18, 2020. ceh.unicef.org/spotlight-risk/e-waste.
41 Marsh, Jane. 2021. "The Harmful Effects of E-Waste to Humans." Environment Co. October 9, 2021. environment.co/the-harmful-effects-of-e-waste-to-humans/.
42 Cooper, Liz. 2024. "The Crisis That Makes Us Sick: The Health Impacts of E-Waste." Human-I-T. November 26, 2024. www.human-i-t.org/the-health-impacts-of-e-waste/.
43 "The Crisis That Makes Us Sick: The Health Impacts of E-Waste." Human-I-T.
44 "Generative AI Is Creating Looming E-Waste Challenges, and How Can It Be Tackled by Circular Economy----Institute,Xiamen,Urban, Environment,Academy,Health,Sciences." 2023. Iue.cas.cn. 2023. http://english.iue.cas.cn/rh/rp/202410/t20241029_693009.html.

are implemented."[45] Chatbots like ChatGPT will generate 1.5 million to 5 million tons of electronic waste by the end of this decade, since AI hardware is gradually discontinued every two to five years.[46] Generative AI is an environmental threat, since it is estimated that it can produce over 5 million tons of e-waste by 2030.

Data centers for this type of AI require continuous technological improvements, which means continuous waste byproducts.[47] Generative AI focuses on developing content such as images, videos, sound, or text. Traditional AI is programmed to accomplish specific tasks, but generative AI has multiple possible "tasks" to achieve. Thus, generative AI has a bigger impact on the environment. A single AI-generated image consumes the equivalent energy of half a charged smartphone. ChatGPT-3, a generative AI, produces 626 pounds of carbon dioxide, equivalent to 300 round-trip flights between New York and San Francisco.[48] Generative AI will add even more electronic waste due to its rapid expansion and consumption by users.

AI models need servers to properly function. A server is a system that delivers services, data, or resources to client devices across the network.[49] Big companies like Google, Amazon, Meta, and Microsoft are very invested in the matter. Data chips, components within a server, have increased in production. During 2024, AI servers may make up to 12.2 percent of all server shipments around the world.[50] Chip production consumes a significant amount of energy, approximately 100 megawatt-hours, and requires over 1 million gallons of water daily. Additionally, the process generates tons of chemical waste annually.[51] Chemical waste from chip manufacturing can come from solid waste, liquid chemicals, or gases with dangerous substances like ammonia gas and sulfuric acid.[52]

Ammonia can lead to heart attacks, strokes, asthma, and lung cancer. It is a compound made of nitrogen and hydrogen. Nitrogen is crucial for sustaining life on Earth, but when it combines with ammonia compounds, it can harm ecosystems. When there is an excess of nitrogen in the environment, plants can choke out other species. Nitrogen can also contaminate water, causing algae to multiply at an accelerated pace. This blocks sunlight for plants lower in the water. When algae dies because of the harsh conditions of the contaminated nitrogen water, the process of decomposition consumes the oxygen in the water, which suffocates aquatic life.[53] Sulfuric acid is also a danger to the environment. It causes acid rain. Acid rain causes major damage to forests, crops, waterways, and other habitats. An added risk to the ecosystem due to sulfuric acid is foliage damage. Foliage damage means that plants get dark pigmentation or bleaching on plant leaves. Sulfuric acid can also create a low-lying haze that reduces visibility, blocks out sunlight, and affects plant growth. Sulfuric acid can also cause respiratory illness, damage human lungs, and increase asthma and bronchitis.[54]

45 "E-Waste from AI Computers Could 'Escalate beyond Control.'" Dw.com. Deutsche Welle. October 28, 2024. www.dw.com/en/e-waste-from-ai-computers-could-escalate-beyond-control/a-70619724.
46 "The Key Role of Automation in AI Hardware Recycling." *Forbes*, March 29, 2024. www.forbes.com/councils/forbestechcouncil/2024/03/29/the-key-role-of-automation-in-ai-hardware-recycling
47 "Scientists Predict AI to Generate Millions of Tons of E-Waste." ScienceAlert. November 8, 2024. www.sciencealert.com/scientists-predict-ai-to-generate-millions-of-tons-of-e-waste.
48 Dhanani, Roma. 2024. "Environmental Impact of Generative AI | 20 Stats & Facts 2024." The Sustainable Agency. September 27, 2024. thesustainableagency.com/blog/environmental-impact-of-generative-ai/.
49 "What Is a Server? | Complete Guide to Understanding Servers." ServerWatch. July 21, 2021. www.serverwatch.com/guides/what-is-a-server/.
50 "Press Center - Global AI Server Demand Surge Expected to Drive 2024 Market Value to US$187 Billion; Represents 65% of Server Market, Says TrendForce | TrendForce - Market Research, Price Trend of DRAM, NAND Flash, LEDs, TFT-LCD and Green Energy, PV." TrendForce. 2024. www.trendforce.com/presscenter/news/20240717-12227.html.
51 "The Chip Industry's Dirty Little Secret: It's Very Dirty." Fortune. January 29, 2024. fortune.com/2024/01/29/chips-act-semiconductor-factories-environmental-impact-water-electricity-carbon-chemical-waste/.
52 The Environmental Impact of IC Chip Manufacturing and Disposal." Rantle East Electronic Trading Co., Limited. May 15, 2023. www.icrfq.net/environmental-impact-of-ic-chip-manufacturing-and-disposal/.
53 "What Is Ammonia and How Is It Harmful?" n.d. The Bureau of Investigative Journalism. www.thebureauinvestigates.com/stories/2024-04-26/what-is-ammonia-and-how-is-it-harmful/.
54 "The Environmental Impact of IC Chip Manufacturing and Disposal." Rantle East Electronic Trading Co., Limited. May 15, 2023. www.icrfq.net/environmental-impact-of-ic-chip-manufacturing-and-disposal/.

The latest technology is essential for efficient and high-performing data centers. AI e-waste includes Central Processing Units (CPUs) and Graphic Processing Units (GPUs), batteries used for backup power, memory modules, and printed circuit boards.[55] Central processing units and graphic processing units work together to increase the throughput of information and the number of simultaneous calculations of an application. The newest CPUs and GPUs upgrade the data being processed in a specific amount of time.[56] Companies heavily invest in the production of GPUs because of the demand in the market sector.[57] The demand for GPUs in the market sector is expected to grow to 22.46 billion by 2034. This expansion is powered by the growth of AI models and their hardware requirements to support AI, deep learning, and data analytics.[58]

Additionally, batteries are essential for the sustenance of data centers without power generation sources. When the primary power supply from the grid (the facility responsible for distributing energy) is lost, or when generators have not yet started operating, batteries can generate power.[59] Batteries are key solutions in these scenarios. They provide instant power to systems when there are variations in the power supply. The amount of electricity provided by the grid can vary for several reasons. For example, intermittent renewable power sources, such as wind power, depend on wind conditions.[60] This shortens the amount of electricity provided.

Artisanal cobalt miners in the Democratic Republic of Congo (Credit: International Institute for Environment and Development)

Mining materials needed to produce batteries comes with a high environmental cost. During the extraction process, harmful fumes are released into the atmosphere. Cobalt mining, for example, is vital for battery production. The methods used to obtain this resource contribute to deforestation, water pollution, and ecosystem breakdown. The extraction of nickel, graphite, and other essential materials also leads to pollution, resulting in carbon pollutants and natural habitat degradation.[61]

55 "Generative AI Has a Massive E-Waste Problem." IEEE Spectrum. November 4, 2024. spectrum.ieee.org/e-waste.
56 "CPU vs GPU | Definition and FAQs | HEAVY.AI." n.d. Www.heavy.ai. www.heavy.ai/technical-glossary/cpu-vs-gpu.
57 "Coherent Market Insights Pvt Ltd." Coherentmarketinsights.com. 2023. www.coherentmarketinsights.com/blog/insights/leading-companies-graphic-processing-unit-gpu-industry-2135.
58 "Data Center GPUs Market Research Report 2024-2025 & 2034 - HPC Market Expansion Creates Major Opportunities for GPU Server Leaders like Dell and Google." GlobeNewswire News Room. Research and Markets. May 20, 2025. www.globenewswire.com/news-release/2025/05/20/3084707/28124/en/Data-Center-GPUs-Market-Research-Report-2024-2025-2034-HPC-Market-Expansion-Creates-Major-Opportunities-for-GPU-Server-Leaders-Like-Dell-and-Google.html.
59 "Data Center Battery Storage and AI: Cutting through the Hysteria and Solving Problems." 2024. Datacenterdynamics.com. June 12, 2024. www.datacenterdynamics.com/en/opinions/data-center-battery-storage-and-ai-cutting-through-the-hysteria-and-solving-problems/.
60 "Mythbusting: 'Wind Power Is Unreliable, Inefficient and Harmful to Nature.'" 2024. Statkraft.com. 2024. www.statkraft.com/newsroom/explained/mythbusting-wind-power-is-unreliable-inefficient-and-harmful-to-nature/.
61 "The Environmental Impact of Battery Manufacturing: Investigating the Environmental Implications of Battery Production for Electric Cars and Exploring Strategies to Mitigate Its Impact - News - Cyberswitching." Cyberswitching. June 20, 2023. cyberswitching.com/the-environmental-impact-of-battery-manufacturing/?srsltid=AfmBOoqu1Lzlp3IbHozBDr-04l7eOBWLo-BuC2-gJwaxBGnzHwWLkBTt.

Energy Considerations

A 2022 UN press release stated, "Energy is at the heart of climate change - and key to the solution."[62] Energy drives the problem because burning fossil fuels for electricity is the single largest source of greenhouse gases, but it also holds the solution if the world shifts toward renewables. Renewable energy is derived from natural sources. Renewable energy is replenished faster than it is consumed, like solar energy, wind energy, geothermal energy, hydropower, ocean energy, and bioenergy.[63] Non-renewable energy is derived from the extraction of Earth's resources. The most common source of non-renewable energy is burning fossil fuels.[64]

Both energy sources contribute to the carbon footprint, which is a measure of the amount of greenhouse gases (GHGs) released into the atmosphere by a specific activity. GHGs are gases in the Earth's atmosphere that trap heat, causing global warming and climate change. It is commonly expressed in tons of carbon dioxide (CO_2).[65]

Renewable energy sources are far less carbon-intensive. Solar energy produces 0.05-0.2 lbs of CO_2 per kilowatt-hour.[66] In comparison, non-renewable energy sources, like oil, produce 2.1 lbs of CO_2 per kWh.[67]

This distinction is crucial because AI massively increases electricity demand. To produce a generative AI image, a generator can consume as much energy as fully charging a smartphone.[68] As AI develops with more innovative features, more energy is required. Generative AI includes Duolingo Max, Microsoft Bing, ChatBot, Cleo, and AI Video Generator, among others.[69] Electricity demand from data centers is expected to grow drastically in the coming years. Such predictions say that massive amounts of energy will be required to support AI data centers, based on current trends. This is alarming, as AI is a contributor to global warming and climate change.[70] However, growth is not always equal. In Japan, for example, data centers are on track to occupy more than one-half of the national energy demands. In Malaysia, on the other hand, this is only expected to occupy one-fifth.[71]

Energy drives the problem because burning fossil fuels for electricity is the single largest source of greenhouse gases, but it also holds the solution if the world shifts toward renewables.

Companies like Microsoft and Google are key actors when it comes to AI deployment. Both reported increased carbon footprints after expanding data center operations. Google's CO_2 emissions have risen by 50 percent since 2019. Microsoft noticed a 30 percent increase since 2020. As AI develops with more innovative features, more energy is required. Generative AI includes Duolingo Max, Microsoft Bing, ChatBot, Cleo, and AI Video

62 *Webtv.un.org*. 2022. "Powering a Safer Future," September 5, 2022. www.un.org/en/climatechange/powering-safer-future.
63 United Nations. 2025. "What Is Renewable Energy?" United Nations. 2025. www.un.org/en/climatechange/what-is-renewable-energy.
64 "Non-Renewable Resource." Corporate Finance Institute. corporatefinanceinstitute.com/resources/esg/non-renewable-resource/.
65 repsol. 2024. "What Is a Carbon Footprint and Why Is It Important?" REPSOL. 2024. www.repsol.com/en/sustainability/sustainability-pillars/climate-change/reducing-carbon-footprint/index.cshtml.
66 Mateo, Samuel. 2025. "The Carbon Footprint of Traditional Energy vs. Renewables | SmartEnergy." SmartEnergy. April 30, 2025. smartenergy.com/the-carbon-footprint-of-traditional-energy-vs-renewables/.
67 Mateo, Samuel. 2025. "The Carbon Footprint of Traditional Energy vs. Renewables | SmartEnergy." SmartEnergy. April 30, 2025. smartenergy.com/the-carbon-footprint-of-traditional-energy-vs-renewables/.
68 Lyons-Cunha, Jenny. 2025. "AI Energy Consumption: Is It a Problem? | Built In." Built In. 2025. https://builtin.com/artificial-intelligence/ai-energy-consumption.
69 Lukan, Ema. 2023. "50 Useful Applications of Generative AI in 2023 (+ Examples)." Www.synthesia.io. September 27, 2023. https://www.synthesia.io/post/generative-ai-examples.
70 "As Generative AI Asks for More Power, Data Centers Seek More Reliable, Cleaner Energy Solutions." 2024. Deloitte Insights. Deloitte. November 18, 2024. www.deloitte.com/us/en/insights/industry/technology/technology-media-and-telecom-predictions/2025/genai-power-consumption-creates-need-for-more-sustainable-data-centers.html.
71 IEA. 2025. "AI Is Set to Drive Surging Electricity Demand from Data Centres While Offering the Potential to Transform How the Energy Sector Works - News - IEA." International Energy Agency. April 10, 2025. www.iea.org/news/ai-is-set-to-drive-surging-electricity-demand-from-data-centres-while-offering-the-potential-to-transform-how-the-energy-sector-works.

Generator, among others.[72] The pace at which companies build data centers means most electricity needed to power them must come from fossil fuel-based power plants.[73] Plants emit around 900-1,200 g of CO_2 per kWh, including the extraction of coal, oil, and gas, and the transportation of the fuels.[74]

Indirect emissions of data centers are also estimated to grow 80 percent over the course of the decade.[75] During an OpenAI chatbot's training phase, it consumed 1,287 MWh of energy, equivalent to the annual energy consumption of 120 standard American homes.[76] According to a 2021 research paper from Google scientists and the University of California at Berkeley, GPT-3 generated about 552 tons of CO_2.[77] As AI data centers continue to consume so much energy, more CO_2 will be released into the environment. This will further exacerbate the greenhouse effect. The takeaway is clear: AI's climate impact is not fixed. If its energy comes from clean sources, AI can be part of the solution; if powered by fossil fuels, it will deepen the greenhouse effect.

Water Consumption

The computers and technologies required to maintain AI systems use and waste energy, including heat. Therefore, cooling systems are required to keep an optimal environment for staff, hardware, and equipment to function. The more technologies running, the greater the heat produced. Water is essential for the production of AI.[78] These systems manage to use water in data centers. Water cooling lowers high temperatures produced by high, quick throughput. The global demand for cooling systems is estimated to grow up to 14 percent annually.[79] The US Department of Energy (DOE) invested USD 40 million in five projects to create advanced, power-saving cooling systems tailored for data centers. These projects are carried out in national labs, universities, and businesses. The main goal is to reduce the energy that data centers need. They also aim to reduce the carbon footprint produced by data centers.[80] These solutions are promising but are not yet very accessible.

Due to immense facilities and the heat production of data centers, a data center can consume between three and five million gallons of water daily for cooling purposes. This is equivalent to the water usage of a city with 30,000-50,000 civilians. This water usage causes pressure on aquatic ecosystems. Water extracted from natural resources can disrupt flow patterns and decrease aquatic habitats. Further, the "once-through" method releases used water into local waterways. This can alter oxygen levels and affect temperature-sensitive species. Monitoring programs are essential to understand and tackle the effect that water usage from data centers has on the ecosystem.

Development evolves rapidly in different geographic regions with varying ecological vulnerabilities.[81] Water consumption also varies by data center. Ireland is a low water consumer within its data centers,

72 Lukan, Ema. 2023. "50 Useful Applications of Generative AI in 2023 (+ Examples)." Www.synthesia.io. September 27, 2023. www.synthesia.io/post/generative-ai-examples.
73 "Fossil Fuel Power Plants | EBSCO." 2024. EBSCO Information Services, Inc. | Www.ebsco.com. 2024. www.ebsco.com/research-starters/power-and-energy/fossil-fuel-power-plants.
74 Wogirz, Laura. 2024. "CO2 Balance: Renewable Energies vs. Fossil Fuels - Holistic Climate Management." Holistic Climate Management. October 22, 2024. natureoffice.com/en/co2-balancing/comparison-of-the-co2-balance-renewable-energies-vs-fossil-fuel/.
75 AI. 2025. "AI and Climate Change – Energy and AI – Analysis - IEA." IEA. 2025. www.iea.org/reports/energy-and-ai/ai-and-climate-change.
76 Morgan, Clyde. 2025. "ChatGPT's Energy Consumption: A Closer Look." Ainvest. February 12, 2025. www.ainvest.com/news/chatgpt-s-energy-consumption-a-closer-look-25021010974072aca1ec96a5/.
77 Zewe, Adam. 2025. "Explained: Generative AI's Environmental Impact." MIT News. Massachusetts Institute of Technology. January 17, 2025. news.mit.edu/2025/explained-generative-ai-environmental-impact-0117.
78 "Reducing Data Center Peak Cooling Demand and Energy Costs with Underground Thermal Energy Storage | NREL." 2025. Nrel.gov. 2025. www.nrel.gov/news/detail/program/2025/reducing-data-center-peak-cooling-demand-and-energy-costs-with-underground-thermal-energy-storage.
79 Borgini, Julia. 2022. "Data Center Cooling Systems and Technologies and How They Work." SearchDataCenter. May 3, 2022. www.techtarget.com/searchdatacenter/tip/Data-center-cooling-systems-and-technologies-and-how-they-work.
80 "DOE Announces $40 Million for More Efficient Cooling for Data Centers." 2023. Energy.gov. May 9, 2023. www.energy.gov/articles/doe-announces-40-million-more-efficient-cooling-data-centers.
81 John, Nirmal. 2025. "AI Water Consumption: The Hidden Environmental Cost of Artificial Intelligence." GigeNET. April 2, 2025. www.gigenet.com/blog/ai-water-consumption-the-hidden-environmental-cost-of-artificial-intelligence/.

Solar Farm in Humboldt, Tennessee (Credit: USDAgov)

while Washington state is an entity that consumes more water.[82] This happens due to structural designs of cooling and climate conditions. Transparency is essential to obtain realistic statistics about water consumption. If a data center's location is in a region of water stress, this data center may shift to more compact processing with a smaller water footprint.[83]

Water stress is when the demand for usable and safe water exceeds the available amount. Differing from water scarcity, this concept considers water quality, accessibility, and the capacity of a region to meet its needs for water.[84] Distributing AI tasks across regions can help in preventing water-stressed areas from taking on too much of AI's environmental impact.[85] Corporate transparency is needed to effectively address the sustainability issue.

In Aragón, Spain, water consumption by data centers has caused concern for the local community in a region that already suffers from drought. Another community concern is a lack of citizen participation. Previous data center projects were published in the Official Gazette of Aragón but residents were not aware of the matter beforehand. Amazon proposed the construction of three new data centers in Aragon, next to an existing Amazon data center, licensed to use 755,720 cubic meters of water a year.[86] This amount is capable of irrigating 233 hectares of corn, one of the region's main crops. However, this was still not enough water for the company, so Amazon thus asked permission from the Spanish government to upgrade the amount of water consumed in data centers by up to 48 percent. Amazon has pledged to offset their water usage, but NGOs and experts are skeptical. As of mid-2025, the review of Amazon's request is ongoing.

There are an estimated 38 active data centers owned by big tech firms in areas already facing water scarcity, as well as 24 more under development.[87] This continued development threatens not only human populations but also biodiversity, agriculture, and many more industries that are being harmed by pollution. Google built its first Latin American data center in Santiago, Chile.[88] The public expressed opposition, but the government celebrated the investment. This attitude

82 Ren, Shaolei. 2023. "How Much Water Does AI Consume? The Public Deserves to Know - OECD.AI." Oecd.ai. November 30, 2023. oecd.ai/en/wonk/how-much-water-does-ai-consume.
83 "How Much Water Does AI Consume? The Public Deserves to Know - OECD.AI." Oecd.ai.
84 Klobucista, Claire, and Kali Robinson. 2023. "Water Stress: A Global Problem That's Getting Worse." Council on Foreign Relations. Council on Foreign Relations. April 3, 2023. www.cfr.org/backgrounder/water-stress-global-problem-thats-getting-worse.
85 Briefing, China. 2022. "China Data Centers - New Cross-Regional Plan to Boost Computing Power." China Briefing News. March 30, 2022. www.china-briefing.com/news/china-data-centers-new-cross-regional-plan-to-boost-computing-power-across-regions/.
86 Raúl Gascón. 2025. "Del Consumo de Agua a La Especulación: Crecen Las Voces Críticas Con El 'Boom' de Centros de Datos En Aragón." El Español. May 17, 2025. www.elespanol.com/aragon/economia/20250517/consumo-agua-especulacion-crecen-voces-criticas-boom-centros-datos-aragon/1003743761313_0.html.
87 "Revealed: Big Tech's New Datacentres Will Take Water from the World's Driest Areas." The Guardian.
88 "Water Wars: Court Halts Google Data Center in Chile amid Climate Controversy." n.d. Digital Infra Network. digitalinfranetwork.com/news/water-wars-court-halts-google-data-center-in-chile-amid-climate-controversy/.

changed completely as Chile faced severe droughts, claiming that environmental issues of data centers have become a problem for civilians.[89] Nevertheless, Google continued its plans and built a second data center in Cerrillos, consuming 7 billion liters of water annually, equivalent to supplying 80,000 people. Due to the scope of the issue, an environmental court intervened. This court forced Google to re-evaluate its plans and tackle the water consumption issue. Google did take action, and they changed their cooling methods from a water-based system to a water-efficient fan system (air cooling). In this case, public and judicial pressure played a vital role in pushing the company to adopt more sustainable practices.[90]

Both of these cases illustrate a wider pattern. Data center expansion begins with little public input, triggers backlash in water-stressed regions, and only then leads to corporate pivots toward more efficient cooling. The lessons from Aragón and Chile are clear, that without transparency and enforceable limits, data centers risk worsening droughts and undermining community trust. Strong public oversight forces tech companies to invest in sustainable cooling methods.

Ethical Dilemmas and Regulatory Challenges of AI

The Chief Digital Officer of the United Nations Environment Programme (UNEP), Sally Radwan, stated that "we don't know [everything] about the environmental impact of AI, but some of the data we do have is concerning."[91] AI systems rely on major natural resources and generate an immense environmental footprint. The industry consumes lots of water, produces CO_2 emissions, and generates much electronic waste. The international community has to make sure that AI's effect on the planet is a net positive before AI escalates its operations.

AI models can help monitor the environment and assist governments, businesses, and individuals in making more planet-friendly choices. For example, UNEP utilizes AI models to detect oil and gas vents, a greenhouse gas that contributes to climate change. This is a main driver of global warming and climate change.[92] In this way, AI can help the international community contribute to eco-friendly practices.[93] Also, AI could be utilized in ways to help mitigate other problems it creates. AI models can forecast which facilities could violate environmental regulations. This would upgrade the detection of water pollution by over 600 percent by using machine learning algorithms.[94]

Another notable impact of AI on the environment stems from mining processes. The production of hardware that runs in data centers requires critical minerals, such as several rare earth minerals. These minerals and their industrial output generate toxic pollutants that contaminate surrounding ecosystems, putting local communities at risk. In Mongolia, the refining process for earth materials produced a toxic lake with more than 180 million tons of waste powder from the ore processing.[95] Overall, the environmental impact that AI has is concerning. Mining and producing these materials also cause an impact on the environment, leading to soil erosion and pollution.[96]

As AI continues to develop, so should its regulations. An estimated

89 Narayan Ammachchi. 2025. "Water-Guzzling Data Centers Spark Outrage across Latin America - Nearshore Americas." Nearshore Americas. January 30, 2025. nearshoreamericas.com/water-guzzling-data-centers-spark-outrage-across-latin-america/.
90 "Water-Guzzling Data Centers Spark Outrage across Latin America - Nearshore Americas." Nearshore Americas.
91 "AI Has an Environmental Problem. Here's What the World Can Do about That." UNEP. September 21, 2024. www.unep.org/news-and-stories/story/ai-has-environmental-problem-heres-what-world-can-do-about.
92 World Meteorological Organization. 2023. "Greenhouse Gases." World Meteorological Organization. November 15, 2023. wmo.int/topics/greenhouse-gases.
93 UN Environment Programme. 2024. "AI Has an Environmental Problem. Here's What the World Can Do about That." UNEP. September 21, 2024. www.unep.org/news-and-stories/story/ai-has-environmental-problem-heres-what-world-can-do-about.
94 Flanagan, Molly. 2025. "AI and Environmental Challenges." UPenn EII. 2025. environment.upenn.edu/news-events/news/ai-and-environmental-challenges.
95 HRRC. 2025. "The Human and Environmental Impact of Artificial Intelligence." February 6, 2025. www.humanrightsresearch.org/post/the-human-and-environmental-impact-of-artificial-intelligence.
96 "Can We Mitigate AI's Environmental Impacts?" Yale School of the Environment. Yale University.

Submerged computer into a liquid coolant (Credit: Kowalski7cc)

93 percent of experts recognize the need for AI regulation.[97] Many countries have already implemented mechanisms to regulate AI. For instance, the United Kingdom published its National AI Strategy, based on a 10-year plan to tackle AI concerns. This plan mainly aims to establish effective national and international governance frameworks for AI technologies. This is designed to foster innovation and attract investment while safeguarding public interest.

In 2021, the European Commission proposed the first EU AI Law, developing an AI risk-categorization approach. The European Artificial Intelligence Act (AI Act) started to become applicable on 1 August 2024. The act aims to encourage the responsible development of AI in the EU.[98] This involves evaluating and sorting AI systems based on the potential harm they could inflict on users. The Parliament's priority was to ensure that AI systems used in the EU are environmentally friendly, non-discriminatory, transparent, safe, and traceable. This established new responsibilities and forced the community and industries to engage with sustainability, including providers and users of AI.[99] Such frameworks are essential and can be built upon when navigating the complexity of AI.

Regulating AI's environmental footprint faces serious obstacles. Current laws are fragmented across regions, making it easy for companies to move operations where oversight is weakest. Data on electricity, water, and raw material use is often treated as proprietary, which prevents regulators from even knowing the scale of the problem. Existing frameworks mostly focus on the fairness and safety of algorithms, while the hidden costs of chip manufacturing, e-waste, and water stress fall outside their scope. The pace of AI development also far outstrips the pace of lawmaking, meaning that by the time rules are enforced, new generations of models have already changed the resource landscape. Finally, governments face a trade-off: they want the economic benefits of AI data centers, but stronger environmental regulations might deter investment. These overlapping challenges show why global coordination and standardized reporting are essential for effective governance.

For UNEA, these regulatory dilemmas are a reminder that AI's environmental impact cannot be managed by any single state. Data centers draw power across borders, rare earths are mined in one region and processed in another, and models are deployed globally. National strategies, while useful, risk creating a patchwork of uneven

97 Pimentel, Brandon. 2024. "Navigate Ethical and Regulatory Issues of Using AI." Thomson Reuters Law Blog. July 1, 2024. legal.thomsonreuters.com/blog/navigate-ethical-and-regulatory-issues-of-using-ai/.
98 European Commission. 2024. "AI Act Enters into Force." European Commission. August 2024. commission.europa.eu/news-and-media/news/ai-act-enters-force-2024-08-01_en.
99 European Parliament. 2023. "EU AI Act: First Regulation on Artificial Intelligence." European Parliament. European Parliament. June 8, 2023. www.europarl.europa.eu/topics/en/article/20230601STO93804/eu-ai-act-first-regulation-on-artificial-intelligence.

standards. This is precisely where UNEA's role becomes critical: it can foster cooperation, push for standardized reporting of energy, water, and material use, and encourage the adoption of lifecycle assessments that capture AI's hidden costs. By anchoring AI governance within the broader framework of environmental sustainability, UNEA can ensure that AI's growth aligns with global climate and development goals, rather than undermining them.

Current Status

Case Study: Ohio State

Ohio, a Midwestern state in the United States, is a territorial leader in the data center industry and ranks fourth in the country for its volume of data centers, with around 172 facilities. This significant number is due in part to the Ohio Data Center Sales Tax Exemption.[100] The exemption provides a partial or complete sales-tax break on the purchase of eligible data center equipment. To qualify, projects must meet minimum investment and payroll requirements of at least 100 million USD in capital over three years and annual employee compensation of at least 1.5 million USD.[101] This incentive significantly lowers building costs, making Ohio a major investment opportunity for large companies. For instance, the Tax Credit Authority approved a 15-year sales tax exemption for Microsoft, estimated to be worth USD 72.5 million.[102]

In addition to policy incentives, Ohio's cooler temperatures and proximity to the Great Lakes reduce costs associated with intensive cooling, positioning the state favorably compared to warmer southern states. The data center sector also contributes substantially to employment and the economy. AI centers supported around 85,000 jobs and generated billions of dollars in economic output in 2023, boosting the regional economy.[103]

While economically beneficial, these investments carry an environmental price. The environmental impact of data centers in Ohio includes increased water use, higher energy consumption, and rising CO_2 emissions. According to Professor Jess Bielicki of Ohio State University, it is crucial to track where the energy comes from, as the vast majority of Ohio's power still originates from non-renewable sources.[104] Ohio ranks 46th among US states for renewable energy.[105] Since 2019, its primary source of electricity has been natural gas, followed by coal. Nuclear accounts for about 12 percent, and only about 5 percent of Ohio's power comes from solar and wind.

The rapid pace of AI data center construction has increased CO_2 emissions, with Microsoft reporting that the state's emissions rose by up to 30 percent since 2020 due to expansion.[106] Data center electricity demand is also rising steeply: Goldman Sachs anticipates a 160 percent increase by 2030. American Electric Power (AEP) projects that consumption will grow from 100 megawatts to 500 megawatts during

100 "Data Centers in Ohio: A Rising Power Player amid Growth and Challenges." @BrickerGraydon. January 6, 2025. www.brickergraydon.com/DevelopOhio/data-centers-in-ohio-a-rising-power-player-amid-growth-and-challenges.
101 "Data Center Tax Abatement in Ohio." JobsOhio. 2025. www.jobsohio.com/incentives-programs/data-center-tax-exemption.
102 "Indefensible Tax Breaks for Data Centers Will Cost Ohio - Policy Matters Ohio." Policy Matters Ohio. January 7, 2025. policymattersohio.org/research/indefensible-tax-breaks-for-data-centers-will-cost-ohio/.
103 "As the Great Lakes Become a Data Center Hub, AI's Water Usage Impact Remains Unknown." Clevelandmagazine.com. Cleveland Magazine. June 27, 2025. clevelandmagazine.com/in-the-cle/news/articles/as-the-great-lakes-become-a-data-center-hub-ai-s-water-usage-impact-remains-unknown.
104 "Environmental Impact of Data Centers in Central Ohio." 2023. NBC4 WCMH-TV. August 8, 2023. www.nbc4i.com/news/local-news/columbus/environmental-impact-of-data-centers-in-central-ohio/.
105 "What Could Energy Transition Look like in Ohio?" ArcGIS StoryMaps. Esri. December 30, 2024. storymaps.arcgis.com/stories/0876777e135549438491071c115092c1.
106 "Data Centers Are Big Business in Ohio, but Their Environmental Impacts Are Becoming a Concern." Ideastream Public Media. November 4, 2024. www.ideastream.org/show/sound-of-ideas/2024-11-04/data-centers-are-big-business-in-ohio-but-their-environmental-impacts-are-becoming-a-concern.

Amazon Web Services (AWS) data center in the US (Credit: Tedder)

the 2020s. This is more than twice Ohio's nuclear energy capacity.[107] Water stress compounds the challenge. Data centers connected to municipal water systems are not required to report their water usage, creating gaps in monitoring. This is alarming because about 42 percent of Ohio's citizens rely on groundwater from the Lake Erie watershed for household needs.[108] Cooling systems do not return the water they consume, putting additional strain on ecosystems.

Major tech companies are doubling down on Ohio. Mark Zuckerberg, CEO of Meta Platforms, announced the construction of a massive new Ohio data center called Prometheus, scheduled to come online in 2026. Meta is also developing Hyperion, a 10 billion USD facility in Louisiana that is projected to be the largest in the world.[109] Together, Meta plans to invest up to 60 billion USD in new data centers in 2025 to advance its ambitions for "superintelligence."[110] Microsoft is likewise planning a 1 billion USD investment to build three campuses in Central Ohio, with construction starting in July 2025 and completion expected in 2027.[111] These ambitious projects will increase the scale of Ohio's role in AI infrastructure but raise concerns about sustainability.

A recurring concern in Ohio is the lack of transparency. According to Helena Volzer of the Alliance for the Great Lakes, local governments have signed confidential agreements with major tech companies, limiting public knowledge of energy and water usage.[112] Fewer than one-third of data centers in the state track water consumption. This lack of precise data undermines both public trust and the ability to design effective sustainability measures.[113]

Ohio demonstrates the double-edged nature of AI data centers: they provide jobs and economic growth but also intensify environmental pressures on energy grids, water systems, and emissions. To balance these trade-offs, it is vital for Ohio to strengthen sustainability requirements. Linking tax incentives to renewable energy sourcing, water-use limits, and transparent reporting would help ensure that economic benefits do

107 BETTER ENERGY POLICY for OHIO." Accessed July 19, 2025. www.buckeyeinstitute.org/library/docLib/2025-01-22-Better-Energy-Policy-for-Ohio-policy-report.pdf.
108 Jaden Stambolia. 2025. "As the Great Lakes Become a Data Center Hub, AI's Water Usage Impact Remains Unknown." Clevelandmagazine.com. Cleveland Magazine. June 27, 2025. clevelandmagazine.com/in-the-cle/news/articles/as-the-great-lakes-become-a-data-center-hub-ai-s-water-usage-impact-remains-unknown.
109 "Zuckerberg Says Meta to Build Several Gigawatt-Size Data Centers." 2025. OODAloop. July 14, 2025. oodaloop.com/briefs/technology/zuckerberg-says-meta-to-build-several-gigawatt-size-data-centers/.
110 Admin_TUL. 2025. "Meta's Hyperion AI Data Center Promises Big: $10 Billion Investment Just for Next-Gen AI Model Training?" The USA Leaders. July 16, 2025. theusaleaders.com/news/hyperion-ai-data-center/.
111 "Microsoft to Invest $1bn in Data Center Campuses in Central Ohio." 2024. Datacenterdynamics.com. October 29, 2024. www.datacenterdynamics.com/en/news/microsoft-to-invest-1bn-in-data-center-campuses-in-central-ohio/.
112 "Inside Central Ohio's Data Center Boom." Axios. Axios Columbus. April 28, 2025. www.axios.com/local/columbus/2025/04/28/central-ohio-data-center-boom.
113 "Inside Central Ohio's Data Center Boom." Axios.

not come at the expense of long-term environmental stability.

AI Climate Dilemma

The climate impact that AI has is difficult to calculate. Different types of AI include machine learning models, large language models, vision programs, and more. These various types require different amounts of energy and can emit varying quantities of pollutants. Despite AI's water consumption, e-waste, and energy demands, it can also help address environmental problems, including devastation caused by intense, heat-amplified hurricanes.[114] Within AI's capacity for achieving human-like tasks, it offers significant advantages for environmental monitoring. AI can process extensive satellite visuals, examine deforestation, and detect contamination through environmental sensors. These actions can be used to address the effects of greenhouse gas emissions.[115]

The Radar for Detecting Deforestation, known as RADD, is a system that detects deforestation. Traditional satellite tech was obstructed by clouds, rain, smoke, and haze. These obstacles delay the detection of deforestation, as the system needs to wait for a day with clear skies. RADD can perform deforestation analysis despite the weather obstructions. This system gives authorities and organizations a greater ability to detect deforestation in specific areas. The system works with AI, which makes it efficient since it provides the exact locations where illegal deforestation is taking place.[116]

AI can learn how to interpret and correct satellite image errors. The traditional method of analyzing satellite visuals is time-consuming and subject to human error. AI techniques use data interpretation to perform satellite visual analysis efficiently. This method can help areas such as urban planning, agriculture, and environmental monitoring. Access to real-time information about the environment is a key capability that AI brings to the table. Real-time information includes data on deforestation, pollution, and natural disasters. Information on specific environmental challenges presents a global benefit, since it pinpoints exact problems. This facilitates the creation of targeted solutions to preserve the natural world. AI algorithms can also generate data regarding biodiversity loss and determine how climate change affects different living species.[117]

In 2025, IBM, in partnership with NASA, announced an AI model for weather and climate. This system is designed to improve climate and weather projections. This innovation consists of three main objectives. The first objective is to provide an anticipated warning of hurricane winds and flooding events. The second objective focuses on hurricane forecasting, allowing the model to identify regions where additional hurricane protection might be necessary. For instance, Hurricane Ida, which affected Louisiana in 2021, caused 75 billion USD in damages. IBM argues that environmental harms can be avoided in the future. The third and final objective of the new IBM and NASA AI model is the improved estimation of gravity waves. According to NASA, a gravitational wave is "invisible ripples in the fabric of space-time that propagate at the speed of light… [and indicate] the most violent events in the universe."[118] In Earth's atmosphere, gravity waves influence cloud formation and global weather patterns, such as where aircraft turbulence appears. Traditional climate models fail to capture gravity waves properly at high resolution. However, this new AI model can capture them, which signifies a game-

114 "AI's Climate Impact Goes beyond Its Emissions." Edited by Sophie Bushwick. Scientific American. December 7, 2023. www.scientificamerican.com/article/ais-climate-impact-goes-beyond-its-emissions/.
115 "The Truth about AI & the Environment: Pros and Cons." Www.astutis.com. April 2024. www.astutis.com/astutis-hub/blog/artificial-intelligence-environmental-impacts.
116 Johannes), J. 2023. "AI System Predicts Illegal Deforestation: Already Prevented the Clearing of 30 Hectares near a Gold Mine'." WUR. December 5, 2023. www.wur.nl/en/research-results/research-institutes/environmental-research/show-wenr/ai-system-predicts-illegal-deforestation-already-prevented-the-clearing-of-30-hectares-near-a-gold-mine.htm.
117 "The Role of AI in Enhancing High-Resolution Satellite Imagery - the Environmental Blog." 2025. The Environmental Blog. March 20, 2025. www.theenvironmentalblog.org/2025/03/the-role-of-ai-in-enhancing-high-resolution-satellite-imagery/.
118 "Hubble Gravity Waves - NASA Science." 2024. Nasa.gov. September 5, 2024. science.nasa.gov/mission/hubble/science/science-behind-the-discoveries/hubble-gravity-waves/.

changing advancement in global environmental knowledge.[119] This innovative model provides significant relevant knowledge regarding the environment and possible outcomes.

CoGo is an AI-based company that assists in tracking carbon emissions. This AI helps the environment by providing specific data on an individual customer's carbon emissions. CoGo offers three products to its customers. The first product, "Carbon Insights," provides personalized carbon insights to help reduce carbon footprint. This product explores how a person's investments impact the environment. For instance, when a person uses public transport, they produce fewer CO_2 emissions than driving a car. When public transport is taken, it tracks the carbon emissions the person saved by choosing public transport. This encourages citizens to make eco-friendly decisions.

"Electrification" is CoGo's second product. This product is targeted toward customers who own homes and cars. When these customers intend to make a new investment, CoGo advises them on eco-friendly improvements. CoGo customers receive personalized advice regarding their purchases for their specific home or vehicle. The third product CoGo offers, "Carbon Manager," can be considered a solution for tackling the issue. It aims to precisely quantify carbon pollution created by small businesses and generate options for cutting CO_2 emissions.[120] Export Logistics uses CoGo and promotes that it quantifies how big a difference sustainable choices will make. Using CoGo enables people to accurately measure carbon emissions.[121]

AI has a negative impact on the environment, but it also provides benefits for climate change mitigation and CO_2 management. Therefore, the promotion of responsible AI use is essential. A culture of transparency and accountability must also be fostered. To accurately assess AI's environmental impact, stakeholders must prioritize providing relevant data on AI models and data sources. To ensure the ethical creation, use, and disposal of AI technologies, governments and regulatory bodies must adopt precise rules and restrictions. Delegates are encouraged to hold collaborations between companies, academics, and policymakers. Creating solutions that prioritize technological advancements and environmental sustainability can be highly efficient. Also promoting multidisciplinary research and knowledge sharing. [122]

AI can help in achieving the SDGs due to AI's capacity for performing human-like tasks. If AI is applied safely, it could mean huge progress toward achieving the SDGs.

Sustainable Development Goals

At the opening of ECOSOC's Special Meeting of the Global Digital Compact, the United Nations Secretary-General proclaimed that countries should look beyond national and unique interests. Instead, the global community should work toward a global perspective. Collaborative approaches can achieve a bigger impact and larger-scale solutions. These collaborative approaches should be linked to responsible development. Moreover, he implied that AI can help in achieving the SDGs due to AI's capacity for performing human-like tasks. If AI is applied safely, it could mean huge progress toward achieving SDGs.[123]

119 "Introducing Prithvi WxC, a New General-Purpose AI Model for Weather and Climate." IBM Research. IBM. September 23, 2024. research.ibm.com/blog/foundation-model-weather-climate?sf202047273=1.
120 "Carbon Manager | Bring Small Businesses with You on Your Climate Journey." 2025. Cogo.co. 2025. www.cogo.co/products/carbon-manager.
121 "Export Logistics Case Study." 2025. Cogo.co. 2025. www.cogo.co/export-logistics.
122 "The Green Dilemma: Can AI Fulfil Its Potential without Harming the Environment?" Earth.org. July 18, 2023. earth.org/the-green-dilemma-can-ai-fulfil-its-potential-without-harming-the-environment/.
123 "UNSDG | Harnessing Artificial Intelligence for Sustainable Development Goals (SDGs)." 2024. Unsdg.un.org. May 8, 2024. unsdg.un.org/latest/announcements/harnessing-artificial-intelligence-sustainable-development-goals-sdgs.

SDG six, Clean Water and Sanitation, aims to achieve sustainable water for all.[124] AI's reliance on data centers and their cooling systems may impede progress on this SDG. Data centers are projected to withdraw 4.2 to 6.6 billion cubic meters by 2027, and most of the water AI uses to cool its hardware most often comes from freshwater resources and is not returned. The production of AI hardware incurs a cost in terms of water consumption. These processes lead to water pollution, which mainly affects Target 6.3 of SDG 6.[125] Target 6.3 is not having hazardous discharges in water and improving water quality. It is important to mitigate water consumption by data centers since it directly affects rivers and aquifers, threatening biodiversity and community health. It is vital to emphasize that technological innovation needs to be sustainable for it to be a long-term innovation.[126] To tackle the issue, the international community must prioritize sustainable and ethical frameworks for industries.

Goal seven, affordable and clean energy, is affected by AI data centers. Since AI demands excessive amounts of electricity, grids can suffer malfunctions in normal operations.[127] Another SDG affected by AI is SDG 11: Sustainable Cities and Communities. AI can help develop sustainable cities and do urban planning. It helps in multiple aspects of cities, from monitoring pollutants to supporting efficient energy and resource consumption.[128] However, it also has to be considered that AI can cause damage to the environment too.

Global Digital Compact Regional Consultation in Dhaka (Credit: Bangladesh Press Information Department)

SDG thirteen, Climate Action, targets the broader issue at hand. UNEA is driven by the environment and its pollutants. AI drives the overexploitation of resources.[129] For AI to achieve its efficient work, it demands high-energy consumption, water usage, and adequate hardware. These demands lower the pace in achieving SDG 13. Target 13.2: It is essential to apply. Target 13.2 is based on integrating climate change measures into policies and planning. Implementing this target is vital since it would ensure that the environmental impact is regulated at a national level.[130]

124 United Nations. 2025. "The 17 Sustainable Development Goals." United Nations. 2025. sdgs.un.org/goals.
125 "Indicator | SDG 6 Data." n.d. Www.sdg6data.org. www.sdg6data.org/en/indicator/6.3.1.
126 "AI's Excessive Water Consumption Threatens to Drown out Its Environmental Contributions." sdgs.un.org/sites/default/files/2024-05/Gupta%2C%20et%20al._AIs%20excessive%20water%20consumption.pdf.
127 "AI's Impact on the SDGs." Change Oracle. February 26, 2024. changeoracle.com/2024/02/26/ai-and-the-sdgs/.
128 "An Empirical Analysis of AI Contributions to Sustainable Cities (SDG11)." arxiv.org/pdf/2202.02879.
129 Marwan Al-Raeei. 2024. "Artificial Intelligence for Climate Resilience: Advancing Sustainable Goals in SDGs 11 and 13 and Its Relationship to Pandemics." *Discover Sustainability* 5 (1). doi.org/10.1007/s43621-024-00775-5.
130 Sustainable Development Goals. 2019. "Sustainable Development Goals." Base. 2019. www.singstat.gov.sg/find-data/sdg/goal-13.

Bloc Analysis

Points of Division

As AI systems continue to develop, so do their environmental footprints. People around the world are being impacted more by this footprint every day. In considering solutions to mitigate this evolution, countries must consider their positions on environmental protection and waste prevention. They must also consider their stance on AI development and readiness for incoming infrastructure and technologies. It is in combining AI development with the mitigation of environmental impacts that divisions can be best made.

The Environmental Protection Index (EPI) is a summary of sustainability efforts around the world.[131] It compares 58 factors divided into 11 categories. These are combined to give scores from zero to 100. Factors considered include sanitation, mitigation, emissions, and more. The use of EPI scores can help delegates to identify strengths and gaps in environmental policy. This measure can best be combined with AI Preparedness Index (AIPI) scores to consider both ends of the topic.[132] The AIPI considers various indicators in assessing national and regional scores, ranging from 0 to 1. These include ethics, digital infrastructure, economics, and labor policies.

It is in comparing these scores that clear contrasts can be drawn. Efforts in environmental and technological developments can vary but often have a clear relationship as well. Figures provided for comparison are fluid, and bloc positions can also be determined by specific policies within each country. Overall, collaborative efforts are needed between countries in each bloc in order to best fit the needs of growing technologies and the environment.

Low EPI (<40), High AIPI (>0.65)

Countries in this bloc struggle with their efforts toward ending the climate crisis. They tend to have high global AI engagement and current AI data center infrastructure.[133] Such countries might lack policies on responsible energy usage or otherwise deprioritize environmental guidelines. The development of innovative AI is crucial for economic growth, and it has become a vital factor in the global economy.[134] The countries of this bloc might thus be more concerned with economic benefits than environmental costs. Many countries with high AIPI scores are classified as advanced or major advanced economies, as they have the financial, human, and natural resources for continuous development of AI hardware and systems.[135]

Struggling EPI scores in this bloc tend to be caused by a lack of success in meeting climate agreements or goals. They can also be caused by a lack of environmental policy or lack of proper policy enforcement. This can be caused by both barriers in policy and capacity.

The United States of America is a prominent country in this bloc, hosting data centers across the country and being home to many developers. However, recent developments in the country's environmental policy have changed its position in various categories of the EPI.[136]

In collaboration, these countries can often provide assistance in technological development

131 Yale Center for Environmental Law & Policy, *2024 Environmental Performance Index Report*, Yale EPI (published January 6, 2025), https://epi.yale.edu/downloads/2024-epi-report-20250106.pdf.
132 International Monetary Fund (IMF), "AI_PI@AIPI / ADVEC / EME / LIC," IMF DataMapper, accessed September 20, 2025, https://www.imf.org/external/datamapper/AI_PI@AIPI/ADVEC/EME/LIC
133 "The AI Engagement Index: Countries Leading the AI Adoption in 2025." 2025. Apxml.com. 2025. apxml.com/posts/ai-engagement-index-country-rankings.
134 Georgieva, Kristalina. 2024. "AI Will Transform the Global Economy. Let's Make Sure It Benefits Humanity." International Monetary Fund. January 14, 2024. www.imf.org/en/Blogs/Articles/2024/01/14/ai-will-transform-the-global-economy-lets-make-sure-it-benefits-humanity
135 International Monetary Fund (IMF), "AI_PI@AIPI / ADVEC / EME / LIC."
136 Yale Center for Environmental Law & Policy, *2024 Environmental Performance Index Report*.

for other, struggling countries. For example, they might push for voluntary sustainability standards instead of binding treaties, emphasize market-driven innovation, or share their AI technology with others but avoid strict limits on their own emissions.

Medium EPI (40-60), medium AIPI (0.40-0.65)

This bloc contains countries that have stable energy production and are progressively integrating artificial intelligence. These countries generally have the capacity to generate renewable energy and also have infrastructure to support and utilize AI data centers. As they are currently growing their AI infrastructure, such countries might have more time for thoughtful, sustainable development. These countries are uniquely positioned to make environmentally friendly choices as they build data centers and develop regulations.

Countries in this bloc may look towards developing both technologically and in their environmental policy. They may seek aid from both other blocs in doing so sustainably. Brazil, for example, has a rapidly growing digital economy and is a regional hub for AI investors.[137] The country aims to position itself as Latin America's premier hub for hyperscale data centers tailored to artificial intelligence (AI) workloads. Other countries in this bloc include Costa Rica, Barbados, and Bulgaria.[138]Countries in the bloc must consider the circumstances and the regulatory challenges of the consumption of energy, e-waste generated, and water consumption of data centers. The AI growth potential is undeniable but must be done sustainably.

Renewable and non-renewable energies alike are both at the forefront of developments in this bloc. These can be considered in regional aid programs and partnerships. Costa Rica, for example, has recently increased its renewable energy by 98 percent, causing a surplus in power.[139] This surplus in generated energy has been exported to countries with lower capacities, including Panama and El Salvador. Similar partnerships are highly encouraged within this bloc and can be formed using resources available within a particular country or region. This bloc might act as bridge-builders in negotiations, proposing balanced frameworks that encourage renewable-powered AI growth, advocating for financial or technical aid to ensure sustainable infrastructure, and pushing for shared regional standards on e-waste or water use.

High EPI (<60) , low AIPI (<0.40)

Despite global over-energy consumption, 1.3 billion people worldwide still lack access to electricity.[140] Countries or regions struggling with adequate access to power also are limited in their AI engagement. While AI development has an environmental footprint, its absence also negatively affects countries that cannot access it, especially given AI's growing significance in the global economy. As the global economy is reshaped and benefited by AI, it is crucial for countries to learn how to implement it sustainably.

Many countries within this bloc struggle with integration and access. This trend is consistent with many countries in Sub-Saharan Africa, for example, where seven out of ten people struggle with access to power. This region also emits generally fewer carbon emissions than some of the tech leaders. The entire continent of Africa only emits around one-fifth of the carbon emissions that the USA does.[141]

Several countries are being left behind in the AI revolution due to various factors, including economic limitations, insufficient

137 "Brazil Bets Big on AI Infrastructure." ION Analytics. June 6, 2025. ionanalytics.com/insights/infralogic/brazil-bets-big-on-ai-infrastructure/.
138 Yale Center for Environmental Law & Policy, *2024 Environmental Performance Index Report.*
139 "11 Countries Leading the Charge on Renewable Energy." Climate Council. Climate Council. August 15, 2022. www.climatecouncil.org.au/11-countries-leading-the-charge-on-renewable-energy/.
140 "Without Electricity, 1.3 Billion Are Living in the Dark." Washington Post. 2015. www.washingtonpost.com/graphics/world/world-without-power/.
141 "Artificial Intelligence in Africa: Challenges and Opportunities." n.d. www.policycenter.ma/sites/default/files/2024-09/PB_23_24%20%28Azeroual%29%20%28EN%29.pdf.

technological innovation, and differing national priorities. While a country's interest in the AI revolution can be a matter of national policy, AI continues to drive innovation in economy and technology worldwide.[142] Countries in this bloc may seek partnerships with other blocs to increase AI developments and avoid falling behind in new technological revolutions. This can involve financial partnerships, educational programs, and more to increase engagement and development. This push for shared AI technology asks for funding to support green AI, argues that wealthier countries should carry more responsibility, and stresses fairness and access in global rules.

Committee Mission

Delegates in UNEA are called upon to create frameworks for sustainability in an ever-changing global landscape. Technology necessitates a global approach. AI needs regulation to be equally beneficial for all sectors.[143] UNEA is concerned with how benefits within the economic sector might not benefit the environmental sector. Without proper regulation, AI will only benefit a select few, including powerful companies. To address AI's environmental impact, it is necessary to establish robust frameworks. Policy frameworks are key to tackling this issue. Organizations like the OECD and UNESCO have ethical guidelines that highlight the importance of sustainability in AI. However, these efforts lack the backing to make a demonstrable change. A multidimensional perspective is an effective option for addressing the problem. Policies should incentivize the development of energy-efficient AI, and data centers should rely on renewable energy for a lower impact on the environment.[144]

Encouragingly, the United Nations Environment Programme (UNEP) and the International Telecommunication Union (ITU) created a new initiative called the Coalition for Environmentally Sustainable Artificial Intelligence. This initiative aims to place AI on a more sustainable path. Announced at the AI Action Summit in Paris, the coalition includes 37 tech companies, over 100 partners, and 11 allied countries. The goals of this initiative are to encourage AI initiatives that help the planet, such as decarbonizing economies and preserving biodiversity. Another goal of the Coalition is to create standardized methods for measuring AI's environmental impact. It will also prioritize research on sustainable AI, which is vital for the continued development of the technology.[145] Delegates are encouraged to seek inspiration from this coalition and build upon it to continue these practices.

The international community faces a challenge in calculating AI's impact. Big tech companies often fail to disclose environmentally relevant data. This makes it difficult for countries to properly tackle the issue since they lack trustworthy information to properly develop efficient solutions. Moreover, studies do not always consider the full AI lifecycle. The full AI lifecycle includes manufacturing, the extraction of material needed to build hardware used in data centers, model deployment, and disposal.[146] Thus, UNEA's mission is to provide direction on how to balance human development with AI and environmental concerns.

142 "Ready or Not? Countries Set to Be Left behind in Terms of AI Development." Digital Journal. February 10, 2025. www.digitaljournal.com/tech-science/ready-or-not-countries-set-to-be-left-behind-in-terms-of-ai-development/article.
143 www.facebook.com/unep. 2025. "New Coalition Aims to Put Artificial Intelligence on a More Sustainable Path." UN Environment. 2025. www.unep.org/news-and-stories/press-release/new-coalition-aims-put-artificial-intelligence-more-sustainable-path.
144 Sustainability Directory. 2025. "Policy Frameworks for Sustainable AI. Scenario." Prism Sustainability Directory. April 7, 2025. prism.sustainability-directory.com/scenario/policy-frameworks-for-sustainable-ai/.
145 "China Issues Action Plan for Global AI Governance and Proposes Global AI Cooperation Organisation | Digital Watch Observatory." 2025. Digital Watch Observatory. July 29, 2025. dig.watch/updates/china-issues-action-plan-for-global-ai-governance-and-proposes-global-ai-cooperation-organisation.
146 Luna, Javier Canales. 2024. "Sustainable AI: How Can AI Reduce Its Environmental Footprint?" Datacamp.com. DataCamp. September 22, 2024. www.datacamp.com/blog/sustainable-ai?dc_referrer=https%3A%2F%2Fgemini.google.com%2F.

Environmental Approaches to Combat Mosquito-Borne Diseases

Photo Credit: Muhammad Mahdi Karim

Mosquito-borne diseases have long been a problem. Mosquitoes are responsible for more human deaths than any other creature. They kill more people than other humans and snakes, the two next deadliest species, combined.[1] This is due to the mosquito's role as a carrier for a number of lethal diseases, including dengue fever, Zika, malaria, and Chikungunya.[2] Disease carriers are living creatures that can pass on infectious diseases between humans, or from animals to humans. Many carriers are bloodsucking insects that consume disease-causing microorganisms from an infected host. Afterward, they pass the disease onto the next host they bite.[3] Currently, these diseases represent over 17 percent of the diseases worldwide.[4]

Mosquitoes are found almost everywhere on Earth, so controlling this group of diseases is a global issue. The spread of mosquito-borne diseases is becoming increasingly tied to environmental changes. As the atmosphere warms, mosquito season lasts longer. The warming of regions that are usually cooler extends the geographical space for mosquitoes to live. In turn, this affects how and where diseases are spread.[5] Environmental destruction, with practices like deforestation, can also create more mosquito-friendly areas. Urbanization and global trade have also helped species spread. Mosquitoes can migrate internationally with the shipments of goods like tires and plants, where pools of water can form. Since mosquitoes breed in standing water, their larvae can travel with these goods and start populations in suitable habitats. Because of this, many areas that were previously considered free of these diseases are now experiencing outbreaks.[6]

Over the years, humans have developed ways to hinder the spread of these diseases. However, not all mosquito species behave the same, making them difficult to monitor. Some have developed resistance to the chemicals we use against them. The chemicals themselves may also harm environments. Vector control is an environmental and ecological issue. As such, it requires novel strategies using new tools. The use of satellite imaging, biological control, and urban planning reforms are very popular emerging approaches. Moving forward, targeting these diseases will require perfecting existing methods and embracing innovative solutions.

Topic Background

Origins, Evolution, and History of Mosquito-Borne Diseases

Mosquito-borne diseases continue to evolve and develop. They encompass a wide range of illnesses that rely on a complex interaction between the human host, the mosquito, and a disease-causing agent, typically a virus or parasite. The close relationship among these players suggests a history of co-development shaped in part by the growth of human civilizations.[7]

Although there are thousands of mosquito species worldwide, only three are known to transmit infections to humans. Even within these groups, only a select number

1 Timothy Winegard, "Five Ways Deadly Diseases Carried by Mosquitoes Have Steered the Course of Human History," BBC Science Focus Magazine, July 1, 2024, www.sciencefocus.com/planet-earth/five-ways-deadly-diseases-carried-by-mosquitoes-have-steered-the-course-of-human-history.
2 Winegard, "Five Ways Deadly Diseases Carried by Mosquitoes Have Steered the Course of Human History."
3 Silvia Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," *Environmental Research* 191 (August 15, 2020): 110038, doi.org/10.1016/j.envres.2020.110038.
4 Giunti, Becker, and Benelli, "Invasive mosquito vectors in Europe: From bioecology to surveillance and management."
5 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038.
6 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors."
7 Jeffrey R. Powell, "An Evolutionary Perspective on Vector-Borne Diseases," *Frontiers in Genetics* 10 (December 17, 2019), doi.org/10.3389/fgene.2019.01266.

of species are capable of biting humans and spreading disease.[8] As with any other type of infectious disease, the players in mosquito-borne diseases are dynamic. They evolve to fit their situations. Research shows the yellow fever mosquito did not originally feed primarily on humans. However, it evolved to prefer biting humans after finding good breeding grounds of pooled water around human settlements. Similarly, Culex mosquitoes previously fed on birds but have now evolved to bite humans too.

The mosquito-borne diseases that we know today likely started out as general diseases that could be transmitted by a range of vectors to a range of hosts. With the rise of agriculture, mosquitoes built habitats in pools of water and rice fields. The disease-causing agents, called pathogens, also found a good host and a viable carrier. Thus, it became beneficial for the pathogens and the mosquitoes to evolve a close affinity to humans, as they provided them with necessary resources to grow and reproduce.[9] Nowadays, mosquitoes and the pathogens they carry have adapted and integrated very closely with human populations. They thrive in towns, villages, cities, and other types of human settlements.

Painting of Yellow fever in Buenos Aires, 1871 (Credit: Wellcome Collection Gallery)

Mosquito-borne pathogens range from single-celled organisms with a nucleus and organelles, like the malaria parasite, to tiny viruses.[10] Out of all the different types of pathogens, RNA viruses are the quickest to evolve.[11] The increase in West Nile fever over the past decades is a prime example of this. This disease is caused by an RNA virus. Recent outbreaks in Europe have been linked with bird migration from Africa, which suggests that the virus likely jumped hosts.[12] In the United States, the virus adapted in around 10 years to be transmitted by mosquitoes that were local to the country, showing that the virus can adapt quickly to new vectors.[13]

Mosquito-borne diseases have been part of human life since very early history. For instance, malaria has affected humans since early Chinese and Greek civilizations.[14] Some estimate that the disease killed over 100 billion over the course of human history.[15] Before the malaria parasite was discovered, the disease was already closely linked to areas with swamps, which we now know are prime mosquito

8 Bernard Agyei Adams, "Mosquito-borne diseases and their vectors," Target Malaria, targetmalaria.org/latest/blog/mosquito-borne-diseases-and-their-vectors/.
9 Powell, "An Evolutionary Perspective on Vector-Borne Diseases."
10 Kenneth J. Arrow, Claire Panosian, and Hellen Gelband, "A Brief History of Malaria," *Saving Lives, Buying Time: Economics of Malaria Drugs in an Age of Resistance,* (Washington DC: National Academies Press; 2004), www.ncbi.nlm.nih.gov/books/NBK215638/.
11 Powell, "An Evolutionary Perspective on Vector-Borne Diseases."
12 Luis Hernandez-Triana, "Exploring the Rise of Vector-borne Diseases," Alpha Science, July 6, 2023, aphascience.blog.gov.uk/2023/07/06/vector-borne-diseases-2/.
13 Powell, "An Evolutionary Perspective on Vector-Borne Diseases."
14 Arrow, Panosian, and Gelband, "A Brief History of Malaria."
15 Winegard, "Five Ways Deadly Diseases Carried by Mosquitoes Have Steered the Course of Human History."

breeding sites. The characteristic smell of wetlands inspired the name *mala aria*, meaning "bad air."[16] Despite our long history with these diseases, it was not until 1877 that scientists discovered that mosquitoes were the ones to infect humans. The first disease to be linked to mosquitoes was lymphatic filariasis, caused by a worm parasite, because of the ability to easily see the parasite larvae inside mosquitoes.[17] Less than a decade later, in 1881, a doctor in Cuba realized that yellow fever followed similar seasonal patterns to mosquito lifestyles. Mosquitoes were confirmed to be a vector of the disease when a US Army physician carried out an experiment in 1900. He let *Aedes aegypti* mosquitoes bite soldiers with yellow fever and then healthy ones, himself included. He discovered that the previously healthy soldiers showed symptoms of yellow fever.[18] The malaria parasite was first discovered in humans in 1880, but it was not until 17 years later that it was discovered that the parasites grew in mosquitoes too.[19] Some other diseases have emerged recently, like Zika, which was first discovered in 1947 in Uganda. It was found in Aedes mosquitoes in the next year and had its first large outbreak in 2007. Over the past 70 years, the virus has spread from Uganda and Tanzania to many other countries in the tropics, with very rapid expansion in the 2010s.[20]

Mosquito evolution and human activities are very closely linked. Mosquito-borne disease prevalence is affected by vaccines and drugs employed against pathogens, the use of pesticides, and human behavioral activities like using screens on windows and doors to restrict the vector. Many mosquitoes have now developed resistance to insecticides, and pathogens have evolved strains that are resistant to the drugs we use to treat many diseases.[21] Further, the impact of human activities on the environment is also changing the habitats of mosquitoes. Similarly, human travel and migration patterns also spread mosquitoes and the diseases they carry.[22]

Just like how humans have played an important role in shaping the genetics and habitats of mosquitoes and the diseases they carry, they have also played an instrumental role in human history and genetics. A good example is malaria's relationship with the hemoglobin S gene. This is a variant of the normal beta-hemoglobin gene, which causes sickle cell anemia.[23] The malaria parasite infects red blood cells and digests hemoglobin, the molecule we use to transport oxygen.[24] Inheriting a copy of the hemoglobin S gene from both parents causes sickle cell anemia, a genetic disease where red blood cells change shape and become less efficient. They become rigid and can no longer transport oxygen as efficiently. However, if someone only inherits hemoglobin S from one of their parents, they become significantly less susceptible to malaria. When their red blood cells become infected with malaria, they change shape. Malaria can no longer grow in the rigid cells, and they are discarded by the body. Other uninfected cells remain round-shaped and can continue to deliver oxygen.[25] Over the past millennia, people with one copy of the hemoglobin S gene had an important evolutionary advantage. Thus, nowadays, there are also high numbers of sickle cell anemia in regions where malaria is endemic.[26]

Mosquito-borne diseases have also changed the course of human history in other ways. For instance, they were an important contributor in the United States'

16 Arrow, Panosian, and Gelband, "A Brief History of Malaria."
17 Heather D. Marshall et al., "History of Mosquitoes as a Disease Vector: The Story of Yellow Fever," EBSCO Information Services, April 26, 2022, www.ebsco.com/blogs/health-notes/2002364/history-mosquitoes-disease-vector-story-yellow-fever.
18 Marshall et al., "History of Mosquitoes as a Disease Vector: The Story of Yellow Fever."
19 Arrow, Panosian, and Gelband, "A Brief History of Malaria."
20 "Zika: The Origin and Spread of a Mosquito-borne Virus," World Health Organization, 2016, www.who.int/publications/m/item/zika-the-origin-and-spread-of-a-mosquito-borne-virus.
21 Powell, "An Evolutionary Perspective on Vector-Borne Diseases"; Arrow, Panosian, and Gelband, "A Brief History of Malaria."
22 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038.
23 Arrow, Panosian, and Gelband, "A Brief History of Malaria."
24 Arrow, Panosian, and Gelband, "A Brief History of Malaria."
25 Mia Rozenbaum, "How sickle cell protects against Malaria," Understanding Animal Research, June 19, 2019, www.understandinganimalresearch.org.uk/news/how-sickle-cell-protects-against-malaria-a-sticky-connection.
26 Arrow, Panosian, and Gelband, "A Brief History of Malaria."

War of Independence battles. *Anopheles* mosquitoes were native to Yorktown, where the battle that ended the American Revolutionary War took place. British troops fell ill after being stationed in Yorktown during mosquito season. This weakened state of British forces was a contributing factor to ending the war.[27] Furthermore, colonial powers in the 17th century also took advantage of what they knew about mosquito-borne diseases. They were aware that certain South American trees could protect them from it. This knowledge allowed them to secure colonial outposts in tropical countries burdened with the parasite.[28]

Historically, attempts to control mosquito-borne diseases often focused on drastic environmental changes, such as draining wetlands or clearing vegetation. While these measures sometimes reduced mosquito populations, they also destroyed habitats vital for biodiversity, disrupted water cycles, and degraded ecosystems that help regulate climate. Today, UNEA must recognize that effective solutions require balance. Protecting public health from mosquito-borne diseases should also preserve the ecological functions of wetlands, forests, and other landscapes. Efforts to reduce disease should not come at the cost of long-term environmental sustainability.

Mosquito larvae growing in a storm puddle (Credit: Mary Hollinger)

Environmental Factors Driving Mosquito Growth

Changes in mosquito populations are linked to changes in the environment. Mosquitoes are massively impacted by any changes in their living space. These include temperature, rain, climate, and extreme weather events. Also, since their habitats are closely related to human ones, they are also very sensitive to changes in human activity. Major activities that have an impact are climate change, deforestation, and urban development.[29] These changes can influence increased biting, seasonal behavior, hatching rates, and death rates. For example, a study in São Paulo, Brazil, analyzed various factors that are affecting mosquito populations. It found that rainfall and temperature were majorly affecting their growth rate.[30] Hence, different areas in the country had different levels of population density.

Further, a 2020 review found a positive association between temperature and mosquito density. This means that, on average, if temperature increases, the mosquito population is also likely to increase.[31] Changes in temperature can also affect mosquitoes' ability to fly, how they seek hosts, and how

27 Winegard, "Five Ways Deadly Diseases Carried by Mosquitoes Have Steered the Course of Human History."
28 Winegard, "Five Ways Deadly Diseases Carried by Mosquitoes Have Steered the Course of Human History."
29 Wenfei Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," *Journal of Mosquito Research* 14, no. 4, (January 1, 2024): 195-203, doi.org/10.5376/jmr.2024.14.0019.
30 Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.
31 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038.

they develop from larvae to adults. Studies on *Anopheles* mosquitoes in tropical areas showed that higher temperatures were linked to smaller larvae and shorter lifespans. Similar studies on *Culex* mosquitoes indicated that higher temperatures were linked to faster development but lower survival rates.[32] Other studies focusing on West Nile Fever, transmitted by *Culex* mosquitoes, showed higher temperatures were associated with longer mosquito seasons.[33] Temperature is the most important factor affecting malaria. This is because malaria parasites are also very sensitive to temperature.[34]

Several projections suggest that climate change will expand mosquito habitats for several species. This could increase the risk for outbreaks of diseases such as dengue, malaria, and West Nile fever in temperate regions.[35] The effects of climate change can lengthen mosquito seasons worldwide and expand mosquito habitats to new regions.[36] Global expansion of *Aedes* mosquitoes is projected in Europe and high-elevation tropical and subtropical regions.[37] The World Mosquito Program also warns that climate change has increased the vectorial capacity of mosquitoes. This is the average number of people getting infected from one original infection, which is greater per mosquito. In the last 70 years, the number of infections transmitted by the yellow fever mosquito increased by 13 percent.[38] Climate change can also change the traits of mosquito populations. Rising sea levels and the expansion of water bodies with high salinity can push mosquitoes to evolve to be more resistant to salinity, expanding breeding grounds even further.[39]

Extreme weather changes also affect mosquito populations. Droughts, high rainfalls, floods, and heatwaves all provide good conditions for mosquitoes.[40] Droughts encourage people to store water in containers where mosquitoes breed and reproduce, and rainfall or floods can create massive pools of water. Therefore, changes in rainfall, including timing and intensity of rain, is linked to changes in mosquito populations. In 2021, Germany experienced severe floods. As a consequence, the mosquito density increased tenfold.[41] Heatwaves also make it possible for mosquitoes to reproduce in non-tropical areas and expand their habitats. Countries experiencing unusual rises in temperature, like during *El Niño* events, are especially vulnerable and must be studied on a case-by-case basis.[42]

When mosquito density increases, it does not just affect human health; it also reshapes ecological interactions. More mosquitoes mean more food for predators like fish, birds, bats, and amphibians, which can temporarily boost their populations. However, this can destabilize food webs if predator numbers rise and then crash once mosquito levels return to normal. The sudden surges in mosquito density also often coincide with extreme weather events that stress ecosystems. Floods may create vast new breeding sites but also displace species and wash away soil nutrients, compounding environmental disruption. Climate anomalies amplify these effects, allowing mosquitoes to invade new areas and disturb ecosystems that have never adapted to their presence.

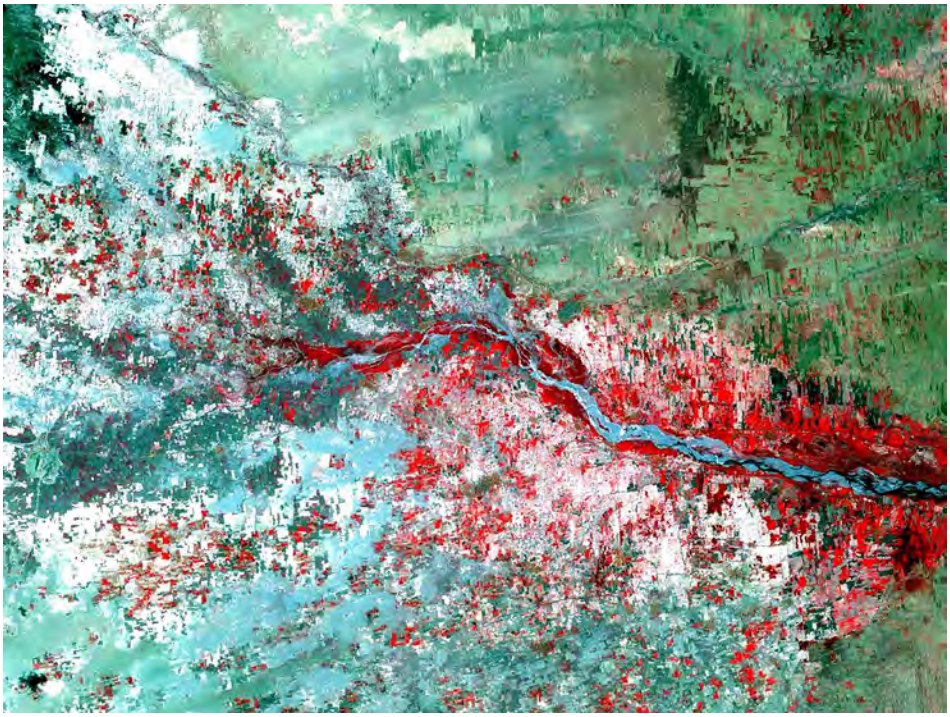
32 Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.
33 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038.
34 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038.
35 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038.
36 World Mosquito Program, "Explainer: How Climate Change Is Amplifying Mosquito-borne Diseases."
37 Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.
38 World Mosquito Program, "Explainer: How Climate Change Is Amplifying Mosquito-borne Diseases."
39 Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.
40 "Explainer: How Climate Change Is Amplifying Mosquito-borne Diseases" World Mosquito Program, (April 22, 2022), www.worldmosquitoprogram.org/en/news-stories/stories/explainer-how-climate-change-amplifying-mosquito-borne-diseases.
41 World Mosquito Program, "Explainer: How Climate Change Is Amplifying Mosquito-borne Diseases."
42 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038; Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.

Deforestation is a large contributor to mosquito abundance.[43] Forests that have been turned into urban areas or grazing land show an increase in mosquito density, especially in artificial water storage containers, puddles, and drinking troughs for cattle.[44] Deforestation has also been linked to a decrease in diversity in mosquito species.[45] Deforestation tends to reduce mosquito species diversity since cutting down forests wipes out the specialized habitats that support different mosquito species. Forest mosquitoes that rely on shaded pools, tree holes, or dense vegetation often decline or disappear altogether. However, the species that do survive tend to be the generalists and the very species most efficient at spreading diseases.[46] Although deforestation reduces overall mosquito diversity, it can actually increase the abundance of the most dangerous mosquito species. Many mosquitoes, which experience population growth with deforestation, also feed on cattle. This creates an environment in which livestock could become hosts of mosquito-borne diseases. This could negatively affect the productivity of farms and create an environment where diseases from cattle could jump to humans through mosquitoes.[47]

Community members in Ghana at a capacity building event focused on bednet use as part of a malaria-control program (Credit: Elitre)

Moreover, human factors, such as building cities, land usage, and migration, can create new habitats for mosquitoes, which bear disease.[48] Urbanization has created many aquatic breeding sites for mosquitoes of different species. These include buckets, flower pots, and swimming pools.[49] Socioeconomic differences in urbanization also play a huge role in this. Housing development and population growth make predicting the climate change impact harder. For instance, lower-income communities without access to running water are more likely to have standing water and garbage, which increases mosquito population densities.[50] The systems that we develop to monitor these diseases have to take human activities into consideration.

43 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038; Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.
44 Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.
45 Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.
46 Nathan D. Burkett-Cadena and Amy Y. Vittor, "Deforestation and Vector-borne Disease: Forest Conversion Favors Important Mosquito Vectors of Human Pathogens," *Basic and Applied Ecology* 26 (September 23, 2017): 101–110, doi.org/10.1016/j.baae.2017.09.012.
47 Burkett-Cadena and Vittor, "Deforestation and Vector-borne Disease: Forest Conversion Favors Important Mosquito Vectors of Human Pathogens."
48 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038.
49 Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.
50 World Mosquito Program, "Explainer: How Climate Change Is Amplifying Mosquito-borne Diseases"; Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," 195-203.



Yemen's potential mosquito habitat in vegetation post floods, in red. (Credit: NASA Goddard Space Flight Center)

Mosquito populations are different in parts of the world. Therefore, tracking diseases spread by mosquitoes can be very difficult. When thinking of solutions, delegates should think about the need to introduce many different ideas that consider implementation, tracking, and outbreak response.[51]

Traditional Disease Control Methods

Over time, humanity has developed methods to control these mosquito diseases. Traditional control methods include the use of barrier methods, the reduction of breeding sites, and the use of chemicals to kill or repel vectors.[52] Some vaccines and treatments have been developed, but vector control methods remain the most prominent. The simplest forms of vector control are barrier methods. These methods are often simple and include closing doors and windows to rooms to prevent mosquitoes from entering, especially at night. Nets are also widely used for this purpose. Nets can be placed on windows to allow proper air circulation while still restricting mosquito passage. They can also be placed over beds to protect members of the household while they rest or sleep.[53] Other recommendations include the use of clothing that covers large areas of the skin.[54]

Often, direct methods are combined to increase effectiveness. For example, DDT and pyrethroids have been extensively used against all major mosquito vector species. Insecticides are incorporated within mosquito nets to increase longevity. In India, they are one of the main vector control strategies. In countries with many mosquitoes, these nets are sold and produced by many companies.[55] When mosquitoes try to pass through these nets, the pesticides in them disrupt their nerve cells. This prevents the transmission of signals through their nervous system and ultimately kills them.[56] Similarly, the use of insect repellents on exposed skin is widely recommended.

However, pesticides are often misused, and gaps in knowledge or care can cause problems such as chemicals flowing back into water supplies, drifting through the air to unintended areas, or

51 World Mosquito Program, "Explainer: How Climate Change Is Amplifying Mosquito-borne Diseases."
52 Badrudeen Teslim,"Traditional vs. Modern Vector Control Methods: A Comparative Study," 2023, www.researchgate.net/publication/387381731_Traditional_vs_Modern_Vector_Control_Methods_A_Comparative_Study.
53 "Recomendaciones Para Controlar Los Mosquitos," Ministerio De Salud Y Protección Social De Colombia, Accessed June 4th, 2025, www.minsalud.gov.co/salud/publica/Paginas/enfermedades-transmitidas-por-el-Aedes-aegypti.aspx.
54 Ministerio De Salud Y Protección Social De Colombia, "Recomendaciones Para Controlar Los Mosquitos."
55 Bharat Singh et al., "Insecticidal Paint: An Alternate Integrated Vector Management Strategy for Mosquito Control," *Process Safety and Environmental Protection* 186 (March 30, 2024): 486–94, doi.org/10.1016/j.psep.2024.03.118.
56 Afeefa Chaudhry, "Mosquito Control Methods and Their Limitations," *Pure and Applied Biology* 8, no. 4 (September 7, 2019), doi.org/10.19045/bspab.2019.80184.

being disposed of unsafely.[57] These can build up and pollute water, soil, and air, among other valuable resources. Additionally, a lack of proper use can lead to harming the wrong species. When this occurs, it further damages biodiversity in these regions. This is a major part of UNEP's triple planetary crisis.[58] Biodiversity is crucial in controlling populations of mosquitoes and other vectors and must be emphasized in finding solutions to disease-carrying species.

Chemical repellents are also a very common traditional method to protect people from mosquito-borne diseases. Repellents interfere with the ability of mosquitoes to find hosts to bite. However, their use comes with certain risks. Most bug repellents contain DEET (N,N-diethyl-meta-toluamide) as their main active ingredient. Other, less effective repellents use pyrethrins, which are made from chrysanthemum flowers. Pyrethrins are usually nontoxic but can cause respiratory complications in high doses.[59] It is possible for humans and animals to be poisoned with both types of bug spray. DEET can cause burning on certain areas of the skin and can dangerously lower heartbeat and blood pressure if swallowed. DEET poisoning can also induce a coma in the worst situations. This is especially a concern for children swallowing the repellent. Children are much more sensitive to having DEET on their skin for too long, which can cause seizures.[60] Pyrethrins cause coughing, irregular oxygen levels, tremors, seizures, and vomiting.[61] All this considered, when used carefully and correctly, using these repellents can be the most sensible choice, especially in an area with high mosquito-borne disease incidence.[62] Other botanical insecticides, with varying degrees of effectiveness, can be used as sustainable alternatives to chemical pesticides in areas where these are unavailable or their use is not allowed to prevent pollution. Mint, lemongrass, sweet basil, and citronella extracts can all help control vectors.[63]

In the next 25 years, it is estimated that over 70 percent of people on Earth will live in cities, which suggests that chemical control will have an increasingly important role in the future.[64] Indoor residual spray is a widely applied strategy recommended by the WHO and local governing bodies. It consists of spraying indoor spaces with DDT and other chemical pesticides to make surfaces difficult for mosquitoes to live on. These chemicals reduce the lifespan of mosquitoes that come in contact with the surface or kill them directly.[65] It is also possible to manufacture insecticidal paint that serves this same function. Other chemical options against mosquitoes include insecticidal space spray. These sprays create clouds of insecticide droplets that can kill mosquitoes mid-flight.[66] This can be especially useful in emergencies. However, not all options are as easy to access and use.[67] With growing populations in need, it is important to consider the sustainability of such solutions, both in their impacts and distribution.

The reduction of breeding sites is another major tool for controlling mosquito populations. One adult mosquito can lay between 80 and 150 eggs at a time, four times a day, meaning that mosquitoes can reproduce quickly and in huge numbers.[68] This can be prevented starting in the home by increasing access to clean water. According to

57 United Nations Environment Programme (UNEP), *"Frequently Asked Questions,"* accessed August 20, 2025, www.unep.org/who-we-are/frequently-asked-questions.
58 United Nations Framework Convention on Climate Change (UNFCCC), "What Is the Triple Planetary Crisis," accessed September 20, 2025, unfccc.int/news/what-is-the-triple-planetary-crisis.
59 *The A.D.A.M. Medical Encyclopedia*, s.v. "Bug Spray Poisoning," last updated November 2, 2023, medlineplus.gov/ency/article/002763.htm.
60 *The A.D.A.M. Medical Encyclopedia*, s.v. "Bug Spray Poisoning."
61 *The A.D.A.M. Medical Encyclopedia*, s.v. "Bug Spray Poisoning."
62 *The A.D.A.M. Medical Encyclopedia*, s.v. "Bug Spray Poisoning."
63 Chaudhry, "Mosquito Control Methods and Their Limitations."
64 Chaudhry, "Mosquito Control Methods and Their Limitations,"
65 Singh et al., "Insecticidal Paint: An Alternate Integrated Vector Management Strategy for Mosquito Control."
66 [1] World Health Organization, *WHO CDS WHOPES GCDPP 2003.5*, WHO publication, www.who.int/publications/i/item/who-cds-whopes-gcdpp-2003.5.
67 Singh et al., "Insecticidal Paint: An Alternate Integrated Vector Management Strategy for Mosquito Control."
68 Ministerio De Salud Y Protección Social De Colombia, "Recomendaciones Para Controlar Los Mosquitos."

Sterile Insect Release Ceremony for Dengue Mosquito Control in Brazil (Credit: IAEA Imagebank)

UNICEF and the World Health Organization (WHO), in 2022, only 54 percent of urban and 28 percent of rural households had access to safe drinking water. Out of these households, only a small group had access to proper sanitation.[69] In that same year, about two billion people lived in areas with less water, suggesting how some communities depend on stored water.[70] This creates a perfect location where larvae can hatch, develop into pupae, and then grow as mosquitoes. Different species of mosquito have preferences on the type of water where they like to lay eggs. Some species have the choice to reproduce in wastewater, and others in pools or other bodies of still, clean water. These differences highlight the need for different strategies for each type of species. Overall, however, UNEA delegates should consider how to protect clean water in the environment and encourage control methods with limited environmental impact.

There are several general control recommendations that are widely possible. These can start with public education or other campaigns. The Colombian Ministry of Health and Social Protection suggests brushing and cleaning pools consistently as well as putting chlorine in flower pots, cleaning patios, and carefully disposing of food containers.[71] It is also important to clean these containers regularly. In tropical areas, it is also important to design water collection points in ways that do not allow pools of standing water to be created.[72]

Overall, commonly used methods are effective. They have been used for several decades with important success. They are often accessible and affordable, as they have very low upfront costs. However, they can fail when not used consistently or when mosquitoes develop resistance to these chemicals.[73] As delegates in UNEA, the negative impact of pesticides must also be weighed against their effectiveness.

Emergence of Eco-Friendly Solutions

Mosquitoes are constantly evolving, which means that they quickly adapt to methods to control them. For example, mosquitoes in multiple Southeast Asian countries, like Malaysia, Thailand, and Myanmar, are now not affected by certain common pesticides.[74] Because of this, we have had to develop new ways to control the spread of mosquito-borne diseases.

69 "Water and sanitation interventions to prevent and control mosquito-borne disease: focus on emergencies", World Health Organization and the United Nations Children's Fund (UNICEF), 2024, www.who.int/publications/i/item/9789240090644
70 World Health Organization and the United Nations Children's Fund (UNICEF), "Water and sanitation interventions to prevent and control mosquito-borne disease: focus on emergencies."
71 Ministerio De Salud Y Protección Social De Colombia, "Recomendaciones Para Controlar Los Mosquitos."
72 World Health Organization and the United Nations Children's Fund (UNICEF), "Water and sanitation interventions to prevent and control mosquito-borne disease: focus on emergencies."
73 Singh et al., "Insecticidal Paint: An Alternate Integrated Vector Management Strategy for Mosquito Control."
74 Jue Tao Lim et al., "Efficacy of *Wolbachia*-mediated sterility to reduce the incidence of dengue: a synthetic control study in Singapore," *The Lancet Microbe* 5, no. 5, (May 2024): 422 - 432, www.thelancet.com/journals/lanmic/article/PIIS2666-5247(23)00397-X/fulltext.

With recent technology growth, we can use biological pesticides, natural predators, radiation, surveillance systems, and integrated approaches to control mosquitoes.

Chemical pesticides might harm non-target organisms. This includes beneficial insects like bees and aquatic plants and animals.[75] The ecological repercussions of aggressive mosquito control strategies can have long-lasting impacts on the environment.[76] In England, certain types of pesticides have been directly linked to long-term changes in pollinator populations.[77] Many experts recommend the use of biological control agents instead. Biological control agents are organisms that can control the population of a target species. In this case, it is disease-carrying mosquitoes. They are specific in their mode of action. This means that they have very limited impact on non-target species. These agents are often mosquito predators, pathogens, or parasites and can affect mosquitoes in different stages of their life cycles.

For example, mosquito larvae can be controlled by bacterial toxins produced by *Bacillus thuringiensis israelensis*.[78] This is a species of bacteria commonly used in agriculture for pest control. These spores, however, only affect certain species of mosquitoes and flies. They have no effect on other organisms.[79] Mosquito larvae numbers can also be controlled through predators such as copepods, turtles, and guppies.[80]

Adult mosquito numbers can be controlled by fungi, which are already an important part of natural ecosystems.[81] Fungi are an especially interesting control agent because fungi that infect insects are not harmful to other animals or plants. These fungi attach to the exoskeleton of their hosts. Next, they infect the hosts' circulatory system. When the insect becomes colonized, the fungus breaks down the insect body. Then, structures grow to make spores and reproduce.[82] While using fungi to control mosquitoes is not widespread, similar environmentally friendly strategies have been used to successfully control beetle populations in forests.

Further, growth in genetic engineering has allowed for biopesticides. Scientists can introduce new genes into the DNA of organisms. DNA contains the instructions to make all the proteins an organism needs. Currently, researchers are exploring ways in which more fungi can be created to impact flies and mosquitos.[83] Similarly, bacteria have been able to limit the growth and vectorial capacity of adult mosquitoes. Further, plant-based repellents have been studied extensively. They are usually more environmentally friendly than common repellents. Most importantly, they also have proven to be very efficient.[84]

A Sterile Insect Technique (SIT) is another environmentally friendly control mechanism. It was developed jointly by the UN International Atomic Energy Agency (IAEA) and the UN Food and Agriculture Organization (FAO), in collaboration with WeRobotics.[85] This technique consists of breeding mosquitoes,

75 Vivekanandhan Perumal et al., "A review of entomopathogenic fungi as a potential tool for mosquito vector control: A cost-effective and environmentally friendly approach," *Entomological Research* 54, (2024), doi.org/10.1111/1748-5967.12717.
76 Perumal et al., "A review of entomopathogenic fungi as a potential tool for mosquito vector control: A cost-effective and environmentally friendly approach."
77 Perumal et al., "A review of entomopathogenic fungi as a potential tool for mosquito vector control: A cost-effective and environmentally friendly approach."
78 Peter Dambach et al., "Beyond top-down: community co-creation approaches for sustainable dengue vector control," *Global Health Action* 17, no. 1, (2024), doi.org/10.1080/16549716.2024.2426348.
79 ISAAA, *Agricultural Biotechnology (A Lot More than Just GM Crops)*, (Los Baños: International Service for the Acquisition of Agri-biotech Applications, May 2014), www.isaaa.org/resources/publications/agricultural_biotechnology/download/agricultural_biotechnology.pdf.
80 Dambach et al.,"Beyond top-down: community co-creation approaches for sustainable dengue vector control."
81 Perumal et al., "A review of entomopathogenic fungi as a potential tool for mosquito vector control: A cost-effective and environmentally friendly approach."
82 Perumal et al., "A review of entomopathogenic fungi as a potential tool for mosquito vector control: A cost-effective and environmentally friendly approach."
83 Perumal et al., "A review of entomopathogenic fungi as a potential tool for mosquito vector control: A cost-effective and environmentally friendly approach."
84 Dambach et al.,"Beyond top-down: community co-creation approaches for sustainable dengue vector control."
85 International Atomic Energy Agency, Food and Agriculture Organization, and WeRobotics, "Mosquito-packed drones ready to join fight against Zika and other deadly diseases," *UN News,* April 19, 2018, news.un.org/en/story/2018/04/1007672.

using radiation to sterilize the males, and releasing them over large areas with drones. The radiation sterilizes without harming the ability to mate. The released mosquitoes will mate with the females in the wild but will not produce offspring. Thus, the mosquito population will decline over time.[86] This control strategy was originally developed for flies but is also useful for the control of *Aedes aegypti* mosquitoes.[87] This technology allows local authorities to cover 20 hectares of land in around 5 minutes, with the capacity of drones projected to increase to 150 thousand mosquitoes per flight.[88] However, this control method has its challenges. Sterile mosquitoes must be continuously released, or the population of mosquitoes slowly returns. Scientists have also been able to introduce a gene that makes female mosquitoes hatch without ovaries. While the females are infertile, males can carry the gene and pass it on to female offspring. This means that the gene can persist in the population without constant release of sterile females.[89]

Geographic information systems (GIS) are another important development of the last few years. A GIS is a type of computer system that can analyze geographic data specific to a particular location.[90] This is used in many areas of climate monitoring, where accessible. The growth in the use of these systems has been very useful for mosquito-borne disease control. It can map areas facing high risks, predict how vectors will be distributed in the future, and plan targeted interventions.[91] In Mexico, a group of researchers collected data from dengue infections between 2008 and 2020. They found a 62 percent overlap with Zika hotspots and a 53 percent overlap with chikungunya incidence. Their data strongly suggests that geographical disease surveillance for one disease is often useful for predicting outbreaks of other diseases transmitted by the same vector.[92] In the United States, the National Aeronautics and Space Administration (NASA) works closely with local authorities as well as public health officials to map the locations of mosquitoes that could potentially carry disease.[93]

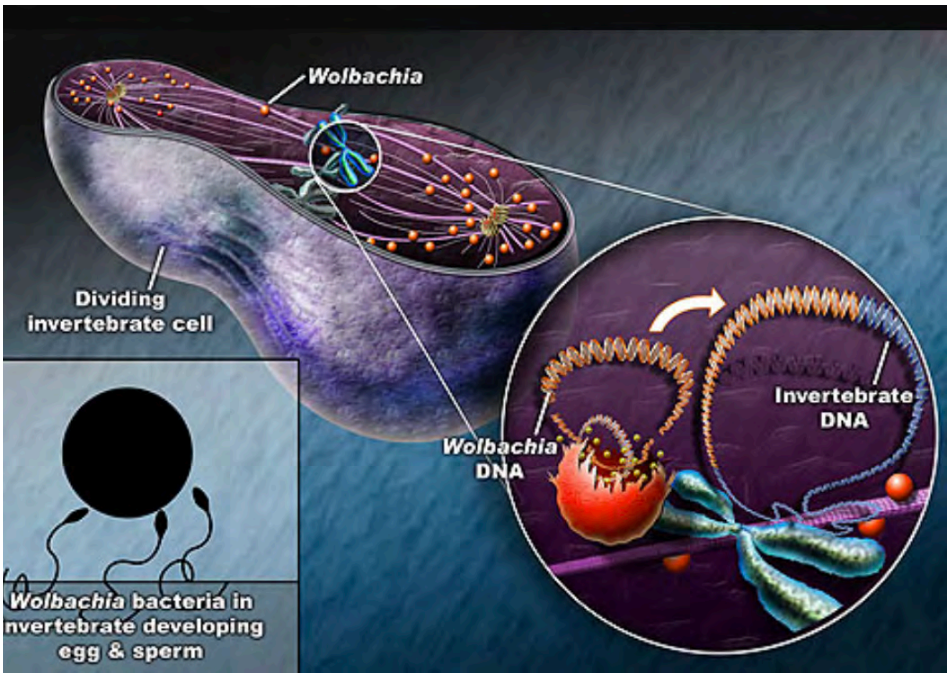
These newer strategies are not always effective when used on their own. Frameworks must be developed for integrated mosquito control. It allows communities and countries to enhance effectiveness and reduce costs of vector control.[94] Often, national vector control programs are overseen by a national health agency or health-related body. Bodies that coordinate other important areas, such as agriculture and construction, might be unaware of their impact on vector populations.[95] Thus, UNEA promotes cross-sector collaboration, as human health and the environment are inextricably linked. Interactive community workshops and awareness campaigns can also be very useful.[96] They give community members tools needed to participate in vector control. Workshops can also help inform communities on how to manage household insecticides and identify breeding sites. It is through such programs that better knowledge can be gained and global collaboration can be fostered. New techniques

86 International Atomic Energy Agency, Food and Agriculture Organization, and WeRobotics, "Mosquito-packed drones ready to join fight against Zika and other deadly diseases;" "El éxito en el control del mosquito: un enfoque integrado," Environmental Protection Agency, accessed June 23, 2024, espanol.epa.gov/control-de-plagas/el-exito-en-el-control-del-mosquito-un-enfoque-integrado
87 International Atomic Energy Agency, Food and Agriculture Organization, and WeRobotics, "Mosquito-packed drones ready to join fight against Zika and other deadly diseases."
88 International Atomic Energy Agency, Food and Agriculture Organization, and WeRobotics, "Mosquito-packed drones ready to join fight against Zika and other deadly diseases."
89 Dino Grandoni, "We finally may be able to rid the world of mosquitoes. But should we?" *The Washington Post*, June 3, 2025, www.washingtonpost.com/climate-environment/2025/06/03/mosquito-extinction-gene-editing-malaria/.
90 "What is a geographic information system (GIS)?" United States Geological Survey, accessed June 23, 2025, www.usgs.gov/faqs/what-a-geographic-information-system-gis.
91 Brugueras et al., "Environmental Drivers, Climate Change and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," 110038.
92 World Mosquito Program, "Explainer: How Climate Change Is Amplifying Mosquito-borne Diseases."
93 World Mosquito Program, "Explainer: How Climate Change Is Amplifying Mosquito-borne Diseases."
94 Dambach et al.,"Beyond top-down: community co-creation approaches for sustainable dengue vector control."
95 Peter N. Ng'ang'a, Polycarp Aduogo, and Clifford M. Mutero, "Strengthening community and stakeholder participation in the implementation of integrated vector management for malaria control in western Kenya: a case study," *Malar J* 20, no. 155 (2021). doi.org/10.1186/s12936-021-03692-4.
96 Dambach et al.,"Beyond top-down: community co-creation approaches for sustainable dengue vector control."

must be made accessible around the world, limiting any barriers to usage or access.

Case Study: Dengue, *Wolbachia,* and the World Mosquito Program

Wolbachia is a genus of common bacteria found in insects. It is currently one of the most promising ways to control diseases such as dengue.[97] They are parasitic bacteria. This means that they live inside the cells of insects and hijack their biological systems, but they are unable to survive outside their hosts.[98] These bacteria were first isolated in 1924 and first considered for pest control in 1990.[99] *Wolbachia* can make some insects, such as mosquitoes, sterile under certain conditions.[100] When a male insect is infected with *Wolbachia* and mates with an uninfected female, their eggs do not hatch. When an infected female breeds with any male, all of their offspring are infected.[101] In biology, this phenomenon is known as cytoplasmic incompatibility. This control is essential, as many of these diseases reach beyond human populations. Dengue, for example, is also capable of infecting



Artist interpretation of *Wolbachia* entering host cell and DNA being incorporated into DNA of host cell (Credit: National Science Foundation)

primates, birds, pigs, and other potentially endangered species—making mosquito-borne diseases a direct concern for biodiversity and ecosystem stability.[102]

Mosquito-borne diseases like dengue are not confined to humans alone. Their ability to infect primates, birds, pigs, and even potentially endangered species means outbreaks ripple far beyond public health. When ecosystems are disrupted by disease, biodiversity loss accelerates, which undermines ecosystem resilience and the ability to adapt to climate change. Sick or declining bird populations disrupt seed dispersal and pollination, stressed primate groups can alter forest regeneration, and infected livestock like pigs affect food security and rural economies. If endangered species become hosts, their already fragile survival is put further at risk, accelerating biodiversity loss. In short, diseases spread by mosquitoes are not only a human health crisis but also a biodiversity and ecosystem stability crisis. This aligns with UNEA's mission to integrate human health, environmental protection, and

97 "Mosquitoes with *Wolbachia*," Centers for Disease Control and Prevention, accessed June 22, 2025, www.cdc.gov/mosquitoes/mosquito-control/mosquitoes-with-wolbachia.html.
98 Awoke Minwuyelet et al., "Symbiotic *Wolbachia* in mosquitoes and its role in reducing the transmission of mosquito-borne diseases: updates and prospects," *Frontiers in Microbiology* 14 (2024), doi.org/10.3389/fmicb.2023.1267832
99 Minwuyelet et al., "Symbiotic *Wolbachia* in mosquitoes and its role in reducing the transmission of mosquito-borne diseases: updates and prospects."
100 Centers for Disease Control and Prevention, "Mosquitoes with *Wolbachia*."
101 "How it works," World Mosquito Program, accessed June 22, 2025, www.worldmosquitoprogram.org/en/work/wolbachia-method/how-it-works.
102 S. X. W. Gwee et al., "Animals as Potential Reservoirs for Dengue Transmission," *One Health* (2021), https://www.sciencedirect.com/science/article/pii/S2352771421000069.

sustainable development into a unified approach.

Wolbachia is naturally present in around half of the insect populations around the world. Scientists were able to take bacteria from flies and use it to create infected *Aedes* mosquitoes.[103] Countries like the United States release *Wolbachia*-infected mosquitoes in similar ways to the IAEA and the FAO's implementation of SIT. They breed *Wolbachia*-carrying mosquitoes and release only the males. Because of cytoplasmic incompatibility, this has the same effect as releasing radiation-sterilized mosquitoes.[104] This provides a targeted way to reduce disease-carrying mosquitoes without harming non-disease-bearing species, protecting overall ecological balance.

The potential uses of *Wolbachia* for disease control go beyond approaches like the release of infection. Studies on this method have shown negligible risk to human life and the environment, especially since *Wolbachia* has been present in several insect species for hundreds of years.[105] Further, *Wolbachia* is not infectious, even between mosquitoes. It can only be transmitted from parent to offspring. Also, it does not alter the behavior of mosquitoes or interfere with current vector control methods like pesticides or repellents.[106] The release of *Wolbachia*-infected mosquitoes does not require any form of genetic modification. This makes Wolbachia a feasible strategy in countries with strict GMO regulations, broadening access to sustainable solutions across different governance systems.[107] In controlled trials in Yogyakarta, Indonesia, areas treated with *Wolbachia* had 77 percent fewer dengue cases and 86 percent fewer dengue hospitalizations. The bacteria was effective against all known strains of dengue virus.[108] The vectorial capacity of infected mosquitoes was almost null.[109] The WMP has significantly decreased dengue in Brazil, Colombia, Indonesia, and Australia.[110]

Diseases spread by mosquitoes are not only a human health crisis but also a biodiversity and ecosystem stability crisis. This aligns with UNEA's mission to integrate human health, environmental protection, and sustainable development into a unified approach.

There is still a need for more control cases to accurately assess the successes of the method in certain countries.[111] However, some argue that the World Mosquito Program (WMP)'s *Wolbachia* method could pay for itself in reduced disease-related costs. It is estimated that the annual economic burden of dengue in Southeast Asia is about USD 950 million. In Latin America, the annual cost can be over USD 3 billion.[112] It was calculated that the *Wolbachia* program saves 369 Disability-Adjusted Life Years (DALYs) per 100,000 members of the population. This means that every 10 years and for every 100,000 people, 369 years of healthy life that would otherwise be lost to the disease are regained.[113]

103 World Mosquito Program, "How it works."
104 Centers for Disease Control and Prevention, "Mosquitoes with *Wolbachia*."
105 Minwuyelet et al., "Symbiotic *Wolbachia* in mosquitoes and its role in reducing the transmission of mosquito-borne diseases: updates and prospects."
106 Lim et al., "Efficacy of *Wolbachia*-mediated sterility to reduce the incidence of dengue: a synthetic control study in Singapore."
107 Quevedo, Surjadjaja, and Jackson, "World Mosquito Program *Wolbachia* Factsheet."
108 Quevedo, Surjadjaja, and Jackson, "World Mosquito Program *Wolbachia* Factsheet."
109 Abdullah Al Noman et al., "Importance of *Wolbachia*-mediated biocontrol to reduce dengue in Bangladesh and other dengue-endemic developing countries," *Biosafety and Health* 5, (2023): 69-77, doi.org/10.1016/j.bsheal.2023.03.003.
110 Al Noman et al., "Importance of *Wolbachia*-mediated biocontrol to reduce dengue in Bangladesh and other dengue-endemic developing countries."
111 Pedro M. Sanggara et al., "The Effectiveness of *Wolbachia* Deployment as a Dengue Control Method: A Systematic Review," *Journal of Health and Medical Sciences* 7, no. 4, (2024), doi.org/10.31014/aior.1994.07.04.332.
112 Donald S. Shepard et al., "Economic evaluation of *Wolbachia* deployment in Colombia: A modeling study," *IPLoS One* 20, no. 4, (April 2025), doi.org/10.1371/journal.pone.0307045.
113 Shepard et al., "Economic evaluation of *Wolbachia* deployment in Colombia: A modeling study."

The program demonstrates how investments in environmentally sound solutions can reduce human suffering while saving billions in public health costs, supporting UNEA's emphasis on cost-effective and sustainable strategies.

In summary, *Wolbachia* is one of the most prominent and effective emerging vector control strategies to date. So far, this method has only been tested at large scales with *Aedes* mosquitoes, and most of the studies have been on dengue. Like any other vector control strategy, it is not a one-size-fits-all solution. However, this is an effective and environmentally advantageous.

Air Force entomologists sharing expertise with locals (Credit: DeAndreCurtiss)

Current Status

Prevalence and Geographic Spread of Mosquito-Borne Diseases

Mosquitoes are present all over the world, but they are not distributed evenly. Climate change and human activity are reshaping ecosystems everywhere, altering the landscape of mosquito-borne diseases.[114] The growth of cities increases the risk of transmission, and climate change is expanding both the geographical range and seasonality of diseases.[115] This means infections are expected to rise across larger areas and over longer periods within a year.

Climate change has had a major impact on mosquito populations. Increases in tempe

rature and rainfall make it easier for mosquitoes to reproduce, while floods and high humidity extend their lifespans.[116] Even small changes in temperature or precipitation can boost survival and reproduction rates. Development and deforestation also play a role: new buildings concentrate human populations, making it easier for mosquitoes to feed on humans rather than other animals such as monkeys.[117]

Areas with endemic mosquito-borne diseases usually have infections present at a constant level.[118] These countries are often located between the tropics, with warm weather year-round. For example, malaria is endemic in several African countries, while

114 Sadie Ryan, Catherine Lippi, and Anna Stewart-Ibarra, "Mapping geographic and demographic shifts for container breeding mosquito-borne disease transmission suitability in Central and South America in a warming world," *PLOS Climate* 3, no. 5, (May 2024), doi.org/10.1371/journal.pclm.0000312.
115 Ryan, Lippi, and Stewart-Ibarra, "Mapping geographic and demographic shifts for container breeding mosquito-borne disease transmission suitability in Central and South America in a warming world."
116 Abbasi, "Global expansion of Aedes mosquitoes and their role in the transboundary spread of emerging arboviral diseases: A comprehensive review."
117 Giunti, Becker, and Benelli, "Invasive mosquito vectors in Europe: From bioecology to surveillance and management."
118 *The A.D.A.M. Medical Encyclopedia*, s.v. "Endemic," accessed July 25, 2025, medlineplus.gov/ency/article/002362.htm

many in Central and South America face viral diseases transmitted by Aedes mosquitoes. A study on the Americas projected that Brazil, Colombia, and Venezuela will face the highest population-level impacts due to climate change, with strong correlations between rising temperatures and increased disease risk.[119]

Tropical regions are not the only ones affected. Subtropical and temperate areas are becoming better habitats for mosquitoes, particularly Aedes aegypti and Aedes albopictus, which transmit dengue and Zika.[120] These invasive species have spread worldwide, now present in temperate regions of North America, Southern Europe, and East Asia. Their adaptation to colder climates, combined with warming trends in Europe and Asia, has made these regions increasingly hospitable.[121] The European Centre for Disease Prevention and Control reports that 13 countries now have established, self-sustaining Aedes albopictus populations.[122] In 2022, mainland Europe recorded 71 locally acquired dengue cases, the same as the total number of cases from 2010–2021, and the highest number of West Nile fever cases since 2018.[123] While case numbers remain low compared to endemic regions, health systems are often unprepared for such outbreaks.

Anopheles mosquitoes, which transmit malaria, remain concentrated in tropical countries. Malaria transmission is more intense in warmer regions because the Plasmodium parasite struggles to complete its growth cycle in cooler climates.[124] During the 20th century, malaria was common in temperate regions such as Europe, Australia, and North America. Since then, social and economic development, habitat destruction, and health interventions have sharply reduced prevalence. Today, most malaria cases occur in sub-Saharan Africa, with fewer in Oceania, the Americas, and Southern Europe.[125] However, migration of Anopheles from northern Africa and the Middle East continues. Since 2009, Greece has reported malaria almost yearly.[126] Anopheles stephensi, is particularly concerning, with an affinity for urban environments.

Invasive mosquito species have spread worldwide, now present in temperate regions of North America, Southern Europe, and East Asia.

In summary, the three main types of human-biting mosquitoes are spread across the globe in distinct but shifting patterns. Mosquito control proposals in committee must account for these geographic and climatic differences. The accelerating spread of mosquitoes due to climate change should be a call to action for UNEA delegates to present multisectoral proposals that integrate disease control with strategies to mitigate environmental change.

Current International Action for Vector Control

While most environmental disease control methods are applied locally, international collaboration is needed to target the spread of disease across national borders. Coordinating global efforts and sharing resources can help reduce the impact that these diseases have. UN bodies such as WHO, UNEP, and UN-Habitat have been central in proposing frameworks, pilot programs, and technical guidance. They have also highlighted the

119 Ryan, Lippi, and Stewart-Ibarra, "Mapping geographic and demographic shifts for container breeding mosquito-borne disease transmission suitability in Central and South America in a warming world."
120 Ryan, Lippi, and Stewart-Ibarra, "Mapping geographic and demographic shifts for container breeding mosquito-borne disease transmission suitability in Central and South America in a warming world."
121 Abbasi, "Global expansion of *Aedes* mosquitoes and their role in the transboundary spread of emerging arboviral diseases: A comprehensive review."
122 Smitha Mundasad, "Mosquito-borne diseases becoming increasing risk in Europe," *BBC*, June 22, 2023, www.bbc.com/news/health-65985838.
123 Mundasad, "Mosquito-borne diseases becoming increasing risk in Europe."
124 Max Roser and Hannah Ritchie, "Malaria," Our World in Data, Accessed July 27, 2025, https://ourworldindata.org/malaria.
125 Center for Disease Control and Prevention, "Where Malaria Occurs."
126 Giunti, Becker, and Benelli, "Invasive mosquito vectors in Europe: From bioecology to surveillance and management."

importance of cross-border cooperation. Further, regional bodies, as well as non-governmental actors, can play a critical role. They can support national and local governments in the fight against mosquito-borne diseases. Delegates should remember that the UN already has advisory and technical bodies in place, like WHO's Vector Control Advisory Group, that can guide implementation of solutions proposed in UNEA.

In May 2017, for example, an urban planning design was presented by experts in the UN Chemicals and Waste Convention. They suggested low-cost changes to houses in urban areas that would reduce malaria transmission significantly.[127] In Africa, around 80 percent of malaria transmission happens in homes, since *Anopheles* mosquitoes prefer indoor habitats.[128] Proposals included replacing straw roofs with tin ones. Others included properly screening doors and windows, which would help keep mosquitoes outside.[129] In 2022, these ideas were incorporated into the joint WHO–UN Habitat *Global Framework for the Response to Malaria in Urban Areas*, emphasizing the importance of targeting poor urban planning.[130]

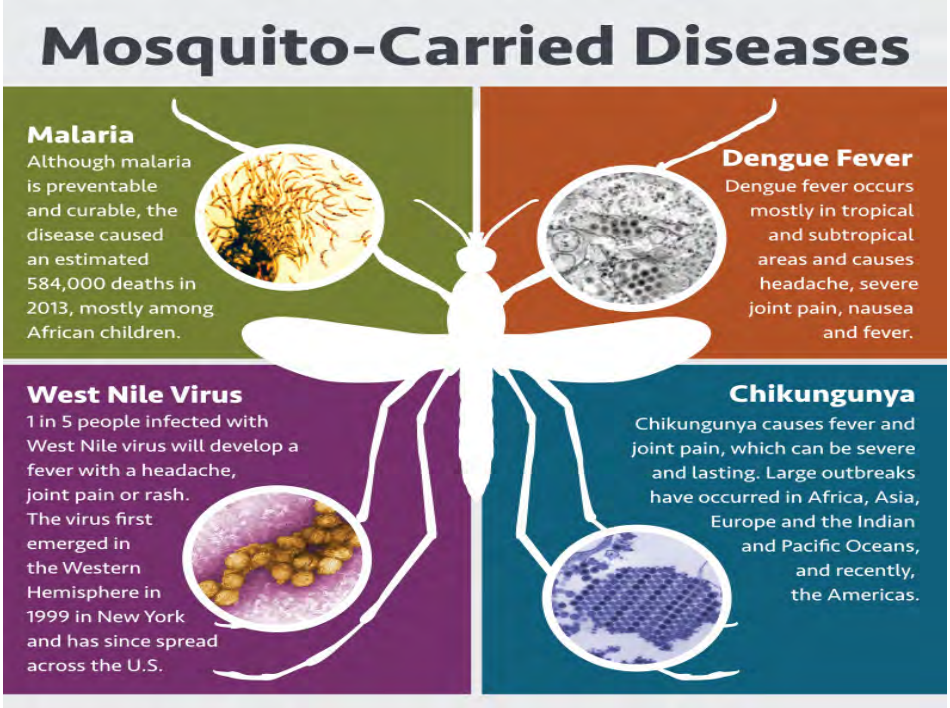
In 2016, the Pan American Health Organization (PAHO), a UN regional body, created the Mosquito Awareness Week. It is a week that focuses on sharing resources, raising awareness, and mobilizing community members. They direct attention to increasing collaboration between sectors.[131] In 2017, the UN endorsed the creation of the Global Mosquito Alert. It was launched as a way to optimize data sharing and implement citizen science for global disease surveillance.[132] While the project was active, it offered a shared platform to share information about outbreaks in a timely manner and improve outbreak response.[133] With the data they gathered, the Global Mosquito Alert produced Best Practices Guides to serve as toolkits for the implementation of local vector control.

Over the last many years, other international groups like UNICEF have worked with many states to control mosquito related diseases, especially which can be dangerous for children. Their policies have tried to focus on vector control products that protect children and are affordable and accessible.[134] They also give out protection nets to protect people from mosquitos. They usually have pesticides and can be helpful in areas with a high risk of malaria. [135]

Other actions include the adoption of the Global Vector Control Response by the WHO in 2017. This response guide is set to last until 2030. It aims to strengthen national capacities for integrated vector management and outbreak response. It highlights the need for the active pursuit of novel strategies.[136] They encourage the development of new eco-friendly insecticides, the use of GIS, biological control with organisms like *Wolbachia*, and the widespread use of physical barriers.[137] Overall, the WHO advocates for strong political commitment to vector control at national and local levels, encouraging the cooperation between local authorities in the fight against diseases carried by mosquitoes.[138]

Non-governmental organizations like Target Malaria also have an important role in international initiatives. For example, they

127 Initiatives Fight Mosquito-Borne Disease" SDG Knowledge Hub, June 6, 2017, sdg.iisd.org/news/un-initiatives-fight-mosquito-borne-disease/.
128 SDG Knowledge Hub, "Initiatives Fight Mosquito-Borne Disease;" Singh et al., "Insecticidal Paint: An Alternate Integrated Vector Management Strategy for Mosquito Control."
129 SDG Knowledge Hub, "Initiatives Fight Mosquito-Borne Disease."
130 World Health Organization and UN Habitat, *Global framework for the response to malaria in urban areas,* (Geneva: World Health Organization, 2022) unhabitat.org/sites/default/files/2023/07/global_framework_for_the_response_to_malaria_in_urban_areas_2.pdf.
131 "Mosquito Awareness Week," Pan American Health Organization, accessed 22 June 2025, www.paho.org/en/mosquito-awareness-week.
132 SDG Knowledge Hub, "Initiatives Fight Mosquito-Borne Disease."
133 SDG Knowledge Hub, "Initiatives Fight Mosquito-Borne Disease."
134 "Vector control to prevent mosquito-borne diseases," UNICEF, accessed 22 June 2025, www.unicef.org/supply/vector-control-prevent-mosquito-borne-diseases.
135 UNICEF, "Vector control to prevent mosquito-borne diseases."
136 *Global vector control response 2017–2030*, (France: World Health Organization, 2017), www.who.int/publications/i/item/9789241512978.
137 *Global vector control response 2017–2030.*
138 *Global vector control response 2017–2030.*



NIH Graphic on various mosquito-borne diseases (Credit: NIAID)

recently proposed the use of genetically modified gene-drive mosquitoes for malaria control.[139] Currently, genetic engineering vector control options are non-gene-drive. This means that genetic modifications do not persist or spread in the population. Their proposal for gene-drive mosquitoes would not need the constant release of mosquitoes.[140]

Working with other states is critical for effective vector control, especially because it is easy for mosquitoes and diseases to travel across national borders. Because of this, it is critical that countries within a region work together.[141] The UN system has long emphasized regional coordination, particularly in areas with high travel and trade.[142] People carrying diseases can spread them if there are big populations of mosquitoes where they go. So, working together, communicating, and creating shared plans is critical to protecting people from the spread of the viruses.[143]

While it is important to take steps locally, it is equally important for global collaboration to effectively control the spread of disease. Existing UN-led policies like the Global Vector Control Response (2017–2030) already provide frameworks for action, but UNEA delegates can strengthen them, expand their scope, and ensure implementation.

Sustainable Development Goals

The 2015 Sustainable Development Goals (SDGs) provide a roadmap for global action, and vector control connects directly to several of them.[144] It is important to remember that targeting issues such as vector control also requires focusing on many different sectors. The environmental control of mosquito-borne diseases is very closely related to SDGs 3, 6, 11, and 13.

The first SDG related to this topic is SDG 3: Good Health and Wellbeing. The fight against mosquito-borne diseases is intimately linked to the task of strengthening health systems across the globe. Target 3.2 calls upon actions to end preventable deaths of children under five to keep under-five mortality at least as low as 25 per 1,000 live births per country.[145] This target is especially relevant for countries in the African continent, where children under five constitute over three-quarters of total malaria deaths.[146] Further, Target 3.3 aims to end epidemics of malaria, neglected tropical diseases, such as

139 "International policy framework for genetically modified mosquitoes," Target Malaria, March 2025, targetmalaria.org/wp-content/uploads/2022/08/Regulatory_FS_EN_InternationalPolicyFramework_Mar_25.pdf.
140 Target Malaria, "International policy framework for genetically modified mosquitoes."
141 *Global vector control response 2017–2030.*
142 Target Malaria, "International policy framework for genetically modified mosquitoes."
143 *Global vector control response 2017–2030.*
144 United Nations Sustainable Development, "The 17 Goals," accessed June 25, 2025, sdgs.un.org/goals
145 United Nations Sustainable Development, "Goal 3," accessed June 25, 2025, sdgs.un.org/goals/goal3.
146 "Malaria," World Health Organization, December 11, 2024, www.who.int/news-room/fact-sheets/detail/malaria.

dengue and chikungunya, and other communicable diseases.[147] Also, Targets 3.b and 3.c aim to support the development and distribution of vaccines and medicines and to strengthen the capacity of countries' health systems, respectively. It is especially important to encourage early warning, risk reduction, and proper management of national and global health risks, particularly in developing countries.[148]

The next important goals related to the topic are SDG 6: Clean Water and Sanitation and SDG 11: Sustainable Cities and Communities. SDGs 6 and 11 emphasize the role of water management, sanitation, and urban planning in reducing mosquito breeding sites and building climate-resilient, resource-efficient cities.[149] Adequate capacity building within local communities is key to targeting the issue of mosquito proliferation in urban areas. It empowers residents to identify, prevent, and respond to mosquito breeding sites in their own environments.

Finally, Goal 13: Climate Action is central for mosquito control and UNEA as a committee. This is evident in Targets 13.1 and 13.2, which focus on resilience to climate events and the integration of climate change measures in policy.[150] Many of the changes in mosquito habitats across the globe are related to climate change. Mosquitoes have started to expand into temperate areas in the past decade, which is a matter of global concern. Target 13.3 aims to improve education and institutional capacity on climate change early warning and mitigation.[151] A growing number of academics are studying the connection between climate change and mosquitoes. Therefore, it is important that government officials, as well as citizens, are informed on the matter to ensure the best decision-making. Altogether, the SDGs show how vector control is interconnected with health, water, urban planning, and climate action.

Bloc Analysis

Points of Division

Countries have different views on how to control mosquitoes. They are affected by the issue on different scales, so countries view the issue with a different level of urgency. For example, many countries have experienced these diseases constantly for decades. Some of these countries can keep diseases at a relatively stable and low level with local resources. Others have health systems that are overpowered by aggressive mosquitoes that have evolved resistance to our control strategies. A different group of countries has not been affected by these diseases for centuries, and their current healthcare systems are not prepared for outbreaks.

Approaches to climate change will also largely impact the blocs taken in this committee. Tensions between local and international regulations largely reflect priorities in terms of climate change policy. Approaches to address global warming may vary. What matters is prioritization. This means that blocs should emerge based on where they best see fit.

This diversity informs the type of solutions countries endorse as well as how they approach funding, innovation, and cross-border cooperation. Overall, it is important to keep in mind that these differences bring richness to debate and cooperation. Delegates are encouraged to listen to the needs and suggestions of other blocs and integrate their perspectives into their resolutions. Especially with a topic related to healthcare

147 United Nations Sustainable Development, "Goal 3," accessed June 25, 2025, sdgs.un.org/goals/goal3.
148 United Nations Sustainable Development, "Goal 3," accessed June 25, 2025, sdgs.un.org/goals/goal3.
149 United Nations Sustainable Development, "Goal 6," accessed June 25, 2025, sdgs.un.org/goals/goal6.
150 United Nations Sustainable Development, "Goal 13," accessed June 25, 2025, sdgs.un.org/goals/goal13.
151 United Nations Sustainable Development, "Goal 13," accessed June 25, 2025, sdgs.un.org/goals/goal13.

and the environment, these differences of opinion are meant to make proposals better and more comprehensive.

Countries Dealing with Massive Climate Change Events

Within the committee, a group of states find themselves majorly affected by many climate change events, and as a result are being forced into making significant changes. This includes natural disasters and global warming. As a result, these states aim to align with international climate agreements and are activists for SDGs. Among it all, these conditions have caused a massive growth in mosquito populations.

For example, the Small Island Developing States (SIDS) are severely impacted by climate change and thus meet yearly to discuss new policy ideas to tackle climate change.[152] Climate change has impacted their social services, disease control, and economic development. This group consists of countries such as Antigua and Barbuda, the Bahamas, Fiji, Kiribati, Maldives, Palau, Samoa, Seychelles, and Vanuatu.[153] Over the last few years they have collectively worked on many new initiatives and programs, such as the SAMOA Pathway and Multidimensional Vulnerability Index.[154] The SAMOA Pathway, for instance, creates a framework for small island nations to track and deal with sea level rises.[155] In 2023, they launched a toolkit for all partner nations to follow to achieve the agreed-upon goals and aims.[156]

States part of this bloc will focus on immediate solutions to the problem with the goal of preserving the environment and reducing the impact of mosquitos on their healthcare systems.

Countries Dealing with Changes but Taking Minimal Steps

The second bloc consists of states that find themselves facing major effects of climate change but are still slow and inconsistent in passing relevant policies and solutions. These countries experience rising temperatures, bad air quality, deforestation, and more but often choose to prioritize short-term economic growth. Their goals are rooted in industrial expansion, natural resource extraction, and quick growth rather than environmental sustainability. As a result, their policies are often slower than the actual need for urgency.

This bloc comprises states such as India, Indonesia, and Brazil. For example, Brazil continues to practice unsustainable cutting down of trees in the Amazon.[157] About 17,000 sq km of the forest was reserved for soy agriculture without cutting down any trees.[158] However, a recent policy has removed that, allowing for companies to continue cutting down all those (previously protected) trees.[159] Similarly, India and Indonesia are both heavily dependent on fossil fuels. The spread of various mosquito-borne viruses has been linked to the environmental destruction in these countries.

Overall although these countries have introduced measures such as reforestation, clean energy and carbon reduction, their policies have been small and limited. As a result, they continue to struggle with record levels of illnesses.

152 Nurse et al., "Small Islands," in*: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, 2014), 1613–54, hal.science/hal-01090732v1.
153 Nurse et al., "Small Islands."
154 "About Small Island Developing States | Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States," n.d. www.un.org/ohrlls/content/about-small-island-developing-states.
155 UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States. "A TOOLKIT FOR MONITORING AND REPORTING ON THE SAMOA PATHWAY." Report, January 25, 2023. www.un.org/ohrlls/sites/www.un.org.ohrlls/files/files/finalreport_sp_160123.pdf.
156 UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, "A TOOLKIT FOR MONITORING AND REPORTING ON THE SAMOA PATHWAY."
157 Jonathan Watts, "Brazil Authorities Suspend Key Amazon Rainforest Protection Measure," *The Guardian*, August 21, 2025, www.theguardian.com/environment/2025/aug/21/brazil-authorities-suspend-key-amazon-rainforest-protection-measure.
158 Watts, "Brazil Authorities Suspend Key Amazon Rainforest Protection Measure."
159 Watts, "Brazil Authorities Suspend Key Amazon Rainforest Protection Measure."

Countries Not Yet Affected by Climate Change, but Taking Major Steps

The last bloc in this committee finds themselves less impacted by major climate change events but are still introducing measures to prevent future crises. These countries have recognized that while their population does not face these challenges yet, environmental change is a global concern. And these protective measures have resulted in record low levels of mosquito habitats and related illnesses.

Examples of states in this bloc include European countries and other states like Canada, Japan and New Zealand. Over the last many years, they have invested in renewable energy, strict environmental regulations like wastewater dumping and urban planning. Their health care system has also worked on creating relevant policies to prevent mosquito-related diseases from spreading. Therefore, these states are global leaders in the international climate area with a high emphasis on achieving the targets set in the Paris Agreement. States in this bloc will focus on more long-term solutions and goals by exploring their international responsibility. In addition, they consider the combined environmental and public health costs of tomorrow.

Committee Mission

The United Nations Environment Assembly is the highest global body for making decisions about environmental issues. Its main job is to review policies, start discussions, and help guide future environmental actions.[160] UNEA is the governing body of the United Nations Environment Programme (UNEP). This means that they define the work of UNEP and determine the budget of the world's leading authority on the environment.[161] UNEA is also a General Assembly committee. This means that its resolutions are a set of recommendations for the international community. While they are not legally binding, they still carry a lot of weight. This is because countries often use General Assembly recommendations as a base to build their own laws and support systems.

Delegates in UNEA have the responsibility to propose solutions that target mosquito-borne diseases from an environmental standpoint. They are called to focus on the aspects of the issue that are most pressing. The Assembly should focus on strengthening research and innovation on the matter. While the impact of environmental factors has been studied on certain mosquito species, others are overlooked. Focusing on proper environmental research allows for better decision-making in the future.[162] Further, it is crucial to enhance global capacity to control existing mosquito populations. For this reason, delegates should think of ways to integrate traditional and newer tools into frameworks that countries can adopt.[163]

Another important task UNEA has is to help strengthen intersectional action. Delegates are encouraged to pay attention to all the factors that affect mosquito populations and bring them to light during committee. Additionally, the need to engage members of local communities in initiatives has been highlighted on multiple occasions. It is one of the main pillars of the WHO's Global Vector Control Response.[164] Moreover, delegates should think of ways to improve current disease

160 United Nations Environment Programme, "The United Nations Environment Assembly," accessed July 26, 2025, www.unep.org/environmentassembly/.
161 United Nations Environment Programme, "What you need to know about the UN Environment Assembly," February 18, 2022, www.unep.org/news-and-stories/story/what-you-need-know-about-un-environment-assembly.
162 *Global vector control response 2017–2030.*
163 *Global vector control response 2017–2030.*
164 *Global vector control response 2017–2030.*

surveillance. Especially with recent technological advancements, surveillance capabilities have a lot of room for growth.[165] This will allow for better outbreak control and disease mapping. Most importantly, delegates in UNEA must focus on collaboration. Countries across the world are affected very differently by the issue. Hence, it is important to gather a wide set of perspectives to produce the best resolution.

When crafting solutions, the SDGs are a great starting point. Thinking of ways to achieve the targets that are relevant to the committee ensures that solutions are aligned with the UN's greater goals. Furthermore, it can be useful to read important documents on the topic. These usually outline what the greatest challenges in the field are.

GLOSSARY

Cytoplasmic incompatibility (n.) A reproductive phenomenon in insects where eggs from matings between infected males and uninfected females are incompatible with life.

Genus (n.) **(plural: genera)** A group of very closely related species within a biological family.

GIS (abbr.) Geographic information system, a type of computer system that is able to analyze geographic data specific to a particular location.

Obligate intracellular (adj.) **(of a pathogen or parasite)** that can only survive within host cells, like Wolbachia bacteria.

Pathogen (n.) A disease-causing agent, usually a virus, bacterium, fungus, or parasite.

SIT (abbr.) Sterile Insect Technique.

Vector (n.) An organism capable of carrying a disease and transmitting it to humans. Mosquitoes are the deadliest vector of human diseases.

Vectorial capacity (n.) The ability of mosquitoes to carry and transmit disease. Higher carrying capacity means that more people get infected per mosquito, and vice versa.

165 *Global vector control response 2017–2030.*

Research and Preparation Questions

The following research and preparation questions are meant to help you begin your research on your country's policy. These questions should be carefully considered, as they embody some of the main critical thought and learning objectives surrounding your topic.

Topic A

1. What is the estimated carbon footprint of AI infrastructure, and how does it compare to other major industries?
2. What kinds of national and regional policies exist to manage the energy consumption and emissions linked to AI development and deployment?
3. To what extent are governments and companies promoting renewable energy use in the tech sector, particularly for AI applications?
4. How does the expansion of AI affect vulnerable or indigenous communities, especially in relation to resource access, displacement, or pollution?
5. Are there global examples of "digital colonialism" or resource exploitation connected to the production of AI hardware?
6. How does the international trade of AI technologies influence both local economies and the global environment?
7. What role should international cooperation play in setting ecological standards for AI development and use?

Topic B

1. How can countries empower local communities to participate in mosquito control efforts, and what role should education and awareness campaigns play in ensuring sustainable and practical solutions?
2. With the advent of climate change and the subsequent expansion of mosquito habitats, how should countries adapt their public health facilities and urban planning strategies?
3. How can countries work together to control the spread of disease-carrying mosquitoes, in a way that respects each nation's independence and sovereignty?
4. How can countries balance the urgent need to control mosquito populations while still avoiding damaging the surrounding ecosystems?
5. Are there any alternative, environmentally safe methods that your country has considered? What challenges arise when trying to implement such methods as opposed to traditional ones?

Important Documents

Topic A

"AI's Excessive Water Consumption Threatens to Drown out Its Environmental Contributions." sdgs.un.org/sites/default/files/2024-05/Gupta%2C%20et%20al._AIs%20excessive%20water%20consumption.pdf.

"Artificial Intelligence for Climate Action in Developing Countries: Opportunities, Challenges and Risks INFORMATION NOTE Acknowledgements." n.d. unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/2024_events06/389603138d6f451684671a0cecbe50f6/9cc827fbb3134e31aa20bbdf5268dbfd.pdf.

"Global Water Consumption by Generative AI – Technical Report." 2022. Aidrinkswater.com. 2022. www.aidrinkswater.com/report.html.

Hederman, Rea, and Greg Lawson. n.d. "BETTER ENERGY POLICY for OHIO." www.buckeyeinstitute.org/library/docLib/2025-01-22-Better-Energy-Policy-for-Ohio-policy-report.pdf.

Sharma, Snigdha, and Shailja Thakur. 2024. "Impact of Artificial Intelligence on the Environment." International Journal of Research Publication and Reviews Journal Homepage: Www.ijrpr.com 5: 4792–98. ijrpr.com/uploads/V5ISSUE10/IJRPR34408.pdf.

UNESCO. 2022. "Recommendation on the Ethics of Artificial Intelligence." Unesco.org. 2022. unesdoc.unesco.org/ark:/48223/pf0000381137.

United Nations. 2024. "Artificial Intelligence (AI) End-To-End: The Environmental Impact of the Full AI Lifecycle Needs to Be Comprehensively Assessed - Issue Note." Unep.org. doi.org/978-92-807-4182-7.

Topic B

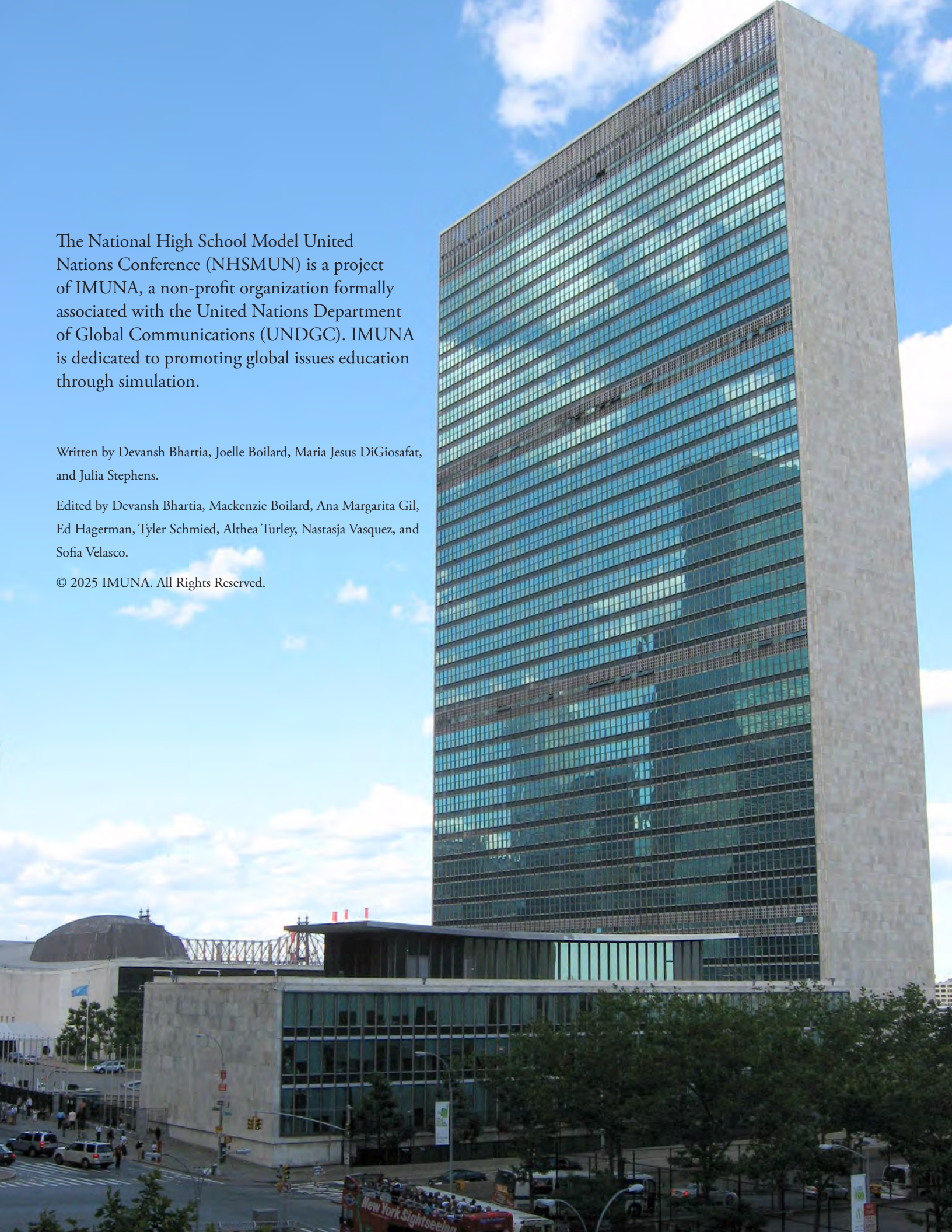
Global vector control response 2017–2030, (France: World Health Organization, 2017), www.who.int/publications/i/item/9789241512978.

Jeffrey R. Powell, "An Evolutionary Perspective on Vector-Borne Diseases," Frontiers in Genetics 10 (December 17, 2019), doi.org/10.3389/fgene.2019.01266.

Silvia Brugueras et al., "Environmental Drivers, Climate Change, and Emergent Diseases Transmitted by Mosquitoes and Their Vectors in Southern Europe: A Systematic Review," Environmental Research 191 (August 15, 2020): 110038, doi.org/10.1016/j.envres.2020.110038.

"Water and sanitation interventions to prevent and control mosquito-borne disease: focus on emergencies", World Health Organization and the United Nations Children's Fund (UNICEF), 2024, www.who.int/publications/i/item/9789240090644.

Wenfei Zhang, "Role of Climate and Environmental Changes in Mosquito Population Dynamics," Journal of Mosquito Research 14, no. 4, (January 1, 2024): 195-203, doi.org/10.5376/jmr.2024.14.0019.



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Written by Devansh Bhartia, Joelle Boilard, Maria Jesus DiGiosafat, and Julia Stephens.

Edited by Devansh Bhartia, Mackenzie Boilard, Ana Margarita Gil, Ed Hagerman, Tyler Schmied, Althea Turley, Nastasja Vasquez, and Sofia Velasco.