CSTD

UPDATE PAPER

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Dear Delegates,

Welcome to the Commission on Science and Technology for Development (CSTD) for NHSMUN 2025! My name is Michele Nieto, and I will be your Assistant Director for session I of the conference. This is my first year on NHSMUN staff so I look forward to this experience just as much as you do! My first-ever model of the United Nations was NHSMUN 2023 (coincidence? I think not!) and I attended the committee UNEA in which I got the opportunity to speak at the headquarters of the United Nations in front of all the delegates of session II. If you have any questions regarding MUN or NHSMUN, do not hesitate to ask; I will do my best to answer!

I am from Caracas, Venezuela but I lived for five years on a small island in the Caribbean called "Aruba". Thanks to this life-changing experience I am now a polyglot because I got to learn three languages and I'm currently on my fourth (Spanish, English, Dutch, Papiamento, and now French). I graduated from "Colegio Cristo Rey de Altamira" in July 2024, and I'm currently studying at "Universidad Central de Venezuela" in which I'm majoring in International Studies. Before MUN, I was always a talkative, extroverted person. However, MUN has equipped me with the tools to express myself better and has made me sure of what I want my future career to be. But aside from MUN, I love listening to music. My favorite singers are Alvaro Diaz, La Vida Boheme, Rawayana, and Los Amigos Invisibles (if you have any recommendations, let me know!). I also like going on walks with my dog Leia (an 11-month-old Rottweiler puppy and the love of my life), and I really like arts and crafts!

As a former delegate I understand how stressful the conference can feel, but try to look at it this way, it's also my first time being DAIS. It's okay to be nervous, but don't let your nervousness get the best of you. Don't be afraid to raise that placard! See this as an opportunity to build communication skills, to be more confident, and how to build a network. As an international student, I see MUN as an opportunity to get to know people from other countries and as an experience to better your skills.

The directors have compiled an amazing and detailed guide covering "Implementing Biotechnology for Disease and Pest Control" and "Utilizing Space Technology for Sustainable Development." This will be very helpful as well as the Update Paper which will give you insight on the latest events with these topics. I am very excited to witness the fantastic and respectful debate you will hold and the solutions that will be developed. I can't wait to meet all of you and succeed!

Best,

Michele Nieto
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Dear Delegates,

I hope you are all ready for a great time in the CSTD! My name is Anthony Schirrmeister, and I will be the assistant director for Lauren Sheward during Session II. While this is my first time on staff for NHSMUN, I was a delegate for UNTOC last year at that year's conference. Aside from that, I spent three years in Model UN at my high school. I'm very excited to be back since NHSMUN is such an exciting place to be where you can meet so many people from around the world. I graduated high school last June in my hometown of Patchogue, in the United States, which is very close to where NHSMUN is held. Now, I'm starting my second semester at Stony Brook University, where I study linguistics. Outside of school and MUN, I like to play games like Dungeons and Dragons with friends, watch musicals, and I've been trying to work on my art skills recently.

Even for delegates who have been to conferences like this before, it's a big place and it can be scary to talk to so many people at once, but the experience you'll gain and the people you'll meet will make it worthwhile! Look into the guides and do your research, but most importantly… Be confident! This is your chance to debate with people worldwide, so have fun and work hard!

Best,

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CSTD

NHSMUN 2025

TOPIC A: IMPLEMENTING BIOTECHNOLOGY FOR DISEASE AND PEST CONTROL

Photo Credit: Ibrahim Khairov

Introduction

Agricultural pest control is a very relevant topic as it is rapidly changing and developing. Recently, governments, companies, and individuals have started to look more carefully at how the world grows crops and how those methods affect the environment. This means that more scrutiny must be applied to these methods to ensure people's and the environment's safety. Diverse challenges occur yearly for the people who feed the world. So, the Commission on Science and Technology for Development must address these problems. Just as new pests can create issues, so can the technology used to keep them away. It is also important to find and implement as many options as possible since pests are outpacing and outsmarting the strategies that the world has now.[1] Some technologies now, if used properly, can even help solve problems before they happen.

Even in the past few weeks, new technologies have been created to aid pest control. This is highly useful in adapting dynamics and diverse pest control around the world. While these new technologies have their uses in the field, they require scrutiny since they are developing technologies. In other fields, such as agriculture, they pose new challenges and may create new dangers that can cause more problems than they can solve. If delegates truly want to aid farmers and agricultural workers in need, they must find common ground to find the risks of these technologies, since these methods may be used whether they are safe or not. The CSTD can be a source of knowledge and safety for farmers, which is needed due to the rapid pace of technological advancements.

To create change in the world, delegates must understand the problems and the solutions. To do this, delegates must have open minds and work together, but must also critique solutions, to not worsen the lives of millions around the world through a hasty and unfinished investigation. This is a topic related to all others in discussion of the environment, climate, and the world food supply. Therefore, it must be understood that much knowledge and thought should go into this debate. In this update paper, some of the most important and cutting-edge examples of new technologies in pest control will be discussed. This includes the use of many different data management systems and the use of new biopesticides that are created with nanotechnology.

Uses for Artificial Intelligence

Many surprising developments have recently occurred in the field of machine learning. Machine learning is the process of teaching an Artificial Intelligence (AI) to complete human tasks by giving the AI examples (training data) of a human doing that same task. The AI will try to work on its own, then learn from mistakes and complete tasks until it approaches the accuracy of a human in that particular task.[2] It learns by editing its algorithm, a program that makes an output that people can read. A "smarter" AI will make the best algorithm based on the dataset it is trained on. Since an algorithm can only be as strong as its training data, AI can actually become worse at their task from biased or incorrect data.[3]

AI is used for many different things. It can even be taught to create formulas for new chemicals, including some that could be used in pesticides and agriculture. AI can learn this skill through training in massive amounts of data from work done by humans to develop useful chemicals. With this training, AI models can search through an unthinkable number of possible chemical compounds that would take a human many lifetimes to search through. Then, it picks out the chemicals that are useful based on training data.[4] Another ability AI

1 Karsten Koerber and Peter Maienfisch, "Recent innovations in crop protection research," *Pest Management Science* (September 2024), https://doi.org/10.1002/ps.8441.
2 "What Is Artificial Intelligence (AI)? Definition, Uses, and More," University of Cincinnati, accessed December 26, 2024, https://online.uc.edu/blog/what-is-artificial-intelligence.
3 Julie Rogers and Alexandra Jonker, "What is data bias?" IBM, October 4, 2024, https://www.ibm.com/think/topics/data-bias.
4 Laura Wood, "Biopesticides Market Forecast Report to 2029 - Chemical Pesticide Bans and Awareness Programs by Government Agencies Drive Biopesticides Market Growth - A USD 15.66 Billion Market by 2029", GlobalNewswire, November 5, 2024, https://www.globenewswire.com/news-release/2024/11/05/2974808/28124/en/Biopesticides-Market-Forecast-Report-to-2029-Chemical-Pesticide-

possesses in chemical manufacturing is that it can prioritize certain goals for what the chemical can do.[5] An AI could do this by comparing chemicals that it finds to others with known effects. This process can be used to find sustainable chemicals that don't damage the environment and are useful to farmers as pesticides.[6] However, an AI model must have sufficient training data in order to be able to see potential dangers in various chemicals. It is important to note that AI is still a developing technology and can improve with time and research. Regardless, this change would rapidly increase the amount of different chemicals in use in the environment. Chemicals need time and study before they are implemented into use. At the rapid rate that AI can create new chemicals, some of those chemicals can be highly dangerous. Not giving the right attention could have dangerous side effects for people worldwide since chemicals can have many effects at once. For example, useful pesticides used on a crop could have negative health effects on the people who eat those crops. Some pesticides have been known to irritate or damage humans that touch or eat them and even may contribute to cancer.[7] Since AI can be inconsistent, it is impossible to quickly know whether a chemical invented by AI has a health impact like this.

AI has many other uses in agriculture. It is very promising in speeding up developing and managing pest control methods other than pesticides. AI can be trained to monitor crops, evaluate pest levels before they reach dangerous levels, and so much more.[8] It is very promising in monitoring pest infestation levels, which can work with Integrated Pest Control (IPM) strategies to help farmers know when to take action with pesticides and other methods to protect crops without waste. In other words, those systems can guard crops and predict when an issue is coming. This is less expensive and time-consuming than manual checks by employees. It is also more flexible than rigid programs, which are vulnerable to changing circumstances. An AI could recognize and adapt quickly, and the use of its training data could predict the increase in dangerous infestations.[9] The ability of AI to predict pest issues is also very interesting. AI can use the history of weather patterns and pest populations to keep farmers informed about potential dangers.[10] In countries such as India, national AI systems take in information from farmers across the country to give advice on what areas of the country are in danger of pest infestations.[11]

Many people, including experts and government officials, don't consider AI reliable. Large language models– AI programs that can process and generate text– are known to forge lots of information.[12] Experts claim that AI can "hallucinate" and create false information since AI isn't truly intelligent. Hallucination refers to when an AI creates completely false information. AI's "intelligence" comes from pattern recognition based on its dataset and its algorithm.[13] As a result, the information given by AI comes from patterns and probability, and it is never clear if anything from AI is reasonable or a hallucination. This issue is because even the most well-trained AI cannot guarantee perfection. Experts can't figure out if an AI is hallucinating or not because an AI's pattern recognition is too complex for a human to understand. Since AIs have so much training data, they will be very large and complicated. While they are useful, this complexity means AI logic can't be followed and checked over. Hence, AI output is always impossible for humans to easily check. Imperfection

Bans-and-Awareness-Programs-by-Government-Agencies-Drive-Biopesticides-Market-Growth-A-USD-15-66-Billion-Market-by-2.html.
5 Sebastian Kubiak, "EU AI Act: what changes does it bring to the chemical industry," Spyrosoft, November 20th 2024, https://spyrosoft.com/blog/chemicals/eu-ai-act-in-the-chemical-industry.
6 Kubiak, "EU AI Act: changes to the chemical industry."
7 "Human Health Issues Related to Pesticides," EPA, Last updated on September 26, 2024, https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/human-health-issues-related-pesticides.
8 Iftekhar Anam et al., "A Systematic Review of UAV and AI Integration for Targeted Disease Detection, Weed Management, and Pest Control in Precision Agriculture," *Smart Agricultural Technology*, November 1, 2024, 100647–47, https://doi.org/10.1016/j.atech.2024.100647.
9 Henryson, "AI in Pest Control: A Game-Changer For The Industry."
10 Vasyl Cherlinka, "AI and Pest Management: Protecting Yields with Smart Technology", AgriBusiness Global, November 18, 2024, https://www.agribusinessglobal.com/agtech/ai-and-pest-management-protecting-yields-with-smart-technology/.
11 "New AI platform will connect farmers and scientists over phone, aid in pest control", *The Hindu*, August 15, 2024, https://www.thehindu.com/news/national/new-ai-platform-will-connect-farmers-and-scientists-over-phone-aid-in-pest-control/article68530026.ece.
12 Brian Buntz, "Why scientific AI needs clear lines of sight — especially for fields like drug development," Drug Discovery and Development, December 3, 2024, https://www.drugdiscoverytrends.com/why-scientific-ai-needs-clear-lines-of-sight-especially-for-fields-like-drug-development/.
13 Buntz, "Why scientific AI needs clear lines of sight"; Rogers, "What is data bias?"

Pesticide application in Adana, Turkey
Credit: Zeynel Cebeci

can come in many other ways, including bias in the data it was trained with. Since the AI training data is one of the only things under human control with ML models, bias in this dataset can create data bias. Data bias. Data bias is an issue with all AI and causes AI to make mistakes based on bad training data.[14] Bias can never be removed from all data, but work can make things better, and experts can lessen these problems.[15]

Another important detail is the cost of using large AI models. AI is typically housed in large data centers on large computer equipment. Computers built for AI take up a lot of natural resources to build.[16] Microchips used for AI require rare earth elements that aren't mined in a safe way for the environment. While this can create economic activity that can benefit some, it requires minimal resources already needed worldwide. Another cost of AI is electricity. Estimates show that AI electricity usage will take up four percent of all electricity usage.[17] With rising carbon emissions, more electricity usage is not something that anyone wants in the world. If AI continues to gain use worldwide, reducing power usage will become more difficult. AI can also pollute the environment in other ways—data centers where AIs are housed release toxic chemicals such as lead and mercury. Data centers also consume lots of water. Water is used to create and cool data centers. While cooling is not so expensive for personal computers, computers housing AI are much bigger and need a lot of cooling material, and water is often this material. Global AI water use is estimated to use more water than millions of people around the world.[18] A quarter of people worldwide already lack access to clean water, so this cost is unsustainable. However, some experts are hopeful that the high cost of AI can be brought down.[19] Since the CSTD was created to give advice on environmental sustainability, this is a very important part of AI to consider.

Many governments and other organizations have started to create protocols and regulations to control AI in fields where it may be dangerous. This includes the EU, which has made complex rules on where AI may or may not be used.[20] This legislation bans the use of AI in certain industries where mistakes and hallucinations can be highly dangerous. It also permits the use of AI in other areas where it is useful. This

14 Rogers and Jonker, "What is data bias?"
15 Rogers and Jonker, "What is data bias?"
16 UNEP, "AI has an environmental problem. Here's what the world can do about that," news release, September 21, 2024, https://www.unep.org/news-and-stories/story/ai-has-environmental-problem-heres-what-world-can-do-about.
17 "Can We Mitigate AI's Environmental Impacts?", Yale School of the Environment, October 10, 2024, https://environment.yale.edu/news/article/can-we-mitigate-ais-environmental-impacts.
18 UNEP, "AI has an environmental problem."
19 Yale School of the Environment, "Can We Mitigate AI's Environmental Impacts?"
20 Kubiak, "EU AI Act: changes to the chemical industry."

shows caution but some optimism in AI. AI systems used in agriculture in the EU need to comply with these regulations and work to protect workers in case of mistakes. The United States has shown a similar response to AI systems in agriculture and encourages citizens to continue the development of AI systems.[21] This shows that the USA is also open to working more with AI. India has been very quick to implement AI. The country recently created a national AI-powered pest monitoring system called the National Pest Surveillance System (NPSS) to make farmers across the country more aware of dangerous outbreaks. The NPSS works by gathering information from citizens and using that data to inform farmers around the country.[22] The Indian government also advised farmers to work with AI technology and scientists to find new chemicals and strategies to use.[23] The government's motivation is to help farmers gain independence from large pesticide companies. This can also give India more power over its agriculture since Western countries hold many patents in agriculture. For many, AI is a great way of giving cheap, but high-quality advice to needy people. Governments have different intentions and worries about AI. While some want to use AI to solve older, global economic issues, others want to restrict usage before it is developed enough to be reliable. Even now, early in AI development, governments have used AI at different rates. Some governments have banned AI in some sectors and worry about the amount of information that will be collected for AI. Another worry is that of privacy. Other governments have done the opposite and are already using AI for big projects for citizens. A major point of contention is where to draw this line—defining the boundaries of safe and ethical AI use in disease and pest control. The Commission should aid in this process since AI influence can have dangerous effects on the environment if left unchecked.

AI looks like it will be a staple of modern life for years to come. It is finding uses in so many different industries. It is likely the biggest new technology for integrated pest management and should be embraced. However, there is a long way to go before acceptable standards for dangerous industries are reached. Until then, there may be consequences, and delegates should decide what should be done to mitigate these dangers. Additionally, the rapid pace that AI works will only increase the fears that countries opposed to new pesticides have. It's hard to know the ethical impact that AI's rapid creation of new chemicals will have among countries already worried about similar biopesticides. Even among countries that have lots of investment in pesticides, many are comfortable with current technology or may worry about privacy concerns involved with AI. Others do not have the experience needed in this sort of technology.

Nanotechnology in Pest Control

Another development in pest control in recent months is nanotechnology. Nanotechnology is the study of materials too small to see, whether man-made or biological.[24] Nanotechnology offers interesting new solutions to popular pesticide delivery methods and is very promising for use in current strategies. A big issue in using all types of pesticides, including biopesticides, is that the chemicals in use require constant application. They need to be in contact with the plants that they protect so that they can target pests since they can easily miss the plants that they are meant to protect.[25] According to Dr. Mustafa Akbulut, a researcher at Texas A&M University, up to 90 percent of pesticides used in agriculture are wasted and are left to clutter the environment in which they are used.[26] To combat this, scientists and researchers have started to use nanotechnology to deliver them to where they are needed and help them stay where they need to be.[27] While nanopesticides are not perfect and are still being researched, it has the potential to reduce enormous amounts of waste

21 "Inventory of USDA Artificial Intelligence Use Cases", USDA official website, last modified December, 2024, https://www.usda.gov/about-usda/reports-and-data/data/usda-open-data-catalog/inventory-usda-artificial-intelligence-use-cases.
22 "New AI platform will aid in pest control."
23 "New AI platform will aid in pest control."
24 Carey Lozano, "Nanotechnology," *National Geographic*, October 12, 2024, https://education.nationalgeographic.org/resource/nanotechnology/.
25 Raven Wuebker, "Neem Seed Extract Improves Effectiveness of Pesticide",Texas A&M University, last modified November 27, 2024, https://engineering.tamu.edu/news/2024/11/neem-seed-extract-improves-effectiveness-of-pesticide.html?utm_source=miragenews&utm_medium=miragenews&utm_campaign=news.
26 Wuebker, "Neem Seed Extract Improves Pesticides."
27 Wuebker, "Neem Seed Extract Improves Pesticides."

generated by dumping raw pesticides directly onto plants.

The neem seed extract is one important chemical that has been researched in recent months for use as a nanopesticide. Neem trees are found in South Asia. They are fast-growing trees that produce natural pesticides in their seeds which have many useful abilities that other pesticides lack.[28] Neem seed extract has the ability to latch onto crops way better than other pesticides.[29] This greatly reduces the risk of hurting plants and contaminating soil and prevents waste. Neem seed extract works by using its particular chemistry to fuse onto a leaf instead of just landing on top. The extract changes the surface of the plant slightly to help it stay where it lands. Neem seed extract is very good at this process and can alter plant surfaces on a large scale to stick where they need to go. As a result, more pesticides will end up where they need to be and won't go to waste. The extract will then be able to act as a pesticide when needed. Neem seed use in nanotechnology is still in progress but could benefit farmers worldwide and inspire new developments for the future.

Another new piece of nanotechnology for use in agriculture is nano delivery. Nanodelivery controls when chemicals such as medicine are released. It ensures that chemicals arrive in the right location.[30] This works by only allowing chemicals to activate when they come into contact with certain things. Carriers of pesticides can be designed only to activate when they come in contact with a chemical that only pests or weeds have.[31] Carriers stop the pesticide from causing damage until it contacts one of these chemicals. Thus, they will only attack the pests and weeds that they are designed to target. However, nano delivery can take a long time to make and requires a lot of testing. Sri Lanka is one of the countries that has moved towards nano delivery. In Sri Lanka, rice farming is an essential part of the economy. However, since it is an island country, land is scarce and must be used best. This has led to a high number of agrochemicals being used, which has started to pollute the environment. From 1991 to 2018, agrochemical use grew by 43 percent.[32] As a result, about 50 percent of Sri Lankan farmers are at risk of health risks from pesticides. Implementing nano delivery has helped to replace agrochemicals and make rice farming more sustainable. Since nanotechnology reduces the amount of pesticides in use and limits their harm, farmers will be more safe to make food that the rest of the country needs.

Nanotechnology can also help in monitoring crops. Nanosensors are a piece of nanotechnology that can detect small changes in the environment around them.[33] These sensors are usually used for medicine, but experts are finding uses in agriculture as well. Bugs and plants use certain chemicals to communicate with each other. The idea behind nanosensors is to use the chemicals used by pests to communicate to find out when they arrive near crops. In soybean farming, soybean crops are attacked most commonly by stink bugs. Stink bugs emit predictable chemicals, and nanosensors have become very good at detecting them.[34] This means soybean farms can use nanosensors to automatically alert farmers when their most dangerous pest is near crops. This process can make IPM strategies, AI detection, and advice systems even better at what they do. If this technology is used for other pests and weeds, it could give more accuracy to farms worldwide. It has been used in farming. However, experts are worried about the long-term effects they might have. Some nanopesticides are possibly toxic.[35] Research is very new and ongoing, so more work needs to be done. In general, long-term effects of nanopesticides are rarely studied.[36]

28 Melissa Petruzzello, "Neem", *Encyclopedia Britannica*, December 4, 2024, https://www.britannica.com/plant/neem-tree.
29 Wuebker, "Neem Seed Extract Improves Pesticides."
30 Aswini Rajendran, "Nano delivery systems in stem cell therapy: Transforming regenerative medicine and overcoming clinical challenges," Nano TransMed 4, (December 2025), https://doi.org/10.1016/j.ntm.2024.100069.
31 Rajendran, "Nano delivery systems."
32 Zeyu Want, et al., "Exploring Silica Nanoparticles: A Sustainable Solution for Pest Control in Sri Lankan Rice Farming," *Technologies* 12, no. 11 (October 23, 2024): 210, https://doi.org/10.3390/technologies12110210.
33 Ibtisam Abbasi, "Global Nano-Sensors Market: Current Trends and Technological Developments," last updated October 7, 2024, https://www.azonano.com/article.aspx?ArticleID=1284.
34 Douglas Dias, et al., "Nanosensors for Detecting Volatile Compounds in Pest Management: A Focus on Agricultural Sustainability," *ACS Agricultural Science & Technology* 4, no. 11 (October 16, 2024), https://pubs.acs.org/doi/10.1021/acsagscitech.4c00531.
35 Jones Kapeleka, Mwema Mwema, "State of nano pesticides application in smallholder agriculture production systems: Human and environmental exposure risk perspectives," *Heliyon* 10, no. 20 (October, 2024), https://doi.org/10.1016/j.heliyon.2024.e39225.
36 Ubang Udoh, et al., "The Role of Nanotechnology in Enhancing Biotechnology and Biodiversity Conservation Efforts in Nigeria: Opportunities, Challenges, and Future Prospect," International Journal of Advanced Biological and Biomedical Research 13, no. 2 (2025):

Nanosensors can also detect other things in agriculture, such as levels of nutrients that some plants need to survive.[37] Nanosensors have a 99 percent accuracy in detecting nitrates and a 95 percent accuracy for phosphate.[38] Nitrates and phosphates are important nutrients that all plants need to grow. These sensors have been shown to improve costs and labor in completing these tasks compared to humans checking for nutrients manually. Nanosensors can also be a big help in sustainability. The constant use of pesticides of all kinds can lead to agrotoxins. Agrotoxins are a group of chemicals that can contaminate crops. These can be residues from pesticides or other organisms, such as unwanted fungus, and can affect anyone who consumes the crop.[39] They have been hard to detect normally, but nanosensors are very good at detecting them. Using nanosensors in this way can alert farmers to the presence of agrotoxins and they will be able to remove them faster than ever before.[40]

Despite all of this evidence showing the usefulness of nanotechnology, it has some drawbacks that must be acknowledged. A factor that is present in all elements of agricultural production is cost. Nanotechnology, due mostly to the specialty required to research it, is highly expensive to develop and produce.[41] This factor is irrelevant to large companies and career researchers specializing in this expensive and time-consuming work to maximize efficiency. The cost of implementing nanotechnology can be difficult. This is a very big issue since nanosensor systems rely on other technologies, such as AI management systems. This causes issues for countries that already lack investment in biotechnology since they are already behind in many ways. This could lead to those countries falling further and further behind.[42]

Despite its high cost, some developing countries have started to use nanotechnology to become more sustainable. Nigeria has many researchers who have begun studying how it is used in farming and other fields. What they have found is that nanotechnology is very promising, but they

197-218, https://doi.org/10.48309/IJABBR.2025.2041778.1544.
37 Anjali Bharti, Utkarsh Jain, Nidhi Chauhan, "From lab to field: Nano-biosensors for real-time plant nutrient tracking," *Plant Nano Biology* 9 (August 2024), https://doi.org/10.1016/j.plana.2024.100079.
38 Bharti, "Nano-biosensors for real-time plant nutrient tracking."
39 Amruta Shelar, et al., "Recent advances on highly sensitive plasmonic nanomaterial enabled sensors for the detection of agrotoxins: Current progress and future perspective," *Computers and Electronics in Agriculture* 227, part 1 (December, 2024), https://doi.org/10.1016/j.compag.2024.109545.
40 Shelar, "Recent advances on highly sensitive plasmonic nanomaterial."
41 Lalita Rana et al., "Nexus between nanotechnology and agricultural production systems: challenges and future prospects," *Discover Applied Sciences* 6, no. 555 (October, 2024). https://doi.org/10.1007/s42452-024-06265-7.
42 Udoh, "The Role of Nanotechnology in Enhancing Biotechnology and Biodiversity."

Pest Control in Bahasa Indonesia
Credit: Anis Mujahid Akbar

have found some problems. This includes a lack of research into the environments of less developed countries.[43] Since nanotechnology, such as nano delivery, needs a detailed understanding of where it is being used, this is a roadblock for many countries in addition to the cost. Also, these researchers have found that many nanotechnology studies do not study the long-term effects of some nanoparticles used.[44] These issues raised by Nigerian researchers apply to all countries behind biotechnology funding.

Conclusion

Pest control is a very dynamic field and many new technologies are playing an increasingly larger role in it. Innovations are always coming into the field, and food production that attracts a lot of attention. Any discovery has the potential to alter the way people around the world get access to their food. The world population is constantly growing and more food is always needed for these new people.[45] Every day, pests and other dangers threaten these needs. Pests are a part of nature and can never be removed from the world. What can be done is to keep them away by controlling their numbers worldwide.

By using AI and nanotechnology, waste and time-consuming labor can be removed. This can bring increased security to the agricultural market. With AI-automated monitoring systems, farmers can learn about issues with pests before they have time to grow. Many developments in nanotechnology, such as nanosensors and nanocarriers, can potentially cut down on waste, both in cost and in sustaining the environment. Developments such as nanosensors can make IPM even more useful and accurate. These benefits cannot be replaced, and thus cannot be ignored.

However, it is also important to recognize the dangers, costs, and ethical considerations involved in this process. This is to properly advise governments, companies, and organizations around the world who wish to properly implement new technology. Providing this sort of advice takes a great deal of careful decision-making. Statements should not be made without reasonable knowledge of the topics at hand. History shows us that eager and careless adoption of new technologies guarantees disaster. So, a clear set of guidelines from the Commission can be very important in the future protection of agricultural yield. Delegates are encouraged to look into more details and be aware of both dangers and benefits.

43 Udoh, "The Role of Nanotechnology."
44 Udoh, "The Role of Nanotechnology."
45 Rida Zainab et al., "Prospects and challenges of nanopesticides in advancing pest management for sustainable agricultural and environmental service", *Environmental Research* 261, (November 2024), https://doi.org/10.1016/j.envres.2024.119722.

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TOPIC B: UTILIZING SPACE TECHNOLOGY FOR SUSTAUNABLE DEVELOPMENT

Photo Credit: NASA/Crew of STS-132

Introduction

Earth is like a small, delicate island in the vast emptiness of space. The world is facing problems like climate change and lack of resources. To solve these, delegates need to think outside our planet and use space technology. Once meant just for exploring space, this technology can help us create a more sustainable future. One of the main entities that have helped our world become the way it is today is the United Nations Office for Outer Space Affairs (UNOOSA). The General Assembly founded it on December 13th, 1958, in its resolution 1348 (XIII).[1] This group was initially created as a small unit of experts within the United Nations, and their main job was to help a special committee that focused on using space peacefully. [2] Now, the United Nations Commission on Science and Technology for Development (CSTD) designated 'Exploring Space Technology for Sustainable Development and the Benefits of International Research Collaboration' as a priority theme for its twenty-third session.[3]

Space technology is used in many ways without even thinking about it. Things like satellites help us talk to each other on our phones, predict the weather, find our way around with GPS, and learn more about our planet.[4] Spacecrafts carry people into space, while rockets are powerful engines that launch these spacecraft and satellites. Telescopes are like giant eyes that help us see faraway stars and planets. Robots help us explore space and even fix things. Going further into this topic, it is important to know what Sustainable Development Goals (SDGs) are. As of 2015, with the ratification of the Paris Agreement, these are a call to action to end certain obstacles the world is facing, such as poverty, planet destruction, etc., and were created to ensure all people peace and prosperity by 2030.[5] There are 17 SDGs, measured in 169 targets and 247 indicators, and they can all be connected to the application of space technology. This shows how the versatility of space technology can help us achieve the UN's goals. For example, SDG 2 aims to end hunger. By using space based tools to monitor crops and improve farming, people can produce more food and make sure everyone has enough to eat.[6] Additionally, SDG 3 focuses on good health. Satellites can help track diseases like those spread by mosquitoes, which can improve public health in places like Argentina, Chile, and Paraguay.[7] Since the Sustainable Development Goals were meant to be accomplished in the next five years, it is crucial to implement space technology-based solutions as soon as possible. The space economy is growing very quickly. It is expected to be worth around USD 1.8 trillion by 2035, compared to today's USD 630 billion.[8] All of this means that space is becoming essential to our society. Improving all of these technologies, areas like satellite communication, Earth monitoring, space tourism, and space resource management will help our world develop even more.

The Role of Space Technology in Environmental Monitoring and Disaster Response

Our understanding of our planet has changed throughout the years because of all the data that has been collected about Earth and outer space. Nowadays, scientists can track how our environment changes, what natural resources are available,

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2 United Nations Office for Space Affairs, "History."
3 "Exploring Space Technologies for Sustainable Development," United Nations Conference on Trade and Development, accessed on December 13, 2024, https://unctad.org/system/files/official-document/dtlstict2021d1_en.pdf.
4 Virgil Labrador, "Satellite Communication | Definition, History, & Facts," Encyclopedia Britannica, December 2, 2024, https://www.britannica.com/technology/satellite-communication/How-satellites-work.
5 "The SDGs in Action," United Nations Development Programme, accessed on December 13, 2024,https://www.undp.org/sustainable-development-goals.
6 United Nations Development Programme, "The SDGs in Action."
7 "APPLICATION OF SPACE TO THE SUSTAINABLE DEVELOPMENT GOALS," United Nations, accessed on December 13, 2024, https://www.un.org/sites/un2.un.org/files/outer-space-and-the-sdgs-en.pdf.
8 Emma Charlton, "Here's How Space Technology Affects Our Daily Lives," World Economic Forum, September 27, 2024, https://www.weforum.org/stories/2024/09/4-surprising-ways-space-technology-shapes-our-everyday/.

The aftermath of the DANA in Valencia, Spain
Credit: Piedad López // JCCM

and how to react to natural disasters with better strategies.[9] Imagine taking a picture of the Earth from space. That's what remote sensing is. It involves using special cameras to take pictures of our planet from our atmosphere, like from a satellite or an airplane.[10] These pictures help scientists learn about the Earth without traveling into space. To put this all into perspective, real-life examples would be the cameras in satellites and planes that take pictures of large areas to see the land from a zoomed-out. Also, the sonar systems in ships create images of the ocean floor and do not need a human to dive into the deep sea, or the heat cameras on satellites that keep track of the ocean temperature changes.[11] In the case of disaster response, the path of large forest fires can be mapped from space, the moisture in our atmosphere can be tracked to help predict the weather, and the growth of cities and changes in farmland or forests can be studied in a time-lapse of several years or even decades.[12] At the same time, climate change is a world challenge that delegates should consider; to fight climate change and prepare for its effects, the world needs to predict accurately what its effects will be in the future. In the year 2024, World Space Week was celebrated from October 4 to October 10. This week's purpose is to help people understand and manage Earth's climate.[13] Nowadays, satellites can study greenhouse gas emissions, extreme weather, deforestation, drought, sea level changes, and coastal degradation. A less obvious example of space technology is solar panels. Solar panels or photovoltaics (PV) capture the sun's energy and transform it into electricity. Solar power is very important for combating climate change because it offers a more sustainable and cleaner alternative to non-renewable energy sources that contribute to greenhouse gas emissions, like burning coal. Apart from helping to combat climate change, it has other benefits such as reducing electricity bills and cutting down carbon dioxide emissions.[14]

It is important to know the key role of satellites in disaster handling. Satellites give us a far-away view of disasters and keep communication lines open even when things like cell

9 Conor Feehly, "We Have the Satellite Data to Show Climate Change Is Real. Now What?" Space.com. Space, October 10, 2024, https://www.space.com/climate-change-satellite-data-environmental-action-fossil-fuel-burning.
10 Lars Eklundh, "Remote Sensing," Lundt University, November 21, 2024, https://www.nateko.lu.se/research/remote-sensing
11 Ariana Tantillo, "Surface-Based Sonar System Could Rapidly Map the Ocean Floor at High Resolution," MIT News | Massachusetts Institute of Technology, December 2024, https://news.mit.edu/2024/surface-based-sonar-system-could-rapidly-map-ocean-floor-high-resolution-1218.
12 "What Is Remote Sensing and What Is It Used For? ," U.S. Geological Survey, August 28, 2024, https://www.usgs.gov/faqs/what-remote-sensing-and-what-it-used.
13 Samantha Mathewson, "These Space Tech Spinoffs Are Helping Scientists Fight Climate Change," Space.com. Space, October 9, 2024, https://www.space.com/how-space-technology-aids-climate-change.
14 Energy Saving Trust. "Solar Panels," November 8, 2024. https://energysavingtrust.org.uk/advice/solar-panels/.

towers are damaged or don't exist in remote areas.[15] However, satellites gather tons of data, and there is currently no efficient way to process and send all that information quickly. This often means that important information doesn't reach people who need to help during emergencies quickly enough.[16] One of the most important developments is the rise of Low Earth Orbit (LEO) satellites. These satellites orbit closer to the Earth, which means that information can be shared faster due to their faster internet speeds.[17] Companies like Project Kuiper and SpaceX's Starlink are leading in providing global access through these satellites. Also, 5G satellite integration is being implemented.[18] This means satellite communications and the 5G are joining together, ensuring fast and reliable communication.

In October of 2024, heavy rain began in Valencia, Spain, but on the 29th and 30th, the population experienced historic levels of flooding since 1967, and property damage and loss of life occurred soon after.[19] This was caused by a phenomenon called DANA, a Spanish acronym for high-altitude, cut-off low-pressure storm system. This consists of a cold air mass that collides with the warm Mediterranean air, forming a slow-moving storm with very heavy rainfall.[20] On October 29th, a record-breaking amount of rain fell in a short amount of time.[21] Some places near Utiel and Chiva got over 300 millimeters of rain in just four hours. In some parts of Valencia, it rained more than eight hours than it usually does in an entire year. For context, in Spain, the average amount of rainfall in 2023 was around 536 mm.[22]

As of November 7, 2024, 217 fatalities have been recorded and 93 people are still missing.[23] The Spanish Weather Agency (AEMET) stated huge amounts of rain fell in the Chica area of Valencia. They recorded 491 liters of rain per square meter in just eight hours. The government in Valencia is being criticized for not warning people about the dangerous storm soon enough. They only sent out text alerts about the flooding eight hours after it started, even though the AEMET had issued a "severe danger" or red alert warning at 7:36 a.m. on Oct. 29. This meant that many people were already stuck in their homes stores, or cars when the flooding hit because they did not have enough time to prepare. Experts say that better warnings could have prevented so much damage.[24] In other municipalities of Spain, the National Weather Service began warning people on October 25, 2024. As of November of this year, more than 220 people died, and around 80 are still missing.[25] This has been the deadliest tragedy a single European country has faced since 1967, when floods in Portugal cost the lives of around 500 human beings.[26] Misinformation was a big issue here since the people did not know what to do when there was a flood, even less with such a massive amount of rainwater entering living spaces and establishments. Sadly, there was poor

15 GINA, "Real-Time Satellite Images to Enhance Natural Disaster Response - GINA," October 16, 2024, https://www.ginasoftware.com/blog/real-time-satellite-images-to-enhance-natural-disaster-response/.
16 "Ciseres: AI-Powered Satellites for Rapid Disaster Response – ESA Vision," Esa.int., October 15, 2024. https://vision.esa.int/ciseres-ai-powered-satellites-for-rapid-disaster-response/.
17 Charles Alexi, "Satellite Communications Have Made Remarkable Advances, Driven by Technological Advances, Lower Launch Costs, and the Growing Demand for Global Connectivity. Several Key Innovations Are Reshaping How Businesses Operate, from Remote Areas to Bustling Cities," Linkedin.com, October 19, 2024, https://www.linkedin.com/pulse/new-technologies-reshaping-satellite-communications-sector-alexi-uhbee.
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19 Andrei Khalip and Inti Landauro, "What caused deadly floods in Spain? The impact of DANA explained," *Reuters*, published November 4, 2024. https://www.reuters.com/business/environment/spains-deadly-dana-weather-phenomenon-its-links-climate-change-2024-10-30/.
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26 Becky Gillespie, "How Prepared Is Lisbon for a Monster Flood?" Portugal.com, October 31, 2024, https://www.portugal.com/news/how-prepared-is-lisbon-for-a-monster-flood/.

coordination with regional and national authorities, and there has been no investment to fix buildings and streets for them to face these challenges.[27] A map created on October 31st by the satellites Sentinel-1 and Sentinel-2 showed around 15,633 hectares of flooded zones, which helped approximate that around 190,000 people were affected by this natural disaster.[28] Spain's Civil Protection Agency activated the International Charter "Space and Major Disasters," which provides data to help in the response phase of major disasters.

On the other hand, space technology has helped save lives. The 2010 Haiti earthquake is a tragic example of this. It happened on January 12, 2010, and it was recorded to have a magnitude of 7.0, with 52 aftershocks measuring around 4.5 or greater. It killed an estimated 220,000 people and left millions homeless.[29] In the aftermath of this disaster, satellite imagery was used to assess the damage and identify areas that needed the most assistance. All of this data collected helped coordinate rescues and deliver aid to those who needed it.

Global Positioning System for Precision Agriculture

Imagine you're standing in the middle of a farm and the only thing you can see is a huge field, but somehow you can see a detailed map of the land before you. This isn't magic! It is the power of Global Positioning System (GPS) technology that is transforming the way that people do agriculture. GPS technology is a series of satellites orbiting the Earth and which are always transmitting signals. The GPS receiver, which is usually a smartphone or a newer model car, uses these signals to track your precise location.[30] First, it was used only for military reasons in the 1970s, but this was changed, and this system is now accessible for the public to use.[31] In space, 24 satellites orbit Earth, helping humans reach their destination.[32] On the ground, a control center manages the satellites, confirming they're working correctly and giving them instructions. Finally, your GPS device or receiver is your link to this system, it collects the signals from the satellites and uses them to figure out where you are. Together, these three parts create the GPS that the world knows and appreciates.[33]

By giving exact location data, farmers can upgrade planting, irrigation, and harvesting practices.[34] GPS-guided machinery ensures accurate planting because it uses data to find the spots in the soil where the crops will be more likely to grow. Variable Rate Technology (VRT) optimizes resource use by letting farmers apply water, fertilizers, and pesticides in different amounts across a field using real-time data and considering specific crop requirements. Internet of Things (loT) devices give data on continuous monitoring of environmental conditions and crop status, in order for farmers to make informed decisions on what is going on at the moment.[35] Geographic Information System (GIS) facilitates crop health monitoring by using multispectral and hyperspectral imagery to detect early signs of plant stress or disease.[36] Abiotic factors are a serious threat to crops, these include all the physical and chemical aspects of an ecosystem. These factors may be present in the atmosphere, hydrosphere, and lithosphere, but they are all interrelated. Some examples are water, sunlight,

27 Vive UNIR, "DANA En Valencia: Más Prevención Y Preparación Para Aceptar La Incertidumbre," UNIR, November 7, 2024, https://www.unir.net/revista/marketing-comunicacion/dana-valencia-mas-prevencion-y-preparacion-aceptar-incertidumbre/.
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35 Getahun, Kefale, and Gelaye, "Application of Precision Agriculture Technologies for Sustainable Crop Production and Environmental Sustainability: A Systematic Review"
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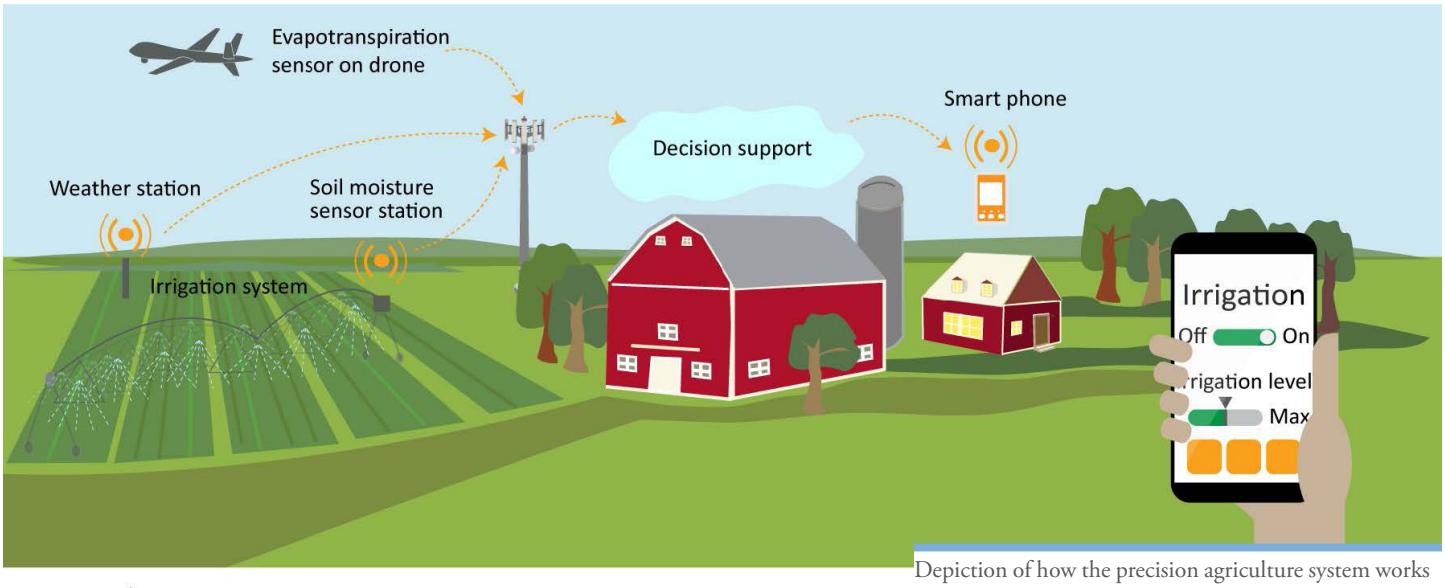

Source: GAO. | GAO-20-128SP

Depiction of how the precision agriculture system works
Credit: U.S. Government Accountability Office

temperature, soil, atmosphere, pH, air humidity, wind, and elevation.[37]

This data is crucial for making informed decisions, reducing waste, and having better crop management. As a result, farmers can use resources more practically and boost capacity. There are many benefits to this technology in agriculture, such as cost savings. This is because it chooses specific areas for the planting of seeds and makes sure there is precise planting, fertilization, and reduced waste. Time is used more efficiently because of GPS-guided machinery, which leads to a drop in the overuse of supplies like water and chemicals, meaning less environmental impact.[38] However, this type of technology has downsides, like expensive initial costs, especially for smaller farms. Lower-income farms could opt for the Farm Loan Program in the United States. These loans help farmers and ranchers by giving them an amount of money to start, expand, or maintain the family farm, and they can choose different methods to pay the money back later on.[39]

If the equipment is to be used effectively, farmers need ongoing training. Farm Management Software (FMS) is a system that helps farmers run their businesses. It helps keep track of crops and livestock, creates reports, and alerts farmers of the harvested crop. Farmers are encouraged to get training on this so that they know how it works and how to use it effectively.[40] If not used correctly, data would be inaccurate and may lead to the under and overuse of fertilizers and pesticides, destroying the crop. Further, these technologies may not be suitable for certain terrains or adverse weather conditions since the signal can be lost.[41] GPS systems work best when combined with other technologies, such as augmentation systems, real-time kinematic, and inertial navigation systems, which can be difficult to set up and use.[42] The future of the GPS network is something that must be thought about. Also, satellite data can effectively predict weather patterns influenced by climate

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42 Samli Drones, "While GPS Generation Has Revolutionized Precision Agriculture, Supplying Farmers with Correct Positioning Data for Diverse Applications, There Are Nonetheless a Few Challenges Associated with Its Use on This Context: Signal Interference: GPS Signals Can Be Affected by Factors Together with Tall Home."

change. All of this information helps farmers maximize crop yields. Some significant advances include more accurate signals, and Artificial Intelligence (AI) and machine learning will permit real-time data processing, allowing farmers to make better decisions. To take advantage of these improvements, people in governmental positions should consider investing in research and development to make computer systems more reliable and useful for farming. GPS-driven machinery and monitoring systems will help farms become independent, and emerging technologies—such as unmanned aerial vehicles—will help farmers monitor crop health and apply fertilizers or pesticides while reducing waste.[43]

On the other hand, precision agriculture offers an economic advantage to those who choose to use it. For example, the United States is one of the biggest producers of corn, with approximately 315 billion tons per year, making around USD 9.2 billion; cotton contributed around USD 21 billion to the industry, and wheat produced USD 12.7 billion. Also, if more farms use this system, the United States could potentially increase its crop production by six percent, putting the United States in a very important economic position.[44] This technology has been used worldwide in countries like the United States, China, Canada, Brazil, and Australia. While the concept of precision agriculture has been around for a while, it has been adapted at different times in individual countries. For example, the United Kingdom and France began implementing it in the late 1990s (1997-1998). Argentina started around the same decade. But more recently, in 2014, the Russian government decided to declare precision agriculture as a national priority.[45] The early adoption of these technologies in the United Kingdom, France, and Argentina, recalls the importance of early investment and technological infrastructure development. Also, Russia's recent declaration of this national priority emphasized the role the government has and how important its commitment and investment is in large-scale implementation.

Conclusion

The global positioning system and space technology started a new era of innovation, especially in environmental watch, disaster response, and agriculture. Both of these technologies created incredible opportunities. The power of satellites and GPS signals has helped us target many world challenges. The world can get information about the health of the planet. Delegates know how to better use our resources. Most importantly, delegates can make more sustainable actions for the future and how to reduce the impact of natural disasters.

Nowadays, with the help of satellites with more advanced sensors, the world can get real-time data on climate change, deforestation, pollution, and natural disasters. All of this collected data helps policymakers, emergency responders, and scientists. They can expect natural disasters, respond more efficiently to these situations, and help reduce their impacts. It is very important to come up with a rich plan of action because this can help prevent loss of life and destruction of cities, people, goods, wildlife, and animals.[46]

Nowadays, GPS technology has made agriculture easier. Using GPS-guided tools, farmers and ranchers use fertilizers, pesticides, and plant seeds in the exact spot they need to be to grow healthier. Also, waste and environmental impact are lowered when this technology is used. GPS-based systems track the health of the soil, moisture, and other factors. It lets farmers improve their practices. This has not only helped agricultural production but also served as a better method of land management. As technology improves, the combination of space technology and the global positioning system will open up new opportunities and help humans in many ways. Also, this includes satellites with better sensors and more

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precise tracking of pollution sources and environmental challenges. If scientists and governments work together to use remote sensing technology in disasters best, it would help lower casualties. One way to achieve this would be to share data faster, clearer, and more ways so people can act quicker. Governments should also raise awareness of what to do in this type of situation and give scientists the resources they need and the tools to improve technology and strategies. The future also holds real-time satellite images and GPS-based communication systems that can help in the faster evaluation of disaster damage. This will help us give out resources and coordinate rescue efforts. This GPS-guided system acts like an assistant. It lets farmers water their crops by using the exact amount, ensuring they use the correct fertilizers, and identifying and managing pests. GPS technology can be used to track the growth of cities, and by using this data experts can plan new roads and housing.

By combining all of these powerful tools, the CSTD can build a more sustainable, stronger, and prosperous future for future generations. By addressing these global difficulties, delegates can protect the planet and improve the quality of life.

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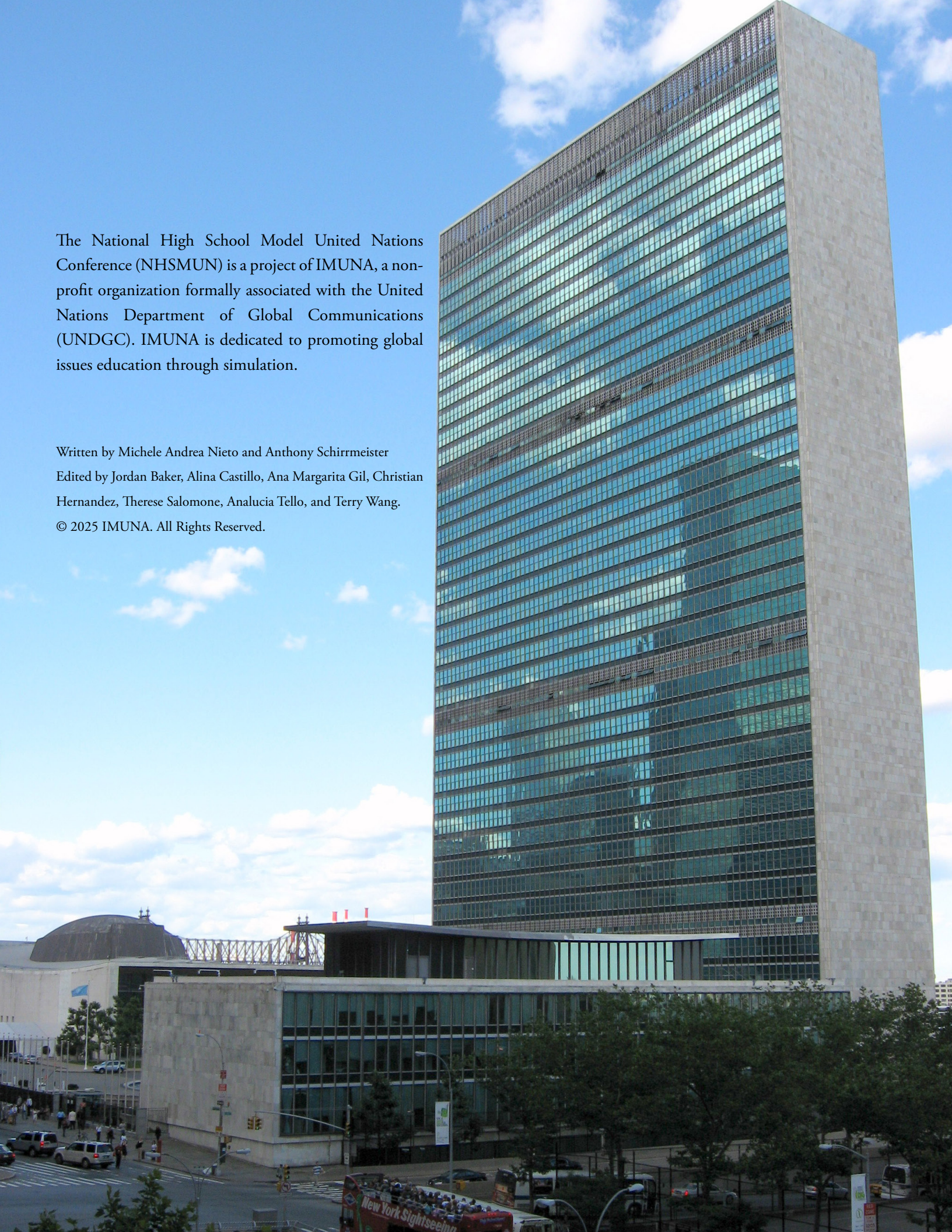

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