

November 2025



-No 1

# Ecology Journal

# PLANTED

TED Ankara College Ecology & Social Awareness Club



*Centaurea tchihatcheffii*: Local endemic to Gölbaşı



# Table of Contents

Letter from the Editor-in-Chief	04
Academician Section	05
A Brief Overview on Climate Change & the Turkish Climate Law	
Are We on the Right Path to a Sustainable World?	
Conserve Water	
Minimize Plastic Waste	
Environmental News & Updates	16
Application Preferences to Protect Ecology	
Eco-Friendly Actions at TED Ankara College & in the Community	17
TED Ecology & Social Awareness Club	
TED Robotics FIRST Robotics Competition (FRC) Team (8780)	
Green Technology & Innovation	20
Strategies to Reduce Greenhouse Gases	
Airplane Powerplants & their Efficiencies	
Fun & Interactive Section	26
Ecology Organizations & Donation	27
References	28

# Masthead

## Editor-in-Chief

Osman Murat DOĐU  
[osmandogu2026@gmail.com](mailto:osmandogu2026@gmail.com)

## Editorial Team

Demir NAZLIAKA  
[dnazliaka@gmail.com](mailto:dnazliaka@gmail.com)  
Osman Murat DOĐU  
[osmandogu2026@gmail.com](mailto:osmandogu2026@gmail.com)

Duru AKIN  
[duruakin0301@gmail.com](mailto:duruakin0301@gmail.com)

Ela KORKMAZ  
[elakrkmz2009@gmail.com](mailto:elakrkmz2009@gmail.com)

## Designer

Duru AKIN  
[duruakin0301@gmail.com](mailto:duruakin0301@gmail.com)

Özkan Dađlı  
[odagli@tedankara.k12.tr](mailto:odagli@tedankara.k12.tr)

## Advisor in Ecology

Dr. Hüseyin ÇİLDİR  
[hcildir@tedankara.k12.tr](mailto:hcildir@tedankara.k12.tr)

## Writers

Dr. Berkay ÇELEBİ  
[berkay.celebi@iklim.gov.tr](mailto:berkay.celebi@iklim.gov.tr)

Prof. Dr. Bülent İNANÇ  
[inancbulent@itu.edu.tr](mailto:inancbulent@itu.edu.tr)

Prof. Dr. Ayşegül AKSOY  
[aaksoy@metu.edu.tr](mailto:aaksoy@metu.edu.tr)

Prof. Dr. Faika Dilek SANİN  
[dsanin@metu.edu.tr](mailto:dsanin@metu.edu.tr)

Osman Murat DOĐU  
[osmandogu2026@gmail.com](mailto:osmandogu2026@gmail.com)

Demir NAZLIAKA  
[dnazliaka@gmail.com](mailto:dnazliaka@gmail.com)

Karen AFARACI  
[karenafaraci@hotmail.com](mailto:karenafaraci@hotmail.com)

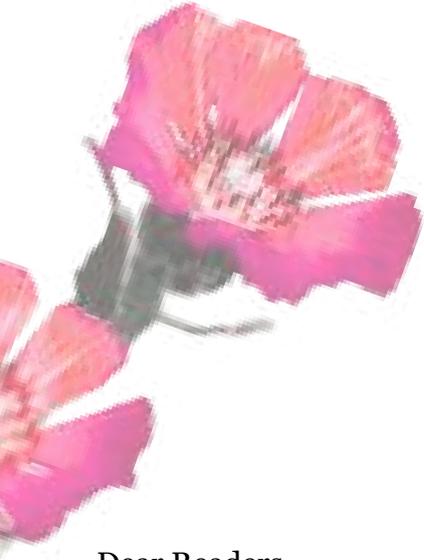
Mira Ceylin KILIÇ  
[kilicmiraceylin@gmail.com](mailto:kilicmiraceylin@gmail.com)

Mustafa Ege YARDIMCI  
[megeyardimci@gmail.com](mailto:megeyardimci@gmail.com)

---

## Kaan USLU

[kaan359035@gmail.com](mailto:kaan359035@gmail.com)



# Letter from the Editor-in-Chief

Dear Readers,

As the editor, I am proud to announce the first ecology journal of TED Ankara College, PLANTED, and would like to thank all the students, teachers, professors, and our school director who contributed to the writing of this journal.

It is difficult to pay attention to every single catastrophe that comes up in the news cycle in today's world. However, global warming, rising sea levels, gradual loss of biodiversity and deforestation are not hypothetical issues. We can't ignore anymore the silent screams of our Earth. We are at the point of no return when it comes to climate change, and we must change our production and consumption patterns to protect the future. We have a responsibility to protect the environment and maintain the balance of our world as future leaders.

Making personal, daily decisions is the first step. We can all take convenient actions like recycling, conserving energy, and promoting sustainability around us. Beyond these activities, the goal is to develop a principle that regards the Earth as a home that requires maintenance rather than a repository of infinite resources.

The biodiversity that supports life is in danger. We are disturbing the balance that nature has established for millions of years with each tree we cut. However, there is still hope: Visionary people like us, who hope to have a liveable home in the future, are organizing environmental events, pioneering green technology, and driving change in our society.

We are determined to take responsibility as the TED Ankara College Foundation High School Ecology & Social Awareness Community. We will do this by planning eco-friendly projects collaboratively. Protecting environmental equilibrium is essential and should not be neglected. We have the power and commitment to shape the future. Let's make a positive impact together!

Sincerely,

Osman Murat DOĞU  
Editor-in-Chief

# Academician Section

## A Brief Overview on Climate Change & the Turkish Climate Law\*

Writer: Dr. Berkay ÇELEBİ  
[berkay.celebi@iklim.gov.tr](mailto:berkay.celebi@iklim.gov.tr)  
Environmental Engineer  
Directorate of Climate Change of Türkiye

In order to understand the rationale and contents of the Turkish Climate Law, there are several topics we need to cover as background information. Firstly, we need a broad grasp of what is actually meant by climate change and greenhouse effect. Next, we need to be aware of the historical and ongoing global efforts. Lastly, we should discuss where Türkiye stands, in terms of both how we are affected and what we are doing.

### Climate Change

First and foremost, it is crucial to understand the science behind greenhouse effect. This effect refers to the process by which certain gases in Earth's atmosphere trap heat from the sun, keeping the planet warm enough to support life. Without the greenhouse effect, Earth would be a much colder place, with an average surface temperature of about  $-18\text{ }^{\circ}\text{C}$ , which as you may have noticed, is too cold to sustain life. Instead, the current average is about  $15\text{ }^{\circ}\text{C}$  [1]. This heat-trapping phenomenon is driven by greenhouse gases (GHG), which act, as the name implies, like a greenhouse, letting sunlight in but preventing some of the heat from escaping.

The most common GHG include carbon dioxide ( $\text{CO}_2$ ), methane ( $\text{CH}_4$ ), nitrous oxide ( $\text{N}_2\text{O}$ ), and water vapor ( $\text{H}_2\text{O}$ ). These gases occur naturally, but human activities have significantly increased their concentrations in the atmosphere, intensifying the greenhouse effect. For instance, burning fossil fuels like coal, oil, and natural gas for energy releases vast amounts of  $\text{CO}_2$  into the atmosphere. Similarly, deforestation reduces the number of trees that can absorb  $\text{CO}_2$ , further adding to the problem. Figures 1 and 2 given (taken from the Intergovernmental Panel on Climate Change (IPCC)'s Synthesis Report on the 6<sup>th</sup> Assessment Report [2]) show the GHG emissions from human activities and changes in global surface temperatures, respectively.

*\*Turkish Climate Law No. 7552 entered into force upon publication in the Official Gazette on July 9, 2025.*

## Global Efforts Against Climate Change

By the 1980s, scientists and policymakers began to recognize the urgent need to address global warming. This recognition led to the formation of international organizations and agreements designed to tackle climate change. IPCC was formed in 1988, under the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP) to assess scientific information on climate change and its impacts. IPCC is recognized for its thorough assessment reports, which are widely utilized by policymakers. These reports are considered to be some of the most credible sources of scientific information on climate change.

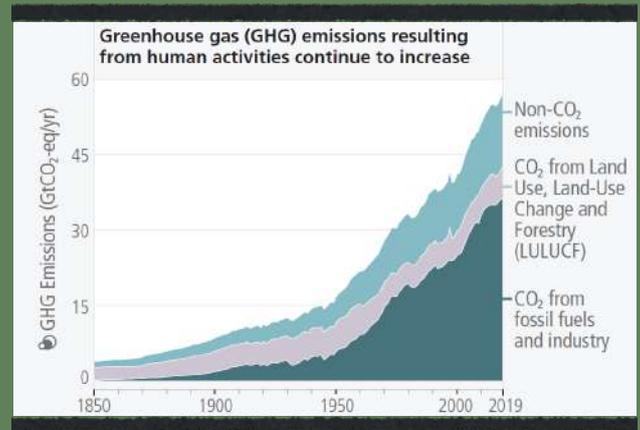


Figure 1: GHG emissions from human activities, amounts expressed in gigatons of CO<sub>2</sub> equivalent per year [2]

In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was adopted at the Earth Summit in Rio de Janeiro. UNFCCC established the framework for future international climate agreements, with the goal of stabilizing GHG concentrations in the atmosphere to prevent dangerous human interference with the climate system. As it stands, it is the main international treaty dealing with climate change.

Meetings of Parties to the Convention are called Conference of Parties (COP). With COP 1 in 1995, countries began negotiations to enhance the global response to climate change. In 1997, at COP 3, the resulting Kyoto Protocol was adopted. This agreement legally commits developed countries to specific emission reduction targets. Additionally, it emphasizes the need for adaptation, one of the core pillars of efforts against climate change.

Measures specified under the Kyoto Protocol were unfortunately not enough to halt the advance of climate change. After several years of negotiations, a new agreement was drafted at COP 21 in Paris. In contrast to Kyoto Protocol, Paris Agreement follows a bottom-up approach, in which the countries themselves determine their national contributions to efforts against climate change. The core aim of the Paris Agreement is “to strengthen the global response to the threat of climate change by holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C” [3]. Note that 2024 was documented to be the first year to exceed 1.5 °C above pre-industrial levels [1].

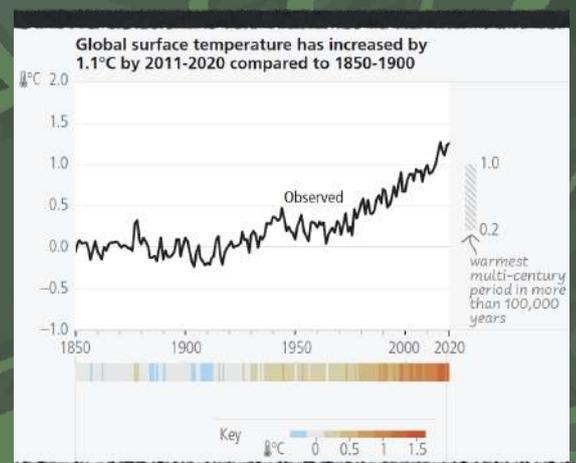


Figure 2: Changes in global surface temperatures [2]

## **Position of Türkiye in International Climate Change Negotiations**

Türkiye's history with UNFCCC and agreements under it is complicated to say the least. At its inception, UNFCCC categorized countries into two annexes, which were reflective of their development status at the time (1992). Annex II Parties were OECD members and were considered as developed countries. Annex I Parties included both the countries listed in Annex II and post-Soviet countries, which were labelled as "economies in transition". Remaining countries were classified as non-Annex and regarded as developing countries. Initially, as a founding member of the OECD, Türkiye was included as an Annex II Party under the UNFCCC.

This later became an important issue for us, as Annex II Parties are obligated to reduce their emissions, provide financial resources to enable developing countries to implement emission reduction measures and to support their efforts in adapting to the adverse effects of climate change. As Türkiye's historical responsibility for GHG emissions are negligible (accounting to less than 1% of global historical emissions) and we are considered to be a developing country under many classifications, we did not initially join the Convention.

In 2001, at COP 7, through agreement of all Parties, Türkiye was removed from Annex II. Following this amendment, Türkiye joined the Convention as an Annex I country which implied that Türkiye could still be considered a developed country.

Later, in 2009, we have also joined the Kyoto Protocol, which did not impose any mandatory emission reductions for Türkiye.

Türkiye has actively participated in the negotiations preceding the Paris Agreement. However, our Annex I status under UNFCCC was still a considerable hindrance. Because of this situation, although Türkiye signed the Paris Agreement after COP 21, it was not ratified. After 5 years, in 2021, Türkiye ratified the Paris Agreement, explicitly stating that we have done so as a developing country. With the ratification, our 2053 Net Zero Emissions target was announced and Directorate of Climate Change was established soon after.

## **Turkish Climate Law**

While the history of international climate negotiations was not generally favorable for us, Türkiye stands at the forefront when dealing with effects of climate change. According to IPCC, the Mediterranean basin is among the most vulnerable regions to climate change. Resulting extreme weather events such as extended droughts, heavy precipitation, heat waves and forest fires will become more common. Observant readers may have noticed the prevalence of such news in the last few years. Furthermore, the 1.5 °C increase was already experienced in the Mediterranean region, before the rest of the globe.

At the same time, it should be noted that current GHG emissions from Türkiye are less than 1% of the total global emissions. This fact signifies that climate change is a global issue and every country should contribute to the efforts within their capabilities. In that regard, as a Party to Paris Agreement, Türkiye needs to prepare her nationally determined contribution (NDC) to global climate change efforts and submit it to UNFCCC. Combination of these factors on how we are affected, our net zero emissions target and our national obligations necessitated a high-level legal basis. Correspondingly, the first Climate Law of Türkiye was enacted by our Grand National Assembly in July 2025.

Primarily, Climate Law defines the main principles of national efforts against climate change. It is explicitly stated in the Climate Law that GHG emissions will be mitigated. This will be done in accordance with our NDC, net zero target, development priorities, national circumstances and prepared action plans. Similarly, on adaptation to climate change, our NDC, national priorities and action plans will be taken into consideration and all relevant institutions will formulate strategies, conduct risk assessments and act on defined measures, as applicable. Moreover, effects of climate change on sustainable water use, biodiversity, protected areas, desertification, agriculture and disaster risk management are also mentioned, along with a call for promoting nature based solutions to handle these issues.

Climate Law will also introduce the emissions trading system (ETS) to Turkish companies with high GHG emissions. ETS is one of the carbon pricing tools, used to associate a cost to GHG emissions. With ETS, the ruling body sets a yearly GHG emission limit to each predetermined company. By the end of each year, these companies either reduce their emissions or trade emissions among themselves to satisfy their set limits. The main aim of ETS is to drive the progress towards GHG mitigation by financially incentivizing it. With the Climate Law, elements of the ETS and responsible institutions are defined. Additionally, any revenue arising from ETS will be utilized in accordance with the principles stated in the law.



Another aspect of the Climate Law that is worthy of mentioning here is that it will provide the legal basis for our ongoing work on Turkish Green Taxonomy. Green taxonomies are classification systems that may cover economic activities, sectors or projects. In essence, they establish the rules, under which an activity may be considered green or sustainable. Main use of taxonomies is the standardization of sustainability criteria and prevention of greenwashing, which can broadly be defined as the practice of overstating the environmental impact of a product, service or activity. Currently, the most detailed taxonomy has been developed by the European Union, however many other jurisdictions have their own.

Last but not least, the Climate Law calls to Ministry of Education and Council of Higher Education to update the curriculums at all levels to include topics like climate change and green transformation. In the end, we know that climate change has the potential to affect the future generations in a more potent manner. And undoubtedly, we will need you, members of future generations, to be more aware and ready to take the necessary actions.

### **About the Author**

Dr. Berkay Çelebi is a graduate of TED Ankara College. He earned his Bachelor of Science (2012) and Master of Science (2015) degrees from the Environmental Engineering Department of Middle East Technical University. His PhD work focuses on developing generative AI models for groundwater modelling. To advance his AI research, he attended Stanford University as a Fulbright Scholar in 2021-2022. Since 2022, he has been working at the newly established Directorate of Climate Change of Türkiye, in the Climate Finance and Incentives Department. He represents Türkiye in international climate finance negotiations and contributes to the development of the Turkish Green Taxonomy.

# ARE WE ON THE RIGHT PATH TO A SUSTAINABLE WORLD?

In the years 1986–87, when I was a senior student at the ITU Department of Environmental Engineering, there were no advanced biological wastewater treatment plants or sanitary solid waste landfills that we could visit for a technical tour. The Golden Horn (Haliç) functioned almost like a septic tank, and bad odor was considered a normal part of life. When leaving the dormitory for the bus stop, I would wrap my face with a scarf, thinking it might protect my throat from burning due to air pollution. While driving toward the Golden Horn, we would close the car windows as early as the Mecidiyeköy area to lessen the smell a bit. The absence of aquatic life in the Gulfs of İzmit and İzmir was considered quite ordinary. We had little hope that anything could be done to improve the situation.

From those days to today, great progress has been achieved. However, there is still a long way to go to reach—or surpass—the level of economically developed countries. As you can see, tremendous efforts have been made, and considerable labor and budget have been devoted to reducing existing environmental pollution and protecting the environment for the future. Managing the environment is a difficult task, and allocating sufficient financial resources is essential. This requires awareness, sensitivity, responsibility, and diligence.

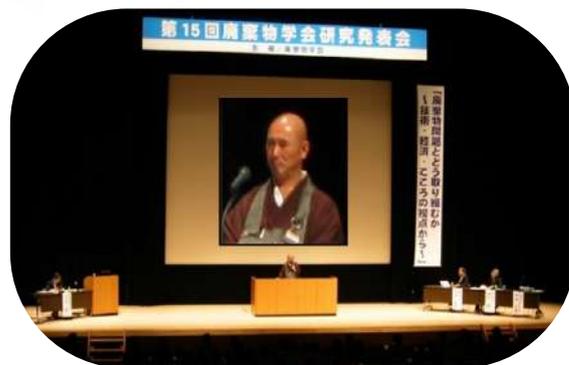
Writer: Prof. Dr. Bülent İMANÇ  
[inancbulent@itu.edu.tr](mailto:inancbulent@itu.edu.tr)  
Department of Environmental Engineering  
Istanbul Technical University

Yet, are we truly on the right path toward a real solution? Is the environment solely the responsibility of the State? If so, why are we still not where we want to be despite so much effort and expenditure? We should not view the environment merely from the perspective of economic benefit or sustainability, but as something entrusted to us—and we should strive to set an example for the entire world in this regard. The environment is not only a legacy for our grandchildren but, first and foremost, a trust from the Creator—meaning it does not belong to us in the first place. Therefore, it cannot truly be “inherited”; what we may leave behind could only be the damage we have caused. Our perspective on the environment should thus extend beyond just a few generations and possess much deeper meaning. To this end, new steps must be taken in both national and religious education to foster the right and desired environmental consciousness.

## A Personal Experience

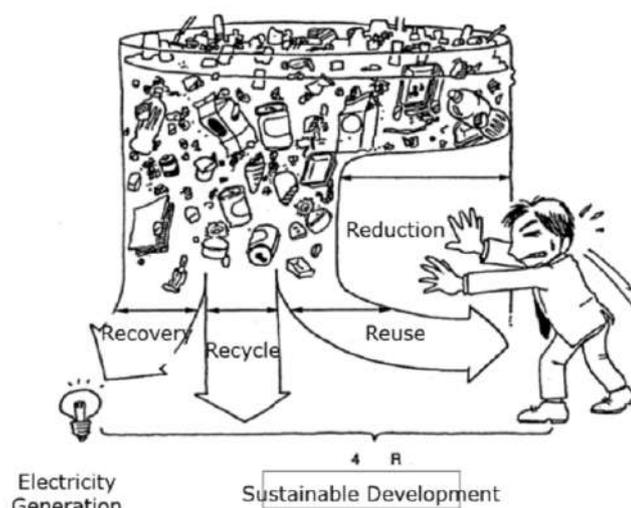
Between 2001 and 2005, while working at the National Institute for Environmental Studies (NIES) in Japan, I participated in the 15th Japan National Solid Waste Symposium, which included a panel titled “How Should We Approach the Waste Problem? – A Perspective from Technology, Economy, and Kokoro (Humanity/Morality/Conscience/Sensitivity)”. The panelists were Professor Tanaka from Okayama University’s Department of Environmental Engineering, Professor Sawa from Kyoto University’s Department of Economics, and Buddhist monk Mr. Noda.

Monk Noda shared that he had previously worked in a company before becoming a monk, and that most members of his temple were businesspeople and executives. He continued: “One day, during our routine prayer gathering, the head monk asked everyone what kind of car they had come with. Most mentioned large and powerful vehicles. The head monk then said: ‘From now on, come with smaller cars.’” He went on to say that the waste problem cannot be solved merely through technological or economic means, but rather through individual restraint and reduced consumption—emphasizing a lifestyle similar to the well-known Turkish proverb “bir lokma bir hırka” (“a morsel of food and a piece of cloth”), which symbolizes modest living.



## A Reflection from Prof. Hiroshi Takatsuki

Professor Hiroshi Takatsuki, an emeritus professor at Kyoto University, is also a talented cartoonist who publishes under the pseudonym HIGH MOON (the English translation of his surname). He has produced numerous cartoons on environmental and waste management themes, available at <https://highmoonkobo.net>. In this essay, a few of his most relevant cartoons. As can be seen from Professor Takatsuki’s works, the key point is reducing waste generation—or, more precisely, reducing the activities that lead to waste generation. This can only be achieved through lower consumption—in other words, “a morsel and a cloak.” No country and no waste management system on Earth is capable of truly managing all solid, liquid, and gaseous wastes. What we can do is merely mitigate, slow down, and spread the impacts over time.





Note: From now on, we are required to live a more simple life.



Note: Even if each one is 'environment-friendly', mass production results in massive environmental impacts

## The Role of the Public Sector

The public sector should take ownership of environmental protection even more than the private sector. Unfortunately, our approach often remains compliance-based—motivated by meeting regulations rather than genuine responsibility. Sometimes, we even justify cutting environmental expenditures by prioritizing short-term financial gains over moral obligations, and then expect to be praised for “saving costs.”

For instance, during the construction of the BTC Crude Oil Pipeline, financed by the World Bank and running from Posof to Ceyhan, extensive scientific biodiversity studies were conducted for the first time in Turkey. Environmental sensitivity mapping and oil spill scenarios based on meteorological and oceanographic data were prepared for the İskenderun Gulf, and monitoring of sea turtle nesting began.

During the construction phase, work was halted for 3–4 months to avoid disturbing the breeding season of the endangered Caucasian Black Grouse (*Tetrao mlokosiewiczzi*)—even though this caused delays. Yet, I heard some criticizing BTC management as “inefficient” and even mocking them for halting a project “because of a bird.” Public institutions must demonstrate exemplary behavior in environmental protection, since they bear responsibility on behalf of the entire society.

## Localization of Environmental Terminology

To enhance environmental awareness and understanding, environmental terminology should be localized and nationalized. Translated and imported concepts often remain confined to professional jargon. We must develop an environmental language that truly resonates with our society.

Our struggle to comprehend and explain the steps necessary for a sustainable world is largely due to the direct translation of foreign terms. Because these concepts did not originate from our culture and language, their meanings are not universally understood.

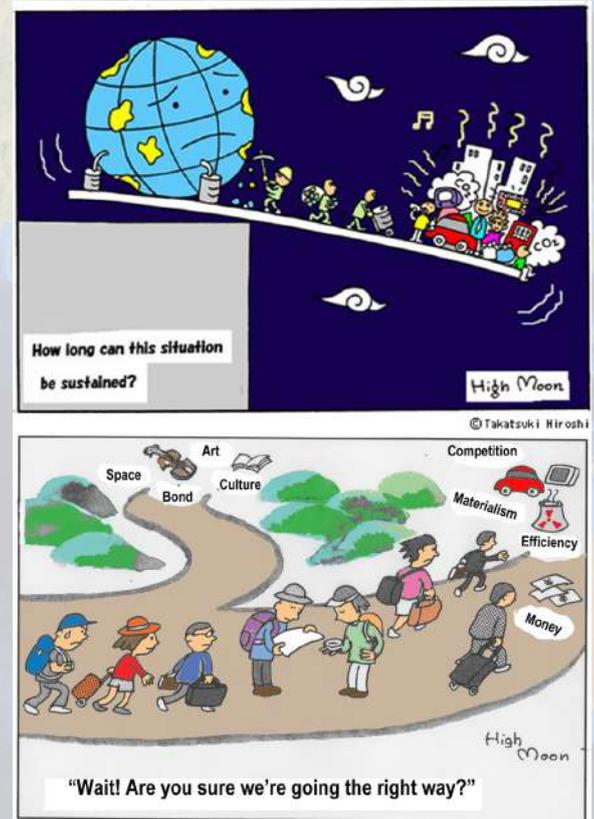
A similar issue exists in the field of occupational safety. In English, “safety” refers to accidents and injuries, while “security” refers to intentional harm or attack. In Turkish, however, both are translated as “güvenlik” or “emniyet.” Consequently, our legal and regulatory systems created the term “iş güvenliği” (occupational safety)—leading to expressions such as “iş güvenliği gloves” or “iş güvenliği glasses,” even when used at home, far from any workplace context. This linguistic perception problem is one of the biggest obstacles to effective solutions.

## Ecological Footprint Components

The ecological footprint consists of several subcomponents, such as:

1. Carbon footprint
2. Water footprint
3. Cropland footprint
4. Forest footprint
5. Built-up land footprint
6. Fishing ground footprint
7. Grazing land footprint

As seen in Professor Takatsuki's cartoons, developing "eco-friendly" products or practices is not sufficient. When their cumulative global production impacts are considered, they are not ultimate solutions—they merely slow down the progression toward an undesirable end.



**Note:** People are reconsidering their former way of life as a result of 3.11.

## Conclusion

Unfortunately, with few exceptions, those who define themselves as "environmentalists" in our country often express their stance through opposition to everything, typically based on incomplete or insufficient knowledge. On the other hand, even Environmental Engineers themselves are not always sufficiently "environmentalist." Therefore, in addition to reforming national and religious education, we must also reconsider the education of environmental engineers.

## About the Author

ORCID: 0000-0002-5995-8657

Prof. Dr. Bülent İnanç graduated from ITU's Department of Environmental Engineering in 1987 and received his M.Sc. degree from ITU's Institute of Science and Technology in 1989. He earned his Ph.D. in Environmental Engineering at Kyoto University, Japan, in 1995, and subsequently served as a Research Associate at the same university. He became Associate Professor in 1996 and served at Marmara University until 2001 as Laboratory Director, Department Chair, and Faculty Board Member. Between 2001 and 2005, he was Senior Researcher at the National Institute for Environmental Studies (NIES) in Japan. From 2006 to 2016, he served as Deputy General Manager and Board Member of BOTAS International Limited (BIL), which operates the Turkish section of the BTC Crude Oil Pipeline. In 2017, he became a Professor at the ITU Department of Environmental Engineering. He has also served as Head of the Department of Molecular Biology and Genetics and Director of MOBGAM (Molecular Biology, Biotechnology and Genetics Research Center) at ITU, Deputy President of the Turkish Water Institute (SUEN), and Vice Rector of ITU. Since 2020, he has been a Board Member of the Blue Peace Middle East Initiative, and chaired the Board from 2020 to 2022. He works on international water policy issues for Turkey and the Middle East and speaks English and Japanese fluently.



# Conserve Water

Writer: Prof. Dr. Ayşegül AKSOY  
aaksoy@metu.edu.tr  
Department of Environmental Engineering  
Middle East Technical University

Although two-thirds of Earth is covered with water, only about 2.5% is fresh water (not saline). Moreover, of that amount, only about 1% can be used for domestic water, such as drinking water. According to the World Health Organization, 50 L/person/day of water is sufficient for drinking, cooking, food, and personal hygiene under non-outbreak conditions. However, currently the average water consumption in the World reaches 3 times of this amount. In industrialized countries, the average usage may reach over 200 L/person/day. We need to avoid overconsumption of water to conserve our scarce fresh water resources starting from the water-consuming activities in our homes. Simple precautions such as installing water-efficient appliances, taking shorter showers, fixing leaking plumbing fixtures, maximizing washing loads, etc. may be significant in reducing water usage. We may also reuse water through collecting the water used for rinsing fruits and vegetables to water plants.

## About the Author

Prof. Dr. Ayşegül Aksoy is a distinguished academic and researcher with extensive contributions in her field. With a career spanning over two decades, she has published numerous peer-reviewed articles, books, and conference papers. Her work is widely recognized for its depth, originality, and interdisciplinary approach. Currently serving as a professor at Middle East Technical University (METU), Prof. Dr. Aksoy is also involved in mentoring graduate students and leading innovative research projects. Her dedication to advancing knowledge and education continues to inspire both her peers and students.



# Minimize Plastic Waste

Writer: Prof. Dr. Faika Dilek SANIN  
[dsanin@metu.edu.tr](mailto:dsanin@metu.edu.tr)  
Department of Environmental Engineering  
Middle East Technical University

Plastics are lightweight but durable materials; thus, they are used in large quantities in many different applications of life, such as the production of cars, aircraft, packaging, pipework, etc. The longevity and stability of plastics make them present for a long time in the environment, even after their useful life and spread all over the globe. By the build-up of plastic objects in the environment, plastic pollution happens, which has negative impact on humans, animals, and the environment that supports wildlife. Each year millions of tons of plastic waste is generated in Türkiye. Unfortunately, the ratio of the amount of waste processed to the amount of waste generated is very small.

Environmentally sound plastic waste management should start with the minimization of plastic waste production. One critical reason leading to plastic pollution problem is the short life of a significant amount of plastics used in daily life. So total elimination or minimization of the consumption of short-life plastics can help mitigate this problem. Many nations are banning/restricting single-use plastics and searching for alternative materials that are sustainable and eco-friendly. The second step is the improvement of plastic waste management by the application of simple and sustainable approaches. Towards this end, effective collection and separation of the collected plastic waste at the source are key issues in effective waste management. Improving the knowledge and awareness of consumers on the correct sorting of household waste helps with this step. Additionally, carrying out an effective collection, separation and recycling for plastic wastes are important actions to be done by the governments to control the plastic pollution.

## About the Author

Prof. Dr. Faika Dilek Sanin is a renowned environmental engineer and professor at Middle East Technical University (METU). With expertise in wastewater treatment, sludge management, and micropollutants, she has led numerous research projects and published extensively in international journals. She has held key academic leadership roles and also contributed to industry through advisory positions. Prof. Dr. Sanin is recognized for her impactful work in environmental sustainability and for mentoring the next generation of engineers and researchers.



# Environmental News & Updates

## Application Preferences to Protect Ecology



### **JouleBug**

JouleBug is an employee engagement mobile app that educates and mobilizes your people to take action toward your company's sustainability goals. JouleBug is a fun, interactive app designed to help users live more sustainably by turning eco-friendly actions into daily habits through gamification. It blends social interaction, real-world challenges, and rewards to promote environmentally conscious behaviors.

<https://www.joulebug.com/>



### **Love Clean Streets**

It is a project that aims to clean up the streets in the UK. Since the trash on the streets is a huge problem for the environment, their removal is a must. The users of this application can report environmental issues.

<https://lovecleanstreets.info/>



### **iRecycle**

The app aims to inspire every individual and community by their efforts against plastic pollution via innovative recycling solutions, education, and community networks.

<https://irecycle.world/>



### **AWorld**

The United Nations' ActNow initiative, which encourages people and communities to take climate-positive action, has AWorld as an official partner. The app's main goals are to assist users in tracking their carbon footprint, forming environmentally friendly routines, and combating climate change.

<https://aworld.org/>

# Eco-Friendly Actions at TED Ankara College & in the Community

## TED ECOLOGY & SOCIAL AWARENESS CLUB

### Flower Sale

Our Club carried out a flower sale on Teacher's Day that aimed to motivate people about spreading the green. The income was donated to plant breeders. Additionally, we built birdhouses around the TED Ankara College campus.

Karen AFARACI  
[karenafaraci@hotmail.com](mailto:karenafaraci@hotmail.com)  
Mira Ceylin KILIÇ  
[kilicmiraceylin@gmail.com](mailto:kilicmiraceylin@gmail.com)  
Mustafa Ege YARDIMCI  
[megeyardimci@gmail.com](mailto:megeyardimci@gmail.com)  
Kaan Uslu  
[kaan359035@gmail.com](mailto:kaan359035@gmail.com)

## TED ROBOTICS FIRST ROBOTICS COMPETITION (FRC) TEAM (8780)

### NiTiPlant

While the need for renewable energy is increasing globally, the biggest challenge in this field seems to be the high installation cost. An alternative renewable energy source is developed to form an innovative solution: NiTiPlant provides a low-cost and efficient alternative solar energy.

Developed by TED Robotics, NiTiPlant generates electricity at half the cost used in production of conventional solar energy with the same amount of power. This makes a difference as it aims to support developing regions with widespread adoption of renewable energy systems.

To ensure the project extends beyond a physical device, as the mechanic, software and public relations team of TED Robotics, we take the lead on this project and developed an internet based monitoring platform, called "MoNiTi. With this system created, users across the world are now able to observe real-time performance data.

In the development phase, professors from multiple universities worked to confirm the physical calculations and variables of the system. The detailed three dimensional models were modeled on Fusion 360. The behavior was examined experimentally on the NiTiNol alloy material employed in the system and efficiency analysis was backed up by literature study.

In order to globally promote NiTiPlant, TED Robotics participated in the SolveED Youth Innovation Challenge organized by MIT. During this process, the team successfully created the first prototype of the Monitor control server, moving beyond theoretical design.

NiTiPlant is intended to mark an important step toward a sustainable future both from a technological and an environmental point of view. Its low-cost, accessible, smart clean-energy model will grant the power of the sun to communities around the world.

### **Contribution of the Green Flow Project to Ecosystem Restoration in Cooperation with the Mediterranean Conservation Society**

The Mediterranean Conservation Society (AKD) was founded in İzmir in 2012 as a national non-governmental organization focused on the conservation of biodiversity in Türkiye's Mediterranean ecosystems, the restoration of marine habitats, and the monitoring of endangered species. It especially works on improving the sustainability of habitats belonging to the Mediterranean monk seal (*Monachus monachus*) and the sandbar shark (*Carcharhinus plumbeus*), supporting at the same time the socio-economic continuity of the traditional coastal fishing practices.

Within this framework, the TED Robotics team collaborated with AKD to present the Green Flow Project and set shared research goals aimed at improving the ecological quality of Mogan Lake. During the meetings, the current pollution profile of the lake ecosystem was assessed, and a long-term action plan for improving water quality was developed.

One important step in this collaboration was the participation of the team in the "Macro and Micro Marine Litter Sampling Training." This program allowed participants to acquire practical knowledge on the identification of micro-plastic pollution, standardization of sampling, and classification of pollution sources. The findings from this training provided the methodological basis for the pilot clean-up and data collection studies planned at Mogan Lake.

This collaboration serves to illustrate the increasingly important role of interdisciplinarity in local freshwater ecosystem restoration and the potential value of an integrated approach to environmental technology, biological monitoring, and community participation.

### **Knowledge Sharing and Collaboration with the Take Care of Your Trash Association**

It is only when technological innovation is combined with behavioral change and public awareness that environmental sustainability can become lasting. The TED Robotics team met with the Take Care of Your Trash Association to share ongoing sustainability projects and learn about the activities of the Association. The discussions covered waste management, enhancing the efficiency of recycling systems, environmental education programs, and awareness campaigns based on urban ecology.

The talks underlined that holistic approaches involving behavioral change and participation of local administrations are imperative. This resulted in the identification of collaboration opportunities for future campaigns, field research, and impact assessments for social accountability with a focus on environmental awareness. Community-focused projects evolved in this context that aimed to support wider adoption of waste-conscious and environmentally friendly living practices.

# Assessment of the Efficiency of Phytoremediation of Mogan & Eymir Lakes within Green Flow Project Perspective

## 1. Introduction

During recent years, water pollution became one of the most important environmental and social problems in the world. In Türkiye, with increasing industrialization, urbanization, and agricultural activities, the pollution of surface waters has been an important problem lately. In this respect, this situation is especially evident in the closed lake basins, like Mogan and Eymir Lakes in Ankara.

This study, part of the Green Flow Project, investigates the effectiveness of phytoremediation, or plant-based purification, in enhancing the quality of the water in these lakes.

## 2. Materials and Methods

Water samples were taken from Mogan Lake, Eymir Lake, and Ankara tap water (used as the control group). Three aquatic plant species were selected:

- *Lemna minor* (duckweed)
- *Eichhornia crassipes* (water hyacinth)
- *Pistia stratiotes* (water lettuce)

Each plant species was placed in each kind of water sample under the same environmental conditions for three days.

## 3. Measurement Protocols

The following parameters were measured:

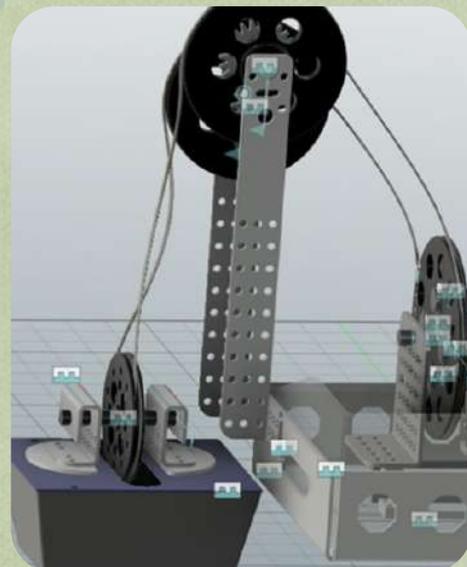
- pH
- Color (visual clarity and tone)
- Turbidity (NTU)
- TDS (Total Dissolved Solids)

Measurements were taken at three time intervals:

- Before plants were placed in water (0 hour)
- One hour after placement
- After 72 hours

## 4. Summary of Findings

The results show that some aquatic plants significantly influenced water quality parameters. Water hyacinth and duckweed caused noticeable decreases in TDS and turbidity values. A slight increase in pH was also observed. These findings support the potential applicability of phytoremediation as a natural treatment method in closed freshwater ecosystems.



# Green Technology & Innovation

## Strategies to Reduce Greenhouse Gases

Writer: Osman Murat DOĞU  
[osmandogu2026@gmail.com](mailto:osmandogu2026@gmail.com)  
TED Ankara College

The main cause of air pollution and the greenhouse effect is the excessive global emission of greenhouse gases (primarily carbon dioxide, CO<sub>2</sub>, and methane, CH<sub>4</sub>), particularly as a result of burning fossil fuels for energy and power generation [1]. The world's ecosystems are disturbed by climate change and environmental pollution, threatening the economy, human health, and natural resource availability [2].

Carbon dioxide is the major component of greenhouse gases, so lowering carbon emissions is a global concern [3]. According to recent studies, technological advancements have caused a significant increase in the amount of carbon dioxide (CO<sub>2</sub>) emissions in the atmosphere compared to the previous century [4]. In addition to that, a growing human population leads to an increase in energy demands. The majority of energy needs today are met by burning fossil fuels, which release enormous amounts of greenhouse gases (GHG) [5].

### 1. Transition to Renewable Energy:

The transition to renewable energy (RE) has become key to mitigating climate change, improving energy conservation, and providing sustainable development. This transition includes renewable sources like solar, wind, hydro, and geothermal energy to reduce the reliance on finite and environmentally damaging fossil fuels [11].

In the next twenty years, the amount of energy consumed worldwide will increase with population growth and the expansion of data centers for Artificial Intelligence. Interest in the development of alternative energy resources has increased recently due to rising fossil fuel prices and worries about the effects of greenhouse gas emissions on the environment. A major turning point in the demand for alternative energy sources was the Fukushima-Daiichi accident. On March 11, 2011, the Fukushima-Daiichi nuclear power station (FDNPS) suffered major damage after the 9.0 magnitude East Japan earthquake and subsequent tsunami. It was the largest civilian nuclear accident since Chernobyl in 1986. Radioactive material was released from the damaged plant, and tens of thousands of people were evacuated [12]. Since there are no risks of similar scale associated with renewable energy, it is now regarded as a more desirable fuel source than nuclear.

As I mentioned before, greenhouse gases are mainly made up of carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>). Global warming, an increase in average global temperature, a rise in sea levels, and a subsequent increase in the number and extremity of natural disasters are particularly caused by greenhouse gas emissions, which cause heat to be trapped in the atmosphere [6, 7, 8]. The increase in CO<sub>2</sub> levels worldwide also raises the possibility of an unpredictable climate, which could endanger sea life and, most significantly, human survival [9]. In other words, rising energy demand results in a larger carbon footprint and greater environmental damage [10].

As a result, we must urgently make the necessary changes to maintain the ecological balance and we must work to eliminate the factors that cause excessive CO<sub>2</sub> emissions and environmental pollution.



## 2. Energy Efficiency:

An electrical network's energy efficiency could be taken into account at various points in time, including during power generation, transmission, distribution, and consumption. Some currently available technologies are virtual power plants (VPP), smart grids, electric vehicles (EV), and combined heat and power (CHP) [3].

### a. Electric Vehicles

One of the world's most energy-intensive industries, transportation accounts for up to 27% of the world's primary energy demand [13]. Consequently, the transportation industry plays a major role in our Planet's greenhouse gas emissions, which are the main cause of climate change [14, 15]. Nevertheless, switching to EVs is not adequate. The electricity which is produced to charge the batteries of these cars should be generated with eco-friendly methods.

### b. Combined Heat and Power

Combining the use of electric power and heat is known as cogeneration, or combined heat and power (CHP). It is anticipated that its efficiency will be significantly higher than that of each source. The majority of power distribution companies do not provide steam or hot water—just electricity. When a portion of the energy is discarded as waste heat, CHP is an efficient use of fuel, especially since heating accounts for nearly 30–40% of a nation's total energy load. It captures some or all of the waste energy as a by-product of heating [3].

### c. Virtual Power Plants

An array of dispersed energy resources, including solar photovoltaic panels, wind turbines, and micro-CHP, managed and controlled by a central control unit is called a virtual power plant (VPP). The term Distributed Energy Resources (DER) can be used for fossil or renewable energy fuels. A DER system is developed to address issues with energy waste brought on by transmission losses and long distances. DERs are therefore typically found near distribution networks [3].

### d. Smart Meters

Reducing peak demand during a specific time period is the primary goal of demand-side management for power generation companies. In this regard, a smart meter is a device to record the consumption of electricity in hourly intervals, and the information is monitored by both the utility company and the customer. A smart meter can have two-way communication and intelligence management for home appliances [3].



### **3.Sustainable Agriculture:**

After World War II, American agriculture was the envy of the world for almost 40 years, setting new records for labor efficiency and crop yield almost every year. In addition to becoming highly specialized and mechanized, American farms during this time became largely reliant on borrowed funds, fossil fuels, and chemical pesticides and fertilizers. Today, these farms are linked to decreased soil productivity, deteriorating environmental conditions, decreased profitability, and hazards to the health of people and animals [16]. On the other hand, the application of drones into agriculture had a significant impact, increasing crop yields and reducing waste caused by outdated farming machinery. Developing and applying new technologies in agricultural fields can make a meaningful difference for both human health and environmental sustainability.

### **4. Carbon Capture and Storage (CCS):**

Three steps make up the CCS methodologies: CO<sub>2</sub> capture, CO<sub>2</sub> transportation, and CO<sub>2</sub> storage. Various methods are being developed to capture CO<sub>2</sub> at fixed point sources, such as power plants and cement manufacturing facilities. The most common methods so far are absorption, adsorption, separation by membranes, and cryogenic separation. After that, the captured gas mixture is compressed into a liquid and supercritical fluid, which is then shipped or transported via pipeline to the storage location. The options for storing CO<sub>2</sub> include mineralization, ocean storage, and geological storage. In essence, CCS keeps CO<sub>2</sub> out of the atmosphere by capturing it from exhaust gas and injecting it into deep reservoirs that contain fluids for thousands of years. CCS is a significant technological choice because it minimizes the impact of CO<sub>2</sub> on the Earth's climate system while enabling societies to preserve their current carbon-based infrastructure. Nevertheless, this technology is still being developed [17].

### **5. Waste Management:**

Not only does waste play a significant role in the greenhouse problem, but it is also a sector where taking environmentally friendly actions is politically acceptable. It has become much easier to persuade most people to change the way they handle solid waste. As a result, waste management is a promising area to reduce carbon emissions and ought to be included in any all-encompassing plan for mitigating climate change [18].

In summary, the excessive release of greenhouse gases from burning fossil fuels—especially carbon dioxide—has become a major contributor to climate change and wider ecosystem disruption.

These problems are worsened by population growth and the radical increase in energy demand, underscoring the urgent need for action. Switching to renewable energy, implementing sustainable agricultural practices, and improving energy efficiency with state-of-the-art technologies like virtual power plants, smart grids, electric vehicles, and combined heat and power systems can all significantly reduce emissions. Furthermore, improved waste management and CCS present viable ways to lessen the negative environmental effects of our waste generation and energy use. By adopting these tactics, societies can make transition to a low-carbon future, guaranteeing the preservation of natural resources for future generations.

# Airplane Powerplants & their Efficiencies

Writer: Demir NAZLIKA  
[dnazliaka@gmail.com](mailto:dnazliaka@gmail.com)  
TED Ankara College

Since the invention of the airplane by the Wright Brothers in 1903, airplanes have played an important role in the lives of countless people. It is difficult to imagine a world without airplanes. Airplanes are used very frequently in many fields and regions, and they play a fundamental role in both the military and the commercial market. Airplanes have many different types of engines, and as the aerospace industry advances, so do the engines involved. Aeroplanes utilized piston engines and propellers until the late 1940s, which saw the introduction of a new type of engine which powers most aircraft in the modern day: the jet engine. The jet engine was first developed in the late 1930s and since then has become a key component of our lives. It can be seen in almost all airplanes today, and they are very popular in military planes such as fighters, and bombers, and in civilian planes like cargo planes and airliners. However, the widespread use of airplanes is not without harm to the environment. Emissions from aviation are a significant contributor to climate change as the engines used in aircraft release CO<sub>2</sub> emissions and have strong warming effects due to the release of nitrogen oxides into the air [1]. This article will discuss the effects of aviation on the environment, along with how different engines used in airplanes affect the environment.

Despite their utility in the world, airplanes and their engines present a major problem for the world. Almost all of them utilize fossil fuels to power their engines. Unlike cars, airplanes currently do not have an electric alternative due to the size and mass of the battery that would be required to match the power of the jet engines of airliners, which commonly produce over 30,000 horsepower. When comparing an airplane to a car, increasing the mass of a car by 35% leads to an increase in energy use of 13-20%. But this is not the case for airplanes, since energy use is directly proportional to mass: increasing its mass by 35% means the plane needs 35% more energy (when all other factors are equal) [2]. Basically, the current stage in airplane technology means that there is no practical alternative for jet engines in the world today. There are multiple examples of electrically powered airplanes, though they are not advanced enough to completely replace planes such as jet airliners and combat aircraft. Electrically powered engines are not yet suitable to replace jet engines on aircraft, but different types of jet engines with varying efficiencies and effects on the environment have developed over the course of aviation history. Some of these engine types include the turbofan, turboprop, and turboshaft engine. These engines play very important roles in our lives, as turboshafts are used in helicopters while turbofans are present in almost all types of jet airliners like the Boeing 737 and the Airbus A350. The turboprop engine also plays an important role in the aviation industry today, as it is used in many airliners and military airplanes, such as in transport and light attack aircraft. We will discuss these engines and how efficient these engines are.

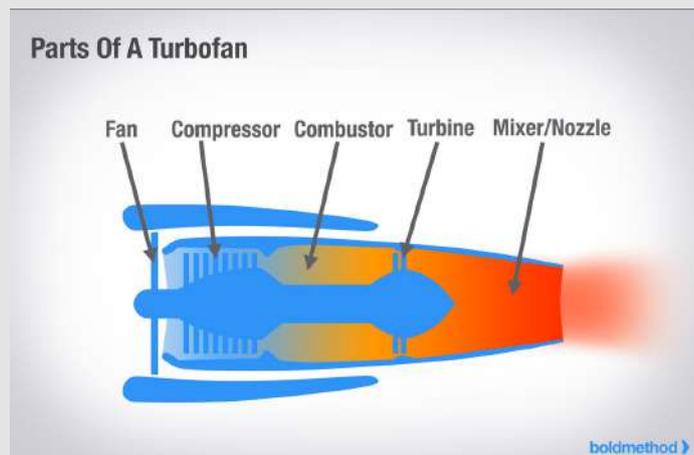
The turbofan engine was first developed in the mid-1940s and has been widely in use since the mid-1960s. It is a much more efficient alternative to the turbojet engine, since the turbofan engine utilizes a fan which sucks air into the engine. Once air enters the engine, some of the air passes through the fan and continues into the compressor and then the combustion chamber, where it is mixed with fuel and combusted.



[Image 1]: An illustration of an airplane [3]

Once the air is combusted, it moves out to the nozzle, just like a basic turbojet operating on the principles of suck, squeeze, blow, bang. This creates a layer of hot gas in the exhaust. Meanwhile, the rest of the air that did not enter the core bypasses the whole system, surrounding the hot air with cold air. The amount of air which bypasses the engine compared to the air that goes through the air is known as the bypass ratio in the aerospace industry [4], and an increase in bypass ratio increases the efficiency as a whole. Jet airliners utilize high bypass ratio engines, while military combat aircraft, such as the F-16, use low bypass ratio engines.

The main reason the turbofan is so widely used is because of how efficiently fuel is used in this engine. Since much less fuel is used for the same distance compared to a standard turbojet engine, the cost of operating the aircraft is drastically reduced. So thanks to this engine, the price of airliner tickets is much lower compared to how they would have been in a turbojet powered airplane. Alongside the positive effects in terms of fuel efficiency, which really helps the environment, the turbofan generates less noise, drastically lowering noise pollution in return for being slightly heavier and more expensive [5].



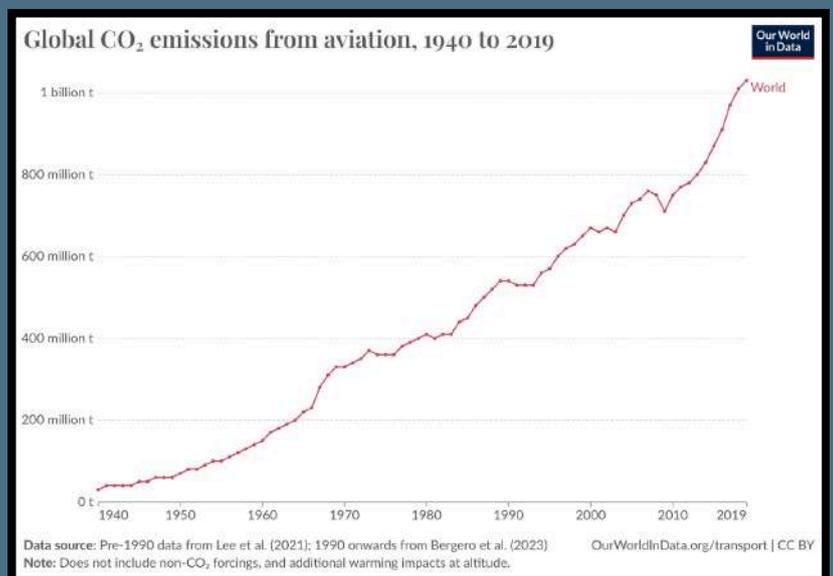
[Image 2]: Parts of A Turbofan [6]

Another engine widely used in airplanes, which is efficient, even more efficient than the turbofan engine, is the turboprop engine. Unlike the previously mentioned engines, the turboprop utilizes a propeller. In fact, it is simply a jet engine with a propeller attached to the front or back of the engine [7]. Rather than converting the energy into thrust coming from a jet pipe, the turboprop engine turns this into power that drives a propeller to create the thrust which propels the airplane. Propellers have been used in airplanes since the first aircraft made by the Wright Brothers. However, these early aircraft had a piston engine attached to the propeller, unlike the modern turboprop, which has a jet engine attached to the propeller.

This engine can be seen in airliners and some military aircraft, though the turboprop isn't as common as its turbofan engine counterparts. This is because turboprop powered airplanes cannot reach the speeds of turbofan powered airplanes. This is due to the propeller of the airplane. Propellers drastically lose efficiency when the blades begin to operate at higher Mach numbers, causing the airspeed to be limited. As a result, turboprop airliners are preferred on shorter range and regional routes. These airliners fly at slower speeds and lower altitudes than jet airliners and are often more efficient; hence their preference by some airliners.

As mentioned, there are many types of jet engines, and turboprops and turbofans are very efficient, causing less CO<sub>2</sub> emissions compared to the turbojet counterparts, which were inefficient, loud, and generated less power in the first jet airliners of the past, such as the De Havilland Comet and Boeing 707. However, this does not change the fact that airplanes produce CO<sub>2</sub> emissions, negatively impacting the environment. Flying contributes to 2.5% of the world's carbon emissions, and this might seem low considering how much of a carbon intensive activity flying is [9]. This is because around 10% of the world flies in most years. Still, the amount of CO<sub>2</sub> emitted by aviation has doubled. In 1990, the amount of CO<sub>2</sub> emitted by global aviation was 0.5 billion, while this rose to 1 billion in 2019. This has prompted the aerospace industry to look for lowering CO<sub>2</sub> emissions. Despite the lack of an alternative in terms of engine replacements, there is an alternative in terms of fuel for the engines used in aircraft. This is through sustainable aviation fuel from non-petroleum feedstocks that reduces emissions from air transportation [10]. The use of sustainable aviation fuel is rising, and more than 360,000 commercial flights have used it in 46 different airports. However, the high cost and limited availability of sustainable aviation fuel have permitted the wide use of this new alternative in the aeronautical community. The fuel is 2-3 times more expensive than regular jet fuel, and this is very significant since the biggest cost item for airlines is the fuel used in the airplanes [11].

In summary, airplanes play a key role in CO<sub>2</sub> emissions, and the reduction of these emissions is targeted through multiple ways. Engines like the turbofan engine and turbojet engine are very efficient, which contributes to the reduction of CO<sub>2</sub> emissions by using less fossil fuels compared to engines like the turbojet engine. Despite the lack of an alternative for engines like the jet engine and piston engine to prevent the altogether emissions of CO<sub>2</sub>, there are alternative fuels to power airplanes. The rise of Sustainable Aviation Fuel will play a key role in reducing carbon dioxide in the future, though the fuel is not currently popular due to its cost and lack of availability.



[Image 3]: Global CO<sub>2</sub> emissions from aviation, 1940 to 2019 [8]

# Fun & Interactive Section



## DIY Ecosystem Projects

Build a Terrarium: Create a mini self-sustaining ecosystem!

### Materials You'll Need:

1. Glass container (jar, vase, or aquarium, preferably with a lid)
2. Small pebbles or gravel (for drainage)
3. Activated charcoal (keeps water fresh and prevents mold)
4. Potting soil (choose based on plant type, e.g., cactus soil for succulents)
5. Plants (succulents, mosses, ferns, or small tropical plants)
6. Decorative elements (rocks, mini figurines, optional)
7. Tools: Spoon, tweezers, and a spray bottle

### Step 1: Choose the Right Plants

- Closed Terrariums → Ideal for tropical plants, ferns, and mosses because they thrive in humidity.
- Open Terrariums → Ideal for succulents and cacti (they prefer drier air).

### Step 2: Build the Base Layers

1. Add Pebbles (~2-3 cm thick):
  - Ensures proper drainage to prevent root rot.
2. Sprinkle Activated Charcoal (~1 cm):
  - Keeps water clean and stops bacteria buildup.
3. Add Potting Soil (~5-7 cm):
  - Make sure there's enough depth for the plants' roots.

### Step 3: Planting

1. Make small holes in the soil using a spoon or fingers.
2. Place plants into the soil, starting with the largest ones.
3. Press soil gently around each plant to stabilize them.

 **Tip:** Use tweezers for delicate plants or hard-to-reach spots.

### Step 4: Decorate & Customize (Optional)

- Add small rocks, mosses, or mini figurines to make it unique. Also, create “paths” or “mini landscapes” for a natural look.

### Step 5: Water & Maintenance

- Closed Terrariums: Lightly mist the plants.
- Water sparingly (every few weeks).
- Open Terrariums: Water when the soil feels dry (every 1-2 weeks).

### Light Needs:

- Place in indirect sunlight, too much sun can overheat the glass.

### ✓ Terrarium Tips:

- Condensation? → If the glass fogs up, open the lid for a few hours.
- Yellowing leaves? → Might be overwatering, reduce frequency.
- Dusty glass? → Clean with a damp cloth (outside only).

# Ecology Organizations & Donation

## Effective Organizations in Türkiye



Doğa Derneği, the partner of BirdLife International in Türkiye  
ÇEKÜL (The Foundation for the Protection and Promotion of  
the Environment and Cultural Heritage)

WWF-Türkiye (World Wide Fund for Nature)

TEMA Foundation

Kuzey Ormanları Savunması (Northern Forests Defense)

TED Ankara College Ecology & Social Awareness Club



## Effective Global Organizations

**Doğa**

WWF (World Wide Fund for Nature)

The Nature Conservancy (TNC)

Greenpeace

IUCN (International Union for Conservation of Nature and  
Natural Resources)

BirdLife International



**GREENPEACE**

**Donate Trees**

Trees For All

The Nature  
Conservancy 



**Trees for All**



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