Collateral Environmental Impacts of Economic Sanctions on Iran

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For the past 40 years, Iran has been the target of economic sanctions. Iran has implemented various survivalist policies in response to sanctions, resulting in significant environmental consequences. This study presents the inaugural comprehensive analysis of the inadvertent environmental consequences of international economic sanctions on Iran. Some people say that sanctions are not the main cause of Iran's major environmental problems, but they have had an undeniable effect on the country's environment by: (1) limiting its access to technology, services, and know-how; (2) blocking international environmental aid; and (3) making its economy more dependent on natural resources. Sanctions have effectively restricted Iran's economic growth and its capacity to detach its economy from natural resources, consequently enhancing the significance of natural resources in Iran's political economy. In general, sanctions have made it much more expensive for the environment to produce goods, but this is not a priority for the Iranian leaders who run the country in survival mode while aggressively pursuing their ideology. The study urges increased focus on the neglected environmental consequences of sanctions on Iran, which bear significant health, justice, and human rights ramifications that may be transgenerational and transboundary.

Keywords: Sanctions, Iran, Environmental Politics, Environmental Justice, Environmental Security, Environmental Economics, Environmental Diplomacy, Unclear Program, Nuclear Deal, JCPOA

Introduction:

Countries, groups of countries, and intergovernmental organizations punish states that they think are acting strangely according to international norms and are a threat to their own interests. Beginning International economic Sanctions have been in place for decades because they are thought to be able to normalize behavior and get rid of threats. of countries, and intergovernmental organizations punish states that they think are acting strangely according to international norms and are a threat to their own interests. In theory, economic Sanctions do not have immediate and obvious harmful and deadly effects like wars do. They seem like nice and soft foreign policy tools that can get the job done by only hurtingthe economy of the country that is being punished. However, in reality, the effects of economic sanctions can extend beyond the economic realm [1].

Sanctions can cause a lot of damage to regular people and their economic well-being [2][3][4][5][6]. The deterioration of human rights and the onset of food and health insecurity issues resulting from sanctions are commonly cited humanitarian reasons for questioning the legitimacy and efficacy of such measures [7][8][9][10][11][12][13][14][15][16]. Economic sanctions could also have an effect on the environment [17][18][19][20][21][22]. The short-term and long-term environmental consequences of international economic sanctions are significantly constrained.

The United States, the United Nations (UN), and the European Union (EU) have all put major economic sanctions on Iran over the past 40 years [23][24]. have been heated arguments about whether these sanctions have worked and whether they changed Iran's behavior by hurting its economy. So, the effects of economic sanctions on Iran have gone beyond the country's economy [25][26][27][28][29] and can last even after the sanctions are lifted [30] having a lot of trouble with the environment right now. of the most obvious signs of Iran's environmental degradation over the past 40 years are: more water shortages, rivers, wetlands, and aquifers drying up, air and waste pollution, soil erosion, deforestation, desertification, sand and dust storms, land subsidence sinkholes, wildfires, and losses of biodiversity [31][32][33][34][35][36][37]. Officials in Iran have blamed economic sanctions for their effects on the environment. Some have even said that sanctions have caused "severe" and "irreparable" damage to Iran's environment [38][39][40][41][42][43]. These claims have not been proven, and there is very little information about how economic sanctions might affect Iran's environment [44][45].

Table 1. Major Environmental Problems in Iran and Their Primary Drivers

Environmental Issue	Key Drivers	Observed Impacts	Aggravating Factor from Sanctions
Water Bankruptcy	Over-extraction, inefficient agriculture, dams	Drying rivers, wetlands, aquifers	Restricted access to efficient irrigation tech
Air Pollution	Vehicles, industry, low-quality fuel	High PM2.5/PM10 levels in major cities	Delayed adoption of Euro 5 standards & DPFs
Wetland & Lake Shrinkage	Water diversion, droughts, overuse	Lake Urmia, Hoor Al-Azim severely degraded	Blocked modern water management technologies
Deforestation & Desertification	Overgrazing, land-use change, poor management	Soil erosion, sand & dust storms	Limited access to reforestation & monitoring tools
Land Subsidence & Sinkholes	Excessive groundwater extraction	Damage to infrastructure	Restricted advanced groundwater monitoring tech
Solid Waste & Pollution	Poor management, lack of recycling infrastructure	Soil & water contamination	Hindered investment in waste treatment facilities

Table 2. Mechanisms Through Which Economic Sanctions Impact Iran's Environment

Mechanism	Description	Examples from Iran Context	Environmental Consequence
Restricted Access to GTKS	Sanctions limit import of green technology, know-how, and services	Delayed Euro 5 standards, DPFs, modern refineries	Higher emissions, inefficient resource use
Blocked International Environmental Aid	Sanctions hinder funding and cooperation from GEF, World Bank, CGIAR, etc.	Unused GEF allocations, canceled projects	Lost opportunities for conservation projects
Increased Dependence on Natural Resources	Sanctions push economy toward resource-intensive sectors for survival	Unsustainable agriculture for food self-sufficiency	Accelerated water depletion & land degradation

Shift in Policy Priorities	Survival mode prioritizes short-term security over long-term environment	Relaxation of environmental rules	Weakened environmental governance

Table 3. Impact of Sanctions on Key Environmental Sectors in Iran

Sector	Pre-Sanctions Situation	Post-Sanctions Changes	Net Environmental Effect
Energy & Petrochemicals	Access to modern low-emission tech	Use of older, higher-emission domestic alternatives	Increased air & water pollution
Transportation	Plans for cleaner vehicles & fuels	Delayed emission standards & filters	Worse urban air quality
Agriculture & Water Management	Potential for efficient irrigation tech	Continued unsustainable expansion	Severe water bankruptcy & wetland loss
Waste Management	Limited but growing recycling efforts	Hindered investment in treatment facilities	Increased soil & groundwater contamination

The Research:

The primary aim of this study is to present the inaugural assessment of the unintended environmental consequences of the international economic sanctions levied against Iran. A lot of different kinds of evidence the study shows how economic sanctions on Iran have had unintended effects on the environment. study results, it is imperative to consider the following critical aspects:

The study does not assess the effectiveness of economic sanctions in achieving their short-term and long-term objectives. The study does not examine the efficacy of sanctions in modifying Iran's conduct relative to alternatives such as warfare and diplomacy.

The study does not contend whether economic sanctions against Iran should be abolished, maintained, or intensified in light of their environmental consequences. The argument requires a more thorough evaluation of sanctions and falls beyond the purview of this study. To judge how well sanctions work and what damage they do, you need to look at how they affect different sectors and what trade-offs they make at the same time.

The study does not aim to ascertain which party involved in the sanction—the sanctioning states (sanctioner(s)) or the sanctioned state (sanctionee)—bears greater responsibility for the environmental damages. Damages have been inevitable due to the prevailing economic sanction practices and mechanisms.

The study does not examine the human rights ramifications of environmental consequences of economic sanctions, while recognizing the interconnectedness of human rights and the environment, and acknowledging that enjoyment of human rights is unattainable without access to a safe, clean, and healthy environment.

Environmental issues in Iran, examined in this study, did not emerge suddenly; Rather, they developed over decades of unsustainable management rooted in myopic development strategies still have big environmental problems today, even if there were no sanctions, because of how it runs its environment now.

Economic Sanctions have hastened environmental degradation, but should not be regarded as the primary catalyst for the nation's myopic development policies, insufficient resolution to tackle its environmental issues, and the prioritization of ideological goals over sustainable development. Sanctions against Iran have been changing in terms of how strong and wide they are. The effects of sanctions build up over time and usually show up in the long run. When looking at the study's results, it's important to keep in mind that the Iran sanctions problem is always changing and that the enforcement-response games for economic sanctions are always changing. The analysis is unable to ascertain how modifications in sanction

frameworks, reactions to sanctions, situational factors, or historical courses of action might have influenced the environmental status and the efficacy of sanctions. When looking at the effects of Iran sanctions, it can be very misleading to think that statistical correlations are the same. Results of this study should not be employed to justify the erroneous decisions made by Iranian policymakers and their environmental repercussions in recent decades.

Been changing in terms of how strong and wide they are. The effects of sanctions build up over time and usually show up in the long run. People who impose sanctions and the people who get them, in this case, Iran, have been constantly changing their plans to make the most of the effects of sanctions and to lessen their effects. Regarding the study's results, it's important to keep in mind that the Iran sanctions problem is always changing and that the enforcement-response games for economic sanctions are always changing. analysis is unable to ascertain how modifications in sanction frameworks, reactions to sanctions, situational factors, or historical courses of action might have influenced the environmental status and the efficacy of sanctions.

Due to the effects of Iran sanctions, it can be very misleading to think that statistical correlations are the same as causations. 3. For instance, an increase in the number of polluted days in Tehran in a given year cannot be solely attributed to the imposition or removal of sanctions, since the count of polluted days may be influenced by other factors, including wind, precipitation, and temperature fluctuations throughout the year. To accurately elicit observations and discern the fundamental causal mechanisms of a problem, one must possess an understanding of the historical and technical context, along with the associated complexities.

Madani provides supplementary precautionary notes concerning the examination of the environmental ramifications of economic sanctions as an issue classified within complex, coupled human–nature systems, characterized by numerous interacting and evolving subsystems, drivers, and variables.

What are Iran's environmental problems, and did sanctions make them worse?

Iran is currently facing a variety of environmental issues. The Most well-known environmental problem in the country is water bankruptcy. growth and poor spatial distribution of the population, economically inefficient and environmentally unsustainable agricultural growth, and poor water management are the main causes of the country's serious water problems, which are made worse by changes in the climate. Air quality is getting worse. More than 90% of Iran's water is used for farming. and production have continued to grow, even though water is becoming less available and droughts happen often. growth, which was largely driven by the goal of making Iran self-sufficient in food so that it didn't have to rely on the international market to meet its food needs, would not have been possible without the country's unsustainable use of its water resources. The total amount of water used is more than the country's total budget for renewable surface and groundwater. meet the rising water demand, non-renewable groundwater is being used and surface water is being stored behind large dams and moved through inter-basin water infrastructure systems. was once one of the largest hypersaline lakes in the world, but has shrunk a lot, mostly because of human activity in northwestern Iran. caused groundwater levels to drop, and using too much surface water has greatly cut down on river flows (for example, Zayandeh-Rud, Karun, Dez, Karkheh, Kor, Qezelozan, and Sefidrud), which has dried up wetlands [46].

The quality of underground and surface water resources has gotten worse because there is less water available and more biological and chemical pollution from agricultural, industrial, medical, and household waste and effluent. The Ramsar Convention called Iran's biggest wetland a "Wetland of International Importance" in 1971 and a "UNESCO Biosphere Reserve" in 1976. It dried up because of too many dams, water diversion, and more water use for farming, as well as frequent droughts erosion, wildfires, flood damage, landslides, and

desertification have all gotten worse because of deforestation, changes in land use, less moisture in the soil, over-grazing, over-plowing, over-cropping, and bad land management. Lake Urmia's shrinkage tragedy is one of the most well-known signs of environmental damage in Iran, but it is not the only one. Some of the other big wetlands in the country have shrunk because less water is coming in.

The country's water problems go beyond just not having enough water. parts of the country, this has made water not good for many uses. The Caspian Sea in the north and the Persian Gulf and Sea of Oman in the south are polluted a lot by rivers and people living near the coast in Iran and its neighbors.

Increasing because forests aren't being protected well enough, there isn't enough water, there are too many droughts, trees are being cut down too much, logging is illegal, wildfires are happening, cities are growing, and forests are being turned into farms and factories.

The highest average density of domestic sheep in any arid range country in the world was in 2008. It also had fifth largest sheep population in the world, with about 52 million animals that the number of animals in the country was more than twice what the rangelands could handle. The number of animals on the Ilam Province's rangelands was more than five times what they could hold big problem for protected areas, especially those in dry and semi-dry rangelands. water and waste, overuse of fertilizers, and pesticides have all hurt the quality of soil in the country, making it less suitable for farming.

Threatened people's health and caused major damage to the ecosystem, reduced agricultural productivity, and increased soil loss and the removal of valuable organic matter and soil nutrients. This is because wetlands have dried up, farms have been abandoned, land use has changed, forests have been cut down, soil has eroded, and deserts formed. Much groundwater is being taken out of the aquifers, and the water levels are dropping, which is causing land to sink and sinkholes to form in different parts of the country. This is a threat to important infrastructure. The most common causes of air pollution in Iran's cities are rapid and uncontrolled urbanization, high population density, the inefficient use of non-renewable energies and low-quality fuels, the growing and aging fleet of gasoline and diesel vehicles, limited public transportation capacity, and being close to active industrial zones. populous city, ranks among the world's most polluted megacities regarding ambient PM10 levels parts of the country, like the Sistan and Baluchestan Province, which is Iran's second largest province by area in the southeast and borders Afghanistan and Pakistan, and the Khuzestan Province, which is in the southwest borders Iraq, and other provinces in the west like Kermanshah, Kohgiluyeh and Boyer-Ahmad, Kurdistan (Kordestan), dust storms happen a lot. places are affected by dust from Iran's neighboring countries and by dust from local sources like drying wetlands, less moisture in the soil, cutting down trees, soil erosion, and desertification. According to the World Health Organization (WHO) database, Zabol was the most polluted city in the world in 2016 when it came to PM2.5 levels. It is in Sistan and Baluchestan Province and is near Afghanistan. Cities were among the ten most polluted cities in the world, based on PM10 levels, according to the WHO database. time, Ahvaz (Ahwaz), the capital of Khuzestan Province, was the most polluted city in the world. Sanandaj, the capital of Kurdistan Province, was the third most polluted city, Kermanshah, capital of Kermanshah Province, was sixth most polluted city, and Yasouj, capital of Kohgiluyeh and Boyer-Ahmad Province, was the ninth most polluted city number doesn't include the economic costs of lower agricultural productivity, lost ecosystem services, damaged infrastructure, lower quality of life and visibility, and lost school days for kids and college students because schools, universities, and even government offices are closed when the air quality is very bad. These are just a few of the major indirect costs of air pollution. Pollution in Iran poses a significant threat to public health and carries substantial economic, social,

judicial, and even security ramifications. The country collects 90% of its municipal solid waste, but because it doesn't have the right system for separating waste at the source, most of it goes straight to landfills without being recycled. Quality harms the ecosystem, infrastructure, and cultural/historical natural heritage sites, and it also lowers agricultural productivity. amount can't be handled well because the waste sector doesn't have enough infrastructure, planning, or investment. Economic cost of the sickness and death caused by Tehran's air pollution is thought to be 2.6 billion USD per year. Pollution is getting worse because there aren't any recycling facilities or rules and incentives that could encourage people to use less plastic and recycle more. Daily municipal solid waste production per person is only 745 grams, or 272 kilograms per person per year. This is much less than the daily municipal solid waste production per person in many developed countries, such as the United States (2.58 kg), Canada (2.33 kg), Australia (2.23 kg), Germany (2.11 kg), and France (1.92 kg). big danger to the ecosystem, soil, and surface and ground water. factors and drivers that have turned waste into one of Iran's most pressing environmental problems include: population growth; more people buying and making things; factories and farms that don't use resources wisely; not enough space for landfills and not enough time to choose the right sites for them; not enough infrastructure for collecting, processing, managing, and recycling waste; rules and institutions make sure waste is managed properly; not enough cooperation between the authorities in charge; and not enough systematic efforts and rules and financial support to encourage less waste production and more recycling fish, and 710 kinds of marine fish. parks, 170 protected areas, 45 wildlife refuges, and 37 national natural heritage sites. The Department of Environment protects these areas, which make up almost 11% of Iran's land. Department of Environment can't protect these areas and the ecosystem that depends on them as well as it should because it doesn't have enough environmental issues in Iran, along with some human activities that directly harm the country's plants and animals (like building roads and having accidents not subject to sanctions to Iran and receiving money from Iran through official banking channels, has made vendors and banks too cautious. Because of this, people don't do business with Iran even when the changes in the weather have made Iran's environmental problems worse. Over the last 40 years, Iran has had a lot of long, severe droughts that have made water less available, hurt rainfed agriculture, dried up wetlands, and caused desertification, more groundwater use, and damage to ecosystems. Conditions are getting worse over time, which is a sign of its unsustainable growth. Improving the country without paying enough attention to how it will affect the environment is now putting national security at risk. The lack of had a lot of extreme weather events, like droughts and floods, that have cost a lot of money. Floods, during the same timeframe, were devastating and resulted in fatalities. no consensus among scholars regarding the extent of the historical impacts of climate change. projections, on the other hand, show that Iran will be warmer and drier, which could make the water shortage worse and cause ecological damage that could lower agricultural productivity. change is also likely to make extreme events like floods, droughts, heat waves, and wildfires happen more often and with more force. Damage to the environment in Iran also makes its people and ecosystem more likely to be affected by extreme events in the future. flooding during Nowruz 2019 in Iran, which had not happened in decades, served as a wake-up call about how unpredictable climate norms can be, the possible effects of climate change , and how vulnerable a country is when it has made major changes to its ecosystem [47].

Water is hurting farming, which could lead to food insecurity. degradation (like farmers and fishers losing jobs) and bad living public health conditions in some areas (like dust storms in rural and urban areas) can lead to unemployment. This can cause people to move, settle in suburbs, and create economic inequality, which can then lead to social instability, tensions, protests, and national security problems. No matter what the sanctions do, Iran's environmental problems can't be fixed without big changes to how its environmental

governance institutions work, how they are run, and how they plan for development. It is clear that Iran's environmental problems, which we talked about above, didn't happen overnight. They happened after decades of bad management based on short-sighted development strategies. Consequently, acknowledging sanctions as the fundamental cause, as asserted by certain Iranian officials, is unwarranted. Sanctions are not the cause of Iran's current environmental problems, just like caused Iran's environmental problems, but they have affected the country in three main ways: (1) they have made it harder for Iran to get technology, services, and knowledge; (2) they have stopped international aid for the environment; and (3) they have made Iran's economy more dependent on natural resources.

To technology, services, and knowledge no doubt that economic sanctions have affected Iran's banking system and financial transactions. To stop money from coming into and going out of Iran through official and sanction - free banking channels and break the law, the price goes up. Higher cost makes Iran even less interested in foreign GTKS and makes it less likely that it will be able to get GTKS in areas that it doesn't think are important or urgent, like the environment. Environment is an important issue for both technical and sustainable development, but in practice, it has not been treated as such by public policy. For more information on this argument, see Section 4.3 and Madani. With the sanctions, international GTKS vendors no longer want to do business in Iran. If you give GTKS to Iran or do business with them, you could face big fines and other punishments. want to work with Iranian businesses because the risk of losing money is too high under sanctions. risk, along with the high costs and practical difficulties of getting the necessary US Treasury Department licenses to do business with Iran, and the problems with sending goods that aren't breaking any sanctions. This makes it harder for Iran to get the GTKS, which are already exempt from or can be exempted from sanctions. Sanctions make people less interested in investing in Iran's different economic sectors, which slows down technological and scientific progress, innovation, and efficiency improvements in areas like energy, water, food/agriculture, mining, production, and service. These improvements could help Iran's development have a smaller impact on the environment. For instance, the re-imposition of sanctions in 2018 made people less interested in investing in Iran's energy market. Quercus, a British investor in renewable energy, was one of the companies that stopped all of its work in Iran, including its plan to build a 500-million-euro solar power plant. International media, Iranian officials, and scientific literature have repeatedly said that US sanctionsmade it harder for Iran to get medicine, medical equipment, and food. However, the US economic sanctions on Iran do not apply to the sale of food, medicine, or medical devices to Iran under a "general license".

A British investor in renewable energy was one of the companies that stopped all of its work in Iran, including its plan to build a 500-million Euro solar power plant with a capacity of 600 MW. foreign GTKS that are cheaper than Iranian ones, the sanctionee (Iran) has two choices: either because of its need to get certain GTKS instances, or because the South Pars refineries use a certain kind of absorbent to get rid of mercury in natural gas. make this kind of absorbent, like Johnson Matthey (JM) and Axens, won't sell it to Iran. Result, mercury is not being properly removed from natural gas, which hurts the environment (and public health) at both the production points (refineries) and the consumption points (houses, offices, schools, hospitals, factories, etc., both inside and outside). Companies that have sold equipment to Iran in the past are not willing to give them spare parts and the service they need (repair, operation, inspection, and maintenance). Companies that had long-term contracts to provide a range of technical services, such as software updates, optimizing operations, delivering new knowledge, training, instrumentation, and inspections, have stopped their contracts and services because of sanctions. There are no penalties for the people who bought the services. of these problems, Iran can't get the best technology and know-how, which makes it less efficient with its resources and makes its sectors' ecological footprints bigger.

There have been many instances of this in the vehicle manufacturing and transportation industry, and the emissions have had a big impact on the environment. makers have repeatedly put off adopting the Euro 5 emission standard, saying that sanctions have made it hard for them to get the technologies they need. Construction and Transportation Commission of the Tehran City Council put a stop to the budget for putting diesel particulate filters (DPFs) on the 700 old buses (defined as buses that are more than 8 years old) used by the Tehran Bus Company (a subsidiary of Tehran Municipality, which is overseen by the Islamic City Council of Tehran) for public transport. 6000 buses, and more than half of them run on diesel. The average age of the company's buses is 11 years, and more than half of them are in the "old" category. If the company doesn't retrofit its fleet, almost 90% of its buses will be "old" by 2023. In 2019, Senior Vice President Eshaq Jahangiri told the Minister of Industry, Mines, and Business and the Head of Iran's Department of Environment not to require diesel particulate filters to be put on diesel trucks under the sanctions. This was done at the request of Iran Khodro Company, which is one of the biggest vehicle makers in Iran and the Middle East (Figure 1). These choices, made because of the economic sanctions, have a direct effect on the amount of air pollution, which has a big effectson health, the economy, and the environment.

Some people say that the diesel made in Iran doesn't meet the quality standards that DPFs need to work, making them useless and unnecessary. This is in addition to the fact that sanctions make it hard and expensive to get DPFs. Iran's Department of Environment has turned down this argument. Still, even if the argument is true, sanctions are the biggest thing standing in the way of making Iran's fuel better. So, even if the claim is true, it is clear that the economic sanctions have had a direct effect on air quality in Tehran (as a catalyst that has made air pollution worse).

Accepting lower-quality GTKS from foreign or domestic suppliers that are cheaper but not as good (for example, used, old, or not meeting environmental quality standards)

For instance, after the US put sanctions back in place in 2018, Siemens refused to ship the syngas compressors it had made for the Zanjan Fertilizer Project (ZFP) under an old purchase agreement. This was because it was afraid of being targeted by the US. Siemens didn't want to lose its $20 billion a year in sales in the US, where it has about 50,000 employees. Instead, it only wanted to make asmall amount of money in Iran. Many other companies with a strong presence in the US have also refused to do business with Iran because they are afraid of losing their share of the US market. ZFP ended up with Chinese compressors that didn't meet environmental standards as well as they should have, which caused more emissions. There have been similar stories in Iran's methanol industry. Iran could become one of the biggest producers of methanol in the world. But the sanctions have made it harder for it to get the newest technologies. The Eslamabad-e Gharb refinery in Iran has not been able to get autothermal reforming technology (ATR) from JM and Haldor Topsoe. So, Iran is starting this refinery with older technologies, which means it will use more water and leave a bigger carbon footprint. In 2020, Iran's neighbor Turkmenistan built the world's largest ATR-based methanol plant with the help of Haldor Topsoe. In a different way methanol project in southern Iran, Haldor Topsoe, the project's international licensor, broke its contract after sanctions were put back in place and refused to deliver three important parts of the equipment. After that, these parts were replaced with Iranian ones that didn't meet the environmental standards set out in the Process Design Package (PDP) and approved by the original licensor.

In 2006, INPEX Corporation, Japan's biggest oil and gas exploration and production company, stopped working on an oil extraction project in the Iranian part of Hoor Al-Azim, a big wetland that crosses borders in southwestern Iran and has big oil fields underneath it. Chinese and Iranian companies worked together to carry out the project. But they didn't follow through on the original design plans that would have worked for oil drilling in wetlands

(wet environments). The oil rig and equipment that were installed and put into use as part of the project are good for drying places. Because of this, not only was the wetland area kept dry while the project was being built, but also releasing large amounts of water into some parts of this manipulated wetland (both Iran and Iraq have made big changes to the natural conditions of the Hoor Al-Azim wetland by building dikes, culverts, and roads) is now too dangerous because of the damage it can do to the installed equipment. The drying up of Hoor Al-Azim made the project cheaper to carry out while sanctions were in place. However, it has caused a lot of damage to the ecosystem and turned the wetland into a major dust source in the region. This has affected the lives and health of people in the Khuzestan Province during long periods of dust storms that have never happened before in the area.

In 2010, when the law went into effect that put economic sanctions on Iran's gasoline imports, Iran was getting 40% of its gasoline from other countries. President Barack Obama thought that punishing Iran's gasoline suppliers and putting more pressure on the international banking system to stop working with Iran would make it harder for the country to buy refined petroleum and the goods and services it needs to modernize its oil and gas sector, which is the backbone of its economy. This prediction was mostly right. Iran's petrol imports fell by 75%, but the country quickly responded to the new sanctions by increasing its local refining capacity. This allowed Iran to make cheap, deadly oil that could power vehicles but was very bad for the environment. At the time, Iran's locally produced oil had ten times the number of contaminants as imported oil. The sulfur level in diesel fuel sold in Tehran was 8000 parts per million (ppm), which is 800 times higher than what the US Environmental Protection Agency (EPA) says is safe. Like the other examples above, Iran tried to deal with the sanctions' effects on the oil and natural gas sectors by making choices that were bad for the environment but could help the country survive in the short term.

In some cases, the sanctioned may not save money by using domestic GTKS delivery, but it can help lower the risks of national insecurity. For Instance, even though growing wheat in the country may be more expensive than bringing it in, leaders of the country may think that continuing to grow food in the country, even if it is not very efficient, is worth it because they are afraid of food shortages and national security issues. Iran has had a lot of tensions and wars with other countries since the Islamic Revolution in 1979, so food security has been a big issue for the country's leaders. The Experiences of other countries under sanctions and seeing how easy it is for them to lose access to food imports have made food insecurity a big fear. Because of this, Iran has worked hard to achieve its ambitious goal of being able to grow all of its own food. This policy has had a lot of bad effects on the country's water and environment. Even though these things have happened, the leaders of the country think this policy is necessary because they are very worried about national security, which has gotten much worse when sanctions and extreme international pressure were put on them. Another reason for growing the agricultural sector is to create jobs. A large part of the population relies on the agricultural sector for work, which is a national security concern because shrinking this sector could lead to unemployment for the poorest economic groups in society. Iran sees its dependence on food as a major weakness that its enemies and sanctions can use against it, even though exporting food to Iran is supposed to be free of sanctions and importing some of the food it needs can lower the economic and environmental costs of food production for Iran. also pushed for policies that encourage self-sufficiency and low levels of international dependence in other areas, like car manufacturing, gasoline, and pharmaceuticals, even though these policies have long-term environmental costs for the country.

11, 2019, Kazem Chehehgosha, Iran's Senior Vice President's Chief of Staff, sent a letter in Persian to Reza Rahmani, the Minister of Industry, Mines, and Business, and Issa Kalantari, the Vice President and Head of the Department of Environment. Chehrehgosha writes this official letter to Rahmani and Kalantari to let them know about the Senior Vice

President Eshaq Jahangiri's order regarding the request from Iran Khodro Company (IKCO), a major Iranian vehicle manufacturer, not to install diesel particulate filters (DPFs) on diesel vehicles until the "oppressive sanctions" are lifted and the production of high-quality fuel is guaranteed. Jahangiri told Rahmani and Kalantari to look at the IKCO's request with a "positive view" and give permission "for some time," taking into account the "sanction conditions and the country's need for the referenced trucks (in the request)."

In all cases, the government has put short-term issues like national security, job creation, and revenue growth ahead of long-term environmental concerns. clear that Iran's environment can suffer greatly when GTKS are needed specifically for the environmental sector (such as air quality monitoring equipment, instruments, environmental/energy software, and training) or when they are not needed specifically for the environmental sector but have significant positive effects on the environment (such as hybrid cars, new passenger planes with better fuel efficiency, improved petrochemical technologies, or cement production technologies with lower carbon and water footprints).

The Economic sanctions have also affected environmental research and education. As in other cases, obstacles to the transfer of research and training funds and financial dealings with Iran have been the main reasons for this effect. World 02 00015 g002and research institutes are seen as government institutions, and their staff are employees. This means that, in theory, giving them money or sharing knowledge with them could break the sanctions rules. universities and citizens, alongside ambiguity regarding what constitutes a knowledge transfer that infringes sanctions, currency devaluation, restricted access to equipment, instruments, software, and expertise, diminished travel of international researchers to Iran under sanctions, and following the implementation of the Visa Waiver Program Improvement and Terrorist Travel Prevention Act of 2015 (which mandates that citizens of 38 countries, previously able to travel to the US without a visa under the Visa Waiver Program (VWP), must now secure a visa if they have visited or been present in Iraq, Syria, Iran, Sudan, Libya, Somalia, or Yemen after 1 March 2011), and further limited access to training and capacity-building initiatives (Figure 2), are among the various repercussions of sanctions on environmental research and education. Many of these effects and limits make it harder for Iran to learn, come up with new ideas, make technological and scientific progress, get an education, and build capacity in the environmental field. These are all important for solving the country's serious environmental problems.

Sign up for the "Introduction to Sustainability" massive open online course (MOOC) on Coursera, an online education site, they got this message. learning sites like EdX and Udacity say that US export control laws and international sanctions are the main reasons why they can't provide education services to people in Iran.

The Environment also directly affected international aid for the environment, which has had clear negative effects on Iran's environment (in terms of lost opportunities). No sanctions on international aid and development funds, as well as working with and getting research and training help from intergovernmental organizations. Without sanctions, Iran can no longer use these options make it hard to carry out aid projects, and the US is a major donor to intergovernmental organizations, which makes it hard for Iran to get money and services from these groups.

Global Environment Facility (GEF) has given money to many countries to help them deal with important environmental issues such as land degradation, biodiversity, chemicals and waste, international waters, sustainable forest management, and climate change. Received almost 31 million USD from GEF for 18 environmental projects. This is a small amount compared to Iran's national income and government budget, but because the government doesn't give much money to environmental causes and there isn't much environmental activism in Iran, even small amounts of international environmental aid can have a big impact.

have given much more money, up to $52.67 million (Figure 3). Sanctions made it much harder for GEF to send money to Iran, starting with the fifth round of GEF funding. round (2010–2014), Iran only used about 15% (4.2 million USD) of the money that had been set aside for it (28.77 million USD). The money was never used. seventh round (2018–2022), GEF gave Iran 10.89 million USD, but so far, no money has been used.

Environment Facility (GEF) has helped Iran with projects in the last four funding rounds. difference between the money that was set aside and the money that was actually used in the fourth round because projects were canceled, not because of sanctions. made it harder for Iran to get the money it was supposed to get in the other rounds.

The World Bank is another intergovernmental organization that has been affected by sanctions that hurt Iran (Figure 4). The World Bank's last project in Iran ended in 2012. The World Bank recently approved a 50 million USD COVID-19 emergency response project, making Iran one of the 100 developing countries that will receive COVID-19 emergency response funding from the World Bank. The World Health Organization (WHO) will implement the project, which is being funded "on an exceptional basis based on humanitarian needs." This means that the government of Iran will not receive any of the funding. The last time the World Bank gave emergency response funding to Iran was in 2004, after the 2003 Bam earthquake. The Alborz Integrated Land and Water Management Project (with a World Bank funding commitment of 120 million USD) was approved for funding in 2005, along with another water-related project, the northern cities water supply and sanitation project (completed in 2010 with a World Bank funding commitment of 224 million USD). Final assessment reports for both projects talk about a number of procedural problems that came up because of the UN sanctions, which made it harder for the projects to go smoothly. These problems included a long wait for funds from the World Bank, delays in implementation, problems with procurement, and long approval processes for procurement, as well as travel restrictions. is Figure 4. The World Bank gave Iran money from 1970 to 2019.

A non-profit agricultural research institute that works to reduce poverty and improve food, water, and nutritional security, environmental health in the face of global challenges like climate change, had recently reported working with Iran and decided to give money to a project that aimed to increase crop production in four western Iranian provinces that don't have enough water. a global research partnership of funders and international agricultural research centers that works to make sure everyone has enough food, improve natural resources, and reduce poverty. Economic sanctions have also made it harder for this intergovernmental organization to improve the environment in Iran. International Maize and Wheat Improvement Center (CIMMYT), a CGIAR center (an international non-profit research-for-development organization) that works to improve food security, worked with Iran to improve its wheat system. This helped Iran make new types of seeds that work well in both hot and cold climates Efforts to improve food security have direct effects on water and the environment. The country's environment would benefit greatly from improvements in the agricultural sector. The US put sanctions back in place, CIMMYT stopped supporting the project in Iran, and closed its office in Karaj on November 1, 2018, just a few months after opening its conservation agriculture center in Khuzestan as part of a joint project with Iran. The group said it made its choice because "growing constraints on CIMMYT's operations in Iran as a result of increased sanctions". days later, on November 3, 2018, the International Center for Agriculture Research in the Dry Areas (ICARDA), which is also a member of CGIAR, closed its office in Tehran and said it would no longer support projects in Iran. They said this was because of "growing constraints on ICARDA's operations in the Islamic Republic of Iran as a result of increased US sanctions". Also affected the work of some intergovernmental organizations in Iran, mostly because it is hard to move money through the official banking system.

Found ways to deal with the money problems over the years. Although the sanctions have made things more complicated, some intergovernmental groups that do work that has a big impact on the environment and are less politically influenced by the United States, like WHO, FAO, UNEP, UNHCR (United Nations High Commissioner for Refugees), UNIDO, WFP (World Food Program), and UNICEF, have kept working with and supporting projects in Iran. None of these groups has a head office in the United States. not been the case for many funding entities, regional donors, non-profit organizations, and governments that wanted to help with environmental projects in Iran but had trouble sending money there, even for small projects. and gifts for natural disasters and emergencies (like sending cash relief packages to Iran after the big floods in spring 2019) that are not subject to sanctions have been hard in practice because of the barriers that sanctions have put up in the international banking system.

Economy More Dependent on Natural Resources:

To Madani, the answers to these questions can be found in the causal dynamics that control how a country under sanctions acts when it tries to grow. and 4.2 gave a number of examples that show how sanctions have really affected Iran's environment. relaxed environmental rules and even broke its own constitution to lessen the effects of sanctions on its development path because it is determined to keep growing and follow through on the plans that led to the sanctions in the first place. As a result, the country has been able to keep making structural improvements by making big sacrifices in the environmental sector that will have long-lasting and, in many cases, permanent effects. Most important question is why Iran has been willing to give up its environmental needs in favor of its structural infrastructure, like its defense infrastructure. one should ask why a country that has made technological and research advances in many areas to lessen its reliance on other countries under sanctions has not been able to do the same in the environmental sector, where the technology and even the money needed are much simpler and smaller?

Dynamics create the third type of environmental effect of sanctions: the economy of a country that is under sanctions becomes more dependent on natural resources. Effects are often more important because they make the other environmental effects of sanctions stronger and more common, and they last for a long time. general causal model that shows how economic sanctions can have a big effect on the environment. The model reveals the causal dynamics that create an inverted-U-shaped relationship between economic development and environmental degradation, akin to the recognized Environmental Kuznets Curve (EKC), as illustrated in Figure 5. In a way that is similar to the economic downturn, but they can have a bigger effect and stop things from happening. The economy weakens, it can't diversify as much, unemployment rises, and it has trouble getting imports and new technologies. Sanctions are big outside forces that put pressure on the economy and slow its growth. make up for losses in production and imports, and lower the unemployment rate by encouraging growth that depends on natural resources. Access to international markets and the possible effect on food security led the country to continue its unsustainable agricultural policies in order to reduce its reliance on other countries. In this case, putting more stress on natural resources is a common way to fight against degrowth, economic downturn, low income and production, and rising unemployment. The strategy takes some of the pressure off the economy every now and then, but it could have long-term effects on the environment if the economy can't get out of the degrowth and recession trap.

The connection between economic growth and environmental damage when there are sanctions. it hard to change the makeup of the economy. Sanction effect alters the EKC curve's shape and makes the economy more dependent on natural resources (Figure adapted from Madani).

Be a big problem for separating income from natural resources, which makes economic growth more harmful to the environment. deal with the effects of economic sanctions on the car industry, they have made low-quality cars. Due to sanctions on gasoline imports, Iran had to make its own gasoline. reasons for acting this way besides the fact that its income has gone down, the cost of imports has gone up, and it has a deficit for some goods. A big danger to the safety of the country. needs to create more jobs. Given this need, Iran has strong reasons to keep and, if possible, even grow its natural resource-dependent sectors (like oil and gas, petrochemicals, agriculture, mining, car manufacturing, and construction) that hurt the environment to create jobs. shows that natural resources are becoming more important to Iran's political economy and that sanctions are speeding up the damage to the environment. also make the environmental sector less important and less urgent for policy makers than other issues like jobs, economic growth, defense, national security, food, energy, and housing. A system that is in crisis management mode can only handle short-term problems, like environmental issues. In this case, problems that could threaten national security right away (like a lack of important goods or weapons) are more important than environmental damage. This is why Iran has been able to launch a military satellite and build missiles, but not make high-quality cars, DPFs, and others.

Technologies that are easier to make and could help the environment. In Madani, when sanctions are in place, an ambitious country like Iran is willing to use its resources aggressively and give up long-term national benefits to achieve its ideological goals, which the countries that impose the sanctions see as "abnormal." Islamic Revolution of 1979, Iran faced a lot of political and economic pressure from other countries. This made it more "thirsty for development" and more eager to build engineering infrastructure that can be seen as signs of progress (like the Milad Tower, concrete dams, and refineries). make people proud, help the economy, and create jobs, but it has big environmental effects in the long run. A state that is fighting to stay alive in the face of international sanctions may also change how it feels about working with other countries on environmental issues and environmental activism. Paris climate change agreement, but

It has never been ratified because of problems with its own politics. It's hard to say if Iran would have signed the Paris Agreement if the US hadn't put the sanctions back in place. But given the current circumstances, it seems very unlikely that this agreement will be ratified anytime soon. In the fields of research and knowledge production, a shift in attitude towards international cooperation and fewer interactions between countries can lead to less openness and less access to information. Iran has also made its environmental space more secure and put some environmental experts in jail because it is afraid that environmental problems could bring political opposition groups together and become a serious threat to national security.

Final Thoughts:

Iran has a lot of environmental problems because of years of bad planning, bad environmental management, and development that can't be sustained. The problems will get worse in the future unless major changes to policies are made and things are done right away. However, the present framework of environmental governance and the condition of the nation's political economy offer scant prospects for significant alterations in the prevailing trends of environmental degradation.

This study examined the impact of economic sanctions on environmental degradation in Iran. Sanctions have not caused Iran's environmental problems, but they have made them worse. Sanctions have had a big effect on Iran's environment because they have made it harder for Iran to get technology, know-how, services, and environmental aid. Sanctions have effectively restricted Iran's economic growth and its capacity to dissociate its economy from natural resources. This has augmented the significance of natural resources in Iran's political

economy and rendered economic production considerably more detrimental to the environment.

The findings presented in this paper align with the anticipated trends and catalysts of intensified environmental degradation, as elucidated by Madani. The observations reported pertain to Iran; However, analogous trends may be anticipated in other nations exhibiting similar socio-economic and political circumstances under the strain of sanctions. It is important to note that, in addition to economic sanctions, other things can hurt a country's economy, like corruption, natural disasters, wars, national or international crises (like the 2007–2008 financial crisis or the coronavirus (COVID-19) pandemic), and wars. These things can also speed up the process of environmental degradation.

This study did not evaluate if sanctions were effective or ineffective in reaching their goals, and if sanctions must be lifted or strengthened, nor whether those imposing sanctions on Iran must be blamed for the environmental impacts of sanctions. The study contended that Iran's environmental sector has inadvertently suffered due to the pressures exerted by sanctions and the strategies employed by Iran to mitigate such pressures. Both the sanctioning and sanctioned states must be held responsible for the serious effects this has on human rights, health, and justice.

Environmental issues are transboundary, with effects that transcend political and geographical boundaries. Iran's environmental issues affect its neighbors, the Middle East, and the whole world. These issues are important enough that they have already hurt Iran's relationships with its neighbors, including Iraq, Turkey, and Afghanistan. They could also threaten regional stability in the long run, even after the economic sanctions are lifted. Environmental issues are also transgenerational and require extensive time to resolve. Iran's environmental problems, which have gotten worse because of sanctions, can't be fixed right away after the sanctions are lifted. The long-term effects of these issues will have an impact on future generations in Iran and the surrounding area.

Table 4. Summary of Environmental Consequences of Sanctions on Iran and Recommended Focus Areas

Type of Impact	Description	Severity	Recommended Policy Focus
Direct (Tech & Aid Blockage)	Limited access to green technology and international aid	High	Ease humanitarian & environmental exemptions
Indirect (Economic Dependence)	Increased reliance on natural resources for survival	Very High	Support economic diversification
Policy & Governance Shift	Prioritization of short-term survival over environment	High	Strengthen environmental governance post-sanctions
Transboundary & Transgenerational	Effects extend beyond Iran and to future generations	High	Regional & international environmental diplomacy

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