THE TIME LIMIT ON OUR ATMOSPHERE AND US

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OUTLINE

Question: What are the effects of pollution on the atmosphere?

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Pollution. Since the emergence of the "superior" race of humans, pollution and waste have always been a problem. Whether it is land, water, or air, pollution has confronted every civilization from the ancient Mesopotamians to the modern world with increasing intensity. However, to understand completely about pollution, one must describe it. A basic definition is the introduction of materials into an environment that decreases the purity of that environment.

What are the effects of this pollution on our atmosphere? The focus of this report is on atmospheric contamination so one must go back to the Industrial Revolution when air pollution began increasing in volume and toxicity at alarming rates.

The Great Powers of Europe and the United States both became heavily industrialized by burning very contaminative fuels, mainly coal, oil and natural gas. Also known as fossil fuels, these energy sources contain large amounts of carbon dioxide (CO_2). When burned, this gas, among others, is released into the skies. CO_2 does occur naturally in the atmosphere but it also has the ability to trap Earth's outgoing excess radiation and contain it for long periods of time. This process, known as global warming, has been increasing as a result of the build-up of carbon dioxide. Late 19th century scientists recognized the potential danger. Swedish scientist Svante Arrhenius first compared the process in Earth's atmosphere to that of a greenhouse in 1883. The "greenhouse effect" slowly became an accepted theory followed shortly by a promotion to scientific fact. Just how much CO_2 is in the atmosphere, though? Since the Industrial Revolution over 400,000 billion tons of CO_2 have been pumped into our vast sky (Milne, 16). From the turn of the century to the present the gas has increased 20%, at about 5½ billion tons annually (Milne, 22). All of this is a result of the First World nations, and does not take into account the developing countries. For them, fossil fuels are the only source of power that is cheap enough for their use. "Fossil fuel burning may be five times its current level by 2200." (Milne, 25). The danger is that energy is being transformed into heat at a much faster rate than would naturally occur. This means that "...demonstrable climate changes could occur by the end of this century, if not sooner..." (Schneider qtd. in Milne, 36). The irony of the situation is the world's forests historically drank any excess CO_2 but now they are being cut down at astronomic rates.

Deforestation has been called the most serious environmental problem. It is the systematic cutting or burning of vast areas of forests for development. By the late

1980's the world's forestry covered only 25% of the Earth's surface. Over 50% of the original forests have vanished since 1950. In the last 200 years alone Latin America has lost over 37%, South East Asia 38%, and Africa 52%. At the current rate all Far East lowland rain forest will be gone by 2000. The genocide is not limited to developing nations. The United States during the late 19th century was diminishing 85% of New England's rich timberlands. However, the biggest battleground at present between the developers and the conservers is the continent of South America, mainly Brazil. Brazil constitutes about 25% of South America's land area. Most of this area is dominated by the Amazon River Basin and rain forest; the richest remaining woodland in the world. The trees are cut for the paper mills of Sao Paulo, Belem, and other growing industrial sites. The cutting and slash-and-burn techniques destroy an estimated forest the size of Cuba annually (Milne, 47).

Aerosol cans have become a staple of modern lifestyle. Chlorine compounds called chlorofluorocarbons (CFCs) are the propellants in these cans. Spraying the active ingredient into the air seemed effective and harmless. They were marketed as Freons. However, after released, CFCs would float up into the upper atmosphere and be affected by the sun's powerful radiation. Solar emissions split the fluorocarbons molecules into separate atoms of chlorine and oxygen. Also in the same location are ozone (O_3) molecules which protect the surface of the Earth from ultraviolet radiation (UVR). When CFCs reach the high altitudes and metamorphosize, the chlorine molecules begin to destroy O_3. **One** chlorine molecule can demolish between 10,000 and 100,000 molecules of ozone (McCuen, 62). Since there are no natural occurring forms of chlorine in the stratosphere, O_3 molecules never had an encounter with them. The devastating results will be discussed later.

Unfortunately, CFCs are not alone in their damaging actions. Nitrogen has just as much destructive power as its cousins the CFCs. Although it comprises about 78% of the atmosphere, when combined with oxygen in combustion vehicles' engines, it becomes a deadly compound for ozone--nitric oxide. Nitric oxide and its relatives of nitrogen dioxide, nitrous oxide, and nitrate destroy O_3 very easily. It is a natural process but with increasing amounts of nitrogen in the atmosphere effects will be felt. The amounts are increasing mainly because of fertilizers. In the U.S. alone, fertilizer use has increased an astounding 1400% between 1954 and 1969 (McCuen, 85). Other

sources include supersonic aircraft and the Earth's heat unbalance.

All of these problems are further aggravated by the tremendous population explosion. By 1850 the world population had reached one billion. One hundred thirty years later the number was 4 billion. The biggest increases took place in Africa. Kenya leads the world with an 8.1% growth rate. In 1940, there were 175 million people. The count in 1983 totalled 513 million with an estimated 877 million for the turn of this century. Africa still has more in store for her future; a 981% increase for the continent's cities. Asia won't be left in the dark, either. There will be a 625% urban increase concentrated in the South East archipelagos. Also in Asia, an exchange will occur between China and India. India will steal the title of most populous nation in 65 years. What will be the number of Indian residents? Over 1.9 billion is estimated. Mexico City, however, will gain the honorable largest city award. By 2000, it will house 24.4 million people. Besides being the biggest, it will also be the most polluted. With over 6 million cars and its location in a mountain range, the air will be world renowned for its solid characteristics. Air quality degradation will be widespread because of overcrowded urban areas. Cities produce huge amounts of heat. As the size of the city grows, so does heat emission (Young, 49-53).

The causes of air pollution are bad but the effects are even worse. Ranging from visually sickening to climatic changes, the effects will be felt or seen with greater intensity in the coming decades. Unfortunately, experts are seeing permanent changes already in progress.

Much public attention has been given to the ozone depletion problem. It first came to light in 1974. Disapproving public opinion was aroused in 1979 when British satellites revealed a 'hole' in the ozone layer above Antarctica. Natural events such as solar flares can deplete ozone amounts. However, in 1986, American scientists reported that the 'hole' had spread into Drake Passage and was ironically the size of the United States, one of the largest CFC producers and consumers. Later, a similar 'hole' was detected in the Arctic. Although 33% of the size of its southern counterpart, it extends over northern Europe to St. Petersburg. The last hope of nature removing the CFCs by herself was shattered because no natural mechanisms exist in the atmosphere that destroy CFCs. With a larger volume of CFCs in the skies, more ozone will be destroyed. Only a 1% decrease of O_3 translates into a 3% increase of UVR

(Young, 71). UVR retards growth and development in all species of life. At present, the bulk of the world population is in the northern hemisphere. As a result intensive studies about ozone in the north have been made. An estimated 2% overall decline has been detected (Young, 73). For unknown reasons, the largest drops occur every February and October. In Eastern and Central Europe, deficiencies are more acute than in Western Europe or North America. A predicted 16.5% reduction is possible if Freon gases are manufactured and consumed at present rates (Young, 88). Joe Farman of the British Antarctic Survey doesn't leave much hope for the future. "If ozone-destroying gases were halted overnight, it would take more then 50 years to repair the damage." (qtd. in Young, 93).

Another media-dissected problem is the "greenhouse effect". CO_2 after more than a century of build up now has started to take its toll. That is not to say that nature has not been fighting it. Ocean and land plants suck up 500 billion tons of carbon dioxide every year. The oceans especially are helpful because they dissolve the gas in their waters, consuming more than land plants. There is a down side though. Plants get a huge boost with increasing levels of CO_2. They absorb more while growing but during the decaying months of autumn, they release these amounts. The seasonal oscillations of CO_2 between spring and fall are getting wider. The net result has been a warming trend starting in 1960. Average global temperatures have risen 1°C in the past 90 years (Bach/Hall, 115). The Environmental Protection Agency (EPA) in 1983 predicted a 2°C rise by 2030 and by 2100 a 5°C increase. Weather patterns would change with deluges in North Africa and a return to the Dust Bowl for the American Mid-West. Ocean systems will go haywire. The balmy Gulf Stream that transfers Caribbean heat to the British Isles, northwestern Europe and Scandinavia would become weaker, meaning freezing climates for the resident nations. In Asia, the life sustaining monsoons would alternate in becoming stronger and then weaker. Disastrous floods would follow severe drought in India and South East Asia. Around the world, intense heatwaves will follow extreme cold snaps. This century's three coldest winters (1976/77, 77/78, 78/79) were followed by the three warmest winters (1979/80, 80/81, 81/82) (Bach/Hall, 132). The effects in the polar regions are the main concerns though. These will be discussed in depth later. The EPA offers only a gloomy picture of the future. According to their studies, a total ban on global coal consumption would delay the

complete Effect only 15 years; a 300% tax increase on fossil fuels--5 years (Bach/Hall, 143).

Antarctica is a barren frozen world. It is 5½ million square miles with 6.8 million cubic miles of snow and ice sitting on top of it (McCuen, 99). In the northern hemisphere, Greenland contains 700,000 square miles of ice and snow (McCuen, 99-100). Between the two over 80% of the world's solidified water is contained. An example of this is, if the Greenland ice pack melted, the sea levels would rise by 30 feet. Ice shelves keep the ice sheets from sliding into the oceans. Nothing, however, keeps the shelves from flopping into the sea. So much rests on these guardians, though, that if the Antarctic shelves gave way, the entire ice continent could dissolve in 200-300 years. The only way for them to split naturally is by a complete warming of the water around them. A rise of a one foot ocean level would erode most sandy beaches by 100 feet. With the Effect taking place, pessimistic predictions see a 2 ft. rise by the end of this century. The EPA released a study in 1985 that said:

> "...for the next 20 years we can expect sea level rises to be 2 times faster than at the present. Between 2000 and 2025 the rate will jump to 3 times the current one. After that the situation will be too complex for current models to predict accurately..." (McCuen, 121)

A more optimistic foresight is by the National Academy of Sciences: a 2.5 foot rise by 2040 up to an 11 foot rise by 2100 (McCuen, 123). Already it seems as if sea levels have risen. Flooding has increased drastically since 1820 in the lowlands. However, the lowlands are the most fertile areas of the world. An estimated .5 billion people live on flood plains while many millions more live on coastal regions (Milne, 13). Venice is one city that has already fallen prey to the growing tides. In 1876, she experienced high water two times per year. By 1950 high water washed in 16 times annually and today it comes in **at least** 32 times. Across the hemisphere, in Thailand, Bangkok has been named the "Venice of the East". Parts of the city have dropped 3 feet in the past 15 years. She will be underwater by 2000.

The only natural way to control flooding and stabilize a climate is through trees. However, with the tropical rain forest under tremendous pressure, the task has fallen onto the great forests of the northern taiga. Now these forests are being attacked with rain--acid rain. Not until the 1960's did the world scientists recognize

acid rain as a potential danger to the biosphere. It is very widespread and knows no boundaries. It can cross borders and even oceans. Neighboring nations, states or provinces each share pain even if it was not produced locally. This is the result of tall stacks, originally built to keep the air clean. Being more than 500 feet tall enables them to concentrate toxic emissions in the cloud formation range. By falling with the rain, the emissions become deadly acids that eat into metals, marbles, limestones and sandstones. Erosion of buildings speeds up as a result. The U.S. Capitol, Washington Monument, and the Statue of Liberty all are on the ever-growing list of affected structures. On cars, it leeches off paint. In human health it causes cancers and asthma. Eating away at pipes, the contaminated water puts toxins into the drinking supplies. Zinc residues have increased 700% and lead particles 300% in the past century (Boyle, 73). It does the most damage in the plant kingdom though. The rain kills crops such as alfalfa, barley, rye, beans and tobacco. In the forests, ash, aspens, birches, elms, maples, and pine trees fall victim to acid rain death. European forests, especially in the Eastern and Central areas, have suffered massive tree diebacks. Canadian forests have lost 15%-20% of their productivity (Boyle, 102). The knock-on effects are worse. Insects, algae, mollusks and crustacea all decline in number as their home dies right before them. Lakes and their fish get a double dose--first from the sky and then from the runoff. In Canada, 48,500 lakes are unsuitable for fish (Boyle, 113). Scandinavia has lost 5000 Swedish and 1500 Norwegian lakes to the rain's low pH values (Boyle, 115). Anything below pH 4.8 is fishless entirely. The water is a beautiful crystalline blue because not even algae can live in it. The lowest pH ever was in Wheeling, WV in 1978. The reading was less than 2. Lemon juice is pH 2.1.

The world leaders are not oblivious to the environmental crisis; after all we live on the same planet. Numerous international conferences have been held since the early 1970's. In 1974, CFC11 and CFC12, both equivalent to Freon, were banned from 'non-essential' use in the U.S. and Europe. Target goals for a halt on production of all CFCs have been set and all industrialized nations signed the charter. The world is slowly moving towards co-operation in the environmental area. There may be hope yet.

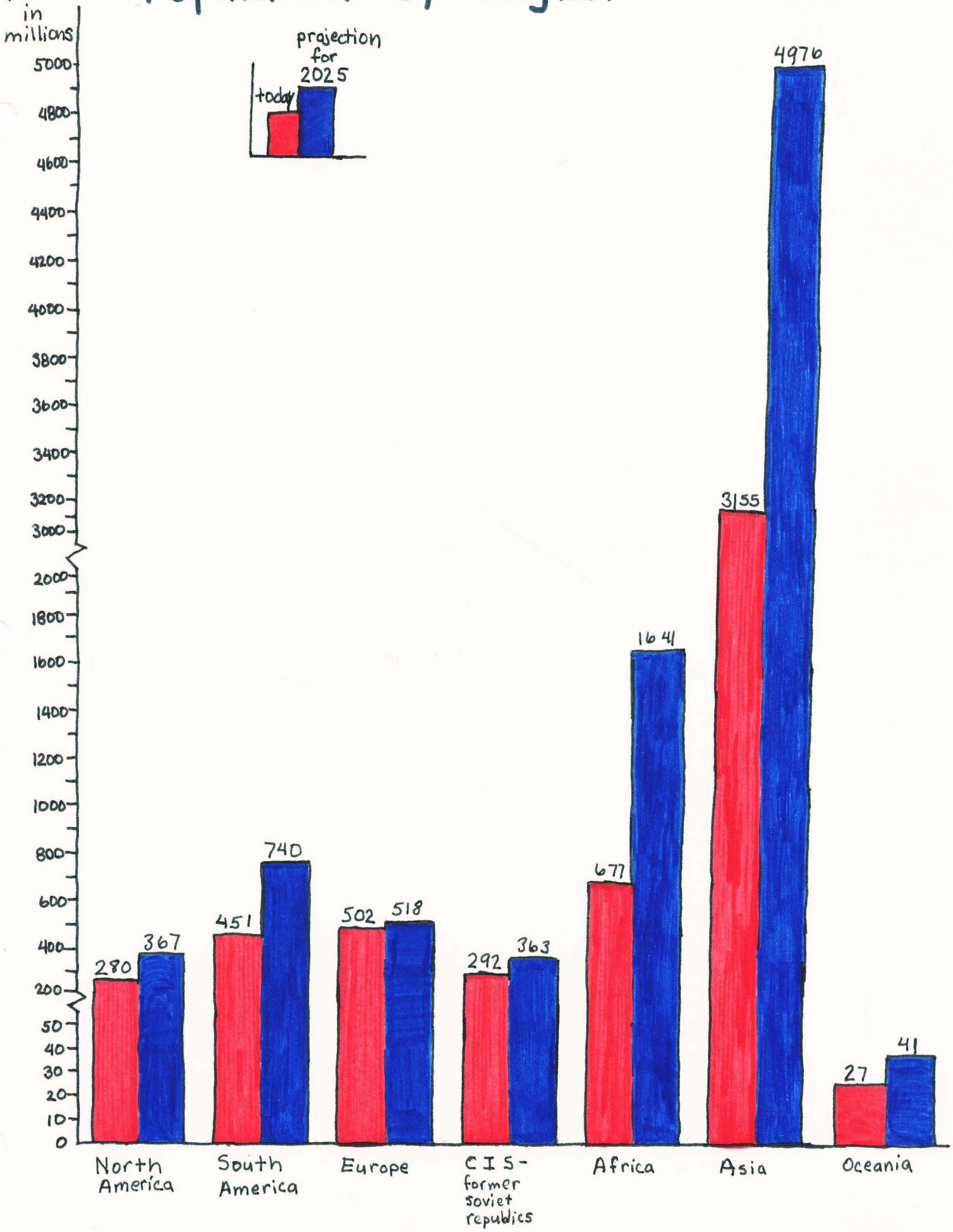
In the U.S., the Department of Environment reported smoke in urban areas down by 80% between 1960 and 1980 (although most Southern Californians would beg to differ). The Clean Air Act has been recently revised with stricter requirements. The ongoing struggle is between the developers' chainsaws and the environmentalists. The West has the remaining areas of forestland and some wish to save it for their children and for the well-being of the planet. Others see the land as frames for houses, as paper rolls and other wood products. It is a very touchy subject and is likely to stay that way for many more years.

The point that must be stressed is this: all pollution is connected. Ozone depletion leads to UVR; UVR leads to dying forests; dying forests increase CO_2; CO_2 warms the atmosphere which melts the icecaps and so on and so on. The world is constantly changing and so is her climate. The nations must work harder than ever now. The clock has started to tick while we worry about what the Royal Family did on their vacation.

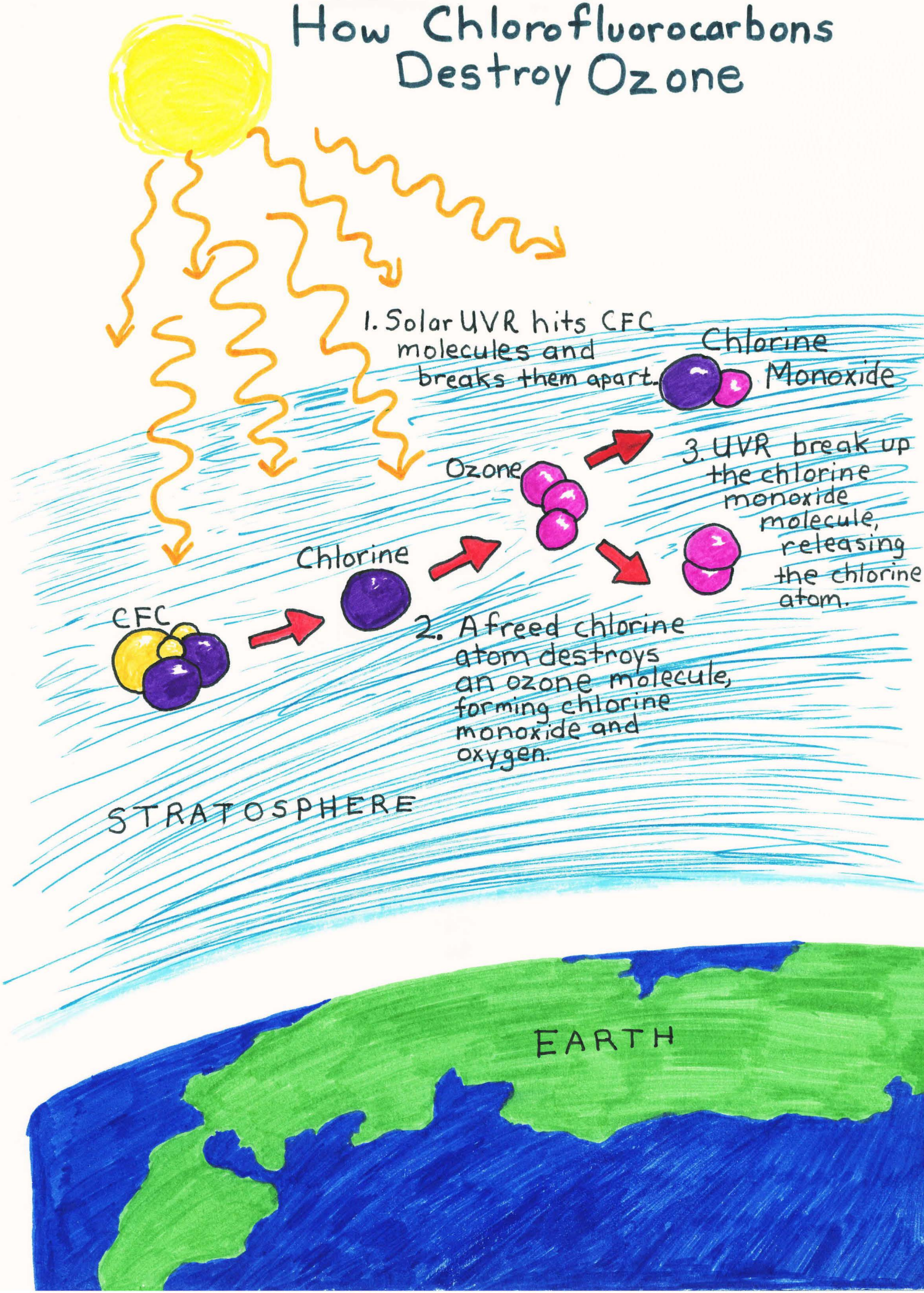
International solutions are never easy. Educate the Third World. Encourage them to use their resources responsibly. Sacrifice some loggers for a forest (would you like to be poor in a clean open environment or well-off, no guarantee, in a confining domed city of 94 million?). Force the money-hoarders to spend dollars on research of new cleaner products. We have enough information. We need answers to the problem, not a new way of looking at it. We don't know how much time we have left; we just felt the ticking a few years ago.

> YOU WILL FIND SOMETHING MORE IN WOODS THAN IN BOOKS. TREES AND STONES WILL TEACH YOU THAT WHICH YOU CAN NEVER LEARN FROM MASTERS.
>
> --St. Bernard

Population by Region



How Chlorofluorocarbons Destroy Ozone



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