

Effects of global warming assignment



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Starting in the 1850s, scientists recognized long-range problems, concentrating at first on sea-level rise and a threat to food supplies. New items were gradually added to the list, ranging from the degradation of ecosystems to threats to human health. Experts in fields from forestry to economics, even national security experts, pitched in to assess the range of possible consequences. It was impossible to make solid predictions given the complexity of the global system, the differences from one region to another, and the ways human society itself might try to adapt to the changes.

But by the start of the 21st century, it was clear that climate change would bring serious harm to many regions – some more than others. Indeed many kinds of damage were already beginning to appear. (This essay does not try to cover the entire history of impact studies, but sketches some examples.

Current scientific understanding of impacts is summarized at the end).

Through the first half of the 20th century, when global warming from the greenhouse effect was only a speculation, the handful of scientists who thought about it supposed any warming would be for the good.

Savant Awareness, who published the first calculations, claimed that nations like his native Sweden “ may hope to enjoy ages with more equable and better climates. “(1) Most people assumed that a “ balance of nature” made catastrophic consequences impossible, and if any change did result from the “ progress” of human industry, it would be all to the good. In any case nobody worried about the impacts of a climate change that scientists expected would only affect their remote descendants, several centuries in the future, if it happened at all.

I - LINKS - for more on this see opinion I A few scientists took a closer look in the late asses when they realized that the level of carbon dioxide gas (CA) in the atmosphere might be rising, suggesting that the average global temperature might climb a few degrees Celsius before the end of the 21st century. Roger Revelle, the most senior of these researchers, publicly speculated that in the 21st century the greenhouse effect might exert “ a violent effect on the earth’s climate” (as Time magazine put it).

He thought the temperature rise might eventually melt the Greenland and Antarctic icecaps, raising sea level enough to flood coastlines. Noting that climate had changed abruptly in the past, perhaps bringing the downfall of entire civilizations in the ancient world, in 1957 Revelle told a Congressional committee that the greenhouse effect might someday turn Southern California and Texas into “ real deserts. ” He also remarked that the Arctic Ocean might become ice-free, to Russian’s advantage.

Everyone understood this was all speculation, more science fiction than scientific prediction. Another senior scientist, more cautious, told his colleagues that they should take seriously the possibility of “ warming, and Seibel changes in rainfall and cloudiness” by the early 21st century.

Meanwhile a pair of graduate students reported that the CA greenhouse effect “ could raise such problems as coastal flooding due to rise in sea level and increased aridity in certain areas. I result More scientists began to look at the matter after 1960, when observations showed the level of CA in the atmosphere was indeed rising rapidly. In 1963 a path- breaking meeting on “ Implications of Rising Carbon Dioxide Content of the Atmosphere” was convened by the private Conservation Foundation. “ Conservation” was the <https://assignbuster.com/effects-of-global-warming-assignment-essay-samples/>

traditional term for a movement that was developing onto “environmentalism,” centered on the growing realization that human activities had expanded to the point where they could damage vital ecosystems on a global scale.

Participants in the meeting began to frame greenhouse warming as an environmental problem “ something “ potentially dangerous” to biological systems as well as to humans. (2) | | The meeting set the pattern for many later exercises. It brought together experts in carbon dioxide and climate (in fact the only experts at that time: Gill Plans and Dave Keeling) with a handful of experts in fisheries, agriculture and so forth. And it exulted in a “ consensus” report, which warned that if fossil fuel burning continued, “ the earth will be changed, more than likely for the worse. But the group, like many later ones, admitted ignorance, and called for more research. They could scarcely say what dangers might await a century ahead. They suspected forest productivity would improve, which did not sound bad, and that the distribution of species including commercial fisheries would change, which could be bad or good. The only thing they felt confident about was that rising temperatures would increase melting of the world’s glaciers, gassing the sea level and bringing “ immense flooding” of low-lying Global warming caught the attention of the U.

S. Presidents Science Advisory Committee. In 1 965 they reported that “ By the year 2000 the increase in atmospheric CA may be sufficient to produce measurable and perhaps marked changes in climate... ” Without attempting to say anything specific, they remarked dryly that the resulting changes “ could be deleterious from the point of view of human beings. “(3) The <https://assignbuster.com/effects-of-global-warming-assignment-essay-samples/>

following year, a panel of the U. S. National Academy of Sciences warned against “ dire predictions of drastic climatic changes.

Dire predictions of one or another climate catastrophe had in fact been a staple of the popular press for decades, as magazines, books and other media peddled colorful speculations of every variety. The Academy panel remarked that the geological record showed swings of temperature comparable to what the greenhouse effect might cause, and “ although some of the natural climatic changes have had locally catastrophic effects, they did not stop the steady evolution of civilization. “(4) I ;=; Government I That was not entirely reassuring.

Concern grew among the few scientists who paid attention to climate theories. Meanwhile the rise of environmentalism was raising public doubts about the benefits of human activity for the planet; smoke in city air and pesticides on farms were no longer tokens Of “ progress” but instigators of regional or even global harm. A landmark study on “ Man’s Impact on the Global Environment,” conducted at the Massachusetts Institute of Technology in 1970, suggested that greenhouse warming might bring “ widespread droughts, changes of the ocean level, and so forth,” but could not get beyond such vague worries(5).

A meeting in Stockholm the following year came to similar conclusions, and added that we might pass a point of no return if the Arctic Ocean’s ice cover disappeared. That would change the world’s weather in ways that the scientists could not guess at, but that they thought might be serious. Their main point in bringing up the Arctic ice, however, was simply to illustrate “

the sensitivity of a complex and perhaps unstable system that man might significantly alter. “(6) opinions Up to this point, scientists expected that greenhouse warming, if it happened at all, would bring no serious impacts until well into the 21st century.

And the 21st century seemed so far away! But was climate change really so distant? In the early 1900s the world saw vivid illustrations of climate fluctuations as savage droughts afflicted the American Midwest, devastated the Russian wheat crop and brought starvation upon millions in Africa. Studies of climate were still in their infancy, and scientists were debating whether the greenhouse effect from CO₂ emissions might be overwhelmed by the cooling caused by other forms of pollution.

A few scientists speculated that industrial emissions of aerosols might cause severe cooling while others suspected that natural cycles might bring a new ice age within the next few centuries. Nobody knew whether warming or cooling was more likely. In the 1970s, a report from the U.S. Central Intelligence Agency (CIA) warned of a “sudden freeze” that might grip the planet. The report concluded that the entire world’s food supply might be imperiled. There would be mass migrations, perhaps even wars as starving nations fought for the remaining resources. Scientists scoffed at the scenario, for none of them expected a radical climate shift,

whether warming or cooling, could come so swiftly. But for a more distant future, the grim speculations could not be entirely dismissed.

Governments were now putting some of the environmental movement's demands into law; that created a practical need for formal "environmental impact" assessments. A new industry of expert consultants strove to forecast effects on the natural environment of everything from building a dam to regulating factory emissions. On a broader scale, people concerned about the environment applied increasingly sophisticated scientific tools to study the impacts of deforestation, acid rain, and many other large-scale activities.

They looked at impacts not only on natural ecosystems but on human health and economic activities. Assessing the long-term impact of greenhouse gases fitted easily into this model. One example was a 1977 report on "Energy and Climate" from a panel of geophysicists convened by the U. S. National Academy of Sciences. By this time the speculations about cooling had faded away, while many scientists felt that greenhouse warming was a strong possibility. The panel got fairly specific about the potential consequences. On the positive side, the Arctic Ocean might eventually be opened to shipping.

On the negative side, there would be "significant effects in the geographic extent and location of important commercial fisheries... Marine ecosystems might be seriously disrupted." Stresses on the polar ice caps might lead to a surge of ice into the sea, bringing a "rise in sea level of about 4 meters within 300 years. As for agriculture, there would be "far-reaching

consequences” which “ we cannot specify... We can only suggest some of the possible effects. A few of these would be beneficial; others would be disruptive. There could be terrible “ human disasters” like the recent African droughts. However, the panel made clear they could not foresee what might actually happen. They concluded vaguely that “ world society could probably adjust itself, given sufficient time and a sufficient degree of international cooperation. But over shorter times, the effects might be adverse, perhaps even catastrophic. “(7) Two years later another Academy anal said much the same, and took brief note of an additional threat ” the rise of CA in the atmosphere would make the oceans more acidic.

Here too they found the consequences beyond guessing. Overall the experts could only conclude that as the world warmed, “ the socioeconomic consequences may well be significant, but... Cannot yet be adequately projected. “(8) Economists and social scientists were just beginning to take an interest in the topic. In 1 980 the Academy appointed an “ Ad hoc Study Panel on Economic and Social Aspects of Carbon Dioxide Increase,” the first semi-official attempt o address these aspects directly, separate from the science.

The panel’s lame conclusion was that any problems would come so slowly that they would be overtaken by unpredictable technological and social changes. At worst, people who found themselves in a region with worsening climate could migrate to a better place, as had often happened in the past. This was supposed to be reassuring. I As studies proliferated, the topic of “ climate impact studies” was starting to look like a respectable field of

research. The significant reports of the late 1970s had all been American, and many scientists wanted to internationalize impact studies.

An attempt was initiated by the International Council of Scientific Unions (ICSU), the United Nations Environmental Programme (UNEP) and the World Meteorological Organization (WMO) "the march of acronyms signals the increasing levels of complexity and bureaucracy that were coming into play. However, a one-week meeting in Villach, Austria, in 1980 did not get any farther than the earlier U. S. Academy studies, and its report was not widely circulated. "The 'internationalization' of the assessment effort was not very successful," admitted one of the leaders, Bert Bolin.

A more substantial team effort, assembled in Stockholm, again reached the same conclusions as the American panels "global warming would have profound consequences for ecosystems, agriculture, water resources, the sea level and so forth. (9) More categories of impacts emerged, each attracting its own little band of specialists. For example, an elaborate 1983 study by the U. S. Environmental Protection Agency, with more than 100 reviewers, studied sea-level rise. The experts concluded that by the end of the 21st century they "could confidently expect major coastal impacts, including shoreline retreat... flooding, saltwater intrusion, and various economic effects." A big step forward was a 1983 U. S. Academy report, the most detailed assessment up till then. It not only included familiar categories like agriculture and sea-level rise, but also pointed out that an increase in extreme summer temperatures would worsen the "excess human death and illness" that came with heat waves. Also, melting of permafrost in the Arctic could require adaptations in engineering. Also, climate shifts "may change

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the habitats of disease vectors. " Finally and most important, " In our calm assessments we may be overlooking things that would alarm us. For there might be effects that no expert could predict or even imagine, effects all the more dangerous because they would take the world by surprise.

Nevertheless the Academy, as usual, did not recommend any actual policy initiatives, aside from the scientists' customary plea for more research. I =< Government I Meanwhile, in 1982 Billion spoke about an international effort with Dry. Mustard Total, the dynamic executive director of UNEVEN. Total, a former professor of biology at Cairo University, wanted to go beyond physical climate studies to bring attention to global ecosystems.

That was the sort of " environmental" study that JINEE could support. Later WHOM was brought in, and CICS agreed to publish the results to help them become widely read. The resulting 560-page report, Billion was proud to say, brought the greenhouse problem " much more to the forefront in the scientific community than earlier assessments had done, particularly amongst those engaged in analysis of the terrestrial ecosystems. " The sequel was a 1 985 CINE/WHOM/SILL conference in Villain, energetically chaired by Total, which further publicized the scientists' warnings.

The assembled experts went on to all for policy initiatives" not to restrict greenhouse gases, to be sure, but at least to mobile an internationally coordinated effort to study policy options. (AAA*) =<=> elimination I The studies to this point had used a simple cause-and-effect model. Physical scientists would run computer models to predict changes in precipitation and the like. Others would follow by calculating immediate consequences, for

example using historical records to predict how crop yields would vary with the weather.

But if farmers could no longer get good results from corn, wouldn't they plant something more suited to their new climate? During the 1980s, some impact studies began to take account of how humans might adapt to climate change. By the end of the decade, some studies were linking models of crop responses with economic models. Complex interactions were no less crucial in natural ecosystems. Life scientists began to calculate how forests, coral reefs and so forth might respond to the rise of greenhouse gases.

For example, could tree species move their ranges poleward fast enough to keep up with the temperature rise? At a still higher level of complexity, some studies began to account for the way one type of climate impact might interact with another. I <=> Simple models | These more sophisticated approaches guided the first comprehensive official U. S. Government report, ordered up by Congress from the Environmental Protection Agency. The report's findings continued the trend toward predicting more numerous and more specific kinds of damage.

The experts concluded (as summarized by New York Times in 1989) that "Some ecological systems, particularly forests... May be unable to adapt quickly enough to a rapid increase in temperature... Most of the nation's coastal marshes and swamps would be inundated by salt water... An earlier drought and runoff could disrupt water management systems... Diseases borne by insects, including malaria and Rocky Mountain spotted fever, could spread as warmer weather expanded the range of the insects." Some Of

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this was already vaguely grasped by the minority of people who followed scientific news closely.

Other predictions, notably the expansion of diseases, had been mentioned in passing before but were only now coming under detailed discussion. (1 k) I => Public opinion I Studies of how climate change might affect human health expanded particularly swiftly in the asses, catching the attention not only of experts but the public. Here as in some other categories, the work was increasingly supervised not by a particular government but by international organizations, from the venerable World Health Organization to the new International Panel on Climate Change (IPCC, established 1988).

Yet here as in some other categories, it was becoming clear that global generalizations were of little value compared with studies at a regional level. For example, insect vectors of tropical diseases like dengue fever and malaria (which already affected half a billion people) would expand their ranges. The main impacts would be felt in developing nations, but people in the developed world tended to worry chiefly about how such diseases might spread to the temperate zones. 11) | Any regional analysis had to start with the climate changes that would result from a given level of greenhouse gases, as calculated by computer models. But although the increasingly sophisticated models had come to a rough agreement on global features like the rise of average temperature, they differed in the details. In places where many factors balanced one another, for example the Sahel region between the Sahara desert and the African rain-forest, one del might predict a benign increase of rainfall and another, terrible droughts. Logic-makers did not much care about the average global temperature " they wanted to know how

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things would change in their own locality. I <= Models (Gems)I Unable to make quantitative predictions of just what might happen in each region, the EPIC decided to study “ vulnerabilities,” that is, the nature of damage that a given system might sustain from any of the likely sorts of climate change. This was in line with an established practice of vulnerability studies in many other areas, from food supplies to earthquakes.

The experts also considered benefits, but the very term “ vulnerability” showed that by now most of them believed the net effects of greenhouse warming would be harmful. Some disagreed, leading to a serious controversy during the discussions leading to the Epic’s initial report of 1990. The eminent Russian climatologist Mikhail Buoyed argued, on the basis of his reconstruction of climates in the distant past, that warming would have important benefits. For Siberia, at least, he had a point ” so long as the warming did not soar higher than in the earlier interglacial epochs he had studied.

In the usual EPIC fashion, the experts papered over their disagreements, inserting some polite phrases accepting that there could be beneficial results in some northern locales. I I The EPIC got much farther in 1 997 with a pioneering report on “ The Regional Impacts of Climate Change. ” Each region of the globe got its own detailed account of vulnerabilities. At this level it was obviously necessary to consider not only the local climate and ecological systems, but also the local economic, social and political conditions and trends, drawing in the social sciences as equal partners with geophysics and biology.

It was becoming a standard practice to consider how people might adapt. For example, the panel concluded that Africa was “ the continent most vulnerable to the impacts of projected changes. ” That was not just because so many parts of Africa were already water-stressed, subject to tropical diseases, and so forth, but still more because population pressure and political failings were causing environmental degradation that would multiply the problems of climate change. Above all, Africans “ widespread poverty limits adaptation capabilities. By contrast, the carefully managed agricultural systems of Europe and North America might even contrive to benefit from a modest warming and rise in the level of CO₂ (which could act as a fertilizer for some crops), although the developed nations would certainly suffer some harmful impacts as well. (12) | An elaborate assessment exercise that the U. S. Government pursued in the asses took a different approach. The authors displayed, side by side, the results of two separate computer models (one constructed in the United Kingdom and one in Canada).

In some regions the model predictions agreed; there seemed little doubt, for example, that Southern California would get a to drier. In other regions they diverged, as when one model projected more rain in the Southeast and the other, less. Overall, the American experts agreed with the EPIC that highly managed ecosystems of farming and forestry’ might do quite well in the first half century Of serious warming. On the other hand, nothing could prevent damaging changes in some natural ecosystems and expensive difficulties along the coasts.

As for threats to health, there would be some problems but “ adaptation is likely to help protect much of the US population. ” And finally, “ some <https://assignbuster.com/effects-of-global-warming-assignment-essay-samples/>

aspects and impacts of climate change will be totally unanticipated,” which people could interpret optimistically or pessimistically, according to taste. (13) Scientists in another major industrial country, chilly Russia, foresaw even less worrisome results from global warming. These assessments, and the publics they addressed, could see the impacts as manageable because they were looking no more than half a century or so ahead. The 22nd century was so far away!

Surely by then, humanity would have taken control of its emissions so that CO₂ would not rise to three or four times the pre-industrial level wouldn't we? Alt;=> Governments The future state of the climate would depend crucially on what emission controls nations chose to impose. That exposed a problem with the standard way of predicting impacts. Scientists had tried to look into the future by extrapolating the visible trends and forces along a single line, calculating a most likely outcome within a range of possibilities: “ global average temperature will rise three degrees plus or minus 50%” or the like.

People would then estimate the consequences Of a three-degree rise. I Professional “ futurologists” in the social sciences, and the policy-makers they advised, had abandoned that method of prediction decades earlier, when they realized that most of their predictions had been far off the mark. They turned to an approach practiced by military planners since the asses: instead of trying to predict the most likely future, imagine a wide range of possible futures, and for each of these develop a detailed “ scenario”.

The aim was to stimulate thinking about how your operations should be structured so they would hold up under any of the likely contingencies. This

approach was applied to environmental questions in the asses by studies that sketched out set of very different possible futures for pollution, exhaustion of natural resources, food production and so forth, depending on just what policies governments might adopt. (1 AAA) Since the asses most corporations and government agencies had used scenarios for their planning..

I The had taken up this method from the outset, assembling experts to write scenarios in a lengthy intergovernmental process. The result, published in 1992, was a set of six different scenarios, each describing a range of ways that the world's population, economies, and political structures might evolve over the decades. Experts in various fields of physical and social science could try to figure how much of each of the various greenhouse gases would be emitted by the society of a given scenario, then compute the likely climate changes, and then estimate how that society would try to adapt.

Much was omitted from these scenarios, not least the feedback by which climate changes might affect the socio-economic system and thereby the emissions themselves. A second try in 1 996 produced no fewer than 40 different scenarios, grouped into families in terms of rate of economic growth, sensitivity to environmental problems, degree of international cooperation ND so forth. (14) There were so many unknowns, and so many differences from region to region with each region demanding its own detailed study, that the small community of researchers could explore in depth only a few of the possibilities.

Many research projects used only one scenario, a middle one with emissions neither sharply restricted nor rising explosively. In its own reports, the EPIC not only laid out clearly the range of scenarios it had investigated, but got increasingly specific about whether the consensus of experts judged a given impact to be “likely,” “very likely,” or “virtually certain. There was plenty of uncertainty, not least because the laborious studies lagged behind the science; the panel’s 2001 impact assessments relied on older computer model results that were derived from the still older 1992 emission scenarios. It was only around 2009 that the impacts community figured out ways to work through the different stages in parallel rather than in the panel’s 2001 and 2007 reports, the most impressive parts resembled the earlier reports that simply laid out a variety of the likely direct impacts, and suggested which regions would be especially vulnerable. Scholars who studied the two-decade series of EPIC assessments reported a clear trend toward more complex and interdisciplinary analysis, in which climate impacts were combined with other stresses and with potential adaptations.

The trend responded to the evolving needs of policy-makers. The scientists’ first goal had been to evaluate the overall danger to the world associated with a given level of greenhouse gases, in order to advise governments how much effort they should make to restrict emissions. By the time that question was answered, greenhouse gases had risen to a level where some serious impacts were inevitable. Leaders in governments and business organizations were now asking for detailed and precise assessments so they could shape policies for adapting to the changes. (15) The scientists’ attempts at precision could be misleading.

For example, studies published from the 1980s into the mid 1990s estimated that by 2100, the sea level might rise anywhere from a few tenths of a meter to a few meters. The upper limit dropped to about half a meter in the EPIC's 1995 report, and it stayed there in later reports. But in fact, the range of scientific estimates on how high the seas could rise in the 21st century remained broad. The rise would exceed a meter if polar ice sheets began to surge into the oceans in the next few decades. Most scientists had always considered that quite unlikely, but there were always some who argued that it was possible.

The EPIC gave scant attention to such impacts that did not seem at least fairly likely to happen, even if they would be catastrophic in the event they did befall us. This was different from the practice in many other kinds of impact studies. For example, the building codes of cities in earthquake zones, and evacuation plans for people living near nuclear reactors, dealt with problems that might have less than one chance in a hundred of happening in the next century or two. The EPIC, by contrast, was preoccupied with impacts that were more likely than not.

Models (Gems) There were still people arguing that climate change would be beneficial. These included a few scientists and a large number of conservatives, amply funded by right-wing private American institutes. For example, a Hoover Institution publication held that "Global warming, if it were to occur, would probably benefit most Americans." There would be lower energy bills and other energy savings, and besides, "More people die of the cold than of the heat." Many asserted, as a Heartland Institute publication declared, that "More carbon dioxide in the air would lead to

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more luxuriant crop growth and greater crop yields. Little if any hard analysis backed up such statements, but there was some truth in them. As Russians in particular noticed, a bit of warming would bring some benefits to cold regions. But even in those regions the people, crops and entire ecosystems would eventually suffer more harm than good, according to the voluminous and detailed tidies worked up by teams of economists, epidemiologists, agronomists and other experts. The public, however, scarcely knew that these teams existed and never read their reports.

The experts' conclusions reached ordinary people at most as a summary paragraph or two in a news story, perhaps "balanced" by a statement from one of the institutions committed to denying any problem existed. Meanwhile some media featured exaggerated warnings of doom. "Global heating will all but eliminate people from the Earth," exclaimed a well-known scientist; a high-ranking bank officer declared that inaction on emissions would bring "the extinction of the human 6) Reality descended upon the abstract world of impact studies as actual consequences of global warming began to appear.

In the late asses, field surveys of sensitive and well-studied groups like birds and butterflies found them measurably shifting their ranges, or even facing extinction, in just the ways that could be predicted from the observed In the early years of the 21 SST century, instead of future possibilities some experts began to estimate the role that global warming might have played in one or another actual disaster. It turned out that because of unexpected complexities, the rich nations were not as safe as some had thought.