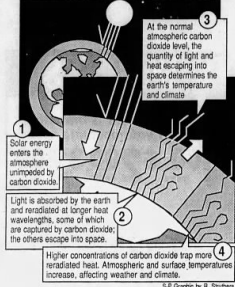


# THE 'GREENHOUSE EFFECT'



The warming of the earth's climate, caused by man-induced changes in the balance of gases in the atmosphere, holds scientists' attention worldwide. They are researching, debating and predicting the impacts of the 'greenhouse effect,' and they are sounding an alarm.

Within 50 years, impacts ranging from the flooding of coastal cities all over the world to marked improvement in the growing season in Canada's prairies may occur. Depending on where you live and how you care your lawn, you may benefit or lose.

One hundred years ago scientists proposed that changing the amount of carbon dioxide in the atmosphere could affect temperature at the earth's surface. Evidence gathered over the last 30 years from atmospheric monitoring has shown a six-per-cent increase of CO<sub>2</sub> in the atmosphere.

Scientists say this is a result of industrial processes and burning fossil fuels. They fear the rate of increase will accelerate in the next 20 to 30 years. Other gases, natural and man-made, may be adding to the ef-

fect, creating an array of atmospheric greenhouse gases that can trap the sun's heat and warm the earth.

Changes that occur in a greenhouse climate will not be catastrophic, but also, almost imperceptible environmental shifts. Nonetheless, over the long term, changes could be dramatic.

Though the most severe effects may be several years away, scientists feel we must act now to avoid future catastrophe or take advantage of the beneficial changes. They suggest countering the greenhouse effect by energy conservation to reduce fossil fuel use, planning for the most certain impacts, and increasing research actively to refine prediction on a regional basis.

Saskatoon freelance writer Steve Smith has studied research material on carbon dioxide and climate change and talked to North America's foremost atmospheric scientists. He looks at the global perspective and at what it might be like for Saskatchewan in a greenhouse climate.

Accent Today

## Long, long, long-range forecast warm

Perhaps the scariest of weather forecasts are those who look into the next decade, even the next century, to research and predict the greenhouse effect, or the warming of the earth's climate.

One of the most eminent and adventurous of these scientists is James Hansen of NASA's Goddard Institute for Space Studies in New York. He predicts a global warming very soon.

"People often think that the greenhouse effect is a problem for our grandchildren, but actually the problem is a lot closer than you think. In fact, the temperature effect should be clearly evident by the 1990s."

Hansen expects an average global temperature increase of between one-half and two degrees Celsius by the end of the '90s. "And within 10 to 20 years of this, the earth will be warmer than it has been in the past 100,000 years."

If this proves true, by the year 2020 we will experience an average temperature increase of around three degrees, with even greater extremes. More conservative estimates of the warming of the earth will not happen until the middle of the 21st century. Whether it occurs, the results might include inland drought, food shortages, coastal flooding, lengthened growing seasons, human migration, forest fires, insect infestations and migration of diseases.

But the greenhouse effect doesn't simply bring disaster. Without its effects to offset, the earth would be a frozen wasteland. The effect occurs because gases such as carbon dioxide (CO<sub>2</sub>) form a kind of barrier in the earth's atmosphere. Energy from the sun passes through the atmosphere and reaches Earth, which radiates a portion of this energy, in the form of heat, back toward space. The layer of CO<sub>2</sub> stops some of the heat from escaping. The more CO<sub>2</sub>, the better a trap it is, so the warmer the earth becomes.

Scientists believe that under natural conditions, the amount of atmospheric carbon dioxide is relatively stable, but they are concerned because evidence shows man is affecting the balance.

The combustion of fossil fuels — used to heat buildings, power vehicles and make steel — has added billions of tons of carbon dioxide into the atmosphere. In this century, we have added more than 100 billion tons of carbon dioxide to the atmosphere. In the next century, we may see an increase

of 100 per cent, or a doubling of the 1982 amount of atmospheric CO<sub>2</sub>.

It is the effect of this doubled amount that scientists refer to when they speak of a "greenhouse" effect.

Researchers believe we are further compounding this effect by the introduction into the atmosphere of gases known as chlorofluorocarbons — man-made byproducts of 20th-century industrial processes like refrigeration and plastic extrusion. There is a few more gases like methane and nitrous oxide which contribute to the greenhouse effect, and scientists become very concerned about a rapid and irreversible climate change.

They believe the degree of impact will vary with geographic location. In the northern hemisphere, the greatest changes would occur in more northern latitudes occupied by countries like Canada, Britain and the Soviet Union.

## Changes will bring calamity to some, bounty to others

A climate warmed by the effect of twice as much carbon dioxide in the atmosphere, an average of three degrees, will create noticeable changes. It might mean calamity to some and bounty to others.

Growing seasons will be longer, which will offer the greatest gains to farmers in northernmost agricultural belts. Land now unusable because of a shortage of growing days may become agriculturally accessible, where soil allows.

Dependent on the region, wetness or aridity may become more extreme. Some regions that now require extensive irrigation, such as California and Central America, may become wetter. In the southern hemisphere, the coast of British Columbia will likely become the wettest region in Canada, while the rest of the country dries out. Some areas will turn to dry regular droughts may occur. This could be the case for southern Saskatchewan.

According to NASA's James Hansen, we shouldn't panic, but there is reason to be concerned.

"I would not expect to have global catastrophes by early in the next century. But there should be noticeable climate effects. There may be more frequent droughts, and there may be an increase in the strength of the hurricanes."

The ocean plays a major role in weather. They control and react to climate. As the atmosphere warms, ocean temperatures will increase and release equatorial heat to the melting of ice polar ice, and sea levels are predicted to rise. Ice which is already floating, such as the Arctic ice sheet, will melt and increase water levels. But melting land-based ice will...

Sea level increases of between one and five metres have been predicted. Depending on the degree of rise, flooding could affect extensive sections of heavily farmed and densely populated river deltas, and some major cities.

In North America, large areas of Prince Edward Island, Nova Scotia and British Columbia and Florida and Louisiana would be lost to the sea. Charleston is expected to have severe flooding in its recently developed historic downtown area.

The impact rising sea levels might have is suggested by the fact that 30 per cent of the world's population lives within 50 kilometres of an ocean or sea.

Other reasons for concern: Food shortages could occur. There might be a shift of climate-related disease and insect populations. In the most severe conditions, some regions may become economically or climatically uninhabitable, and large numbers of people might have to move.

This sounds like a lot of bad news, but scientists are researching positive stories, too. It seems that plant growth is enhanced in a CO<sub>2</sub>-rich environment. John Mayhugh, director of the environment sector of the Saskatchewan Research Council, writes of recent research in his report, *Climate Change in Food for You*.

"For almost every plant, production increased with increasing CO<sub>2</sub> concentrations. A doubling of CO<sub>2</sub> was likely to provide an overall increase of up to 10 per cent in yield for the same weather conditions. This research shows what yields improving by up to 10 per cent and barley by 20 per cent. Mayhugh also points out that plants tend to use water more efficiently at higher CO<sub>2</sub> levels, which might alleviate some effects of the predicted droughts."

One interesting footnote is offered by C.C. Carey, Van Kooten, a natural resources economist with the University of Saskatchewan.

"Of normal forest stands planted. The time of increased CO<sub>2</sub> and a climate warming is the enhanced growth of this forest, which enables it to absorb more pollutants. This could be quite large."

The complexity of weather systems makes it very difficult to predict on a small, regional scale. The models and patterns used in long-term computer calculations are quite broad in sweep, so scientists concede that regional realities might differ from general predictions.

For each possible scenario, and each region, there is a different economic impact. These have not been researched thoroughly, and prediction will remain inconclusive until the accuracy of regional prediction can be improved. Nonetheless, it seems that compared to other countries, Canada would likely benefit overall.

Scientists' research and prediction of climate change are giving us a warning, and a long lead time to plan and prepare.



" Heck, if it got warm enough here, maybe I'd plant bananas." Carrot farmer Peter Korpach

## Lengthier growing season welcome

Though skeptical of the greenhouse effect, Peter Korpach, who has farmed for 18 years in Carleton Place, would willingly adapt his crops to a warmer climate and lengthened season.

Recently he's grown wheat, canola and fall rye, but he said, "We probably don't get any earlier return per acre."

" Heck, if it got warm enough here, maybe I'd plant bananas."

Carrot farmer at the end of the rail line in the northeast farming corner of Saskatchewan. Farmers there have the shortest growing season in the province, with the first-free days a year if they're lucky. With the right crops, a weather break, a low enough overhead and reasonable prices, they can make a living.

Of all farmers in Saskatchewan, they and others in northern farming communities would likely benefit the most from a warmer climate, in a greenhouse climate, the province's mean regional temperatures will likely increase by three degrees in summer and four or five degrees in winter.

John Mayhugh of the Saskatchewan Research Council sees climate regions moving north. "To simplify things, if temperature

warms up by just an annual amount of one degree, Saskatchewan gets a climate roughly like that of Minot, North Dakota."

This would change the character of farming in the whole province, predict Elaine Whelan, a meteorological and agricultural specialist with the Saskatchewan Research Council.

"Saskatchewan farming operations are dependent upon the climate — the spring climate, the germination of the crops. Early precipitation is a major impact, since the fall for harvesting conditions and indeed even insurance, for the re-insuring of fall crops after wind and large crops. Climate change would affect a wide range of these farming operations," she said.

The good news is there will be more frost-free days, and the growing season will be longer by up to two to three weeks in the north. The bad news is the drier atmosphere that may prevail. Less precipitation will not help farmers in the south, where conditions are already drier than desirable. The north might experience drier summers, but more snow in winter. These conditions could leave soil vulnerable to wind erosion and spring runoff.

"The need for soil conservation practices will intensify," Whelan said.

The warmer, longer season should allow for more crop diversity, which might let farmers take their crop selection options, especially in the north where heavy machinery is required to ensure that farmers can bring in their crops in their very short harvest time.

In a warmer climate, heating costs will be less; in a drier climate, irrigation costs will increase; if the climate is wetter, more farmers will have to add drying to their operation, increased rainfall could impair planting and harvesting; easier winters might encourage new insect populations.

