Global and Regional Respiratory Health and Cleantech

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ABSTRACT

This investigation considers the impact on environmental air quality of Global Warming and its relationship to the epidemiology of allergic disease.

Global respiratory health has suffered a similar precipitous decline as environmental air quality drastically decreased in the past two centuries, particularly in industrial regions.

Worldwide, asthma and respiratory allergy and related disease as well as relevant healthcare costs are increasing exponentially in the Temperate Zone border Latitudes.

This scenario presents an ideal opportunity for Cleantech Business & Policy Global and Regional Initiatives.

Keywords: global warming, latitude, allergies, prevalence, respiratory health

1. INTRODUCTION

Cleantech policies and innovations not only are important for industry but have a direct impact on human health. Technological advances in the past two hundred years have enhanced many aspects of our quality of life but at the expense of a detrimental effect on the composition and particulate content of environmental air at specific Latitudes.

Since the Industrial Revolution there has been a marked increase in seasonal allergic respiratory disease. Currently about one out of every five Americans and other residents of the Earth's Temperate Zone is affected by seasonal allergies, as compared to only one in a thousand two centuries ago [1].

Accelerated global warming intensifies the Earth's air circulation patterns outside the Tropics and Polar Circles. In the Temperate Zones when temperature shifts the air is laden with pollen and travels westward above the Tropics and below the Polar Circles, increasing the prevalence of seasonal allergies at these Latitudes [2].

Our overall sustenance and respiratory health depend on our ability to breathe an adequate supply of air free of environmental allergens. Since allergic respiratory disease is directly linked to atmospheric air quality and circulation equilibrium, restoring global temperature stability is crucial in preventing allergic respiratory disease.

Alternative energy sources are crucial in reversing the trend in escalating carbon dioxide in the atmosphere and global warming and make Cleantech a key player in respiratory health.

2. BACKGROUND

In 1860 Tyndall explained that atmospheric gases such as carbon dioxide absorb infrared radiation in the form of heat and act as insulators by preventing solar radiation from being dissipated back into space in the form of light. However, an excess concentration of insulating gases is bound to increase the average global surface temperature. This is consistent with the mean annual global temperature increase observed by the end of last century, and validates the 1896 calculations of Swedish Chemist Svante Arrhenius.

Rapid deforestation has added to the problem by preventing the naturally occurring absorption of excess carbon dioxide by trees. Reforestation slows down the accumulation of carbon dioxide in atmospheric air and excess makes plants grow faster eventually reducing its excess in the atmosphere.

Atmospheric air is a mixture of gases, including 0.03% carbon dioxide, which varies with height and is not noticeable unless it is moving. Intense burning of fossil fuels has altered the composition of atmospheric air in industrialized areas has changed drastically in the past two hundred years. The atmospheric concentration of carbon dioxide, a by-product of combustion, has increased from 282 ppm to 382 ppm in the past two centuries with a concomitant increased annual average global warming of 0.6

degrees Celsius. The forecast for 2100 is 564 ppm, which will cause an increase in average global temperature of two degrees Celsius if the trend continues.

When the atmosphere gets warmer ice melts in the solar caps and incoming solar radiation can no longer get reflected by ice in the form of ultraviolet or visible light and instead gets absorbed by the Earth, causing more global warming and accelerated climate change.

3. SEASONAL CLIMATE CHANGE AND ATMOSPHERIC AIR CIRCULATION

Because of the tilt in the Earth's axis and its rotation round the Sun different latitudes get more solar radiation at different times of the year. The result is a warmer summer climate in the northern hemisphere and a warmer winter climate in the southern hemisphere.

The Tropics get the most incoming solar radiation and do not show marked climate seasonality. They are regions of air ascent and are hot and humid year round because as air rises it cools and condenses its water vapor and rain forms.

At the Poles there is little rain or snow due to the predominant descent of air. The Arctic and Antarctic circles are in complete darkness for part of the year and get the least incoming solar radiation. The ice caps are highly reflective and reflect incoming solar radiation back into space before it is absorbed.

The mid-latitudes have both areas of air ascent and descent. Latitudes around 50 to 60 degrees from the Equator are the main regions of air ascent where clouds and rain or snow from. The main regions of air descent are the dry and arid regions near the subtropics around the 30 degree latitudes.

The Temperate Zones show marked seasonal climate, warmest in opposite hemispheres when the sun is high in the sky at the summer solstices and are subject to the weather systems that form when circulating air currents become unstable and break down in to alternating low and high pressure areas. Because of different energy transport due to sea and wind currents even some places with comparable latitudes exhibit differences in seasonal climate.

General atmospheric air circulation patterns shift with the seasons. Wind blows on Earth at various latitudes in circles called cells and established wind patterns result at specific latitudes.

The Polar Cells are wind circles blowing in the high Latitudes, 60 to 90 degrees from the Equator, where Easterly winds blow from East to West. In low-latitudes 30 degrees from the Equator, the Northeast or Southeast Trade winds once used to sail westward from Europe to America, also blow in circles called Hadley Cells.

Because the Earth spins, northbound moving air from the Equator is deflected from west to east and southbound moving air turns from east to west. Winds tend to flow to the right North of the Equator and to the left south of the Equator rather than flowing directly from areas of high pressure to areas of low pressure.

In 1835 the French scientist Coriolis explained how the rotation of the Earth propelled winds to move horizontally from West to East in a wave-like manner, aided by the tilt of the axis of the Earth toward the Sun. Rotating rising warm air is pulled from warmer regions and transported toward the colder poles at an angle. Freely moving objects experiencing the Coriolis force on the Earth's surface appear to veer to the right in the northern hemisphere and to the left in the southern hemisphere.

In 1856 the American meteorologist William Ferrel discovered and published in the Nashville Journal of Surgery and Medicine his Law that explains the direction of air movements in the great wind systems of the globe: "If a body moves in any direction on the Earth's surface, there is a force arising from the Earth's rotation which deflects it to the right in the northern hemisphere and to the left in the southern hemisphere." [3]

In the mid-latitudes, 30 to 60 degrees north or south of the Equator, prevailing westerly winds blow from west to east in circles called Ferrel Cells. The prevailing westerly winds were once used to sail eastbound from America to Europe. Ferrel Cells border the polar easterly winds at 60 degrees north or south of the equator. At this latitude the air rises and the wind blows back toward the 30 degrees border of the northeasterly and southeasterly Trade winds, where the wind falls and blows back toward the Poles.

4. WIND PATTERNS AND ALLERGIC DISEASE

Surface temperature variations on Earth cause wind, which is air moving due to its varying pressure. Winds are accelerated by a pressure gradient force which triggers the initial movement of air when air packets from high atmospheric pressure areas move to areas of low pressure. When the Sun warms the air at the Equator its volume increases and air rises and moves toward the cold Poles where it falls and moves back to the Equator. The direction of movement around a low pressure area is counterclockwise in the northern hemisphere and clockwise in the southern.

Accelerated seasonal climate change results in drastic temperature, pressure and air circulation disturbances in the Mid-latitudes. As pressure difference increases over a horizontal distance so does the pressure gradient force and winds increase in intensity, particularly at the borders of the Ferrel Cells where the westbound Easterly and eastbound Westerly winds meet.

The actual cause of respiratory allergy symptoms, a hypersensitivity reaction to pollen exposure in predisposed individuals, was not suspected until 1833. Pollen plant as the sole cause was experimentally proven in England in 1877. At about the same time common ragweed was found to be the most active pollen which produced seasonal allergies in America.

The Westerly winds of the Mid-latitudes carry increasingly high seasonal pollen counts. Regional atmospheric air samples during seasonal climate changes correlate with the escalating high prevalence of respiratory allergic disease in residents of the Temperate Zones, particularly at the border Latitudes.

5. CONCLUSION

Data from ice cores reveal that for the past 1000 years atmospheric carbon dioxide concentration remained constant at 282 ppm for 800 years at the end of which the prevalence of allergic respiratory disease was 1/1000. Since the Industrial Revolution prevalence doubled every fifteen years. Currently the CO_2 concentration is 382 ppm and prevalence is 1/5. By 2100 low estimate is 564 ppm which according to Arrhenius would translate into an increase in average global temperature of two degrees Celsius.

The mid-latitudes are the regions on Earth where the richest and most highly industrialized nations are located. The climate in these Temperate Zones is highly seasonal, is subject to westerly wind patterns and seasonal respiratory allergic disease is prominent.

The highest allergic asthma and rhinitis prevalence is found in the borders of the Ferrel Cells around 30 or 50 to 60 degrees Celsius north or south of the Equator. These are the latitudes where high pollen laden strong easterly and westerly winds meet, blowing in opposite directions and also areas of rapid air ascent or descent where high velocity winds travel, triggering the symptoms of seasonal allergies along the way.

Restoring global temperature stability is the key to regional respiratory health and this presents an ideal opportunity for Cleantech Business & Policy Global and Regional Initiatives since regional seasonal allergic respiratory disease is directly linked to global atmospheric air quality and equilibrium.

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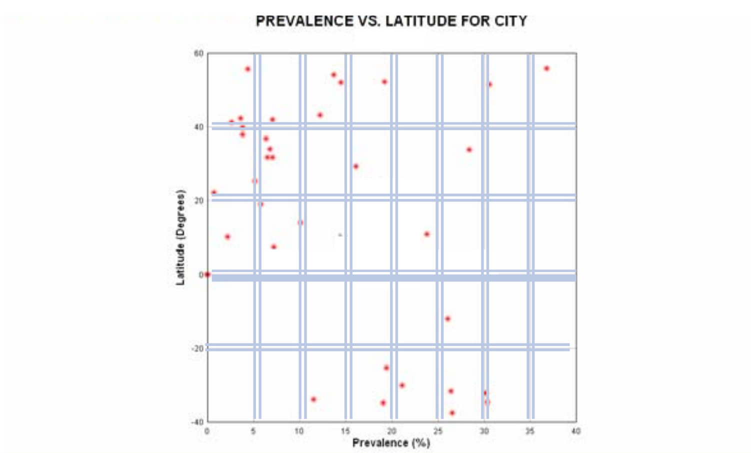
TABLE 1
Regional Asthma Prevalence vs. Latitude

CITY AND COUNTRY	prevalence (%)	latitude (^{o})	
Glasgow, Scotland	36.8	55.89	
London, UK	30.6	51.49	
Adelaide, Australia	30.4	-34.68	
Perth, Australia	30.2	-32.12	
Beirut, Lebanon	28.4	33.91	
Melbourne, Australia	26.6	-37.47	
Sydney, Australia	26.4	-36.69	
Lima, Peru	26	-12.01	
San Jose,Costa Rica	23.8	10.84	
Porto Alegre, Brazil	21.1	-30.03	
Sao Paolo, Brazil	19.4	-22.01	
Asuncion, Paraguay	19.4	-25.29	
Saskatoon, Canada	19.2	52.14	
Montevideo,Uruguay	19.1	-34.89	
Kuwait, Kuwait	16.1	29.33	DPlot
Munster, Germany	14.5	51.95	
Griefswald, Germany	13.7	54.08	
Hamilton, Canada	12.2	43.25	
CapeTown,So.Africa	11.5	-33.91	
Bangkok, Thailand	10.1	14.01	
CiudadJuarez,Mexico	7.4	31.73	
Ibadan, Nigeria	7.2	7.38	
Roma, Italy	7.1	41.89	
Rabat, Morocco	6.8	34.01	
El Paso, U. S. A.	6.5	31.76	
Algiers, Algeria	6.4	36.77	
Cuernavaca, Mexico	5.8	18.92	
Taipei, Taiwan	5.2	25.33	
Moscow, Russia	4.4	55.75	
Athens, Greece	3.8	37.97	
Beijing, China	3.8	39.92	
Kutaisi, Georgia	3.6	42.26	
Tirane, Albania	2.6	41.33	
Bandung, Indonesia	2.2	10.11	
Macau, China	0.7	22.14	

FIGURE 1

High asthma prevalence cities are near 30^{o} N or 60^{o} N and 30^{o} S latitudes in the borders of the Temperate Zones. Low Asthma Prevalence Cities are in the Tropics or near 40^{o} latitudes (see Table 1)



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