- Air—Microbiology

# Climate change could alter the air we breathe |

Bacteria could reach densely populated areas that are currently unaffected

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When it comes to the impact of climate change, nations are on guard for the major ones: rising sea levels, droughts or floods, extreme weather events.

But a warming world may have more insidious repercussions, with a new study l ed by researchers at the Nanyang Technological University (NTU) showing that climate change could also affect the very air we breathe.

Each gulp of air that humans take contains more than just lifegiving oxygen. It is also populated with micro-organisms such as bacteria and fungi.

By studying air samples taken at different heights from ground level up to 3,500m, researchers at NTU's Singapore Centre for Environmental Life Sciences Engineering have shown that as the world warms, the composition of micro-organisms in the air could change.

Their paper was published today in the scientific journal Proceedings Of The National Academy Of Sciences Of The United States Of America.

There are already indicators showing that airborne micro-organisms can impact human health and agriculture, said NTU's Professor Stephan Schuster, who supervised the latest work.

So a changing composition of the air microbiome – micro-organisms in the air – could have implications for human societies, he added.

For example, Prof Schuster's team had found earlier that while healthy people did not suffer ill effects from breathing in micro-organisms from the air, people with respiratory diseases showed an increased immune response, worsening their respiratory symptoms.

"Any change in the dynamics of airborne microbial communities could impact respiratory health in an as-yet unknown – and therefore potentially concerning – way," Prof Schuster told The Straits Times. As global temperatures warm, heat-tolerant micro-organisms that thrive in tropical climates could spread to higher latitudes, affecting biodiversity and agriculture there.

"This could change disease dynamics for various crop species, and potentially also livestock, which are not adapted to tropical airborne microbial communities," Prof Schuster added.

Atmospheric micro-organisms such as fungi and bacteria usually remain suspended in the air once they are blown off the planet's surface. Only a fraction of these find their way back down to the surface.

From samples collected, the researchers could identify about 10,000 airborne microbial organisms, and found that the part of the air column from the ground up to about 1,000m – where the boundary layer is – is rather evenly mixed during the day.

The boundary layer is the part of the atmosphere closest to the ground and is the part of the air column most intimately affected by the ground, through interactions with solid earth or water surfaces.

The team found there is a varying air microbiome composition within the boundary layer over the course of a day.

Above the boundary layer, however, the composition of micro-organisms did not change, regardless of day or night.

These stable upper air layers are not affected by daytime circulation patterns i n the boundary layer, as day and night temperatures above the boundary layer are the same.

The researchers think the lack of temperature changes over the course of a day prevents bacteria in the higher layers from returning to the ground.

At the stable upper levels above the boundary l ayer, they also found the presence of bacteria that can tolerate higher amounts of solar radiation.

These organisms can survive the sun's shortwave radiation, unlike more sensitive micro-organisms living on the ground.

These findings, the researchers say, indicate temperature would be a key factor in changing the composition of the air microbiome.

In a warmer world, higher surface temperatures can raise the height of the boundary layer.

A higher boundary layer would mean that the part of the air column affected by day-night circulation patterns overlaps with the previously stable parts of the atmosphere, where a greater abundance of bacteria thrive.

This could mean all airborne bacteria and fungi, including those that can act as plant pathogens or cause respiratory illnesses in humans and animals, could reach densely populated areas of human societies that are currently unaffected.

How exactly the changing composition of micro-organisms in the air could affect human health and ecosystems warrants further research, Prof Schuster said.

The team hopes to investigate the composition of the air microbiome elsewhere, he added.

"Changes to the planet's airborne micro-organisms driven by climate change could impact agricultural crops and our yields in food production."

The research team found that while healthy people did not suffer ill effects from breathing in micro-organisms from the air, people with respiratory diseases showed an increased immune response, worsening their respiratory symptoms.