

# CLIMATE CHANGE- IMPACTS ON HEALTH & SAFETY

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# CLIMATE AND WEATHER

**WEATHER:** state of the atmosphere measured on a scale of hot or cold, wet or dry, calm or storm, clear or cloudy.

**CLIMATE:** average atmospheric conditions over longer periods of time

Most weather phenomena occur in the troposphere, just below the stratosphere. Weather refers, generally, to day-to-day temperature and precipitation activity

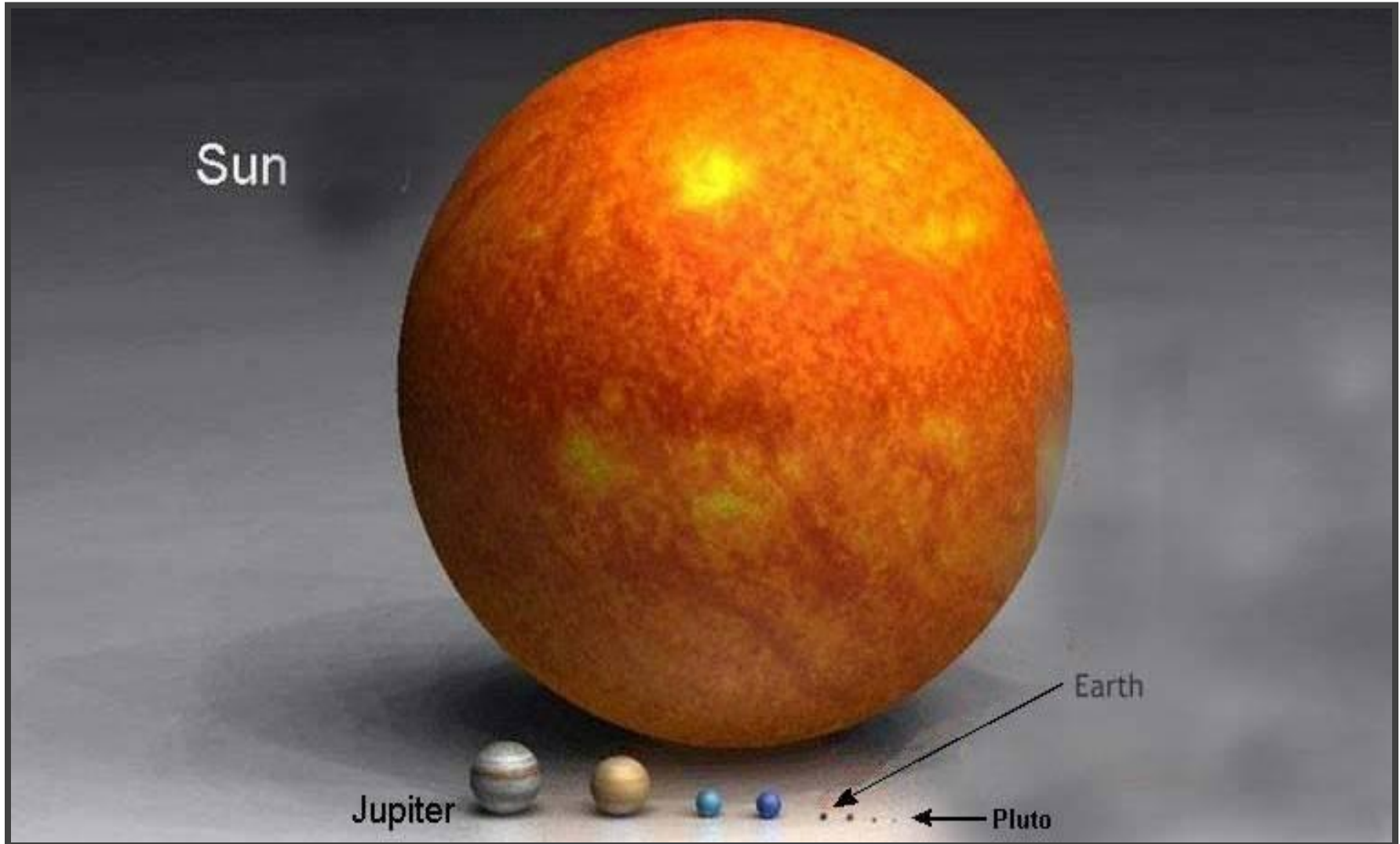


# ENVIRONMENT

## CLIMATE CHANGE AND GLOBAL WARMING

- **CLIMATE CHANGE:** any change in composition of the global atmosphere or regional climate patterns that adds to the natural variability of the climate observed over time.
- **GLOBAL WARMING:** the increase in global temperature that is mainly attributable directly or indirectly to human activities resulting in an increase of atmospheric greenhouse gases.

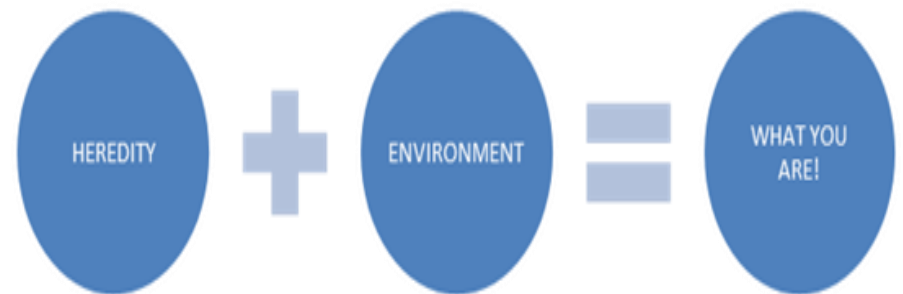
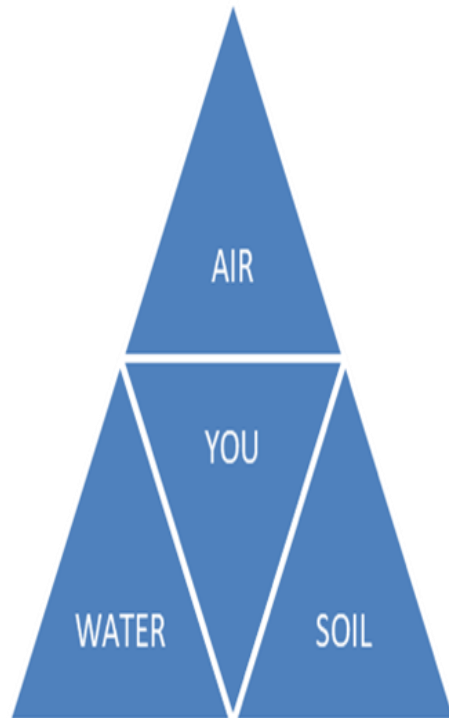
# THE SUN IS NOT ONLY BIG- BUT HOT- AND HAPPILY FAR AWAY!



# CLIMATE CHANGE AND GLOBAL WARMING

- Climate change is occurring and our planet is warming, associated with rising temperatures, changes in worldwide weather patterns and increasing airborne pollen levels and duration. These changes have been observed to impact health, including that of allergic individuals.
- Flooding and severe storms can result in damp buildings and resultant mold exposure. In addition to triggering allergic reactions, increased mold spore exposures have been linked to other lung diseases

# THE ENVIRONMENT AND YOU/ME/US!



# CLIMATE AND WEATHER AFFECT THE ENVIRONMENT- THEREFORE US

- TEMPERATURE
- WATER
- HUMIDITY
- AIR COMPOSITION AND QUALITY
- NUTRIENTS/FOOD INTAKE
- HABITAT/SHELTER
- OTHER
- AFFECTED: ANIMALS AND PLANTS AND SURROUNDINGS

# GLOBAL WARMING: THE FACTS

- **CLIMATE ALWAYS CHANGING**
- CLIMATE CHANGING MUCH MORE RAPIDLY THAN BEFORE
- MAIN CAUSE IS HUMAN ACTIVITY
- MAIN ACTIVITY IS BURNING OF FOSSIL  
FUELS
- HEAT BEING TRAPPED LEADING TO AV.  
GLOBAL RISE OF 1°F, MOSTLY IN PAST 30 YRS





# GLOBAL WARMING

Variations in Earth's orbit affect amount of sunlight warming planet- responsible for cycle of cooling/warming.

- Warm spells (“Interglacial”) every 100,000 years
- Last ice age 11,500 years ago



# CLIMATE CHANGE: SEVERAL DIRECT AND INDIRECT EFFECTS ON HEALTH

- **INDIRECT:** loss of factors which promote health and/or increase in factors which damage health
- **DIRECT:** effect of increased/decreased temperatures on the body



# GLOBAL WARMING: THE FINDINGS

- The disappearing- more “visible” Arctic
- Melting glaciers
- **Loss of permafrost**
- Giant African sands
- **Rising Caribbean temperatures**
- Increasing frequency and severity of hurricanes
- “Bleaching” of Coral Reefs



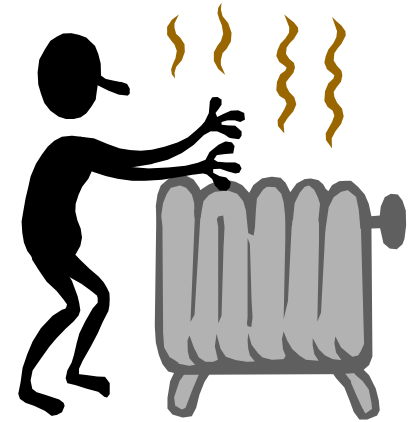
# EPISODES OF GLOBAL WARMING- 2005!



- “Katrina”, **Louisiana** Aug
- 2ft snowfall in **LA** at start of year
- July- worst drought on record triggered wildfires in **Spain, Portugal**; lowest water levels in **France** in 20 yrs
- Lethal heat wave in **Arizona** (110°F) killed > 20 people
- November, **Mumbai**, 37” rain in one day 1000 killed, 20M displaced
- **Japan**- highest pollen counts on record with massive increase in “hay fever” in spring

# GLOBAL WARMING- MORE OUTCOMES

- Thawing permafrost – subsidence of > 15 ft in parts of Alaska
- Snows of Kilimanjaro could disappear in 10 years
- Increasingly hot summers: 1998; 2002; 2003; 2011; 1997. **35k died in Europe heat wave 2003!**



# WHEN YOU'RE HOT...YOU'RE NOT!

- Overall, the odds of dying from heat or cold exposure are low, even in a polar vortex.
- In 2015, for instance, a little over 800 people in the United States died from hypothermia, while over 4,000 died from drowning, 35,000 were killed by falls and 36,000 in traffic accidents.

# COLD TEMPERATURES KILL MORE AMERICANS THAN HOT ONES, CDC DATA SHOW

## The cold kills more people than heat

Deaths from hypothermia (excessive cold) and hyperthermia (excessive heat) in the U.S.



# SOME SERIOUS CONSEQUENCES

Changes in tides and rising ocean levels will obliterate much low-lying coastlands e.g. Maldives, Bangladesh, Louisiana, London.

Could increase incidence of cholera e.g. Bangladesh





# GLOBAL WARMING- SOME SERIOUS CONSEQUENCES!

- **WATER SHORTAGES:** affect domestic use as well as hydroelectric power, fire-fighting
- Drought makes trees more vulnerable to pests
- Dead trees supply tinder for wildfires
- **FIRES** : lead to loss of houses, income, jobs
- Rising insurance premiums- claims could wipe out business

# GLOBAL WARMING: HEALTH IMPLICATIONS

- **Increased illness/death:** heat waves, storms, floods, fires, drought, diminished water supplies, malnutrition, starvation, homelessness
- **Changing distribution of insects:** malaria, dengue; possible new emergent diseases
- **Overwhelming of the Health Services**
- “Although humans....have survived the vagaries of drought, stretches of warmth and cold and more, entire societies have collapsed from dramatic climatic changes” ...

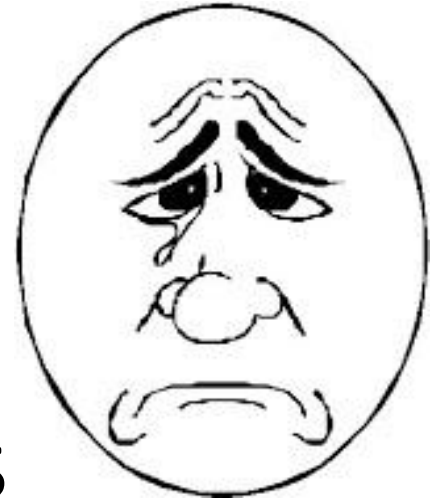
# GLOBAL WARMING- WHO/WHAT AFFECTED?

- POOR
- YOUNG
- ELDERLY
- FOOD/PRODUCTION
- HEAT WAVES
- SMOG



# SOME DIRECT CONSEQUENCES

- WINTER SADNESS
- ALLERGY TO THE COLD
- EXTREMES OF HEAT
- INCREASE IN OCCURRENCE, TYPES  
AND SPREAD OF INFECTIOUS DISEASES



# CLIMATE CHANGE AND ALLERGIC HEALTH

- Climate change affects production and dispersion of pollen and fungal spores, also may impact pollen seasons of trees, grasses and weeds by both increasing the amount of pollen and by extending the duration of the pollen season.
  - **Alterations in the duration and intensity of pollen seasons affect allergic disorders such as rhinitis, conjunctivitis and asthma.**
- Vulnerable populations include children, elderly and those suffering from preexisting reactive airways diseases such as asthma.

# COLD HANDS...? WARM HEART?

- The below freezing temperatures sometimes experienced in parts of the USA may herald danger for people who are allergic to the cold.
- “Cold urticaria”- a rare condition- can cause hives and other allergic symptoms in some people, **when temperatures dip below 39 degrees Fahrenheit.**
- The reason is uncertain, however, the condition seems to be more common in people who have viral hepatitis or leukemia.
- Features usually include red hives on parts of the skin exposed to the cold, and in severe cases, **low blood pressure, palpitations, difficulty breathing, or shock,** The rash typically begins just minutes after exposure and lasts roughly two hours.

# “S.A.D.” .....THE WINTER OF DISCONTENT

- Cause of ‘**Winter depression**’ is uncertain but it is observed that people who suffer from “**Seasonal Affective Disorder**” are particularly sensitive to light, or the lack of it.
- **Manifested by difficulty getting up, bouts of fatigue, overeating**
- Many studies have shown that people with SAD disorder feel better after exposure to bright light
- **May be genetically predisposed to clinical depression and/or light sensitivity; possible involvement of brain chemicals (melatonin), ions in the air**

# GLOBAL WARMING: PESTS AND PESTILENCES

- More mosquitoes “in the wrong place”
- Parasitic infestations
- Mold infections
- Emergent (“released”) microbes



# GLOBAL WARMING- “DEATH IN THE DEEP FREEZE”!!

- As ice melts, viruses hidden for thousands of years may thaw and escape
- 1999 Scott Rogers, Bowling State U, Ohio found TMV in several deep core samples of Greenland ice pack
- **“Tough” virus, entombed in ice for 140,000 years**

# GLOBAL WARMING- “DEATH IN THE DEEP FREEZE”!!

- Since then found many other microbes also in Siberia, Antarctica
- In past 15 years scientists found **viruses, bacteria, algae, fungi, yeasts** hibernating under 4km solid ice “all over the world”
- **Potential for virulent (influenza) virus to survive, recombine....**

# MELTING OF SIBERIAN PERMAFROST

- “As global warming melts the permafrost, deadly diseases lying dormant for hundreds or thousands of years could be unleashed, quickly spreading to livestock and humans.
- A preview of this emerging threat came as recently as July 2016 when a 75-year-old reindeer carcass became unfrozen from soaring temperatures, causing the **first Anthrax outbreak since 1941**. The outbreak killed more than 2,000 reindeer and sickened 13 people in Siberia.”

# TICK-BORNE ILLNESS

- Ticks, like mosquitoes, will likely migrate to new regions and become more active as the summers became longer and hotter.
- **BABESIOSIS**, a tick-borne protozoan disease mostly found in the Northeast and upper Midwest, USA has been increasing. In 2011, more than 1,100 cases from 15 states were reported
- **LYME DISEASE** is another tick-borne disease, caused by *Borrelia burgdorferi* carried by the American blacklegged tick (*Ixodes scapularis*, or “deer tick”) that could move northward if global warming continues unabated. According to the Minnesota Department of Health, the incidence of Lyme disease in the state has been increasing in recent years, indicating that deer ticks are migrating north.

# CHOLERA

- Deadly cholera outbreaks could increase with climate change because the bacteria are attracted to warm weather and warm water. The disease spreads through contaminated water and could increase in developing countries with poor sanitation that and which are affected by climate change.
- The resulting extreme heat and intense storms could lead to flooding and spreading of contaminated water.
- Cholera kills more than 100,000 people globally every year, according to the Centers for Disease Control and Prevention.. **“Cholera likes warm weather, so the warmer the Earth gets and the warmer the water gets, the more it’s going to like it. Climate change will likely make cholera much worse.”**

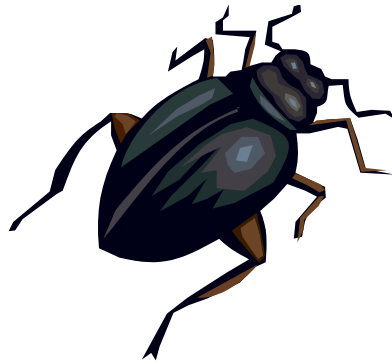
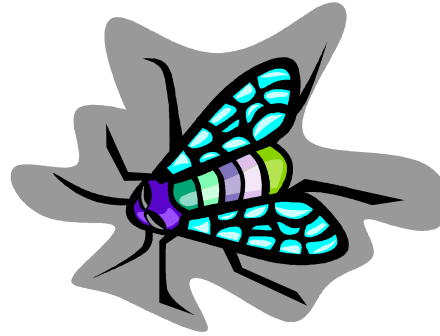
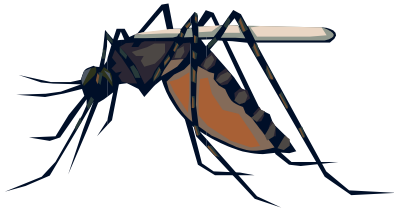
# “ZOMBIE” DISEASES

- As the permafrost continues to thaw from global warming, other previously, deadly frozen “Neanderthal” viruses, smallpox or other ancient illnesses could become released into the environment again.
- In 2015, researchers discovered **a giant virus buried in the permafrost for 30,000 years** that was still infectious; although the virus only infects amoebas and isn’t dangerous to humans, other viruses harmful to humans could likewise be present.

# THE PATHOGENS ARE HAPPY..

- “Climate change will also affect infectious disease occurrence.” A number of diseases well known to be climate-sensitive, such as **Malaria, Dengue fever, West Nile virus, Cholera and Lyme disease**, are expected to worsen as climate change results in higher temperatures and more extreme weather events.”

# GLOBAL WARMING- INSECTS GALORE!





# CLIMATE CHANGE AND VECTOR-BORNE DISEASES

- Climate change affects human health in a variety of ways and with varying intensity/severity.
- These include the emergence and distribution of vector-borne diseases e.g. Malaria, Dengue and West Nile virus (WNV) by altering their rates, ranges, distribution and seasonality
- Vector-borne diseases are affected by a variety of factors including temperature, precipitation and humidity; these influence survival and reproduction rates of the vectors, their habitat, distribution and numbers.
- Climatic factors also impact affect the rates of development, reproduction and survival of pathogens within the vectors

# VECTOR-BORNE DISEASES

- WHO estimates that **one-sixth of the global illness and disability is caused by vector-borne diseases**, with more than half of the world's population currently at risk.
- More than one billion people are infected annually, and **more than one million people die, from Malaria, Dengue, Schistosomiasis, Leishmaniasis, Chagas Disease and African Trypanosomiasis.**
- Also many vector-borne diseases, e.g. lymphatic filariasis and onchocerciasis, cause significant illness and suffering, contributing to a much larger overall burden of disease

# VECTOR-BORNE DISEASES

- Climate and weather conditions also exert a range of more **indirect effects**, through wider effects on the natural environment and on human systems, for example **Drought may affect**
  - water-storage,**
  - land-use and irrigation practices,**
  - **population movement,**
  - vector ecology,**
  - human exposure to infection**

# “LET THOSE WHO HAVE EARS TO HEAR....”

- Modern science has prevented several deadly diseases including tetanus and poliomyelitis, but **man-made global warming could reverse the progress**, as new deadly diseases emerge, consequent on climate change.. “The spread of new deadly diseases could potentially be prevented if the world would listen to warnings from atmospheric scientists and do everything humanly possible to mitigate climate change.”

# VECTOR-BORNE DISEASES: Malaria

- “WHO estimates that in **2012 there were about 207 million cases and 627 000 deaths attributable to malaria** .
- **The climate changes that have occurred over the previous century have significantly altered the areas climatically suitable for transmission.** For example, in Africa, areas that have become unsuitable for transmission, mainly through drying, have approximately equalled those that have become suitable areas owing to increased temperatures and greater precipitation.
- However, the strong protective effect of improving socioeconomic conditions and effective preventive and curative interventions, have led to a decreasing global distribution of transmission over the past century and a decreasing aggregate disease burden in the past decade or so ”

# VECTOR-BORNE DISEASES: Dengue

- It is estimated that there are approximately **100 million dengue infections worldwide each year** . As for malaria, there is very strong laboratory and field evidence for sensitivity to meteorological variables. Modelling studies also suggest that **climate change has favoured, and will continue to favour dengue transmission** .
- By contrast, the evidence of **the protective effect of either general socioeconomic development, or specific disease control measures, is much weaker than for malaria.**

# VECTOR-BORNE DISEASES: Dengue

- **Consequently, dengue incidence is high in many regions where malaria has been effectively controlled.**
- **In addition, dengue transmission tends to be higher in urban areas, particularly those with poor-quality housing, provision of water and sanitation and waste management.**
- The increasing movement of people and of goods has helped the international spread of strains of dengue virus and the vectors. Unfortunately, there is comparatively limited evidence for the effectiveness of vector-control interventions .

# WEST NILE VIRUS (WNV)

- **West Nile virus (WNV)** is a single-stranded RNA virus of the family *Flaviviridae*, genus *Flavivirus*, which also contains the Zika, Dengue and Yellow Fever viruses.
- West Nile virus is primarily transmitted by *Culex* mosquitoes.
- The primary hosts are birds, the virus remaining within a "bird–mosquito–bird" transmission cycle.



# WEST NILE VIRUS (WNV)

- The virus was discovered in Uganda in 1937 and was first detected in North America in 1999.
- WNV has been reported in Europe, Africa, Asia, Australia, and North America.
- In the United States thousands of cases are reported a year, with most occurring in August and September.
- A surveillance system in birds is useful for early detection of potential human outbreaks.

# WNV IN USA

- Research on the effects of weather fluctuations on WNV transmission in the USA and Canada showed that **increased temperatures influence North American WNV distribution and play an important role in the maintenance and amplification of human WNV infections**
- .Positive associations were found with increasing temperature over each of the four weeks prior to symptom onset, an increase of 5°C in the mean maximum weekly temperature being associated with a significantly higher incidence of reported infection.

# GLOBAL WARMING-POSSIBLE DISEASE LINKS

- In 2003 severe 6 year drought probably led to concentration of migratory birds and virus-carrying mosquitoes at water sources in Colorado- with development and rapid spread of **WNV** disease!



# VECTOR-BORNE DISEASES

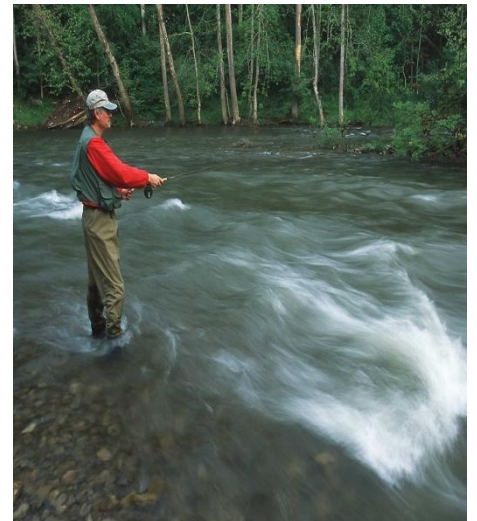
- In summary, climate is an important influence on vector-borne disease transmission
- There is evidence that ongoing climate change is affecting, and will continue to affect the distributions and burdens of these infections.
- The interactions, however, are complex, and an assessment of individual diseases will be necessary to help define/determine appropriate policies for control..

# SAHARA DUST

- **Dust** from the **Sahara Desert** blows across the Atlantic to the U.S. every summer.
- Even healthy people can have an inflammatory response to this dust, which can make one feel sick and lethargic, and cause sinusitis and other respiratory problems.

# SAHARA DUST

- Occasionally the desert dust coming from Africa settles on the ocean in the Florida Keys, providing nutrients to bacteria, some of which consequently multiply.
- Some of these bacteria might later increase disease risk for those using the contaminated waters, e.g. beach-goers, divers and fishermen.



# CLIMATE CHANGE AND HARMFUL ALGAL BLOOMS (“HABs”)

- Scientists also predict that climate change will affect freshwater and marine environments, including stimulating proliferation of harmful “algal blooms” in aquatic environments.
- These blooms may endanger human health, the environment and economies
- Harmful algae usually bloom during the warm summer season or when water temperatures are warmer than usual; this latter may be due to climate change

# ALGAL BLOOMS (Central Park)





# THE EFFECTS OF HARMFUL ALGAL BLOOMS

- Produce harmful toxins that can adversely affect people and animals
- Create 'dead zones' in the water
- Raise treatment costs for drinking water from sources where they exist
- Adversely affect industries that depend on clean water for their operations

# AND SO IT WILL COME TO PASS....

- “CHANGE AND DECAY-  
IN LAND AND AIR AND  
SEA
- LET’S REDUCE THE  
CLIMATE CHANGE FOR  
A BETTER WORLD TO  
BE”!

(adaptation by  
obj,nov.2019)



**The END is here!**

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