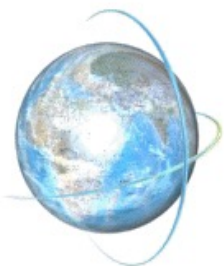




Funded by
the European Union



Greenhouse Gases (GHGs)

Presented by:

Soukvilay Vilavong

Deputy Director for the Environmental Policy Division

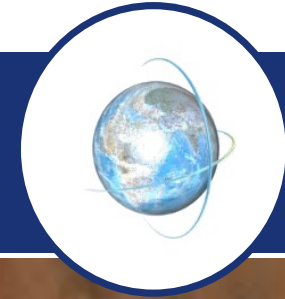
The Department of Environment (DoE), MONRE

Cell phone: +856 20 9925 0099

E-mail: s.vilavong_ems@yahoo.com

@Pakse, Lao PDR, April 28, 2025

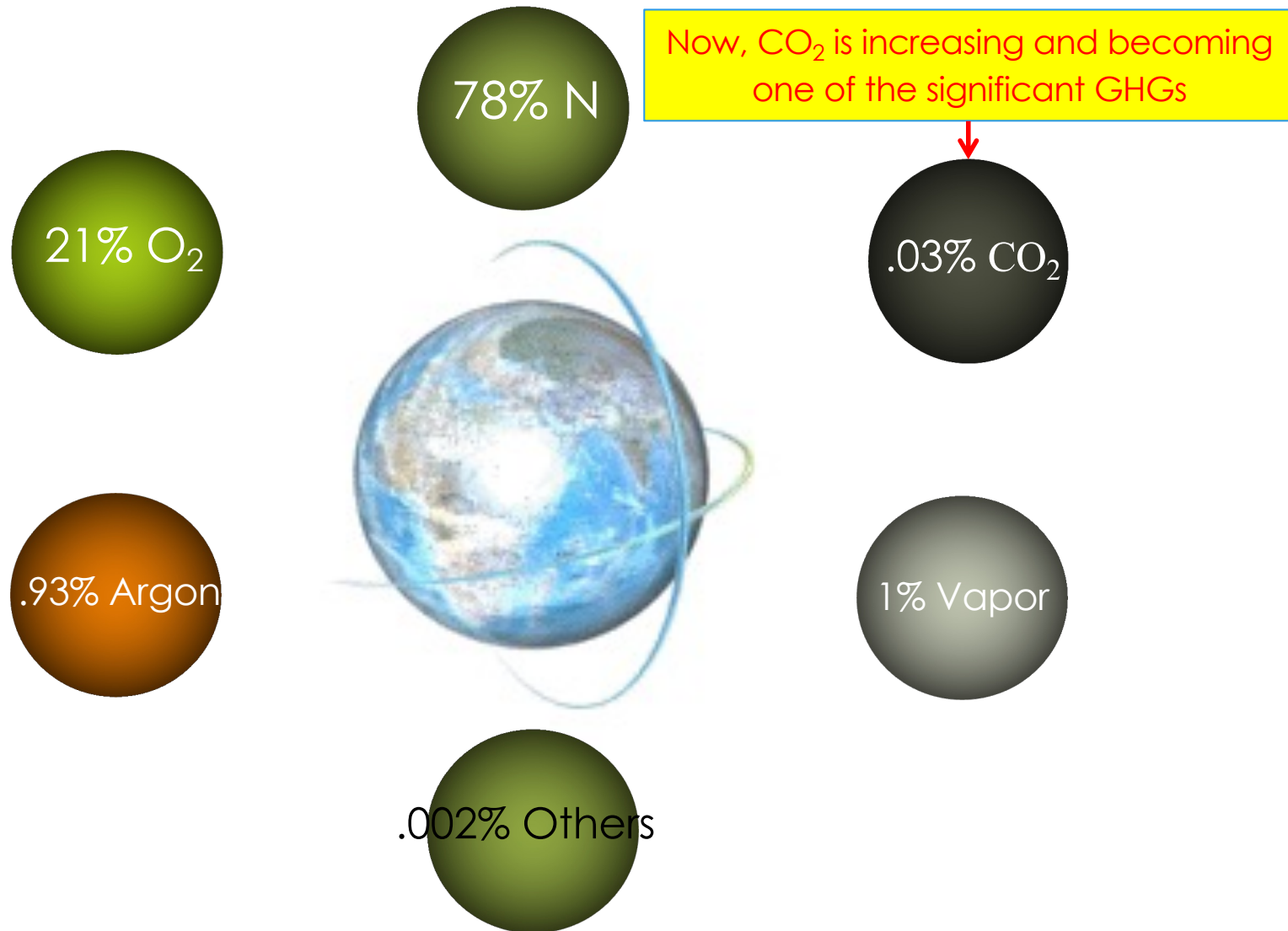
Main Ideas

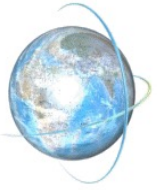


1. Greenhouse Gases (GHGs) and Main Causes
2. Two Significant Greenhouse Effects
3. Mitigation & Adaptation Measures
4. Case study: Lao PDR
5. Two Possible Solutions
6. Possible Objection and Encounter the Problem
7. Conclusion and Recommendations



What is in the air?



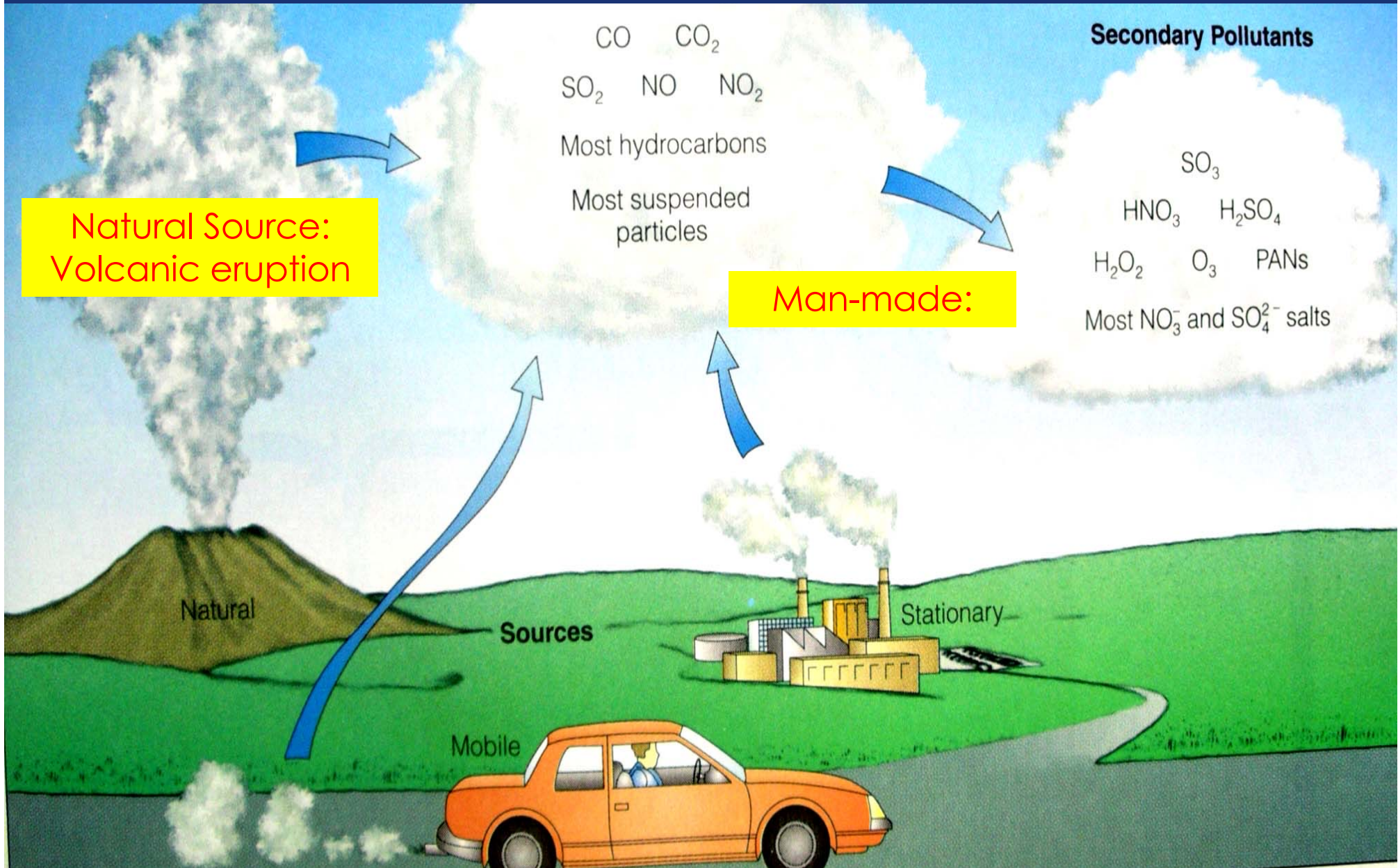


Greenhouse Gases (GHGs) and Main Causes

- GHGs refer to six main harmful gases: Carbon dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF₆) emitted into the Earth's atmosphere.
- GHGs are from both *natural* and *man-made* activities
- However, Scientists believe that *human activities* are significantly responsible for releasing GHGs into the Earth's atmosphere
 - ✓ Burning fossil fuels
 - ✓ Doing conventional agriculture
- ❖ Source:
 - Paterson (2011)
 - unfccc.int/kyoto_protocol/items/3145.php

Significant Causes of GHGs: **Man-made Activities**

1. Burning fossil fuels in industrial plants and in cars is releasing a huge amount of GHGs into the Earth's atmosphere.



Significant Causes of GHGs: **Man-made Activities**

2. **Conventional Agriculture** is responsible for 30% of GHGs emission

Methane (CH_4) emitted from biomass decomposition

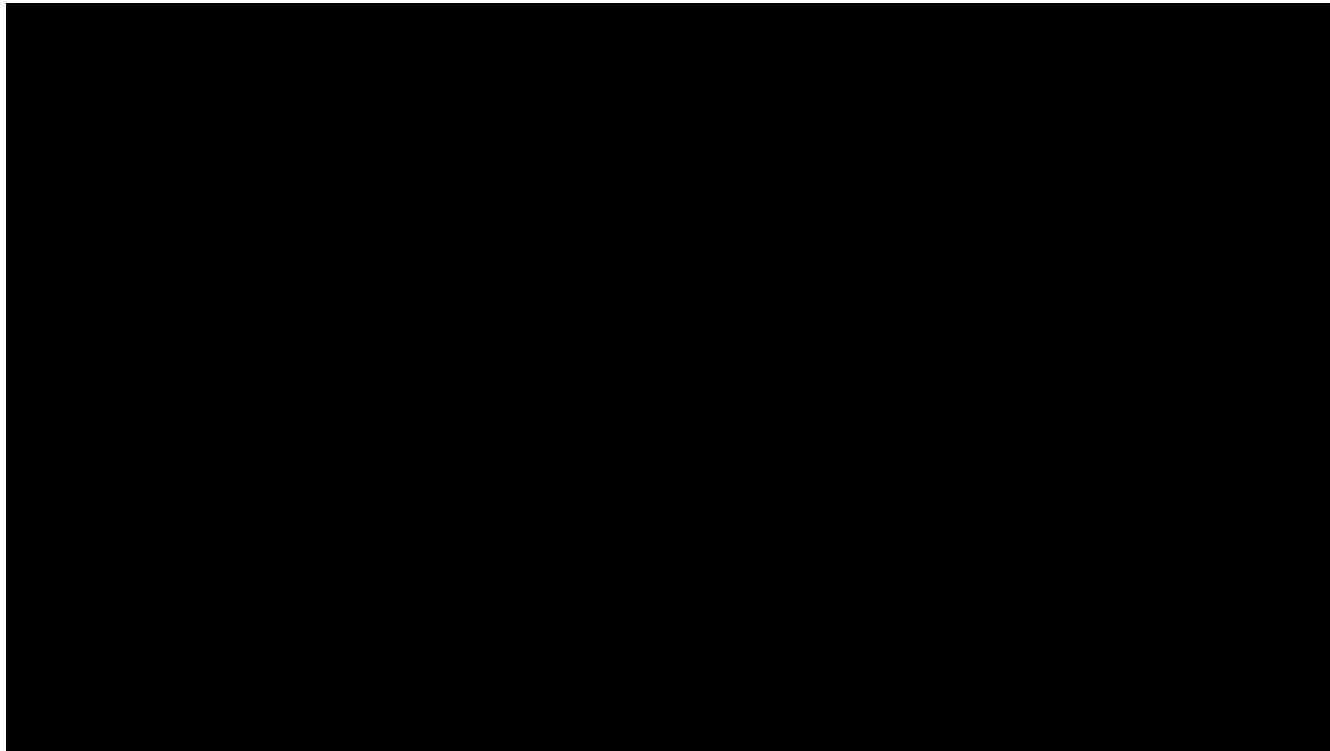


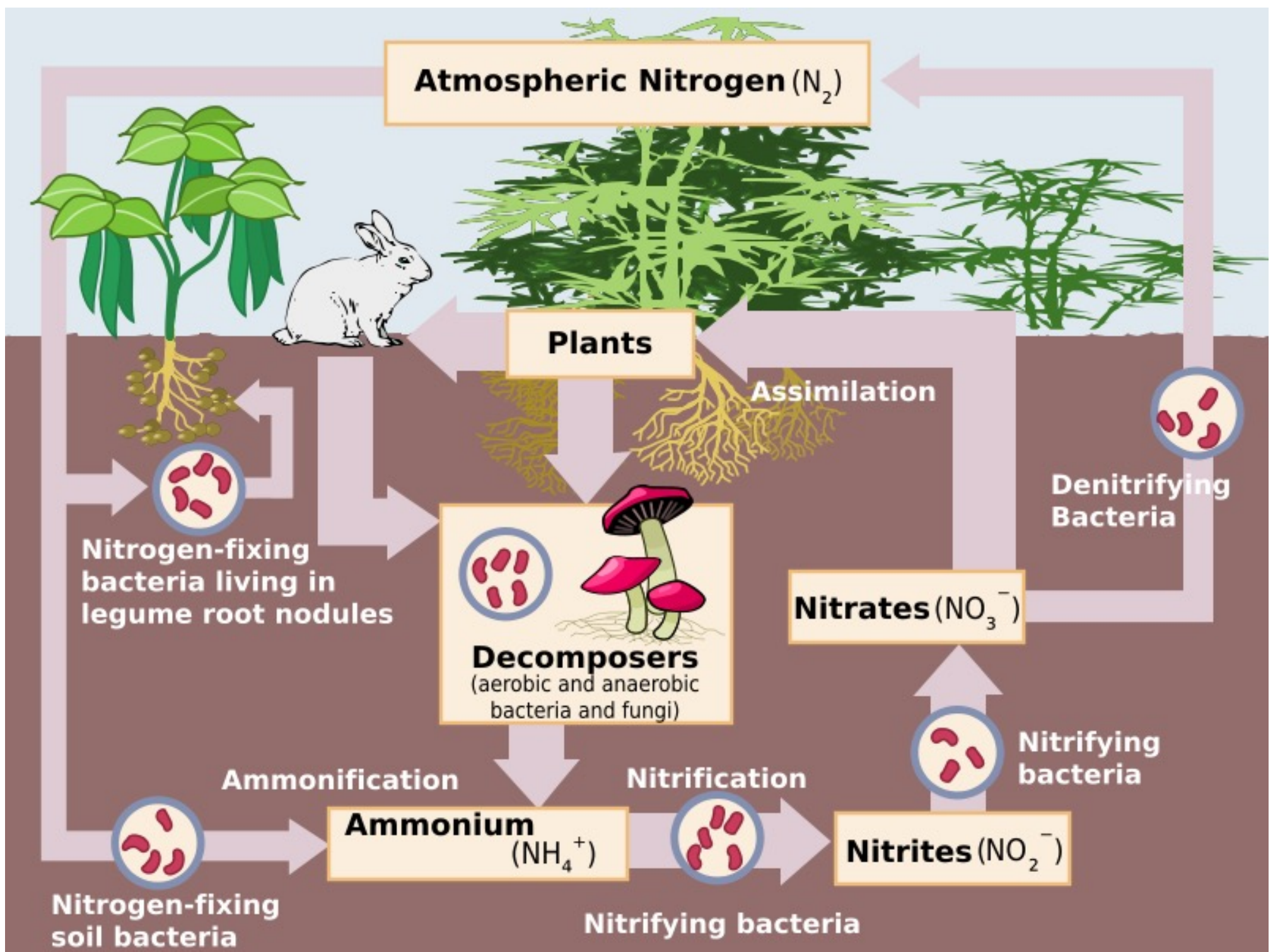
Note: Methane is 23 times more powerful than carbon dioxide.

Nitrous Oxide (N_2O) released from the application of synthesized N fertilizer

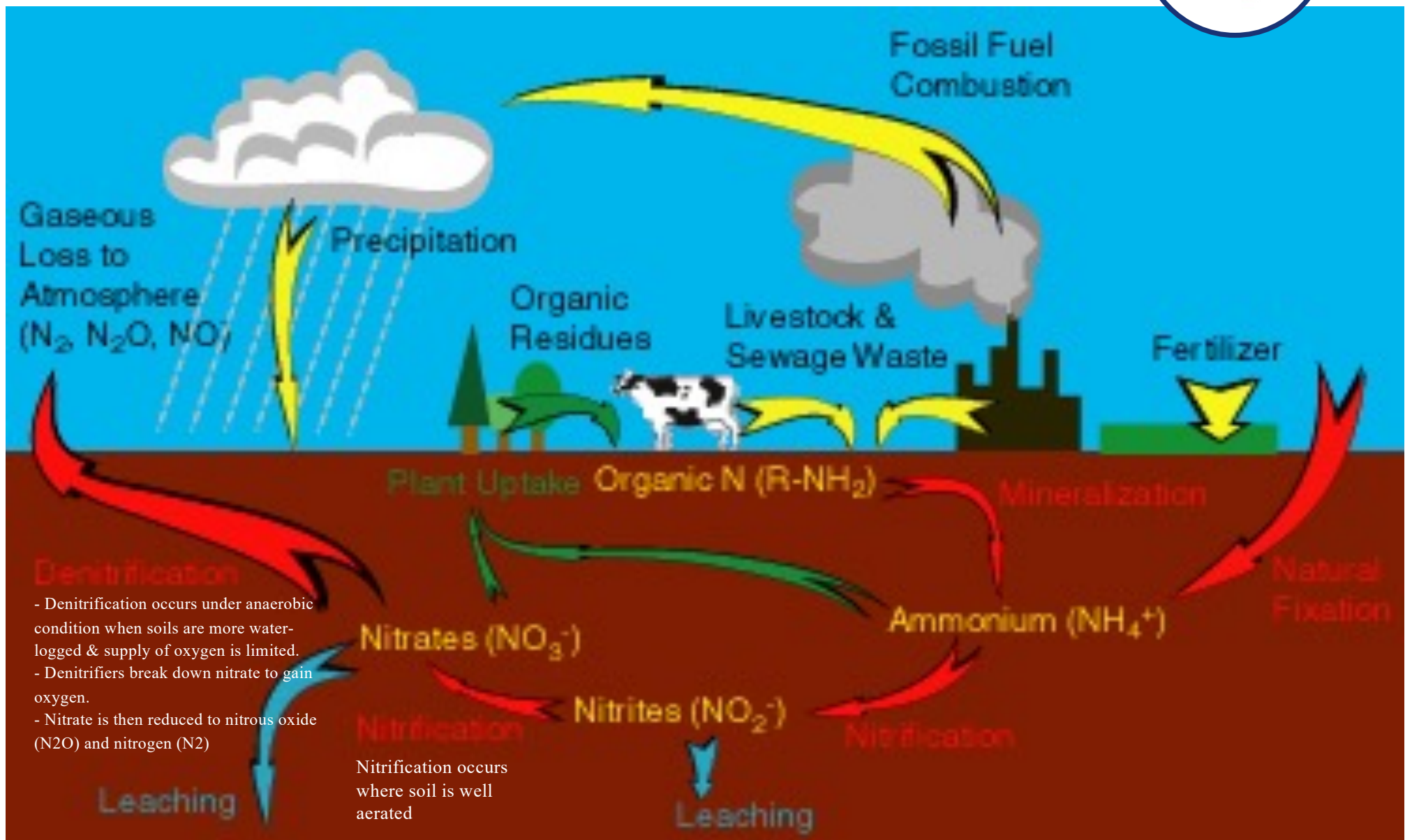


Drinking water contaminated by methane

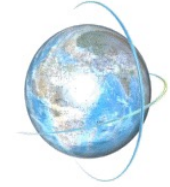




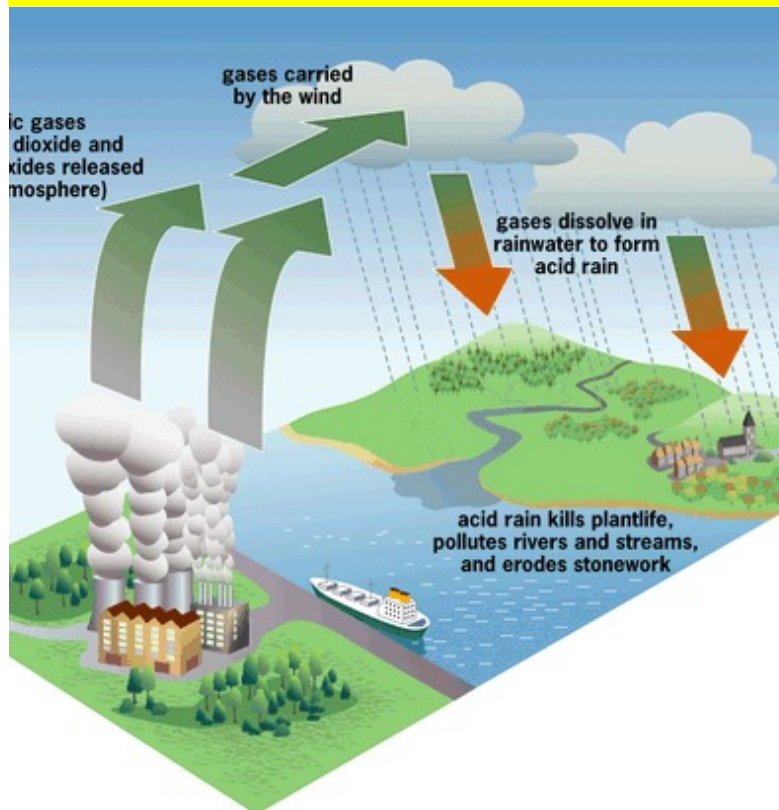
Nitrous Oxide (N_2O) Emitted from Agricultural Soil through N cycle



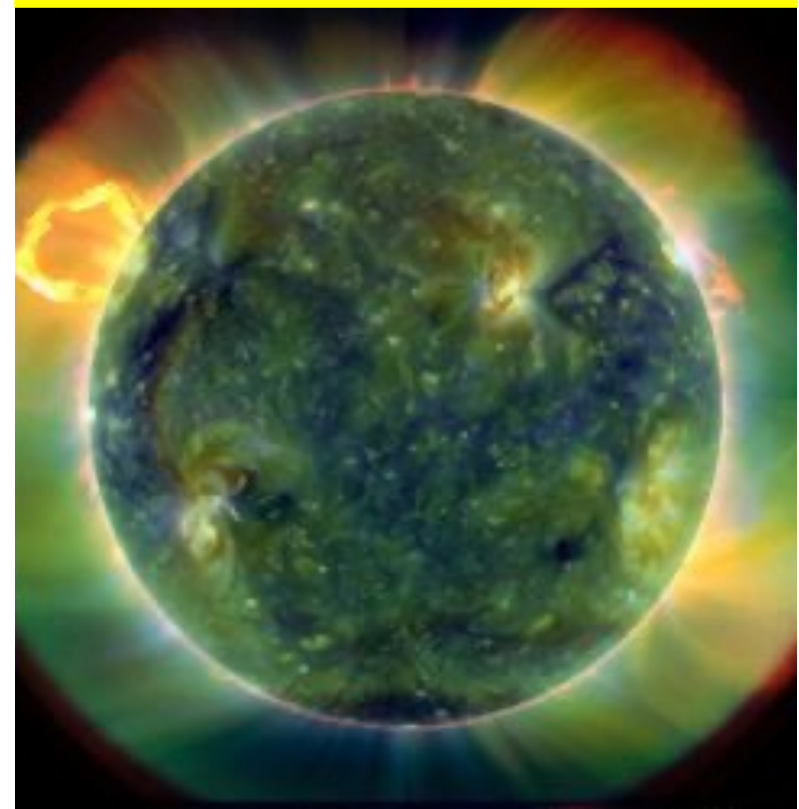
Significant Greenhouse Effects



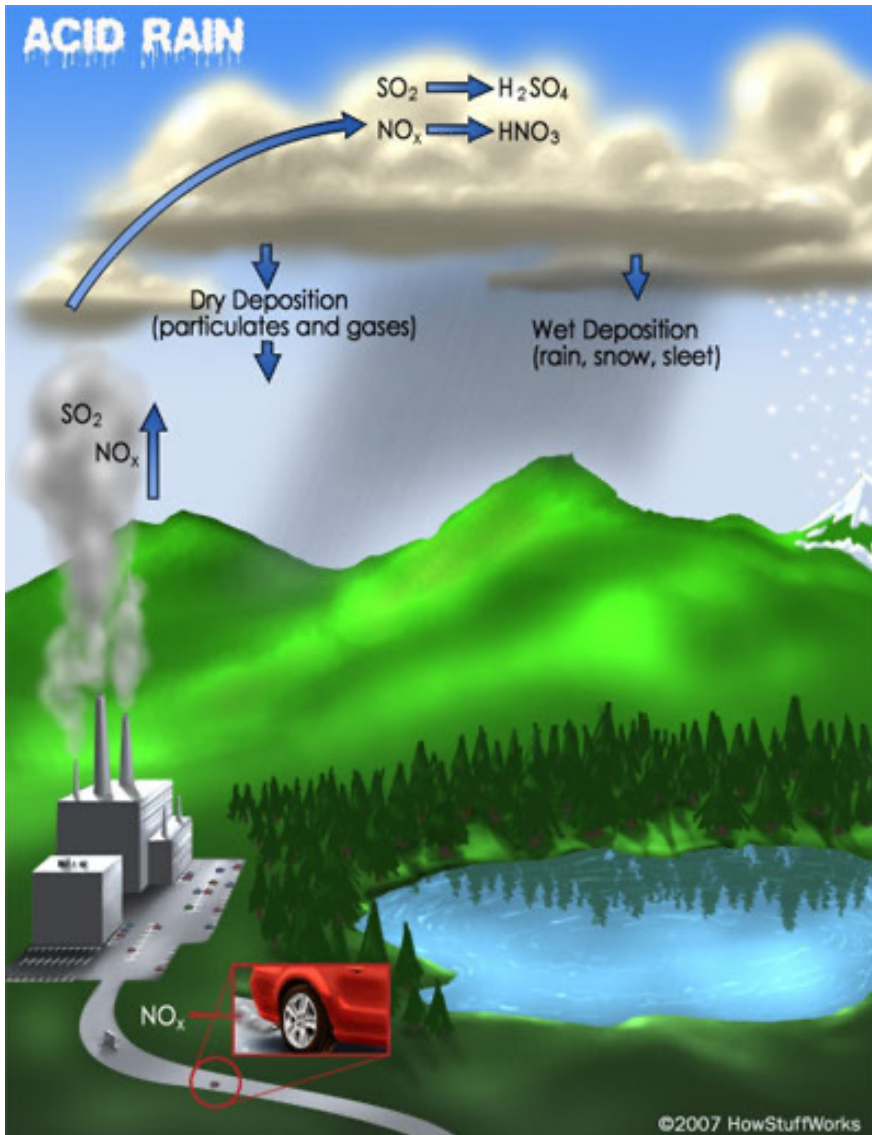
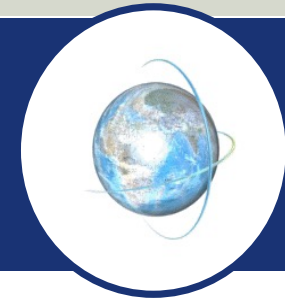
1. Acid Rain



2. Global Warming



1. Acid Rain



How does it happen?

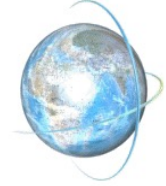
1. GHGs released from burning fossil fuels.
 2. These compounds react with vapor in the atmosphere and form 'Acid'
 2. Acid rain ($\text{pH} \leq 5$) comes back to the earth's surface in the form of *rain, fog, hail, and snow*.
- ❖ Source: Singh & Agrawal (2008)

Effects of Acid Rain

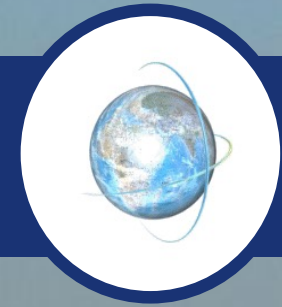


- **Soil:** most soil profiled in European forests was polluted by a large increase in acidity during 1982 – 1983.
- **Rivers:** sport fish populations have been lost in acidified lakes and rivers in Canada.
- **Forests:** about 7.7% of 7.4 million hectares of West German forests were damaged in 1982.
 - Source: Singh & Agrawal (2008)
- **Ancient Building and Heritage Monuments:** deterioration (degradation) of buildings and monuments in Europe (Watson, 1997).
- **Human Health:** a cause of serious respiratory infections in the human body such as asthma and bronchitis (EPA, 2007).

Acid rain damages ancient sculptures in Europe



Acid rain damages forest in Czech Republic



Cut Down Acid Rain Pollution: Cap Trade

Cap Trade Grow Clip:
"Finding the Ways that Work"
with Dr. Nathaniel Keohane V.O.

TRT 1:17

Cut-2
1/20/09

2. Global Warming and Its Effects



■ What is global warming?

❖ According to NASA (2007),

➤ global warming is *“an unusually rapid increase in the Earth's average surface temperature over the past century primarily due to the high concentration of the greenhouse gases (e.g. CO₂, CH₄, N₂O) in the Earth's atmosphere.”*

Source: <http://earthobservatory.nasa.gov/Features/GlobalWarming/>

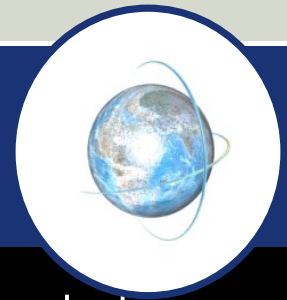


What happens when sunlight reaches the Earth?

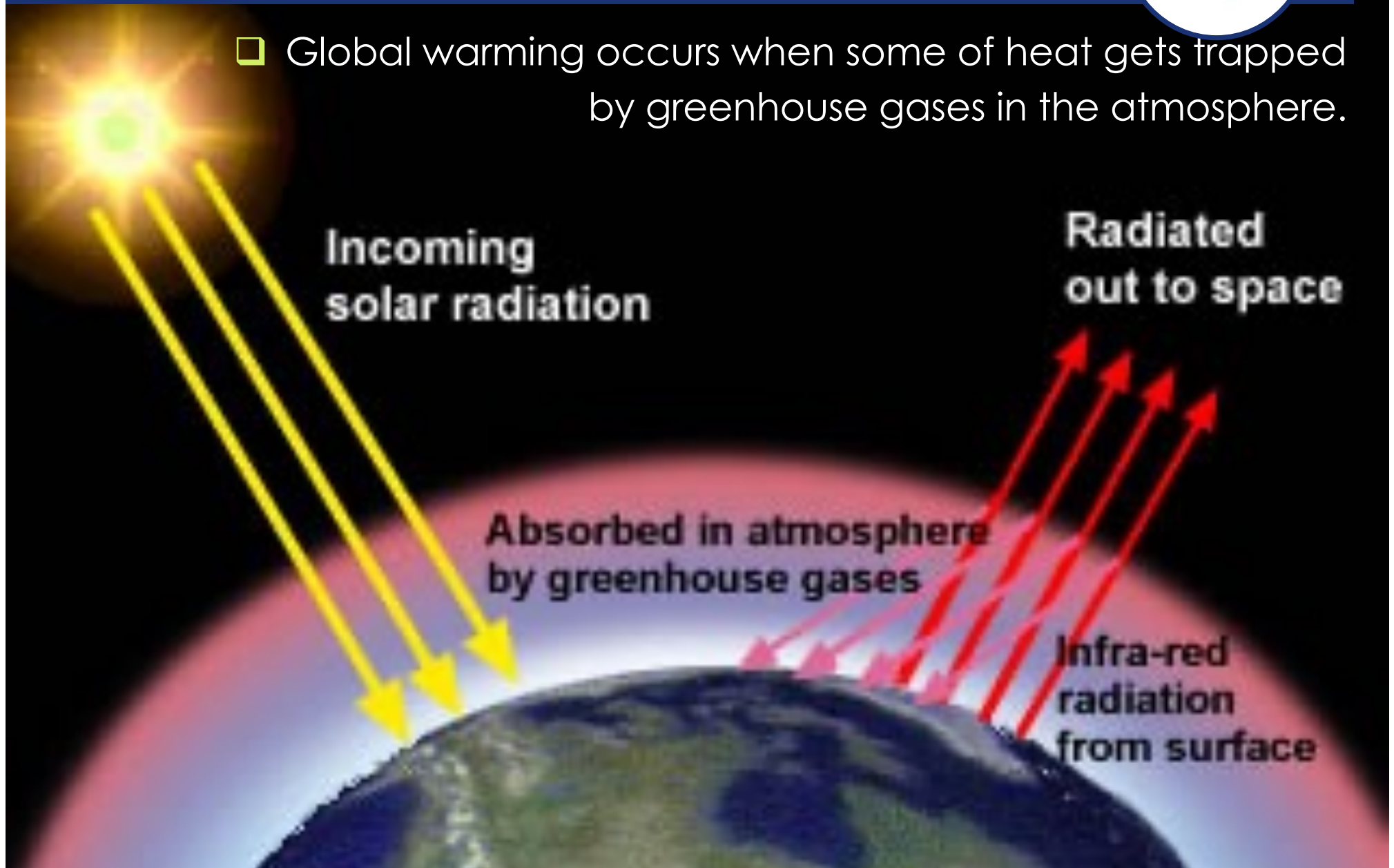


- Typically, when solar heat reaches the Earth,
 - part of it gets absorbed by the atmosphere,
 - some gets absorbed by the ground and the oceans
 - some bounces back or escapes back into space

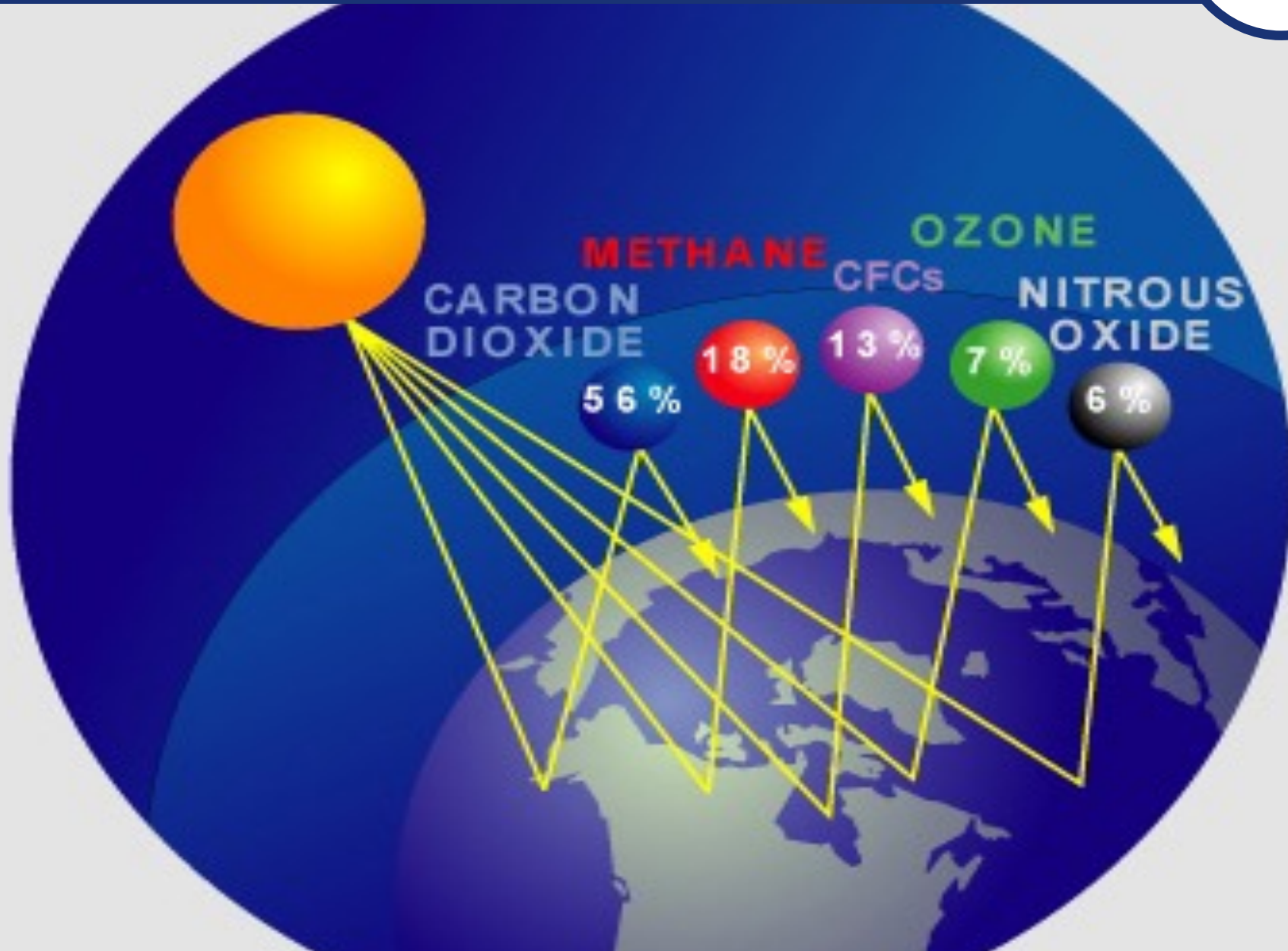
How can global warming occur?



- Global warming occurs when some of heat gets trapped by greenhouse gases in the atmosphere.



Visualized Picture



Main Effects of Global Warming



1. Climate change
2. Melting polar ice cap, glaciers, & Greenland
3. Rising sea level
4. Stronger natural disasters
5. Loss of ecological equilibrium and biodiversity
6. Changes in crop yields
7. Threats to human health



Source: <http://environment.nationalgeographic.com/environment/global-warming/gw-effects/>

Climate Change



- ❑ Many people are sometimes confused with the term of global warming and climate change.
- ❑ They think that climate change and global warming are interchangeable term ~ the same thing.
- ❑ Actually, they are not the same. Global warming refers to rising global temperatures
- ❑ Climate change refers to a change in patterns of temperature, precipitation, humidity, wind, and seasons a long period of time

❖ **In short, global warming causes climate to change.**

- ❑ **Warmer global temperatures in the atmosphere and oceans leads to climate changes affecting precipitation patterns, windstorms, floods and droughts, growing seasons, humidity, and sea level.**
- ❑ **The Earth's average surface temperature tends to be constantly increasing.**
- ❑ **According to NASA's Goddard Institute for Space Studies [GISS] (2011), 2010 and 2005 were the warmest years in recorded history.**

Source:

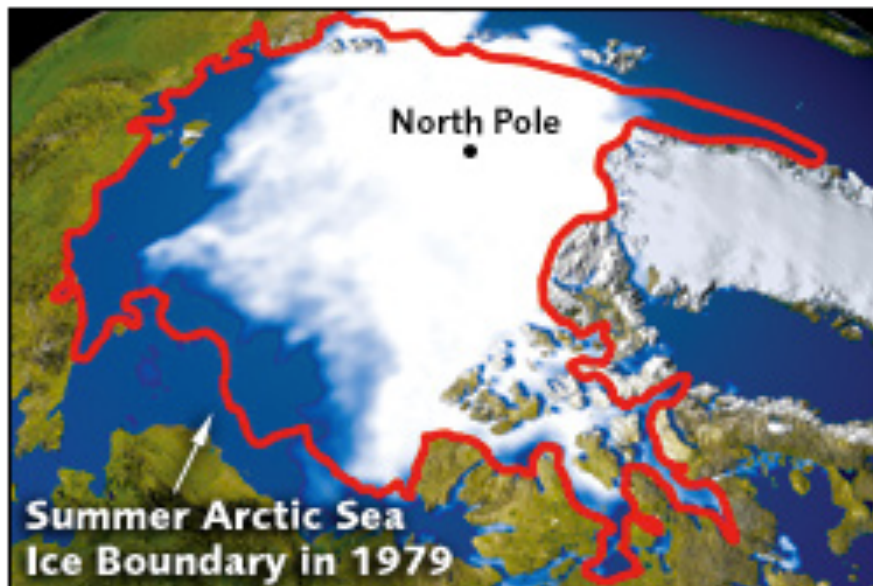
<http://www.giss.nasa.gov/research/news/20110112/>

http://www.nasa.gov/worldbook/global_warming_worldbook.html

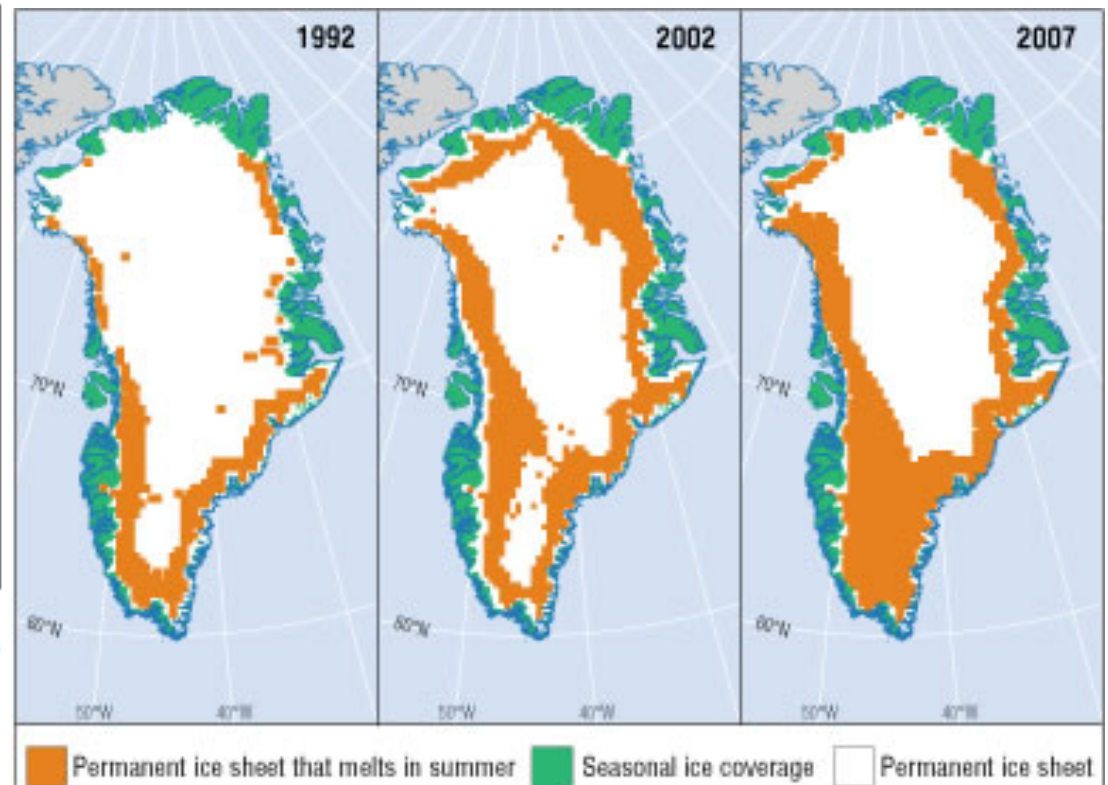
Melting of Polar ice cap, Glaciers, & Greenland ice cap



- Rising global temperature will stimulate speed of melting of polar ice cap, glaciers, and Greenland cause early ice thaw on rivers and lakes



Since 1979, the size of the summer polar ice cap has shrunk more than 20 percent. (Illustration from NASA)



Source:

<http://www.giss.nasa.gov/research/news/20110112/>

www.nrdc.org/globalwarming/fcons/fcons4.asp

http://www.nasa.gov/worldbook/global_warming_worldbook.html

<http://globalwarmingsiren.com/wp-content/gallery/polar-ice-caps/polaricecapsmelting.jpg>

Rising Sea Level and Harm to Ocean Life



- Global warming has resulted in melting away of polar ice cap, glaciers, and Greenland, leading rising sea level.
- Global sea level has already risen by 4 to 8 inches in the past century
- It's estimated that sea level will rise 10-23 inches by 2100
- Melting polar ice cap, glaciers, & Greenland is now threatening marine species.
- Melting of polar ice cap, glaciers, and Greenland causes rising sea levels, resulting to frequent floods, eroding of riverbanks, and mingling of freshwater and seawater sources which causes some changes in chemical composition of seawater.
- These events lead to extinction of several marine species because those marine species cannot adjust themselves to the changed environment.

Source: www.nrdc.org/globalwarming/fcons/fcons4.asp

Loss of Ecological Equilibrium and Biodiversity



- Global warming and climate change result in changes of natural habitats of animals and plants.
- Many species would have difficulty to survive in the regions they now inhabit.
- As already mentioned above, melting of polar ice cap, glaciers, and Greenland ice cap resulted from global warming can lead to extinction of several marine species.
- Another concern is that many species migrate from one place to another to change their habitat
- The most serious concern is that polar bears are at risk of extinction because they are incapable of successfully hunting seals in open water, resulted from less sea ice remains
 - Study revealed that polar bear population in Hudson Bay, Canada, declined by 22% over the past decade alone
 - Surviving bears have suffered from inadequate nutrition and were found to be 15% thinner

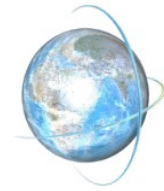
Source:

<http://calstate.fullerton.edu/news/inside/2009/global-warming-teach-in-peter-fashing.html>

<http://calstate.fullerton.edu/news/inside/2009/global-warming-teach-in-peter-fashing.html>

http://www.nasa.gov/worldbook/global_warming_worldbook.html

Global warming affecting natural habitats of polar bears



Changes in Crop Yields



- Canada and parts of Russia might benefit from an increase in crop yields,
- but any increases in yields could be more than offset by decreases caused by drought and increasing temperatures, particularly if the amount of warming were more than a few degree Celsius.
- Yields in the tropics might fall disastrously because temperatures there are already as high as many crops can tolerate

Source:

<http://calstate.fullerton.edu/news/inside/2009/global-warming-teach-in-peter-fashing.html>

http://www.nasa.gov/worldbook/global_warming_worldbook.html

Threats to Human Health



- Rising temperatures favor tropical diseases: **malaria and dengue fever** (insect-borne diseases), **cholera** | 'kälərə | (water-borne diseases), and **asthma** (air-borne diseases).
- Malaria and dengue fever might spread to larger regions because mosquitoes, which carry virus from the patients they bite to the others, can grow well in the tropics and adjust themselves to the temperate regions.
- Longer-lasting and more intense heat waves could cause more deaths and illnesses.
- Floods and droughts could increase hunger and malnutrition.

Source:

<http://calstate.fullerton.edu/news/inside/2009/global-warming-teach-in-peter-fashing.html>

http://www.nasa.gov/worldbook/global_warming_worldbook.html



Effects of Global Warming: *Case study in Laos*

- Increased natural disasters (e.g. flooding)
- Increase of insect-borne disease (such as malaria and dengue fever)
- Lower yields resulting from climate change



In 1966: Historical Flood in Vientiane, Capital of Laos.

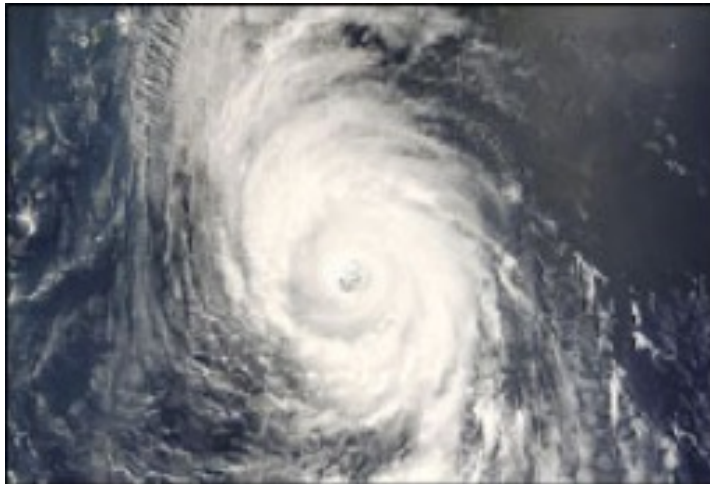


ໃນປີ ຄສ 1966 ນະຄອນຫລວງວຽງຈັນຖືກນ້ຳຖ້ວມ(ປະຕູໄຊ).

in August, 2008: Historical flooding occurred again in Vietiane



In September 2009: Vientiane Time reported that **tropical storm Ketsana** hit southern Laos causing widespread flooding in Xekong and Attapeu provinces



Source:

- 1) <http://lao4laos.com/main/images/stories/pdf/economy/ketsana.pdf>
- 2) <http://www.topnews.in/typhoon-ketsana-causes-flooding-southern-laos-2219412>

In June 2011: Xayaboury province has asked the Ministry of Labour and Social Welfare for **10 tonnes** of rice to help families affected by the flooding triggered by **tropical storm Haima**.



Source: <http://laospdrnews.wordpress.com/2011/06/>

On 2021 August 2013: Vientiane Time reported that About **16 people** died on Wednesday night after landslides buried a number of houses in Pakbaeng district, Oudomxay province, following two days of heavy rain



Source: http://www.vientianetimes.org.la/FreeContent/FreeContent_Sixteen.htm

On Monday, September 30, 2013: The arrival
of **Typhoon Wutip** reached Lao PDR late

- About 224,200 people (32,356 households) in five southern provinces of Salavan, Champasak, Attapeu, Savannakhet and Xekong have been affected by floods
- 280 families in Salavan and Champasak were evacuated with 3 deaths reported in Champasak
- One hospital, five health care centres and nearly 100 ground water pumps were damaged by the floods
- Food, drinking water and medicines are the immediate needs, especially in Salavan, Champasak and Attapeu

Source:

- 1) <http://ireport.cnn.com/docs/DOC-1040600>
- 2) <http://reliefweb.int/report/lao-peoples-democratic-republic/lao-pdr-flooding-situation-report-no-5-30-september-2013>



What Should We Do?



Significant **Global Mitigation** & **Adaptation** Measures of Climate Change



■ **1992: The 1st Earth Summit** was held in Rio de Janeiro, Brazil from 3 to 14 June 1992.



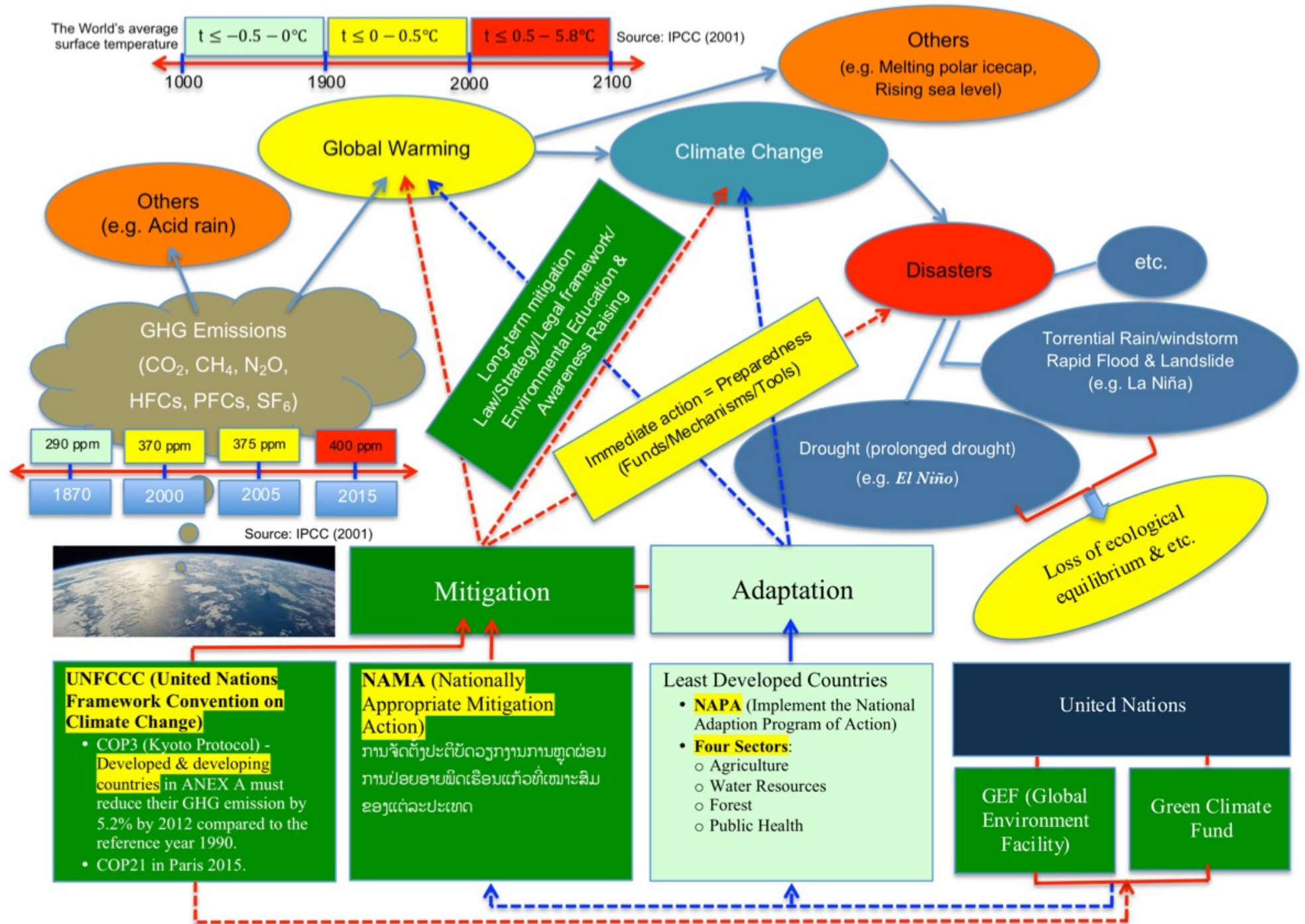
- ✓ Three documents were adopted:
 - 1) Rio Declaration Environment and Development;
 - 2) Agenda 21: Sustainable Development;
 - 3) Statement of Principles for the Sustainable Management of Forests.
- ✓ Three legally binding agreements (Rio Convention) were opened for signature:
 - 1) Convention on Biological Diversity (CBD);
 - 2) United Nations Framework Convention on Climate Change (UNFCCC);
 - 3) United Nations Convention to Combat Desertification.

Lao PDR's Actions against Climate Change

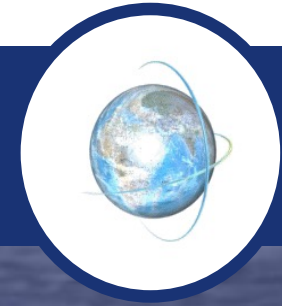
- ❑ The Government of Lao PDR (GoL) acceded to the UNFCCC in 1995. Then they also ratified the Kyoto Protocol in 2003 and the Paris Agreement in 2016.
- ❑ The GoL acceded to CBD on December 19, 1996.
- ❑ The GoL ratified the UNCCD on September 20, 1996.
- Lao PDR was the first ASEAN country to ratify the Paris Agreement in 2015 by agreeing on an INDC, with the support of UNDP utilizing funds from GEF.
- The 2nd NDC is currently being updated.
- On 12 June 2023, Lao PDR launched a carbon market program with the support of Australia and the [Global Green Growth Institute \(GGGI\)](#).
 - ✓ This program, called the "Program for Open and Sustainable Carbon Markets in the Lao PDR," aims to enhance Laos' participation in international carbon markets.
 - ✓ The initiative is part of a broader partnership between the Lao government, Australia, and GGGI to foster sustainable development and address climate change.
- The GoL is currently developing a Decree on Carbon Credits to regulate their management and trade.



Climate Change Mitigation and Adaptation



Conclusion



- ✓ Human activities are significantly responsible for high concentrations of GHGs in the earth's atmosphere.
- ✓ 6 Main GHGs include: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF_6)
- ✓ Man-made GHGs are the main cause of Global Warming and Acid Rain.
- ✓ Promoting reforestation, environmentally friendly production activities and the use of renewable energy would probably mitigate such problems.



**The world is in our hands! Make it a better place for
you and for me, and for the entire human race.**



Thank You for Your Attention!

For more information:

E-mail: s.vilavong_ems@yahoo.com

Any more questions, please???



References

- <http://www.un.org/geninfo/bp/enviro.html>
- <https://www.cbd.int/>
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- <http://www.greenclimate.fund/partners/contributors/resources-mobilized>
- <http://www.triplepundit.com/2016/03/u-s-pays-first-500m-green-climate-fund/>
- https://ec.europa.eu/clima/policies/international/negotiations/paris_en
- https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf
- <http://www.un.org/sustainabledevelopment/development-agenda/>
- <http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/02/green-growth-environmental-scientist-dec12.pdf>