



RYERSON UNIVERSITY

Environmental
Applied Science &
Management

Green Think Tank

**Global Warming - Realities, Root
Cause Analysis, and Solutions**

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Green Think Tank

Global Warming Rescue – three sections

搶救地球 三個環節

1. No more uncertainty, foresee disasters 溫室效應无可否認 六大災難
2. Root Cause Analysis 問題根源 華藏宣言
3. Solutions 根治方法 How can civilization change?



SECTION ONE: REALITIES

No more uncertainty, foresee disasters

溫室效應无可否認 六大災難

1. No More Denial
2. The Scientific Method
3. United Nation Decoration of Global Warming Science
4. The anthropogenic cause of global warming
5. Critical scientific reports
6. Scientific Predictions
7. The Four Symptoms of Civilization Collapse

Section One: Realities

- no more uncertainty & denial
- clear & present danger to humanity and life on earth

Only when the last tree has died,
and the last river been poisoned
and the last fish been caught
will we realize we cannot eat money.

~Cree First Nations Proverb⁵

Why Denial?



1. Code of News Media to report “two sides of a story” plays into the hands of denial machinery
2. People don't want to believe their luxurious life style is killing themselves and the planet. We want our investments and RRSP (oil stocks) to make money. People find comfort in denial or at least uncertainty.

Typical denial excuses

1. I don't believe it.
2. The science is debatable and inconclusive.
3. Global warming is caused by natural phenomena

Science is not a believe system

1. Science is about measurements and error bars. Thousands of continuous measurements on earth and from space by many countries
2. UN declaration
3. Natural phenomena are no excuse and irrelevant to the fact that humans are responsible for green house gas emission.

UN Declaration

“Feb 2, 2007 will be remembered as the date when uncertainty was removed as to whether humans had anything to do with climate change on this planet. The evidence is on the table”

Achim Steiner, executive director, United Nations Environment Program

Global scientific credibility

>50 Earth
Observation
satellites acquire
data at exponential
rate providing
unprecedented
synoptic views of
our planet. (ESA -
AEOS Medialab)



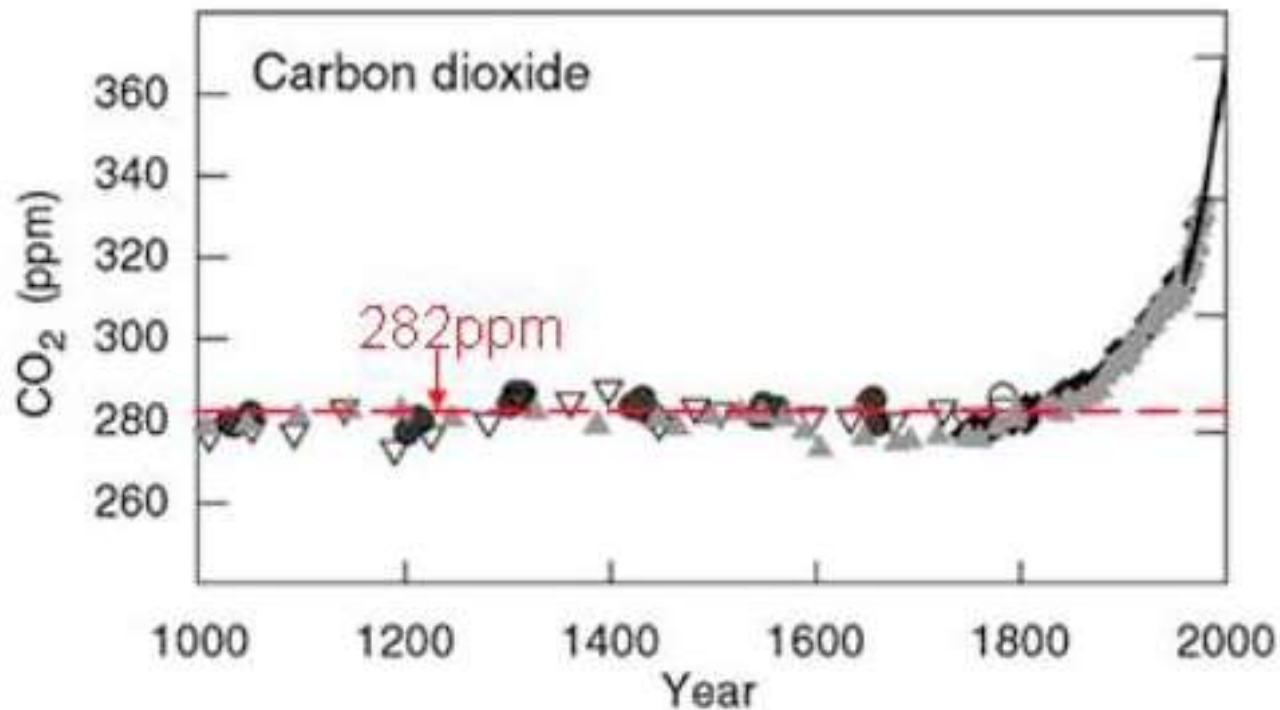
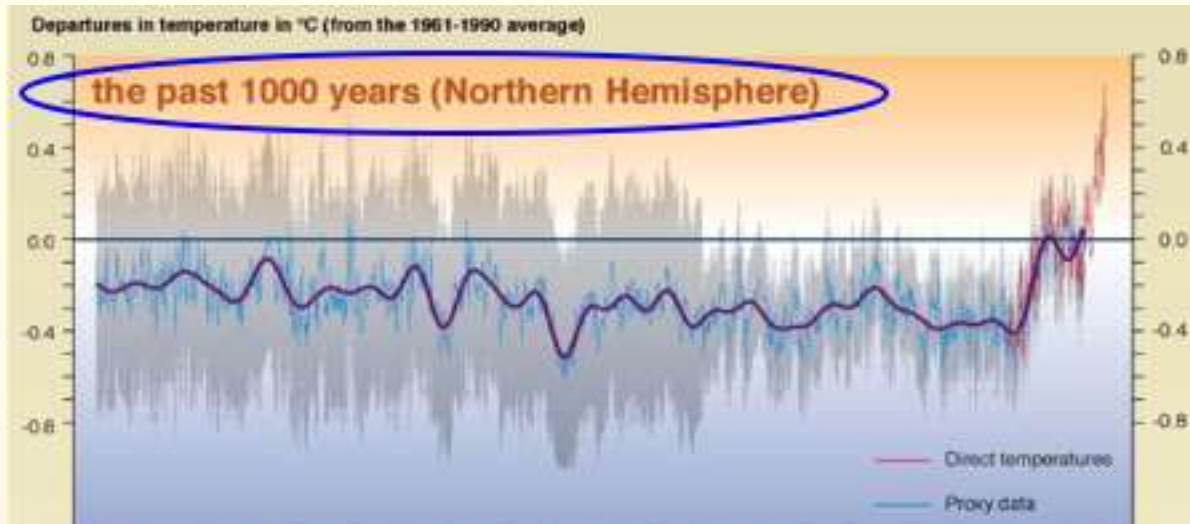
CAUSE: Burning fossil fuel (vehicles & electricity generation) emit CO₂ which **blanket** the earth. Heat from sunlight cannot escape into space



Caused by green house gases (CO₂, H₂O)

- Human activities emit greenhouse gas
 - >7 billion tons of each year or
 - 500 billion tons since the industrial revolution
- Oceans absorbed about ¼ or 125 billion tons and can absorb no more
- Atmospheric CO₂ concentration
 - Today = 380 ppm (parts per million)
 - Pre-Industrial Revolution 1700s = 280 ppm
 - End of the century = 560 to 1,000 ppm
- Double CO₂ increase temperature by 2.2°F

Temp & CO₂ correlate in past 1,000 yrs



Positive proof of global warming.



**18th
Century**

1900

1950

1970

1980

1990

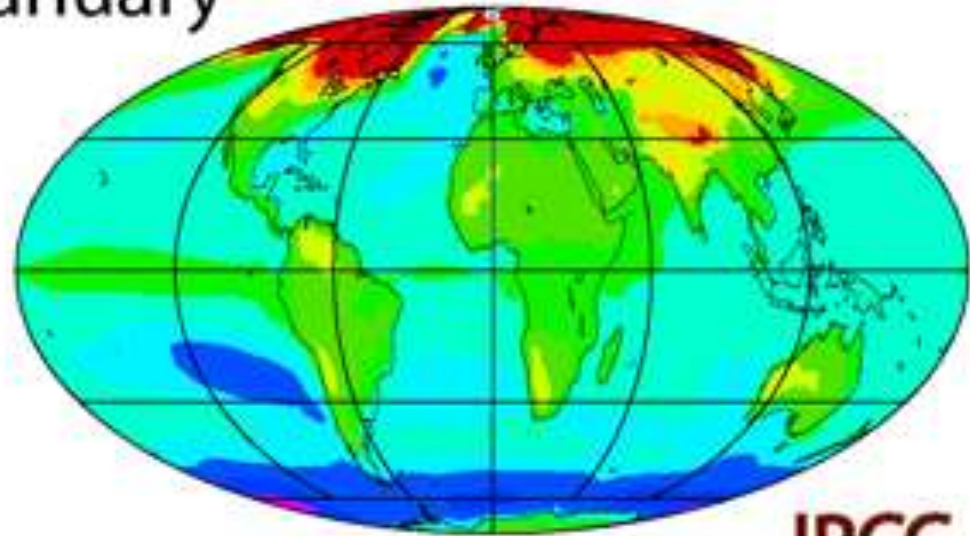
2006

2007 USA

Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report

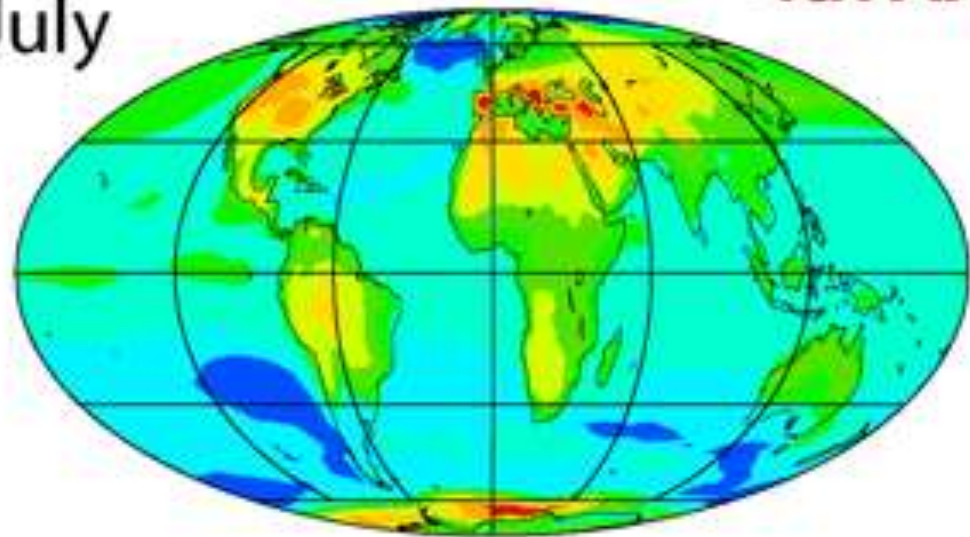
- IPCC measure **Best Case scenario**
- Temperature increase next 100 years
- IPCC & Al Gore share 2007 Nobel Peace Prize

January

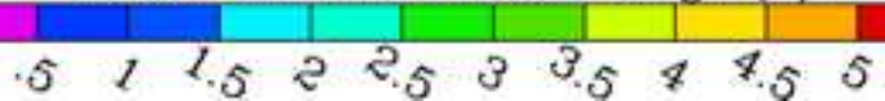


IPCC
4th AR

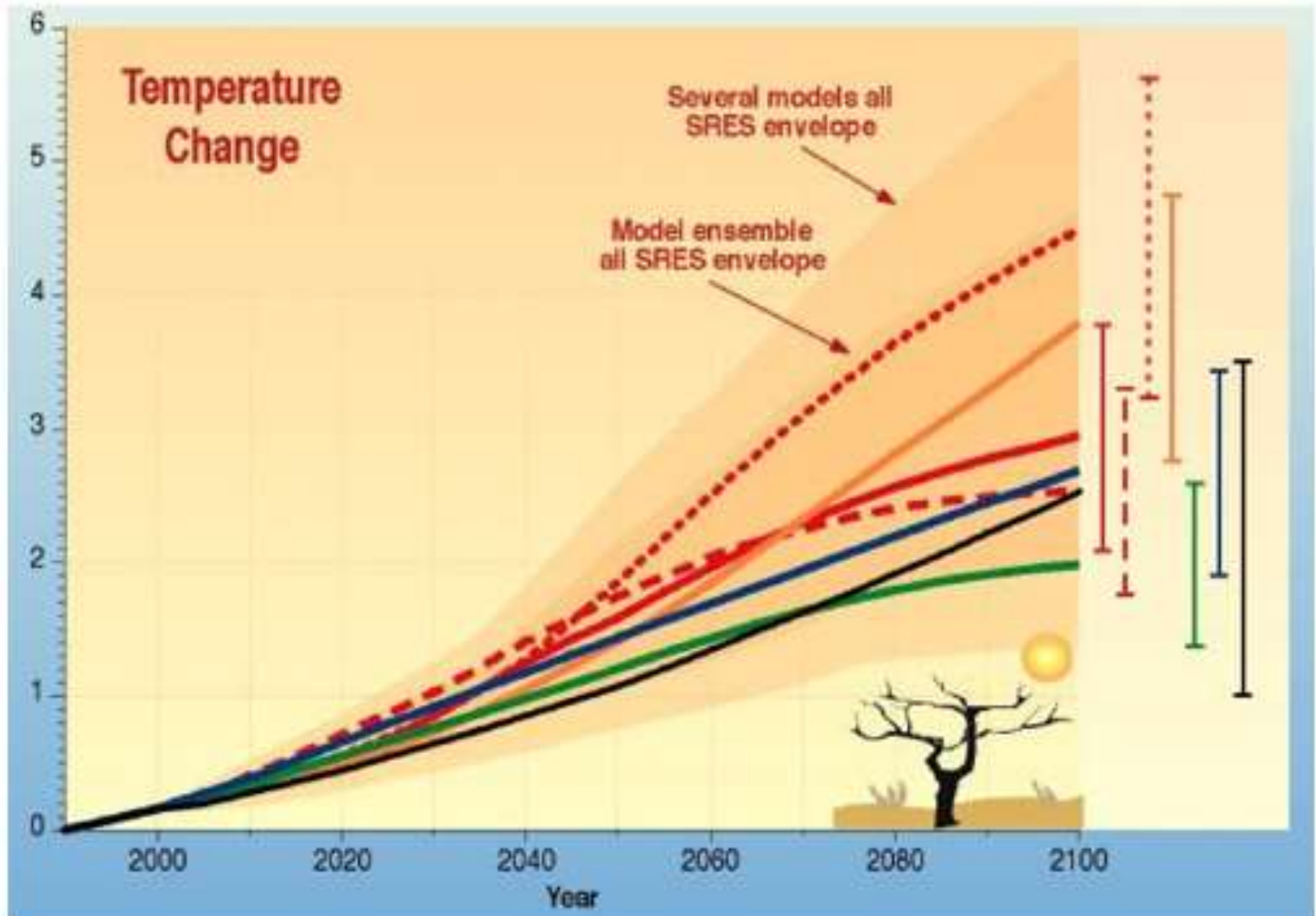
July



Model-Mean Climate Change (K)



In next 100 years, existing human CO₂ will cause rise in 2°C (best case); additional human CO₂ will double to 4°C (worst case)



National Aeronautics and Space Administration (NASA) measured **much worse** case scenario

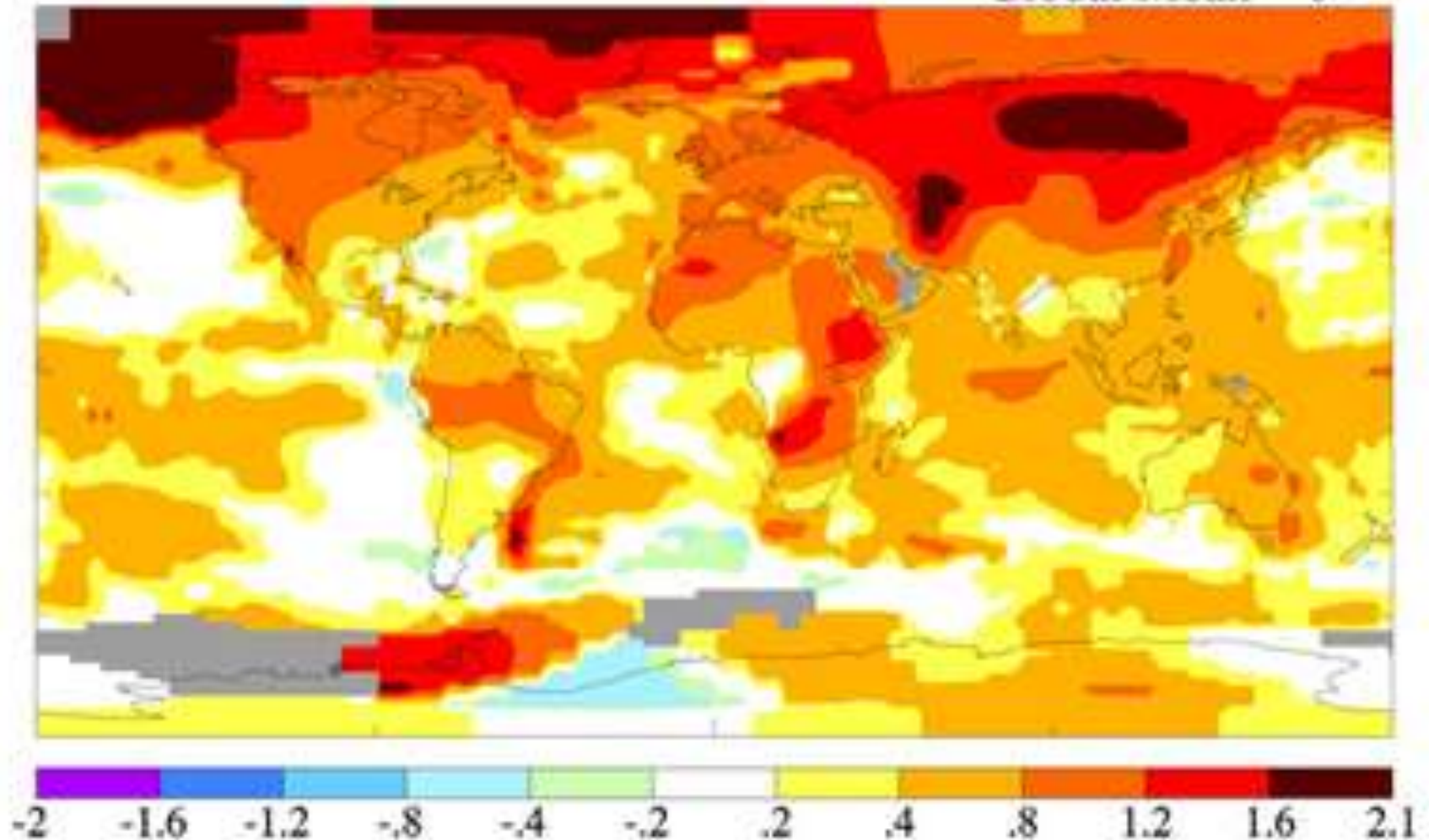
26Sep06 Proceedings of the National Academy of Sciences:

- **“We conclude that global warming of more than 1°C, relative to 2000, will constitute “dangerous” climate change as judged from likely effects on sea level and extermination of species”**
- **3°C over the 21st century could eliminate a majority (60%) of species on the planet**

NASA found accelerated warming

2001-2005 Mean Surface Temperature Anomaly ($^{\circ}\text{C}$)

Global Mean = 0.54



NASA report: Earth is heating up exponentially

- +0.2° C per decade for the past 30 years
- Warmest levels in the last 12,000 years
- Within about 1°C of the maximum temperature of the past million years
- 2001-05 +0.54° C in 4 years
- 2-3° C more = about three million years ago, sea level was 25 meters [80 feet] higher.
- [0.5°/4yr = 16-25 years] Worse Case Scenario
- Contradict IPCC prediction of 23 inches sea level rise within 100 years “business-as-usual” several meters per century with eventual rise of tens of meters

Polar Ice decline

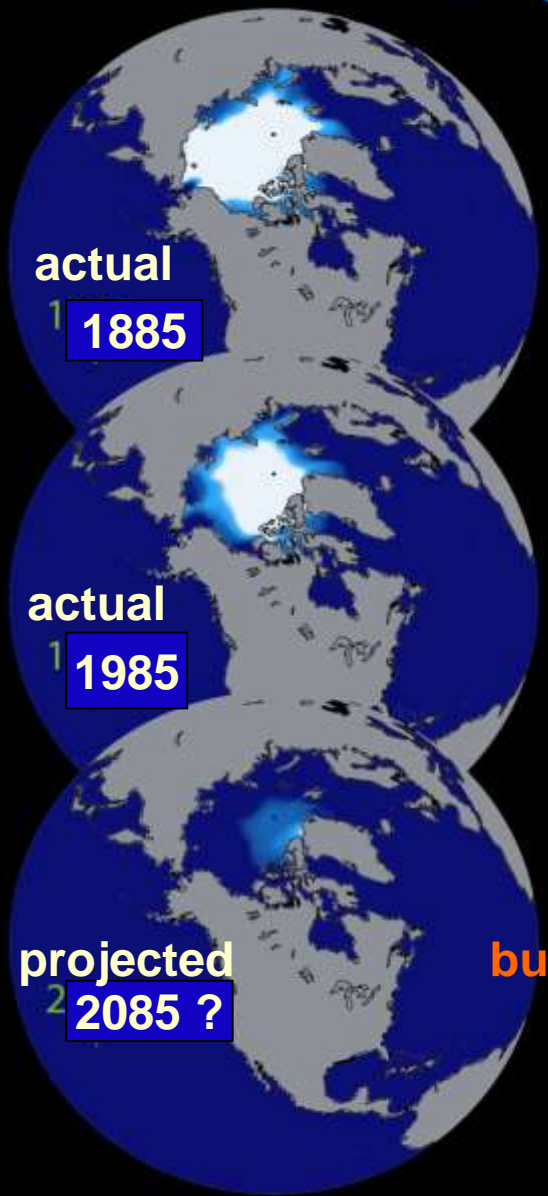
CBC News 11Dec06; Tremblay, McGill & U.S. National Center for Atmospheric Research. Geophysical Research Letters 12Dec06.

- Right now steady decline
 - Higher temperatures → less ice (less **mirror** reflecting sunlight out into space) → more water → more sunlight absorbed by water (**thermos**) → raises temperatures.
 - Next 20 years tip the steady decline to 4x faster decline
 - by Sep 2040 little left (**30 yrs**)
- 2004, chief scientist on Canada's Amundsen research icebreaker predict **50y**. 2007 he predicted **30 yrs**
- Jun06, UBC Byers & European Scientists, NW passage clear in **25y**.



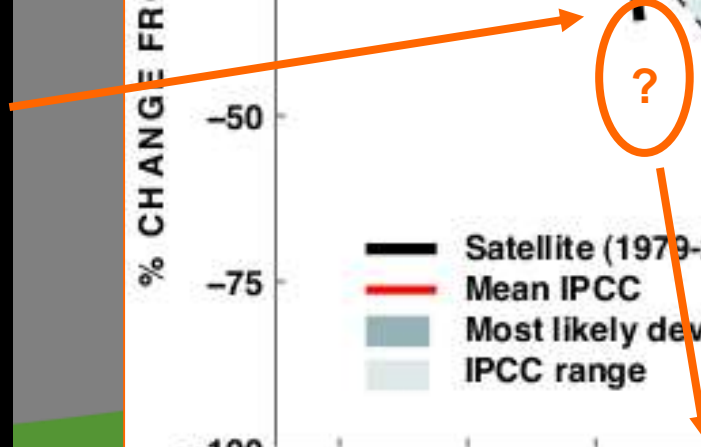
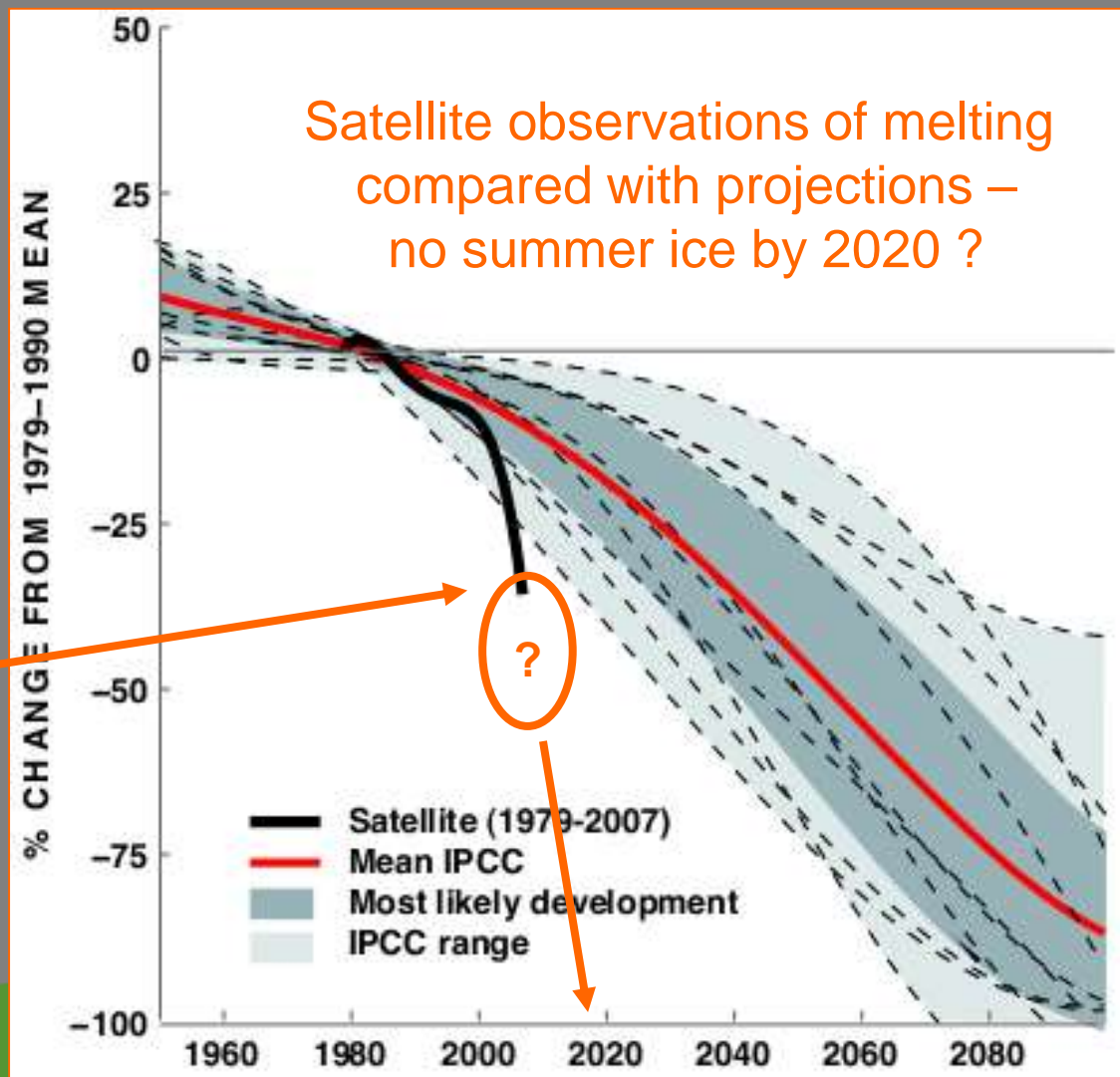
Ice melted in 2006= lake Superior, 2007=Ontario





Aug Sept Oct Avg Sea Ice Concentration

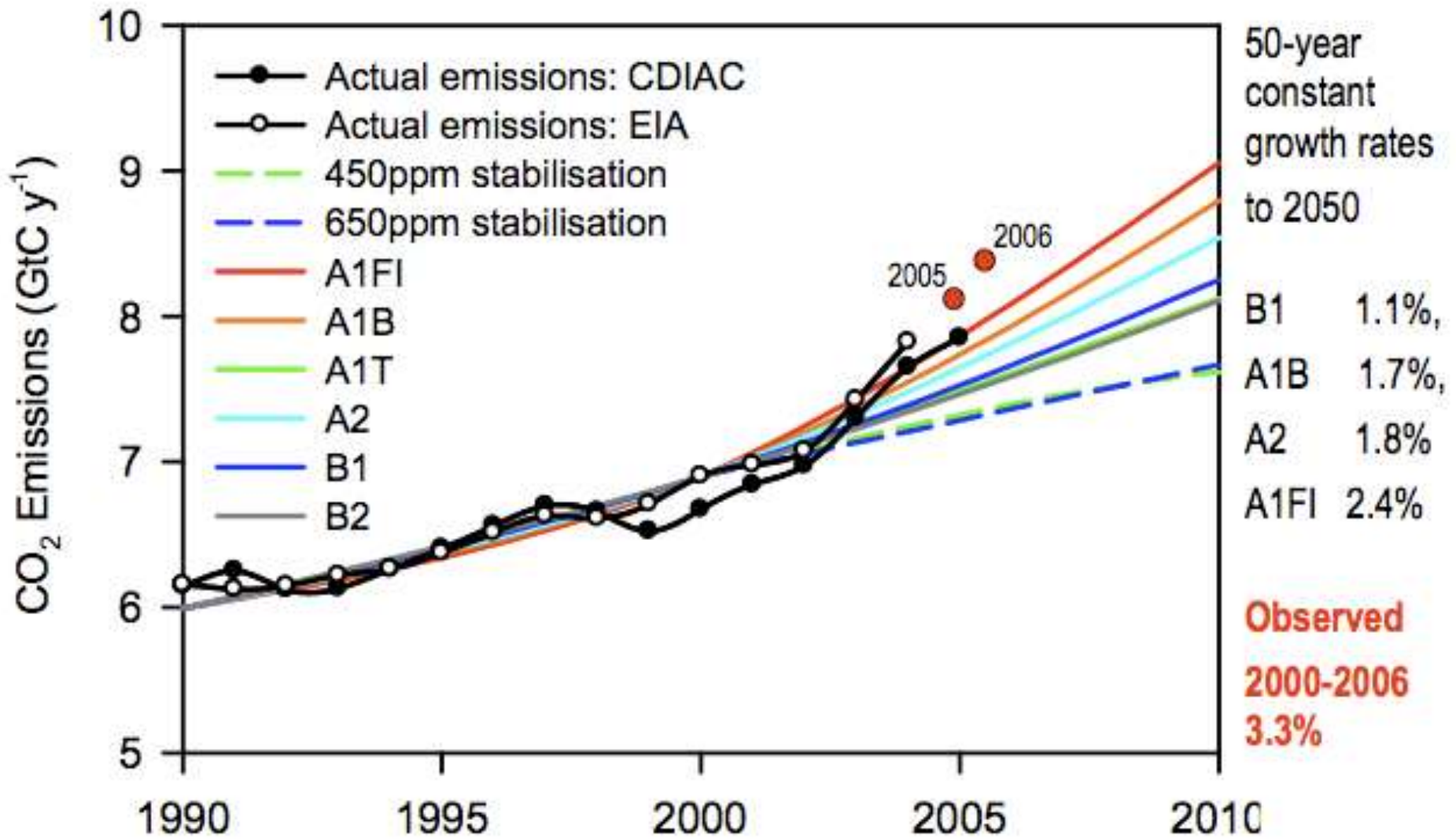
Faster than anyone expected ...



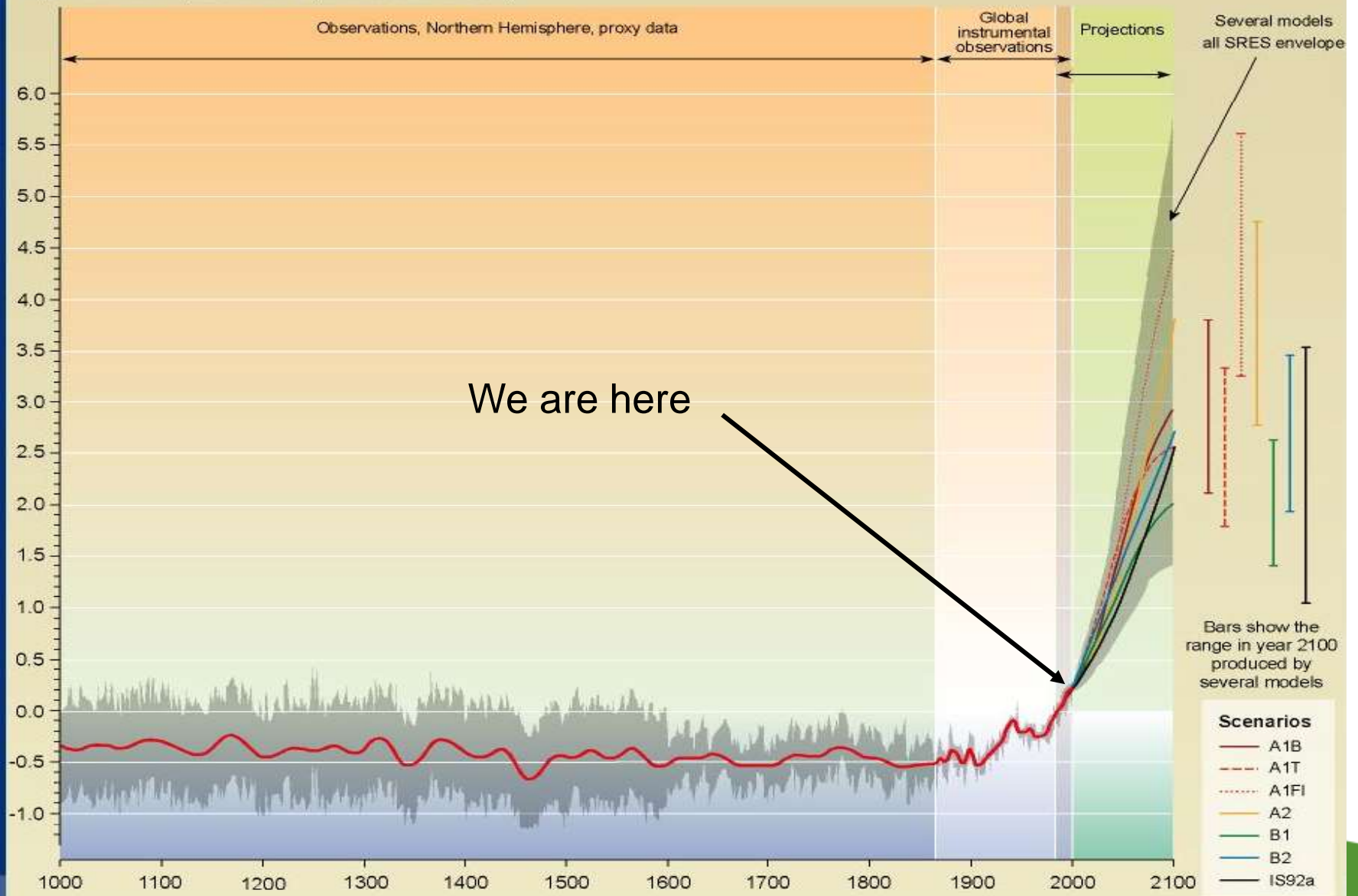
July 17, 2008 Al Gore

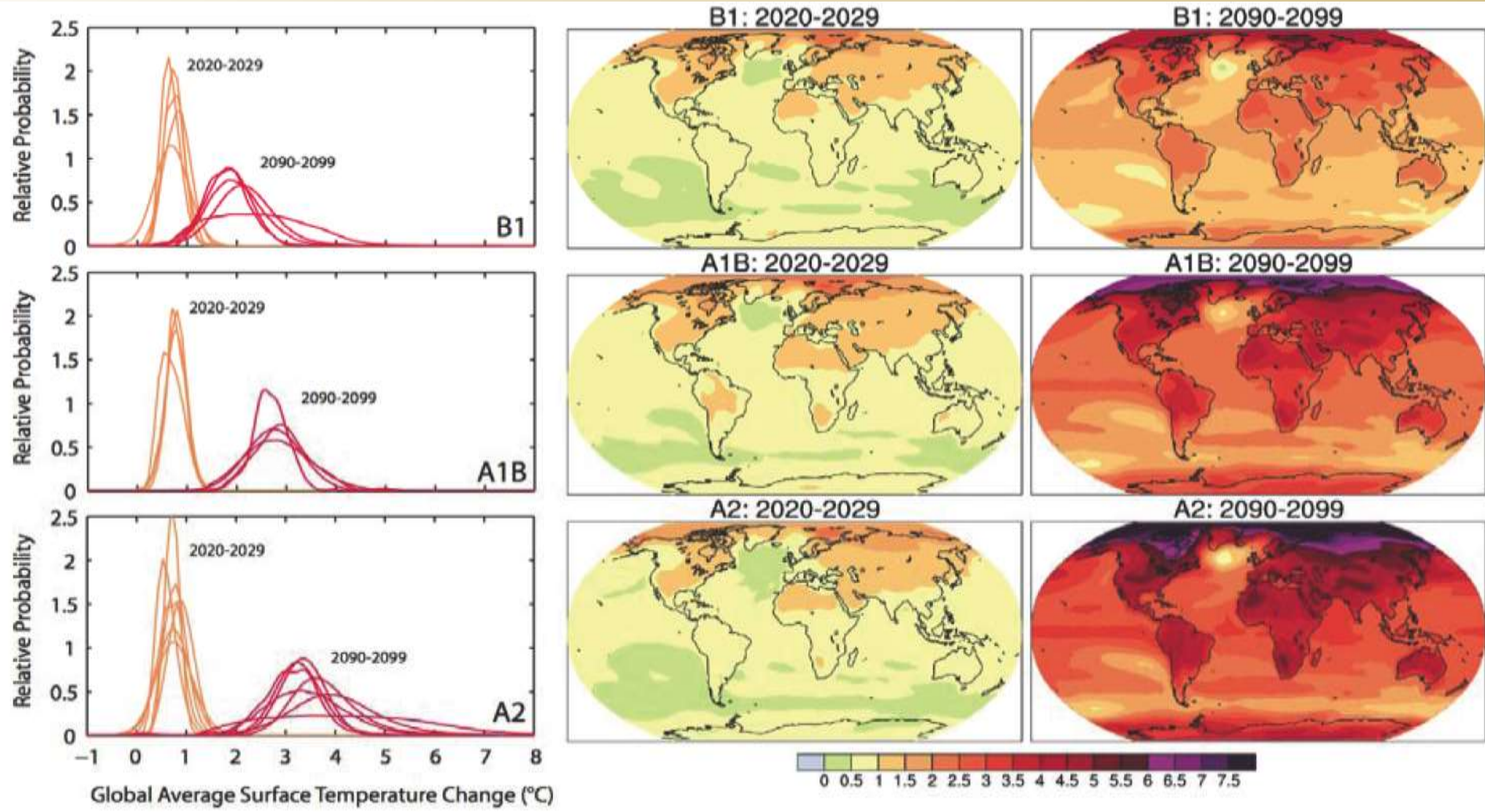
- Scientists with access to data from navy submarines traversing underneath the North polar ice cap have warned that there is now a 75% chance that within **five** years the entire **ice cap** will **completely disappear** during the summer months
- Jakobshavn glacier, one of Greenland's largest, is moving faster than ever before, losing 20 million tons of ice every day, equivalent to the amount of water used every year by New York City





Departures in temperature in °C (from the 1990 value)





Eby M, K Zickfeld, A Montenegro, D Archer, KJ Meissner & AJ Weaver, 2008: Lifetime of anthropogenic climate change. *Journal of Climate*, in press.

No time left

- Even if humans stop all emissions, green house gases concentrations stabilize but the warm blanket is still covering the globe
- Even 100% Kyoto compliance will only reduce global warming by $1/700^{\circ}\text{C}$
- Canada, US, refuse Kyoto
- Australia new government 2007 rectified

Six Global disasters

- 1) Rising Sea level
- 2) Drinking water and crop irrigation
- 3) Food
- 4) Climate
- 5) Disease
- 6) Social economic

1) Rising Sea Level Disasters

1. A rise in sea level of 1m will submerge an area the size of Portugal along China's eastern seaboard, >half its population and 60% of its economic output.
2. 40% world population lives in coastal areas, <60 km from shoreline, coasts will be flooded worldwide.
3. US Geological Survey, half the country gets drinking water from groundwater. Sea water moves inland, making underground water undrinkable. Crops cannot be irrigated

Glaciers are the planet's largest source of fresh water after polar ice



1. Condense cloud moisture
2. Store water as ice
3. Slowly release water to rivers & underground water table (well water)
4. Avoid flood
5. No glacier, no constant fresh water supply
6. Rainfall is unreliable



Adaptation to flooding



Finch Avenue - 2005



2) Drinking water & irrigation disasters

1. In 13 years (1991-2004), twice as much glacial melted in Europe than in the 30 preceding years
2. Conservative estimate, Glaciers vanish from the Alps by 2050; most by 2037
3. Peruvian Andes, Quelccaya ice-cap covers 44 sq km has halved in size since 2006, will be gone in 5 years
4. Rainfall may decline 30% in 3 of 7 major river basins in China

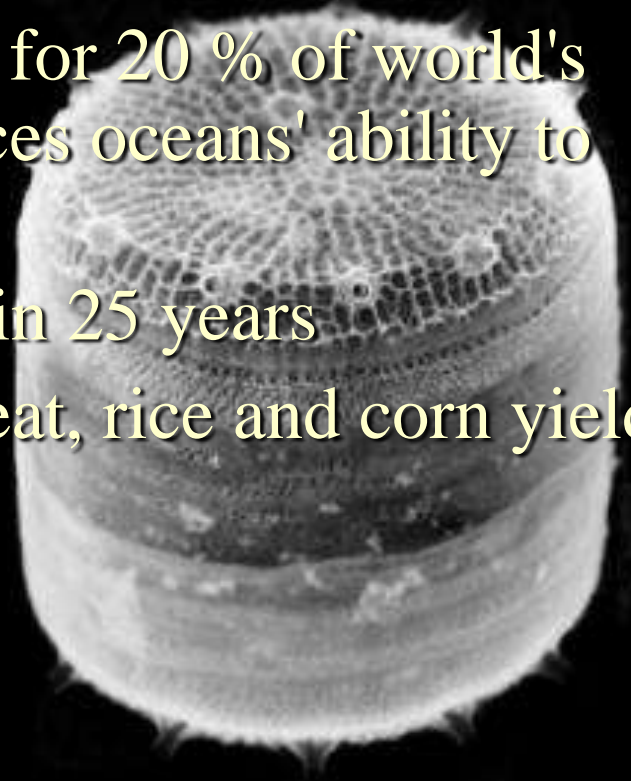


Aletsch glacier in Switzerland Vanished

2005 summer, melting
glaciers caused severe
flooding that devastated
parts of Switzerland

3) Food Disasters

1. >50 % CO₂ dissolve in ocean turning acidic threaten sea life
2. A decade of satellite surveys showed decline in diatoms phytoplanktons, microscopic plants at bottom of food chain.
3. Diatom photosynthesis responsible for 20 % of world's organic carbon. Their decline reduces oceans' ability to absorb CO₂
4. Kill Australia's Great Barrier Reef in 25 years
5. China predict a 37% decline in wheat, rice and corn yields in the second half of the century
6. Newfoundland lost cod stocks
7. Maple tree cannot make syrup



4) Climate Disasters

1. 29 other regions worldwide changes during the 20th century, **rainfall decrease** by $\geq 10\%$ below normal levels, and in all cases **drought lasted for ≥ 10 yrs.** World-wide including Europe, N. America, Australia, China, the former USSR, Middle East, Africa, India & Bangladesh
2. Canadian winters no longer cold enough to kill **pine beetles** which demolish our forest (look bright red from sky)
3. **El Niño** (warm surface waters in the West Pacific move eastward toward South America) altering weather patterns
4. **Heat waves** surge in India over the past century, rising death toll due to heat stress. Serious floods in its N.E. states in July 2005 killed $>1,000$ with economic losses $>$ US \$250 million
5. Sahel **drought** W. Africa late 1960s lasted ~ 2 decades, killed ≥ 1 million and affecting ≥ 50 million

5) Disease Disasters

- Mosquitoes carry dengue fever found at heights of ~2,000 meters above sea level in Mexico and in the Andes Mountains of S. America.
- Tropical diseases shifted northward including:
 1. Cryptococcus gattii B.C. none before 1998
 2. N. America hantavirus in 1993
 3. Expanding terrain of ticks that ferry Lyme disease
 4. 1999, the arrival of the West Nile virus
 5. Malaria and encephalitis in Turkey and Azerbaijan

6) Social Economic Disasters

- **Stephane Dion** 16Jan07 called this his first major speech as Liberal leader “...global warming... the single most serious ecological threat that humanity is facing...”
- The economic costs of failure to meet the challenge would be catastrophic – greater than the combined costs of the Great Depression of the 1930s and the two world wars (British Government study)

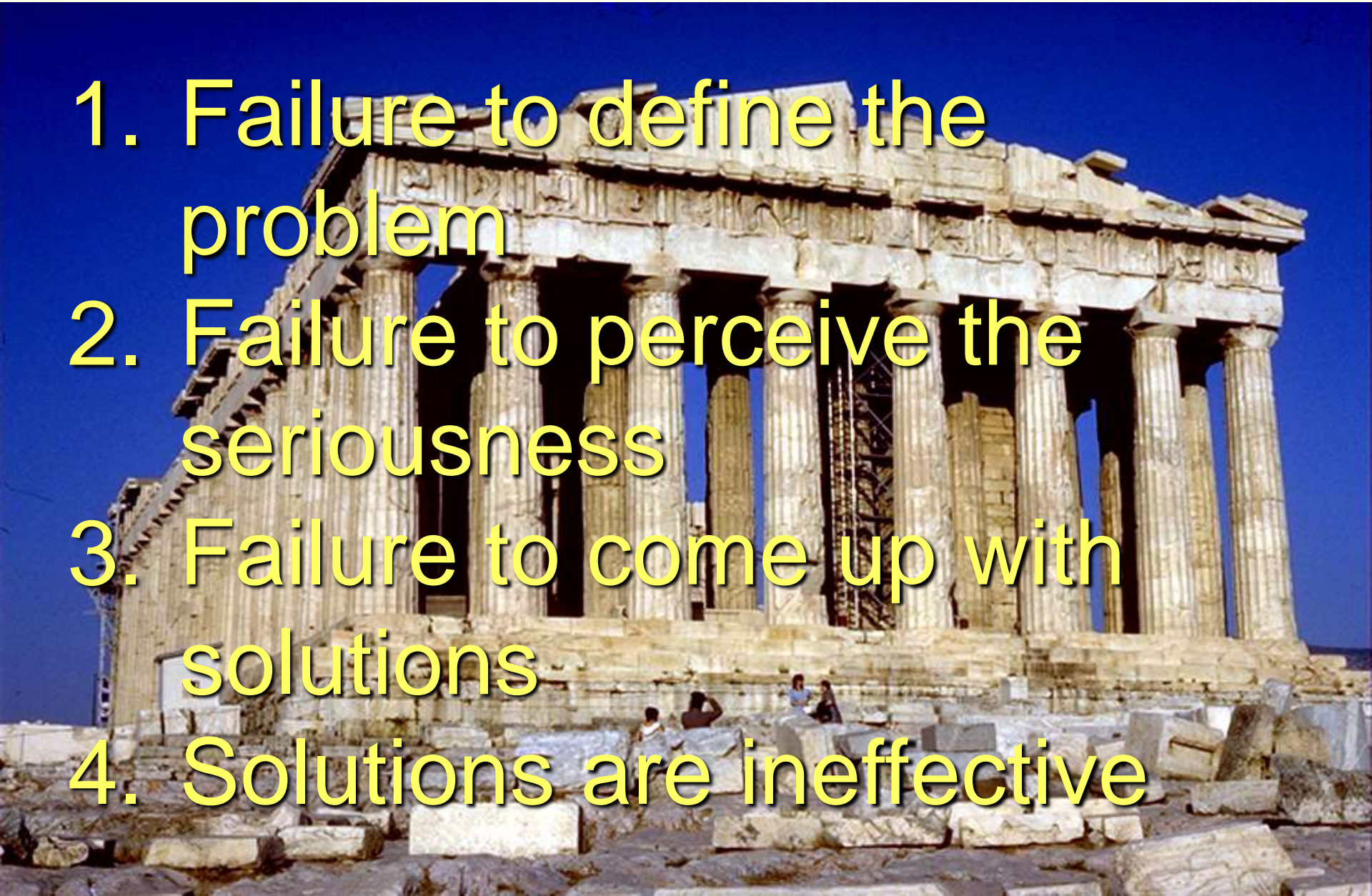
Canada one of the world's highest per capita emitters of greenhouse gases

- Emissions rose 27 % mainly because of Alberta oil
- 758 million tons CO₂ per year
- Exceed Kyoto target by 35% or 200 million tons

- Real (UN, scientific measurement)
- Immanent (25 years)
- Disastrous (extinction and signs of civilization collapse)



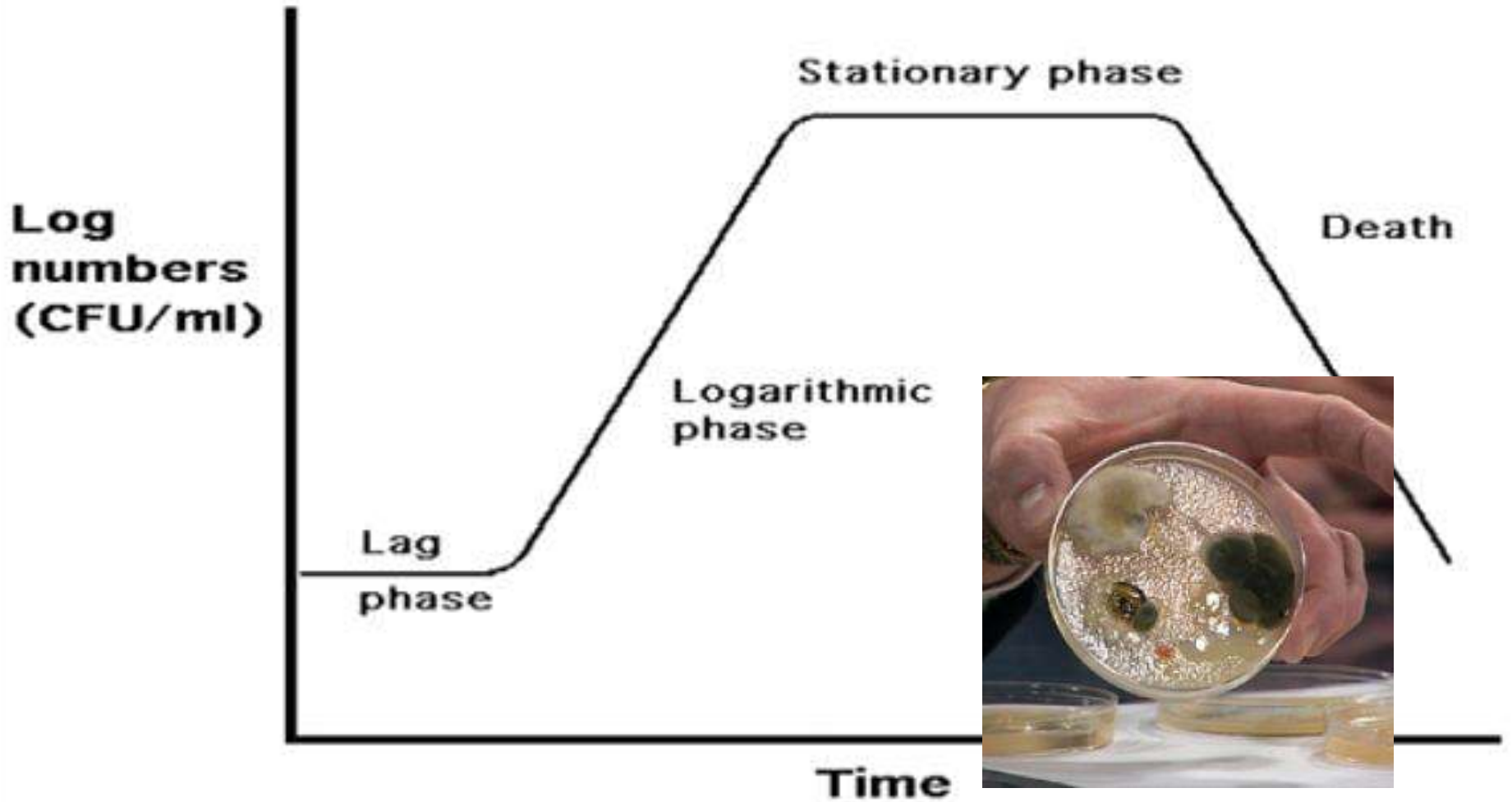
Four symptoms of civilization collapse

1. Failure to define the problem
 2. Failure to perceive the seriousness
 3. Failure to come up with solutions
 4. Solutions are ineffective
- 
- The background image is a photograph of the Parthenon on the Acropolis in Athens, Greece. The temple is shown in a state of significant ruin, with many columns missing or damaged, and large sections of the entablature and roof missing. The sky is a clear, bright blue. In the foreground, there is a large pile of rubble and debris, including broken stone blocks and fragments of columns. A few people can be seen sitting on the debris, providing a sense of scale to the massive ruins.

Section Two: Root Cause Analysis – civilization unsustainable



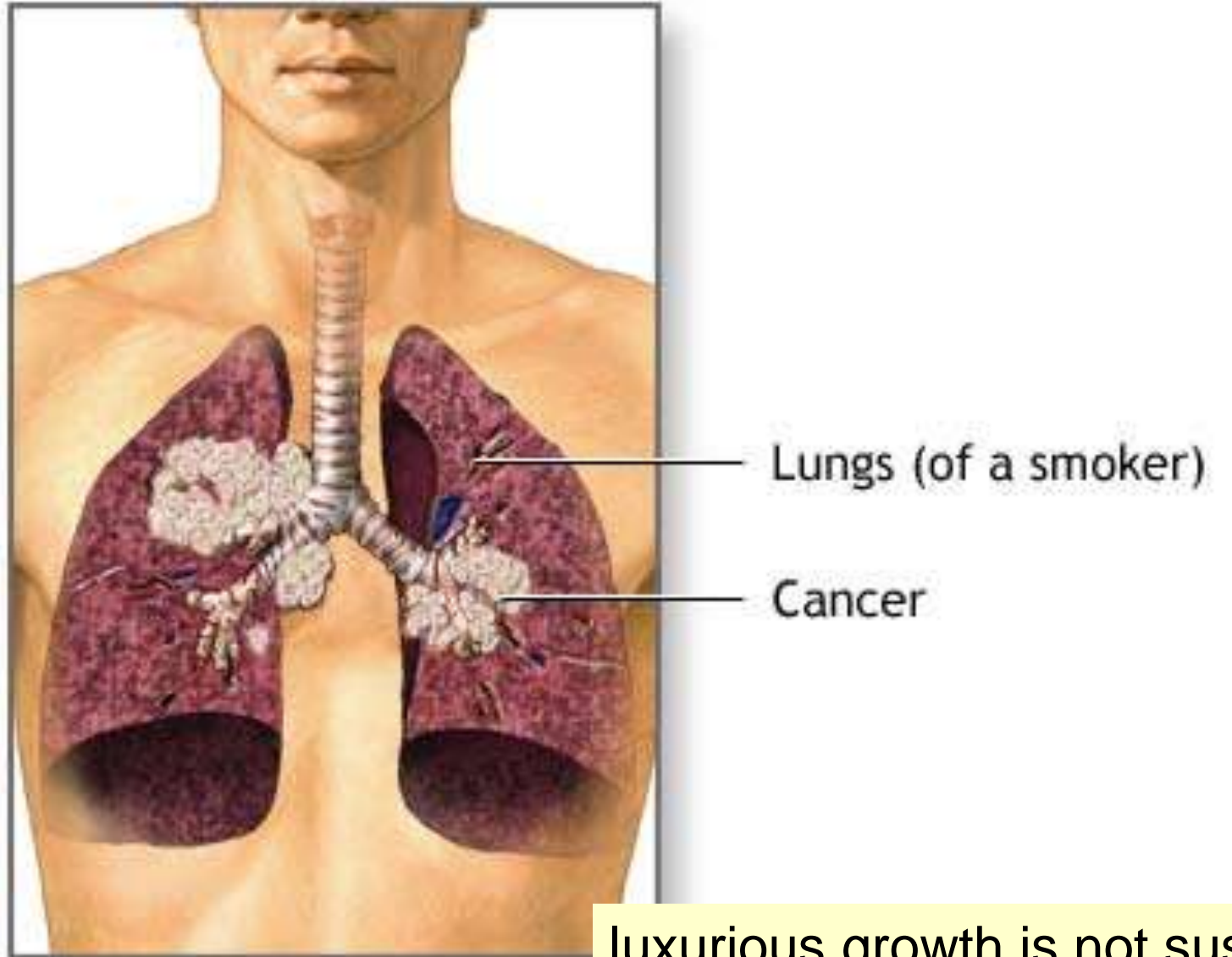
Sustainability with limited resources



Hypothetical bacterial growth curve

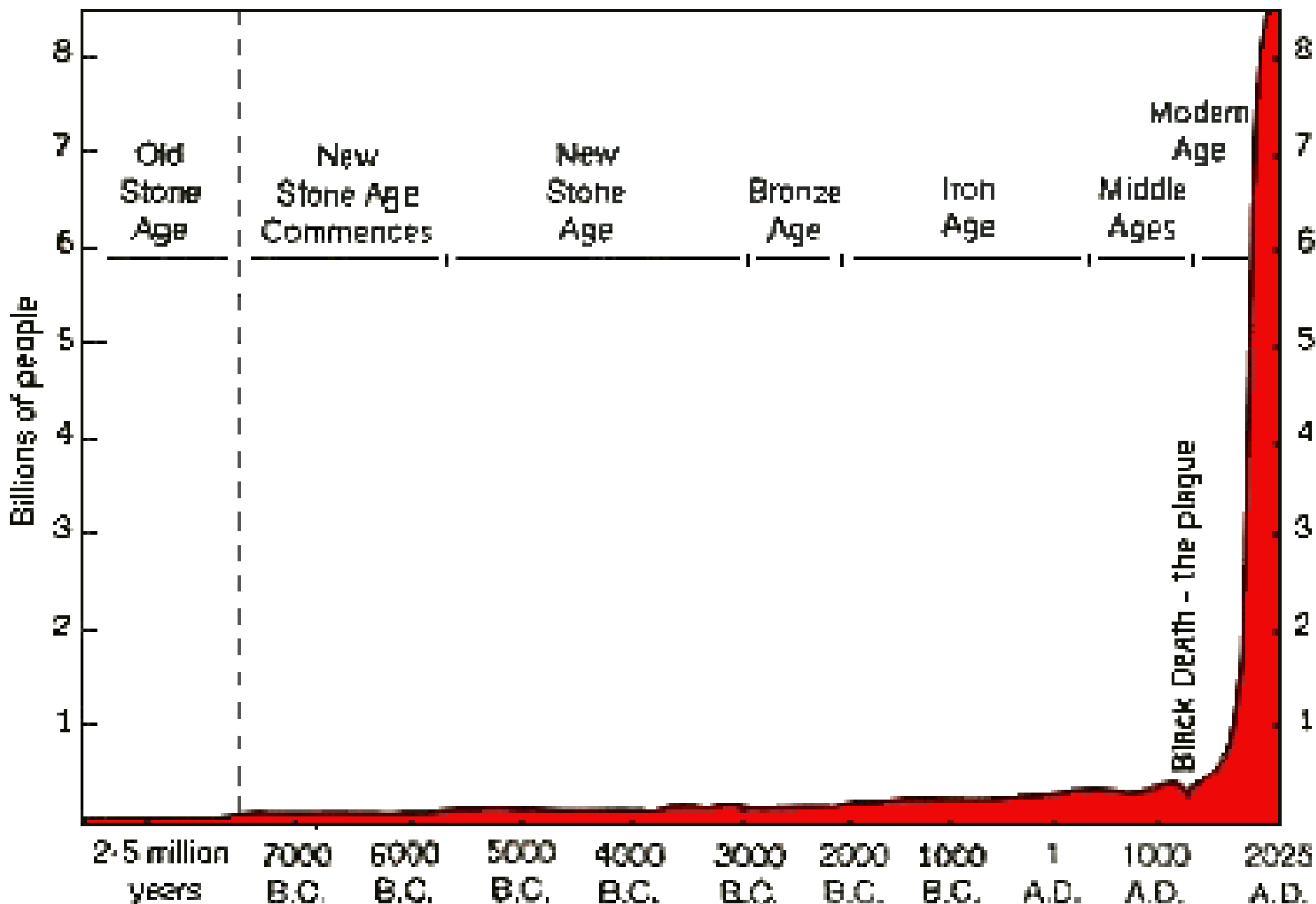
luxurious growth is not sustainable

Sustainability with limited resources



luxurious growth is not sustainable

World Population Growth Through History



Number of Years Required to Add One Billion People to the Population of the Earth with Current Projections into the Future

Date Achieved Years Required

	Date Achieved	Years Required
First Billion	1800	All of Human History
Second	1930	130
Third	1960	30
Fourth	1974	14
Fifth	1987	13
Sixth	1998	11
Seventh	2009	11
Eighth	2021	11
Ninth	2035	14
Tenth	2054	19
Eleventh	2093	39



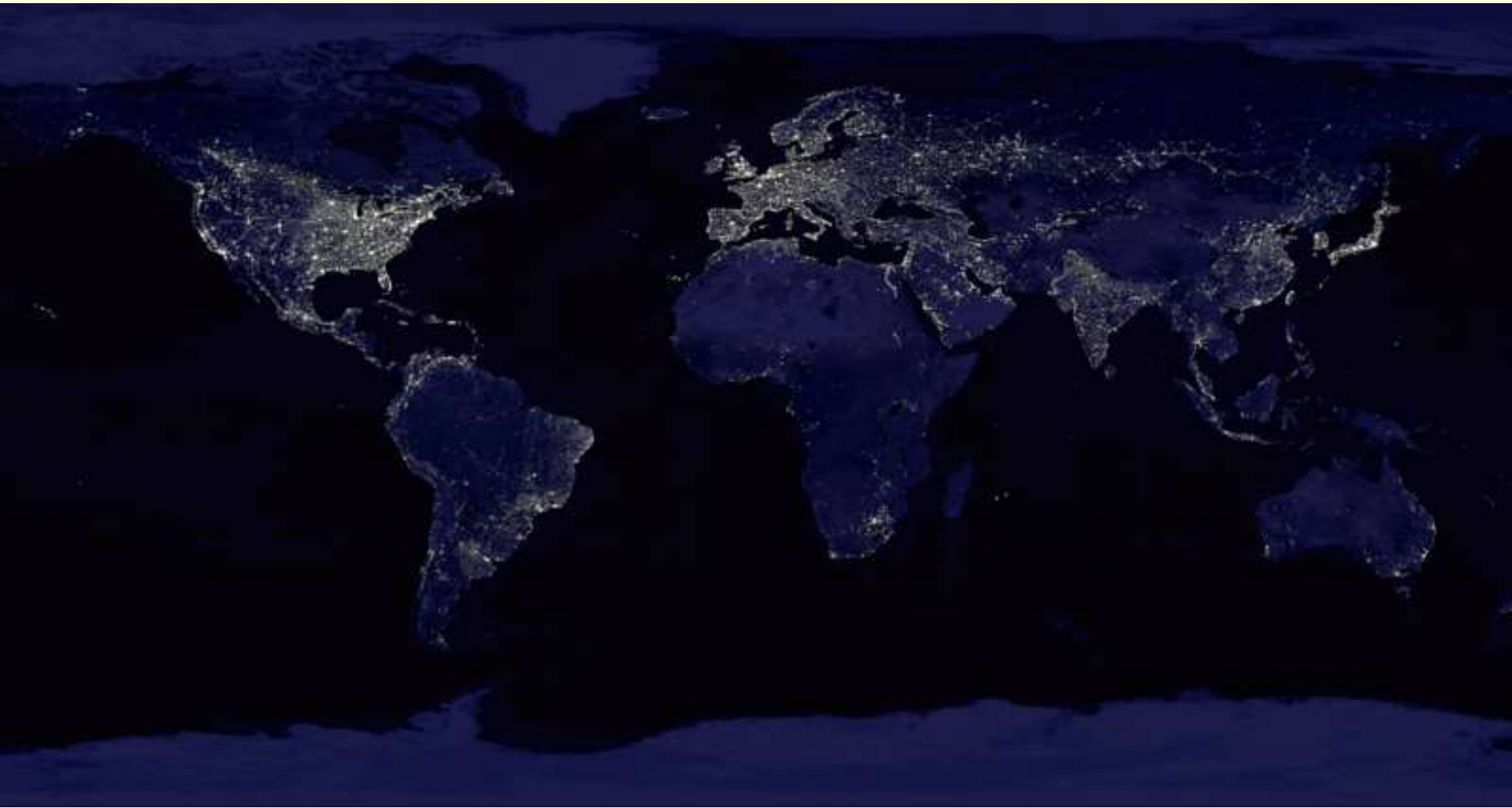
- Fossil energy
- Food (animals & vegetables)

humans

Unprecedented Sustainability Challenges

- Solar energy sustains <1 billion humans
- Pre-industrial revolution up to 2 billions
- Population doubled in the past 40 years to 6 B
- Technology allows transform world energy and biomass into human biomass
- Half the world is living on < \$2 a day
- 20% of the global population is consuming 86% of the world's goods

Satellite Image of Global Light Pollution



Sustainability with limited resources ⁴⁶

Patriarch Lineage

Ven. Haiyun Jimeng

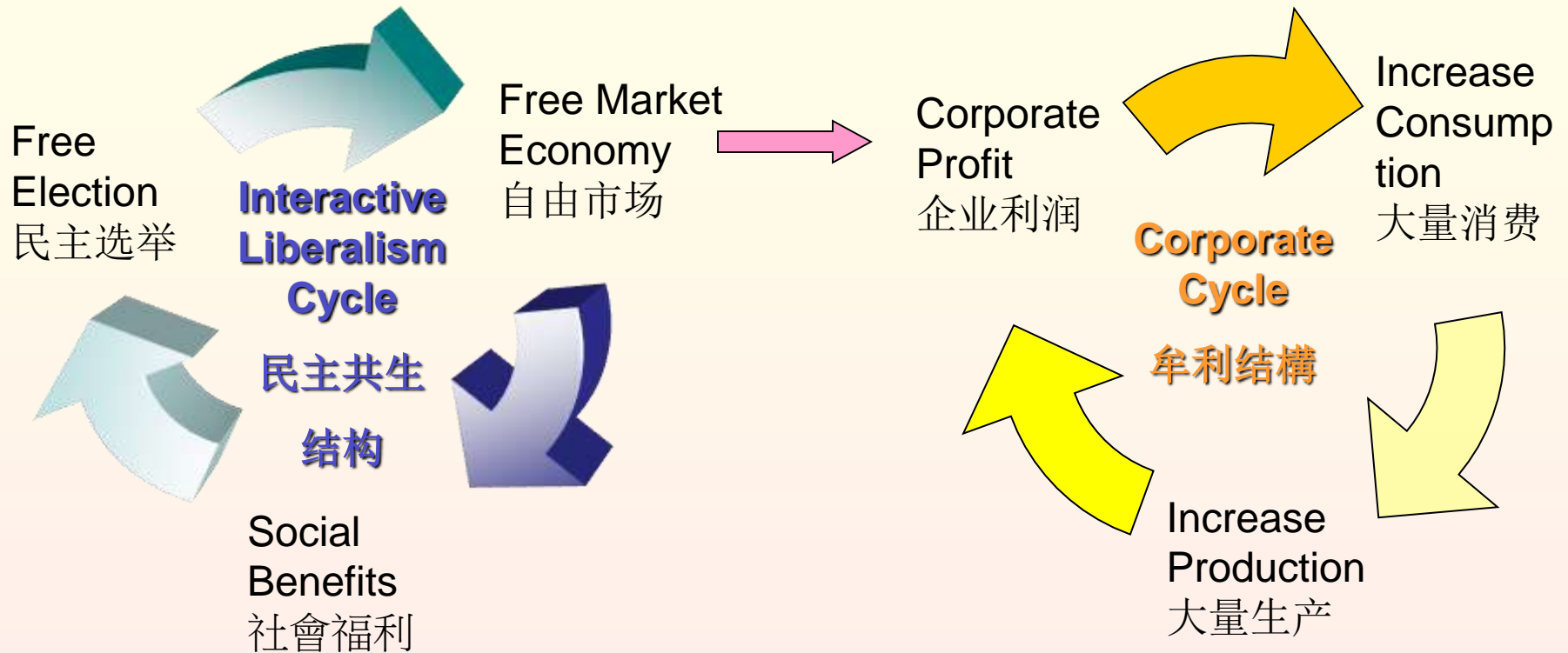
Huayen Grand Master, Da Huayen Monastery,
Republic of China (Taiwan).

Honorary Director & Visiting Professor, Shaanxi
Normal University, Centre for Religious Studies,
Institute of Huayen Studies, People's Republic of
China.

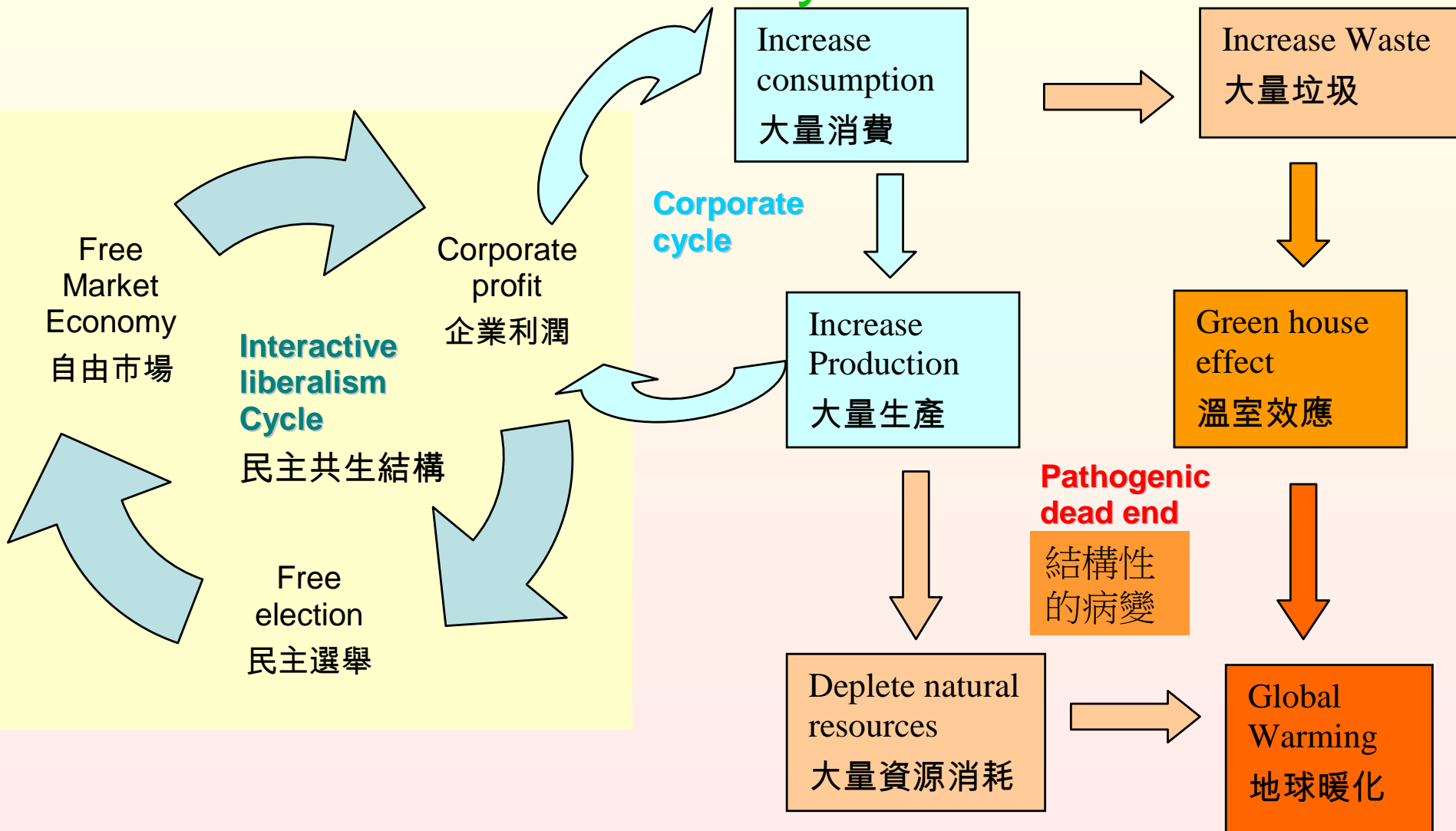
Invited Research Fellow, Chinese Academy of
Social Sciences, Shaanxi Normal University, Centre
for Buddhist Studies, People's Republic of China.



華嚴(華藏宣言)所指問題根源 Root causes as described in the Huayen Declaration



華嚴(華藏宣言)所指問題根源 Root causes as described in the Huayen Declaration





Green Think Tank

Global warming – Section Three

1. No more uncertainty
2. Root Cause Analysis
- 3. Solutions**

How can civilization change?

Quantify qualitative abstracts

GreenThinkTank Main Mission

Identifying the problem 問題根源

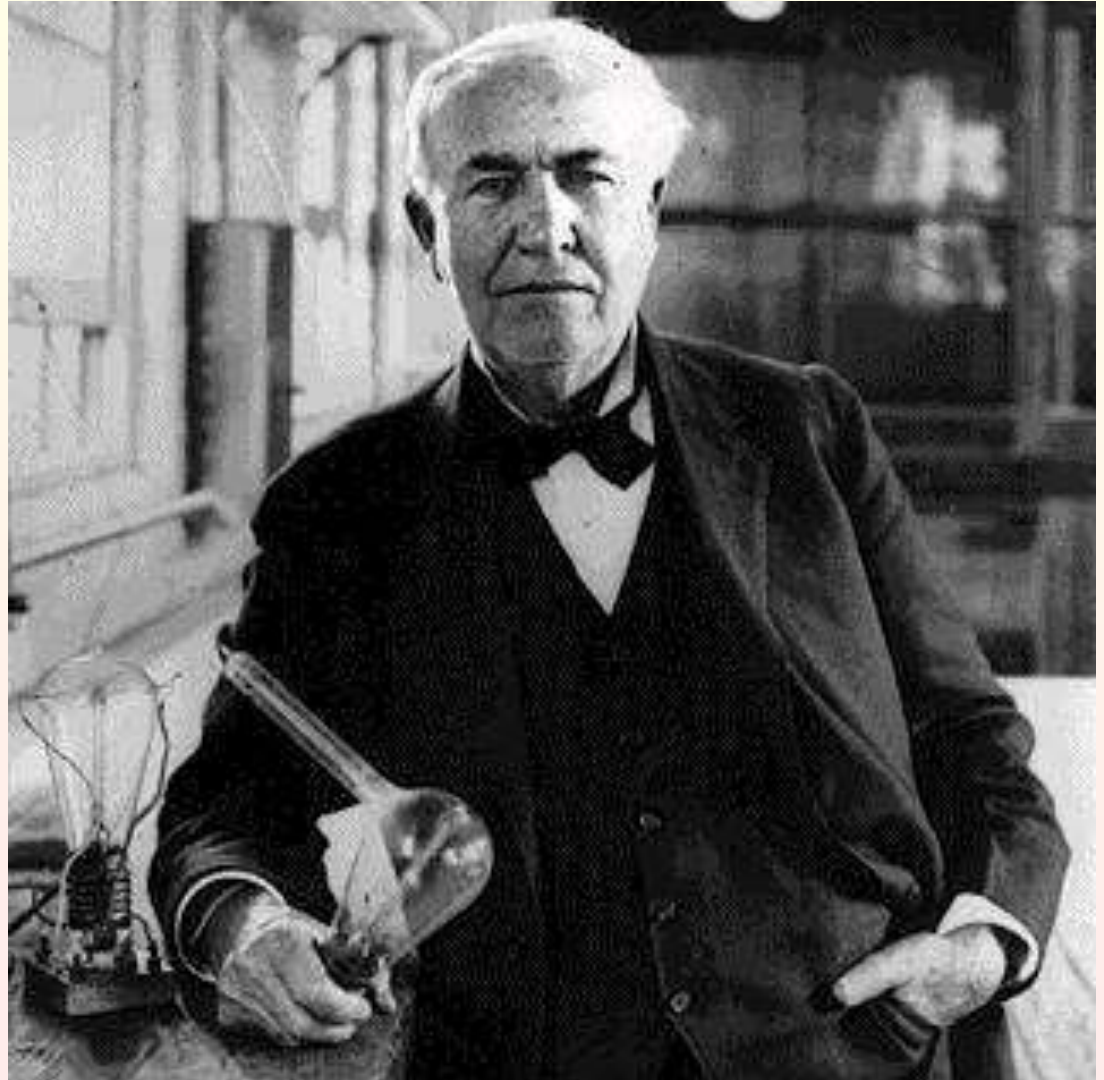
- Humans pursue happiness 人類追求幸福
- Happiness is an abstract quality 人類不懂得從抽象概念,去決定正確的行為
- Decisions are based on quantity, number 人類須要實質指數 去作出決定
- Money (currency) is the only number available 所以(錢)財富 是唯一公認的指數

GreenThinkTank Solution 根本解決方法

- Provide an alternative, quantifiable measurement of happiness 用幸福指數 量化人類行為

If at first the
idea is not
absurd, then
there's no
hope for it.

-Thomas Edison



Qualitative versus Quantitative Descriptions

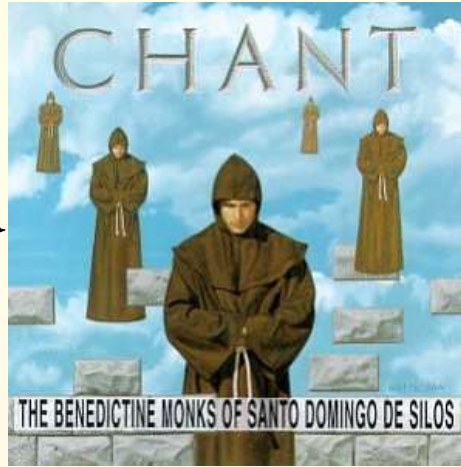
QUALIFY	QUANTIFY
The air is bad	Air Pollution Index is 7
Sun is very hot	UV index is 11
She studied hard	Her exam score is 35
Seat belt saves lives	63% of people killed in car accidents did not wear seat belts
Economy good	Stock indexes are up
Smoking is bad for health	Smoking causes 21% of all heart disease deaths, 86% of lung cancer deaths, 81% of deaths from chronic lung disease. 4,000 chemicals, 43 carcinogens

Quantification data objectives

- Quantity is measurable by number and unit
- The number need not be perfect or accurate to the n^{th} degree, just need to be a relative index
- The calculation maybe extremely complicated but the end number is easily understood
- Majority will react to the number predictably, even if the numbering system is premature (e.g. First stock market in China a decade ago)

Categories/Scale of Happiness Test Subjects

10. Spiritual
9. Rich retired
8. Optimists
7. Celebrities
6. Financier
5. Average Joe
4. Poor people
3. Manic c
2. Suicidal
1. War vet



Identical twins

Happiness/Stressor Measurements 量度

Non-invasive techniques 非侵犯性

1. Subjective Evaluation 主觀

1. Psychological self assessment 自我心理測驗

2. Objective Evaluation 客觀

1. Questionnaires assessment by social circle 由別人評估
2. Lie detector – heart beat, skin conductivity, perspiration, respiration. 測慌機 心跳 皮膚電度 冒汗情況, 呼吸節奏
3. Nuclear magnetic resonance imaging (MRI), CAT scans, CT scans 磁力共振影象 腦掃描
4. Infrared Spectrum 紅外光環

Invasive techniques 侵犯性驗血

1. Metabolomics 代謝物

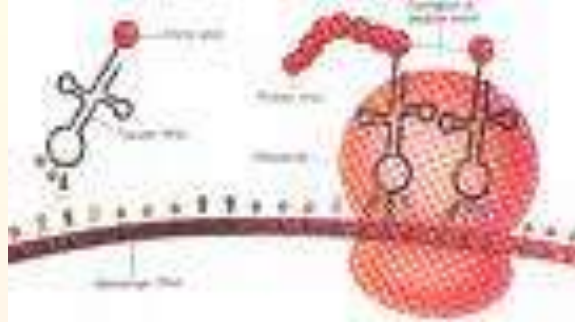
DNA
Genomics
遺傳因子



25 thousand Genes 基因



RNA
Transcriptomics
因子訊號



100 thousand Transcripts

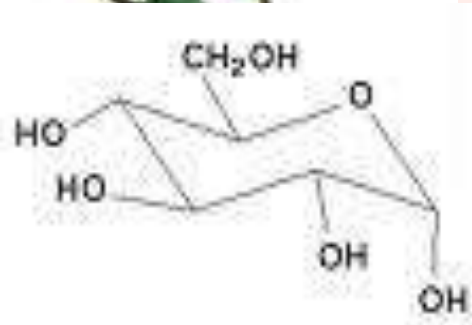


Proteins 蛋白質
Proteomics



1 million Proteins

Metabolites
Metabolomics
代謝物



<2,000 compounds



Metabolomics Lab 代謝物研究組實驗室



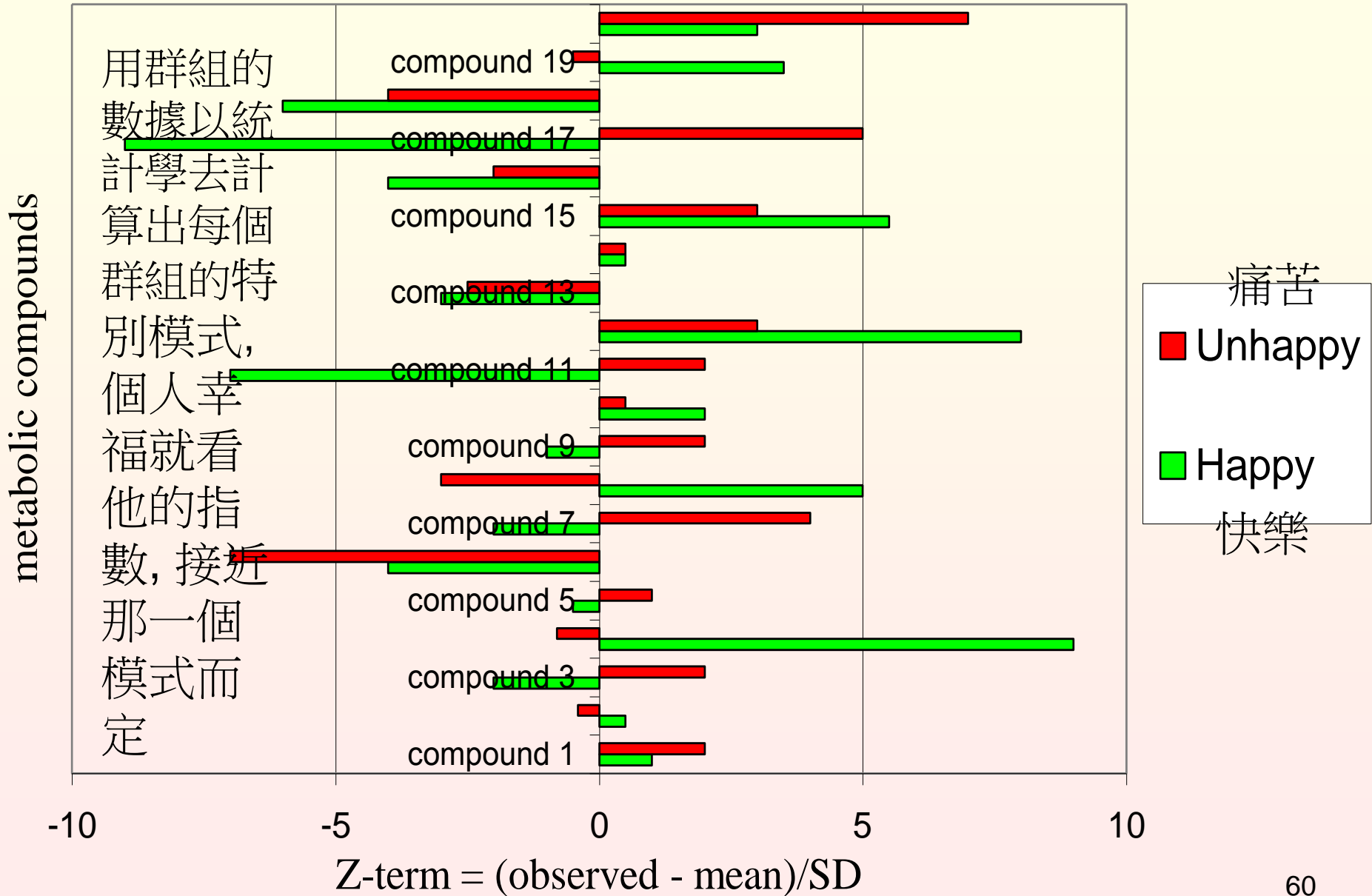
Subject Categories

10. Spiritual
9. Rich retired
8. Optimists
7. Celebrities
6. Financier
5. Average Joe
4. Poor people
3. Manic c
2. Suicidal
1. War vet



Identical twins

Hypothetical Metabolomic Profiles 幸福指數檔案



Happiness Index 幸福指數

人類行為 心靈幸福

- **Is: 是**

- Objective 客觀性
- Neutral 中立性
- Informative 資訊性
- Incentive 鼓舞性

- **Is not: 不是**

- Confrontational 對立性
- Dogmatic 專制性

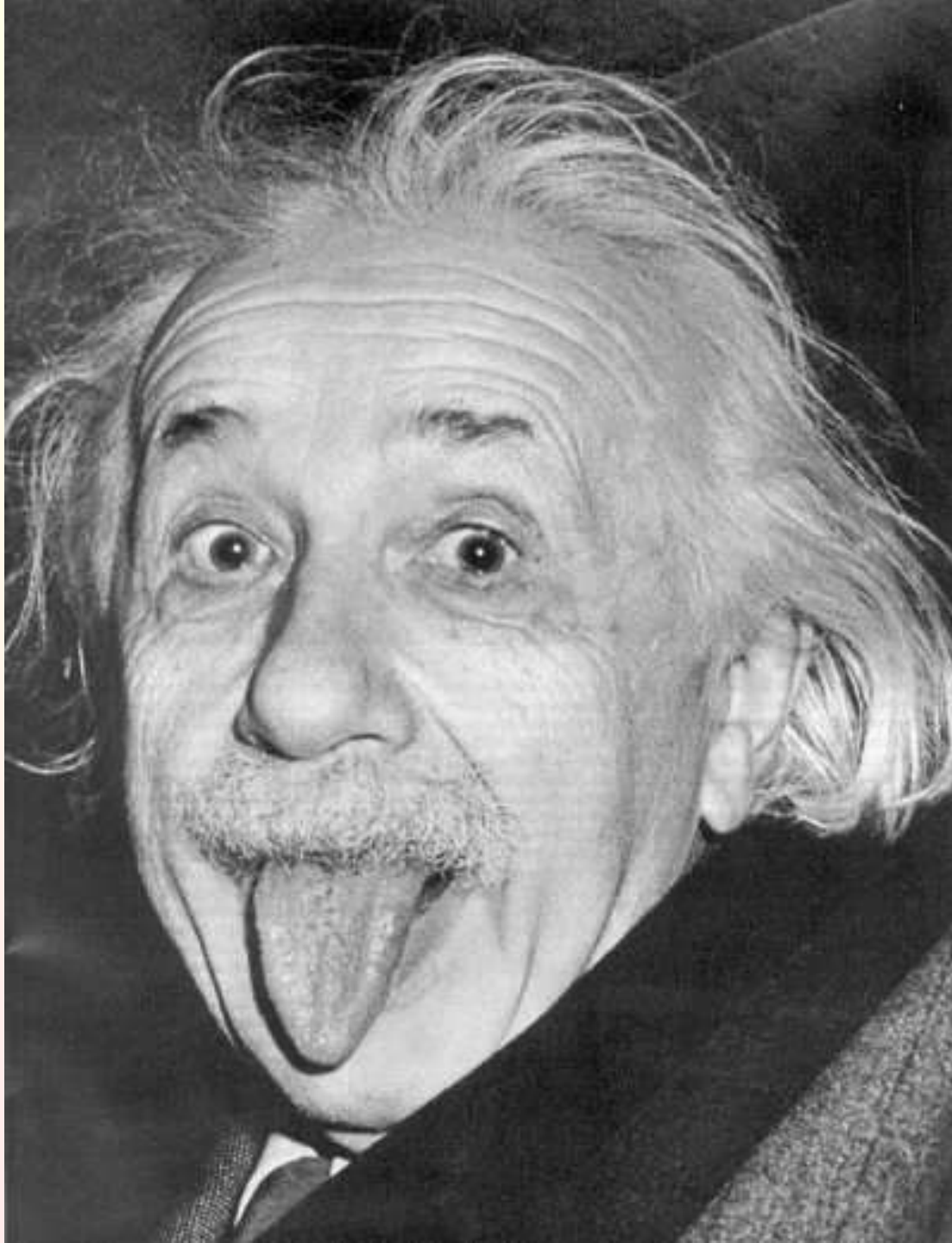
Function of the Happiness Index

- **Will:**

- Measure the well being of society.
- Entice and guide policy makers.
- Redefine quality of life.
- Help individuals to make lifestyle choices in the short and long term.
- Be a powerful alternative to the mighty dollar. and other economic indexes.

- **Will not:**

- Be tradable.
- Be falsify.



Imagination
is more
important
than
knowledge.

*-Albert
Einstein*

"You must be
the change
you wish to
see in the
world."

*Mahatma
Gandhi*



What can I do?



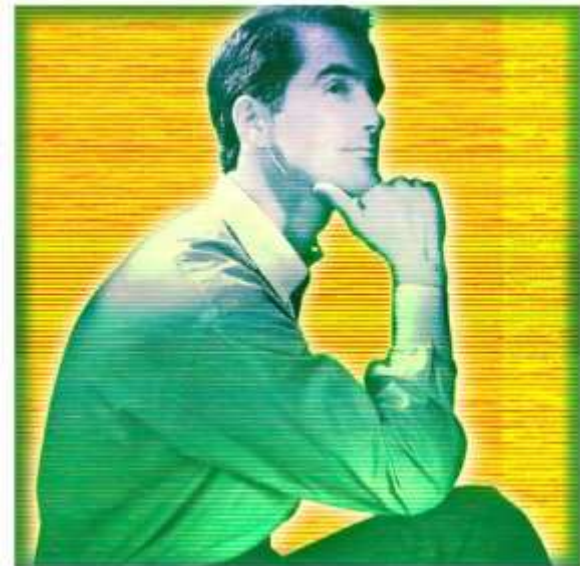
Three levels of contribution:

1. Care, support, informed
2. Get involved, help out
3. Take charge, program development

www.greenthinktank.org

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Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.

Margaret Mead

US anthropologist (1901 - 1978)

Acknowledgements

- Dr. Onyx Wai, Hong Kong Polytechnic University, Department of Civil and Structural Engineering

- Dr. James Li

- Volunteers

- Audience

THE 11TH HOUR

TURN MANKIND'S DARKEST HOUR INTO ITS FINEST



