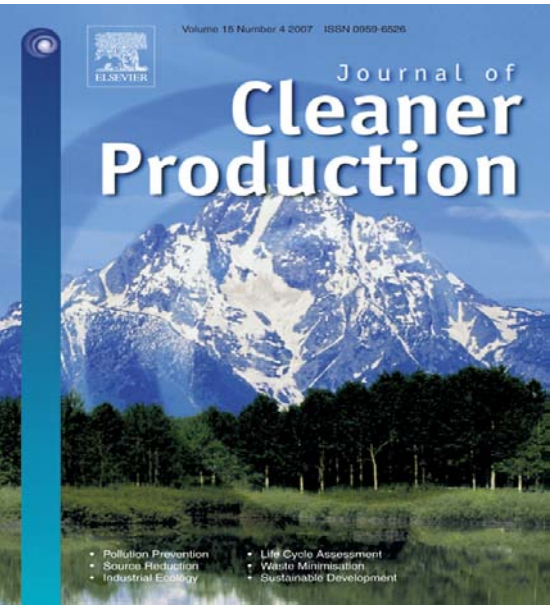
# *"Climate Changes: Evolving Technical, Political, Economic, Ecological and Values Challenges and Opportunties"*

*February 9, 2015*
*IHE-UNESCO*





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- **The Institute for a Secure and Sustainable Environment,**
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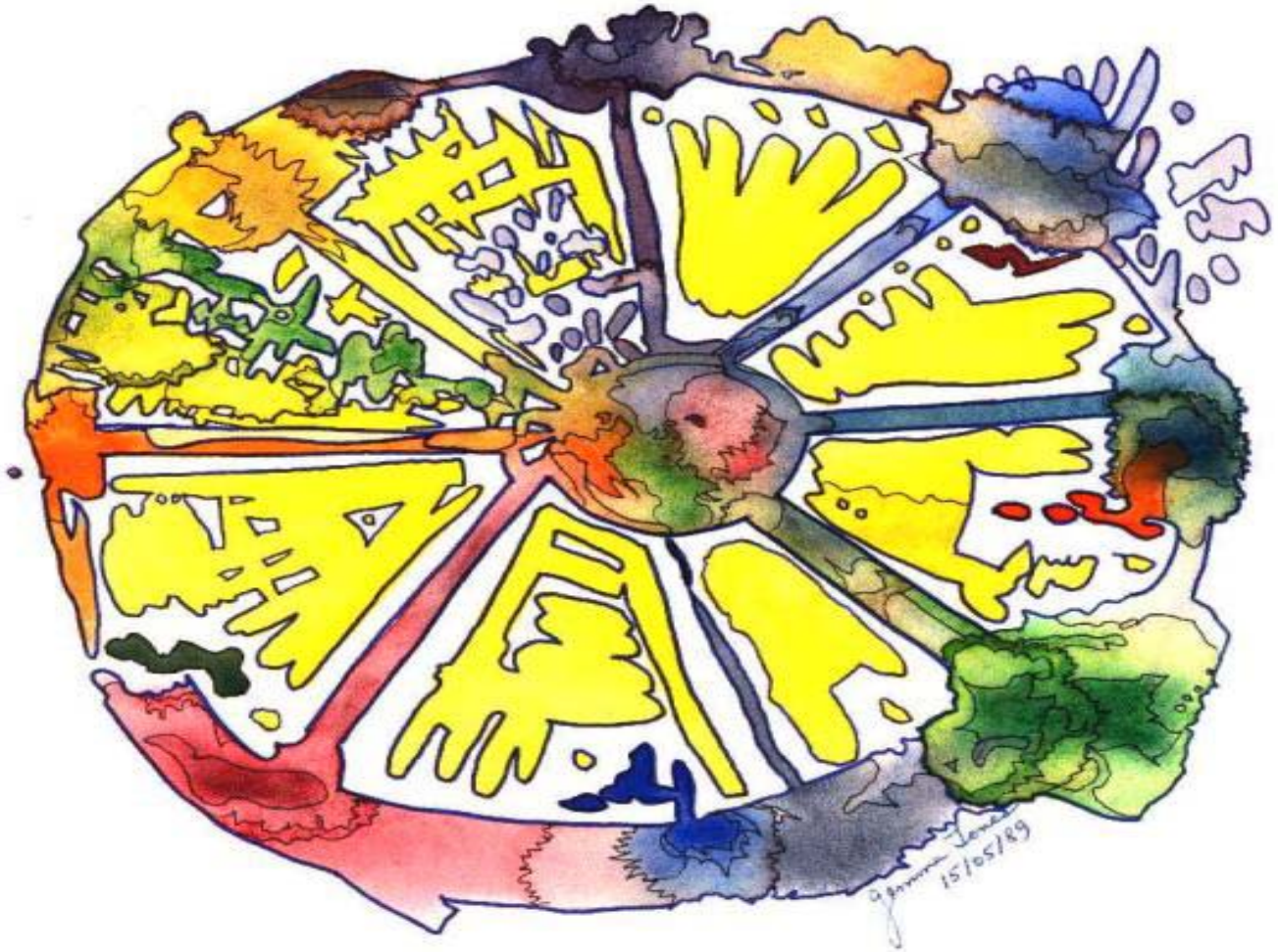
# *Cleaner Production and Heavy Metals and Related Challenges and Opportunties*

# What is Ahead on our Road to the Future?

# Where Are We and Where Are We Going?



# What is Ahead on our Road to the Future?

- *What do we envision for a sustainable future society?*

# What is Ahead on our Road to the Future?

- *What do we envision for a sustainable future society?*
  - *What would it look like?*
  - *How would it function differently from current societies?*
  - *How will we achieve such a society?*
  - *How will we know if we achieve such a society?*
  - *How will we know if we don't achieve such a society?*

# What is Ahead on our Road to the Future?

- *What do we envision for a sustainable future society?*

*Do we have the vision, wisdom and commitment to catalyze the needed societal transformations from dangers to opportunities????*

**-What evidence do we have that we are NOT on the proper path to achieve a Sustainable Society?**

**-What can/should we do to get on the proper path?**

**-How soon do we need to get ON that proper path?**

# What is Ahead on our Road to the Future?

- *What do we envision for a sustainable future society?*

  *Do we have the vision, wisdom and commitment to catalyze the needed societal transformations from dangers into opportunities????*

  *What types of indicators, governance, education/training & values will be needed to make such transitions?*

*If you want to go fast, go alone.*
*If you want to go far, go together.*

**African Proverb**

# Overview of this Presentation

- What are the Roles of Crises as Motivators for People to Change to a Post-Fossil Carbon Society?
- What are the Roles of Good Examples to Motivate People to Change to a Post-Fossil Carbon Society?
- What are the Roles of Alternative Paradigms and Indicators as Motivators for People to Change to a Post-Fossil Carbon Society?

# Overview of this Presentation

- What are the Roles of Crises as Motivators for People to Change to a Post-Fossil Carbon Society?

***What can we learn from history?***

***What can we learn from history?***

***What can we learn?***

*What can we learn from history?*

*What can we learn?*

*Can we learn?*

# What are the Roles of Crises as Motivators for People to Change to a Post-Fossil Carbon Society?

- Carson's "Silent Spring" – pesticides-(1962)
- Ozone layer thinning- halogenated substances-(1974 -1985)
- Bhopol – (1984)
- Colburn's "Our Stolen Future"- endocrine disrupters-(1995)
- Three Mile Island (1979) Chernobyl (1986) Fukishima (2011) Nuclear reactor meltdowns-
- Smogs and Climate Change (1930 – Present)
- http://www.worldwatch.org/brain/features/timeline/timeline.htm

# 危机

# Crisis

# 危

# Danger

wei

# 机

# Opportunity

Ji

# 危机

# Crisis

weiji

# Air Pollution Episodes

- Many of the air pollution challenges that have been addressed were chronic, long-term problems;
- Sometimes we also had short-term smog episodes (Crises!!??)
- Did they motivate us to change?

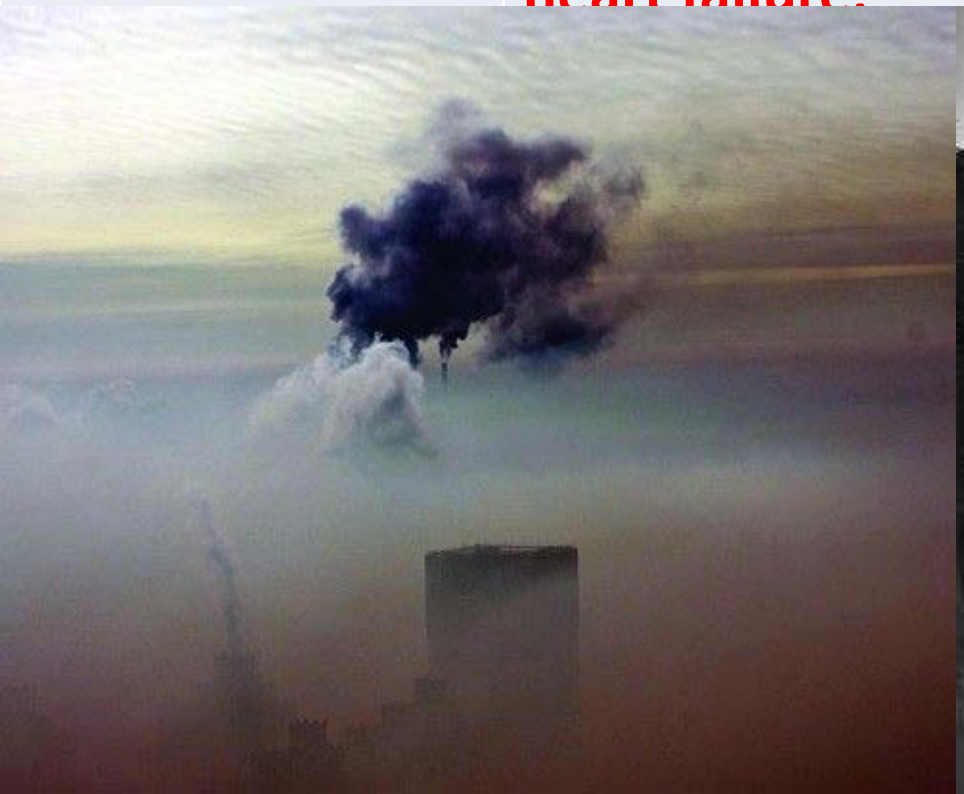
# Six of the Top Ten Environmental *Crisis Incidents* in 20th Century

| 1930.12 | Belgium | Meuse Valley fog |
|---|---|---|
| **Causes** | Combination of industrial air pollution and climatic conditions & pollutants: $SO_2$, $SO_3$, Particulates | |
| **Consequences** | Sixty-Three human deaths in one week; main symptom was dyspnea (shortness of breath); | |

| 1943 | Los Angeles, USA | Photochemical smog |
|---|---|---|
| Causes | Emissions of CH, NOx, CO from vehicles, emissions from oil refineries | |
| Consequences | 75% of the citizens were seriously affected by respiratory and eye infections, millions of trees died in the high mountains; $1.5 billion loss due to air pollution | |

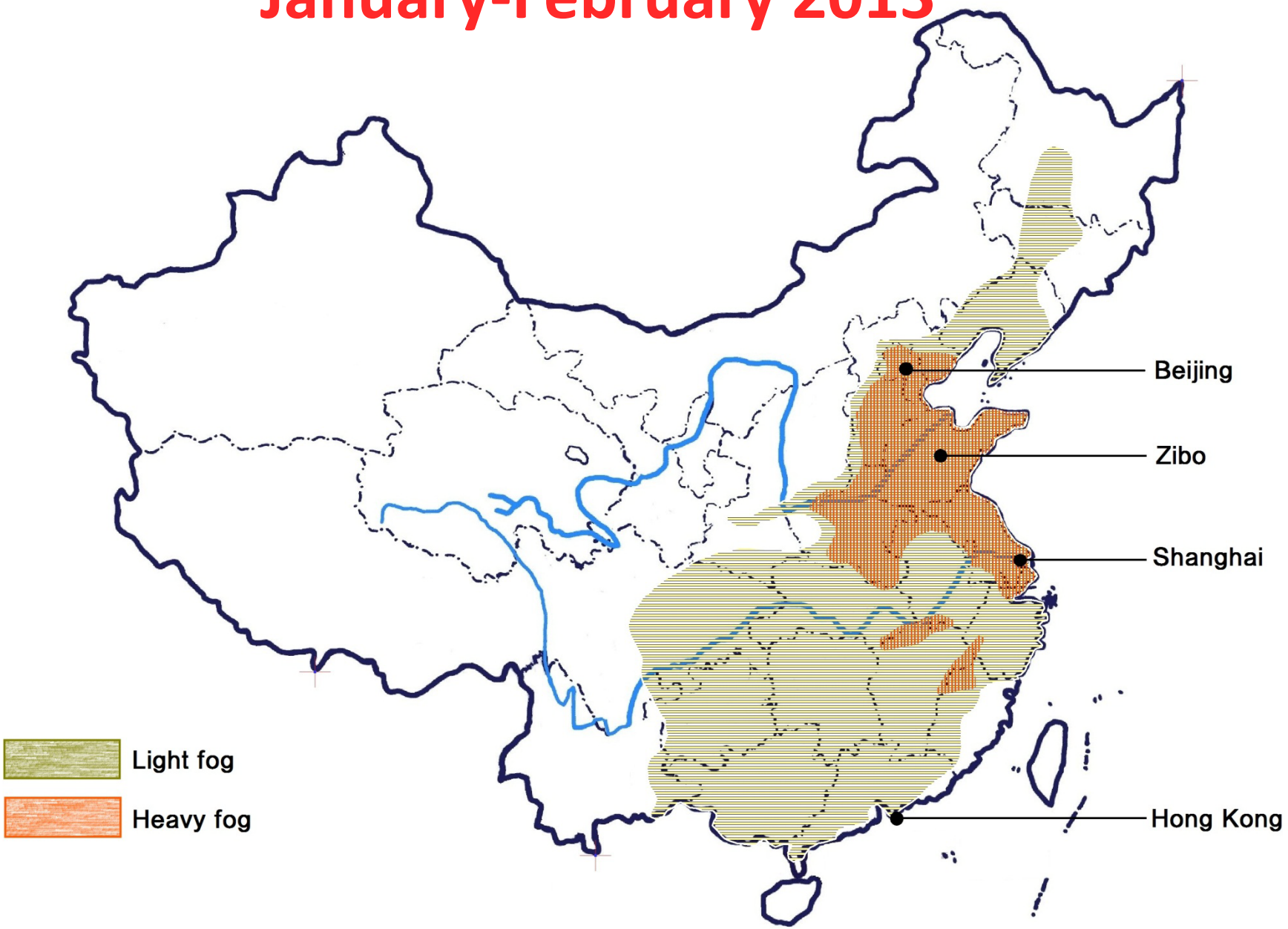
| 1948.10.16-21 | Pennsylvania, USA | Donora smog |
|---|---|---|
| **Causes** | The town lies in a valley with mountains on both sides; toxic gases such as SO2, NOx, HF were emitted from sulphuric acid and steel plants & accumulated in the valley due to a thermal inversion | |
| **Consequences** | Twenty human deaths and 14,000 severe illnesses; symptoms were eye diseases, respiratory and digestive diseases | |

| 1952.12.5-9 | London, UK | Great Smog |
|---|---|---|
| Causes | $CO_2$, CO, $SO_2$, TSP emissions from coal burning; vehicle exhaust—particularly from diesel-fuelled buses; & heavily polluted air from continental Europe | |
| Consequences | Four thousand human deaths in four days; symptoms: bronchitis, acute respiratory failure, heart failure. | |



| 1961 | Yokkaichi, Japan | Yokkaichi asthma |
| --- | --- | --- |
| Causes | SO2, TSP emissions from petrochemical processing facilities and refineries | |
| Consequences | Severe cases of obstructive pulmonary disease, chronic bronchitis, pulmonary emphysema, and bronchial asthma | |

# Great F(Smog) of China
# January-February 2013



Tian ‘an Men Square




The Oriental Pearl TV Tower

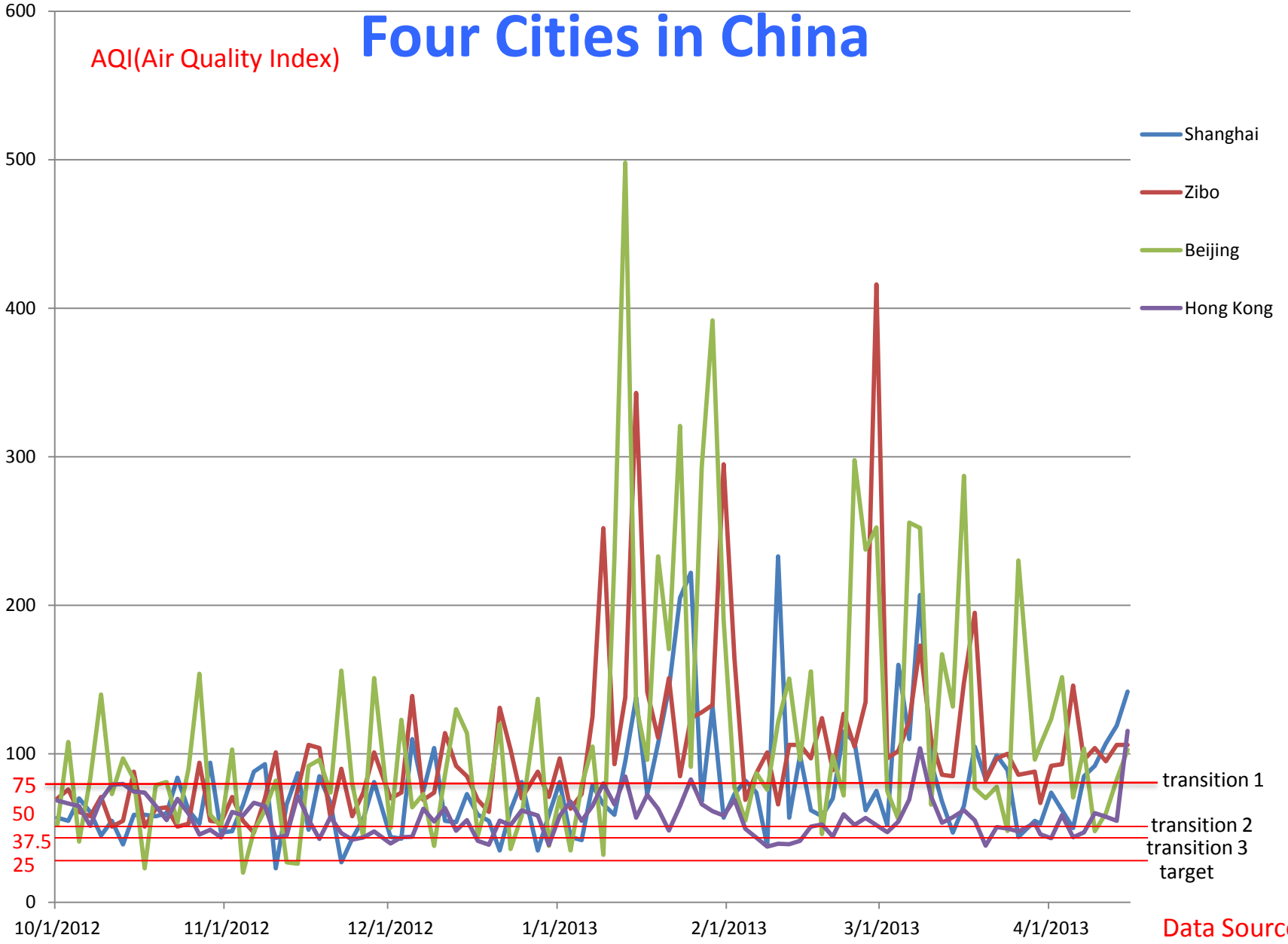
Zibo City




Shandong University

# Beijing's Sky 2012.3.1-2013.3.5 8:00-9:00

# The Air Quality Index of Four Cities in China



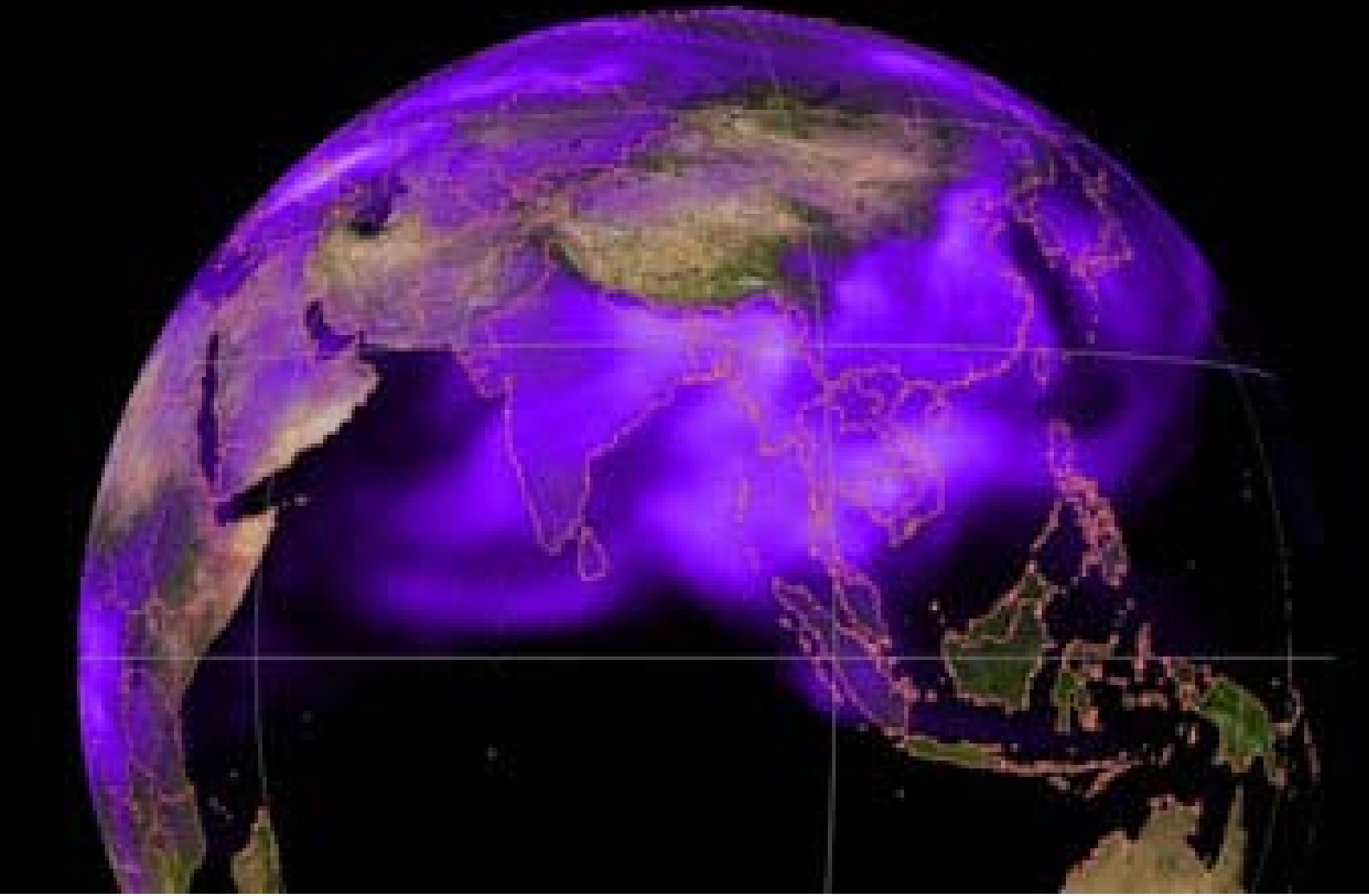

Data Source: EPA

# A few sources of air pollutants



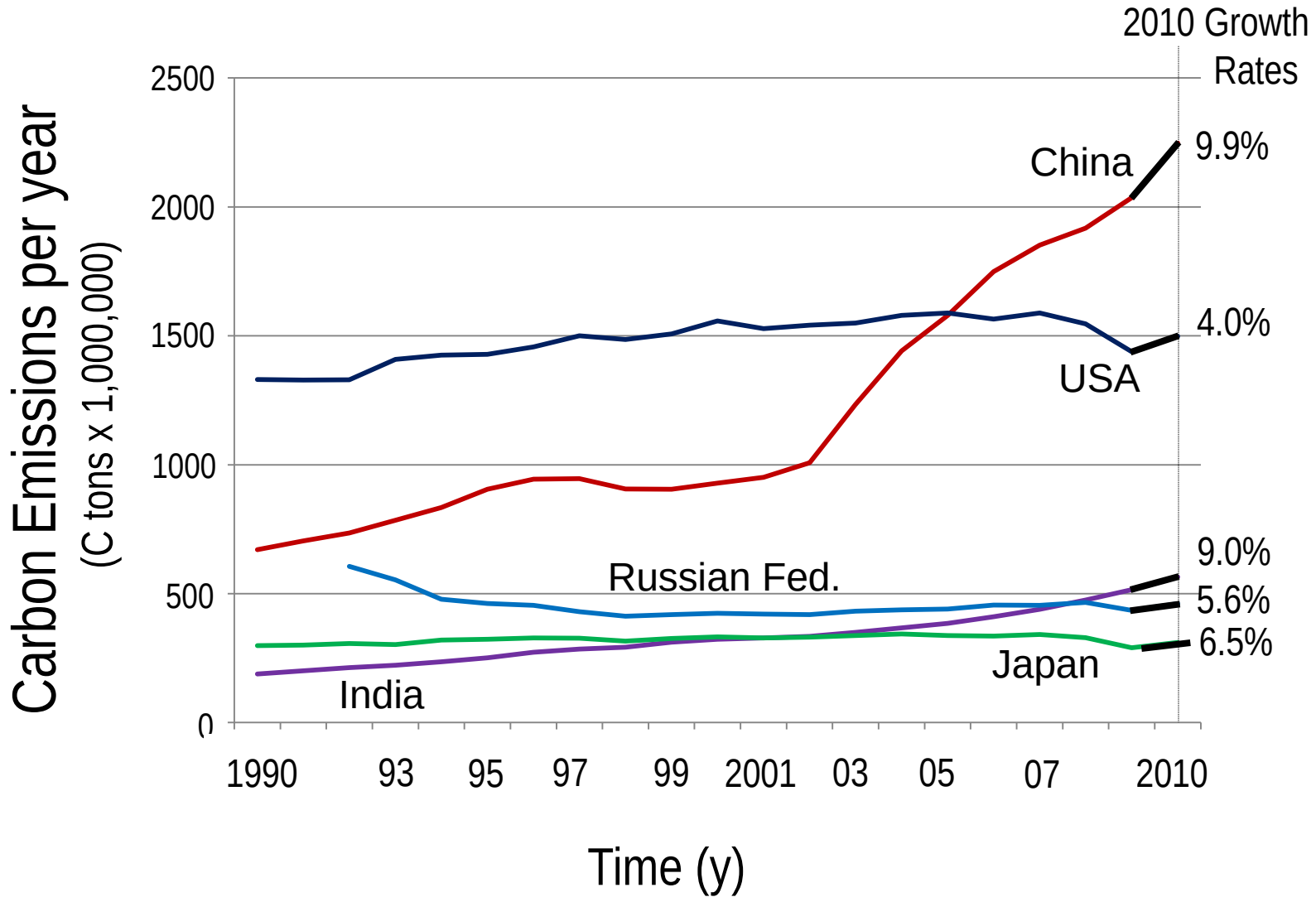
**Soot in exhaust spews out black carbon**

**Controlled burns release huge amounts of sooty black carbon into the atmosphere.**



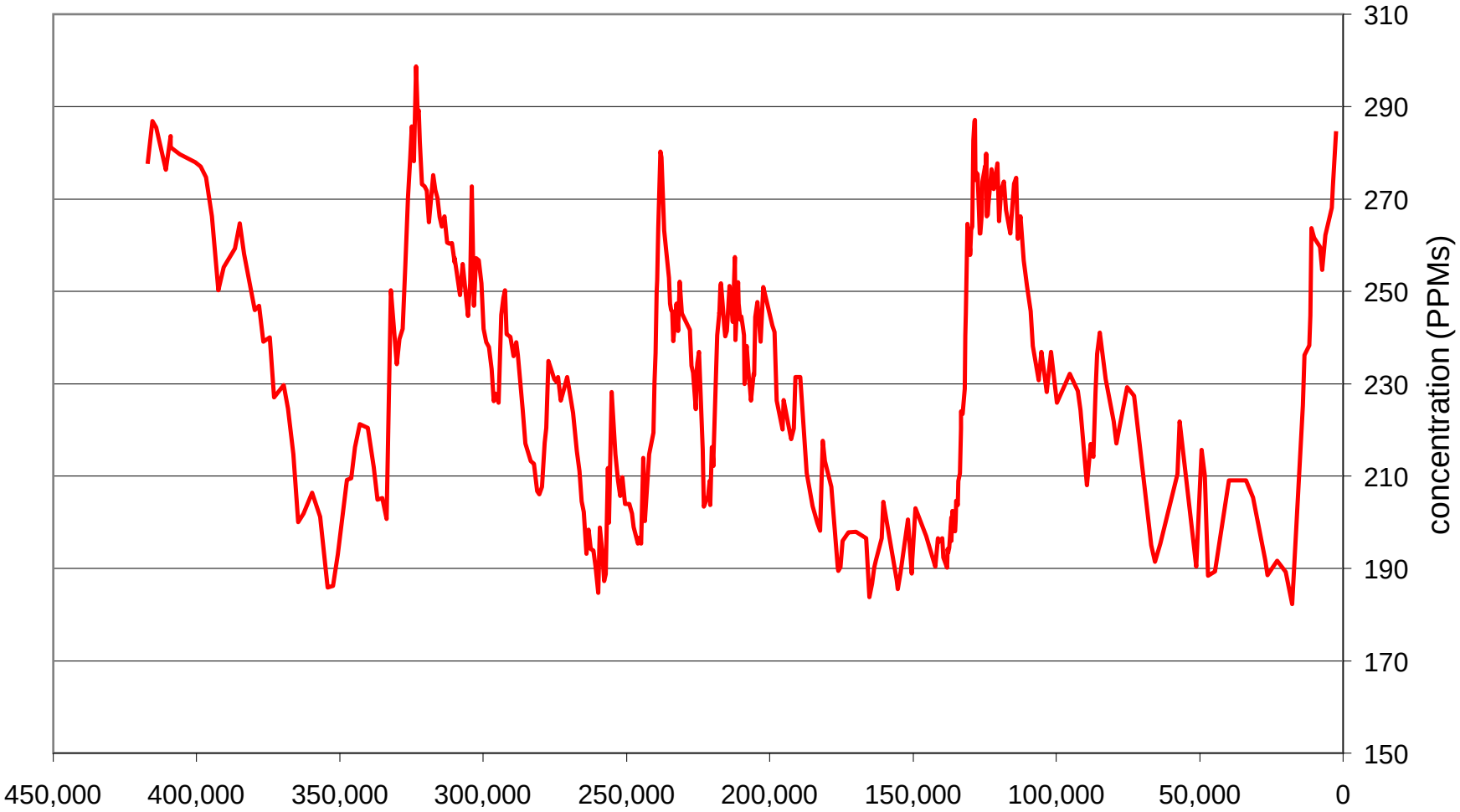
**Black carbon, a short-lived pollutant (shown in purple), shrouds the globe.**

# Fossil Fuel & Cement $CO_2$ Emissions: Top Emitters

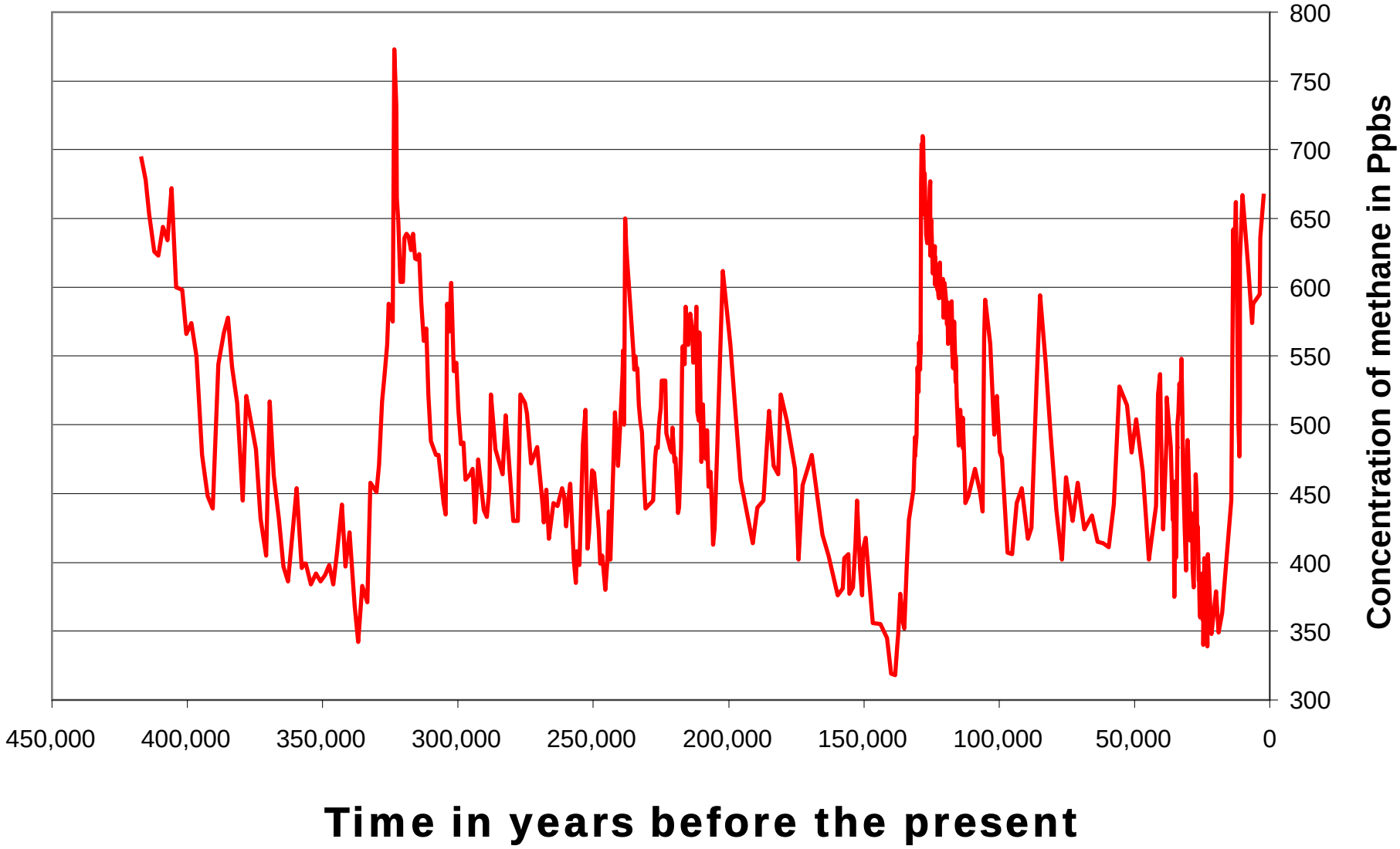



Global Carbon Project 2011; Peters et al. 2011 (in review); Data: Boden, Marland, Andres-CDIAC 2011

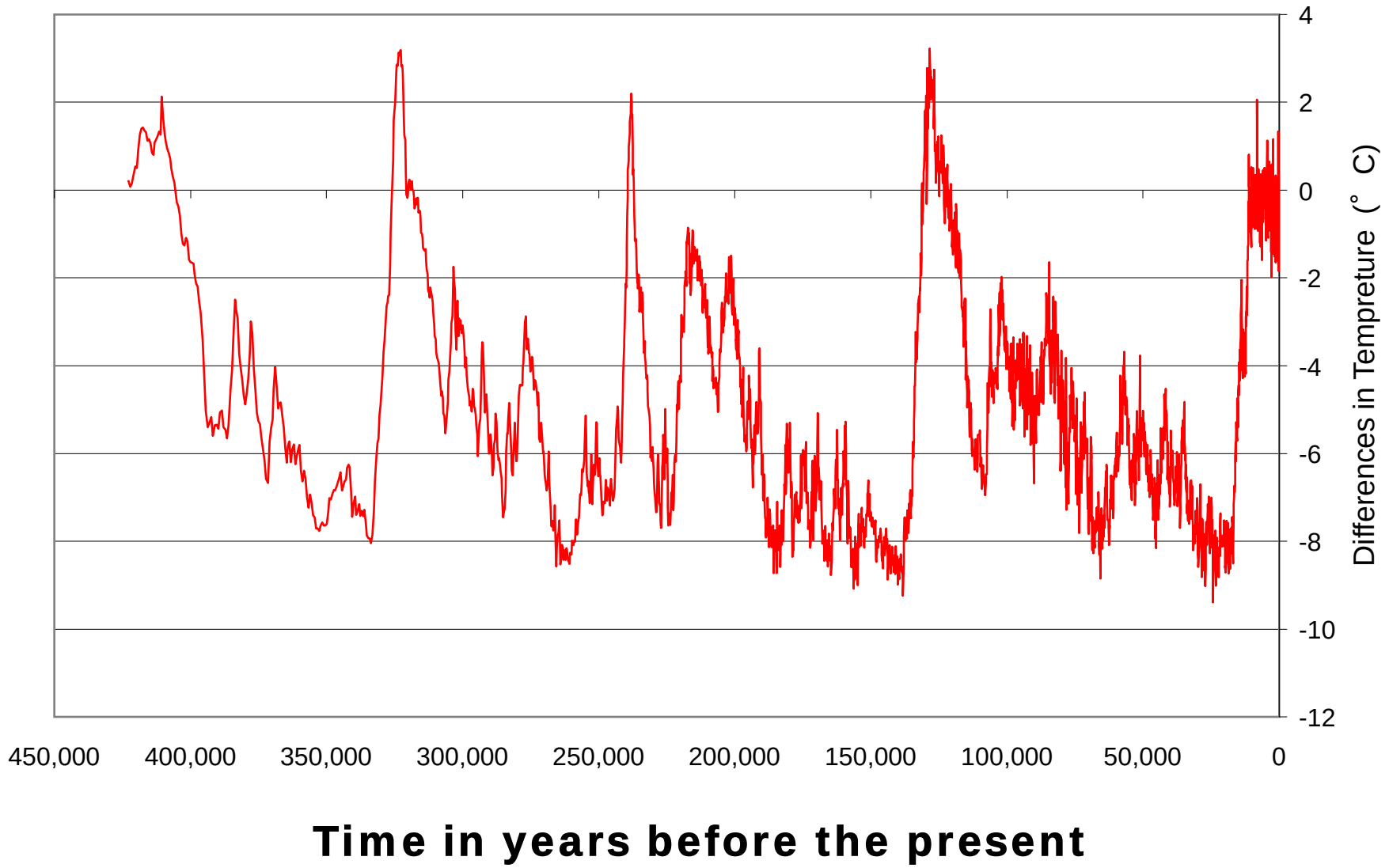
# Concentration of Carbon Dioxide in Antarctic ice



# Methane Concentration in the Antarctic ice



# Atmospheric Temperature Variations as Detected from the Antarctic ice



# Ranges and Concentrations during 450,000 years

- **Carbon dioxide concentration range =**
  **(185 – 295 PPM) (2012 *393* PPM)**
  **Projected by 2050 to**
  **be between *450 & 750* PPM!**

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- **Methane concentration range = (340 -760 PPB) (2004 *1700* PPB)**
  **Projected by 2050???**
- **The average temperature range during this period was 10° C.**

# Increase in Carbon Dioxide Concentration at Mauna Loa, Hawaii

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1880 285 ppm (Est.)

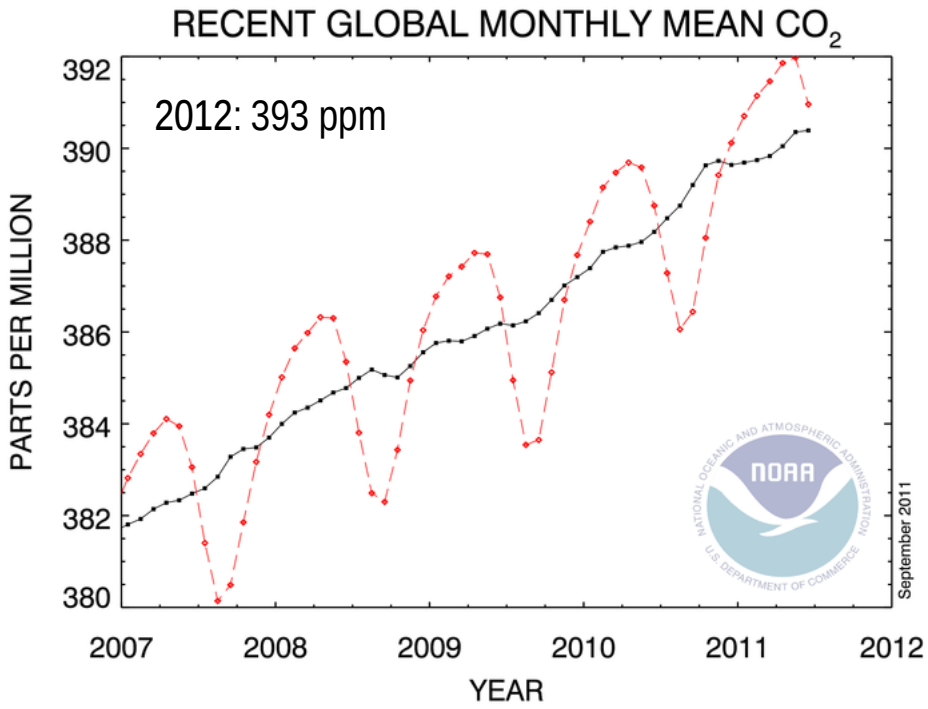
1958 315 ppm

2012 393 ppm

Increase of 108 ppm in 132 years

= ***.82 ppm/yr.***

# Atmospheric $CO_2$ Concentration




Annual Mean Growth Rate (ppm $y^{-1}$)

| | |
|---|---|
| 2010 | 2.37 (3x) |
| 2009 | 1.63 |
| 2008 | 1.81 |
| 2007 | 2.11 |
| 2006 | 1.83 |
| 2005 | 2.39 |
| 2004 | 1.58 |
| 2003 | 2.20 |
| 2002 | 2.40 |

Annual Growth Rates (decadal means)

1970 – 1979: 1.3 ppm $y^{-1}$

1980 – 1989: 1.6 ppm $y^{1}$

1990 – 1999: 1.5 ppm $y^{-1}$

2000 - 2010: 1.9 ppm $y^{-1}$

Data Source: Thomas Conway, 2011, NOAA/ESRL + Scripts Institution

# News, May 12, 2013

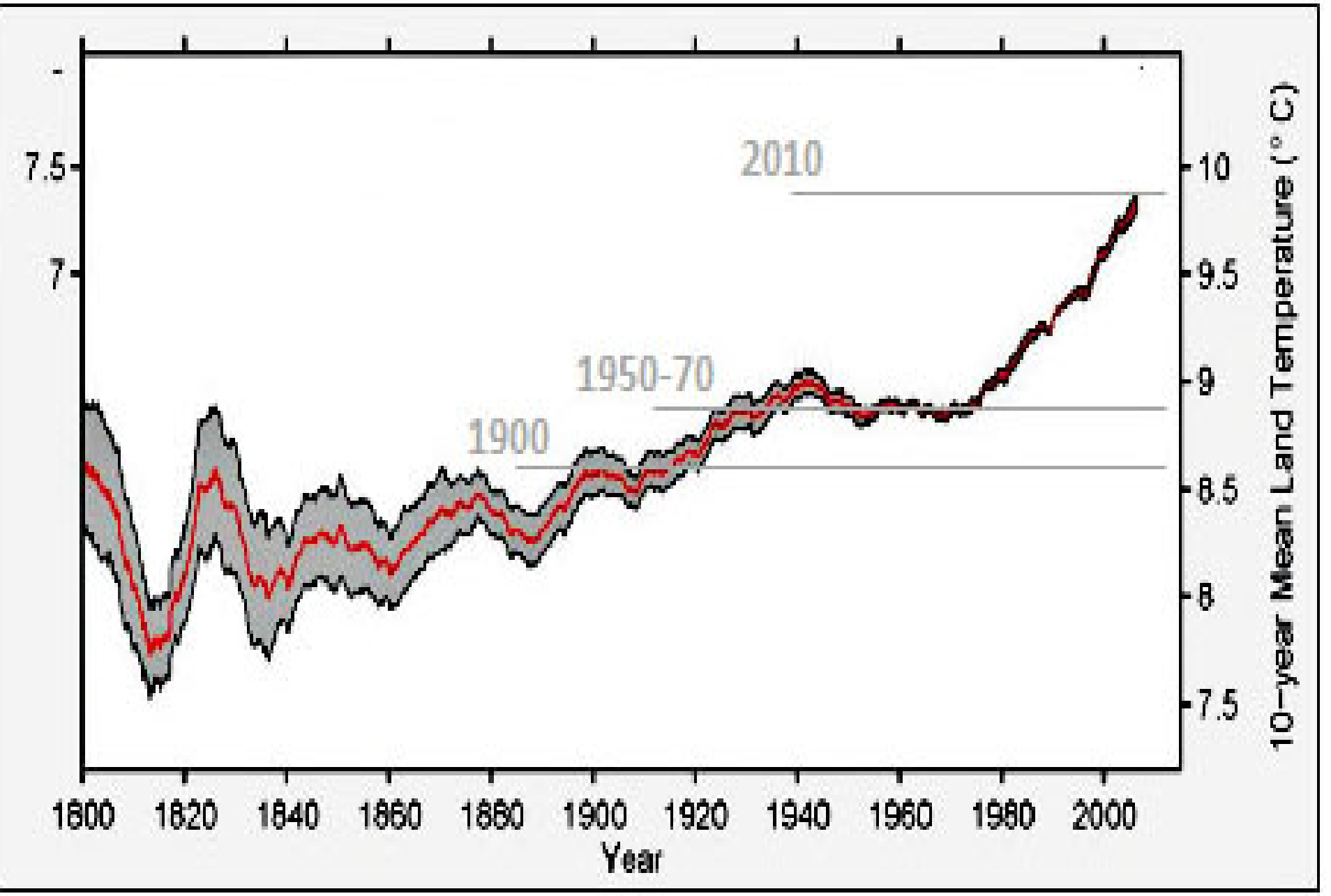
- ***400 PPM Carbon Dioxide!***
- **Mauna Loa, Hawaii**
- ***Which is the highest it has been in the last***
- ***two million years!***

**What is the net quantity of carbon dioxide that is being added each day to the atmosphere, globally?**

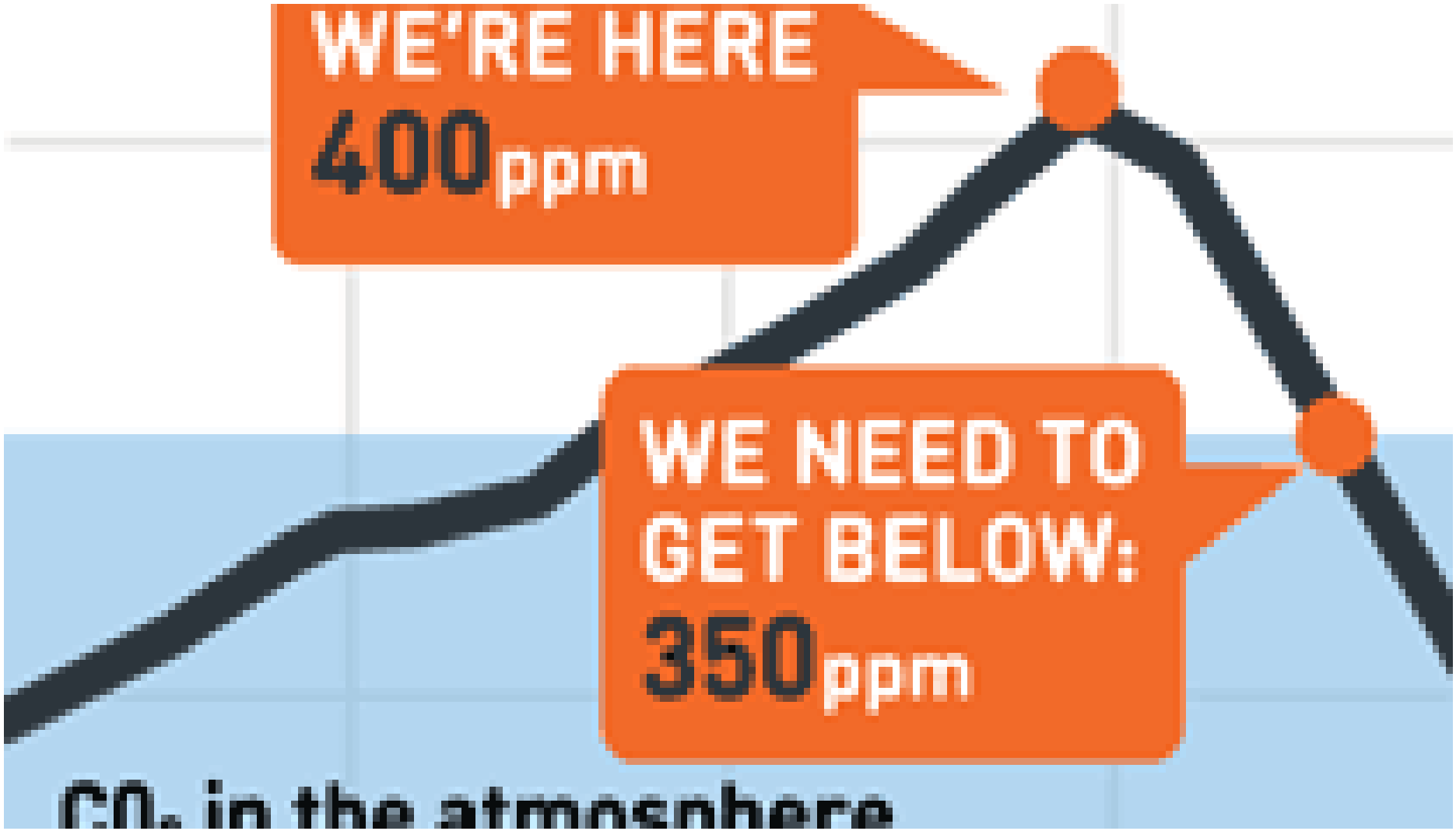
**What is the net quantity of carbon dioxide that is being added each day to the atmosphere, globally?**

**Estimates vary from 100,000,000 tons per day to more than 1,000,000,000 tons per day!**

# Increasing Average Temperatures



# 285, 400, 350 PPM Carbon Dioxide in the Atmosphere



# The Earth is Shrinking!!!

- **The Human Population continues to increase:**
  - **70,000,000 per year!**
  - **That means in 13X the entire population of Finland are added to the earth each year!**

  - **From, "The Earth is Shrinking: Advancing deserts and Rising Seas Squeezing Civilization,"**
    **by Lester Brown**
    **http://www.earthpolicy.org/updates/2006/update61.htm**

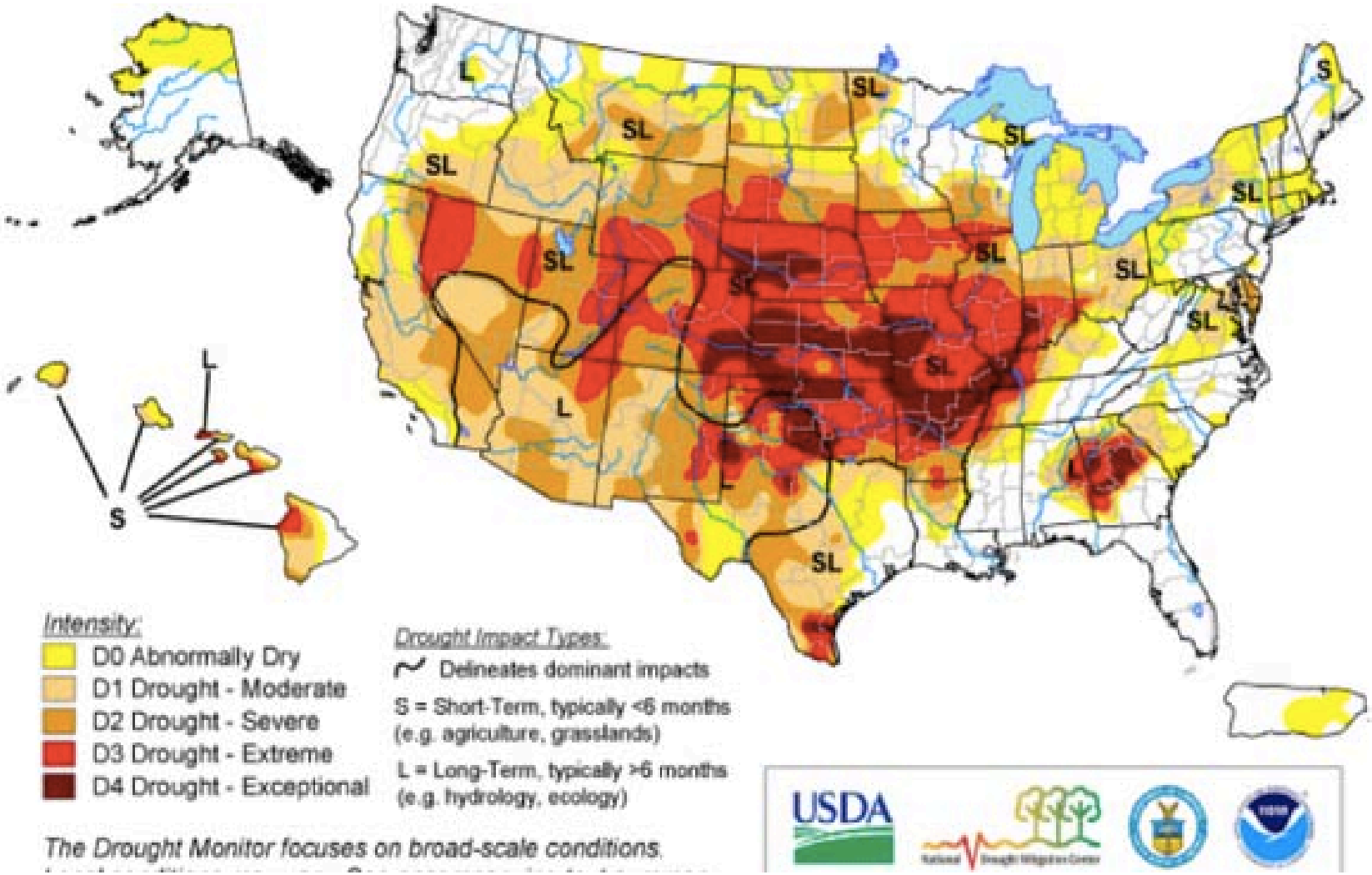
# The Earth is Shrinking!!!

- **Desserts are spreading;**
  - **China is losing productive land to deserts at an accelerating rate**
    - **1950 – 1975 they lost 1,560 sq. km/yr..**
    - **By 2000 they lost 2,480 sq. km/yr.**
  - **In recent years Afghanistan lost 100 villages and Iran lost 124 villages due to advancing desserts;**

# The Earth is Shrinking!!!

- Nigeria had a 4x increase in population from 33 million to 134 million between 1950 and 2006;
- At the same time it had an 11x increase in domestic animal population and lost 3,400 sq. km to deserts;
- *Does anyone see any problems?*
- *What do you think should be done?*

# Drought Index U.S. August 2012



Half of the world's forests have been destroyed by human activity. *Annually*, 9 million hectares of forests are being cut; ***this is an area equal to the size of Portugal!!***


MAN

Over-pumping of aquifers is common on all continents except Antarctica!

20% of coral reefs have been destroyed.

60% are severely threatened.

# The Shellfish Know Climate Change is Real

- The pH of Seawater is approximately 8.2
- Shellfish and Corals use calcium carbonate to make shells/skeletons
- At pHs below 8.1 they have difficulty making these structures;
- Coral dieoff is occurring and oysters, clams are decreasing, causing economic and environmental impacts;

# The Shellfish Know Climate Change is Real

- These filter feeders perform numerous ocean cleaning functions;
- If we continue to increase the global carbon dioxide concentrations, by 2100, the ocean's pH could be 7.8 worldwide and these species may totally disappear from our eco-system!

66% of oceanic fisheries are fished at or beyond their sustainable yields!

**We are now in a period of mass species extinction.**

**104 species become extinct every day!**

***We must find solutions for these problems?***

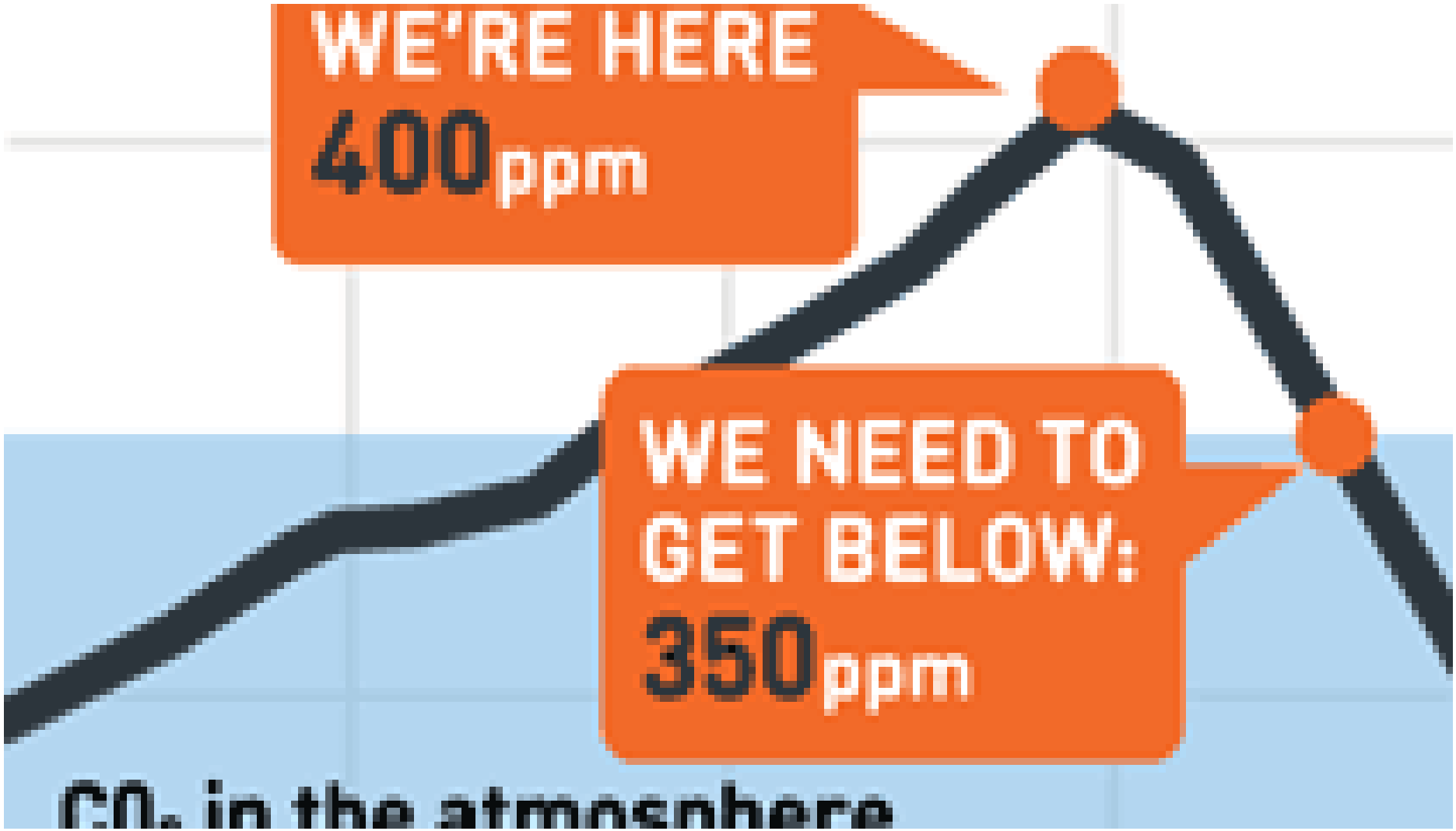

[Chasing Ice - A documentary about receding glaciers]

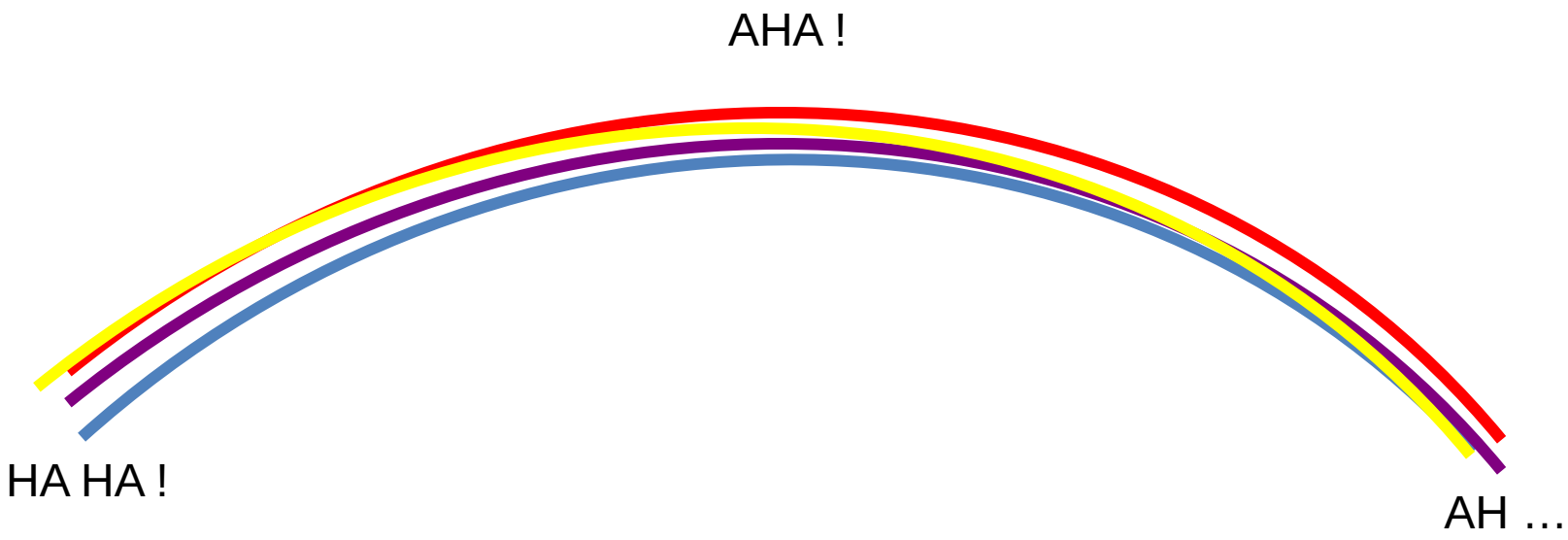
**http://www.imdb.com/title/tt1579361/**

# The Earth is Shrinking!!!

- ***With the melting of ice globally, some scientists project that we will have 1- 3 meters of sea level rise.***
- ***What will that mean for thousands of cities and for hundreds of millions of people, globally?***
- ***What will that mean for food security and and and?***

# 275, 400, 350 PPM Carbon Dioxide in the Atmosphere






# “haha-aha-ah” curve

-after Arthur Koestler

# Have These Crises Stimulated us to Make the Essential Changes?

# What is Ahead on our Road to the Future?

# Overview of this Presentation

- **What are the Roles of Good Examples to Motivate People to Change to a Post-Fossil Carbon Society?**

Foul & Flee

Dilute & Disperse

Concentrate & Contain

End-of-pipe Treatment

**Preventive Approaches**

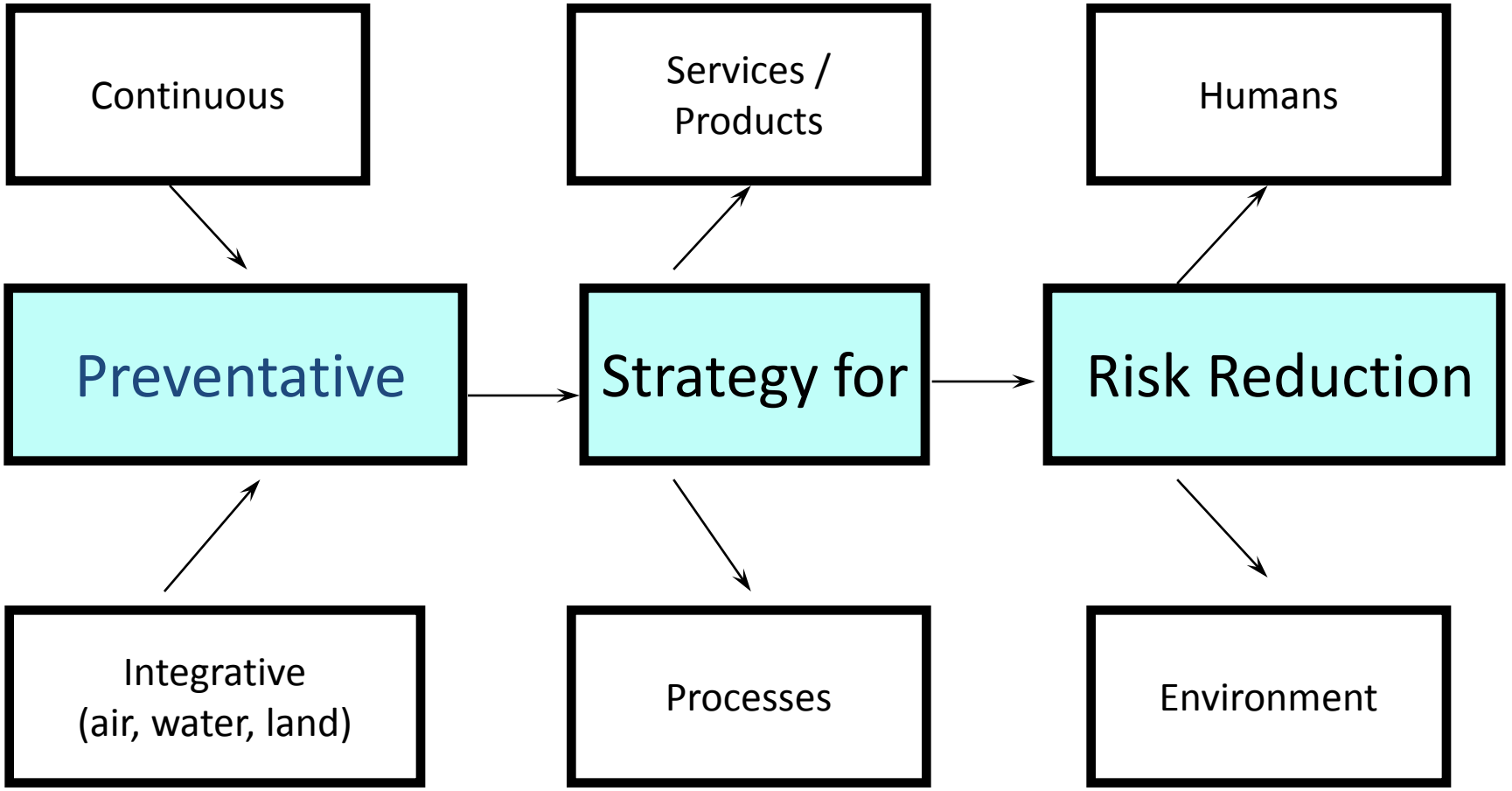
Cleaner Production

Cleaner Products

Sustainable Production & Consumption

**Sustainable Communities & Regions**

# Essential Elements of a Cleaner Production Strategy




Source: United Nations Environment Programme Industry and Environment

# ……CP is accomplished by…..

- Product modifications and changes;
- Input substitutions;
- Process modifications and changes;
- Modifications and changes in operational practices;
- Reuse of materials;
- On site recycling;

# A Norwegian Pulp and Paper Company

*Examples of Phases of Environmental Protection*

# Dilution is the Solution to Pollution

- Build a 23 km long pipe, 1.5 meters in diameter
- Cost: 100,000,000 NOK

# Pollution Control is the Solution to Pollution

- Build a waste water treatment plant
- Cost: 32,000,000 NOK
- Operating cost: 8,000,000 NOK/year

# Cleaner Production is Solution to Pollution

- Incorporate a series of procedural and technical changes within the facility
- Cost: 10,000,000 NOK

# Results of Implementation of Cleaner Production Options

- Saved 5,000,000 NOK/year on chemicals;
- Saved 10,000,000 NOK/year on energy;
- Saved 8,000,000 NOK/year due to increased productivity;

# Summary

- **Cleaner Production options paid for themselves in less than 5 months.**
- **All other approaches had built-in annual *costs*.**
- **Cleaner Production options resulted in more environmental quality improvement than *wastewater treatment would have done!!!***

# Cleaner Production in 'Project Catalyst'

- **Fourteen companies in the Mersey River Basin of the U.K. were to be closed by the authorities due severe noncompliance;**
- **We worked to help them help themselves to implement CP;**

# Project Catalyst Waste Reduction

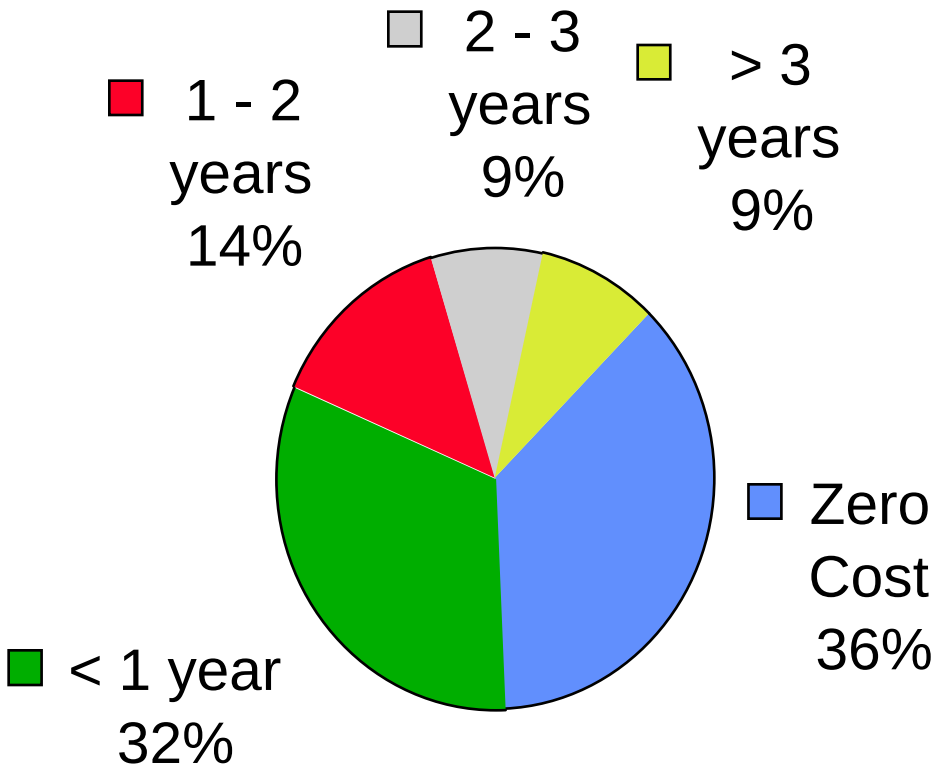
## Opportunities and Benefits

- 149 ways to reduce material inputs that saved £4.6 million
- 121 ways to reduce operating costs that saved £3 million
- 107 ways to reduce water consumption that saved £1.8 million
- 101 ways to cut energy use that saved £1.9 million

Source: Project "Catalyst" U.K. 1994

# Project Catalyst: Waste Reduction Payback Periods

## Percentages of Options by Payback Period




Source: Project “Catalyst” U.K. 1994

# Finding Prevention Options

- Leadership from both line and staff department
  - 3 times as many options
- Employee involvement
  - 2 times as many options
- Cost accounting system
  - 3 times as many options

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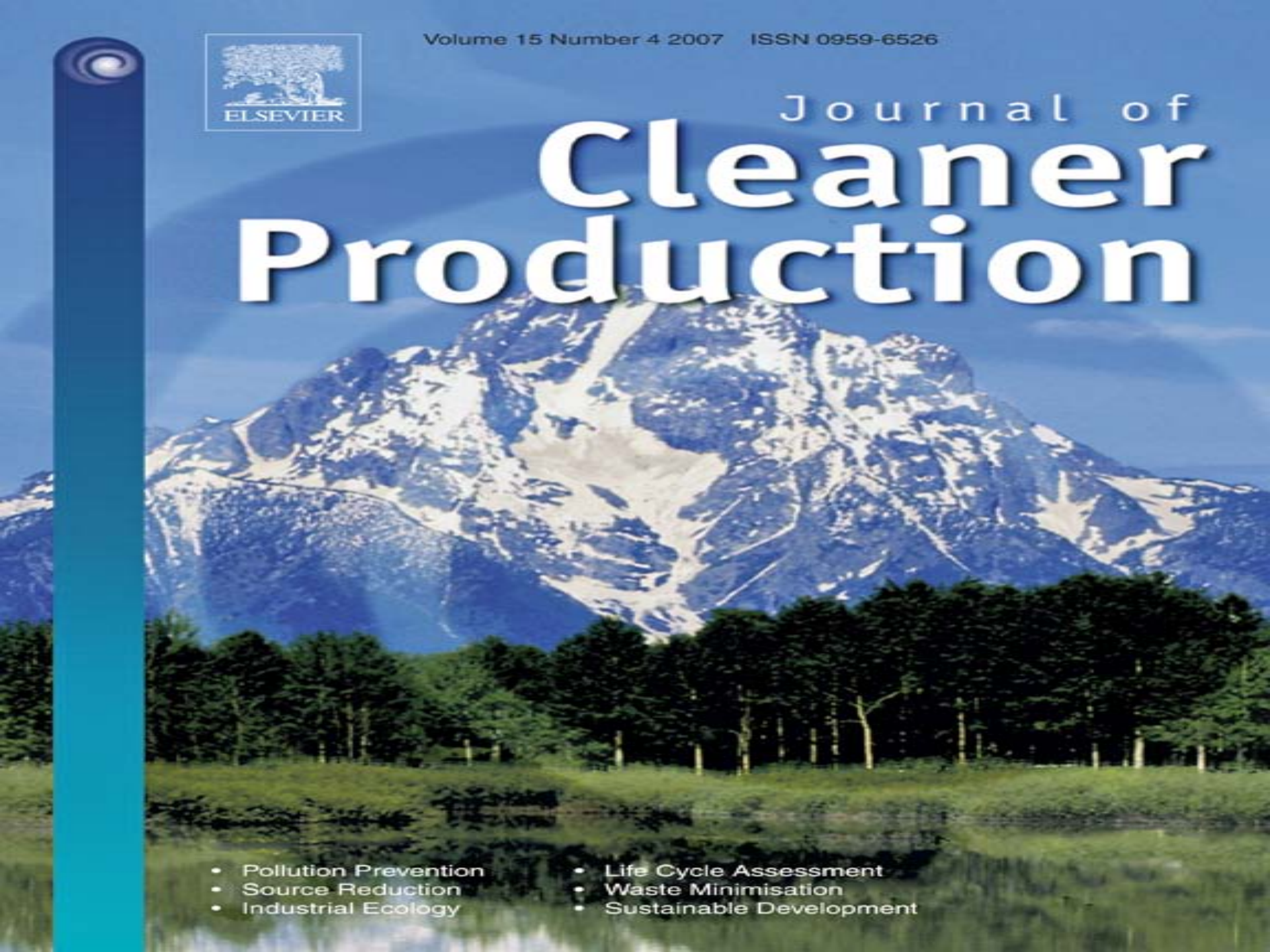
# Journal of Cleaner Production



- Pollution Prevention
- Source Reduction
- Industrial Ecology
- Life Cycle Assessment
- Waste Minimisation
- Sustainable Development

# The Chinese Government is Encouraging its citizen's Involvement with the Approach:

***"Transformation to an Ecologically Sound Society as the Model for our Future Development"***

# Jeremy Rifkin's,
# "The Third Industrial Revolution"

- **Society built upon energy efficiency and renewable energy;**

# Jeremy Rifkin's, "The Third Industrial Revolution"

- Society built upon renewable energy;
- Buildings serve as mini-power plants, which feed into the smart, decentralized energy grid;

# Jeremy Rifkin's, "The Third Industrial Revolution"

- Society built upon renewable energy;
- Buildings designed to serve as mini-power plants that feed electrical energy into the decentralized energy grid;
- Energy stored as hydrogen or in electric vehicle batteries;
- Smart energy internet grid distribution system.


Changes are
happening all
over the world!

# Through ISO and GRI-related efforts

- The ISO series of ISO 9000, 14000, 18000, 26000 and others help company leaders to reduce risks, waste and environmental damages;
- The Global Reporting Initiative and Advances in Corporate Social Responsibility Reporting;

# Through Current ISO/TC 268 Efforts

- **Sustainable Development of Regional Sustainable Management;**
- **Development of Smart/Sustainable City Indicators and Indices**

# Through International Scientific Journals

- The International Journal of Industrial Ecology;
- The International Journal of Life Cycle Assessment;
- The International Journal of Environmental Management;
- The International Journal of Sustainability in Higher Education;

# Through International Scientific Journals

- The Journal of Cleaner Production that was founded in 1992, is now published in twenty-four volumes per year;

- Prof. Donald Huisingh
- Editor-in-Chief
- Journal of Cleaner Production
- http://ees.elsevier.com/jclepro/default.asp

- The Impact factor for 2012 for the
- Journal of Cleaner Production is: 3.398

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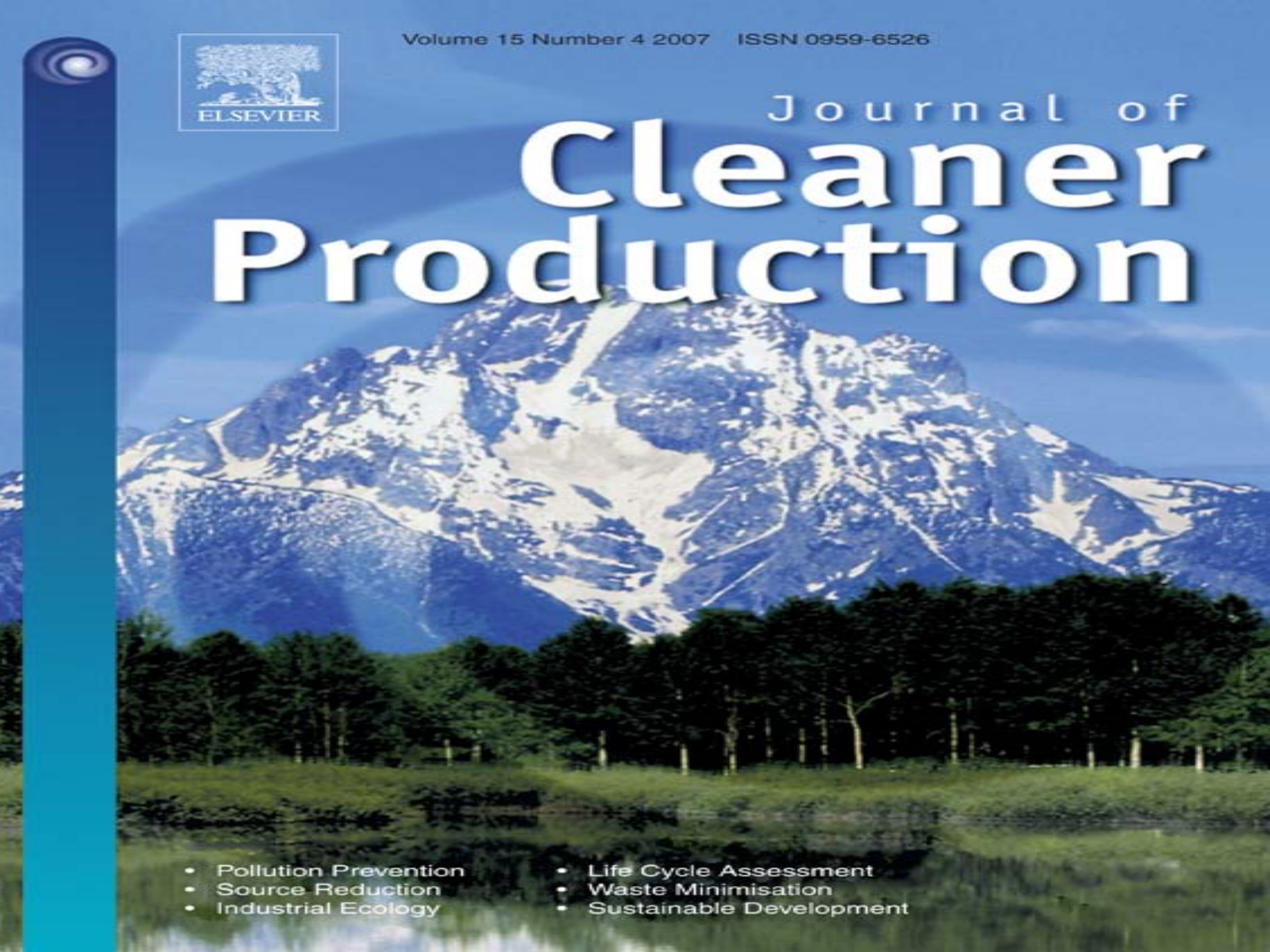

- Pollution Prevention
- Source Reduction
- Industrial Ecology
- Life Cycle Assessment
- Waste Minimisation
- Sustainable Development

# Some Special Issues of the Journal of Cleaner Production

- Sustainable Fisheries;
- Sustainable Agriculture;
- Sustainable Tourism;

# Some Special Issues of the Journal of Cleaner Production

- Innovation and Innovation Diffusion;
- Sustainable Transportation;

# Some Special Issues of the Journal of Cleaner Production

- Sustainable Production and Consumption;
- Extended Producer Responsibility (EPR);

# Some Special Issues of the Journal of Cleaner Production

- Innovations in:
  - Green Chemistry;
  - Green Engineering;
  - Green Buildings;
  - Global Supply Chain Management;
  - Green Employment;
  - Green/Sustainable Regional Issues

# Some Special Issues of the Journal of Cleaner Production

- Sustainable Urban Transformation;

# Some Special Issues of the Journal of Cleaner Production

- Sustainable Urban Transformation;
- Climate Co-benefits in Urban Asia

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- Women, Water, Waste, Wisdom and Wealth;
- Urban and Landfill Mining;

# Journal of Cleaner Production
# Calls for Papers

- **Moving Towards an Ecologically Sound Society: With Special Focus on Preventing Future Smog Crises in China and Globally**
- **Carbon Emissions Reduction: Policies, Technologies, Monitoring, Assessment and Modeling**

- http://www.journals.elsevier.com/journal-of-cleaner-production/call-for-papers/

# Journal of Cleaner Production
# Calls for Papers

- **Systematic leadership towards sustainability**
- **Decision-support models and tools for helping to make real progress to more sustainable societies**

- http://www.journals.elsevier.com/journal-of-cleaner-production/call-for-papers/

# Journal of Cleaner Production
# Calls for Papers

- **Toward a Regenerative Sustainability Paradigm for the Built Environment: from Vision to Reality**
- **Tourism and Sustainability**

- http://www.journals.elsevier.com/journal-of-cleaner-production/call-for-papers/

# Overview of this Presentation

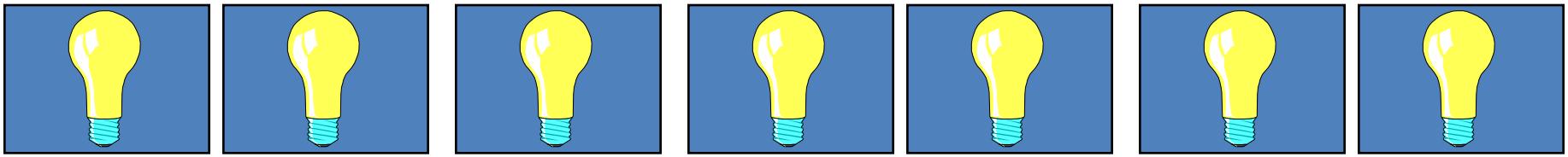
- **What are the Roles of Alternative Paradigms and Indicators as Motivators for People to Change to a Post-Fossil Carbon Society?**

#@!?, #@!?, #@!?, #@!?, #@!?, #@!?,

# Problem Multipliers

# vs.

# Solution Multipliers



# Changing our Ways of Thinking & Acting

If mankind is to survive,
we shall require a
substantially new
manner of thinking.

*Albert Einstein*

# Changing our Ways of Thinking & Acting

We must begin to see the possibility of evolving a new lifestyle, with new methods of production and new patterns of consumption; *a life-style designed for permanence*.

*E. F. Schumacher*

# Sustainable Development In Higher Education Requires Us to Adopt

- **New thinking;**

# Sustainable Development In Higher Education Requires Us to Adopt

- New thinking;
- New paradigms;

# Sustainable Development In Higher Education Requires Us to Adopt

- New thinking;
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- New thinking;
- New paradigms;
- New policies;
- New technologies;
- New management;
- New cooperation;

# Sustainable Development In Higher Education Requires Us to Adopt

- New thinking;
- New paradigms;
- New policies;
- New technologies;
- New management;
- New cooperation;
- New values.

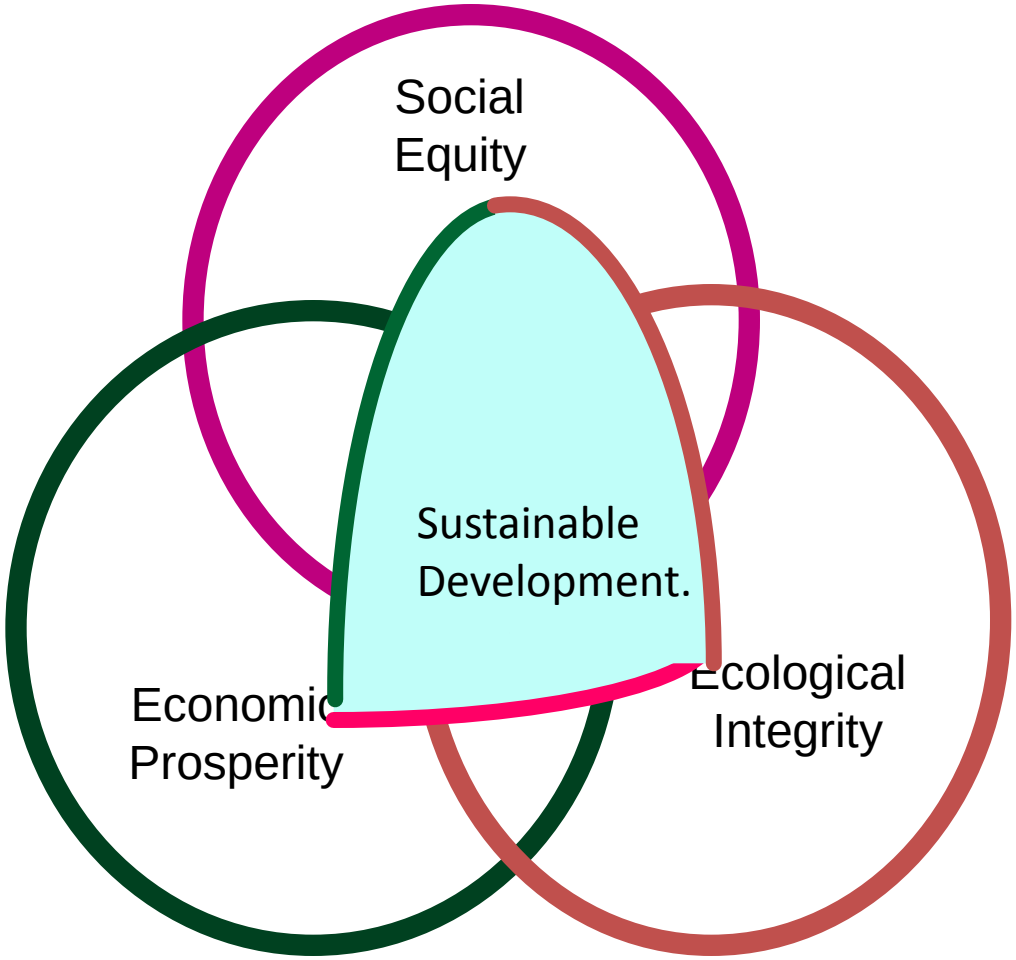
# Some Special Issues of the Journal of Cleaner Production

- Eleven Special Issues have been published on:

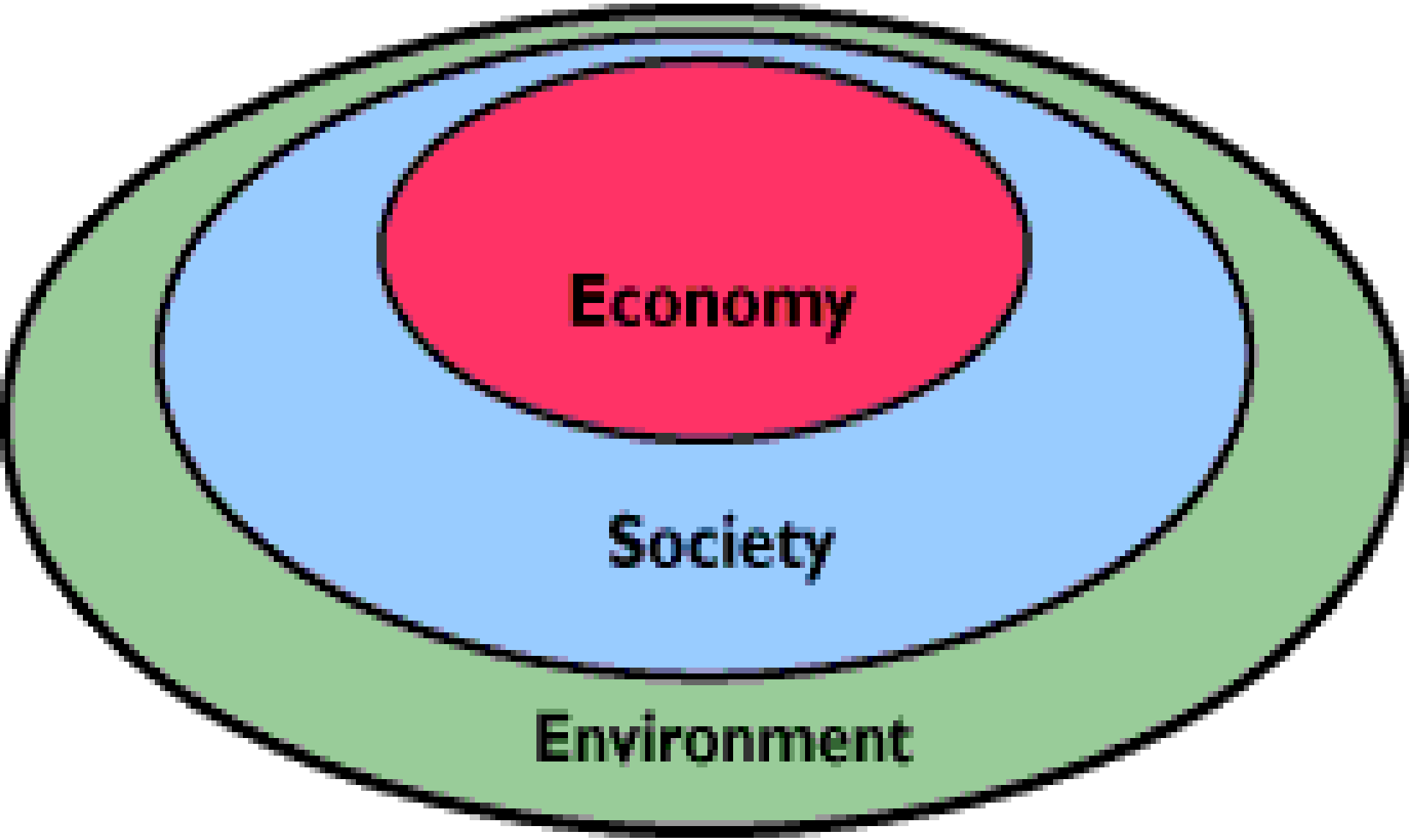
Education for Sustainable Societies


Changes are
happening all
over the world!

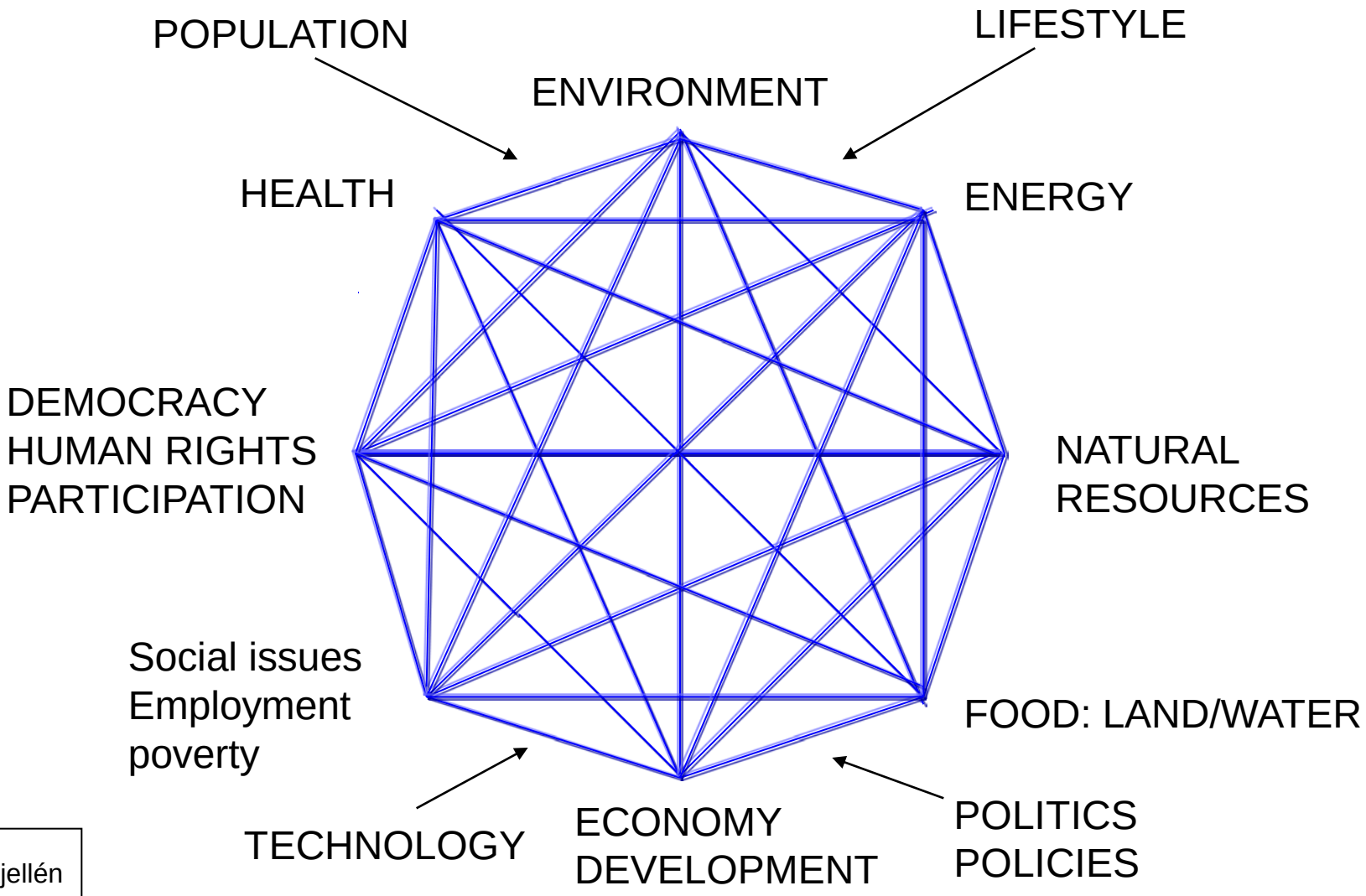
# Sustainable Development



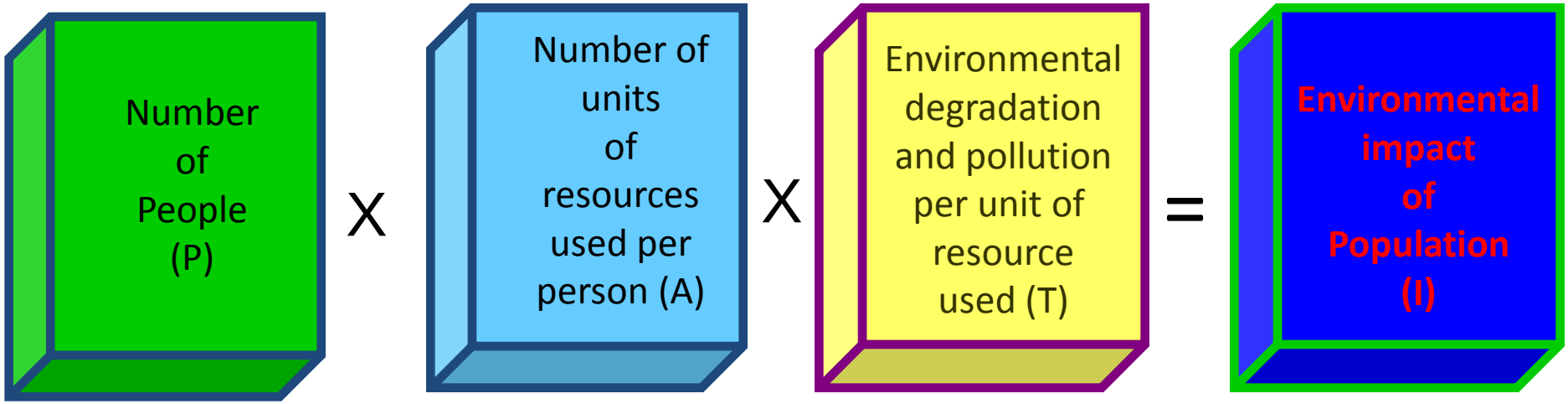
# Sustainable Development?

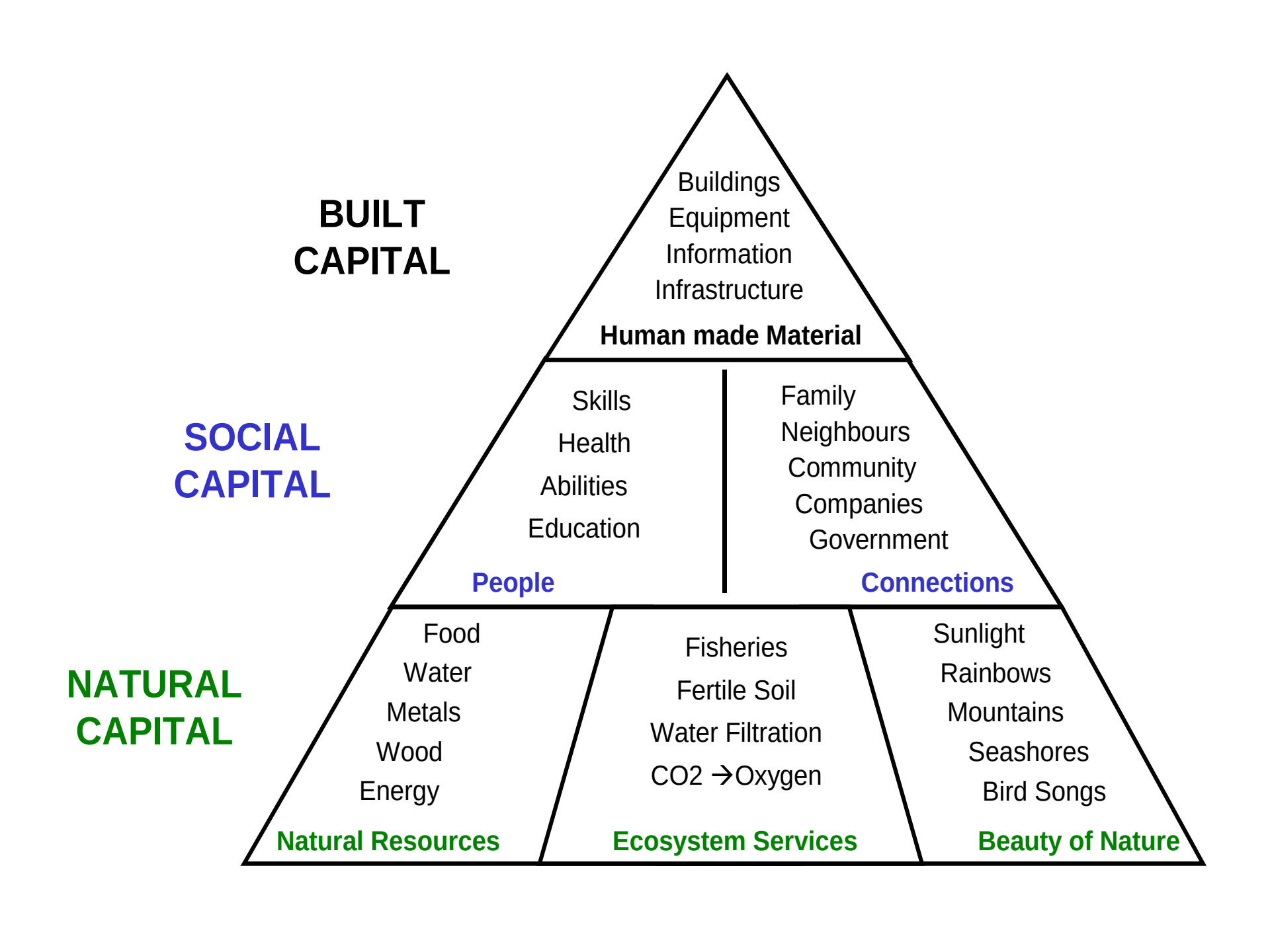


# Diamond of Sustainability



# Interconnectedness of Population, Affluence & Technology




BUILT CAPITAL
SOCIAL CAPITAL
NATURAL CAPITAL
Buildings
Equipment
Information
Infrastructure
Human made Material
Skills
Health
Abilities
Education
People
Family
Neighbours
Community
Companies
Government
Connections
Food
Water
Metals
Wood
Energy
Natural Resources
Fisheries
Fertile Soil
Water Filtration
CO2 →Oxygen
Ecosystem Services
Sunlight
Rainbows
Mountains
Seashores
Bird Songs
Beauty of Nature

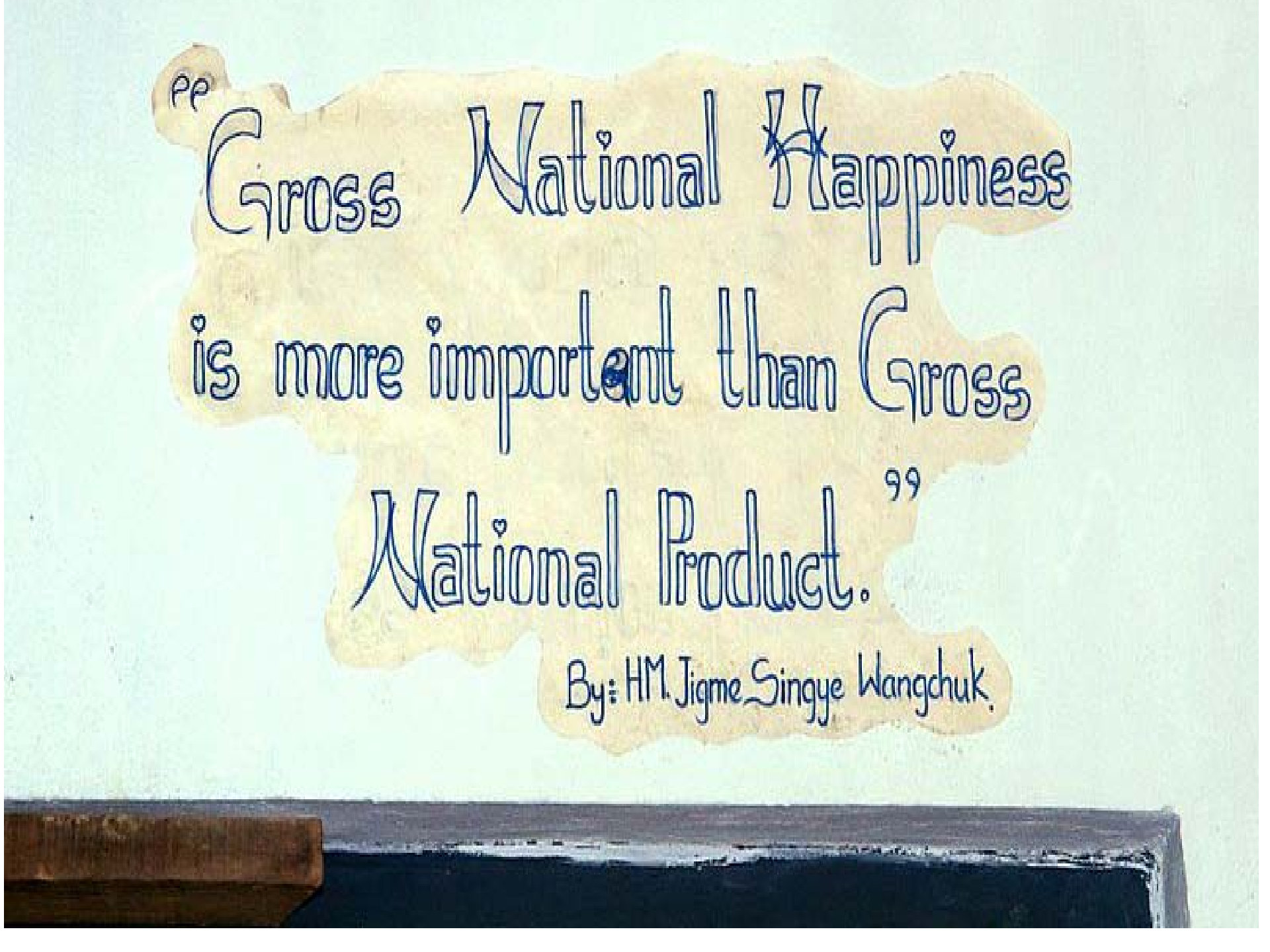
# Trans Generational Perspectives

# A Brief History of Preventive Environmental Protection

- Agenda 21;
- The Earth Charter;
- Millennium Development Goals
- The Precautionary Principle;
- The Natural Step Principles;
- The Melbourne Principles;
- The Decade of Education for Sustainable Development (EfSD) 2005 – 2014;
- The Equator Principles for Sustainable Finance.

# Alternatives to Gross National Product (GNP) or Gross Domestic Product (GDP)

- The Happiness Index (HI);
- The Quality of Life Index (QoLI);
- The Wellness Index (WI);
- The Inclusive Wealth Index (IWI);
- World Happiness Index (WHI);
- The Happy Planet Index;
- The Gallup World Poll (QWP);
- The World Values Survey (WVS)
- The European Social Survey (ESS)
- The OECD Better Life Index
- The UNDP's Human Development Index (HDI);
- The True Sustainability Index;
- Country Futures Indicators;
- Human Development Index (HDI);
- The Calvert-Henderson Quality of Life Indictors;
- The Canadian Index of Well-Being.


"Gross National Happiness
is more important than Gross
National Product."
By: HM. Jigme Singye Wangchuk.

# Bhutan's Four Pillars of Gross National Happiness

1. Good Governance
2. Balanced Economic Development
3. Environmental Preservation
4. Preserve and Promote Culture

# A Psychologist used an Index to Rank Country's People's Happiness

The 20 happiest nations in the World are:

1. Denmark
2. Switzerland
3. Austria
4. Iceland
5. The Bahamas
6. Finland
7. Sweden
8. Bhutan
9. Brunei
10. Canada
11. Ireland
12. Luxembourg

- 13. Costa Rica
  14. Malta
  15. The Netherlands
  16. Antigua and Barbuda
  17. Malaysia
  18. New Zealand
  19. Norway
  20. The Seychelles
- Other notable results include:
- 23. USA
  35. Germany
  41. UK

# Worldwide Support for True Wealth Measures

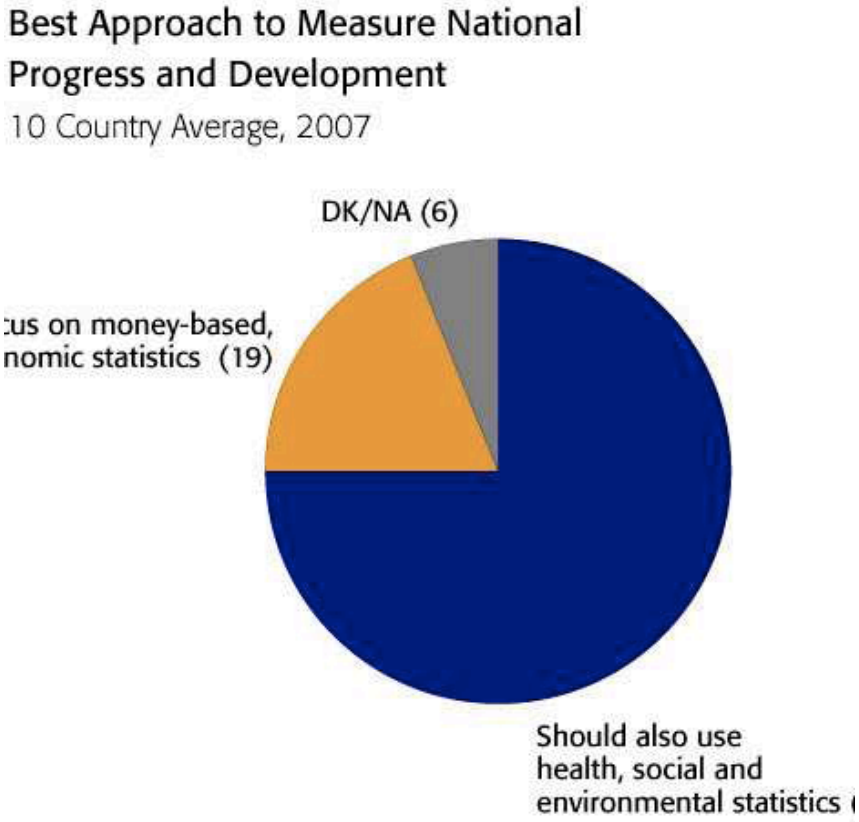
- **Approximately, 1,000 respondents in each of the ten countries were asked which of two points of view was closest to their own:**

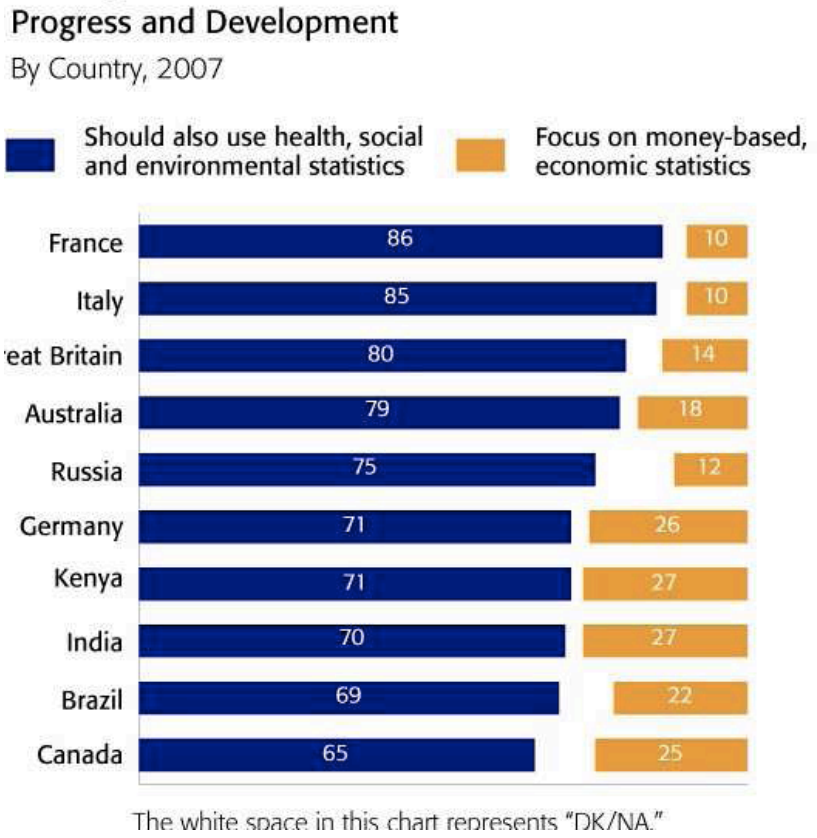
**1.That governments should measure national progress using money-based statistics because economic growth is the most important focus for the country; or**

**2. That health, social and environmental statistics are as important as economic ones and that governments should also use these for measuring national progress.**


- **Mr. Chris Coulter, Vice-President**
- **GlobeScan Incorporated**
- **London, UK**
- **+44 20 7253 1441**
- **chris.coulter@GlobeScan.com**

# Worldwide Support for True Wealth Measures:



**Now let's focus upon the roles of local and regional governments in making the transition to the post-fossil carbon societies.**

# How can we work within cities, regional and national governments to help them to become catalysts and role models for change?

- Learn how the system really works;
- Understand how to work with the system by effectively using leverage points;
- Be a role model for the changes you hope to see evolve in society.

# Be a catalyst and role model for change

- Move increasingly from ”site thinking” to ”regional thinking”;
- Move from production thinking to sustainable production & consumption thinking;
- Foster integration of ethical and social factors into sustainable city and regional planning;

# Be a catalyst and role model for change

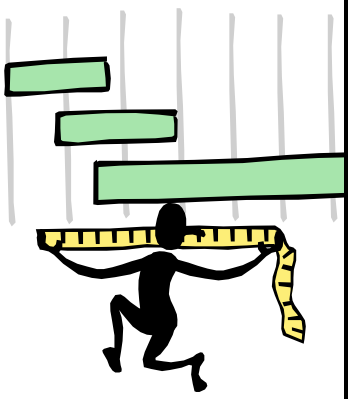
- Foster the development of Sustainable eco-communities based upon bio-regionalism;
- Participate in international networks on sustainable city & regional development.

# Be a catalyst and role model for change

- **Develop and enforce regulations designed to achieve *sustainable societies*;**
- **Develop ecological, economic and ethical *sustainability performance indicators;***

# Be a catalyst and role model for change

- Use sustainability performance indicators to monitor progress toward sustainable societies;
- Report on the progress or lack of progress and correct policies, procedures and processes as needed



# Rob Hopkins, Founder of the Transition Network

***a. The Transition Handbook: From Oil Dependence to Local Resilience,***

***b. The Transition Companion: Making Your Community More Resilient in Uncertain Times,***

***c. The Power of Just Doing Stuff: How Local Action Can Change the World***

**http://www.transitionnetwork.org/about**

# 危机

# Crisis

# 危

# Danger

wei

# 机

# Opportunity

Ji

# 危机

# Crisis

weiji

**Cleaner Production and Sustainable Development are parts of the local and regional**

***Journey***

**..... not the Destination!**

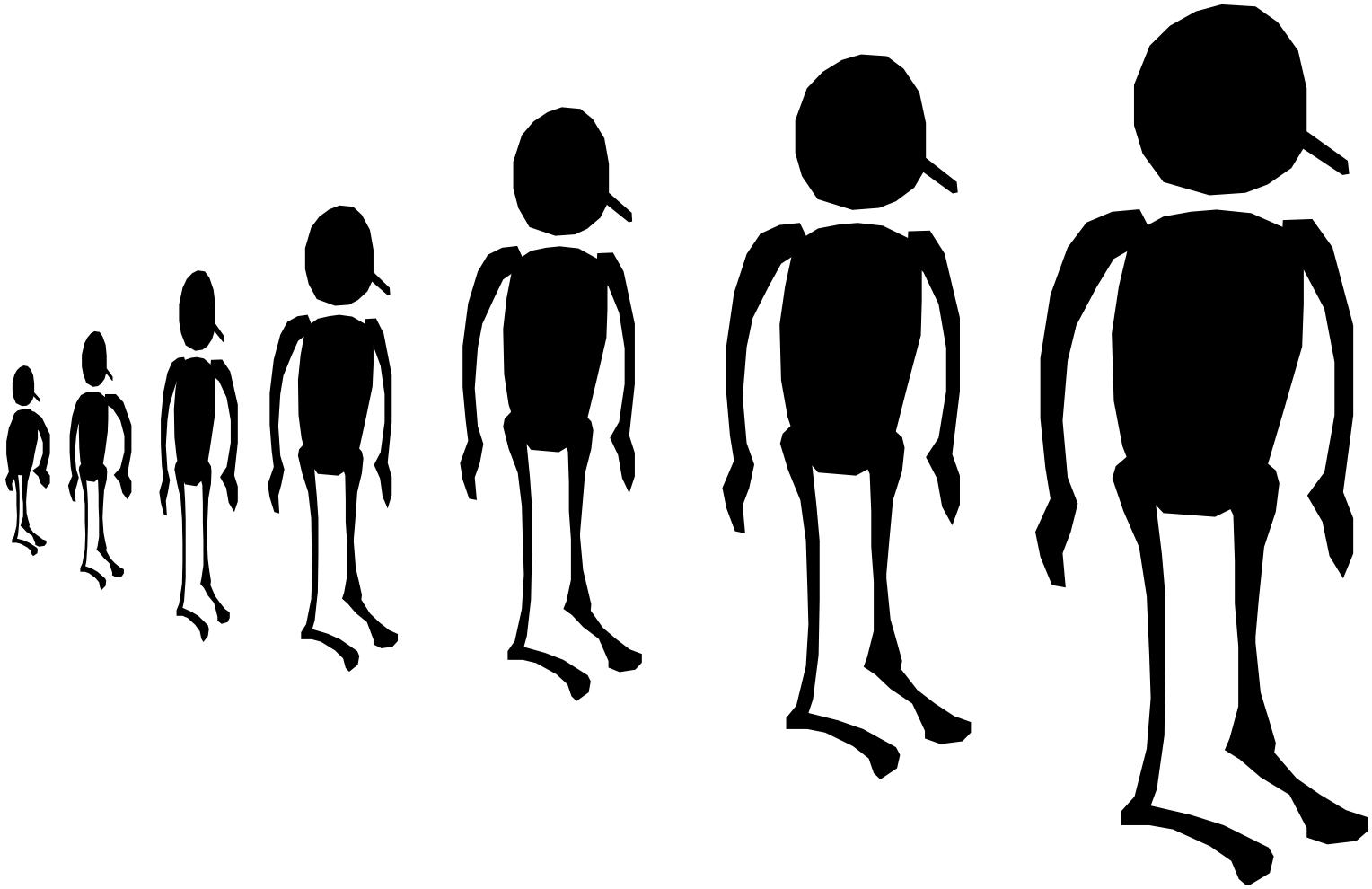
*What can we learn from history?*

*What can we learn?*

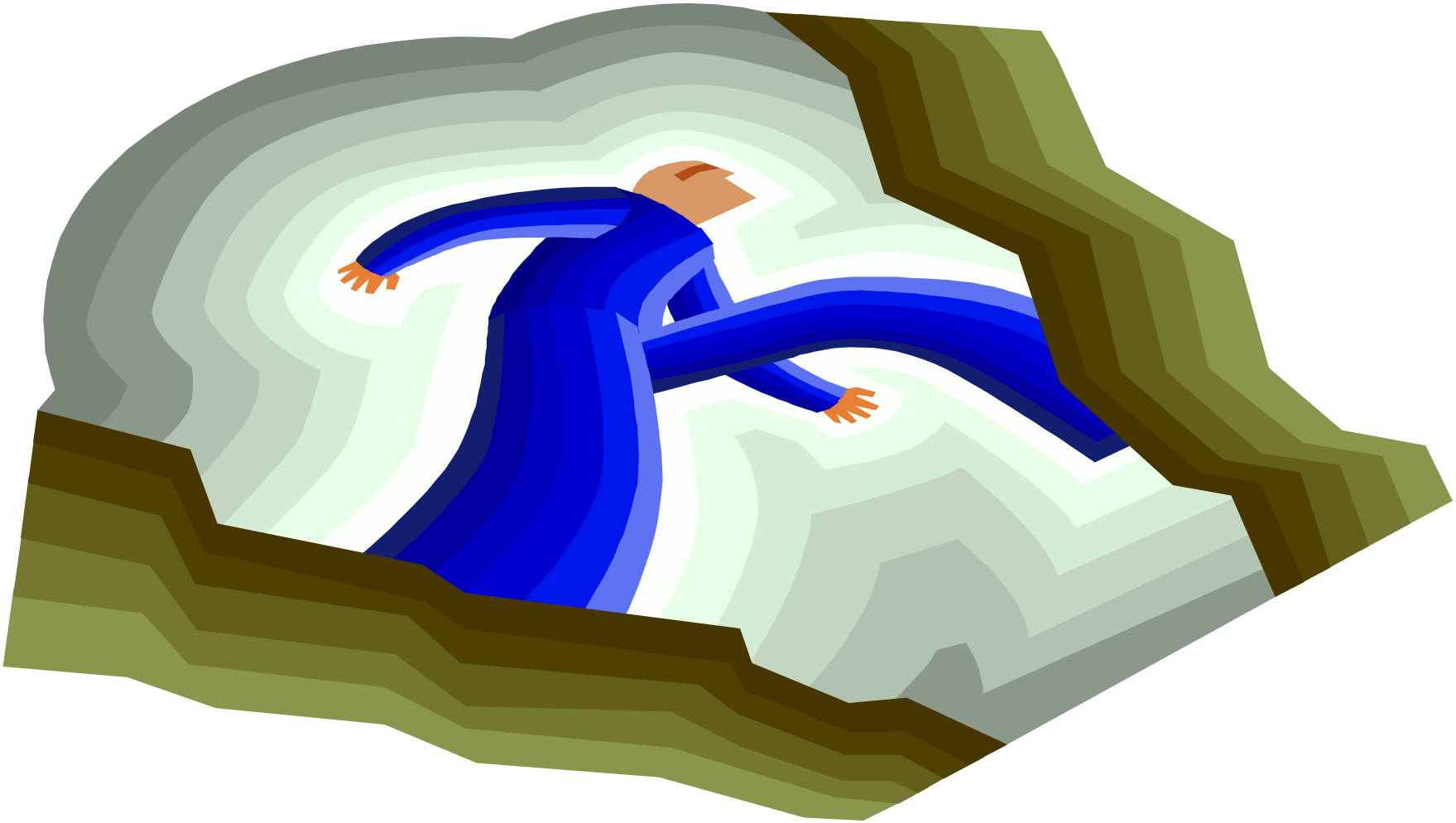
*Can we learn?????*

***Prove it!***
***Show the World***
***and yourself that***
***it can be done!***

# Who should be empowered to make decisions on the local, regional, international and global welfare issues?



- ***Are we <u>ready & willing</u>* to take the necessary steps?**

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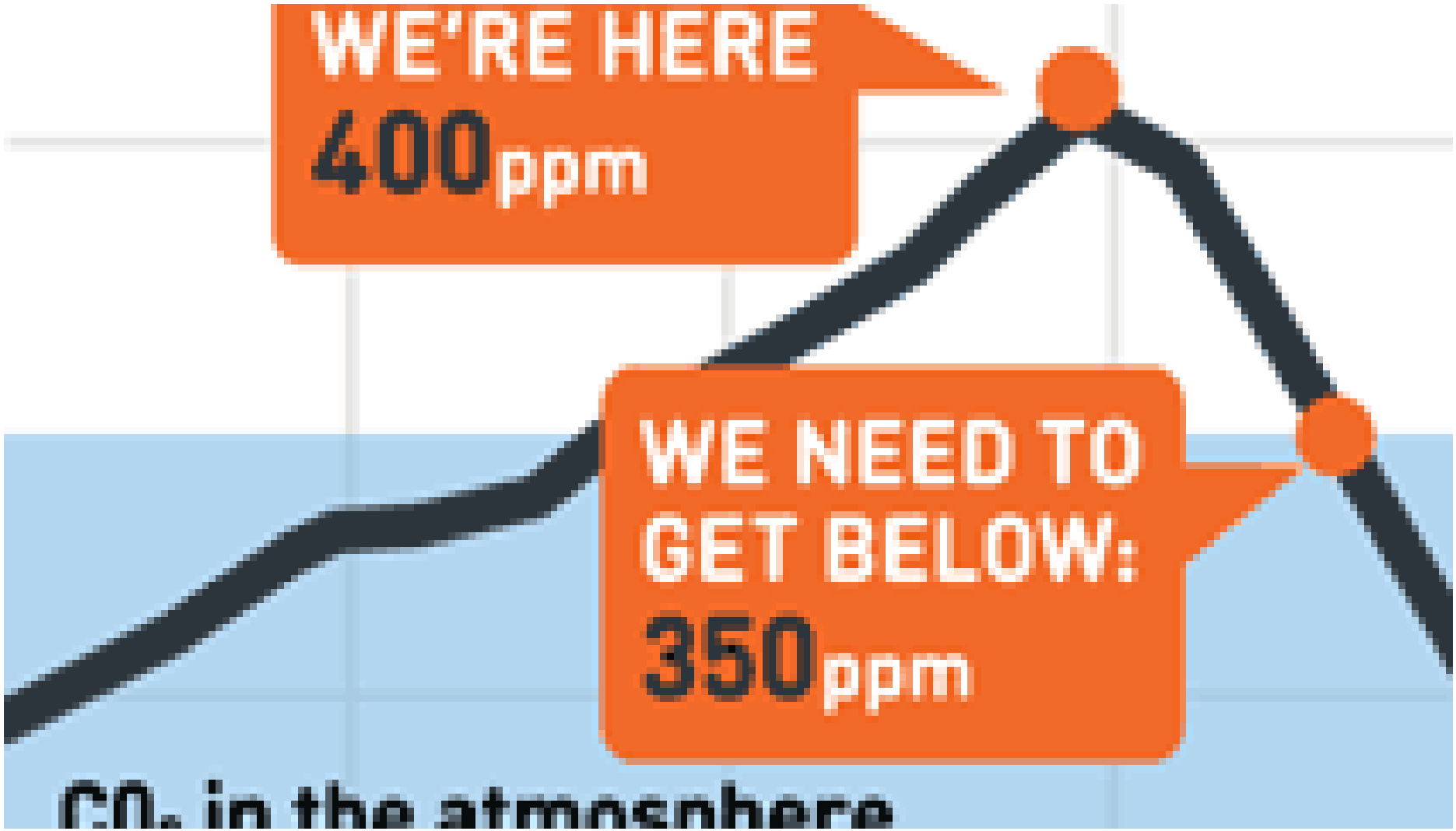
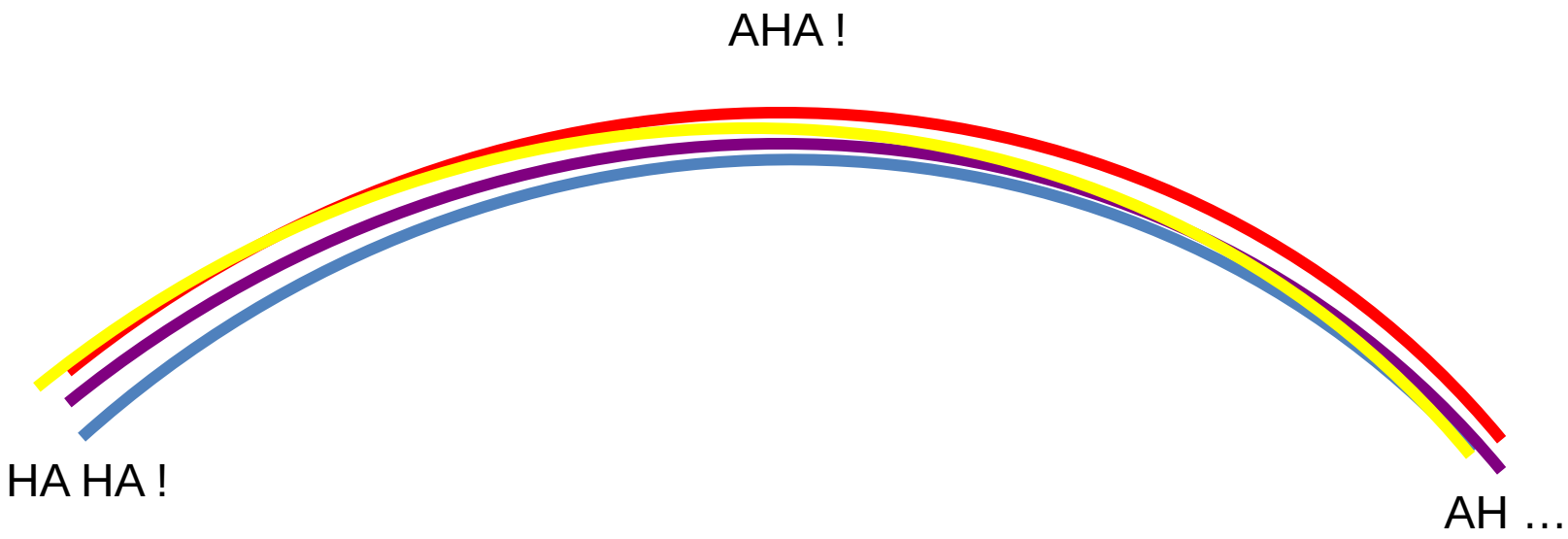
Changes are
happening all
over the world!

# 275, 400, 350 PPM Carbon Dioxide in the Atmosphere

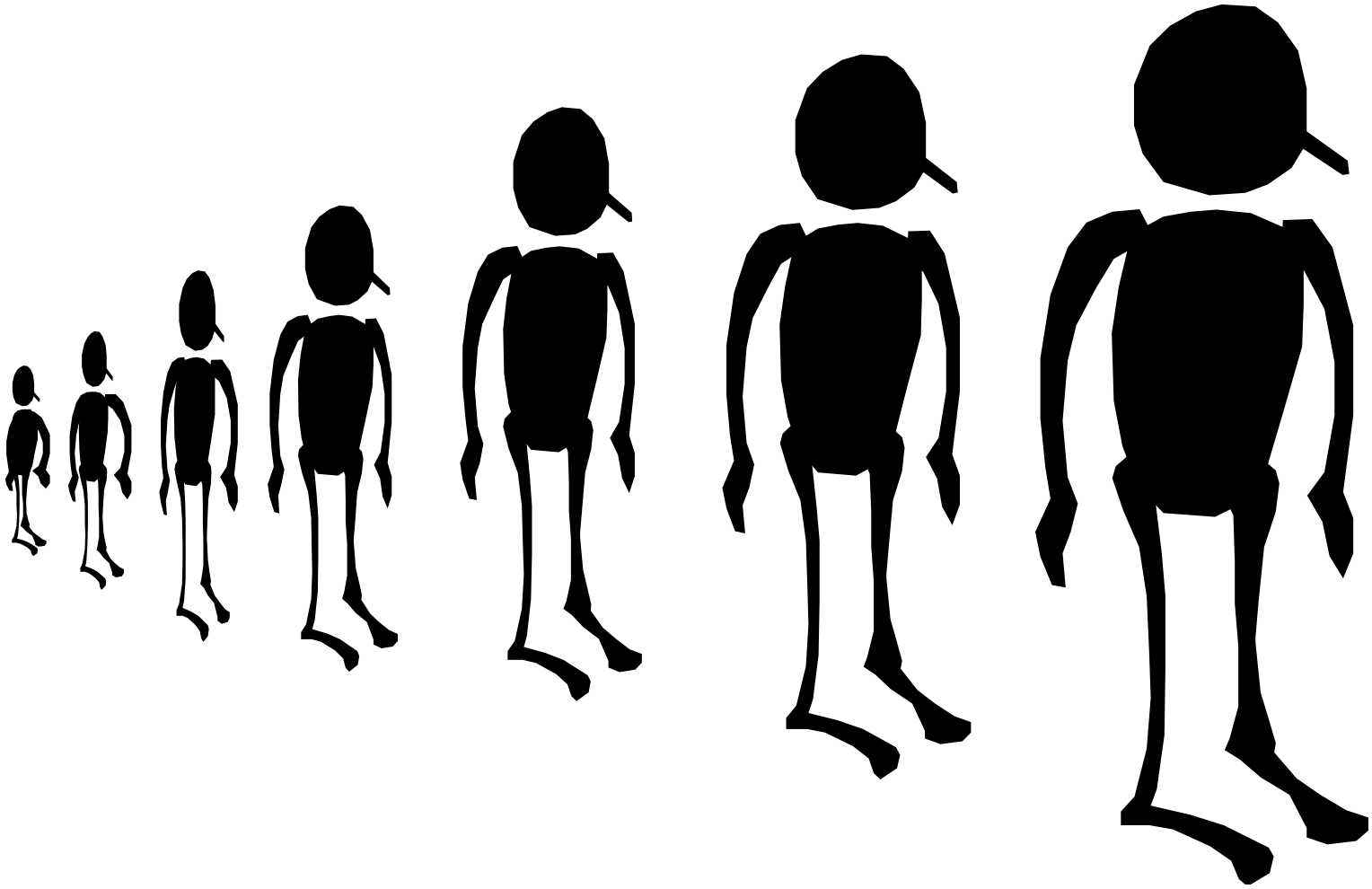


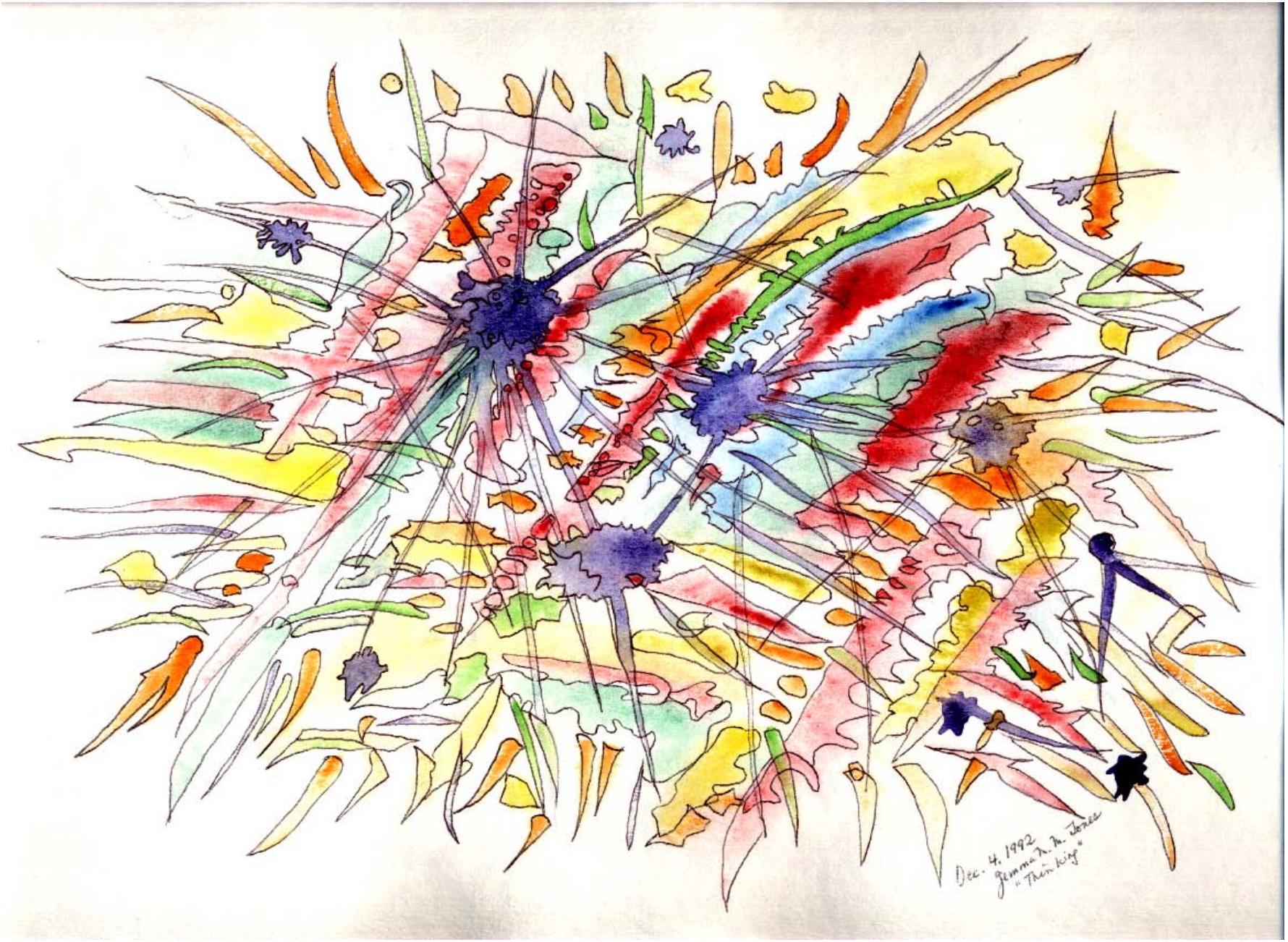


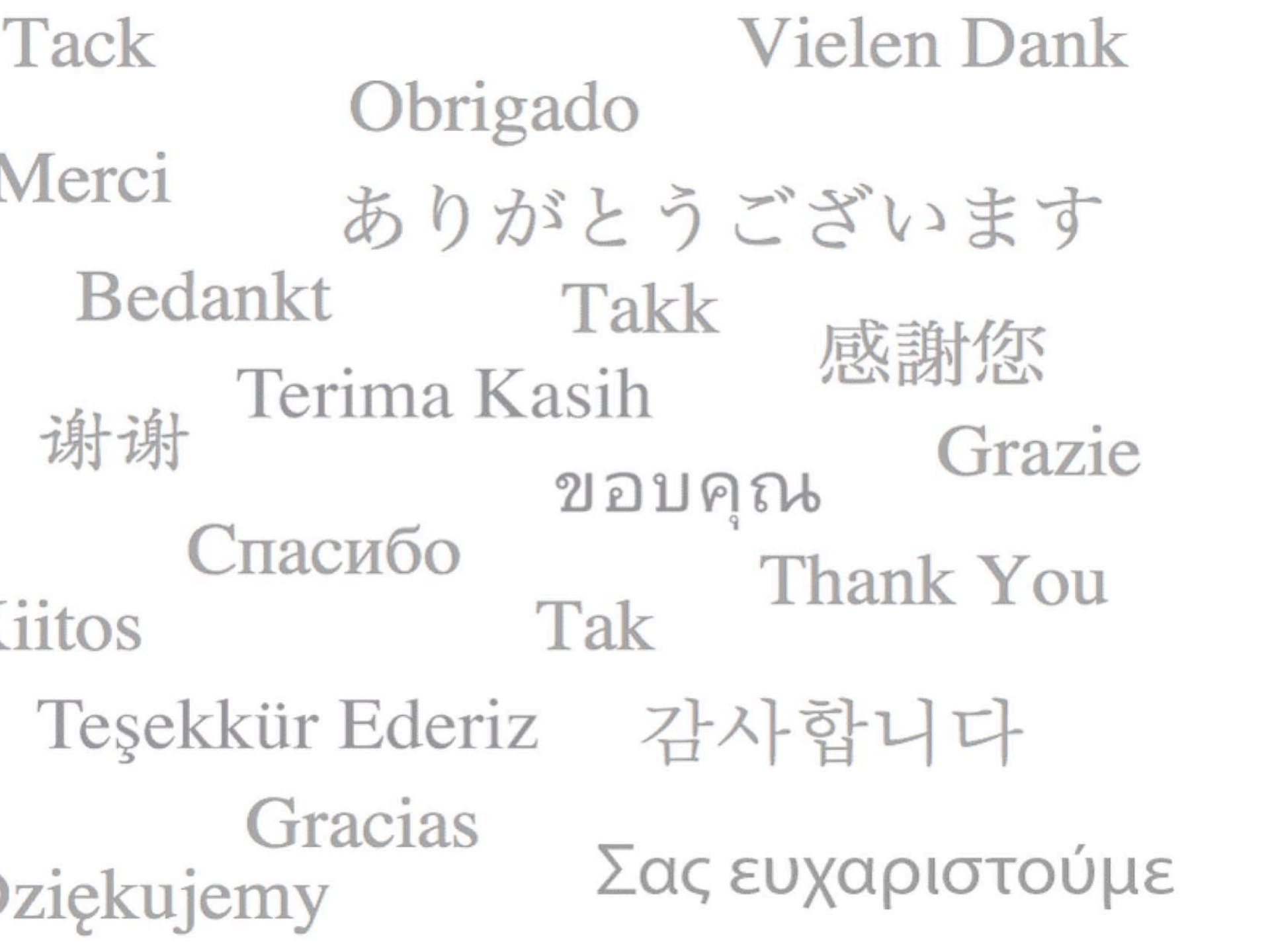

# “haha-aha-ah” curve

-after Arthur Koestler

# Who should be empowered to make decisions on international and global welfare issues?




Dec. 4, 1992
Gemma M. M. Jones
"Thinking"


Tack
Vielen Dank
Obrigado
Merci
ありがとうございます
Bedankt
Takk
感謝您
Terima Kasih
谢谢
Grazie
ขอบคุณ
Спасибо
Thank You
iitos
Tak
Teşekkür Ederiz
감사합니다
Gracias
Σας ευχαριστούμε
ziękujemy