



JOURNAL OF THE ASIA EDUCATION  
TEACHERS' ASSOCIATION

# ASIA

Volume 43, No 4 November 2015



*Celebrating 40 Years – Valuing cultural diversity and promoting  
intercultural understanding in a networked world*



## Mission Statement

AETA, a voluntary non-profit organisation, dedicates itself in this Mission Statement to endeavour to:

1. promote Asian Studies in Australian schools whether as a separate discipline, or as part of studies in other disciplines;
2. publish a journal dedicated to providing appropriate input about Asia to school teachers, as well as being a forum for the dissemination of ideas for improving Asian Studies in Australian schools;
3. publish resources which can be helpful in teaching about Asia in Australian schools;
4. promote and/or participate in conferences, seminars, or other discussions which are aimed at promoting Asian Studies or enhancing their quality
5. make representations to governmental or other bodies regarding Asian Studies courses or their content in school curricula;
6. make representations to tertiary institutions regarding Asian Studies in tertiary courses, particularly for teacher education; and
7. disseminate news about this Association's activities and its views about Asian Studies education through the media and through specialist newsletters and journals.

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Contributions to the Asia Education Teachers' Association journal are most welcome. For policy guidelines for submission of articles to the AETA journal go to – [www.aeta.org.au/journals](http://www.aeta.org.au/journals).

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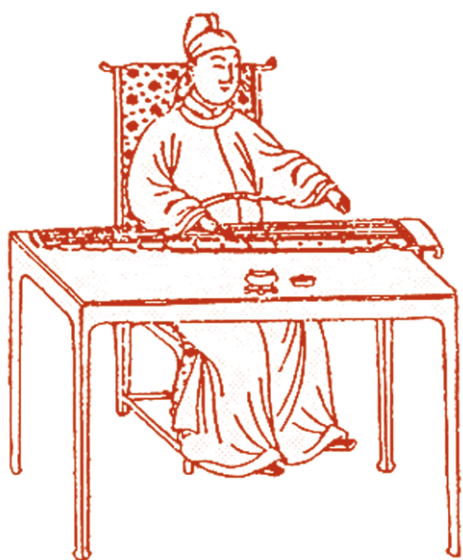
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# From the Editor's Desk

This Journal is enhanced by the generous support of the Global Education Funding from the Federal Government Programme, through the Professional Teachers' Council NSW. This support assists us in providing quality, ready to use materials in the classroom. Global Education has five emphases:

INTERDEPENDENCE AND GLOBALISATION,  
IDENTITY AND CULTURAL DIVERSITY,  
SOCIAL JUSTICE AND HUMAN RIGHTS,  
PEACE BUILDING AND CONFLICT RESOLUTION,  
and SUSTAINABLE FUTURES.

This Journal actually addresses all five, as each one is an integral part of Sustainable Futures but the focus IS Sustainable Futures.

In September, I was fortunate enough to travel to Turkey, the country that links West Asia with Europe...what an amazing melting pot of ideas, cultures, religions, architecture and peoples. Travels through Asia are an excellent way for teachers to gain understanding, acceptance and respect for DIFFERENCE! Some amazing highlights were Gallipoli, ancient Ephesus, Troy, the Blue Mosque and Aya Sophia and most of all, the amazing Turkish people who have accepted over two million refugees. We were amazed at the widespread use of solar panels for electricity and the awareness for the need to protect the environment. We will be featuring Turkey in a Journal in 2016!

In this final Journal for the year, we have included units that will be readily usable in the classroom in 2016. Dr Susan Bliss has prepared several units for us beginning with Sustainability: A Cross-Curriculum Priority [Stages 1 to 6] as well as a comprehensive unit on Air Pollution and a challenging piece on Coca Cola's use of water in India. Her tireless efforts for AETA are greatly appreciated.

Two new contributors join us, Lorraine Chaffer, who has written an excellent piece on Using ICT to study Asia and Aldin Hondo has provided an assignment on Sustainable Asia.

Finally we have a Primary unit by Julie O'Keeffe on Asian Elephants as an Endangered Species.

I would like to thank all those who continue to support us in 'getting' Asia into the classroom. With current world events, intercultural understanding has never been more important. A final thank you to the Executive of AETA without whom this Journal would not happen, especially Dr Jenny Curtis who continues to expand my horizons and my enthusiasm for Asia.

Di Dunlop.

*Valuing cultural diversity and promoting intercultural understanding in a networked world*







*Ruins of the ancient city of Yarkhoto, in the Uygur region of China. Source: Wikimedia Commons*

- “CHINA FROM ABOVE” is a two part series on the National Geographic Channel and is an excellent and comprehensive update on technological innovations for Chinese infrastructure and pollution mitigation.
  - Shanghai is the largest city in China with 24 million people and is the busiest port in China.
  - In China, there are more than 650 million people living in just 656 cities and China is building a city of the size of Chicago every year. By 2030, 350 million people are expected to move from the countryside to the cities in China.
  - The high speed rail system was commenced in 2004 and already has 6000 miles in its network in China. The trip from Beijing to Shanghai used to take 14 hours by train, now it is 5 hours at 180 mph.
  - Because China has the worst pollution levels in the world, it is replacing the use of fossil fuels with wind farms and solar parks. In the NW Province of Xingjiang, there is a wind farm of 300 turbines.
- Over 110 million homes in China are powered by wind farms with plans to double this in the next five years.
- On the Tibetan Plateau there is an enormous solar panel park which is capable of powering a city of 3 million people.
  - Two ancient cities which played important roles as hubs on the Silk Road are enjoying a revival of interest from international visitors. The “dead city”, Yarkhoto, in the Uygur region was once a global village. When the Mongolian conquerors came in the 13<sup>th</sup> century they enforced their religious beliefs on the society. The city was destroyed and is in ruins today. Centuries ago, silk lacquerware and iron implements travelled from China to Central and West Asia and even the Mediterranean. The religious compound of the ruins contains more than 80 structures, including cave temples and a pagoda built in the 4<sup>th</sup> century. The site is 10 kilometres from the city of Turpan.



*CRH high speed rail, Beijing. Source: Wikimedia Commons*



## Global Education – Learning Emphases

- Interdependence and globalisation
- Identity and cultural diversity
- Social justice and human rights
- Peace building and conflict resolution
- Sustainable futures

# SUSTAINABILITY

## A CROSS-CURRICULUM PRIORITY

**Focus: Asia**

**A resource for Stages 1–6  
by Dr Susan Bliss**





**‘Earth provides enough to satisfy every man’s need but not every man’s greed’.**

(Mahatma Ghandi)

## **Sustainability**

The concept ‘sustainability’ notes that all life forms, including human life, are connected through ecosystems on which they depend on for their wellbeing and survival. It means living off Earth’s natural resources without depleting or degrading them.

Sustainable development is future orientated as it aims to meet the needs of the present generation without compromising the ability of future generations to meet their needs.

Sustainability focuses on protecting and restoring environments that have been degraded. As a consequence, informed and responsible actions at the personal, local, regional and national scales, are required for a more ecologically, socially and economically just world. These overlapping domains are referred to as the three spheres of sustainability.

Its global importance led to the launch of the United Nations Decade for Sustainable Development (2005–2014)

## **Cross curriculum priority**

Sustainability is a Cross Curriculum priority in all Australian Curriculums F-10. In all curriculums, the main organising ideas on the topic sustainability are Systems, Worldviews and Futures. These ideas are embedded in the Content Descriptors and Elaborations of each learning area where appropriate.

Sustainability in the curriculum aims to develop knowledge, skills and values necessary for people to act in ways that contribute to more sustainable patterns of living on Earth.

## **Sustainability in countries of the Asian region**

Asia is the fastest growing economic region in the world, however expanding populations, increasing urbanisation and overconsumption of resources challenges the sustainable development of the region

The two Cross Curriculum priorities, Sustainability and Asia and Australia’s engagement with Asia are integrated in articles in this journal.

References:

- ACARA Cross-curriculum priorities [http://www.acara.edu.au/curriculum/cross\\_curriculum\\_priorities.html](http://www.acara.edu.au/curriculum/cross_curriculum_priorities.html)
- Sustainability Curriculum Framework <http://www.environment.gov.au/system/files/resources/9b2e74ca-c909-4d57-bae3-c515c20957de/files/curriculum-framework.pdf>
- Sustainability education publications <http://www.environment.gov.au/sustainability/education/publications>
- Educational Resources <http://www.environment.gov.au/sustainability/education/aussi/educational-resources>

## **Curriculum materials on sustainability**

References:

Cool Australia Curriculum Material <http://www.coolaustralia.org/curriculum-materials/#body-wrapper>. At this website there are about 690 curriculum items K–10. You can search for different topics, subjects and grades (F–10)

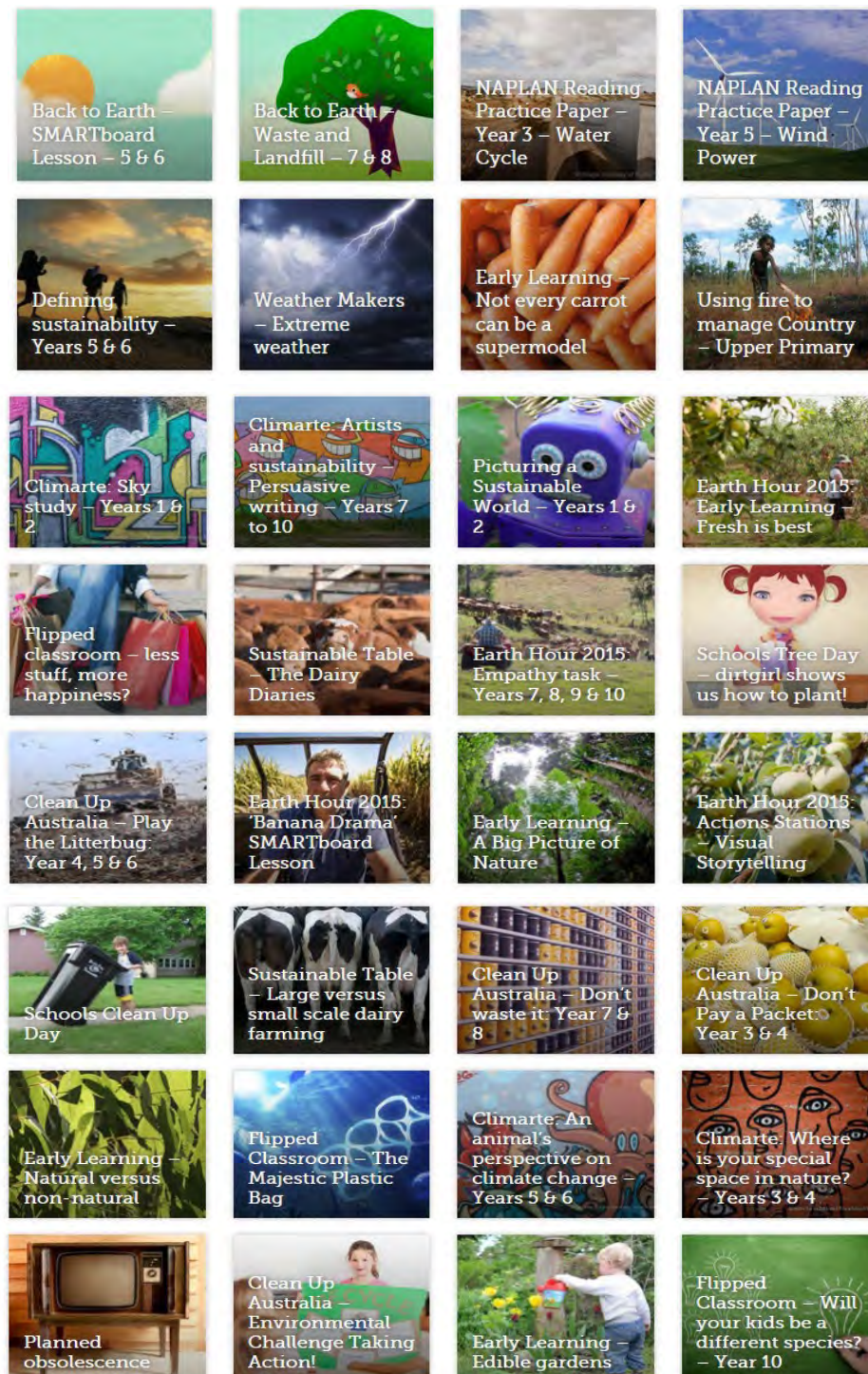


# SUSTAINABILITY

'Many teachers are integrating sustainability in their classrooms in fun and creative ways.

- Physical Education teachers are using fair trade soccer balls
- Home Economic teachers are using local produce to cook seasonal dishes and discussing food miles.
- English teachers are using contentious environmental issues to teach persuasive writing
- Mathematics teachers are using outdoor learning spaces to run experiential geometry lessons.'

Source: <http://www.coolaustralia.org/take-action/australian-curriculum-sustainability/>



# SUSTAINABILITY

## Sustainability: Science, English and Mathematics curriculums

### Science

Science explores a wide range of systems that operate at different time and spatial scales. By investigating the relationships between systems and system components and how systems respond to change, students develop an appreciation for the interconnectedness of Earth's biosphere, geosphere, hydrosphere and atmosphere. Relationships including cycles and cause and effect are explored, and students develop observation and analysis skills to examine these relationships in the world around them.

Students appreciate that science provides the basis for decision making in many areas of society and that these decisions can impact on the Earth system. They understand the importance of using science to predict possible effects of human and other activity and to develop management plans or alternative technologies that minimise these effects.

#### Year 2: Use and influence of science

- People use science in their daily lives, including when caring for their environment and living things (ACSHE035)

#### Year 4: Earth and space sciences

- Earth's surface changes over time as a result of natural processes and human activity (ACSSU075)

#### Year 7: Biological sciences

- Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112)

#### Year 8 Use and influence of science

- Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE136)

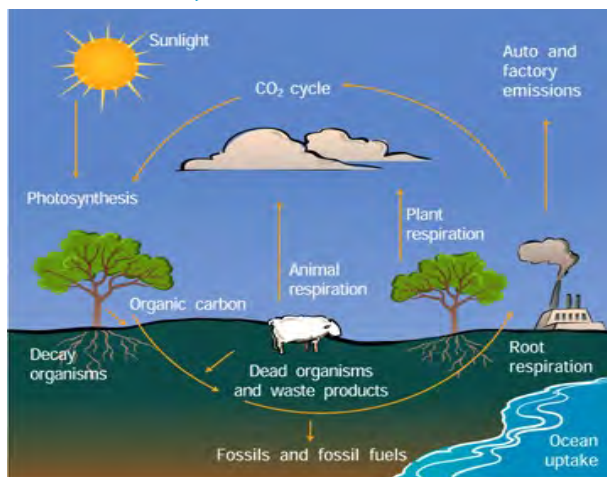
#### Year 9 Biological services

- Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems (ACSSU176)
- Chemical reactions, including combustion and the reactions of acids, are important in both non-living and living systems and involve energy transfer (ACSSU179)

#### Year 10 Earth and space science

- Global systems, including the carbon cycle, rely on interactions involving the biosphere, lithosphere, hydrosphere and atmosphere (ACSSU189)

### The Carbon Cycle



[https://eo.ucar.edu/kids/green/images/carboncycle\\_sm.jpg](https://eo.ucar.edu/kids/green/images/carboncycle_sm.jpg)

### English

English assists students to develop the skills necessary to investigate, analyse and communicate ideas and information related to sustainability, and to advocate, generate and evaluate actions for sustainable futures. The content in the language, literature and literacy strands is key to developing and sharing knowledge about social, economic and ecological systems and world views that promote social justice.

In this learning area, students may interrogate a range of texts to shape their decision making in relation to sustainability. They develop the understanding and skills necessary to act responsibly and create texts that inform and persuade others to take action for sustainable futures.

### Mathematics

Mathematics provides opportunities for students to develop the proficiencies of problem solving and reasoning essential for the exploration of sustainability issues and their solutions. Mathematical understandings and skills are necessary to measure, monitor and quantify change in social, economic and ecological systems over time. Statistical analysis enables prediction of probable futures based on findings and helps inform decision making and actions that will lead to preferred futures.

In this learning area, students can observe, record and organise data collected from primary sources over time and analyse data relating to issues of sustainability from secondary sources. They can apply spatial reasoning, measurement, estimation, calculation and comparison to gauge local ecosystem health and can cost proposed actions for sustainability.



# SUSTAINABILITY

## Sustainability: Geography curriculum

### Years F–6: Content Descriptors

<b>Foundation</b>	<ul style="list-style-type: none"> <li>The reasons why some places are special to people, and how they can be looked after (ACHGK004)</li> </ul>
<b>Year 1</b>	<ul style="list-style-type: none"> <li>The natural, managed and constructed features of places, their location, how they change and how they can be cared for (ACHGK005)</li> </ul>
<b>Year 3</b>	<ul style="list-style-type: none"> <li>The similarities and differences in individuals' and groups' feelings and perceptions about places, and how they influence views about the protection of these places (ACHGK018)</li> </ul>
<b>Year 4</b>	<ul style="list-style-type: none"> <li>The importance of environments to animals and people, and different views on how they can be protected (ACHGK022)</li> <li>The natural resources provided by the environment, and different views on how they could be used sustainably (ACHGK024)</li> <li>The sustainable management of waste from production and consumption (ACHGK025)</li> </ul>
<b>Year 5</b>	<ul style="list-style-type: none"> <li>The influence people have on the human characteristics of places and the management of spaces within them (ACHGK029)</li> <li>The impact of bushfires or floods on environments and communities, and how people can respond (ACHGK030)</li> </ul>
<b>Year 6</b>	<ul style="list-style-type: none"> <li>The location of the major countries of the Asia region in relation to Australia and the geographical diversity within the region (ACHGK031)</li> </ul>



Indonesian firefighters trying to contain forest fires in Banjarbaru, Indonesia amid the South East Asia haze, October 2015. Source: [https://commons.wikimedia.org/wiki/File:Firefighters\\_banjarbaru.jpg](https://commons.wikimedia.org/wiki/File:Firefighters_banjarbaru.jpg)



# SUSTAINABILITY

## Years 7–10: Content Descriptors

Year	Unit 1	Unit 2
7	<b>Water in the world (Year 8 in NSW)</b> <ul style="list-style-type: none"> <li>The nature of water scarcity and ways of overcoming it, including studies drawn from Australia and West Asia and/or North Africa (ACHGK040)</li> </ul>	<b>Place and liveability</b> <ul style="list-style-type: none"> <li>The influence of environmental quality on the liveability of places (ACHGK045)</li> <li>The strategies used to enhance the liveability of places, (ACHGK047)</li> </ul>
8	<b>Landforms and landscapes (Year 7 in NSW)</b> <ul style="list-style-type: none"> <li>The human causes and effects of landscape degradation (ACHGK051)</li> <li>The ways of protecting significant landscapes (ACHGK052)</li> </ul>	<b>Changing nations (Year 9 in NSW)</b> <ul style="list-style-type: none"> <li>The causes and consequences of urbanisation, drawing on a study from Indonesia, or another country of the Asia region (ACHGK054)</li> <li>The reasons for and effects of internal migration in China (ACHGK057)</li> </ul>
9	<b>Biomes and food security</b> <ul style="list-style-type: none"> <li>The distribution and characteristics of biomes as regions with distinctive climates, soils, vegetation and productivity (ACHGK060)</li> <li>The challenges to food production, including land and water degradation, shortage of fresh water, competing land uses, and climate change, for Australia and other areas of the world (ACHGK063)</li> <li>The capacity of the world's environments to sustainably feed the projected future population to achieve food security for Australia and the world (ACHGK064)</li> </ul>	<b>Geographies of interconnections (Year 8 in NSW)</b> <ul style="list-style-type: none"> <li>The effects of the production and consumption of goods on places and environments throughout the world and including a country from North-East Asia (ACHGK068)</li> <li>The effects of people's travel, recreational, cultural or leisure choices on places, and the implications for the future of these places (ACHGK069)</li> </ul>
10	<b>Environmental change and management</b> <ul style="list-style-type: none"> <li>The human-induced environmental changes that challenge sustainability (ACHGK070)</li> <li>The environmental worldviews of people and their implications for environmental management (ACHGK071)</li> </ul> <b>Select ONE of the following types of environment as the context for study: land, inland water, coast, marine or urban</b> <ul style="list-style-type: none"> <li>The application of human-environment systems thinking to understanding the causes and likely consequences of the environmental change being investigated (ACHGK073)</li> <li>The application of geographical concepts and methods to the management of the environmental change being investigated (ACHGK074)</li> <li>The application of environmental economic and social criteria in evaluating management responses to the change (ACHGK075)</li> </ul>	<b>Geographies of human wellbeing</b> <ul style="list-style-type: none"> <li>The reasons for spatial variations between countries in selected indicators of human wellbeing (ACHGK077)</li> <li>The issues affecting the development of places and their impact on human wellbeing (ACHGK078)</li> <li>The reasons for and consequences of spatial variations in human wellbeing on a regional scale within India or another country of the Asia region (ACHGK079)</li> </ul>

# SUSTAINABILITY

## Sustainability: Geography inquiry and skills F–10

### Foundation: \

- Reflect on their learning to suggest ways that they can look after a familiar place (ACHGS006)

### Year 1:

- Reflect on their learning and suggest responses to their findings (ACHGS012)

### Year 3:

- Interpret geographical data to identify distributions and patterns and draw conclusions (ACHGS023)
- Reflect on their learning to propose individual action in response to a contemporary geographical challenge and identify the expected effects of the proposal (ACHGS025)

### Year 4:

- Develop geographical questions to investigate (ACHGS026)
- Interpret geographical data to identify distributions and patterns and draw conclusions (ACHGS030)
- Present findings in a range of communication forms, for example, written, oral, digital, graphic, tabular and visual, and use geographical terminology (ACHGS031)
- Reflect on their learning to propose individual action in response to a contemporary geographical challenge and identify the expected effects of the proposal (ACHGS032)

### Year 5:

- Develop geographical questions to investigate and plan an inquiry (ACHGS033)
- Collect and record relevant geographical data and information, using ethical protocols, from primary and secondary sources, for example, people, maps, plans, photographs, satellite images, statistical sources and reports (ACHGS034)
- Present findings and ideas in a range of communication forms, for example, written, oral, graphic, tabular, visual and maps; using geographical terminology and digital technologies as appropriate (ACHGS038)
- Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge and describe the expected effects of their proposal on different groups of people (ACHGS039)

### Globe – Asia



<http://blogs.rochester.edu/thegreendandelion/wp-content/uploads/2011/02/asia.jpg>

### Year 6:

- Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge and describe the expected effects of their proposal on different groups of people (ACHGS046)

### Year 7:

- **Observing, questioning and planning** – Develop geographically significant questions and plan an inquiry, using appropriate geographical methodologies and concepts (ACHGS047)
- **Communicating** – Present findings, arguments and ideas in a range of communication forms selected to suit a particular audience and purpose; using geographical terminology and digital technologies as appropriate (ACHGS053)
- **Reflecting and responding** – Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations, and predict the expected outcomes of their proposal (ACHGS054)

# SUSTAINABILITY

## Year 8:

- **Communicating** – Present findings, arguments and ideas in a range of communication forms selected to suit a particular audience and purpose, using geographical terminology and digital technologies as appropriate (ACHGS061)
- **Reflecting and responding** – Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations, and predict the expected outcomes of their proposal (ACHGS062)

## Year 9:

- **Collecting, recording, evaluating and representing** – Evaluate sources for their reliability, bias and usefulness, and represent multi-variable data in a range of appropriate forms, for example, scatter plots, tables, field sketches and annotated diagrams, with and without the use of digital and spatial technologies (ACHGS065)

- **Interpreting, analysing and concluding** – Evaluate multi-variable data and other geographical information using qualitative and quantitative methods, and digital and spatial technologies as appropriate, to make generalisations and inferences, propose explanations for patterns, trends, relationships and anomalies, and predict outcomes (ACHGS067)

## Year 10

- **Observing, questioning and planning** – Develop geographically significant questions and plan an inquiry that identifies and applies appropriate geographical methodologies and concepts (ACHGS072)
- **Reflecting and responding** – Reflect on and evaluate the findings of the inquiry to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations; and explain the predicted outcomes and consequences of their proposal (ACHGS080)

## Sustainability: History curriculum

**Ancient History:** *Sustainability* provides opportunities to study of the use of technology in ancient times to access resources and control the environment

**Modern History:** *Sustainability* provides opportunities to study of the effects of developments such as the Industrial Revolution on the environment, the anti-nuclear movement, and movements for environmental sustainability in the modern period.

## Year 8:

- Theories of the decline of **Angkor (Cambodia)**, such as the overuse of water resources, neglect of public works as a result of ongoing war, and the effects of climate change (ACDSEH062)

History unit of work [http://www.achistoryunits.edu.au/verve/\\_resources/htaa\\_year8\\_Angkor\\_year8\\_program.pdf](http://www.achistoryunits.edu.au/verve/_resources/htaa_year8_Angkor_year8_program.pdf)

- The longer-term effects of colonisation, including slavery, population changes and lack of control over resources (ACDSEH076)



Western colonisation in India, Indonesia, Hong Kong and Vietnam; slavery in Asia, population changes (increase in diseases- smallpox, measles, decline in indigenous communities), development of the British East India Company, control of resources, development of plantations (e.g. tea, rubber, sugar, spices), and western laws, infrastructure, buildings and cultures.



# SUSTAINABILITY

## Year 9:

- The short and long-term impacts of the Industrial Revolution, including global changes in landscapes, transport and communication (ACDSEH082)

History unit of work:

<http://www.achistoryunits.edu.au/unit-program/y8-industrial-revolution-overview.html>

## Year 10:

### The environment movement (1960s – present)

- The background to environmental awareness, including the nineteenth century National Parks movement (ACDSEH028)
- The intensification of environmental effects in the twentieth century as a result of population increase, urbanisation, increasing industrial production and trade (ACDSEH125)
- The growth and influence of the environment movement within Australia and overseas, and developments in ideas about the environment (concept of 'sustainability' and 'rights of nature') (ACDSEH126)
- Significant events and campaigns that contributed to popular awareness of environmental issues (ACDSEH127)
- Responses of governments, including the Australian government, and international organisations to environmental threats since the 1960s (including deforestation and climate change). (ACDSEH128)

Teaching program: The Environment Movement

[http://www.pearsonplaces.com.au/Portals/0/teacherlounge/PRHistory10/PH10\\_ch5\\_t](http://www.pearsonplaces.com.au/Portals/0/teacherlounge/PRHistory10/PH10_ch5_t)



### Asia focus: summary

**Year 7:** Ancient China or India – depth study of the Asian world. The physical features of China (such as the Yellow River) and how they influenced the development of civilisations (**overlap Geography with History**)

**Year 8:** Angkor/Khmer Empire, Japan under the Shoguns, Mongol expansion, The Black Death in Asia

**Year 9:** Asia and the world, places Australians fought during WWI

**Year 10:** Significance of WWII with reference to Asia, post WWII migration to Australia, Vietnam War

### Resources Year 10:

List of environmental organisations [http://en.wikipedia.org/wiki/List\\_of\\_environmental\\_organisations](http://en.wikipedia.org/wiki/List_of_environmental_organisations)

- World Resources Institute [http://en.wikipedia.org/wiki/World\\_Resources\\_Institute](http://en.wikipedia.org/wiki/World_Resources_Institute)
- Friends of Nature (China) [http://en.wikipedia.org/wiki/Friends\\_of\\_Nature\\_%28China%29](http://en.wikipedia.org/wiki/Friends_of_Nature_%28China%29)
- Environmental Foundation of India [http://en.wikipedia.org/wiki/Environmental\\_Foundation\\_of\\_India](http://en.wikipedia.org/wiki/Environmental_Foundation_of_India)
- Greenpeace Southeast Asia [http://en.wikipedia.org/wiki/Greenpeace\\_Southeast\\_Asia](http://en.wikipedia.org/wiki/Greenpeace_Southeast_Asia)
- International Centre for Integrated Mountain Development (e.g. China, India, Nepal, Pakistan, Bangladesh) [http://en.wikipedia.org/wiki/International\\_Centre\\_for\\_Integrated\\_Mountain\\_Development](http://en.wikipedia.org/wiki/International_Centre_for_Integrated_Mountain_Development)



# SUSTAINABILITY

## Are Environmental Resources sustainable?

**Environmental resources** can be either **renewable**, **non-renewable** or **continuous**. Sustainability of these resources depends on the type of resource and their use by humans.

Figure 1: Types of environmental resources and their sustainability

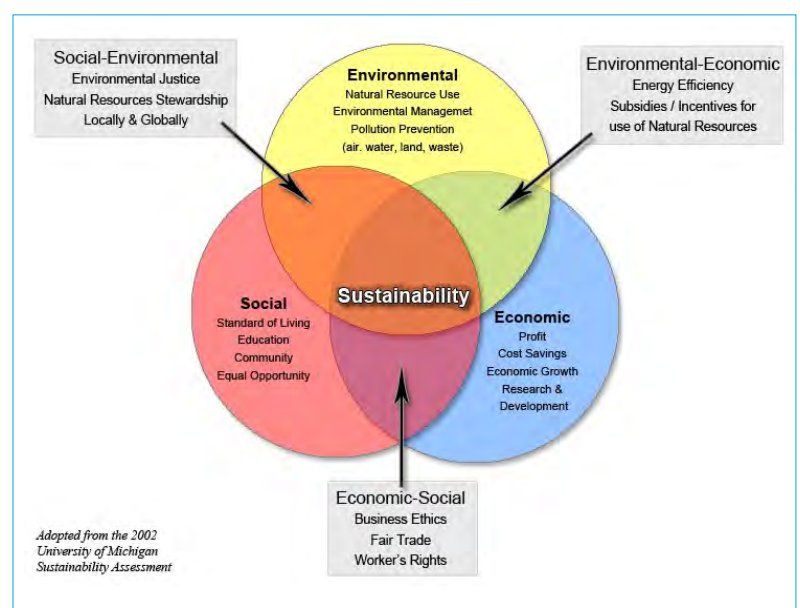


Figure 2: Three spheres of sustainability

## What are the three spheres of sustainability?

**Sustainability** focuses on the ongoing capacity of Earth to provide sufficient resources to maintain human and environmental life. Unfortunately the present rate of consumption of resources is **unsustainable**. This requires active informed **citizenship** at the **local to the global scale** to conserve these resources for future generations.

Source: <http://www.vanderbilt.edu/sustainvu/who-we-are/what-is-sustainability/>





# SUSTAINABILITY

## Three spheres of sustainability: China

China contains most of the world's **rare earth elements** (REE) required to produce hybrid cars, computers, drones, smart bombs and medical imaging. These **non-renewable resources** were formed over hundreds of millions of years and could become depleted at the current rate of mining. Unfortunately the mining of REE may be economically sustainable but not socially or environmentally sustainable.

In Inner **Mongolia**, REE minerals are mined at Bayan Obo, then brought to Baotou for processing. Pollution from the mining and processing of REE is poisoning farms and people *'From the air it looks like a huge lake, fed by many tributaries, but on the ground it turns out to be a murky expanse of water, in which no fish or algae can survive. The shore is coated with a black crust, so thick you can walk on it. Into this huge, 10 km<sup>2</sup> tailings pond nearby factories discharge water loaded with chemicals used to process the 17 most sought after minerals in the world'* (The Guardian). Toxic wastes from the mining and production of REE polluted rivers, soil and groundwater. Crops died and farmers moved from the area causing a decline in the population from 2,000 to 300 people.

Man works at rare earth metals mine at Nancheng county, Jiangxi province, in China.



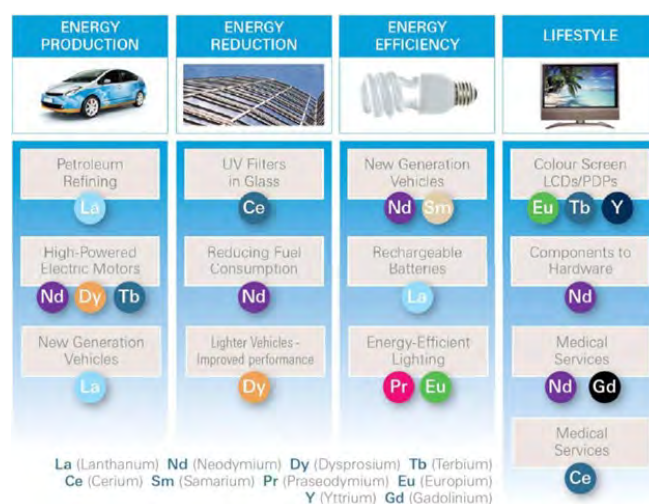
Source : <http://www.guardian.co.uk/business/2011/oct/20/china-rare-earth-supplier-suspends-production>

Figure 3: Rare earth oxides



Source: Wikimedia Commons

Figure 3: Rare earth elements (REE) used today



Source: <http://enercar2.wordpress.com/tag/rare-earth-elements/>

Our luxurious lifestyle is founded on the availability of REE. Unfortunately they contain radioactive elements such as uranium which contaminates rivers and groundwater. Additionally arsenic and lead released during the mining process ends life in water sources. Bukit Merah in Malaysia spent \$100 million to clean a REE contaminated site after residents experienced an increase in birth defects and leukaemia.

Today mines are developing more environmentally friendly mining techniques such as recycling water back into the process and metals removed from rivers are converted to saleable products.

The long term fears involve the overuse of water, deteriorating water quality and the lack of available REE to shift the world to 'green' energy, using wind turbines and solar panels.



# SUSTAINABILITY



Earth from space – Source: <http://wallpaperus.org/wallpapers/06/37/earth-space-1920x1080-wallpaper-2199026.jpg>

## Environmental worldviews

*‘Our Blue Sphere is to be shared by all mankind. Environmental decisions whether local, regional, national or global, will ultimately affect our existence. Planet Earth, our home, must become sustainable for us and all future inhabitants.’ (Our Blue Sphere)*

### Environmental worldviews

*‘What is more important: the health of the world’s ecosystems or the needs and wants of the human races? Your answer may determine your environmental worldview. People often disagree about how serious the environmental problems facing the world and what we should do to solve them. These disagreements often cause conflicts, which arise out of our different environmental worldviews.’ (The Hub for Bright Minds)*

An **environmental worldview** is about our role in the world and our environmental behaviour. People have different worldviews classified as either **human-centre, life-centred or earth-centred**.

**Spaceship Earth** is a worldview term expressing concern over the use of limited resources on Earth and the large human **ecological footprint (EF)**. A **holistic** worldview encourages everyone to act as

a harmonious crew on board the spaceship for the greater good of ‘all’ on board.

**Asia** as the largest and most populous continent is an important global political and economic powerhouse. However, economic growth has led to unsustainable use of scarce resources and a growing ecological footprint. The future management of limited non-renewable resources depends on different worldviews.



Source: [http://farm5.static.flickr.com/4041/4174168980\\_7db6112fee.jpg](http://farm5.static.flickr.com/4041/4174168980_7db6112fee.jpg)

# SUSTAINABILITY

## Types of worldviews

### Human centred

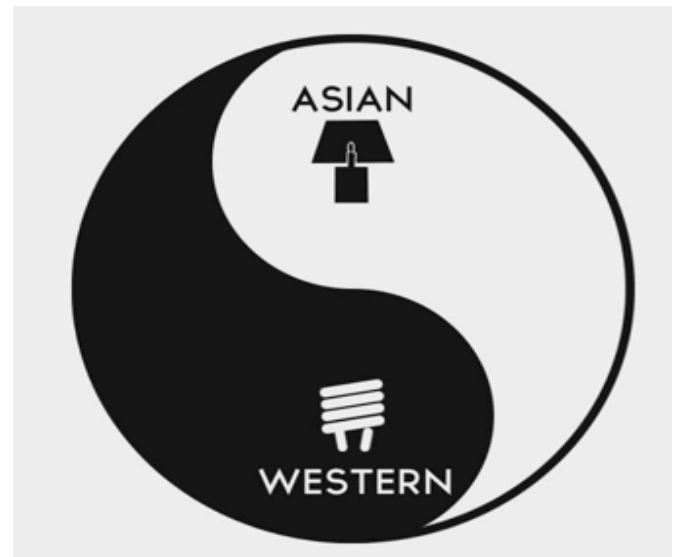
- humans are the most important species on Earth
- humans manage nature to meet their ever increasing needs
- Earth has unlimited supplies of resources and if there are shortages technology will find substitutes
- there is almost unlimited potential for economic growth which is good (GDP)
- success depends on managing Earth for benefit of humans
- Limits: insufficient knowledge about Earth to become managers such as unaware of the total number of species

### Life-centred

- humans have an ethical responsibility to be caring managers of Earth
- human are stewards of Earth implementing management strategies to ensure sustainable use of resources
- discourages growth that harms the environment and wastes resources
- encourage environmentally sustainable \ beneficial forms of economic growth
- success of the human race depends on how well humans manage Earth's life support systems for our benefit and the rest of the world's species and ecosystems

### Earth-centred

- intrinsic value of all life forms
- humans are part of nature and depend on it for survival
- nature exists not only for humans but for all Earth's species
- resources are limited and should not be wasted
- humans encourage Earth-sustaining forms of economic growth
- human success depends on learning how nature sustains itself



## Asian worldview

Some argue that Asian worldviews are generally more **earth-centred** and western worldviews more **human-centred**. These views contribute to the implementation of different strategies to manage environmental resources.

Asian **religions and beliefs** appear to have moulded people's worldviews. For example many Hindus are vegetarians as they believe humans can be reincarnated as animals. Jainism adheres to *ahimsa* or no harm to any living being. Zen Buddhism is a particularly 'eco-friendly' religion. Additionally many Asian indigenous communities living close to nature have greater respect for animal and plant life or a **bio-centric** outlook on nature, compared to many people living in cities in developed countries.

Today more people are moving away from the glorification of wealth to respect nature. In India in the state of Kerala the importance of holistic worldviews by government organisations resulted in the sustainable management of resources such as the Kerala Forest Research Institute in Peechi and the National Institute of Oceanography in Cochin.

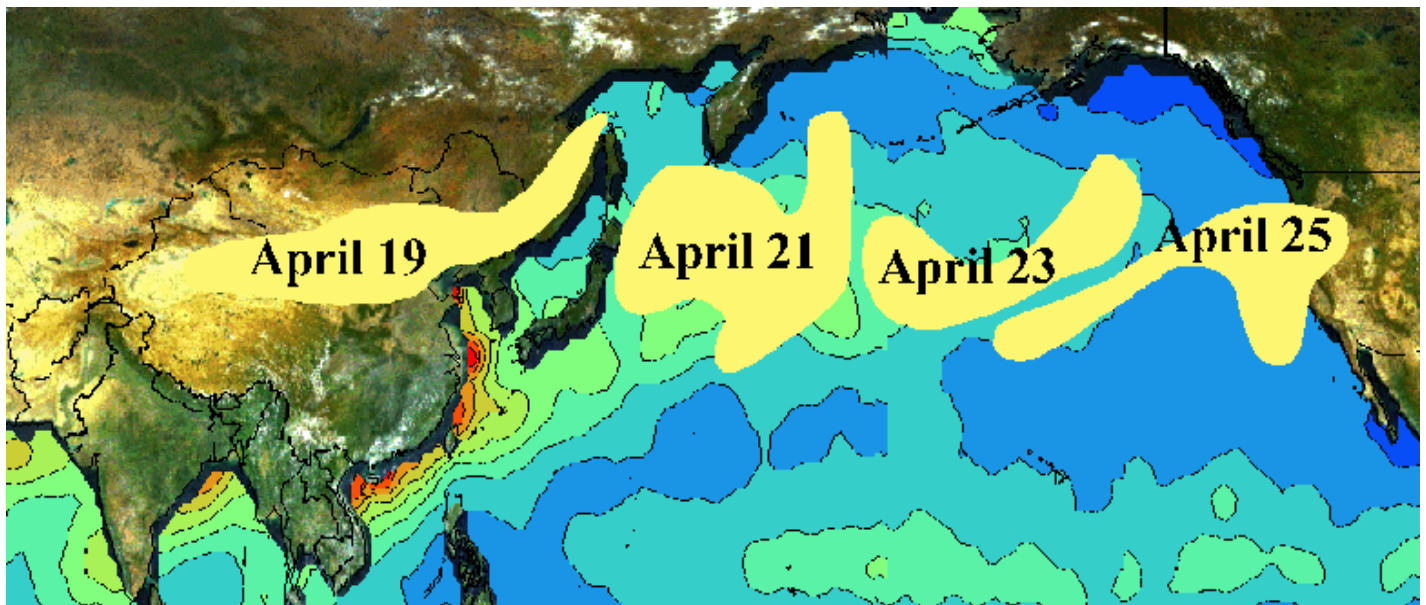


Graphics source: <https://www.youtube.com/watch?v=ICM0p4v4IvE>



# SUSTAINABILITY

Figure 5: Interconnections: Asian dust storms move over North Pacific Ocean to North America



Source: [http://www.mbari.org/chemsensor/HawaiiTransits/MBARI\\_SOLISIndex.htm](http://www.mbari.org/chemsensor/HawaiiTransits/MBARI_SOLISIndex.htm)

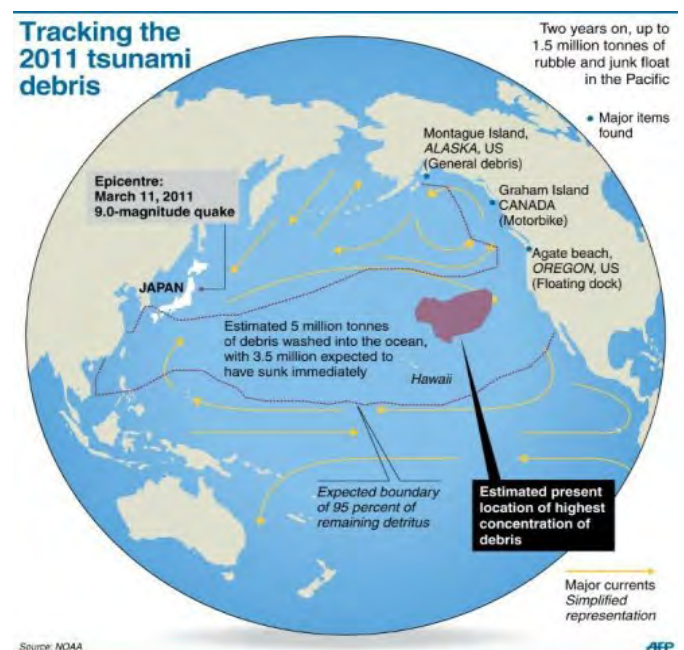
## Holistic Worldview: Interconnections

A **holistic worldview** asserts that everything is connected and that any change or event can cause a realignment of the whole. Often referred to as complex systems – *‘even the flapping of a butterfly in one corner of the world can affect actions in another part of the world.’* As humans share the **global commons** (atmosphere and water cycle) the production of greenhouse gases in one country effects people all around the world.

Large areas of West Asia over 10,000 years ago and China in the 4<sup>th</sup> BC supported grasslands and forests. Over time humans changed these landscapes to deserts caused by a combination of deforestation, overcropping and overgrazing. Today 28% of China is now covered by sand and sand dunes threaten to bury the capital city of Beijing. As a result dust storms from West Asia now blow over the Arabian Sea and from China blow across the Pacific Ocean. These dust storms impact adversely on marine ecosystems. This **Pacific Dust Express** eventually reaches Alaska and Florida in USA (refer to NASA satellite imagery.)

Have you wondered why migrating animals such as birds and whales never get lost? As they do not possess a global positioning system (GPS), loggerhead turtles use the Earth's magnetic field for their 12,900 kilometres journey around the Atlantic Ocean, starlings use the sun and Mallard ducks use the stars.

Figure 6: Connections: Garbage from 2011 Japan tsunami moves to American coasts



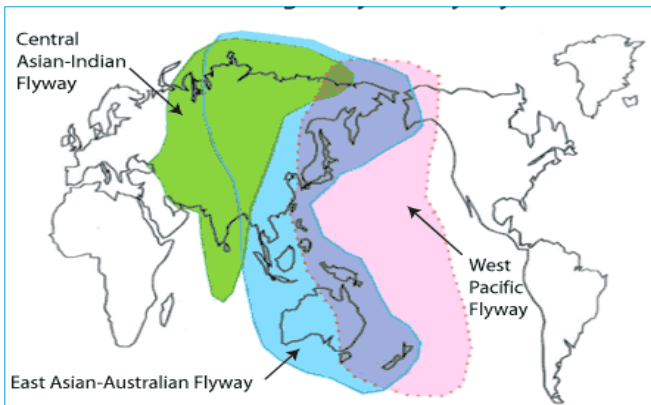
Source: <http://cdn.phys.org/newman/gfx/news/2013/trackingthe2.jpg>

Every second millions of migratory species are on the move. Migration by hoof, wing or fin is usually connected to seasonal changes in weather, food and breeding patterns. However, the migratory patterns of animals in **Asian countries** are under stress from habitat destruction (logging and clearing wetlands), highways, agriculture, urbanisation, dams and climate change.



# SUSTAINABILITY

Figure 7: Connections:  
Asian Migratory Bird Flyways



Source: [http://en.wikipedia.org/wiki/Central\\_Asian\\_Flyway#/media/File:Central\\_Asian\\_Flyway\\_Map.png](http://en.wikipedia.org/wiki/Central_Asian_Flyway#/media/File:Central_Asian_Flyway_Map.png)

The **Central Asian Flyway** (CAF) is the migration routes of waterbirds from Siberia to West Asia and South Asia. The CAF covers 279 migratory waterbird populations of 182 species.

Figure 8: Connections: Sundarbans eco-region in Bangladesh



Source: [http://assets.wwfindia.org/img/original/sundarban\\_map.jpg](http://assets.wwfindia.org/img/original/sundarban_map.jpg)

In **Bangladesh** there are about 628 bird species of which 244 are migratory. However the wetlands of Bangladesh, such as the **Sundarbans**, are being degraded due to population growth and withdrawal of water for irrigation.

Australia is connected to the movement of birds to and from Asia in the **East Asian-Australian Flyway**. Most migratory species visit Australia during summer from the northern hemisphere (China, Mongolia and Japan) and depart between March and May.

The Asian Migratory Bird Flyways and the Ramsar Convention on Wetlands endorses the conservation of migratory waterbirds and their habitats. Immediate action is required to restore these habitats to enable the survival of migratory birds.

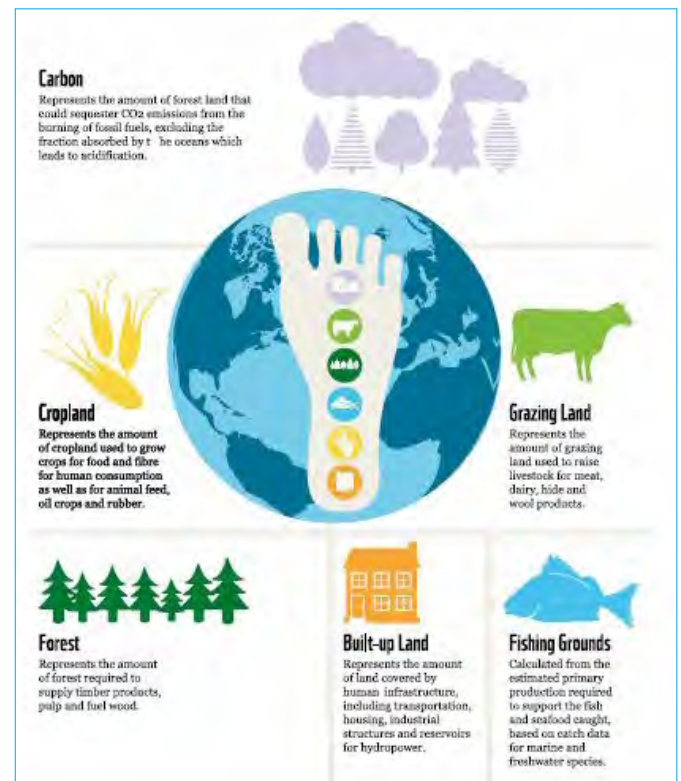
## Ecological Footprint (EF)

Humans depend on nature for goods and services for our wellbeing and economic growth. However, at present the global demand for resources exceeds Earth's regenerative capacity. If this trend continues humans could be on the brink of extinction. This would be unsustainable!

Greenhouse gases from transport and industry are released into the atmosphere every day. Oceans and rivers are used as dumping grounds for sewage, nuclear waste, mercury and other toxic chemicals. As informed, responsible citizens humans need to promote the sustainable use of resources if we are to reduce air, water and soil pollution, global warming and loss of plant and animal species.

The **ecological footprint (EF)** measures the area of land and water required to provide resources and services and absorb wastes, produced by humans. The EF takes into account the quantity of environmental resources used to produce energy (e.g. oil, gas, coal and forests), grow food (e.g. crops, livestock and fish), build infrastructure (e.g. buildings and roads) and dispose of waste (e.g. garbage). As passengers aboard spaceship Earth, life and earth centred worldviews, support the conservation of limited natural resources.

Figure 9: Components of the Ecological Footprint



Source: [http://awsassets.panda.org/downloads/china\\_ecological\\_footprint\\_report\\_2012\\_small.pdf](http://awsassets.panda.org/downloads/china_ecological_footprint_report_2012_small.pdf)

# SUSTAINABILITY

Since the 1970s humans have exploited the Earth's renewable resources at a faster rate than can be regenerated. In 2012 humans required one and a half Earths to sustain current consumption and by 2030 it is anticipated to rise to more than two Earths (WWF).

The **Global Footprint Network** promotes the science of sustainability by promoting the Ecological Footprint.

## Countries in the Asia region

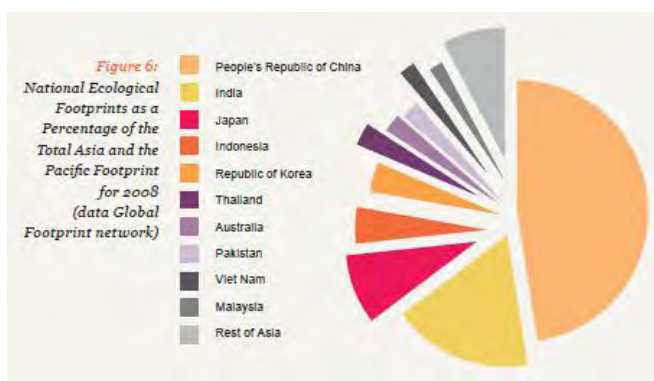
Countries in the Asia region are facing unprecedented environmental degradation. The **main drivers** of environmental change in the region include:

- population growth
- economic growth
- urbanisation
- increase in consumption of resources

Despite the rich natural capital in the Asia region (e.g. forests, coasts, wetlands, rivers, minerals) biodiversity is declining. As population and demand for resources increases the Asia region is experiencing a growing EF and resulting decline in **biocapacity**. For example over exploitation of natural resources over the last 25 years resulted in **Borneo** losing 850,000 ha of forests every year. In China with a population of 1.3 billion people the country already exceeds its biocapacity more than two times.

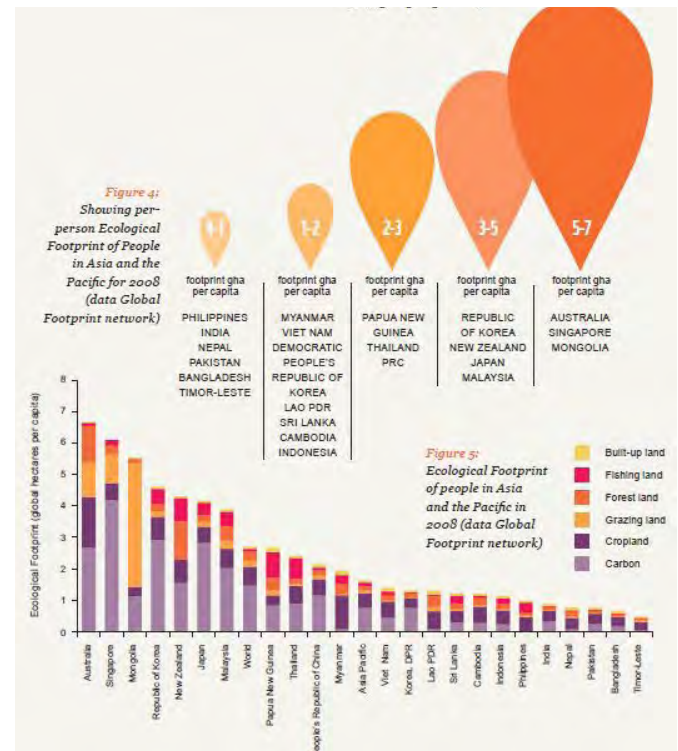
The Asian region has overtaken the rest of the world in consumption of raw materials as people become wealthier (rise of the middle class and billionaires) and manufacturing increases. **China** and India are transitioning from agrarian to industrialised economies and at the present rate of change has resulted in unsustainable use of resources (e.g. air and water pollution, soil degradation and loss of biodiversity)

Figure 10: Ecological Footprint Asia-Pacific



Source: [http://d2ouvy59p0dg6k.cloudfront.net/downloads/asia\\_pacific\\_reporthr.pdf](http://d2ouvy59p0dg6k.cloudfront.net/downloads/asia_pacific_reporthr.pdf)

Figure 11: Ecological footprint per person in the Asia-Pacific Region



Source: [http://d2ouvy59p0dg6k.cloudfront.net/downloads/asia\\_pacific\\_reporthr.pdf](http://d2ouvy59p0dg6k.cloudfront.net/downloads/asia_pacific_reporthr.pdf)



Source: Wikimedia Commons



# SUSTAINABILITY

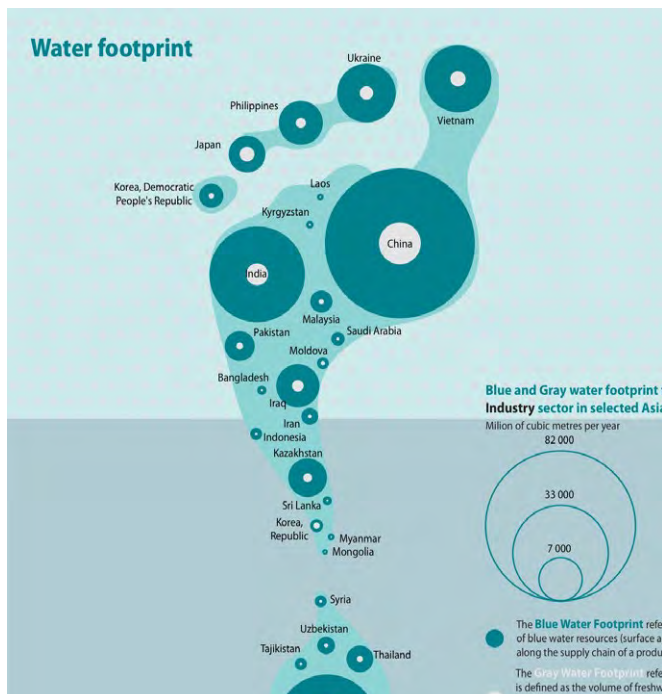
## Carbon and Water Footprint in Asia

The carbon and the water footprints are important components of the ecological footprint (EF):

- The **Carbon Footprint** (CF) measures the amount of greenhouse gases produced by humans.
- The **Water Footprint** (WF) is the total volume of freshwater used to produce the goods and services consumed by humans. The world average water footprint is equivalent to half the volume of an Olympic swimming pool.

The large and growing CF and WF is unsustainable.

Figure 12: Water footprint for Asian countries



Source: <http://temp.waterfootprint.org/downloads/WF-IndustryAsia.jpg>



Photograph: Manikamika Ghat, Varanasi. Source: Wikimedia Commons

### India's Carbon Footprint

The average Indian emits 16 times less carbon dioxide than the average American. However, with a growing population it is predicted that India will become the world's third largest emitter of carbon dioxide by 2020.

The preference of Indian Hindus for cremation in a country of 1.2 billion people exacerbates the problem. To burn a body takes 400-500kg of wood. This means 50-60 million trees are cut every year to burn the dead. At present there is technology to make cremations more environmentally friendly but traditional cultural practices dominate.



Photograph: Ghats at Varanasi. Cremation of dead bodies (J. Bliss)




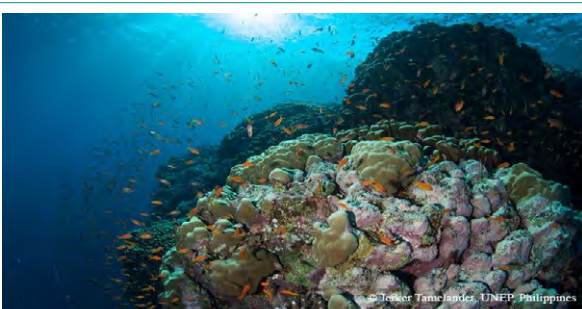

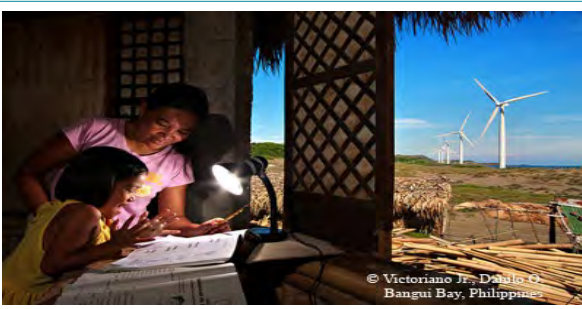

Photograph: Manikamika Ghat, Varanasi. Source: Wikimedia Commons



# SUSTAINABILITY

## Asia-Pacific Region: UNEP environmental thematic priorities

Figure 13: United Nations Environmental Programme

 <p>© Mukhopadhyay Soumenath, India West Bengal, India</p>	<p>Asia Pacific is one of the most vulnerable regions to climate change. Rising temperatures and extreme weather events have contributed to loss of crop yield in many countries. Crop yields are projected to decline by a further 10 percent by 2020.</p>
 <p>© Jesser Tanculander, UNEP, Philippines</p>	<p>The Asia Pacific region boasts a high level of biological and cultural diversity which has shaped its history and economic activities. While the region occupies less than 10 per cent of the planet's total surface, it is home to more than half of the world's human population and some of the most diverse plant and animal species in the world.</p>
 <p>© Abu Kazi Riayat, Chittagong Bangladesh</p>	<p>In Asia Pacific, harmful and hazardous waste threatens millions of people. Left unchecked, these wastes could pose severe hazards. Asia's high population density and often tropical climate put it especially at risk for contamination. Regulations have increased but enforcement remains inadequate.</p>
 <p>© Victoriano Jr., Danilo G. Bangui Bay, Philippines</p>	<p>Most of the global growth in resource use has occurred in high-income Organization for Economic Cooperation and Development (OECD) countries, but recently the Asia and the Pacific region has emerged as a major global resource consumer and has surpassed the rest of world in material use.</p>
 <p>© Weraiyuth Lamang, Thailand</p>	<p>While there has been significant progress in the last decade in the development of environmental institutions and legislation, the region's burgeoning economic growth and growing population have taken a toll on its natural resource base and the environment.</p> <p>Appropriate environmental safeguards are urgently needed to contain this trend. Decision-making that promotes sustainable development requires a sound understanding of the complex relationship between the environment and social and economic development.</p>

<http://www.unep.org/roap/ROAPHome/tabid/794453/Default.aspx#horizontalTab1>



# SUSTAINABILITY

## Stewardship: Active citizenship



As informed citizens humans have a responsibility or environmental stewardship to use and protect the environment through sustainable practices.

Humans require ecosystem services to provide food, regulate climate and support crop pollination.

Already anthropogenic (human) actions challenge the sustainability of ecosystems with atmospheric and water pollution, loss of biodiversity and degradation of land. Stewardship is responsible planning and management of Earth's resources linked to sustainability containing the three dimensions – environmental, economic and social.

Image: <http://www.sthilda.ca/images/earth.jpg>

From the local to the global scale conservation organisations support sustainability principles such as:

- *Non-renewable resources* should not be exploited above rates of renewal
- *biodegradable wastes* should not be added to the environment faster than they can be broken down or recycled
- *protection* of life support functions of the environment

The Earth Summit at Rio in 1992 and Rio+20 in 2012 challenged humans to reduce their EF by 'treading lighter on Earth.' In support, the Millennium Development Goal Seven (MDG) (2000–2015) integrates sustainable programs to reverse the loss of environmental resources. This goal is supported by non-government organisations (NGOs) and governments such as:

- *Global Conservation Trust* – helps Asian countries conserve crop diversity
- *Global Environment Facility* – combats desertification and organic pollutants in Asian countries
- *Global agreements* – the Kyoto Protocol aims to reduce greenhouse emissions. China has agreed to increase its non-fossil fuel share of energy to 20% by 2030.
- *Australian Government* (Department of Foreign Affairs and Trade, DFAT) – helps developing countries in the Asia region to conserve plant diversity, restore soils and use sustainable energy sources
- *United Nations Environment Program* (UNEP)

– uses satellite imagery and **geographic information systems (GIS)** to observe and manage environmental changes in Asian countries such as water quantity and quality. The solar loan program sponsored by UNEP helped 100,000 people finance solar power systems in India.

In the Asia Pacific, UNEP works at the regional, sub-regional and national levels. There are five sub-regions: Northeast Asia, South Asia, Southeast Asia, and South Pacific.

### India's solar program



A farm in Tamil Nadu, India which uses Solar Power to run its water pumps and lights. Source: Wikimedia Commons

# SUSTAINABILITY

## Post 2015 Sustainable Development Goals

The Post 2015, Sustainable Development Goals have been proposed as targets relating to future international development.

### Importance of sustainability in the post 2015 development agenda

'The proposed Sustainable Development Goals to be attained by 2030 are to: (1) end poverty everywhere; (2) end hunger, improve nutrition and promote sustainable agriculture (3) attain healthy lives for all; (4) provide quality education and life-long learning opportunities for all; (5) attain gender equality, empower women and girls everywhere; (6) ensure availability and sustainable use of water and sanitation for all; (7) ensure sustainable energy for all; (8) promote sustained, inclusive and sustainable economic growth, full and productive

employment and decent work for all; (9) promote sustainable infrastructure and industrialization and foster innovation; (10) reduce inequality within and between countries; (11) make cities and human settlements inclusive, safe and sustainable; (12) promote sustainable consumption and production patterns; (13) tackle climate change and its impacts; (14) conserve and promote sustainable use of oceans, seas and marine resources; (15) protect and promote sustainable use of terrestrial ecosystems, halt desertification, land degradation and biodiversity loss; (16) achieve peaceful and inclusive societies, access to justice for all, and effective and capable institutions; (17) strengthen the means of implementation and the global partnership for sustainable development.'

Source: <http://www.eoi.es/blogs/imsd/the-importance-of-sustainability-in-the-post-2015-development-agenda/>

Figure 14: Post 2015 Sustainable Development goals and targets



Source: <http://www.eoi.es/blogs/imsd/files/2015/01/UN-Post-2015-.png>



# SUSTAINABILITY

## Sustainable Development in Asia: Towards green economies

Despite countries in the Asia region following a path of unsustainable development many countries are adopting more sustainable policies and programs to reduce greenhouse emissions (solar energy) and water scarcity (desalination plants). Some countries have improved the management of hazardous waste, reduced the use of artificial chemicals on farms, restored ecosystems and reafforested eroded lands.

Many Asian countries have pledged to reduce greenhouse gas emissions such as Indonesia (26% by 2020) and China (40% of GDP by 2020). South Korea has a National Strategy for Green Growth with the vision of becoming a global green leader by 2020. China's 12<sup>th</sup> five year plan (2011–2015) stipulates a 16% reduction in energy use and a 1.3% increase in forest cover. Such measures could assist these countries move to a Green Economy.

China is piloting low carbon provinces (e.g. Guangdong) and cities (e.g. Chongqing) and carbon emissions trading schemes. Additionally Indian is enforcing fuel-economy standards for vehicles, development of climate-resistant crops and encouraging power generation from renewable sources (e.g. solar, wind and biomass).

In 2014 the inaugural session of the **Asia-Pacific Forum on Sustainable Development (APFSD)** was held. Discussions was on Sustainable Development (currently proposed as “Achieving the Millennium Development Goals and charting the way for an ambitious post-2015 development agenda, including the Sustainable Development Goals”)

Read more at: <http://www.unescap.org/events/asia-pacific-forum-sustainable-development>

**Sustainable Development in Asia (SDA)** has four thematic reports on:

- natural resources
- energy
- environment and climate change
- culture from particular perspectives of agriculture.

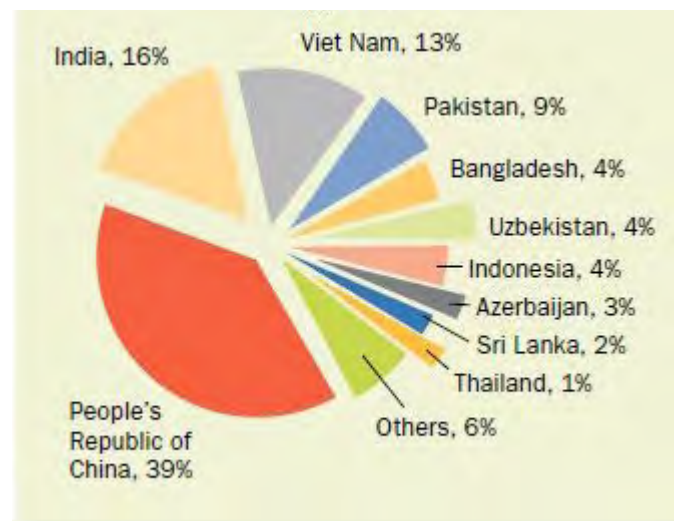
They aim to:

- 1) investigate common sustainability issues faced by all Asian countries, including population increase, poverty alleviation, pollution control, ecological restoration, as well as regional problems, such as water shortage in West and Central Asia, energy security in Northeast Asia, development model and transformation in East Asia;

- 2) analyse and summarise of best practices towards sustainable development in Asia;
- 3) bring forward suggestions and policy options for promoting green transition, system innovation and sustainable development of Asia.

Source: Towards Sustainable Asia [http://www.springer.com/gp/book/9783642166785?token=gbgen&wt\\_mc=GoogleBooks.GoogleBooks.3.EN](http://www.springer.com/gp/book/9783642166785?token=gbgen&wt_mc=GoogleBooks.GoogleBooks.3.EN)

Figure 15: Asia Development Bank (ADB): Greening growth in Asia and the Pacific



Source: <http://www.adb.org/sites/default/files/publication/29067/environment-program.pdf>

The pie chart above shows the top ten borrowers from the ADB with environmental sustainability as a theme 2003 – 2010.



Parallel Funicular, Chongqing port, China. Source: Wikimedia Commons



# SUSTAINABILITY

Figure 16: Asia Development Bank (ADB) Environmental Projects in India, China and Nepal

## Box 2.06: IND 2679: MFF-Sustainable Coastal Protection and Management Investment Program—Tranche 1 (Loan approved in 2010 for \$51.56 million)

**T**he investment program will address immediate coastal protection needs and coastal instability using environmentally and socially appropriate solutions in the states of Goa, Karnataka, and Maharashtra. Target is 150 km of coastline with community and private sector participation. Project 1 shall meet the requirements for 10 km of the coast.

The project will:

- (i) develop sustainable plans and management for shorelines;
- (ii) reduce coastal erosion and instability;
- (iii) adopt softer options such as artificial reefs, beach nourishments, and dune management; and
- (iv) enhance capacity for shoreline planning and development.

The three states will take steps toward encouraging private sector investments in coastal protection and management, including putting in place enabling policies and guidelines for private sector participation in coastal protection and management, when feasible.

## Box 2.09: NEP 2656: Kathmandu Sustainable Urban Transport Project (Loan approved in 2010 for \$10 million)

**T**he project will improve the quality of urban life in the capital city of Nepal by delivering a more efficient, safe, and sustainable urban transport system.

The project will holistically integrate the following components:

- (i) a plan to rationalize and upgrade the existing public transport network, tested through the implementation of pilot routes provided with electric vehicles;
- (ii) traffic management work and measures that will enable heritage routes in the city center to be pedestrianized and improve general walking conditions; and
- (iii) improvement of air quality monitoring.

By 2018, CO<sub>2</sub> emissions and other air pollutants in Kathmandu valley are expected to decrease by 20% from the present baseline.

## Box 2.07: PRC 2436: Ningxia Integrated Ecosystem and Agricultural Development Project (Loan approved in 2008 for \$100 million)

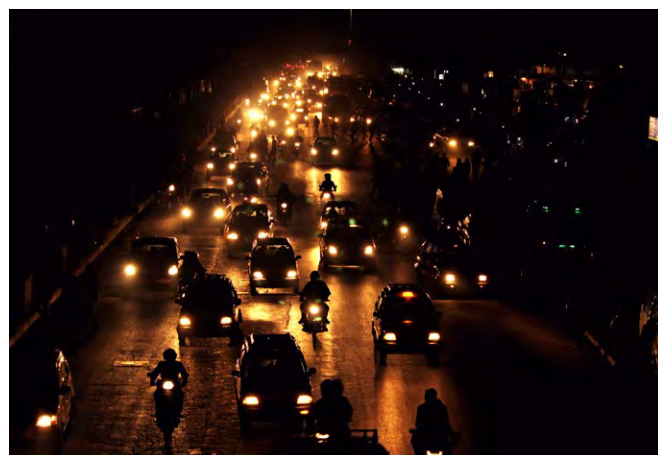
**T**he project will rehabilitate the ecosystems and increase rural incomes in the Yinchuan area, covering 3,655 km<sup>2</sup> of the oasis of the Yinchuan Plain and extending into the Helan Mountains to the west of the Yellow River in Ningxia Hui Autonomous Region.

The project will:

- (i) reform enabling policies and regulations, as well as build institutional, regulatory, and policy capacity to combat land degradation through an integrated ecosystem management approach;
- (ii) demonstrate measures to achieve improved water and land use planning and management;
- (iii) support sustainable rural livelihoods in poor communities through contracts with commercial enterprises;
- (iv) provide support measures to protect 15 globally threatened species (with a Global Environment Facility grant); and
- (v) promote sustainable resource use and protect and conserve wetlands, grasslands, transboundary flyways, and cultural sites through a market-based approach.

Use of an integrated ecosystem management approach shall emphasize the links between natural ecosystem capacities and socioeconomic activities, and shall seek to holistically rehabilitate damaged ecosystem services and functions by tackling the root causes of damaging practices, including reduction of rural poverty.

Source: <http://www.adb.org/sites/default/files/publication/29067/environment-program.pdf>



Traffic in Kathmandu. Source: [https://commons.wikimedia.org/wiki/File:On\\_the\\_Road.jpg](https://commons.wikimedia.org/wiki/File:On_the_Road.jpg)



# SUSTAINABILITY

## Asian Green City Index

Asian countries are experiencing a high rate of population growth in cities and people from rural areas due to push-pull forces. However the scale of migration has impacted adversely on the urban environment. The Asian Green City Index measure energy, CO<sub>2</sub>, transport, waste, water, sanitation, air quality, landuse and buildings. The Index found energy consumption and carbon emissions were rising, especially in China, but there was an increase in policies to limit greenhouse gases and use energy more efficiently. Bangkok (Thailand) is promoting the use of biofuels and Osaka (Japan) the use of solar energy.

Singapore was the leading city with water recycling plants, waste-to energy facilities and Yokohama above average with subsidies for electric vehicles. In Asia there was a positive correlation between wealth (GDP per capita) and environmental performance.

Figure 17: Overall performance of 22 cities in the Asian Green Index



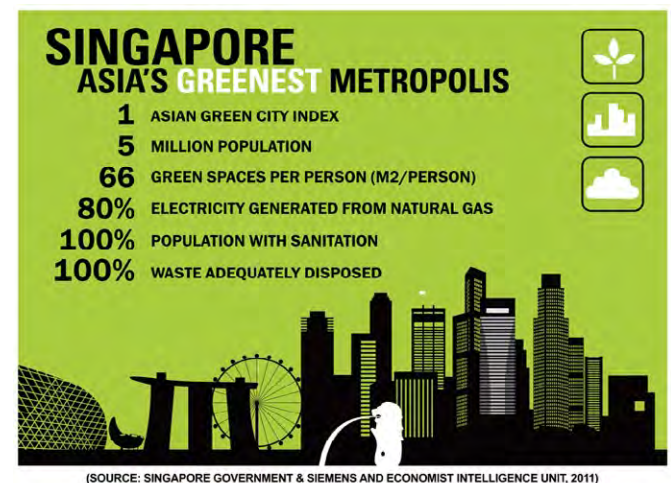
Source: <http://www.thecrystal.org/assets/download/Asian-Green-City-Index.pdf>

Figure 18: Singapore – Asia's greenest metropolis



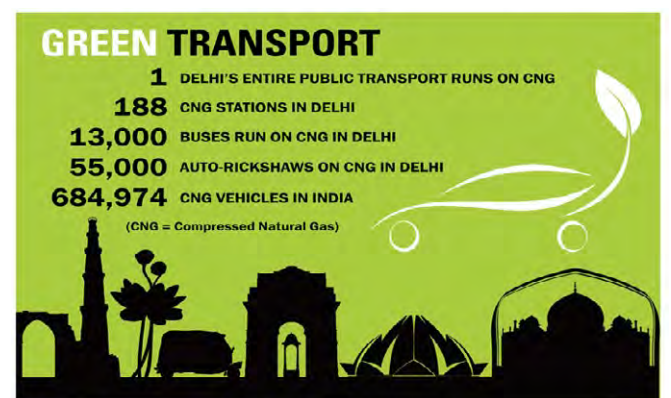
## Asian Green City Index

Slideshare: <http://www.slideshare.net/Management-Thinking/asian-green-city-index-assessing-the-environmental-performance-of-asias-major-cities>



Source graphic and photo: <http://ejap.org/environmental-issues-in-asia/images-green-areas/Green%20Graph-2.jpg>; and [http://www.ubmfuturecities.com/document.asp?doc\\_id=524106&image\\_number=3](http://www.ubmfuturecities.com/document.asp?doc_id=524106&image_number=3)

Figure 19: Green transport in Delhi (India)



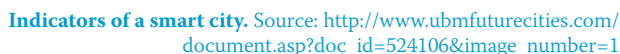
Source: <http://ejap.org/environmental-issues-in-asia/images-green-areas/Green%20Graph-3.jpg>



### Figure 20: Interesting findings on India in the Asian Green City Index



Figure 21: The 10 smartest cities in the Asia-Pacific



Using data from several sources, including Mercer Quality of Living report, the Siemens Green City Index and Rutgers, Cohen comes up with the top 10 Asia/Pacific smart city rankings.

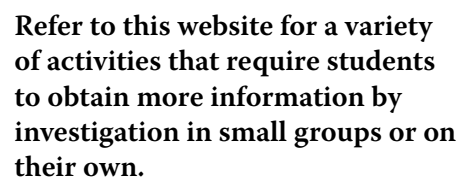
- 1..Hong Kong
2. Singapore
3. Seoul
4. Tokyo
5. Auckland
6. Sydney
7. Kuala Lumpur
8. Taipei
9. Shanghai
10. Osaka

Figure 22: WordL: Sustainable consumption in Asia



## Activities F-6

## Earth Hour – Primary



Students then gather information and present research by different communication methods such as oral or PowerPoint

## Other resources

- Primary School: Cattle and the Environment; Years 5-6 Science and sustainability; K-2 and Years 3-4 Science and sustainability [http://www.target100.com.au/Hungry-for-Info/Education/National-Curriculum-Study-Guides?gclid=CIGF\\_MGHk8UCFVSWvQods1UAiQ](http://www.target100.com.au/Hungry-for-Info/Education/National-Curriculum-Study-Guides?gclid=CIGF_MGHk8UCFVSWvQods1UAiQ)
- China –Stage 2 [http://www.curriculumsupport.education.nsw.gov.au/primary/hsie/assets/pdf/china/chinateach\\_bk.pdf](http://www.curriculumsupport.education.nsw.gov.au/primary/hsie/assets/pdf/china/chinateach_bk.pdf)



# SUSTAINABILITY

- What is a national park? <http://www.curriculumsupport.education.nsw.gov.au/primary/hsie/assets/pdf/natparkinfo.pdf>
- Energy saving activities <http://www.yourenergysavings.gov.au/>
- NASAs Climate Kids <http://climatekids.nasa.gov/carbon/>
- Achieve Science- Sustainability in the Asia-Pacific <http://www.blake.com.au/Achieve-Science-Sustainability-Asia-Pacific-p/9781921680656.htm> (shelter, food, energy, transport, water, waste, clothing and population)
- Department of the Environment – Australia <http://www.environment.gov.au/sustainability/education/aussi/educational-resources>
- Achieve Geography- Sustainability in the Asia Pacific <http://www.blake.com.au/Achieve-Geography-Sustainability-in-the-Asia-Pa-p/9781921680908.htm>
- UNESCO Teaching and Learning for a Sustainable Future <http://sustainability.edu.au/material/teaching-materials/unesco-teaching-and-learning-sustainable-future/>

## Activities 7, 8, 9 and 10

1. Explain the following acronyms: EF, CF, WF, MDG, WWF, GIS and UNEP
2. What is meant by biocapacity?
3. What will occur if humans continue to exceed global biocapacity?
4. Refer to **Figure 1**: List whether the following resources are renewable or non-renewable: coal, wind, water, gold, trees, oil, sun and rivers
5. Refer to **Figure 2**: List the three parts of sustainability
6. Rare Earth Elements
  - a. Construct a table with two columns illustrating the costs and benefits of REE
  - b. Suggest actions for the sustainable use of REE
7. Refer to **Figure 4**: Distinguish between an earth-centred with a human-centred worldview
8. Explain the worldview you follow and the reasons for its selection
9. Refer to **Figures 5 and 6**. Explain how Asia is connected to the rest of the world
10. Refer to **Figures 7 and 8**: Flyways
  - a. Explain why species (animals and birds) migrate
  - b. Describe the different flyways across Asia
  - c. Analyse the impact of an oil spill on migratory birds and marine species
  - d. Explain how animal, bird and marine migration patterns will need to adapt to climate change, clearing of wetlands, logging, hunting and fishing, to survive in the future
11. Refer to **Figure 9**: List the main components of an ecological footprint.
12. Refer to **Figure 10**: Calculate (as a percentage) the ecological footprint of China, India, Pakistan and Australia in relation to total area of the land.
13. Refer to **Figure 11**:
  - a. What three countries have the largest ecological footprint per person in the Asia-Pacific region?
  - b. Compare the ecological footprint of Bangladesh (developing country) with Japan (developed country)
  - c. Suggest strategies to reduce the Asian EF for a more sustainable Earth
14. Distinguish between a carbon footprint and a water footprint
15. Refer to **Figure 12**:
  - a. Distinguish between blue and grey water.
  - b. List the two top consumers of grey water in Asian countries
  - c. Calculate how many cubic metres of water per year are consumed in China, India, Vietnam and Iran.
16. Refer to **Figure 13**: What are the main environmental issues concerning UNEP?
17. What is meant by stewardship?
18. Refer to **Figure 14**: List the Post 2015 Sustainable Development Goals. Why are they important?
19. Refer to **Figures 15 and 16**: Describe how the Asian Development Bank improving the environment of some Asian countries
20. What are the indicators used in Asia's Green Cities Index
21. Refer to **Figures 17 and 18**:
  - a. Why is Singapore ranged well above average
  - b. Research the reasons why Karachi or Mumbai are ranked low on the index
22. Refer to **Figures 19 and 20**: Describe how some Indian cities have improved their environment
23. Refer to **Figure 21**:

# SUSTAINABILITY

- a. What makes a city smart?
- b. Why is Hong Kong ranked 1<sup>st</sup>
- c. Explain why Sydney is only ranked 6<sup>th</sup>
24. In groups draw a mind map of environmental problems in Asian countries.
25. What are your thoughts on the following comments:
  - a. When will we run out of useable planet?
  - b. What should you/we do about it?
  - c. What world do we want?
  - d. If I do not use this resource, someone else will?
  - e. Why should we look after the Earth for future generations?
  - f. Use now, I am gone tomorrow!
  - g. How does the little bit I use or pollute matter?
  - h. Why care, it is a renewable resource?
26. Explain the WWF 'One Planet Perspective' [http://wwf.panda.org/about\\_our\\_earth/all\\_publications/living\\_planet\\_report/living\\_planet\\_index2/](http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/living_planet_index2/)
27. Create an animated conversation on sustainable environmental resources using Xtranormal



Source: [http://newsimg.bbc.co.uk/media/images/41379000/jpg/\\_41379432\\_fireworks\\_416.jpg](http://newsimg.bbc.co.uk/media/images/41379000/jpg/_41379432_fireworks_416.jpg)

28. We pay China and developing countries to produce cheap goods. The wages paid to these people are helping them move out of poverty. They are working their way up the consumerism food chain. So their EF is increasing. In fact, with rare exceptions, everyone's footprint is increasing. So the big questions are: When do we run out of usable planet? How are our EF interconnected in this globalised world?
29. List the 17 Post 2015 Sustainable Development Goals by UNEP in the publication Our Planet: Time for Global Action – <http://www.unep.org/>

30. Complete the questions in the geography unit on measuring the environmental and social footprint of the Beijing Games – [www.geography.org.uk/download/GA\\_Beijing08Digby21618.pdf](http://www.geography.org.uk/download/GA_Beijing08Digby21618.pdf)

## Weblinks

Asia Low Emission Development Strategies (LEDS) – <http://asialeds.org/>

Three spheres of sustainability – <http://images.quickblogcast.com/0/5/1/5/8/293672-285150/TripleBottomLine.png?a=7>

Asian Development Bank Strategy 2020 – <http://www.adb.org/sites/default/files/institutional-document/32121/strategy2020-print.pdf>

View An *Inconvenient Truth* (Al Gore) – <http://www.climatecrisis.net/>. Download at this site. What is the problem with the EF? How should it be managed?

Living Planet Report.– [http://wwf.panda.org/about\\_our\\_earth/all\\_publications/living\\_planet\\_report/](http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/)

Ecological Footprint Links and Resources – <http://www.redefiningprogress.org/programs/sustainability/links/>

Ecological footprints of nations – <http://www.ecouncil.ac.cr/rio/focus/report/english/footprint/>

WWF Global – [http://www.panda.org/how\\_you\\_can\\_help/at\\_home/index.cfm](http://www.panda.org/how_you_can_help/at_home/index.cfm)

Pacific Dust Express – [http://science.nasa.gov/science-news/science-at-nasa/2001/ast17may\\_1/](http://science.nasa.gov/science-news/science-at-nasa/2001/ast17may_1/)

Sustainable Energy Development Strategy for Bangladesh: Going towards Green – <http://asialeds.org/resources/sustainable-energy-development-strategy-bangladesh-going-towards-green?tab=country&name=447>

Asian Green City Index – <http://www.thecrystal.org/assets/download/Asian-Green-City-Index.pdf>

## YouTube

Green growth: a new model for sustainable development in Asia – <https://www.youtube.com/watch?v=NXBopuAyO0w>

My environmental worldview – <http://www.youtube.com/watch?v=F34vWUBnICM>

National Geographic: The Human Footprint [1/10] 15 Dec 2008, 10 min – <http://www.youtube.com/watch?v=ey3rGFNPAGQ&feature=related>

She's Alive, Beautiful, Finite, Hurting, Worth Dying for. 4.59min, 26/6/2011 – <http://www.youtube.com/watch?v=nGeXdv-uPaw>





## Global Education – Learning Emphases

- Interdependence and globalisation
- Identity and cultural diversity
- Social justice and human rights
- Peace building and conflict resolution
- Sustainable futures

# USING ICT TOOLS TO STUDY ASIA

**A resource for Stages 3–6  
by Lorraine Chaffer**

[https://commons.wikimedia.org/wiki/File:Asia\\_Globe\\_NASA.jpg](https://commons.wikimedia.org/wiki/File:Asia_Globe_NASA.jpg)

# USING ICT TOOLS TO STUDY ASIA

**The availability of interactive websites and online presentation tools provides exciting opportunities for students to interact with and manipulate data, to communicate their research findings in interesting and creative ways and to summarise key ideas and concepts from the topics they study in class.**

Using web tools students can conduct research and create visual presentations such as:

- **Graphs** – using their own or imported statistics about Asian countries eg population, GDP e.g. Create a graph (<http://nces.ed.gov/nceskids/graphing/classic/>), Excel
- **Surveys** about aspects of life in Asia – these can be collated for analysis and converted to graphs e.g. Survey Monkey (<https://www.surveymonkey.com>)
- **Maps and tours** of places within Asia and within individual Asian countries e.g. Scribble maps, Google Maps, Google Earth, Google Tour Builder
- **Movies, photo-stories, animations** about countries or aspects of Asian life such as food, religion and migration e.g. Tubechop (<http://www.tubechop.com>), Wideo (<http://wideo.co>), GoAnimate (<http://goanimate.com>), Animoto (<https://animoto.com/education/classroom>), and Digital films (<http://www.digitalfilms.com>)
- **Presentations** containing information and incorporating links to other material such as web pages, movies, maps, graphs and photographs e.g. Prezi, Glogster
- **Infographics**, digital posters containing visual summaries in diagram, photographic or graphic forms. Infographics relevant to Asia can be found with a Google search of images eg “*China infographic*”. There are many online tools for creating infographics such as Piktochart (<http://piktochart.com>) and Infogr.am (<https://infogr.am/education>)
- **Word clouds** are summaries of key concepts or research findings in pictures e.g. Wordle (<http://www.wordle.net>) and Tagxedo (<http://www.tagxedo.com>)
- **Mind maps** for summarising key concepts and brainstorming ideas e.g. Bubbl.us (<https://bubbl.us>) and Text 2 Mind Map (<https://www.text2mindmap.com>)
- **Websites and blogs** e.g. Weebly (<http://www.weebly.com>)

small presentations.

Teachers should check with their schools to see which software is licensed to access additional features. Most online tools also have tutorials making their use very simple.

Some tools are examined in more detail below



<http://prezi.com/>

A zooming presentation similar to PowerPoint but much more interesting because of the movement you create by setting a pathway between parts of your presentation. All of your information is on one page and you zoom around the page sometimes cleverly hidden in strange places. You can include photographs, word documents, PDF files, video clips such as YouTube, graphs, tables. Online tutorials take you step by step through the creating process making the software very user friendly.

Three sample student presentations on different Asian topics are illustrated here:

## 1. Student Prezi on Modern and Ancient Asian buildings (2014)

Source: <https://prezi.com/qavodbxcmqy/asia/>



Most of these Web tools have free access for creating



# USING ICT TOOLS TO STUDY ASIA

## 2. Student Prezi on gender equality in selected Asian Countries



Source: [https://prezi.com/kf\\_1oikomack/asia/](https://prezi.com/kf_1oikomack/asia/) (2014)

## 3. Student Prezi on Vietnam



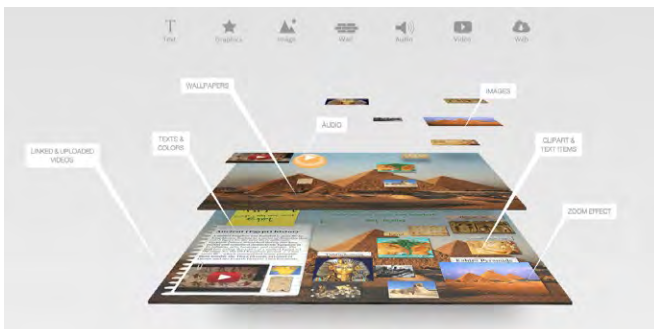
Source: <https://prezi.com/zv6ti0ho-plq/vietnam/> (2015)



<http://www.glogster.com/>

A “glog” is an interactive online poster used to present a variety of information such as maps, graphs, blog posts, and active links to video clips such as YouTube, audio files and other websites.

Creating a Glog achieved by adding layers of data, images and links as illustrated in the image below

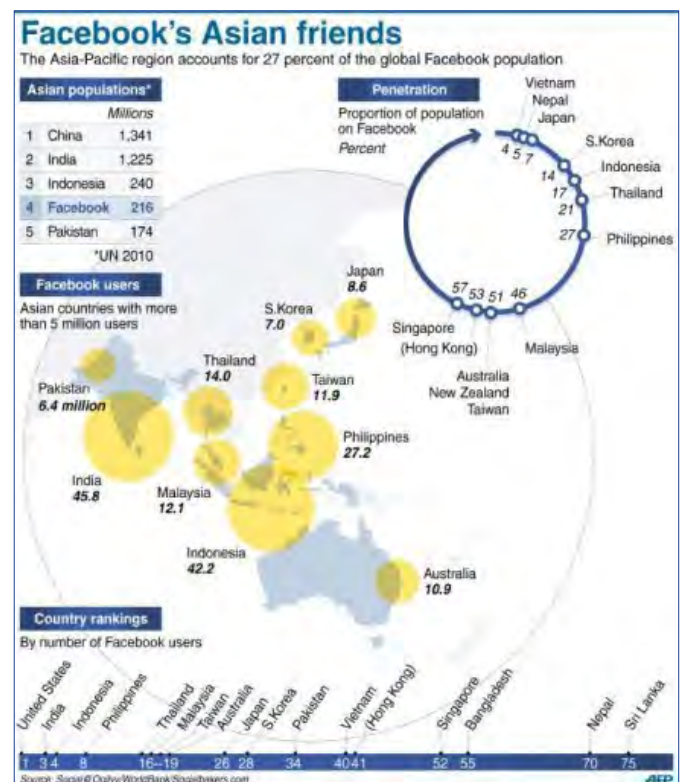


Source: <http://edu.glogster.com/?ref=com> (Screen capture)

The following link provides some guidelines for using Glogster in classrooms – <http://www.readwritethink.org/professional-development/strategy-guides/teaching-with-glogster-using-30790.html>

## INFOGRAPHICS and WORD CLOUDS

Infographics present information visually and graphically by incorporating maps, graphs, diagrams and text. A lot of information is presented in a small space and in a visually attractive format. Infographics are used to share information over the Internet. There are many sites offering basic infographic options for free.



Source: <http://www.thomascrampton.com/facebook/facebook-asia-infographic/>

Simple infographics include those used to create WORD CLOUDS such as Wordle and Tagxedo

## WORDLE

<http://www.wordle.net>

Key words or concepts from a topic can be used to create a word cloud. The more often a word is added to the source text, the larger it appears in the word cloud – a way for students to rank ideas or concepts. There are a variety of fonts, layouts and colours to choose from. Completed Word clouds can be printed, saved and incorporated into documents and presentations.

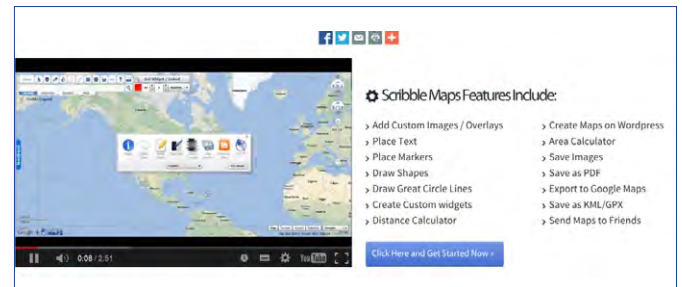


# USING ICT TOOLS TO STUDY ASIA



Source: <https://www.flickr.com/photos/planeta/2743976213/> (Screen capture)

Using Scribble maps, students can mark places on a map and add a travel path, photographs, a legend and outline an area with movable boundaries and labels. These maps can be exported, emailed or printed.



Source: <http://scribblemaps.com/> (Screen capture)

## TAGXEDO

<http://www.tagxedo.com>

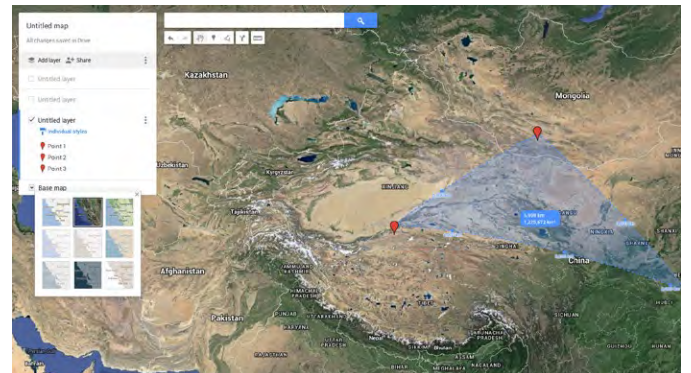
Key words or concepts from a topic can be used to create a word cloud in a selected shape relevant to the study content.



Source: <http://www.tagxedo.com/app.html?player=http://www.tagxedo.com/gallery/china.xap> (Screen capture)

## GOOGLE MAPS

In Google Maps students can create their own maps using a variety of base maps (eg. Map, satellite, terrain and political base maps). They can add placemarks and calculate distances between places and calculate areas.



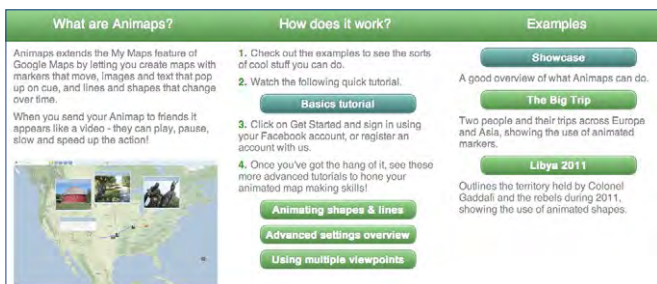
Source: <https://mapsengine.google.com/map/edit?authuser=0&authuser=0&hl=en&hl=en&mid=zVoRjXmGvHW0.k0TSQ9MTtxa1> (Screen capture)

The following are two versions of Google Maps showing Nepal that could be used to plot information about the 2015 earthquake.



## ANIMAPS and SCRIBBLE MAPS

Animaps are maps with moveable markers connected to images and text. They create a tour between places on a map.



Source: [www.animaps.com/#!home](http://www.animaps.com/#!home) (Screen capture)



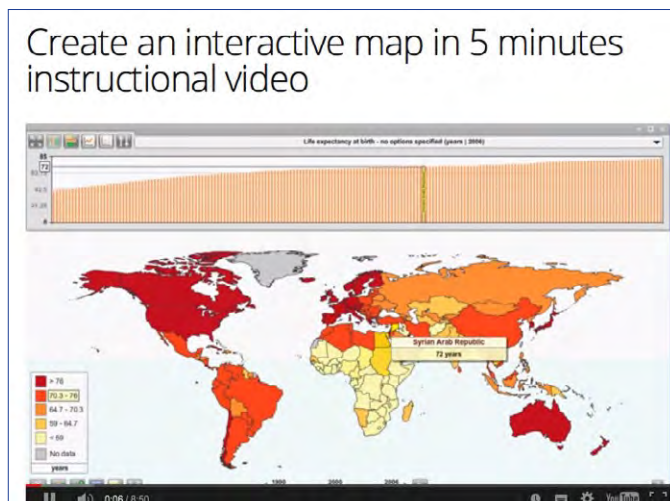
# USING ICT TOOLS TO STUDY ASIA



## STATPLANET

<http://www.statsilk.com/software/statplanet>

StatPlanet is free software for creating interactive maps and graphs using existing data of your choice imported into the program. A tutorial is provided giving step-by-step instructions on creating a world map and/or graph allowing Asian countries to be compared with other countries on a number of indicators



Source: <http://www.statsilk.com/software/statplanet> (screen capture)

## GAPMINDER WORLD

<http://www.gapminder.org> (Home page – select Gapminder World))

This interactive website allows the creation of **scatter graphs** showing how the world's countries perform on selected indicators. These graphs are particularly useful for analysing the relationship between different variables eg birth rates and income and for comparing the performance of different countries.

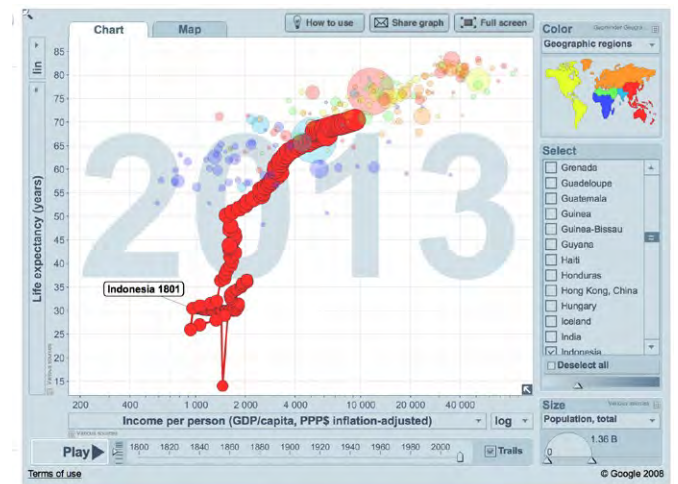
### 1. Comparing countries and continents

This graph shows how long people live and how much money they earn. The colours indicate continents or regions of the world. By clicking the play button the graph changes to show how countries have developed since 1800.



### 2. Tracking change in one Asian Country

Individual countries can be selected to see change over time more clearly. In this example the improving life expectancy and income per person in Indonesian is clearly evident



The website contains links to Hans Rosling Ted talks – analysing the performances of countries on different indicators of development and human well-being.

### Asia's rise, how and when (TEDIndia)

**HANS ROSLING**  
(click to play)

Share | 0:00 / 00:00

About this talk

Hans Rosling, at the first TED-conference in India, predicts when China and India will catch up with the United States in terms of income per person. He graphs global economic growth since 1858, depicting some of the main events using images and animated Gapminder charts.

# USING ICT TOOLS TO STUDY ASIA



Source: <http://www.gapminder.org/videos/hans-rosling-asias-rise-ted-india/> (Screen captures)



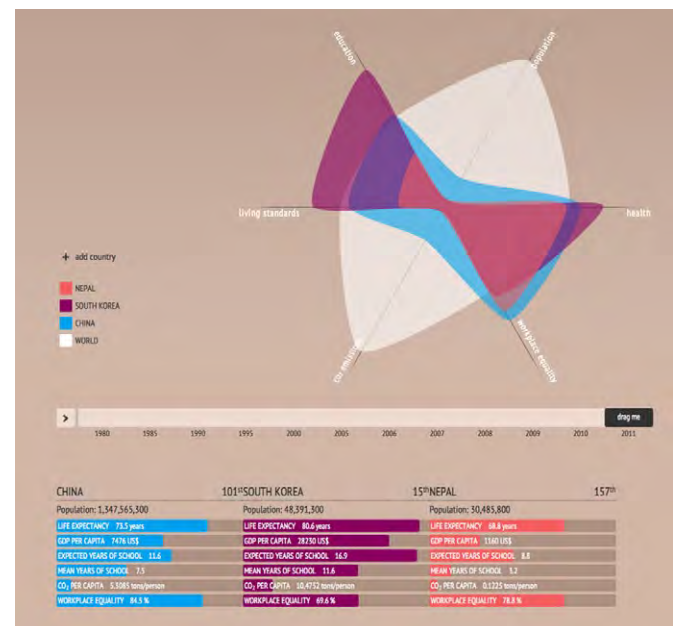
## WORLDSHAPIN

<http://worldshap.in/#/>

The world, continents and countries get their unique shapes in Worldshapin based on how low or high they fare on six development indicators. The three indicators from the Human Development Index (HDI) – Health, Education and Living Standard provide the basic data for Worldshapin along with three additional

indicators – Population, Workplace Equality and Carbon Footprint. Using Worldshapin as an indicator of human wellbeing and sustainability allows students to compare the performance of Asian countries with each other and with the world.

In this example South Korea is compared with China and Nepal. It can be seen that South Korea outperforms China on living standards, education and health and also outperforms the world average on these indicators. However South Korea is behind China on workplace equality, CO2 emissions and population. Nepal is below the world average on all indicators except workplace equality.



Source: <http://worldshap.in/#/CN/KR/NP/> (Screen capture)

## WORLD VISION TEACHING RESOURCE

### Australia's Engagement with Asia: Indonesia

#### Case studies in water, food, urbanisation and human wellbeing.

*Australia's engagement with Asia: Indonesia* is an engaging and easy-to-use teaching resource that supports the Australian Curriculum: Geography. Developed by World Vision and the Australian Geography Teachers' Association, it directly addresses two cross-curriculum perspectives: Sustainability and Asia and Australia's engagement with Asia.

The six chapters cover:

- Urbanisation and human wellbeing (Years 8, 10)  
The challenges of human wellbeing and urbanisation, especially in the megacity of Jakarta.
- Water and human wellbeing (Years 7, 10)  
The environmental, social and economic importance of water, and issues of scarcity and management.

- AusAID in Indonesia (Years 6-10)  
Jacqui de Lacy (Head of AusAID Indonesia) discusses the reasons for and effectiveness of government and non-government programs to improve human wellbeing.
- We live in a diverse world: Indonesia (Years 6-10)  
An overview of Indonesia and Australia's links with the country.
- Interconnections and human wellbeing (Years 9, 10)  
An economic development strategy, Exploring interconnections and Global geographies of human wellbeing.
- Food and human wellbeing (Years 9, 10)  
Biomes and food security and Global geographies of human wellbeing.

Download this resource at: <https://www.worldvision.com.au/get-involved/school-resources/group/australia-s-engagement-with-asia--indonesia>





## Global Education – Learning Emphases

- Interdependence and globalisation
- Social justice and human rights
- Peace building and conflict resolution
- Sustainable futures

# AIR POLLUTION CHOKING ASIA

**A resource for Stages 4–6  
by Dr Susan Bliss**

Source: [https://commons.wikimedia.org/wiki/File:Haze\\_in\\_Kuala\\_Lumpur.jpg](https://commons.wikimedia.org/wiki/File:Haze_in_Kuala_Lumpur.jpg)

# AIR POLLUTION CHOKING ASIA

**Clean air is a basic human right. It is essential to human survival and the conservation of natural resources. In a globally interconnected world, the hazardous spread of atmospheric pollution effects every person on Earth.**



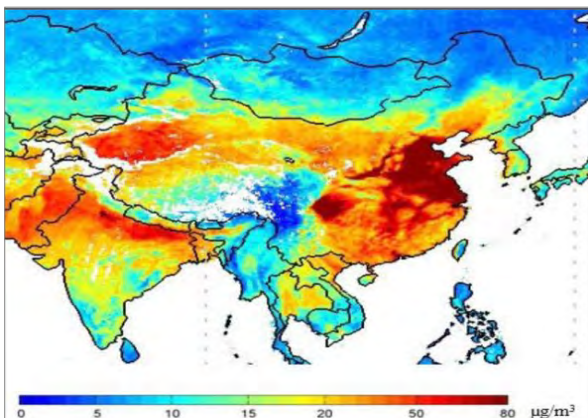
**Satellite image 1: Air pollution over China in December 2013.** Levels of PM2.5 were 300 to 500 micrograms per cubic metre.

Source: [http://en.wikipedia.org/wiki/2013\\_Eastern\\_China\\_smog#/media/File:Chinahaze\\_tmo\\_2013341\\_lrg.jpg](http://en.wikipedia.org/wiki/2013_Eastern_China_smog#/media/File:Chinahaze_tmo_2013341_lrg.jpg)



**Photograph 1: People performing morning exercises on a polluted day in Jiaozuo, Henan province in China March 2015**

Source: <http://www.foxnews.com/health/2015/04/01/california-getting-second-hand-smog-from-asia-researchers-say/>



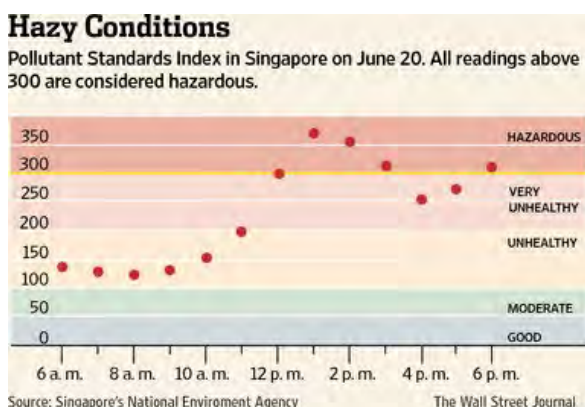
**Map of Asia 1: Areas experiencing air pollution based on monitoring data of PM2.5 in 2013**

Source: <http://www.mdpi.com/1660-4601/11/9/8909/html>



**Photograph 2: Smog in Ulaanbaatar, Mongolia**

Source: <http://i.bnet.com/blogs/smog-city-mongolia.jpg>



**Graph 1: Singapore choked by smoke from forest fires cleared for agriculture, on Indonesia's Sumatra Island, 2013**

Source: <http://blogs.wsj.com/indonesiarealtime/2013/06/20/singapore-air-pollution-index-hits-record-high/>



**Photograph 3: Air pollution from burning garbage, Delhi, India**

Source: <http://nritribune.com/people-complaining-about-garbage-burning-on-whatsapp/>



# AIR POLLUTION CHOKING ASIA



## DEADLY AIR POLLUTION

Since the Industrial Revolution, fossil fuels (coal, oil and gas) have become the main source of energy, causing the atmosphere to become increasingly polluted.

In 1952 the Great London Smog killed 8,000 people, and in 2012 the World Health Organisation (WHO), found 7 million people died as a result of air pollution. About 4.3 million people died from indoor air pollution caused by using coal, wood and biomass stoves, and 3.7 million from outdoor air pollution due to unsustainable practices in the transport, energy, waste management and industrial sectors. Approximately 88% of premature deaths occurred in developing countries, with the largest number in the South-East Asia and Western Pacific regions.

In 2010, the Global Burden of Disease (GBD) Report ranked air pollution in the world's top 10 killer diseases, with 1.2 million deaths a year in East Asia and China, and 712,000 in South Asia (includes India).

Population growth, rapid urbanisation and industrialisation have adversely impacted on air quality. This requires investments in green technology and the implementation of sustainable government policies and programs.

## Deaths from main air pollutants in East Asia and South Asia in 2010



Source: <http://ejap.org/environmental-issues-in-asia/health-issues.html>

## Timeline – Bhopal, India

**Dec 2-3 1984**  
A gas leak at the Union Carbide pesticide plant in Bhopal (in Madhya Pradesh)

**8,000-15,000**  
estimated people killed

**500,000**  
left suffering from toxic after-effects



**Keshub Mahindra**, former chairman of Union Carbide India Limited, also charged



**1985-89**  
The Indian government files a \$3.3bn claim against Union Carbide. In 1989 a \$470m settlement is reached with the Indian government (plus an additional \$43m to be distributed)



**1999**  
Union Carbide is bought by Dow Chemical; a Greenpeace report on the accident site says there is up to 6m times more toxic chemicals and deadly mercury in the area than expected



**2005**  
Four hundred tonnes of waste surrounding the incident site is moved to a warehouse – meanwhile people have been allowed to roam the area for years

**Jun 7, 2010**  
Eight people are convicted of criminal negligence; one of these former Union Carbide employees died but the remaining seven face a maximum of two years in prison

Source: Greenpeace, FT research



Source: <http://im.ft-static.com/content/images/b219b6ee-7259-11df-9f82-00144feabdc0.img?width=870&height=300&title=Bhopal%20timeline&desc=Bhopal%20timeline>

Source: [https://commons.wikimedia.org/wiki/Category:Bhopal\\_memorial](https://commons.wikimedia.org/wiki/Category:Bhopal_memorial)

A chemical plant owned by Union Carbide released **methyl isocyanate** into the atmosphere in 1984 at Bhopal in India.

Over 500,000 people were exposed to the gas and 3,000 people died.

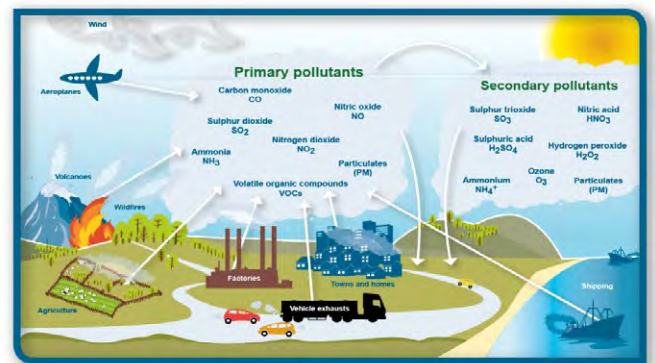


## AIR POLLUTANTS, SOURCES AND IMPACTS

Air pollution is the build-up of impurities in the air that are likely to be harmful to humans, plants and animals. These impurities can be:

- in the form of a gas, liquid or solid
- visible or invisible
- manmade (e.g. industry) or natural (weather)

## Main air pollutants and their sources



Source: [http://www.environment.scotland.gov.uk/media/26674/Sources-of-air-pollution\\_310314.png](http://www.environment.scotland.gov.uk/media/26674/Sources-of-air-pollution_310314.png)

## Main air pollutants

- **Ozone (O<sub>3</sub>):** damages vegetation, including crops.
- **Nitrogen dioxide (NO<sub>2</sub>):** increases risk of respiratory symptoms.
- **Carbon monoxide (CO):** poisonous to humans.
- **Lead (Pb):** it is commonly found around mines, waste incinerators, and iron and steel manufacturers. The lead accumulates in the soil and adversely affects plants, animals and humans.

# AIR POLLUTION CHOKING ASIA

- **Ammonia (NH<sub>3</sub>):** emitted from agricultural processes. High concentrations impacts on the environment and human health.
- **Biological pollutants:** moulds and droppings of pests adversely affects human health.
- **Volatile organic compounds (VOC):** paints, cleaning agents, cosmetics and aerosols affects human health.
- **Sulphur dioxide (SO<sub>2</sub>)** emissions from industry contributes to acid rain and acid snow. The acid kills trees and fish. In Japan acid air lead to the death of forests in Ashio due to high concentrations of sulphur dioxide from a nearby copper plant.

In West Asia (Middle East) sulphur dioxide is a trace component of crude oil, which can cause acid rain when released into the air at oil refineries or petroleum power plants. Oil producing countries such as Iran, Qatar and Saudi Arabia are a major

source of air pollutants.

- **Particulate matter (PM)** effects more people than any other air pollutant. PM varies in size from a large/course PM<sub>10</sub>µm (micrometres) in diameter, to a small/fine PM<sub>2.5</sub>µm in diameter. The main source of PM is from dust storms, grassland fires, and burning of fossil fuels in vehicles, power plants and industrial plants. PM contributes to lung cancer, cardiopulmonary problems and respiratory infections.

In many Asian cities the levels of fine PM<sub>2.5</sub> exceeds the critical limit, as defined by the WHO:

- **Countries:** PM is highest in Asian countries such as Pakistan, Bangladesh, India, Nepal and China and lowest in Philippines, Malaysia, Thailand, Singapore and Japan.
- **Cities:** PM is highest in Asian cities such as Delhi, followed by Islamabad, Dhaka, Beijing and Kathmandu.

## Sources of air pollutants



<b>Transport</b>	<ul style="list-style-type: none"> <li>• cars, motor bikes, tuk-tuks, planes, trucks, ships and steam trains</li> </ul>
<b>Industry/Energy</b>	<ul style="list-style-type: none"> <li>• power plants, oil refineries and industrial facilities (e.g. cement)</li> </ul>
<b>Agriculture</b>	<ul style="list-style-type: none"> <li>• slash and burn farming</li> </ul>
<b>Solid waste disposal</b>	<ul style="list-style-type: none"> <li>• open burning of garbage such as e-waste</li> </ul>
<b>Household</b>	<ul style="list-style-type: none"> <li>• cooking and heating homes, smoking, fumes from paints, and cleaning products.</li> <li>• bacteria, dust and mould can accumulate in air conditioning ducts (sick building syndrome) and cause legionnaires disease.</li> </ul>

Graphic: S. Bliss. Photograph <http://scitechdaily.com/images/Human-Caused-Air-Pollution-Results-in-Two-Million-Deaths-Annually.jpg>



# AIR POLLUTION CHOKING ASIA



## AIR POLLUTION IN ASIAN COUNTRIES – TYPES, CAUSES AND IMPACTS

Rapidly growing cities, more vehicles on the road, industrial activities, growing energy consumption and poor implementation of environmental regulations, has led to increased air emissions in many Asian countries.

During 2012, Beijing's airport was frequently closed as dense **smog** (\*fog and smoke) prevented planes taking off and landing. The air was so thick with smog that residents struggled to see across the road.

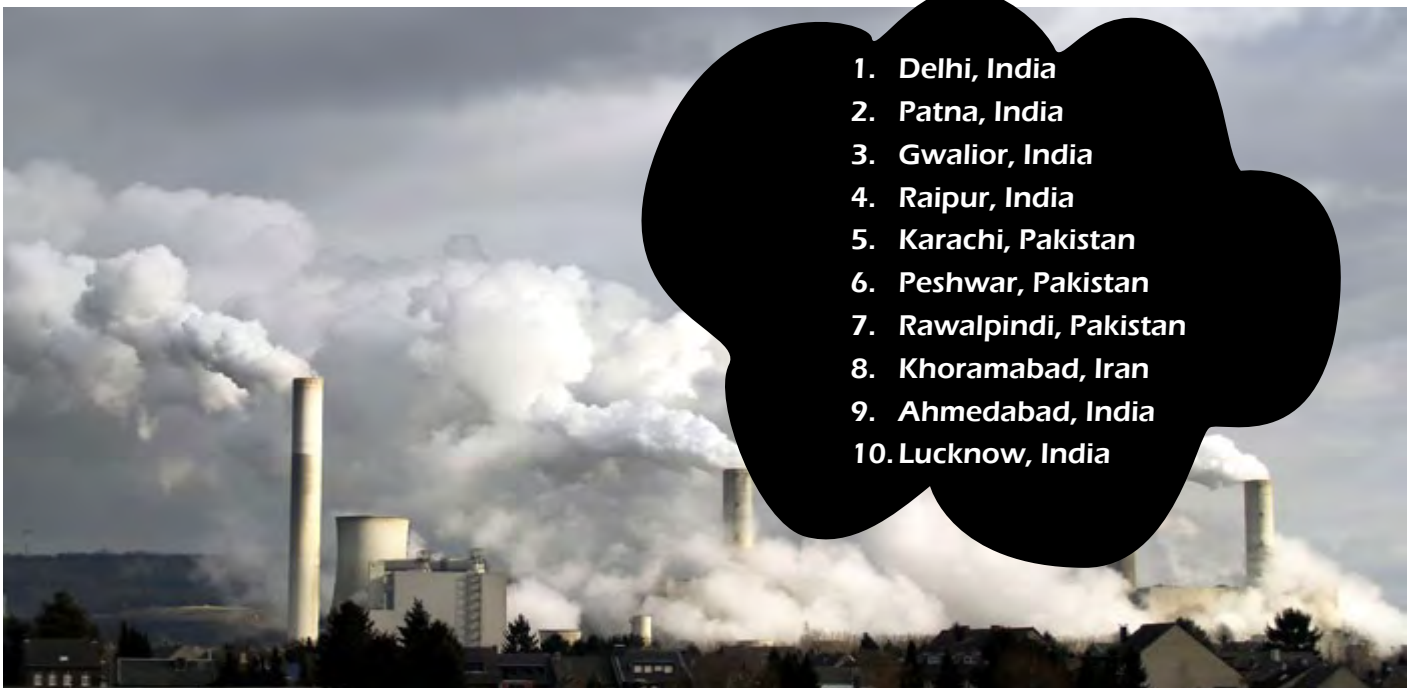
In 2013 severe air pollution adversely affected people living in Bangladesh, Nepal, and Pakistan. In cities such as Tehran (Iran), authorities closed public offices and schools on high pollution days, and in Kabul (Afghanistan) there were more deaths from air and water pollution than from conflict.

Tuk-tuks a major source of transport for people, goods and animals in India



Photograph: John Bliss

### Top 10 cities with highest air pollution (PM2.5) located in Asia



1. Delhi, India
2. Patna, India
3. Gwalior, India
4. Raipur, India
5. Karachi, Pakistan
6. Peshwar, Pakistan
7. Rawalpindi, Pakistan
8. Khoramabad, Iran
9. Ahmedabad, India
10. Lucknow, India

Source: World Health Organisation.. Graphics: S. Bliss. Photo: <http://ste.india.com/sites/default/files/2014/11/11/291093-poll.jpg>

### Reasons for air pollution in Asian countries:

- Urban smokestacks and tailpipes: China is experiencing a sharp rise in urban air pollution as millions of people migrate from rural to urban areas for employment and a better quality of life. However as the urban population grows richer, their demand for transport (tailpipes) and electricity rises. In China, rapid unplanned urbanisation, polluting industries and the use of coal fired power plants (smokestacks) have added to air pollution.

Chinese cities are anticipated to face an influx of another 243 million migrants by 2025. This means the urban population will reach 1 billion people. How will the population influx impact on air pollution if nothing is done?

- Burning for palm oil: In 2013 satellite images of Indonesia showed clouds discharging pollutants into the atmosphere from forest fires. These fires resulted in large quantities of carbon released into the atmosphere. In Indonesia smoke haze is a by-

# AIR POLLUTION CHOKING ASIA

product of the world's \$50 billion palm-oil industry. Natural vegetation has been cleared by fire for the growing of oil palms used in consumer goods such as ice cream and lipstick.

Indonesia also has a large area of peat soils that have been burned to prepare the land for the cultivation of oil palms. Peat smoke now contributes around 40% of Indonesia's greenhouse gas emissions.

Countries have little control over what blows across their borders. As a result in 2002 the Association of Southeast Asian Nations (ASEAN) trans-boundary haze agreement was signed. In 2014 Singapore passed the Trans-boundary Haze Pollution Act. 'It allows regulators to prosecute companies that cause severe air pollution in Singapore by burning forests and peat lands in neighbouring countries.'

Global Forest Watch provides real time information aimed to empower local people to combat forest fires before they burn out of control.

Satellite image showing forest fires and the extent of smoke from fires in 2013.

## Haze is almost an annual event in South-East Asia.



Source: [http://cdn.static-economist.com/sites/default/files/imagecache/full-width/images/print-edition/20130629\\_ASM904.png](http://cdn.static-economist.com/sites/default/files/imagecache/full-width/images/print-edition/20130629_ASM904.png)

## 'For peat's sake!'

Riau is located on the island of Sumatra in Indonesia. Years of deforestation at Riau has left peat wetlands burning out of control. Peat is found at a depth of 30m in Sumatra. Peat is highly combustible and will smoulder long after the fire on the surface has stopped.

It is now illegal to burn peat for commercial development but satellite images show it still occurs. As there is a lot of peat left at Riau, clean air is not a reality for a long time.

## Forest fire in Indonesia



Source: <http://www.rssgmbh.de/de/projekte/naturgefahren/ssffmp.html>

## Air pollution linked to palm oil in South East Asia

- Palm oil replaces food crops

While luxuriating in a warm shower using soap or eating biscuits for recess just check whether you are consuming a small part of a rainforest cleared to grow palm oil. Millions of hectares of rainforests cleared by burning in South East Asia have been replaced by hundreds of kilometres of palm oil trees. Habitat conversion from natural forests to palm oil destroys native foods and the habitats of endangered species such as orang-utans. Additionally thousands of Indigenous hunters and gathers such as the Penan (Sarawak) and Dayaks (Borneo), who depend on the rainforest for food and non-food products, have been forced off their land.

Approximately 82% of the orang-utan's habitat cleared for palm oil is contributing to the death of 50 orang-utans each week. At the present rate of forest clearing, the species could be extinct in the wild within 20 years

- Palm oil for biofuels

Since the 1990s the area under palm oil cultivation increased 43% driven by rising global demand for edible oils and biofuels.

Seventeen countries produce palm oil with Malaysia and Indonesia accounting for 87% of global production. India, China and the Economic Union (EU) are the main consumers.

Approximately 43 of Australia's 100 top grocery brands contain palm oil. Responsible consumers aware of the links between palm oil and the decline of animals and forests and the increase in air pollution have boycotted hundreds of goods containing palm oil such as Kit Kat and Dove soap.



# AIR POLLUTION CHOKING ASIA

## Palm oil costs and benefits

### Costs:

- Logging of rainforests releases greenhouse gases
- Endangered plant and animal species
- Extinction of traditional lifestyles
- Burning of forests quickest method to clear land causing trans boundary haze (haze moving between countries) – impact on health and visibility
- Burning peat soils difficult to control
- Land conflict between palm oil companies and indigenous people
- Over 300 football fields are destroyed every hour in South East Asia

### Benefits:

- Used in cosmetics, ice cream, animal feed and pharmaceuticals
- Billion dollar business
- Six million people employed in Indonesia – improved their lifestyle
- One employer for every seven hectares
- More than one million jobs in Indonesia from grower to processor
- Used for biodiesel production
- Lowest per-unit production costs of all vegetable oils
- Extraction process is a relatively simple

- **Fuelwood and biomass burning:** The burning of fuelwood and biomass are a major cause of haze above India. In India cooking fuel is prepared from mixing dried grass, fuelwood, hay, leaves and animal dung. This mix is dried, and then used as fuel in stoves. When it burns, it produces smoke and indoor air pollutants at concentrations 5 times higher than coal.

According to WHO, 2.8 billion people cook and heat their homes by burning coal and biomass around the globe. This has resulted in more than 4 million people dying prematurely each year

## Using wood fires to cook in Nepal



Source: <http://www.eco-business.com/news/urgent-campaign-curb-pollutants-deadly-effects/>

- **Burning garbage:** The open burning of rubbish, which contains food waste, plastics, tyres and electronics (e-waste), occurs in many Asian countries. The open burning releases toxic pollutants into the atmosphere.

China imports large quantities of e-waste from developed countries. The burning of e-waste is linked to growth of cancer villagers surrounding these garbage sites. Even though e-burning is illegal – it still happens!

## E-waste – Guiyu, Guangdong province, China



Source: <http://www.greenpeace.org/eastasia/campaigns/toxics/problems/e-waste/guiyu/>

## April 2012 a fire containing five million tyres erupted in Jahra, Kuwait.



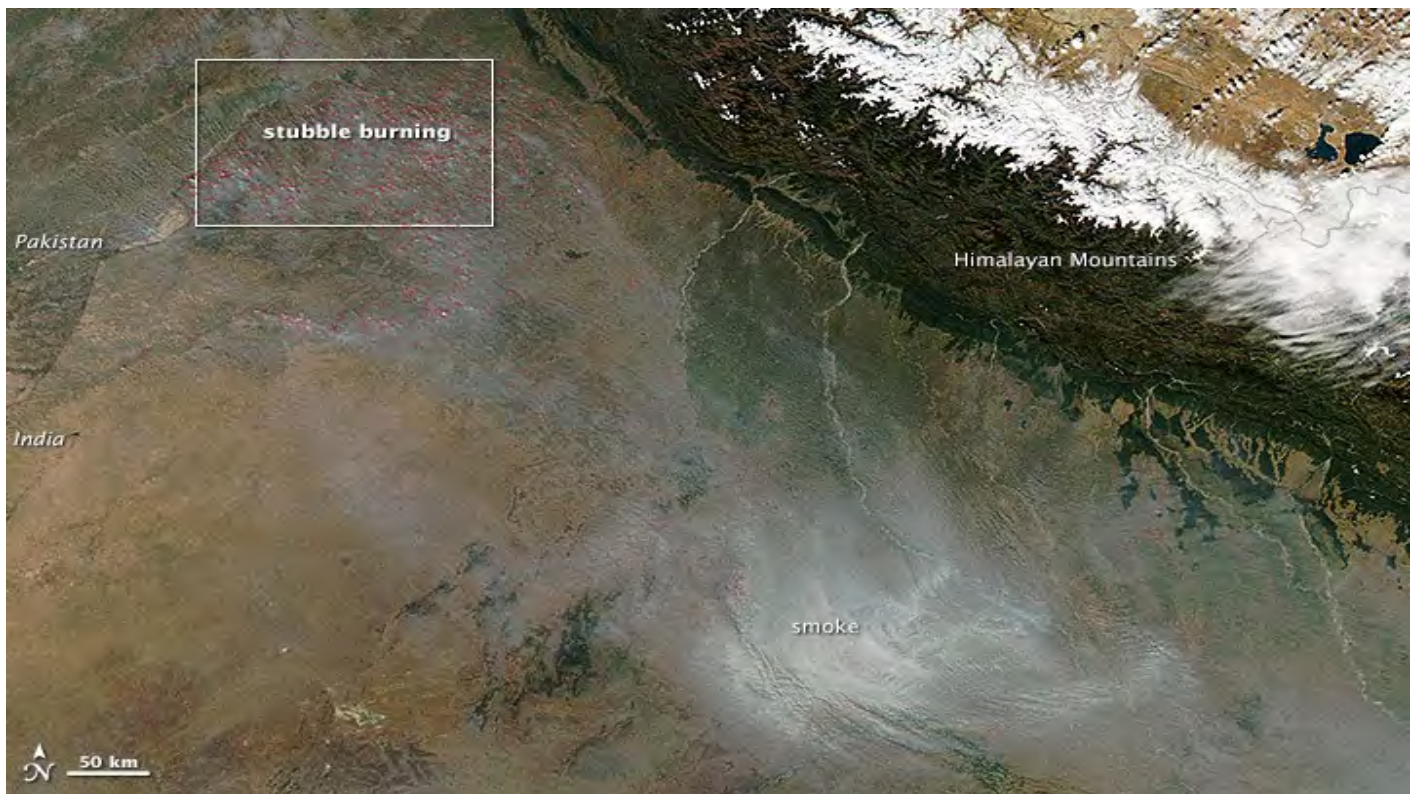
Source: <http://acidcow.com/pics/31755-kuwait-tire-fire-7-pics-video.html>

- **Stubble burning:** India's annual burning of crop residue, results in air pollution. During the autumn and winter months, 500 million tons of crop residue are burnt. The resulting polluted smoke moves from north and northwest India towards the east.



# AIR POLLUTION CHOKING ASIA

Aerial view showing India's annual crop burning, resulting smoke and air pollution.



Source: Courtesy of NASA Satellites, imaged in November 2013 [http://en.wikipedia.org/wiki/Air\\_pollution\\_in\\_India#/media/File:Aerial\\_view\\_of\\_Air\\_Pollution\\_in\\_North\\_India,\\_Agriculture\\_Fires,\\_November\\_2013.jpg](http://en.wikipedia.org/wiki/Air_pollution_in_India#/media/File:Aerial_view_of_Air_Pollution_in_North_India,_Agriculture_Fires,_November_2013.jpg)

- **Oil and chemical fires:** affects human health especially respiratory problems. Smoke from burnt crude oil contains sulphur dioxide, carbon monoxide, soot, hydrocarbons, and dioxins. Exposure to oil well fires in West Asia is commonly cited as a cause of the Gulf War Syndrome.

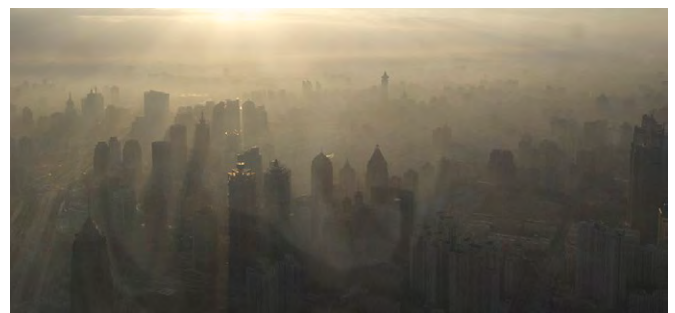
Kuwaiti firefighters fight to secure a burning oil well in the Iraqi Rumaila oilfields in 2003.



Source: [http://en.wikipedia.org/wiki/Oil\\_well\\_fire#/media/File:US\\_Navy\\_030328-M-0000X-005\\_Kuwaiti\\_firefighters\\_fight\\_to\\_secure\\_a\\_burning\\_oil\\_well\\_in\\_the\\_Rumaila\\_oilfields.jpg](http://en.wikipedia.org/wiki/Oil_well_fire#/media/File:US_Navy_030328-M-0000X-005_Kuwaiti_firefighters_fight_to_secure_a_burning_oil_well_in_the_Rumaila_oilfields.jpg)

- **Temperature inversion – upside down air**  
Temperature inversion contributes to air pollution in Asian cities such as Delhi, Kathmandu, Mumbai and Karachi. It is common in cities located in valleys, surrounded by mountains.  
Temperature inversion is the inversion of layers in the atmosphere:
  - **Normal conditions:** warm air is closer to the ground and cooler air is on top of it.
  - **Temperature inversion:** cool air is closer to the ground and warmer air is above it.During temperature inversion, air pollutants are trapped near the ground and are unable to move. Strong winds are required to disperse the pollutants.

Air quality in Shanghai

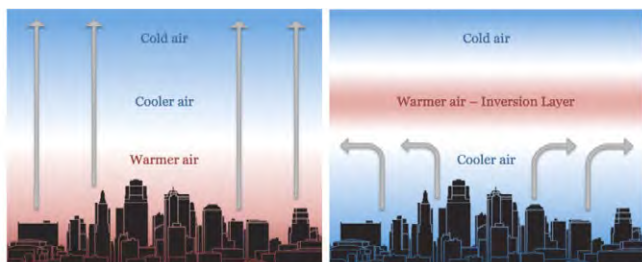


Source: Wikimedia commons



# AIR POLLUTION CHOKING ASIA

## Normal atmospheric conditions and temperature inversion



Arrows show air flow in normal conditions on the left and during temperature inversion on the right. In normal conditions, warm air rises and normal convective patterns persist. During temperature inversion, the warm air acts as a cap, effectively shutting down convection and trapping smog over the city.

Source: <http://understoryweather.com/wp-content/uploads/2015/05/temp-inversion-diagram.png>

## Kathmandu, Nepal – illustrating temperature inversion



Source: <http://mjsenepal.weebly.com/uploads/2/7/8/6/27862303/4582051.jpg?520>

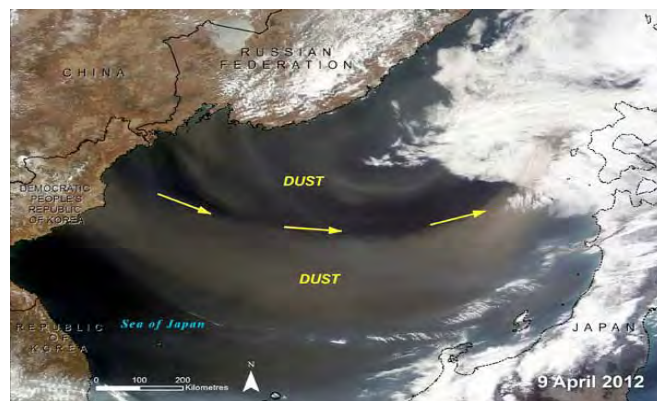
### • Dust Storms – a trans-boundary problem

The primary dust producing areas located in Asia are found in West Asia (Middle East), northwest China and southwest Asia. Dust and sand storms are exacerbated by drought and desertification. The winds generally blowing from west to east pick up tens of millions of tons of top soil each day.

The Sahara desert located near the Arabian Peninsula is the main source of airborne dust, blowing over countries such as Egypt, Saudi Arabia and the United Arab Emirates (UAE). Additionally dust storms occur when sand and dust from the Gobi desert blows across China then onto Korea and Japan. On average about five or six dust and sand storms a year strike Beijing. The yellow sand causes respiratory problems in China and South Korea.

Due to the mobile nature of dust, global forecasting systems help predict the onset, duration and path of a dust storm. However the unpredictability of trans-boundary air movements pose a management challenge.

## April 2012, fine dust from Mongolia blew over China, South Korea, Japan and Sea of Japan



Source: MODIS on NASA's Terra satellite [http://na.unep.net/geas/getUNEPPageWithArticleIDScript.php?article\\_id=96](http://na.unep.net/geas/getUNEPPageWithArticleIDScript.php?article_id=96)

## Sand storm hits Golmud in Qinghai Province, China



Source: <http://www.dailymail.co.uk/sciencetech/article-1282835/Desert-storm-Huge-cloud-sand-descends-Chinese-village.html>

Golmud is home to 200,000 people. Most work in the salt mines. The new industrial city is built close to the Gobi desert.

## Photograph: Factories and power plants pump invisible particles in the air



Source: <http://www.eco-question.com/pollution-theres-something-in-the-air>

These chemicals create smog which is a combination of smoke and fog

# AIR POLLUTION CHOKING ASIA



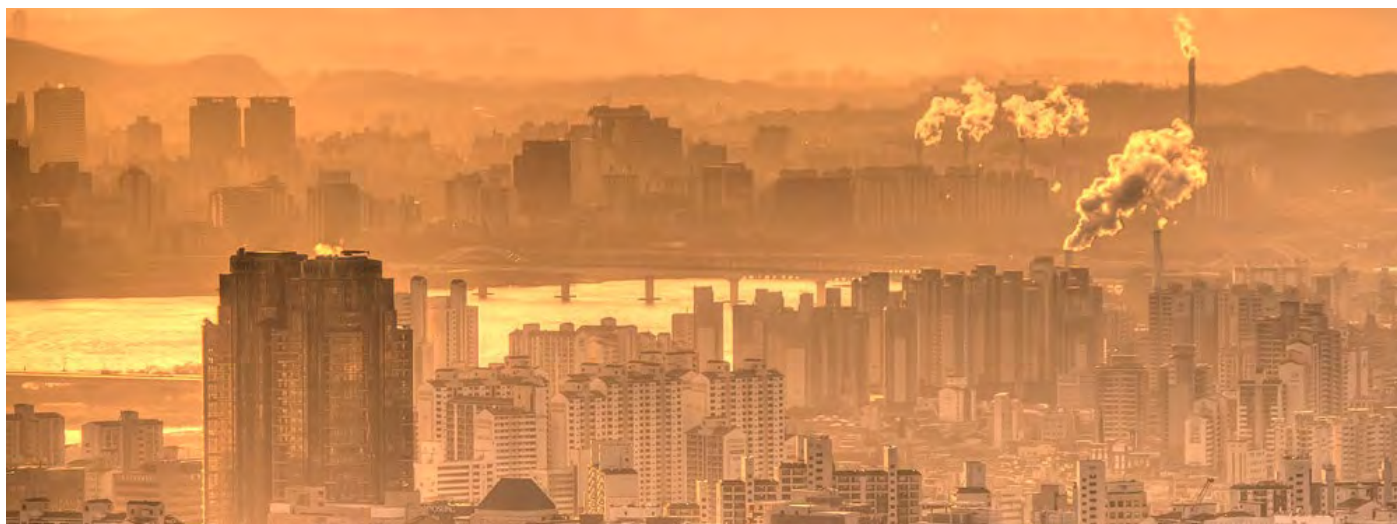
## ACTIVITIES

- What is air pollution?
- What are the main sources of air pollution?
- What is particulate matter?
- Why is small or fine  $PM_{2.5}$  a danger to human health?
- List five internet sites that provide basic information on air pollution.
- Refer to **Photograph 1** and the **Satellite imagery 1**: Explain how maps and satellite imagery provides a visual understanding of air pollution.
- **Refer to Graph 1:**
  - a. How did air pollution vary over time in Singapore on June 20<sup>th</sup>?
  - b. What do you think the word 'hazardous' means?
- In Asian countries air pollution is a deadly threat to humans and the environment. Explain this statement.
- **Refer to the Bhopal Timeline:** Summarise the cause, effects and management of the disaster as a TV report.
- What is meant by the phrase 'the killer in the kitchen'?
- Research how photochemical smog is formed.
- Design a digital collage of photographs on air pollution in a variety of Asian countries. List date, source and location of the photograph.
- In groups research one of the following air pollution incidents: 2006 Southeast Asian haze, Asian brown cloud or March 2014 forest and peat fires in Indonesia: Present your findings as an oral report. Include photographs and satellite imagery to show to the class.
- In 1991 the Kuwait oil fires were deliberately ignited. About 3-6 million barrels of oil went up in smoke each day. Daily  $PM_{10}$  was higher than the desired air quality guidelines for Kuwait, Saudi Arabia and Iraq. Investigate the impact of oil fires on the population and the environment.
- Chinese billionaire Chen Guangbiao is selling cans of fresh air with flavours like 'pristine Tibet' for about 80 cents each. What are your comments on this enterprise?
- Using the internet track the latest fires and haze in the ASEAN region [http://fires.globalforestwatch.org/#v=home&x=115&y=0&l=5&lyrs=Active\\_Fires](http://fires.globalforestwatch.org/#v=home&x=115&y=0&l=5&lyrs=Active_Fires)

### YouTube

- Air pollution <https://www.youtube.com/watch?v=H8NqvkXyvkY>
- Air Quality 101: The Basics 6.21min, 28/1/2009, [http://www.youtube.com/watch?v=Hx\\_yWFQvJT](http://www.youtube.com/watch?v=Hx_yWFQvJT)
- Air pollution- causes, effects and solutions <https://www.youtube.com/watch?v=bTsxx1KZwIM>
- NASA animation shows Asian air pollution moving across the globe <https://www.youtube.com/watch?v=qtAd4p22NRo>
- Asian air pollution not limited to urban areas [https://www.youtube.com/watch?v=iY7P7vn\\_M7E](https://www.youtube.com/watch?v=iY7P7vn_M7E)
- Air pollution killing thousands in Kabul 2.03min, 10/2/2012 [http://www.youtube.com/watch?v=g-8uA8xH\\_Pg](http://www.youtube.com/watch?v=g-8uA8xH_Pg)

## Smog in Seoul, South Korea



Source: [https://commons.wikimedia.org/wiki/File:Smoggy\\_Seoul\\_\(6907570245\).jpg](https://commons.wikimedia.org/wiki/File:Smoggy_Seoul_(6907570245).jpg)



# AIR POLLUTION CHOKING ASIA



## MEASURING AIR QUALITY – BREATHE EASY!

The Air Quality Index (AQI) is used to communicate to people and government agencies the extent of air pollution and what strategies should be implemented.

The following pollutants are used to calculate the air quality index (AQI):

- ground-level ozone
- particulates (PM<sub>2.5</sub> and PM<sub>10</sub>)
- sulphur dioxide
- carbon monoxide
- nitrogen dioxide

The AQI values are grouped into ranges. Each range is assigned a descriptor (e.g. good-hazardous), a colour code (e.g. green to brown), and the corresponding health effects.

## Air Quality Index (AQI) – Pollution Measurement

### Key to Shanghai air quality map and Real time Air Quality Visual Map

AQI	Air Pollution Level	Health Effects
0 – 50	Good	Air quality is considered satisfactory, and air pollution poses little or no risk.
51 – 100	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
101–150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
151–200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects
201–300	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.
301+	Hazardous	Health alert: everyone may experience more serious health effects

Source: <http://aqicn.org/map/>

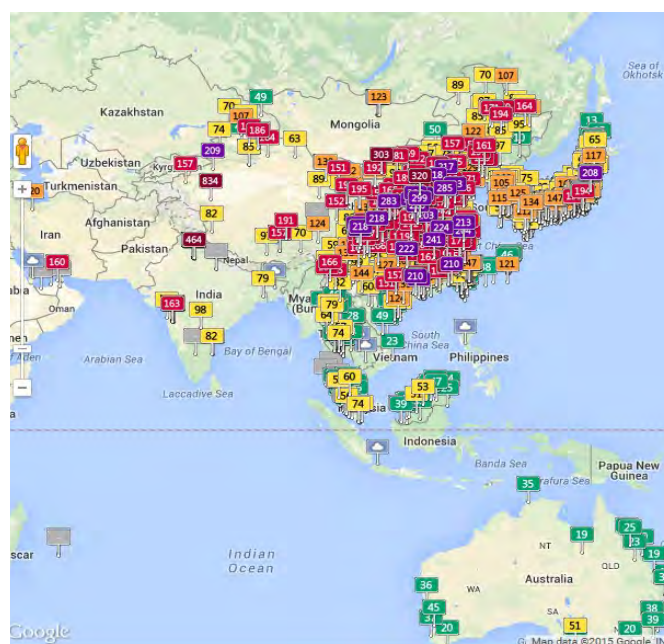
## Variations of the AQI

Countries use different air quality indices such as:

- **China:** Since 2013 air pollution is monitored daily in 163 cities. It measures - sulphur dioxide, nitrogen dioxide, suspended particulates (PM<sub>10</sub>, PM<sub>2.5</sub>), carbon monoxide and ozone.
- **India:** Since 2014 the National Air Monitoring Program (NAMP) covers 240 cities. The AQI includes the same measurements as China plus ammonia and lead.

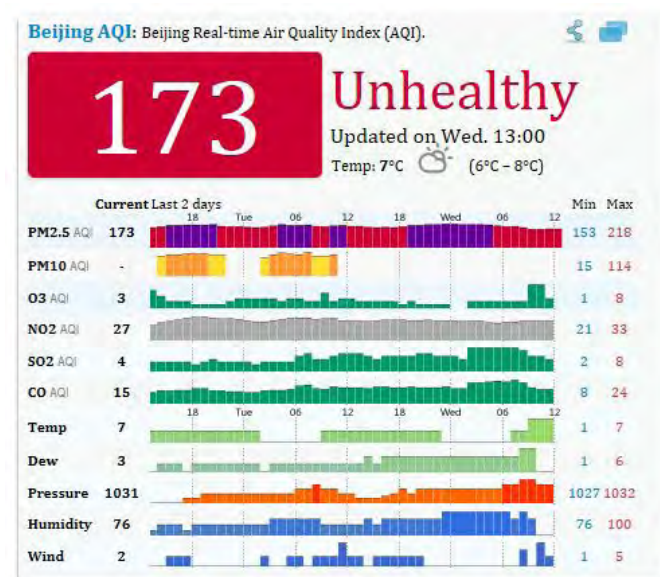
## Air Pollution in Asia: Real-time AQI 14/5/2015

\*Use the AQI key for the significance of colours



Source: <http://aqicn.org/map/>

## Beijing AQI for 11.112015



Source: <http://aqicn.org/map/>

# AIR POLLUTION CHOKING ASIA

## Shanghai Air Quality Baby

In December 2012 Shanghai in China, launched a mascot called 'air quality baby' to improve communication of real-time air quality to the public. 'Air quality baby' varies between a happy and a sad face depending on the level of major pollutants (PM2.5, PM10, sulphur dioxide, nitrogen dioxide, ozone and carbon monoxide).

In 2015 Shanghai experienced one of the highest levels of air pollution ever recorded in China. The AQI of 275 placed the city on a par with the usually polluted capital, Beijing.

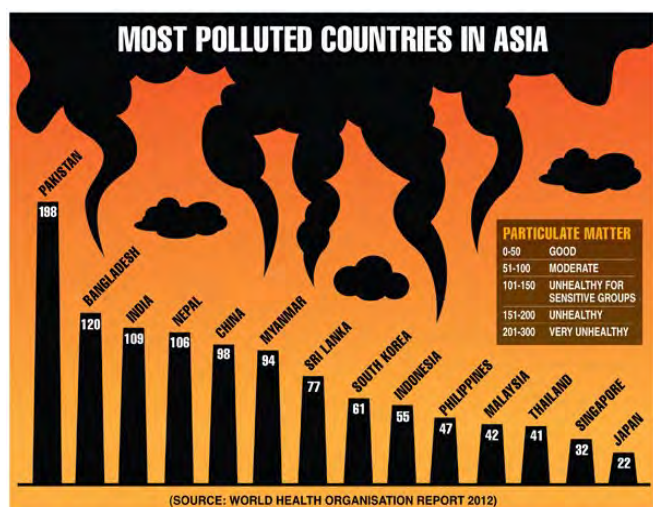
Shanghai air quality baby depicting air quality—happy or sad!



Source: [http://cleanairasia.org/portal/sites/default/files/improving\\_aqmt\\_in\\_asia.pdf](http://cleanairasia.org/portal/sites/default/files/improving_aqmt_in_asia.pdf)

The baby in the red rectangle indicates that air pollution is moderate (51-100 see AQI table) – baby has a happy face

Highest concentration of particulate matter (PM) for countries in Asia



Source: <http://ejap.org/environmental-issues-in-asia/AirPollution.html>



## AIR POLLUTION INDICATORS

Indicators used by the World Health Organisation (WHO) and the Environmental Performance Index (EPI) illustrate poor air quality in countries of the Asia region:

- WORLD HEALTH ORGANISATION** uses PM<sub>10</sub> to represent particles in the air considered as 'pollution'. These particles include smoke, dirt, mould and pollen. A score over 100 is considered unhealthy.

2014 countries of the Asia region with high PM<sub>10</sub>

Country	PM <sub>10</sub>
Mongolia	279
Pakistan	198
Saudi Arabia (West Asia)	<b>143</b>
Egypt	138
United Arab Emirates (UAE)	132
Kuwait	123
Bangladesh	120
India	109
Nepal	106
China	98

Adapted from <http://topcarl.com/the-28-best-and-worst-countries-for-people-who-love-to-breathe/>

Air pollution in Saudi Arabia with a PM<sub>10</sub> (World Health Organisation)



## Pollution in Saudi Arabia

Air Pollution	85.71
Drinking Water Pollution and Unaccessibility	45.83
Unsatisfaction with Garbage Disposal	79.17
Dirty and Untidy	75.00
Noise and Light Pollution	41.67
Water Pollution	62.50
Unsatisfaction to Spend Time in the City	75.00
Unsatisfaction with Green and Parks in the City	90.00

Image source: <http://fm.cnbcm.com/applications/cnbcm.com/resources/img/editorial/2011/10/04/44781337-SaudiArabia.jpg>. Source: <http://4.bp.blogspot.com/-rpomlNHCwBs/UPMYt3TGbzI/AAAAAAAAAAs/4nC45gm5wfw/s1600/Screen+Shot+2013-01-13+at+12.21.24+PM.png>



# AIR POLLUTION CHOKING ASIA

## b. ENVIRONMENTAL PERFORMANCE INDEX (EPI)

In 2014, 178 countries were ranked for air pollution. Asian countries were ranked at the bottom. Bangladesh had the lowest rank at 178 compared to Australia at 15.

### 2014 Environmental Performance Index (EPI) on air quality

\*Note the higher the number the less air pollution and vice versa

Rank	Country	Air Quality Score	Household Air Quality Score	Av. PM <sub>2.5</sub> Score
178	Bangladesh	13.83	9	32.49
177	Nepal	16.23	18	30.69
176	China	18.81	54	2.44
175	Pakistan	23.02	36	33.06
174	India	23.24	42	27.72
173	Laos	29.24	4	53.47
15	<b>Australia</b>	<b>98.33</b>	<b>95</b>	<b>100</b>

Adapted from source: <http://epi.yale.edu/epi/issue-ranking/air-quality>



## GREEN CITY INDEX (GCI) AND AIR QUALITY

Cities are the engines of growth in Asian countries. However, air pollution in cities is a serious problem to the wellbeing of its inhabitants, with average levels of air pollutants above the desired level set by the WHO.

The Green City Index (GCI) noted that cities located in developed countries in the Asian region tend to experience the best air quality. For example, above average air quality occurs in Singapore and Tokyo (Japan).



Source: [http://sg.siemens.com/city\\_of\\_the\\_future/\\_docs/Asian-Green-City-Index.pdf](http://sg.siemens.com/city_of_the_future/_docs/Asian-Green-City-Index.pdf)

### Green City Index on air quality for selected Asian cities

WELL BELOW AVERAGE	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	WELL ABOVE AVERAGE
Karachi Mumbai	Beijing Kolkata Wuhan	Delhi Hanoi Jakarta Seoul Shanghai	Bangkok Hong Kong Kuala Lumpur Manila Osaka Singapore Tokyo	None

Source: [http://sg.siemens.com/city\\_of\\_the\\_future/\\_docs/Asian-Green-City-Index.pdf](http://sg.siemens.com/city_of_the_future/_docs/Asian-Green-City-Index.pdf)



Source: [http://sg.siemens.com/city\\_of\\_the\\_future/\\_docs/Asian-Green-City-Index.pdf](http://sg.siemens.com/city_of_the_future/_docs/Asian-Green-City-Index.pdf)

# AIR POLLUTION CHOKING ASIA

## Singapore: above average (GCI)

Singapore trumps many of its South-East Asian neighbours for improvements to the environment. It is ranked above average by the GCI. However its air quality frequently falls below WHO standards.

There are multiple reasons for haze in Singapore such as: growing number of cars, construction boom, development of industrial hubs (e.g. Jurong Island), oil refining, and smoke from forest fires blowing from Indonesia.

The **National Environment Agency (NEA)**, aims to reduce particles more than ten times smaller than the width of a human hair, as well as levels of sulphur dioxide that contributes to acid rain.

### Singapore clean and dirty air



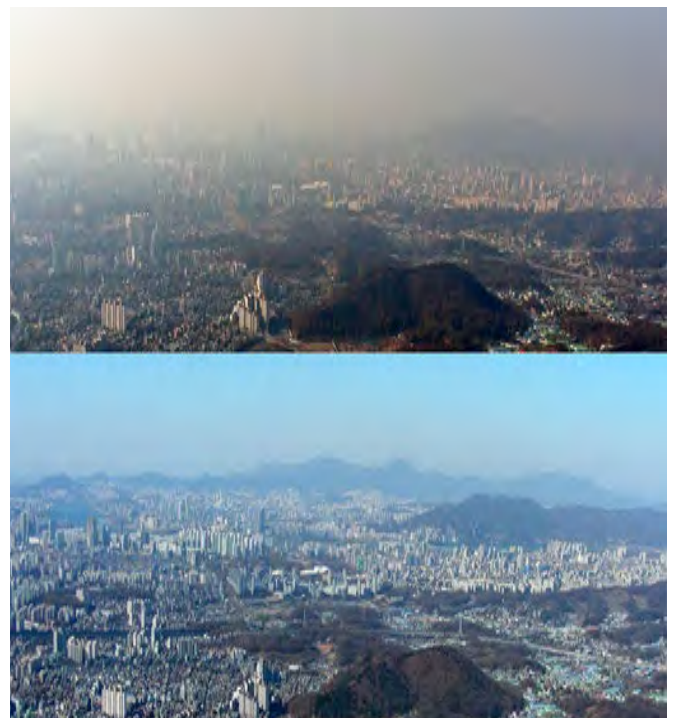
Source: <http://urbanemissions.blogspot.in/2010/12/air-pollution-in-singapore.html>

## Seoul: average (GCI)

Seoul the capital city of South Korea, scored average on the Green City Index on air pollution. The winds blowing from China accounts for nearly half of the microscopic particular matter (PM) in Seoul's air. In winter coal burning in China and in spring the Yellow Dust from China's Gobi Desert blows across the ocean to South Korea.

In the mid-2000s South Korea's air quality started to improve after diesel buses and trucks were powered with cleaner, compressed natural gas. In 2014 Seoul's concerns about air pollution led to a crackdown on barbecues and spas.

### Seoul: polluted air (top) and clean air (bottom)



Source: <http://solar.calfinder.com/blog/products/interactive-living-light-structure-maps-air-quality-in-seoul/>

## Glass sculpture presenting air quality in Seoul

The abstract honeycomb shape is a map of Seoul redrawn into neighbourhoods. It provides real-time information on air quality



Source: <http://images.gizmag.com/hero/livinglight.jpg>



# AIR POLLUTION CHOKING ASIA

## Tokyo: above average (GCI)

Since 2001 the average level of  $PM_{2.5}$  in central Tokyo fell 55% after the government took measures to curb air pollution, such as restrict diesel-powered vehicles. Today, air quality has improved to the point where Tokyo is among the cleanest of the world's Asian mega-cities. However everything is not perfect, as Central Tokyo frequently experiences thick smog from vehicle emissions as well as industrial pollutants and dust storms blowing from China. Aimed to ensure Japanese people are more aware of air pollution on a daily basis, the Real-time Air Quality Index and the Air Report is available for Tokyo.

The 2011 earthquake and tsunami resulted in the Fukushima Daiichi nuclear disaster. Wind carried radioactive material to other areas contaminating soil and water. Crops and animals on nearby farms had higher levels of radioactive particles and people inhaling the air were at a higher risk of developing certain cancers.

Since the event, trace quantities of radioactive particles such as iodine-131 and caesium-134/137, have been detected around the world, since the event.

## Nuclear fallout map after nuclear meltdown at Fukushima Daiichi Plant



Source: [http://www.globalresearch.ca/articlePictures/fukushima\\_radiation\\_nuclear\\_fallout\\_map.jpg](http://www.globalresearch.ca/articlePictures/fukushima_radiation_nuclear_fallout_map.jpg)

## Japanese schoolgirls wearing facemasks



Source: <http://qz.com/299003/a-quick-history-of-why-asians-wear-surgical-masks-in-public/>

- Facemasks were worn during flue pandemic in early 20th century.
- In 1923 the Great Kanto Earthquake filled the sky with ash. As a result facemasks became an accessory.
- Face masks were popular during the 2002 SARS outbreak and the 2006 bird flu incident.
- Recently, the wearing of masks has evolved into social firewalls, to signal a person does not desire to communicate with people around them.
- Today, masks bearing chic designs are available in most department stores

As air pollution becomes a global reality, facemask fashion could become popular around the world.

## Mt Fuji through Tokyo haze



Source: [https://upload.wikimedia.org/wikipedia/commons/5/50/Mt.Fuji\\_%26\\_Tokyo\\_SkyTree\\_%286906783193%29.jpg](https://upload.wikimedia.org/wikipedia/commons/5/50/Mt.Fuji_%26_Tokyo_SkyTree_%286906783193%29.jpg)

# AIR POLLUTION CHOKING ASIA

Tokyo Air Report, 3 June 2015



Source: <https://air.plumelabs.com/Tokyo>



## ACTIVITIES

- What do the acronyms AQI, EPI and GCI mean?
  - What does AQI measure?
  - Explain what an AQI of 300+ means
  - What is the Shanghai Air Quality Baby? Do you think this is a good communication tool?
  - Describe the facial expressions on the baby when the AQI is 300+.
  - What are the three most polluted countries in Asia? Why would this list vary over time?
  - **Refer to the 2014 Environmental Performance Index (EPI) on air quality**
  - What is the EPI air quality score for Australia and Bangladesh? Why do you think there is such a large difference?
  - What Asian country has the worst household air quality score?
  - What factors contribute to indoor air pollution in Asian countries?
  - What Asian country has the worst PM<sub>2.5</sub>?
  - Research the advantages and disadvantages of wearing facemasks to reduce air pollutants.
  - In 2015 NASA released a video showing how air pollution in Asia is changing the weather and climate around the world. (Refer to <http://www.natureworldnews.com/articles/12435/20150131/watch-asian-air-pollution-chokes-world.htm>).
- Explain the relationship.
- **Refer to Air Pollution in Asia: Real-time Air Quality Index Visual Map.** Visit this website and collect a map for today.
    - Explain where the AQI is in the 'red' and 'brown.'
    - Discuss the variations in AQI between countries (<http://aqicn.org/map/>)
  - Saudi Arabia, located in West Asia, is the world's largest producer and exporter of petroleum. However the large wealth generated by its abundant oil reserves has had negative impacts on the environment. In groups, research the impacts of the oil industry on air pollution in the country and overseas (e.g. vehicle exhausts, heating). Present findings using ICT.

## YouTube

- Air Pollution – Causes & Effects, Air Quality Index, Educational Videos & Lessons for Children, Kids (good for primary school) <https://www.youtube.com/watch?v=e35xZ2C4x3w>
- Green Cities Are an Imperative for Asia's Future [https://www.youtube.com/watch?v=O7\\_FgDE5Iwg](https://www.youtube.com/watch?v=O7_FgDE5Iwg)



# AIR POLLUTION CHOKING ASIA

Indian city of Gurgaon blanketed by smog on November 5, 2013



Source: Indian Times via Getty Images [http://www.huffingtonpost.com/2014/09/06/india-smog-crops-ozone-pollution\\_n\\_5777004.html](http://www.huffingtonpost.com/2014/09/06/india-smog-crops-ozone-pollution_n_5777004.html)



## HOLDING YOUR BREATH IN INDIA

The TV news always highlights smog in China's booming megacities. However according to the 2014 World Health Organisation (WHO) Report, New Delhi had the worst air out of 1,600 cities in 91 countries. In fact Delhi's air pollution was twice as bad as Beijing's.

Air pollution is widespread across India, in both rural and urban environments. In 2014 the

Environmental Preference Index (EPI) ranked India 174 out of 178 countries for air quality and the 2014 World Bank ranked India 132 out of 132 countries for air pollution.

The 2013 Global Burden of Disease Report found air pollution in India was the 5th largest cause of death. Approximately 99.5% of India's 1.2 billion people are breathing air above the WHO safe level. As a result air pollution is cutting 660 million lives short by about three years and is so bad that millions of children are suffering from lung damage due to toxic air.

Newspaper report on air pollution in India 2013

## Air pollution 5th largest killer in India

**New Delhi, Feb 15:** Outdoor air pollution has become the fifth largest killer in India after high blood pressure, indoor air pollution, tobacco smoking, and poor nutrition, says a new set of findings of the Global Burden of Disease report. The India and South Asia-specific findings were officially released on Wednesday at a Dialogue Workshop jointly organised by Centre for Science and Environment (CSE), Indian Council of Medical Research and the US-based Health Effects Institute. The Global Burden of Disease (GBD) re-

port is a world-wide initiative involving the World Health Organization which tracks deaths and illnesses from all causes across the world every 10 years. The new findings were released by Aaron Cohen, principal epidemiologist of the Health Effects Institute and co-chair of the GBD Ambient Air Pollution Expert Group.

The report says that about 620,000 premature deaths occur in India from air pollution-related diseases. GBD has ranked air pollution as one of the top 10 killers in the world, and the sixth most danger-

ous killer in South Asia. In fact, particulate air pollution is now just three places behind indoor air pollution, which is the second highest killer in India. "This is shocking and deeply disturbing news. This calls for urgent and aggressive action to protect public health," said Sunita Narain, director general, CSE. The key finding in India states that air pollution is the fifth leading cause of death in India, with 620,000 premature deaths. This is up from 100,000 in 2000 – a six-fold increase. It is seventh leading cause behind the loss of about 18 million healthy

years of life due to illness. It comes after indoor air pollution, tobacco smoking, high blood pressure, childhood underweight, low nutritional status, and alcohol use. These diseases include stroke (25.48%), chronic obstructive pulmonary disease (17.32%), Ischemic heart disease (48.6%), lower respiratory infections (6.4%), and trachea, bronchus and lung cancer (2.02%). Meanwhile, the key findings in South Asia and the world points out that air pollution related diseases cause 3.2 million deaths worldwide every year.

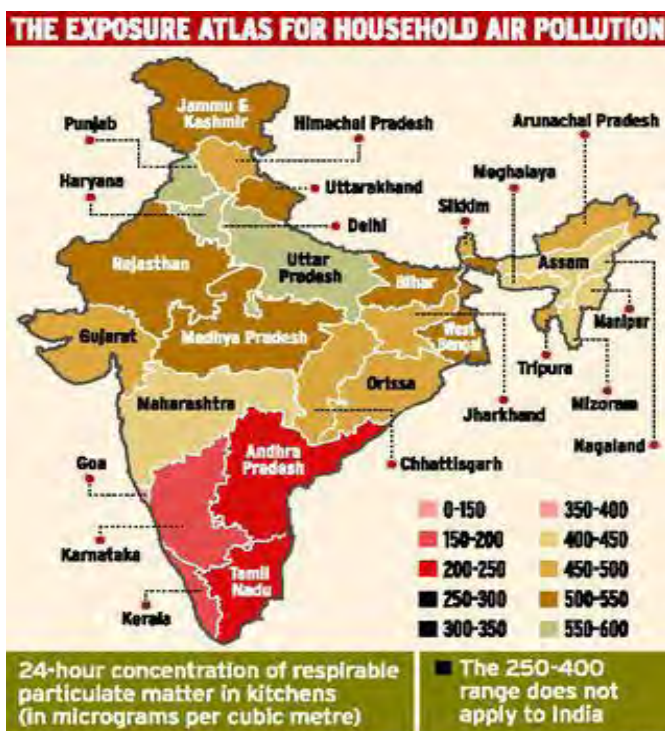
Source: <http://cseindia.org/userfiles/Feb15-pg1.jpg>

# AIR POLLUTION CHOKING ASIA

## Factors contributing to lethal air pollution in India

- Relies on burning fossil fuels for economic growth
- Booming industrialisation and power plants (smokestacks)
- Unchecked vehicle regulations (tailpipes)
- Widespread burning of garbage
- Household air pollution such as burning fuelwood and biomass
- Dust from gravel roads and construction of buildings and infrastructure
- Weather as most hazardous air pollution occurs during winter months, on days with little wind
- Brick kilns as Indian cities grow more bricks are required
- Smog and temperature inversion: When blankets of smog block sunlight, temperatures decrease forcing Indians to use wood and cow-dung to warm themselves. In winter, air pollution is unable to escape to the upper atmosphere. As a result, pollutants get trapped closer to the ground.

## Household air pollution (HAP) in India



Source: <http://www.thehindu.com/news/national/household-air-pollution-way-beyond-safe-limits-in-india/article5418834.ece>

LEFT Source: <http://i2.cdn.turner.com/cnn/2014/images/05/08/air-pollution-infographic.jpg>

## The Gujarati potters' district in Mumbai.

The kilns burn cloth scrap that contribute to air pollution



Source: <https://timeglobalspin.files.wordpress.com/2012/11/par333894.jpg?w=480&h=320&crop=1>

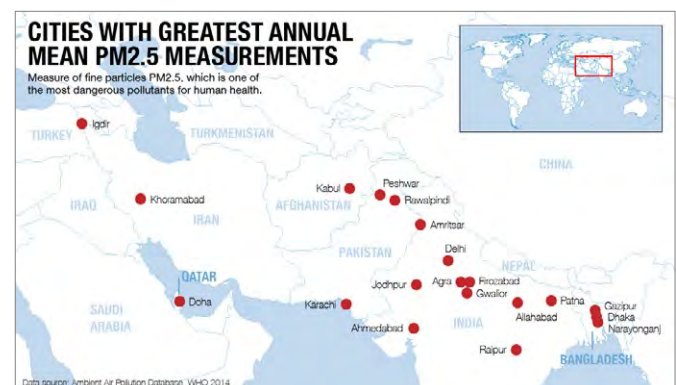
Wealthier Indian states fare better in terms of HAP concentration such as Kerala (150-200). However this figure is still beyond the safe limits recommended by the World Health Organisation of 10-35 micrograms per cubic metre.

## Urban toxic skies

The WHO found that 13 of the top 20 cities in the world with the highest levels of  $PM_{2.5}$  were located in India. Delhi has the highest  $PM_{2.5}$  with 153 micrograms followed by Patna with 149 micrograms. These figures are six times what the WHO considers a 'safe' limit of 25 micrograms.

The top 20 cities with highest annual mean  $PM_{2.5}$  measurement were located in Asia (\*West Asia and South Asia).

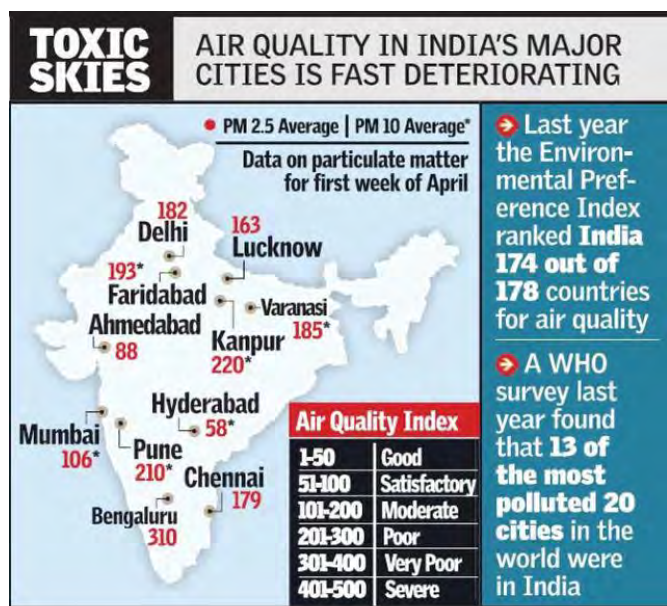
## Cities with greatest annual mean $PM_{2.5}$ measurement





# AIR POLLUTION CHOKING ASIA

## Toxic skies

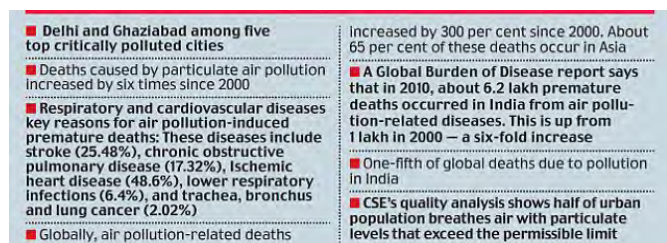


Source: [http://www.thehindu.com/multimedia/dynamic/02365/P1-Lead\\_2365708f.jpg](http://www.thehindu.com/multimedia/dynamic/02365/P1-Lead_2365708f.jpg)



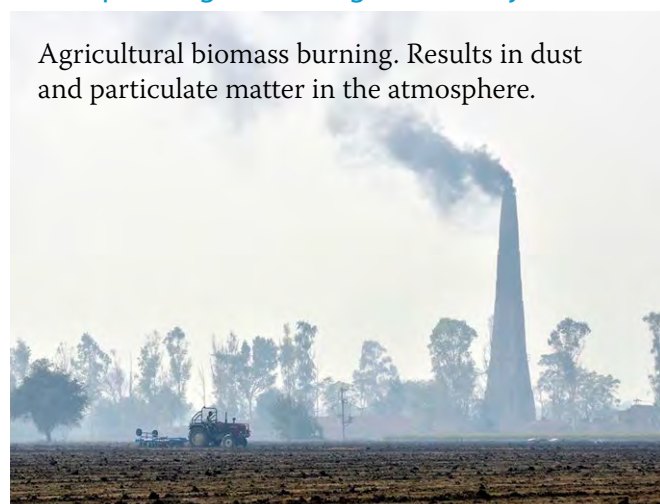
## IMPACTS OF AIR POLLUTION

### How India is choking, the impacts on people



Source: <http://www.dailymail.co.uk/indiahome/indianews/article-2854275/India-pollution-Supreme-Court-appointed-panel-says-menace-worsening.html>

### Wheat planting, near Sangrur, SE Punjab, India



Source: [https://commons.wikimedia.org/wiki/File:NP\\_India\\_burning2\\_\(6314800001\).jpg](https://commons.wikimedia.org/wiki/File:NP_India_burning2_(6314800001).jpg)

## Projected premature annual deaths due to urban air pollution

Economic Group or Region, 2001–2020	
Region	Premature Deaths (thousand per year)
Established market economies	20
Former socialist economies	200
China	590
India	460
East Asia and the Pacific	150
Latin America and the Caribbean	130
South Asia	120
Middle East Crescent	90
Sub-Saharan Africa	60
<b>World</b>	<b>1,810</b>

Source: World Bank.

Source: [http://www.worldwatch.org/brain/images/pubs/vs/vsow/2005\\_air\\_pollution.jpg](http://www.worldwatch.org/brain/images/pubs/vs/vsow/2005_air_pollution.jpg)

## Air pollution impacts on food security

Ground-level ozone, the main component of smog, damages about 6.7 million tons of India's staple crops in a year - wheat (3.8 million tons) and rice (2.3 million tons). Lost crops are worth about \$1.3 billion a year. This could feed around 94 million people or a third of India's poor people

Source: [http://www.huffingtonpost.com/2014/09/06/india-smog-crops-ozone-pollution\\_n\\_5777004.html](http://www.huffingtonpost.com/2014/09/06/india-smog-crops-ozone-pollution_n_5777004.html)

## Towards sustainable strategies?

In 2015 the Indian government launched its first Air Quality Index (AQI). At present 247 Indian cities have air quality monitoring mechanisms.

India has promoted solar and wind power but is also tripling its coal-fired electricity capacity by 2030. This will double sulphur dioxide levels, along with nitrogen oxide and lung-clogging particulate matter.

India's growing population, economic growth and energy demand, could result in further increases in air pollution unless sustainable strategies are implemented.



# AIR POLLUTION CHOKING ASIA

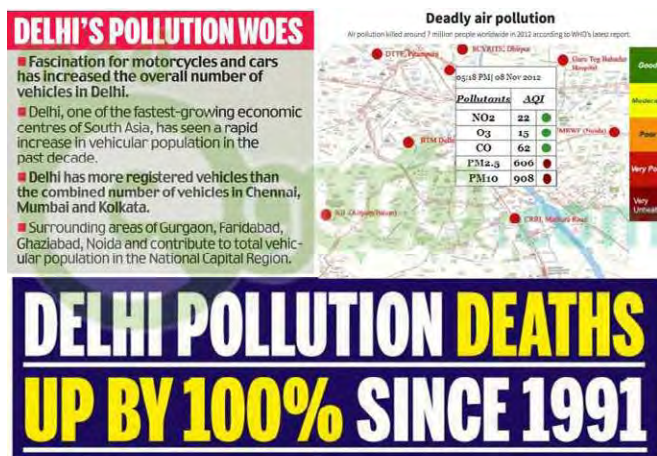


## DELHI – INDIA'S CAPITAL CITY

Delhi has the unwanted honour of the world's most polluted city. The city has the highest level of  $PM_{2.5}$  considered harmful to health and causing the death of about 11,000 people every year. With a metropolitan population of about 17 million people, most of the smog is generated by 7.5 million cars. Over 1,200 cars are added to the streets daily.

Other factors contributing to air pollution in Delhi are: reliance on fossil fuels, coal-fired power plants, use of biomass for cooking and heating, growth of construction sites (dust), and hundreds of brick kilns on the outskirts of the city. The city also experiences temperature inversion as it is located in a bowl that traps the dirty air, especially during winter. When winds blow towards Delhi from the northwest, the burning of agricultural wastes in the bordering states of Punjab and Haryana, intensifies the poor air quality.

### Infographic: Delhi's pollution woes



Source: <http://www.medeguru.com/blog/air-pollution-makes-delhi-worlds-most-polluted-city/>

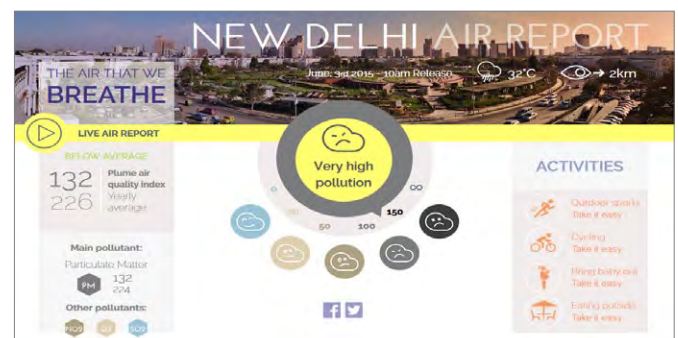
Since the 1990s Delhi has introduced measures to reduce air pollution such as:

- planting trees
- using compressed natural gas on buses
- banning leaded petrol
- constructing the Delhi Metro
- introducing e-rickshaws aimed to promote environmentally friendly transport banning vehicles over 15 years old
- reducing open burning of waste
- proposing making every Sunday 'bicycle day' and switching off street lights during a full moon
- installing air pollution monitoring units

Despite these measures:

- $PM_{2.5}$ ,  $PM_{10}$  and  $NO_2$  still exceeds the WHO safe limits
- $PM_{2.5}$  has continued to increase during the winter months

### New Delhi Air Report – 3 June 2015



Source: <https://air.plumelabs.com/New-Delhi>

### Delhi Metro Airport Express



Source: [https://en.wikipedia.org/wiki/Delhi\\_Metro#/media/File:DelhiMetro\\_AirportExpress\\_20111214.jpg](https://en.wikipedia.org/wiki/Delhi_Metro#/media/File:DelhiMetro_AirportExpress_20111214.jpg)



# AIR POLLUTION CHOKING ASIA



## ACTIVITIES

- Indicate whether the following statements are True (T) and False (F)
  - a. Delhi is the most polluted city in the world when measuring  $PM_{2.5}$  concentrations
  - b. Half of the top 20 most polluted cities are in India
  - c. Air pollution does not move across a country's border
- What do the following reports state about air quality in India: WHO, EPI, World Bank and Global Disease Report?
- **Refer to the newspaper report in 2013.** Summarise the article in one paragraph.
- List the main factors contributing to air pollution in India.
- **Refer to household air pollution (HAP).** List three Indian states with the highest household air pollution.
- **Refer to cities with greatest annual mean  $PM_{2.5}$ .** Name the Indian cities with the highest annual mean  $PM_{2.5}$  measurement.
- **Refer to toxic skies:** What are the words used to describe the AQI at Delhi, Pune, Mumbai and Hyderabad?
- Describe the impacts of air pollution on people and the environment in India.
- Summarise the **infographic** on Delhi's pollution woes as a TV report.
- Explain how India is trying to improve air quality
- Compare the Air Report of Tokyo with New Delhi on 3 June 2015. Why do you think they differ?

## YouTube

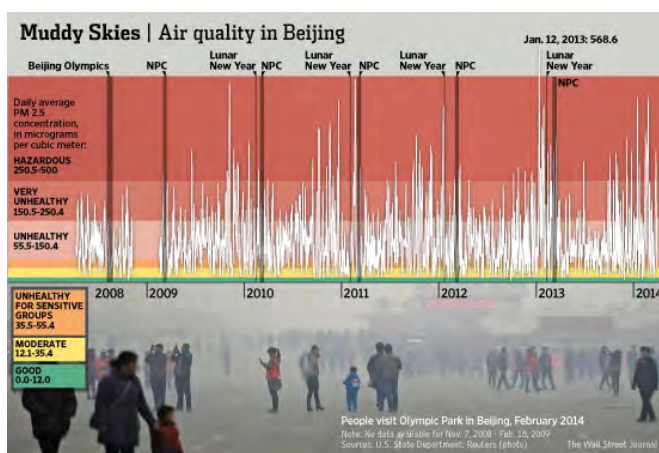
- Air pollution turning deadly in India <https://www.youtube.com/watch?v=fwfc7rir6M>
- Delhi air pollution is the worst on earth <https://www.youtube.com/watch?v=5xFaH9qHi58>
- Air Quality Index: First step to a pollution-free India? <https://www.youtube.com/watch?v=99VLjF4LXmg>
- India's Latest Pollution Plan Won't Clear the Air <https://www.youtube.com/watch?v=hN82qTY1u5k>



## HAZARDOUS AIR IN CHINA

On 12 January 2013 Eastern China was affected by a hazardous smog. It covered 20% of China and affected 600 million people. On 12 January Beijing's AQI reached 755 which was 30 times higher than levels deemed safe by the WHO. As a result airports, highways and schools were closed. Beijing took emergency measures such as temporarily shutting down more than 100 factories and ordering 335 government vehicles off the streets.

### Air quality in Beijing over time – Olympics 2008 to January 12 2013



Source: [http://si.wsj.net/public/resources/images/AI-CH895A\\_CPOLL\\_G\\_20140410082440.jpg](http://si.wsj.net/public/resources/images/AI-CH895A_CPOLL_G_20140410082440.jpg)

### Diagram: February 9, 2013

February 9<sup>th</sup> 2013 was the eve of Chinese New Year. On that day Tianjin levels of  $PM_{2.5}$  hit 577.

The Beijing government asked residents to limit the use of fireworks. This resulted in a 37% drop in sales

On February 10 2013, 74 cities recorded excessive  $PM_{2.5}$  levels



Source of photo: [http://cdn3.scmp.com/sites/default/files/styles/980w/public/2013/12/13/fireworks\\_tiananmen.jpg?itok=spN\\_2xiS](http://cdn3.scmp.com/sites/default/files/styles/980w/public/2013/12/13/fireworks_tiananmen.jpg?itok=spN_2xiS)

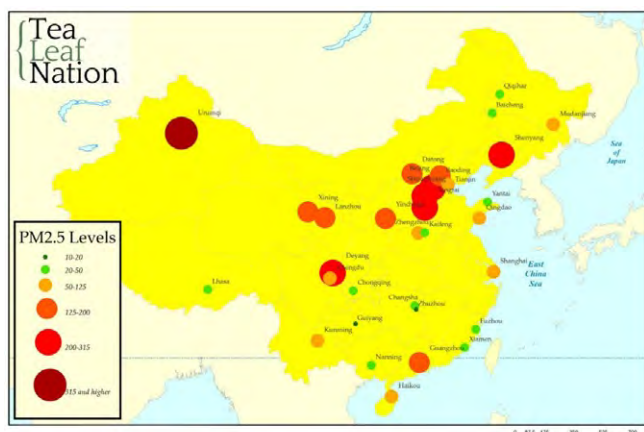
# AIR POLLUTION CHOKING ASIA

In China hazardous air pollution has been the downside to decades' of economic growth. As a result some of China's wealthy and densely populated cities are the most polluted cities in the world. These include Taiyuan, Beijing, Urumqi, Lanzhou, Chongqing, Jinan and Shijiazhuang.

## Air quality in China – a snapshot

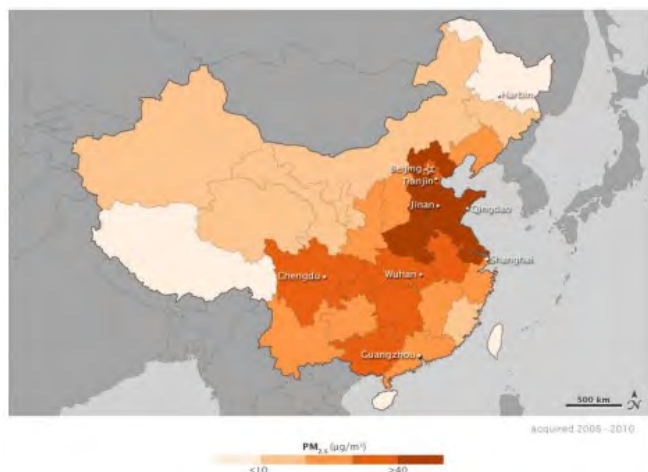
Ürümqi is among one of the ten most polluted cities in the world. Severe winter air pollution is mainly caused by energy-heavy industries and outdated coal-fired heating systems.

### PM<sub>2.5</sub> Levels across China



Source: <http://www.chinafile.us/graphics/TLN-China-Pollution-1500.jpg>

### Satellite map of PM<sub>2.5</sub> intensity – it is not just Beijing!



Source: <http://ftalphaville.ft.com/files/2013/03/China-air-pollution-Nomura.png>



## ACTIVITY

See interactive map for further details

– <https://www.google.com/maps/d/viewer?mid=zClQkWMf11J0.k8EZx7lndDtI&msa=0&ie=UTF8&t=m&ll=32.10119,110.742188&spn=27.74004,54.404297&z=4&source=embed>

### Tianjin pedestrian precinct



Source: [https://commons.wikimedia.org/wiki/%E5%A4%A9%E6%B4%A5#/media/File:Tianjin\\_Gulou\\_Street\\_Drum\\_Tower.jpg](https://commons.wikimedia.org/wiki/%E5%A4%A9%E6%B4%A5#/media/File:Tianjin_Gulou_Street_Drum_Tower.jpg)

## Newspaper headlines

- China opens smog clinic to combat worsening air quality
- China's transport industry biggest polluter (carbon emissions)
- Tianjin – latest Chinese city to restrict car ownership
- China's air pollution is visible from space!
- Beijing buys new buses to clear city smog
- Beijing confiscates barbecues to cut air pollution
- Air pollution caused by over-reliance on burning coal
- Links between air pollution and reduced life expectancy
- China the largest emitter of sulphur dioxide
- Lead plant poisoned 850 children in the Shaanxi province of China
- Industrial pollution made cancer China's leading cause of death
- Sulphur dioxide and nitrogen oxides from China falls as acid rain on Seoul and Tokyo
- Air pollution--losses to fisheries and agriculture and higher health care costs
- The old attitude of pollute-first-repair-later – no longer tenable
- China, South Korea and Japan launch a five-year project to control trans-boundary air pollutants.



# AIR POLLUTION CHOKING ASIA

## China's airpocalypse – blame it on coal

China has 620 operating coal power plants to generate electricity. When coal is burned to produce energy, many of these power plants lack filters to contain hazardous gases and pollutants that are then spewed into the air.

One of the principal users of coal is the steel industry. However in rural areas domestic burning of coal is permitted but no longer allowed in cities. The main reason is that it fills houses with high levels of toxic metals leading to bad Indoor Air Quality.

## Coal for domestic use being transported by tricycle



Source: [http://en.wikipedia.org/wiki/Coal\\_in\\_China#/media/File:Coal\\_Bike\\_China\\_1997.jpg](http://en.wikipedia.org/wiki/Coal_in_China#/media/File:Coal_Bike_China_1997.jpg)

## Suggested strategies to reduce urban PM<sub>2.5</sub> by 2030 in China:

- Reduce coal consumption growth by half
- Reduce coal-related emissions by 70% via clean coal technologies
- Reduce car emissions by more than 80%
- Increase clean energies (gas, nuclear, hydro, wind and solar)
- Reduce sales in cars
- Increase length of railways and subways
- Offer financial incentives to encourage green energy companies
- Close worst polluting industries
- Filters on polluting coal fired plants
- Use clean-air technologies, including monitors, measuring instruments and electronic pollution-control equipment

The Chinese government is providing air pollution measurements and Shanghai aims to spend \$1.63billion over next 3 years to target air pollution, especially PM<sub>2.5</sub>. Today Beijing's residents can download apps to monitor air quality on an hourly basis.

## Stains caused by acid rain mark the ancient Leshan Buddha in China's Sichuan province.



Sources – Article: [http://e360.yale.edu/feature/china\\_takes\\_first\\_steps\\_in\\_the\\_fight\\_against\\_acid\\_rain/2333/](http://e360.yale.edu/feature/china_takes_first_steps_in_the_fight_against_acid_rain/2333/) Image: [https://commons.wikimedia.org/wiki/File:China\\_-\\_Leshan\\_20\\_-\\_Giant\\_Buddha\\_\(135959098\).jpg](https://commons.wikimedia.org/wiki/File:China_-_Leshan_20_-_Giant_Buddha_(135959098).jpg)



## BEIJING – GASPING!

## A man wore a gas mask at the Olympic Forest Park in Beijing in 2014



Source: <http://blogs.wsj.com/chinarealtime/2015/01/06/got-to-admit-its-getting-better-beijings-air-pollution-improved-in-2014/>

# AIR POLLUTION CHOKING ASIA

Beijing air in 2005 after rain (left) and a smoggy day (right)



Source: [http://en.wikipedia.org/wiki/Pollution\\_in\\_China#/media/File:Beijing\\_smog\\_comparison\\_August\\_2005.png](http://en.wikipedia.org/wiki/Pollution_in_China#/media/File:Beijing_smog_comparison_August_2005.png)

## Causes of hazardous smog in Beijing, China

Beijing's air quality is the result of a complex interaction of climactic, geographic and anthropogenic (human) factors. The following summarises the main causes:

### Winter weather "haze"

In winter Beijing lacks precipitation and a few days without wind prevents pollutants from being blown away,

### Agricultural biomass burning

Results in dust and particulate matter in the atmosphere.

### Increasing car ownership

Beijing has 5 million vehicles, and the number is increasing with the growth of the middle class.

### Heating from coal-fired power plants

Around 80% of China's power comes from coal-fired power plants. Beijing plans to eliminate the capital's coal plants by 2020.



### Industrial activities in neighbouring provinces

Beijing is bordered by Shandong and Hebei provinces. Shandong had the third-highest industrial output and Hebei the sixth.

## Beijing's Olympic Games 2008

Before the 2008 Beijing Olympic Games, concerns were raised over air pollution that would adversely impact on the athletes' health.

Before 2008 Beijing was committed to:

- remove 60,000 taxis and buses from the roads
- relocate 200 local factories

As air pollution was still bad, in July 2008 the government implemented stricter pollution controls such as:



Beijing 2008



- suspended production at more factories and coal-fired power plants
- lowered the number of cars on the road
- suspended operations in 40 factories in nearby Tianjin and 300 factories in Tangshan
- Beijing motorists forced to drive on alternate days

When the Games began in August 2008, air quality in Beijing improved. Throughout the Games the Air Pollution Index (API) scores were under 100 – the official target. After the Games the Chinese government pledged to continue their environmental efforts.



# AIR POLLUTION CHOKING ASIA

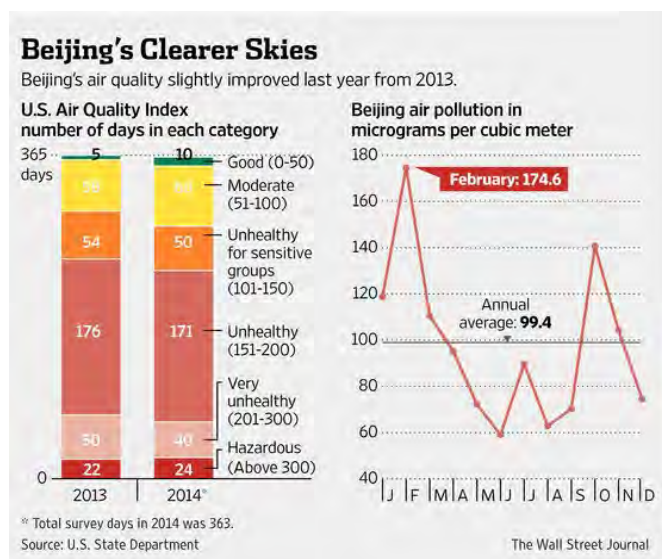
## Beijing Olympic Games 2008



Source: <http://breckpollution.weebly.com/uploads/1/0/6/9/10696124/1328651148.jpg>

Air quality in Beijing improved in 2014. More than 21% of Beijing's days met WHO standard for healthy air. PM<sub>2.5</sub> concentrations fell 3.3% in 2014.

## Clearer skies from 2013



Source: [http://si.wsj.net/public/resources/images/AM-BH009\\_CPOLLU\\_G\\_20150105061807.jpg](http://si.wsj.net/public/resources/images/AM-BH009_CPOLLU_G_20150105061807.jpg)



## TOWARDS SUSTAINABILITY

Four decades of urban growth in Asian countries has come at a cost to human health and the environment. Swelling urban populations, increased concentration of polluting industries and expanding automobile traffic resulted in severe air pollution.



The following cities have grave particulate matter (PM) problems as well as:

- **Beijing, Seoul and Shanghai** have serious to moderate SO<sub>2</sub> problems
- **Bangkok, Jakarta and Manila** have moderate lead (Pb) problems
- **Beijing and Jakarta** have a moderate ozone (O<sub>3</sub>) problem

Today clean air policies and the measuring of air quality are widespread across Asia. Cities making efforts to reduce their carbon emissions includes:

- **Osaka:** subsidising solar energy
- **Bangkok:** promoting biofuels
- **Shanghai:** largest wind farm in China
- **Guangzhou:** world's greenest skyscraper
- **Beijing:** planting trees with a 'Voluntary Tree Planting Day'
- **Hanoi:** aims to turn itself into a 'green, civilised and modern city' by 2050
- **Hong Kong:** Mass Transit Railway (MRT)
- **Delhi:** eco-clubs to shape students' views – aimed to reduce air pollution

## Tuk-Tuks go green in Asian countries

The tuk-tuk or auto rickshaw is three-wheeled motorbike. A puff of oily black smoke is a common sight on the streets of many Asian cities. However, many tuk-tuks in Indian cities have shifted to CNG or LPG autos to improve air quality and reduce pollution. In 2015 a non-profit group in Cambodia developed a solar-powered tuk-tuk. The Philippines wants 100,000 electric tuk-tuks on the road by 2016. The importance of clean and efficient energy paves the way to more sustainable transport options.

## Electric tuk-tuks in the Philippines



Source: <http://gas2.org/2013/08/18/the-philippines-want-to-put-100000-electric-tuk-tuks-on-the-road-by-2016/>

# AIR POLLUTION CHOKING ASIA

## E-waste changes – China and South Korea

Electronic trash, such as cell phone are incinerated to recover metals, such as silver, gold, palladium and copper. Fumes that are released into the atmosphere are toxic such as persistent organic pollutants (POPs), including dioxins (also known as PCDDs).

The International Basel Convention aims to prevent transfer of hazardous waste from developed countries to less developed countries. In China efforts are being made to recycle and reduce e-waste and in South Korea manufacturers must recycle 75% of their electronic production.

### Burning e-waste in Asia



Source: <http://web1.cnre.vt.edu/lsg/GEOG3104S10Web/Group2/Open%20Waste%20Burning/4.jpg>

The sustainability of all living things depends on the desired combination of gasses in the atmosphere. As air pollution is a global problem, air quality can be improved if individuals, groups and governments work to achieve sustainable development.



## ACTIVITIES

- Air pollution costs China more than 10% of GDP. What are the other economic impacts of air pollution on Asian countries?
- Refer to graph on air quality in Beijing over time** – Olympics 2008 to January 12 2013
  - Do you think there is a pattern of hazardous air quality on a yearly basis? Justify your answer.
  - Compare air quality for the 2008 Beijing Games with 2014. Account for the differences.
  - How did air pollution decrease during the 2008 Olympic Games?
- Refer to diagram on February 9, 2013. Why were restrictions placed on fireworks?

- Refer to map of air quality in China- a snapshot.** Name four areas with highest PM<sub>2.5</sub> levels. Research why air pollution in Urumqi is so high.
- Refer to satellite map of PM<sub>2.5</sub> intensity –it is not just Beijing!** What region of China has the highest PM<sub>2.5</sub> intensity? Explain its location.
- In groups design a collage of recent newspaper headlines on air pollution in China. Summarise the headlines as a TV report.
- Explain the main causes of air pollution in China.
- Describe sustainable strategies to reduce PM<sub>2.5</sub> in China.
- Refer to current statistics and state whether air quality has improved in Beijing today.
- List the reasons for differences in air quality between Asian developed countries (e. g. Singapore) and developing countries (e.g. China and India).
- Draw a flow chart or graphic showing the details in the table. Specifically refer to countries in the Asia region

HOW	IMPACTS	EFFECTS
How do toxic substances from a source (Asian home, community and factory) make their way to the air?	What are the impacts of toxic substances emitted from these places on humans?	How do toxic substances effect the environment if actions are not undertaken to reduce their emissions?

- How would you improve air quality if you were the Minister for Transport in China or India?
- You are employed as a weather forecaster. Provide a short speech for TV on air quality across the Asia region.
- Explain how polluted air crosses national boundaries using satellite imagery.
- Research the current Environmental Performance Index (EPI) on air quality. Compare China and India, with Australia. Provide reasons for their differences.
- Explain why indoor pollution could be a bigger environmental problem than outdoor pollution in some Asian countries.



# AIR POLLUTION CHOKING ASIA

- In groups, discuss the sources, processes and impacts of air pollution on people and the environment in one Asian country. Present findings using Web 2.0 tools.
- **Clean Air Asia** promotes better air quality by implementing policies and actions that reduce air pollution and greenhouse emissions from transport, energy, and other sectors. Research two Asian organisations working to improve air quality

## Fieldwork

- A. Use a spreadsheet to conduct a survey on how many students walk, cycle, catch public transport or are driven to school. Collect and analyse data. Discuss the impacts of different forms of transport on the atmosphere
- B. Divide the class into two groups called the 'indoor squad' and the 'outdoor squad'. Groups monitor air quality around the school including cleaning products, ventilation, dust, mould, smoke and building materials. Present an oral report to the class on whether you attend a sustainable school. This website will help the activity [http://www.ehow.com/info\\_7860494\\_indoor-air-pollution-activities-teachers.html](http://www.ehow.com/info_7860494_indoor-air-pollution-activities-teachers.html)

- C. Monitor air quality around your school, evaluate evidence, draw conclusions and present findings to the class as a short report. Equipment available for schools participating in AirWatch [http://www.epa.sa.gov.au/environmental\\_info/air\\_quality/working\\_with\\_the\\_community/airwatch/particulate\\_monitoring\\_equipment](http://www.epa.sa.gov.au/environmental_info/air_quality/working_with_the_community/airwatch/particulate_monitoring_equipment).
- D. Discuss how fieldwork in your local area gives you a better understanding of air pollution in countries of the Asia region.

## Smog couture in China



Source: <http://qz.com/299003/a-quick-history-of-why-asians-wear-surgical-masks-in-public/>

## Benxi Steel Industries, China



Source: [https://commons.wikimedia.org/wiki/File:Benxi\\_Steel\\_Industries.jpg](https://commons.wikimedia.org/wiki/File:Benxi_Steel_Industries.jpg)

# AIR POLLUTION CHOKING ASIA

## Burning rice husk, India



Source: Wikimedia Commons

### ICT

- Improving air quality monitoring in Asia  
[http://cleanairasia.org/portal/sites/default/files/improving\\_aqmt\\_in\\_asia.pdf](http://cleanairasia.org/portal/sites/default/files/improving_aqmt_in_asia.pdf)
- Air quality in Asia: Status and trends  
[http://cleanairasia.org/portal/sites/default/files/documents/AQ\\_in\\_Asia.pdf](http://cleanairasia.org/portal/sites/default/files/documents/AQ_in_Asia.pdf)
- Interactive map of air pollution in Chinese cities over time <http://multimedia.scmp.com/china-air-pollution-in-2014/>
- Pollution quiz  
<http://www.npi.gov.au/students/spike-quiz.html>
- Smogbusters school kit  
<http://www.waytoschoolkit.infoexchange.net.au/>
- Substance fact sheets  
<http://www.npi.gov.au/students/fact-sheets.html>
- Air quality for kids  
<http://www.epa.vic.gov.au/air/aq4kids/default.asp>  
Teacher information and classroom activities on air quality
- What is air quality? What are the main air pollutants? What is being done to reduce air pollution?  
<http://www.environment.gov.au/atmosphere/index.html>
- Clean Air Asia Strategy  
[http://www.iges.or.jp/files/network/PDF/IIASA/20140306/8\\_KayePatdu.pdf](http://www.iges.or.jp/files/network/PDF/IIASA/20140306/8_KayePatdu.pdf)
- Air pollution on Google Maps – Clean Air Asia Google Map <http://googlemapsmania.blogspot.com.au/2013/03/air-pollution-on-google-maps.html>

If you select a city on the Clean Air Asia Google Map you can get a quick overview of the air quality in the city

### YouTube

- The devastating effects of pollution in China  
<https://www.youtube.com/watch?v=q4DtOhe2LfQ>
- Chai Jing's review: Under the Dome – Investigating China's Smog <https://www.youtube.com/watch?v=T6X2uwlQGQM>
- How deadly is China's pollution problem?  
[https://www.youtube.com/watch?v=0f0qXEQ\\_IQE](https://www.youtube.com/watch?v=0f0qXEQ_IQE)
- 20 Signs China's Pollution Has Reached Apocalyptic Levels | China Uncensored <https://www.youtube.com/watch?v=OwOBRH56Ic0>
- A solution to air pollution? <https://www.youtube.com/watch?v=yCU68dMOdHo>
- How can we reduce air pollution?  
<https://www.youtube.com/watch?v=ukZtWnUetq0>
- Air Pollution - Causes & Effects, Air Quality Index, Educational Videos & Lessons for Children, Kids  
<https://www.youtube.com/watch?v=e35xZ2C4x3w>

### Geofacts

- Formaldehyde an indoor air pollutant found in writing paper, wallpaper and furniture.
- Most polluted place on earth, the coal-mining town of Linfen in Shanxi Province, China

### Geoterms:

**Air pollution:** the build-up of impurities in the air that are likely to be harmful to plants and animals, including humans, once they reach certain concentrations





## Global Education – Learning Emphases

- Interdependence and globalisation
- Identity and cultural diversity
- Social justice and human rights
- Sustainable futures

# ASIAN ELEPHANTS

**A selection of worksheets and activities for Stages 2–3 to support a study of endangered species focussing on the consequences of human activity  
by Julie O’Keeffe**



# WHERE ASIAN ELEPHANTS LIVE

Locate and neatly label the countries where Asian elephants are found.

Sri Lanka

India

Vietnam

Laos

Cambodia

Bangladesh

Borneo

Nepal

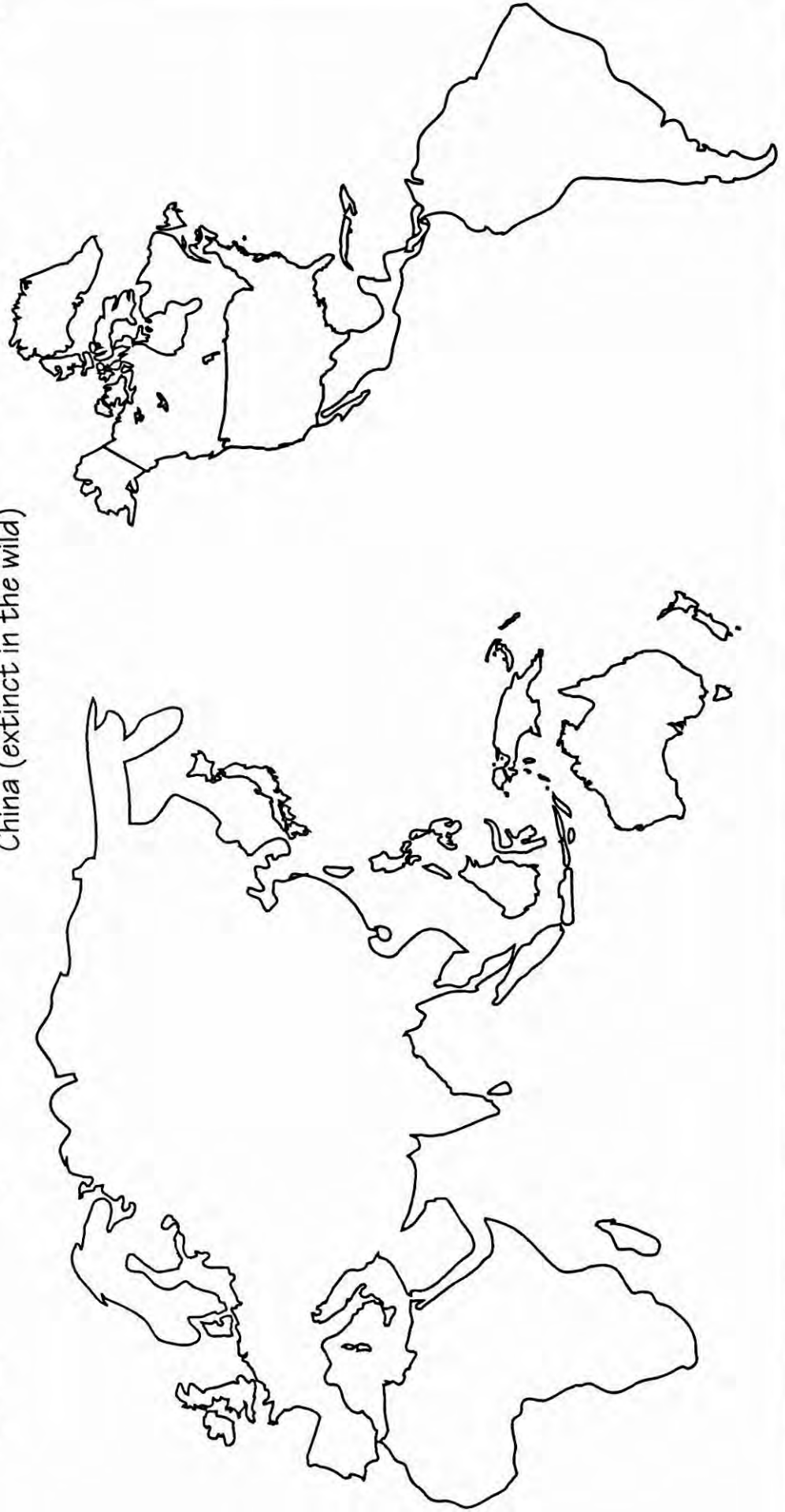
Bhutan

Burma (Myanmar)

Malaysia

Sumatra (Indonesia)

China (extinct in the wild)





# ASIAN ELEPHANTS UNDER THREAT

To find out about what's threatening Asian elephants, go to the following website address:

[http://www.europaworld.org/issue13/asian  
elephantsareunderthreat151200.htm](http://www.europaworld.org/issue13/asian_elephantsareunderthreat151200.htm)



- ☐ The report this information is based on was written by .....  
and .....
- ☐ List 3 reasons given for elephants being forced out of their forest homes.  
(Paragraph 1) .....  
.....  
.....
- ☐ Paragraph 2 talks about action taken by humans against elephants.  
These actions indicate conflict over use of resources. Why do you think  
elephants are being poisoned and shot? .....  
.....  
.....
- ☐ Elephants are also killed in ..... and .....  
collisions.
- ☐ The main point of paragraph 3 is .....  
.....
- ☐ Why are so many people being killed by elephants? (Paragraph 4)  
.....  
.....
- ☐ What action would the World Wildlife Fund (WWF) like to see implemented  
to protect the elephants? (Paragraph 5) .....  
.....  
.....

# HUMANS & ELEPHANTS DON'T MIX IN ASIA

To find out why humans and elephants don't mix, go to the following website address:

<http://www.cbc.ca/stories/2000/12/12/elephant001212>



○ Read through the article, then list 5 reasons to support the headline.

(1) .....

(2) .....

(3) .....

(4) .....

(5) .....

○ How effective is listing the Asian elephant in Appendix One of CITES in protecting the elephant? .....

.....

.....

○ WWF suggests countries with richer governments have a duty to help with elephant protection, and working out the problems between elephants and humans. What do they suggest these governments provide?

.....

.....

.....

○ How do you think governments of developed countries can help with elephant conservation? .....

.....

.....

.....

Should they? .....



# ABOUT ELEPHANTS

Use the following viewpoints and facts as a basis for writing **DISCUSSION** and **EXPOSITION** texts.

- ☐ worshipped
- ☐ sacred
- ☐ revered
- ☐ valued
- ☐ useful to man
- ☐ part of religious and royal ceremonies
- ☐ part of culture

- ☐ shot by angry farmers
- ☐ neglected and die; keepers can't afford to look after them
- ☐ 'worked to death' in logging
- ☐ poisoned by plantation workers
- ☐ killed in train and road collisions
- ☐ hunted for ivory, hide and meat
- ☐ menace
- ☐ prized beast of burden

- ☐ Loss of forest cover.
- ☐ Hungry elephants eat farmers' crops.
- ☐ Elephants' traditional migration routes disrupted.
- ☐ Violent clashes between elephants and humans.
- ☐ Hundreds of people killed annually by elephants.
- ☐ Serious loss of biodiversity.
- ☐ Highly fragmented elephant populations.
- ☐ Decline in work opportunities for Asian elephants.
- ☐ Asian elephants live in a region of the world with the densest human population.

## ★ DEBATE

**'Humans and elephants don't mix in Asia'**

Think of arguments to support and refute this statement.

**'Humans vs elephants'**

Show the main issues of conflict in a ★  
CARTOON STRIP.

★ **Consequence Chart** – Show the effects **LOSS** of **HABITAT** has on the Asian elephant population.

★ **Investigate** the importance of the elephant in Thai culture.

[http://www.circleofasia.com/features/index:  
:elephantinthailand-asp?Id=52](http://www.circleofasia.com/features/index:elephantinthailand-asp?Id=52)

★ **RESEARCH** – How are zoos around the world supporting conservation of Asian elephants?

★ **Represent in graphic form** the Competition for Living Space between Humans and Elephants.

★ **Investigate** the 'Legend of the White Elephants'.

<http://www.crystalinks.com/whiteelephants.html>

# ASIAN ELEPHANTS

○ Research the impact the following are having on the Asian elephant, its habitat and its survival in the wild.

# LOGGING

# MINING

# FARMING

# POACHING

# Establishment of housing / towns

# TOURISM

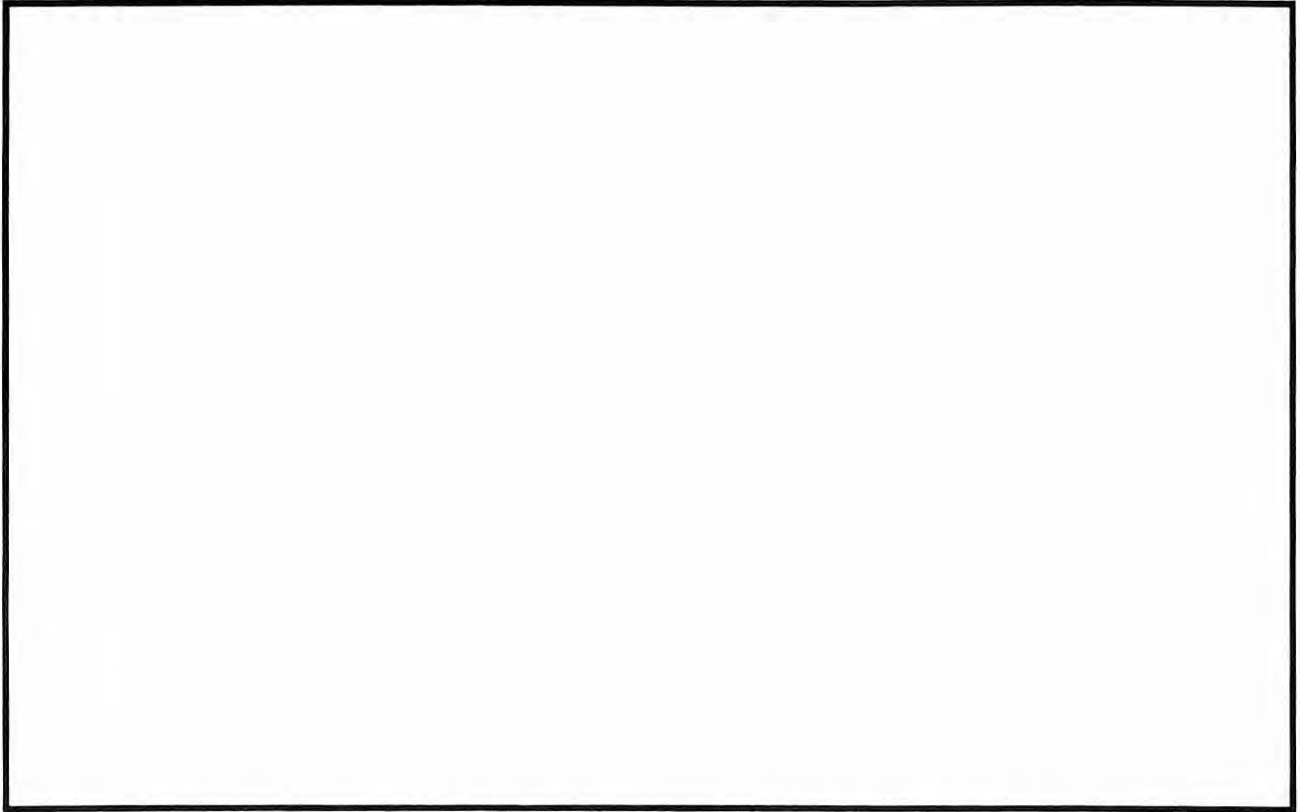
- ☐ Choose one of the above areas.
- ☐ Represent your research to show 'cause and effect' (eg. poster, consequence chart).

○ Represent your research to show 'cause and effect' (eg. poster, consequence chart).

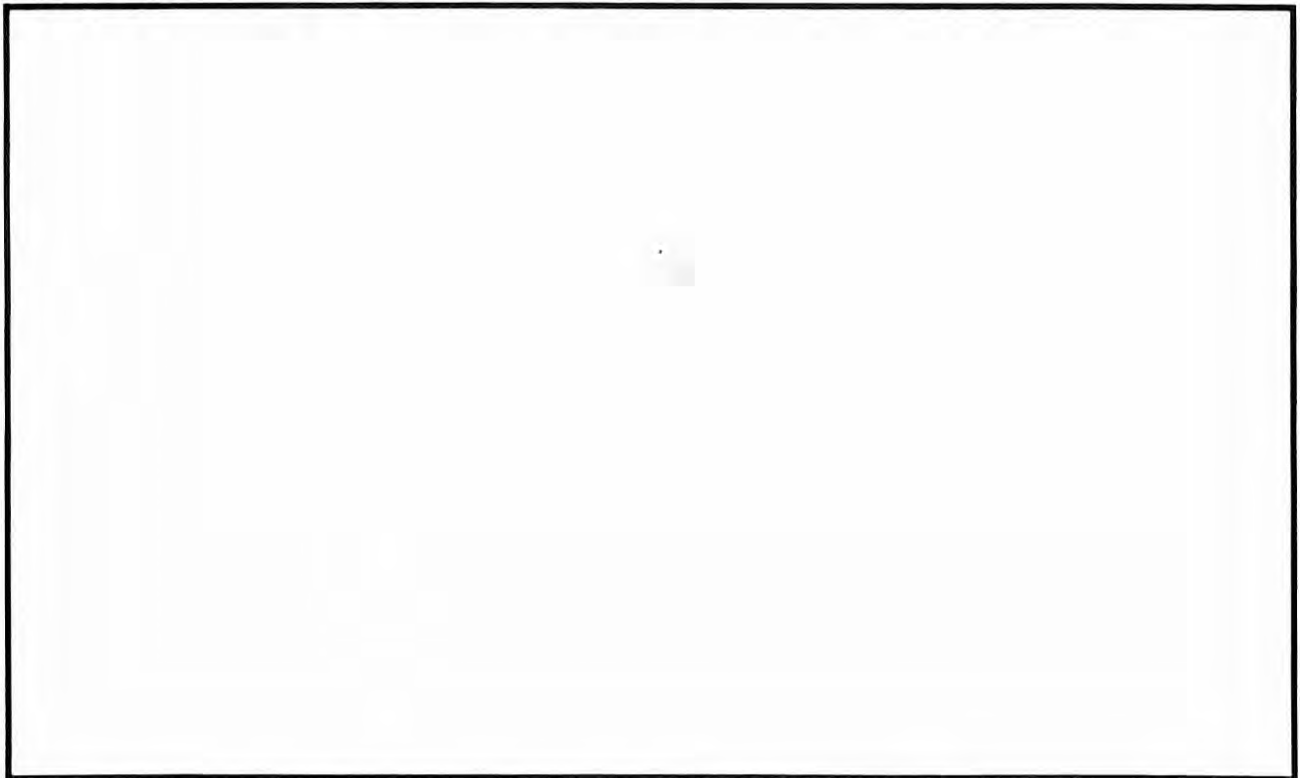


# CHANGE AND IMPACT

**BEFORE** – Show through illustration an undisturbed elephant habitat and way of life.



**AFTER** – Select *one* example from HUMAN SETTLEMENT, LOGGING, MINING, or FARMING to illustrate change and impact on the elephant's habitat and way of life.



# DOMESTICATED ELEPHANTS THREATENED

Find the information to answer these questions on the following website address: <http://news.bbc.co.uk/1/hi/world/asia-pacific/1154863.stm>

## TAG ASIAN ELEPHANTS' CALL

- ☐ List the problems threatening domesticated elephants.

.....

.....

- ☐ How could registering and tagging the elephants with microchip implants improve the life and conditions of the domesticated elephants?

.....

.....

.....

- ☐ There are between ..... and ..... domesticated elephants currently in Asia.

- ☐ List the jobs domesticated elephants used to do. ....

.....

- ☐ Give 2 reasons for the decline in the number of domesticated elephants across Asia. ....

.....

.....

- ☐ What do you think is being used instead of the elephants? .....

.....

- ☐ At the beginning of 1900, Thailand had ..... domesticated elephants.



## DATABASE

- ☐ About 90% of Asia's elephants are near a ..... or within an hour's drive of an ..... , not in the middle of a ..... ' said Mr Lair.

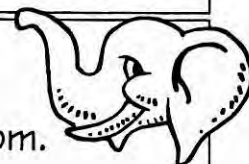
.....

- ☐ An elephant database could be established within ..... years.



# DOMESTICATED ELEPHANTS THREATENED

## SMUGGLING OF BABIES



- List the countries the baby elephants are being smuggled from.

.....

.....

- The country receiving the smuggled baby elephants is .....

- How are the baby elephants captured? .....

.....

- Describe the impact or effect this would have on the rest of the herd,

.....

and on the baby calf. ....

.....

- Elephant calves are sold for about ..... to .....

- What happens to the elephant calves? .....

.....

- What role do tourists play in encouraging people to capture and sell the baby elephants? .....

.....

- What do you think about elephant calf smuggling? .....

.....

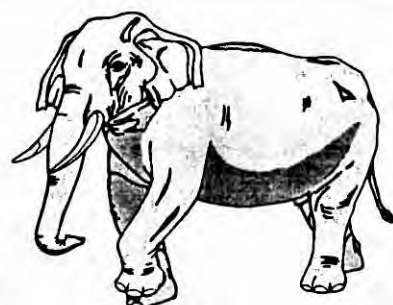
.....

.....

- This story was written on .....

- ★ **READ** the other stories about elephants on this web page. Select one to write a summary of to present.

- ★ **DESIGN** a poster that raises awareness of the problems for domesticated elephants.



# EVA – THE ARTISTIC ELEPHANT

To find out about artistic Eva, go to the following website address:

<http://www.baliadventuretours.com/profile-eva.htm>

☐ Read Eva's story.

☐ List 8 facts about Eva.

(1) .....

(2) .....

(3) .....

(4) .....

(5) .....

(6) .....

(7) .....

(8) .....

☐ View the Elephant Art Gallery. Describe the paintings created by Eva and other elephants. ....

.....

.....

☐ What is the conservation group NOVICA hoping to achieve by selling these paintings? .....

.....

.....

★ DRAW your own picture for Eva.

VISIT <http://www.elephantart.com/catalog/artstate.php> to see more artworks by elephants.



# ASIAN ELEPHANT RESEARCH

List information about the following aspects of Asian elephants. Use a variety of sources for your research, including Internet and reference books.

**Survival skills** (how the Asian elephant has adapted to its environment)

.....

.....

.....

.....

**Body structure**

.....

.....

.....

.....

.....

**Obtaining food**

.....

.....

.....

.....

**Appearance**

.....

.....

.....

.....

**Female Asian elephants**  
(role, behaviour, reproduction)

.....

.....

.....

.....

**Male Asian elephants**  
(role, behaviour, reproduction)

.....

.....

.....

.....

**Efforts to save the Asian elephants**  
○ Organised groups

.....

.....

.....

.....

.....

.....

○ Laws

.....

.....

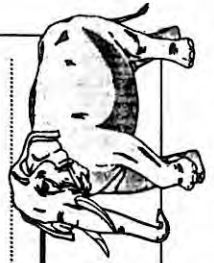
.....

.....

.....

.....

★ Use the information from this research to form the basis of a report on Asian elephants. Each heading becomes a paragraph. Include an introduction and a conclusion.



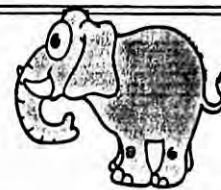
<b>LOCATION of Asian elephants</b> (countries, regions)	<b>Elephants and human relationships</b> (Give examples)	<b>THREATS TO SURVIVAL of</b> the Asian elephant (problems)
<b>HABITAT</b> (type, importance of habitat)	<b>Importance of the elephant in cultures</b>	
	<b>Symbolism of the elephant</b>	
		<b>TYPES OF ASIAN ELEPHANTS</b>
		<input type="radio"/> Sri Lankan Asian elephant
		<input type="radio"/> Sumatran Asian elephant
		<input type="radio"/> Indian elephant
<b>FOOD AND FEEDING</b>	<b>BEHAVIOUR</b> (daily routine, stages of life)	



# ASIAN ELEPHANTS – LET’S EDIT!

Rewrite these sentences neatly and correctly.

the elephant is the largest of the land mammals there are two species the african elephant and the asian elephant



asian elephants live in forests in india nepal bhutan bangladesh srilanka  
burma thailand cambodia laos vietnam malaysia indonesia and borneo

asian elephants live in many different habitats including open grasslands  
marshes savannas and forests

approximately 20% of the worlds population lives in or near the range of  
asian elephants the homes of these elephants are being cleared for  
human settlement logging and agricultural development

asian elephants are large herbivores they eat grasses leaves trees and shrubs

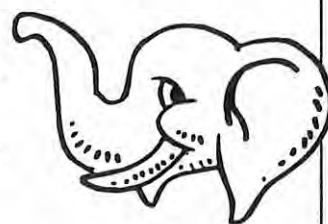
asian elephants communicate with each other by touch sound and scent



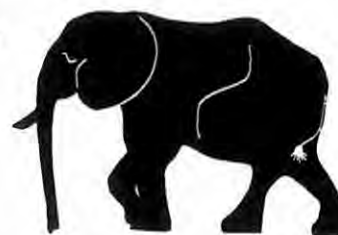
# ASIAN ELEPHANTS

their      there      they're = they are

Complete the sentences with the above words. Think carefully, and use the correct word in each space below.



- ☐ ..... are three kinds of Asian elephant: the Indian, Sri Lankan and Sumatran.
- ☐ ..... a prized beast of burden and are captured legally and illegally in many countries in Asia.
- ☐ The mature females of the herd are very protective of ..... offspring.
- ☐ ..... are two main threats to the future survival of the Asian elephant: habitat destruction and poaching.
- ☐ ..... foods include leaves, grass, shrubs, tree bark and fruit.
- ☐ ..... highly intelligent, sociable mammals.
- ☐ ..... habitat is under pressure from the continuing increase of human population and the timber and mining industries.
- ☐ ..... are between 40 000 and 50 000 Asian elephants left living in the wild in the world.
- ☐ ..... diet varies from acacia trees to wild mangos.
- ☐ ..... used by humans to log forests, transport heavy loads and carry tourists.
- ☐ Some farmers have killed wild elephants because they were eating ..... crops.
- ☐ ..... used to be more wild elephants in Asia.
- ☐ It is estimated that ..... are about 500 wild elephants in Laos.
- ☐ Asian elephants are being forced out of ..... forest homes by logging, agricultural clearance and poorly-planned development schemes.
- ☐ For centuries, elephants earned ..... keep by hauling trees for Asia's logging industry.





# ASIAN ELEPHANTS – WORKING WITH SENTENCES

○ Match these sentence beginnings and endings. CUT OUT, MATCH and PASTE to form complete sentences.

In the wild, the elephant may spend as much as 16 hours per day	150 litres of water in a day.
Male Asian elephants are	pink on the forehead, the ears, the base of the trunk and chest.
The skin colour of Asian elephants is dark grey to brown, with patches of	critically endangered species with less than 40 000 wild elephants in Asia.
Elephants are very social animals and live in family units	foraging for food, eating leaves, grass, shrubs, tree bark and fruit.
The importance of the elephant to the peoples of Asia is	and have patches of depigmentation on their ears, trunk and belly.
An elephant may drink as much as	consisting of a mature female, the most recent offspring and older offspring.
The Sri Lankan species is the largest and darkest of the Asian elephants	killed for ivory tusks.
The long-term survival of the Asian elephant is threatened by	evident in religion, tradition, emblems, and even national flags.
The total body length of Asian elephants ranges from 550 cm to 640 cm	and shoulder height from 250 cm to 300 cm.
The Asian elephant is currently listed as a	widespread habitat loss and poaching.

# ASIAN ELEPHANTS – WORD ACTIVITIES



○ Arrange these words in alphabetical order:

(a) people	shrinking	confrontation	habitat	menace	elephants
(b) hides	capture	poaching	meat	ivory	illegal
(c) matriarch	hairless	social	mammal	herbivore	protective
(d) magnificent	ceremony	exploited	worshipped	sacred	revered
(e) Nepal	Cambodia	Malaysia	Bhutan	Vietnam	Indonesia

○ Break these words into syllables. Each syllable contains a vowel or letter that has a vowel sound.

conservationist	environment	habitat	illegal	elephant
population	deforestation	destruction	threatened	dominant

○ Write opposites for these words:

illegal	capture
hairless	protect
social	revere
exploit	conserve

○ Compound words. Match.

off	forest
rain	lore
grass	fare
folk	ways
war	lands
path	spring

★ WRITE the compound words.



# ELEPHANT FACTS

READ each elephant fact. ✂ MATCH the information with the correct elephant species. Some facts may suit both.

## AFRICAN ELEPHANTS

Males up to 4 m tall at the shoulders

Very big fan-shaped ears

Found in many parts of Africa south of the Sahara Desert.

Female elephants and their young live in family groups of 8 to 10.

The trunk has two lips at the tip.

Reserves & national parks, established to protect elephants, are often not large enough.

Elephants are hunted and killed by people for their ivory tusks.

Besides large meat-eating animals, an elephant's main enemy is people.

Poachers enter parks and reserves to kill elephants for their tusks.

Used to transport heavy loads and work in forests.

Baby elephants are immediately surrounded by the females for protection if a predator, such as lions, approaches.

Males have small tusks.

Loss of habitat is the main threat to the survival of this species.

Live in India, Sri Lanka, Sumatra, and other parts of South-East Asia.

Dome-shaped head and humped back.

Narrow, slender-shaped ears.

Live on the savanna.

Male elephants have very large tusks. A bull's tusks at the age of 60 may weigh 60 kg each.

Bulls live alone or in all-male groups.

Males can weigh up to 5000 kg.

Spray their bodies in dust to protect themselves from insect bites.

Elephants range areas can cover over 2600 square kilometres.

Males grow up to 219 m high at the shoulders.

The trunk has one lip at the tip.

Elephants have enormous appetites.

## ASIAN ELEPHANTS

A charging elephant can run as fast as 32 km/h.

They never move far away from a water source.

Elephants live in family groups of four to eight animals.



# ASIAN ELEPHANTS



- ☐ Reproduce onto A4 card.   ✂ Cut out words and meanings.   ☐ Match.  
☐ Think of some word games you could use these cards for.

adapt	conflict	matriarch	mammal
hide	conservationist	poacher	depigmentation
herbivore	reserve	range	extinct
social	species	habitat	illegal



# ASIAN ELEPHANTS

a struggle, to clash	the area in the world in which a particular kind of animal can be found	the place where an animal lives	unlawful
an area of skin with no colour	to change in order to survive in new conditions	an animal that eats plants	the skin of an animal
an animal that is warm-blooded and has a backbone. Most are covered with fur, or have hair. Females have glands that produce milk to feed their young.	living with other	a person who hunts animals even though it is against the law.	a person who protects and preserves Earth's natural resources such as animals, plants and soil.
No longer living anywhere in the world.	land that has been set aside where plants and animals can live without being harmed.	the female leader of a family group of elephants.	A kind of animal or plant.



# ELEPHANT FACTS

The Asian elephant, whose ancestors originated in Africa and ranged from modern Iraq and Syria to the Yellow River in China, is now found in only thirteen countries from India to Vietnam.



Clearance of forest for settlement and agriculture is disrupting traditional elephant migration routes.

In Vietnam, the Asian elephant population in 1990 was between 1500 and 2000; in 1998 it was less than 150.

Asia's 35 000 to 50 000 surviving elephants are being squeezed into increasingly smaller areas.

The Asian elephant is the largest mammal in Asia.

Land-use planning is imperative for people and wildlife to get what they need to survive.

About 20% of the world's human population lives in or near the present range of the Asian elephant.

Domesticated elephants are found throughout South and South-East Asia. They are trained as working animals.



WWF is working throughout the Asian elephants' range to conserve the remaining populations and their habitat.

The continually growing human population has encroached on the elephants' dwindling forest habitat.

## ORGANISATIONS

Ringling Bros. and Barnum & Bailey Centre for Elephant Conservation

CITES (Convention on the International Trade in Endangered Species)

IUCN – World Conservation Union (Raman Sukumar) <http://www.iucn.org/>

World Wildlife Foundation

Smithsonian Institute's Conservation and Research Centre (Michael Stüwe)

Elephant Conservation Centre of the Thai Forestry Organisation

Food and Agricultural Organisation of the United Nations (Richard Lair)

Society for Conservation Biology

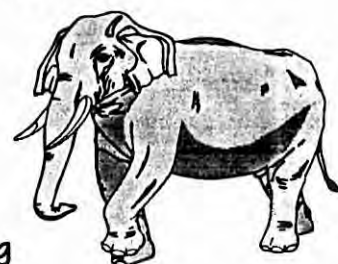
International Elephant Foundation

Friends of the Asian Elephant

Elephant Care International

Living With the Elephants Foundation

EEP (European Endangered Species Program) [www.worldzoo.org](http://www.worldzoo.org)





**Footnote:**

- Elephants sleep on their feet.
- Elephants can't jump.

The elephant lives in herds that have a number of females and young elephants. The bull or male elephant often lives by itself. The elephant looks after its young and teaches them how to behave and look after themselves.

Elephants live in a variety of habitats, including forests, desert scrub and grasslands. All mammals, from elephants to mice, are warm-blooded. They can live in hot or cold places.

Its ears are very large, and it has excellent hearing.

Elephants are plant eaters.

Elephants eat green shoots, leaves, twigs, roots, bark and fruit.

Elephants' big ears help them hear very well. They also help them cool down.

Elephants are the largest animals that live on land.

They live in Africa and parts of Asia.

Sometimes they eat grass.

To eat, elephants tear off leaves and branches with their trunks or rip up bunches of grass.

The ears of an African elephant are like huge fans. On hot days the elephant flaps them back and forth to keep itself cool.

At one time elephants roamed over most of Africa and Asia. Today they are found only in areas south of the Sahara desert in Africa, and in India, Malasia and Nepal.

The elephant is the largest mammal to live on land. It has a big, heavy body. Including its tail and trunk, it is 700 to 800 centimetres long.

The tusks are really two top teeth that have grown very long.

The elephant's trunk is an important feature of its body. Its trunk is long and strong. It is used for breathing, grasping food and drinking, and as a weapon for defence.

The elephant likes water and enjoys playing in it.

The elephant is often called a *pachyderm*. This means it has very tough, thick skin. The skin of old elephants becomes baggy and wrinkled.

# The Elephant

Most elephants have tusks.

ELEPHANT FACTS BY .....						
General Description	Diet	Habitat	Reproduction	Movement	Behaviour	Interesting Facts



**Eyes** .....

**Ears** .....

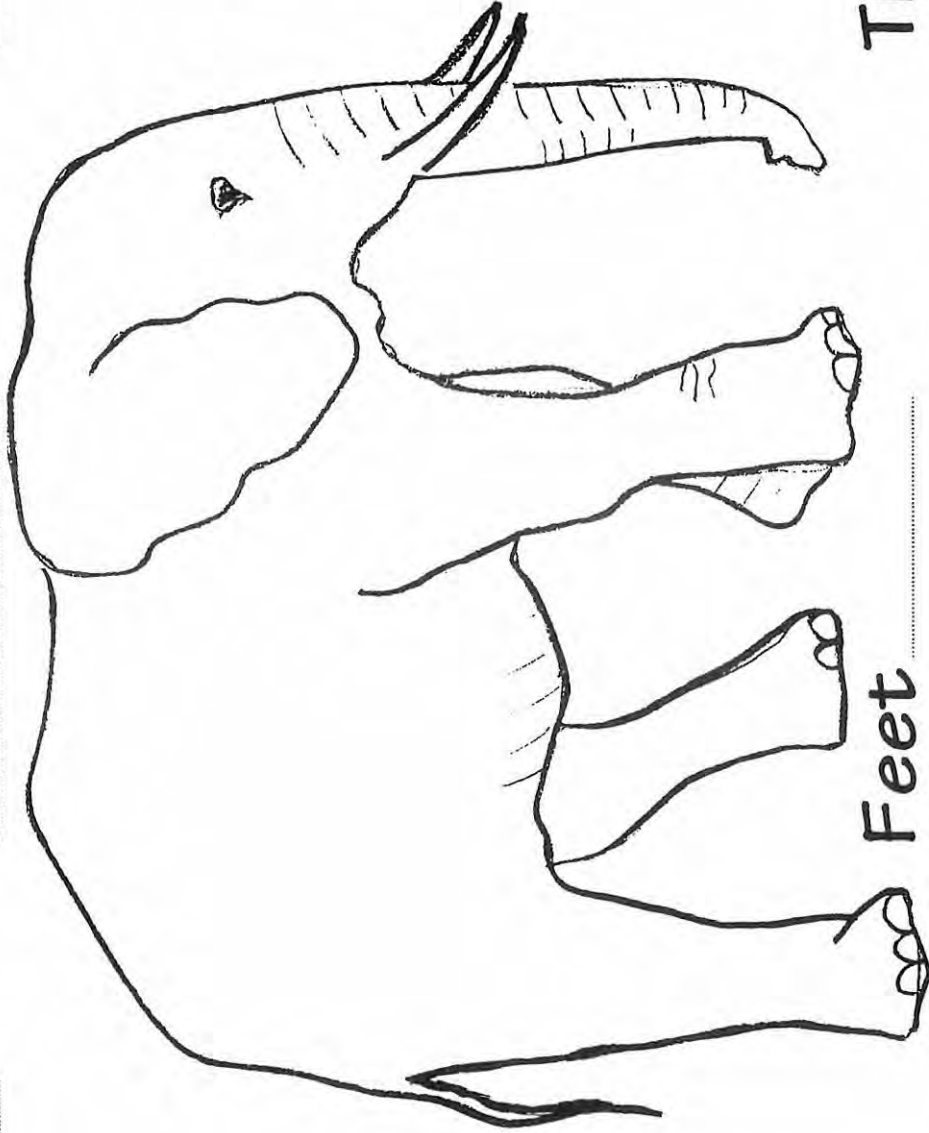
**Skin** .....

**Tusks** .....

**Trunk** .....

**Feet** .....

**Tail** .....



# ELEPHANT FACTS

☐ General description (or what it is)

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☐ Diet (or what they eat)

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☐ Habitat (or where they live)

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☐ Reproduction (or how they have babies)

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☐ Movement and breathing

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☐ Behaviour (or what they do)

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☐ Interesting facts

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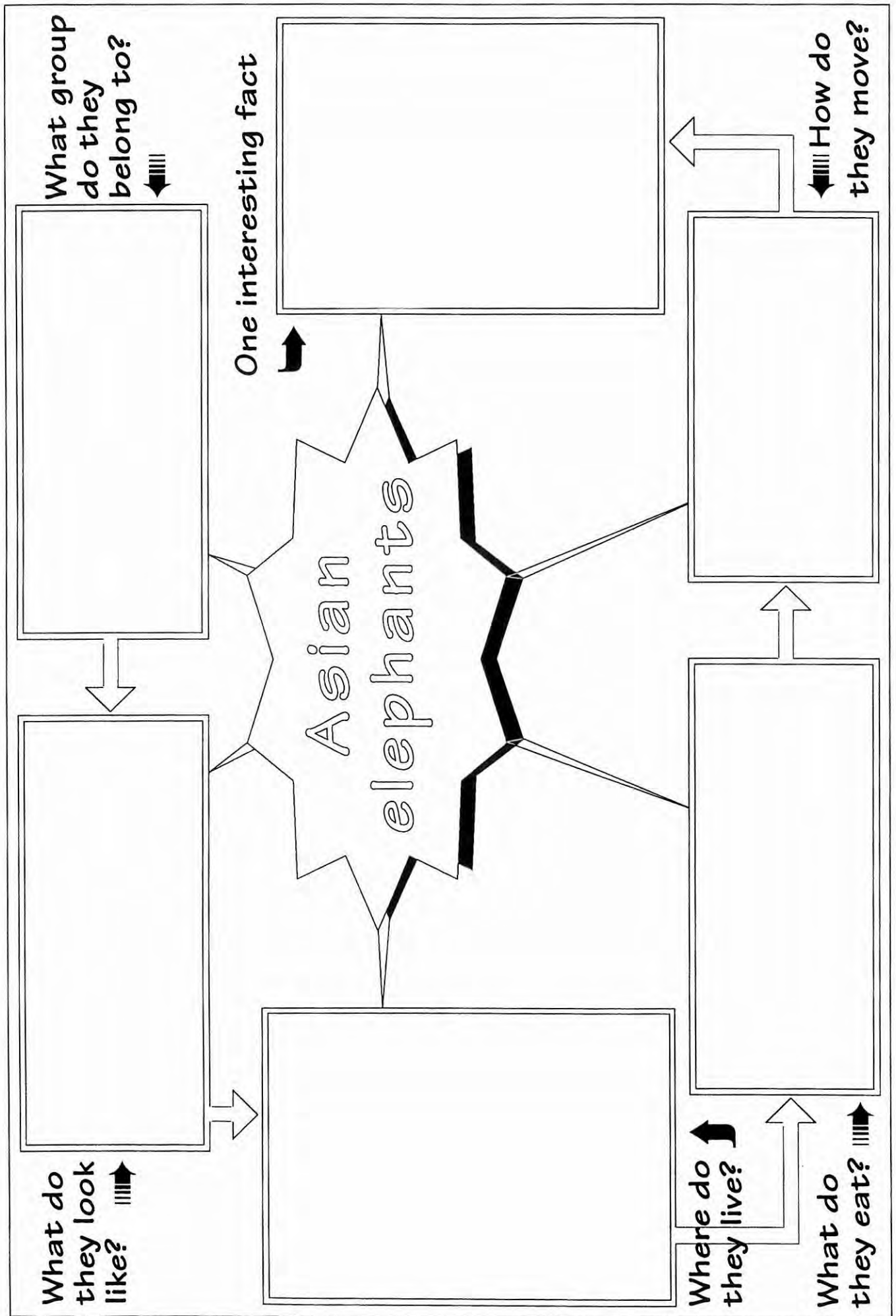
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Draw an elephant









## Global Education – Learning Emphases

- Interdependence and globalisation
- Identity and cultural diversity
- Social justice and human rights
- Sustainable futures

**A resource for Stages 4–6  
by Dr Susan Bliss**





# COCA COLA'S USE OF WATER IN INDIA



**Photograph 1:** A corner store in Goa, India. The Coca-Cola signs advertise 200 ml bottles of coke at five Indian rupees, which was the equivalent of 10 cents at the time. (Rob Elliott/Agence France-Presse — Getty Images)

Source: <http://www.wadsam.com/coca-cola-increasing-its-investment-in-india861/>

India, with a population of 1.2 billion people and a growing middle class, is an important market for the large transnational corporation (TNC), Coca-Cola. As a consequence of its market prominence Coca-Cola India maintains 58 bottling factories, employs 25,000 Indians directly and 1.5 million Indians indirectly, as well as distributes beverages to over 1.5 million outlets across India.

In 1997 Coca-Cola was forced to leave India when the government ordered the company to provide its secret formula and reduce its large market share in India. In 1993, after the government relaxed these restrictions, Coca-Cola and PepsiCo returned to India. Since 1993 Coca-Cola has invested \$7 billion in India that contributed to employment and economic growth, and improved human wellbeing with programs focussing on education, health and water conservation. Aimed to become a more environmentally sustainable company, Coca-Cola has constructed over 500 rainwater harvesting structures in 22 Indian states.

## Environmental concerns

Coca-Cola is India's leading soft drink. However, there have been growing concerns over 'how' Coca-Cola is produced in India. In particular, it has been alleged that the quantity of water required to produce

Coca-Cola resulted in the depletion of groundwater. This caused a decline in water available to grow crops, and as a result led to many Indians suffering starvation and malnutrition. There are also fears that water used to produce Coca-Cola contains high levels of pesticides and other toxic chemicals that bio-accumulates up the food chain.

Village protests in Plachimada in Kerala, Kaladera in Rajasthan and Mehdiganj in Uttar Pradesh ensured Coca-Cola India was compelled to face its unsustainable management actions. Eventually years of protests forced the closure of a Coca-Cola bottling factory in the northern province of Uttar Pradesh as it was extracting groundwater above legal limits and polluting the environment with toxic effluents. The closure of the factory was hailed as a victory for the local community.

## Water quality threatened

Coke-Cola India's bottling plants have been blamed for a decline in both water quantity and water quality. In 2003, the Centre for Science and Environment (CSE), in New Delhi, stated that soft drinks manufactured by Coca-Cola India, contained pesticides that contributed to cancer and the breakdown of the human immune system.

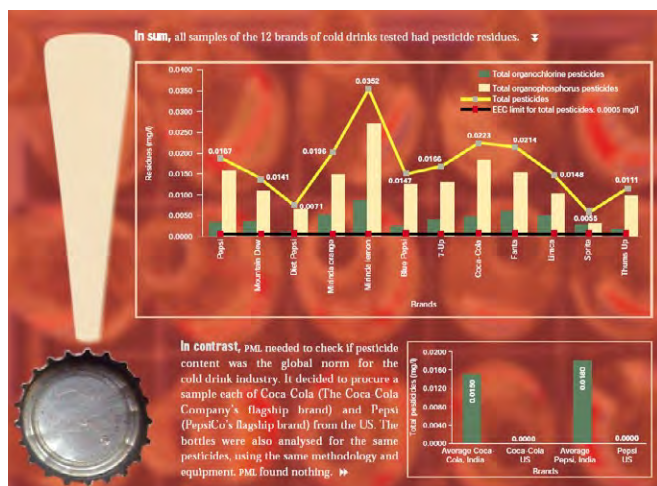
# COCA COLA'S USE OF WATER IN INDIA



**Photograph 2:** In 2014 Indian village women from Banaras in northern Uttar Pradesh demand the closure of Coca-Cola and PepsiCo factories due to fears of groundwater poisoning. (AFP Photo / Raveendran)

Source: <http://rt.com/news/167012-coca-cola-factory-closed-india/>

In India, the CSE found that Pepsi's soft drinks contained pesticide residues more than 36 times higher than the quantity permitted under European Union (EU) regulations, and Coca-Cola's soft drinks contained 30 times higher quantity. Coca-Cola India now claims that its factories filter water to remove contaminants and its products meet minimum health standards.



**Figure 1:** The Pollution Monitoring Laboratory (PML) of the Centre for Science and Environment (CSE) places in the public domain its analysis of the contents of 12 cold drink brands sold in Delhi.

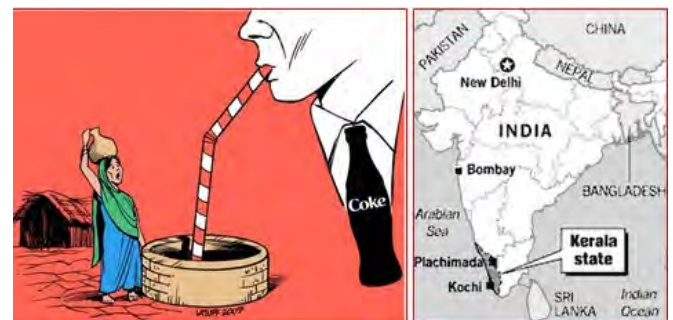
Source: [http://www.downtoearth.org.in/dte/userfiles/images/2\\_1.jpg](http://www.downtoearth.org.in/dte/userfiles/images/2_1.jpg)

## Plachimada in Kerala

Plachimada is known as an important rice producing area and labelled the 'rice bowl' in the southern state of Kerala. In 1998 Coca-Cola India acquired 34.4 acres of land in Plachimada. The company was permitted to produce 561,000 litres of beverage a day using 3.8

litres of water per litre of beverage. However, research found that about 2 million litres of groundwater was extracted per day. As a result within six months the villagers complained that:

- the water had turned milky white and was *unsuitable for drinking and cooking*
- *rice yields had decline* as there were high levels of calcium and magnesium, caused by excessive extraction of water
- *bottle washing* involved chemicals that polluted groundwater and soil
- *severe water shortages* occurred



**Figure 2:** Illustration criticising the Coca-Cola Company and a map of India showing Plachimada in Kerala state.

Source: <http://www.360m.de/wp-content/uploads/2011/06/coca-cola-india.jpg>

In 2002, the Anti-Coca Cola Peoples' Struggle Committee or **Samithy** began its protest against the plant. Over 1500 people, demanded the shutdown of the plant. In '2003, the BBC Radio 4 programme 'Face the Facts' reported the presence of carcinogens in the waste deposited by the plant. This waste had been dumped in the adjoining areas on the pretext of providing fertiliser to the farmers.' (<http://www.ritimo.org/article884.html>)

In January 2004 a World Water Conference organised near Plachimada at Pudussery adopted the Plachimada Declaration that aimed to prevent water scarcity and water pollution.

An outcome of the numerous protests and the Plachimada Declaration led to the following changes:

- 'February 21, 2004, the Government of Kerala declared Palakkad District drought affected, and ordered an immediate restriction on the company's usage of groundwater.'
- 'November 19, 2005, the Water Resource Department included Plachimada under the category 'overexploited,' which prevented further extraction for commercial purposes.'

(<http://base.d-p-h.info/en/fiches/dph/fiche-dph-8891.htm>).



# COCA COLA'S USE OF WATER IN INDIA

In **2005** Coca-Cola was forced to close the bottling plant because it depleted the groundwater and dumped toxic effluent into the water and soil. Some argued that the declining water in wells was attributed to bottling plants located in drought-stricken areas, which aggravated water scarcity in these areas.

Using the '**polluter pays**' principle, the government of Kerala passed a law in 2011 allowing people affected by Coca-Cola's bottling operations in Plachimada to seek financial compensation from the company for ecological damage, water pollution and water scarcity.



**Photograph 3:** Protest at the main gate of the Coca-Cola bottling plant in Plachimada, Kerala, India, April 5, 2006 (Photo by Kasuga Sho)

Source: [http://www.ens-newswire.com/ens/feb2011/20110228\\_hcbplindia.jpg](http://www.ens-newswire.com/ens/feb2011/20110228_hcbplindia.jpg)

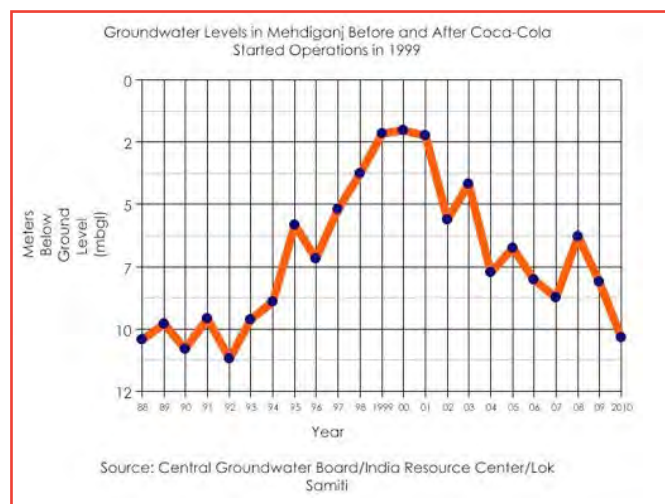
## Mehdiganj in Uttar Pradesh

In 1999 a Coca-Cola plant at Mehdiaganj, located near the holy city of Varanasi, was accused of polluting groundwater by releasing toxic wastewater into the surrounding land. A Coca-Cola official confirmed that there had been a drainage problem but the company had built a pipeline to correct it. Additionally, the dry environment where the plant is located suffered 'critical' water scarcity. Aimed to compensate for water withdrawn from groundwater in the dry environment, the government required the company to recharge 200% of the water it removed from the ground, and invest in water conservation in and around the plant.

Vandana Shiva, an Indian environmental activist, stated that one litre of Coca-Cola takes 9 litres of clean water. This differed to Coca-Cola declaring it only required 3.12 litres. Whatever the disputed quantity of water

withdrawn, groundwater levels dropped 8 metres since the plant opened in 1999

Activists aware of past environmental problems, campaigned against the proposed 2014 expansion of Coca-Cola. As a result the company was forced to abandon its newly built \$25 million bottling plant in Mehdiaganj. While money received from the new Coca-Cola plant would boost the local economy, the environmental dangers outweighed its economic benefits. In 2014 Coca-Cola was temporarily allowed to reopen its existing 'older' plant.



**Figure 3:** Groundwater levels in Mehdiaganj before and after Coca-Cola started operations in 1999.

Source: <http://www.360m.de/2011/coca-cola-%E2%80%93-live-positively%E2%84%A2/>



**Farmers fight Coca-Cola as India's groundwater dries up**  
'Savitri Rai winces as she recounts how police beat her when she protested against groundwater extraction at a Coca-Cola Co. (KO) plant near her farm in India. A decade later, she said her water supplies keep dwindling.'

"We have to dig ever deeper wells," the 60-year-old said outside her mud house in Mehadiaganj village in Uttar Pradesh state, blaming the beverage company's bottling

# COCA COLA'S USE OF WATER IN INDIA

line a kilometre away. Coca-Cola, which declined to comment on Rai's allegations, in August 2014 scrapped a \$25 million expansion at the site, citing delays in permits to extract more water.'

Source: <http://www.bloomberg.com/news/2014-10-08/farmers-fight-coca-cola-as-india-s-groundwater-dries-up.html>

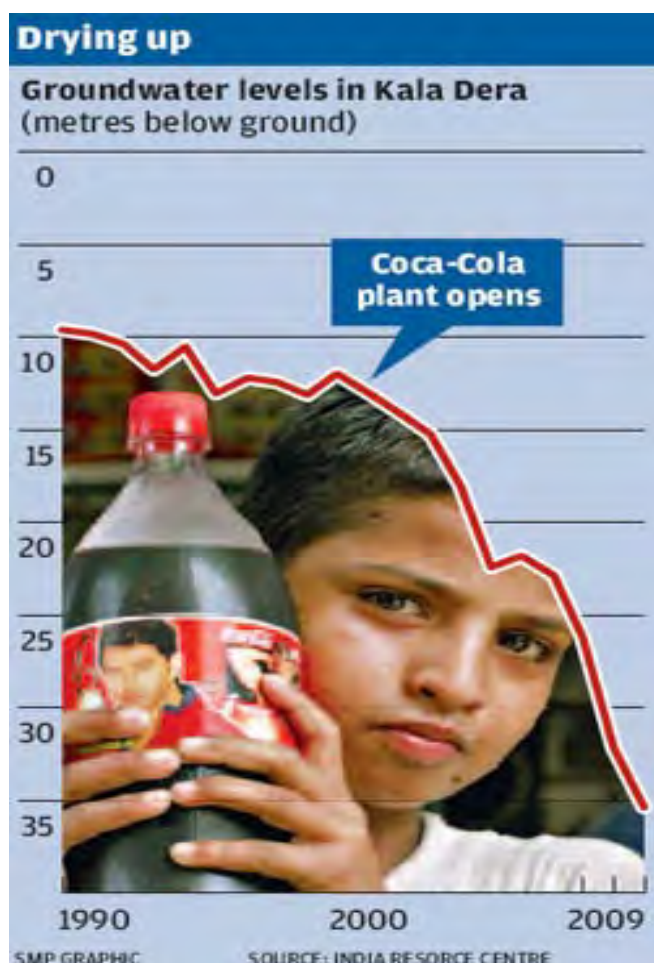
## Kaladera (Kala Dera) in Rajasthan

Kaladera is located 40km from Jaipur in the arid state of Rajasthan. The area experiences little precipitation, frequent droughts, water scarcity and over exploited groundwater. However these environmental problems did not halt Coca-Cola India commencing operations in Kaladera in 2000.

Since Coca-Cola operations commenced groundwater levels fell. For example:

- 1990-2000 groundwater levels fell 3.94 metres
- 2000-2010 groundwater levels plummeted 25.35 metres

Some groups declare it is unfair to blame Coca-Cola for water shortages when agriculture is the largest user



**Figure 4:** Declining groundwater levels since 1990 in Kaladera

Source: [http://killercoke.org/crimes\\_india.php](http://killercoke.org/crimes_india.php)

of water in the area. Coca-Cola accused farmers of wasting water by using traditional irrigation methods instead of water saving drip irrigation. Also, Coca-Cola claims it recharges at least nine times more groundwater than it uses, thanks to the rainwater harvesting methods used at the bottling plant. Over the last six years the company advocates it has improved its water usage ratio (i.e. litres of water used to make one litre of finished beverage)

## Growing Indian market

At the global scale, India overtook Germany as Coca Cola's sixth largest market by volume of sales in 2014. At the regional scale Coca-Cola India contributes 12% of the company's sales in the Asia- Pacific region. Ventakesh Kini, president at Coca-Cola India and South West Asia, said there is still huge potential for growth in India. *'In terms of potential, we have just scratched the surface....only a quarter of India's population has had our beverages.'*

([http://articles.economictimes.indiatimes.com/2014-07-04/news/51076433\\_1\\_pepsico-india-coca-cola-india-fanta](http://articles.economictimes.indiatimes.com/2014-07-04/news/51076433_1_pepsico-india-coca-cola-india-fanta))



**Figure 5:** Coca-Cola – sales, markets and per capita consumption

Source: <http://m.economictimes.com/thumb/msid-37740272,width-200,resizemode-4/india-overtakes-germany-as-coca-colas-sixth-largest-market.jpg>

*'In August 2006, Coca-Cola Company stated that their products are tested using European standards and did not break any laws in India. However, Coke was found containing pesticides 24 times higher than the European standard by an Indian laboratory that Coca-Cola discredit (Burnett & Welford, 2007). Coca-Cola has many bottling plants which are in different locations in India sharing large quantities of water to local farmers especially during seasonal droughts (Burnett & Welford, 2007).'*

(<http://smalallah.com/research/relationship-marketing-coca-cola-in-india/>)



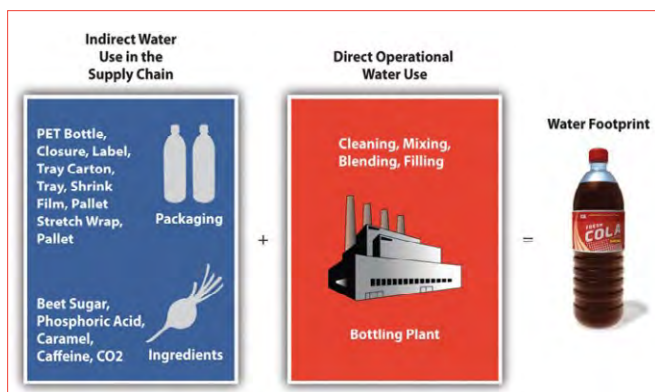
# COCA COLA'S USE OF WATER IN INDIA

Coca-Cola says it is “proud of the progress we are making in India on water resource management.” ... “If our plants in locations facing water shortages are required to alter plant capacity or production, the Company will determine what appropriate actions should be taken.”

(<http://www.indiaresource.org/campaigns/coke/2008/coketomichiganletter1.pdf>)

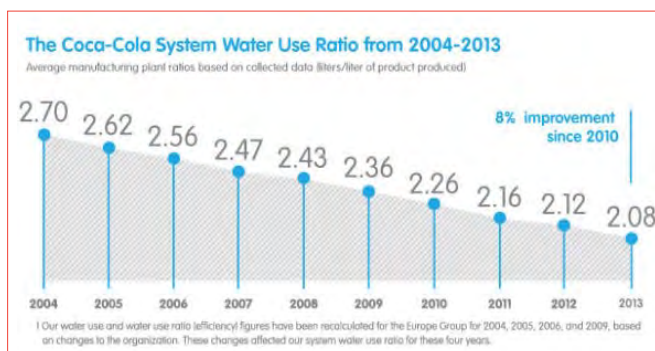
## Towards sustainability – water footprint

Coca-Cola has a large water footprint from the production of beet sugar, to the manufacture of PET bottles, and to the cleaning, mixing and filling in bottling plants. In general Coca-Cola requires 15 litres of green water, 8 litres of blue water and 12 litres of grey water to produce 0.5 litres of Coca-Cola. Most of the water footprint is in the production of sugar beet and the operational footprint only accounted for 1% of the total footprint. By 2020, Coca-Cola aims to improve water efficiency in manufacturing operations by 25% compared with its 2010 baseline.



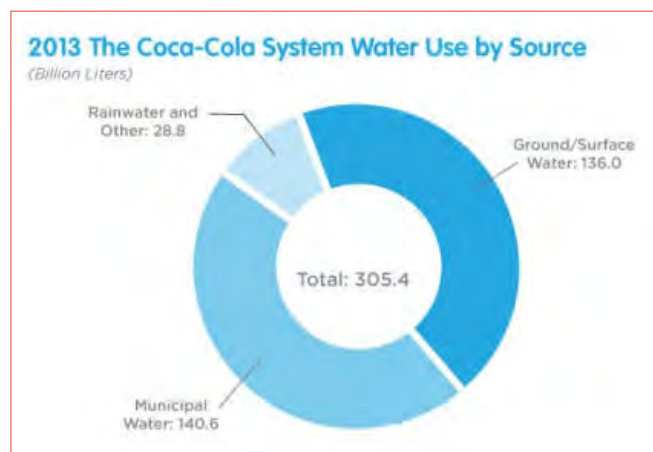
**Figure 6:** Coca-Cola's water footprint

Source: <http://2012books.lardbucket.org/books/sustainable-business-cases/s08-05-life-cycle-management-and-sust.html>



**Figure 7:** Improved water efficiency over time

Source: <http://d1lwft0f0qzya1.cloudfront.net/dims4/COKE/3f44803/2147483647/resize/584x%3E/quality/75/?url=http%3A%2F%2Fassets.coca-colacompany.com%2F4a%2F82%2Fa030d29b4c91a39318a32aa0a87c%2Fwater-use-ratio-chart-598.jpg>



**Figure 8:** Coca-Cola's source of water

Source: <http://www.coca-colacompany.com/setting-a-new-goal-for-water-efficiency#TCCC>

## Geofacts

- In 2003 Coca-Cola registered an 11% drop in sales after pesticide allegations were made.
- In 2005, Coke and Pepsi held 95% market share of soft-drink sales in India.
- In 2006, the Indian state of Kerala banned the sale and production of Coca-Cola due to concerns of high levels of pesticide residue

## Activities

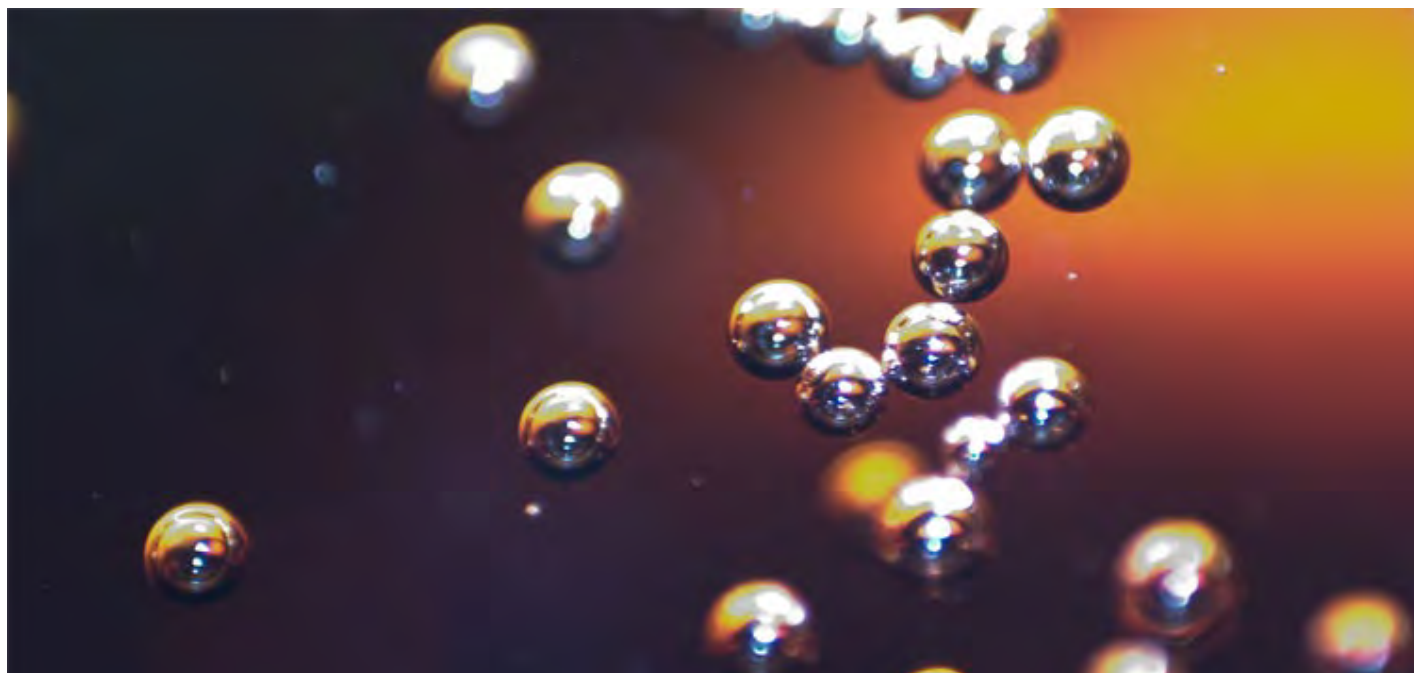
### Knowledge and understanding

1. What is meant by the following terms: TNC, groundwater, rainwater harvesting, bio-accumulate, Samithy, polluter pays principle and sustainability
2. Distinguish between blue, green and grey water
3. Explain the environmental concerns of Coca-Cola India at the local scale
4. Discuss the economic benefits of Coca-Cola to the country and local community
5. Draw a time line showing the changes to Plachimada from 1998-2011
6. List the costs and benefits of Coca-Cola in Mehdiganj in a two column table

### Inquiry and skills

7. Refer to Figure 1 and the internet:
  - a. What are pesticides?
  - b. Why are pesticides used in the production of Coca-Cola?
  - c. Compare the types of pesticides in Coca-Cola with Pepsi

# COCA COLA'S USE OF WATER IN INDIA



- d. Name the drink that contains the smallest and largest quantity of pesticides
- e. Compare pesticides in Coca-Cola in India with US. Explain why they differ.
- f. Discuss the impacts of pesticides in drinks consumed by humans
8. Refer to Figure 2: Explain the message in the illustration
9. Refer to Figure 3:
  - a. Compare the level of groundwater in 1988 with 1999 in Mehdiganj
  - b. Suggest reasons for changes from 1999 to 2010
10. Refer to Figure 4: Compare the groundwater levels in Kaladera in 1990-2009, and provide reasons for the change
11. Refer to Figure 5 and the internet:
  - a. Describe the sales and per capita consumption of Coca-Cola India
  - b. Discuss why India is a valuable market for Coca-Cola
  - c. Research the problems of drinking Coca-Cola on human wellbeing
12. Refer to Figure 6 and the internet:
  - a. What is a water footprint?
  - b. List the components of Coca-Cola's water footprint
13. Refer to Figure 7: Explain how Coca-Cola has reduced its use of water over time
14. Refer to Figure 8: What is the main source of water for Coca-Cola?
15. To whom does water belong? Coca-Cola, Farmer, Everyone, Business, Government, Local community? Justify your answer.
16. Describe how Coca-Cola contributed to the deterioration of groundwater in quality and quantity in India over time
17. The availability of good quality water for drinking and agriculture has been dangerously affected due to the activities of Coca-Cola in India. Discuss how this has impacted on human health and food supplies.
18. Debate for and against Coca-Cola in India covering environmental, economic and social factors
19. According to Coca-Cola, the decline in groundwater is an environmental and farming problem and attributing it to the company is unfair.
  - a. Comment on this statement
  - b. Research strategies used by Coca-Cola to improve water scarcity and water quality in areas where the company plants are located
20. Research Coca Cola's push into China. Include Why? Where? What are its impacts on the Chinese people, the Chinese government, Coca-Cola Company and the environment? Use a variety of secondary sources and present findings using Web 2.0 tools. Include maps, graphs and photographs.



# COCA COLA'S USE OF WATER IN INDIA

## Websites

Coca-Cola India <http://www.coca-colaindia.com/>

Indian officials order Coca-Cola plant to close for using too much water <http://www.theguardian.com/environment/2014/jun/18/indian-officals-coca-cola-plant-water-mehdiganj>

Criticism of Coca-Cola [http://en.wikipedia.org/wiki/Criticism\\_of\\_Coca-Cola](http://en.wikipedia.org/wiki/Criticism_of_Coca-Cola)

Water shortages shuts Coca-Cola plant in India <http://www.cnbc.com/id/101775300#>.

Farmers fight Coca-Cola as India's Groundwater dries up <http://www.bloomberg.com/news/2014-10-08/farmers-fight-coca-cola-as-india-s-groundwater-dries-up.html>

Sludge dirt on Coca-Cola <http://nswcna.blogspot.com.au/2005/08/sludge-dirt-on-coca-cola.html>

Plachimada Declaration <http://www.thehindu.com/2004/01/24/stories/2004012402321300.htm>;  
<http://books.google.com.au/books?id=gOrvghLklKoC&pg=PA201&lpg=PA201&dq=plachimada+declaration&source=bl&ots=XXnhrHmnIC&sig=X4-SwBg0f27n6eiADdHHaJrAhzk&hl=en&sa=X&ei=B5BmVOS5C8PNmwXns4LgBQ&ved=0CCMQ6AEwAQ#v=onepage&q=plachimada%20declaration&f=false>



Coca Cola 1950 – “..Love that American Way of Life”

Source: <http://www.nofructose.com/2015/03/27/coca-cola-1950-love-that-american-way-of-life/>



Led by the communities impacted by Coca-Cola in India, the International Campaign to Hold Coca-Cola Accountable works to apply pressure on the Coca-Cola company as well as the Indian government to meet the demands of the

communities impacted by Coca-Cola's operations. Artwork by Carlos Latuff.

Source: Wikimedia Commons. <http://www.cokejustice.org/>

## YouTube

A Coke controversy: India soft-drink sweatshops <http://www.youtube.com/watch?v=RWSjWWsFy9g>

Coca Cola's unethical practices in India <http://www.youtube.com/watch?v=qlsyjfwkIwU>

Coca Cola kill – India [http://www.youtube.com/watch?v=0zORCF\\_zOB0](http://www.youtube.com/watch?v=0zORCF_zOB0)

Environmental justice: Coca-Cola in India <http://www.youtube.com/watch?v=fajiWmAuvSY>

## Other references

Bangkok Post, "Cola giants criticised amid India water crisis," April 21, 2010 <http://www.bangkokpost.com/news/asia/175345/cola-giants-criticised-amid-india-water-crisis>

India Resource Center (2011): Sharp Drop in Groundwater Levels Around Coca-Cola Bottling Plant. <http://www.indiaresource.org/news/2011/1005.html>

India Resource Center (2010): Government Moves to Claim \$48 Million Compensation from Coca-Cola. <http://www.indiaresource.org/news/2010/1037.html>

The Coca-Cola Company (2011): Live Positively – Water Stewardship. [http://www.thecoca-colacompany.com/citizenship/water\\_main.html](http://www.thecoca-colacompany.com/citizenship/water_main.html)

The Coca-Cola Company (2011): Environmental Initiatives – Community Water Programs. [http://www.thecoca-colacompany.com/citizenship/community\\_initiatives.html](http://www.thecoca-colacompany.com/citizenship/community_initiatives.html)

The Coca-Cola Company (2011): The Water Stewardship and Replenish Report, January 2011. [http://www.thecoca-colacompany.com/citizenship/pdf/replenish\\_2011.pdf](http://www.thecoca-colacompany.com/citizenship/pdf/replenish_2011.pdf)



# **SUSTAINABLE ASIA – INTEGRATING ASIAN PERSPECTIVES THROUGH GEOGRAPHY**

**A Stage 5 resource by Aldin Hondo,  
Minaret College**

**Asia, as a broad term encompasses many different cultures, religions, values and geographical spaces. So with the Australian National Curriculum's emphasis on Australia's engagement with Asia, it is important to ensure that our integration of Asian perspectives is done in a way that is both sensitive and authentic. Australia owes its economic and social success in large part to migration. The positive effects that migration has had on Australia as a nation – a very young nation – are many, and with the economic growth of Asia, especially the rapid growth of the middle class in both China and India, it is important to develop an authentic, mutual respect and understanding between the two continents.**

**Geography at a year ten level encompasses two broad Units: Environmental Change and Management and Geographies of Human Wellbeing. Students are required to develop their critical thinking skills through the application of geographical concepts in each of these topics. In Unit 1: Environmental Change and Management, students learn about the impacts of climate change and what can be done to reverse the se effects. The unit also looks at urban environments and their development and possible decline, all of these topics are framed by another vital cross curriculum capability, Sustainability.**



# SUSTAINABLE ASIA – INTEGRATING ASIAN PERSPECTIVES THROUGH GEOGRAPHY

This assignment was designed with these two important cross curriculum capabilities as its focus. The assignment can be completed in a period of two weeks with two lessons designated from the teaching load, although, you may choose to extend this or shorten it depending on your cohort. Students are required to use the clean energy council website to gather information relating to one of the suggested renewable energy sources. Once students have gathered the information they are asked to prepare the information in a report that outlines the current energy trends in Australia and how their chosen renewable energy source is applied – or not applied – in Australia. As part of the report students need to access a major English language paper in either Japan, China or India – which has been provided to students

– and research the current ways that their chosen renewable energy sources is being used in the chosen country. Students need to find two articles that discuss this and summarise them.

The assessment rubric is designed to get students moving beyond simply recalling information, rather it helps students to explore ideas and connections between broad themes such as sustainability and urbanisation, and further asks students to independently interpret, analyse and evaluate the information.

This task can be modified to be done as pair work, group work or remain an individual task. There is certainly the possibility of choosing many different Asian countries as their research focus; some examples include Mongolia, Korea and Indonesia.

## Renewable Energy in Asia

### Year 10 Geography: Environmental Change & Management

You can find most of the relevant information at:

<http://www.cleanenergycouncil.org.au/technologies.html>

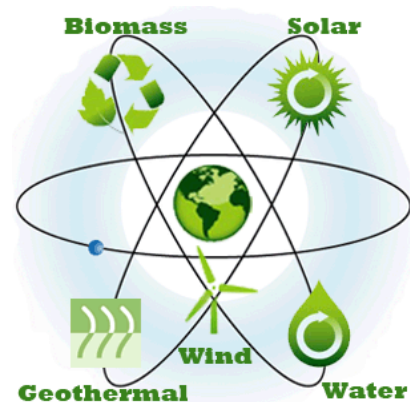
Most articles can be sourced at

<http://www.ecology.com/>

<http://www.japantimes.co.jp/> (Japan)

<http://www.chinadaily.com.cn/> (China)

<http://timesofindia.indiatimes.com/international-home> (India)



From the list below select one renewable energy source and write a report stating why you believe we should be moving towards using this energy source. You must find two articles that show how your chosen energy source is being implemented in Japan, China or India and summarise them as part of your research report.

- Bio Energy
- Geothermal
- Hydroelectricity
- Large-scale solar PV
- Concentrated solar thermal
- Marine energy
- Solar PV
- Solar water heating
- Wind energy

### In your report you need to provide the following details:

- What is renewable energy?
- What is the current energy source being used?
- Explain with the help of geographical diagrams how your renewable energy source works?
- How is your chosen renewable energy source being used currently in Australia?
- How could it possibly be used in the future?
- Provide the advantages and disadvantages of your energy source.

Note: All the information must be in your own words.

# SUSTAINABLE ASIA – INTEGRATING ASIAN PERSPECTIVES THROUGH GEOGRAPHY

If you copy and paste directly from the website without putting it into your own words you will receive a zero for the assessment and this will be reflected in your report.

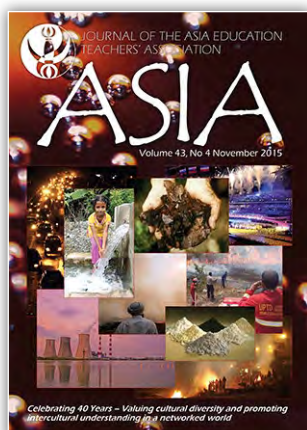
Rubric for Assessment – Investigating Renewable Energy Sources					
National Curriculum		Above Standard (Three Marks)	At Standard (Two Marks)	Below Standard (One Mark)	Not demonstrated (No Marks)
Geographical Inquiry & Skills	Observing, Questioning & Planning	A detailed plan, in line with the inquiry questions, for exploring the advantages and disadvantages of a renewable energy sources is evident.	A solid plan, in line with the inquiry questions, for exploring the advantages and disadvantages of a renewable energy sources is evident.	A rough plan, in line with most of the inquiry questions, for exploring the advantages and disadvantages of a renewable energy sources is evident.	No planning evident.
	Collecting, Recording, Evaluating & Representing	Relevant data is created using reliable information and further data is presented in range of appropriate forms, with and without the use of digital and spatial technologies.	Relevant data is presented in range of appropriate forms, with and without the use of digital and spatial technologies.	Data is presented in range of appropriate forms, with and without the use of digital and spatial technologies.	No data presented, or data may be incorrect or completely irrelevant.
	Interpreting, Analysing & Concluding	A range of relevant geographical data has been integrated to identify and propose explanations for the use of the selected renewable energy source.	Relevant geographical data has been sourced to identify and propose explanations for the use of the selected renewable energy source.	Some geographical data has been sourced to identify and/or propose explanations for the use of the selected renewable energy source.	No supporting data included, or data may be irrelevant or unsuitable.
		Relevant data has been used to explain and support the findings of the sustainability inquiry questions in detail.	Data has been used to explain and support the findings of the sustainability inquiry questions.	Data has been used to explain and support most of the findings of the sustainability inquiry questions to some extent.	Findings are not supported by data.
	Communicating	Detailed findings of the renewable energy inquiry are presented, in booklet format, as concise responses in a visually engaging format, integrating geographical terminology.	The findings of the renewable energy inquiry are presented, in booklet format, as concise responses in a visually engaging format, using geographical terminology.	The findings of the renewable energy inquiry are presented, in booklet format, in a visually engaging format, with relevant responses and detail.	Findings not presented.
General Capabilities	Literacy	Advanced language and structure has been used to record, explain, question, argue, describe and link ideas, evidence and conclusions.	Suitable language has been used to record, explain, question, argue, describe and link ideas, evidence and conclusions.	Age-appropriate language has been used throughout the work, although spelling and grammar may be inconsistent.	Language is unsuitable or in need of thorough revision and/or proof-reading.
	ICT	Advanced ICT skills evident in the acquisition, organisation and presentation of information.	ICT Search facilities have been used to locate, retrieve or generate information and organise information in meaningful ways.	ICT skills have been applied to source information and present it clearly.	ICT skills lacking in finding and organising information.
	Critical & Creative Thinking	Information and evidence has been analysed to produce a thorough investigation of the renewable energy inquiry. Thinking ‘outside the box’ is evident through classroom commitment and responses to the topic.	Information and evidence has been analysed for validity and relevance. A deeper investigation of the renewable energy inquiry is evident through classroom commitment and work.	Information relevant to the task has been analysed and processed to assist in the renewable energy investigation.	Irrelevant information and wasted class time indicate a lack of critical and creative thinking.
MARK:					/24





## Policy for submission of articles to the AETA Journal

- Articles, programmes, units of work, worksheets, ideas, resources, reviews etc. are welcome as submissions to the Editor for inclusion in the Journal
- As the Association is a non-profit organisation, no payments are made to those who submit articles which are subsequently used.
- Copyright remains with the author and any copyright payments will be paid to the author.
- No members of the Executive are paid for their work or contributions to the Journal.
- The authorship of all articles is acknowledged in the Journal.
- Copyright of material must be acknowledged for any material used by a contributor where original material is used, and proof of permission must be provided to the Editor.
- The use in the Journal of an article is at the discretion of the Editor.
- Material, including images submitted for publication, must be in editable digital format and may be accompanied by hard copy.



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