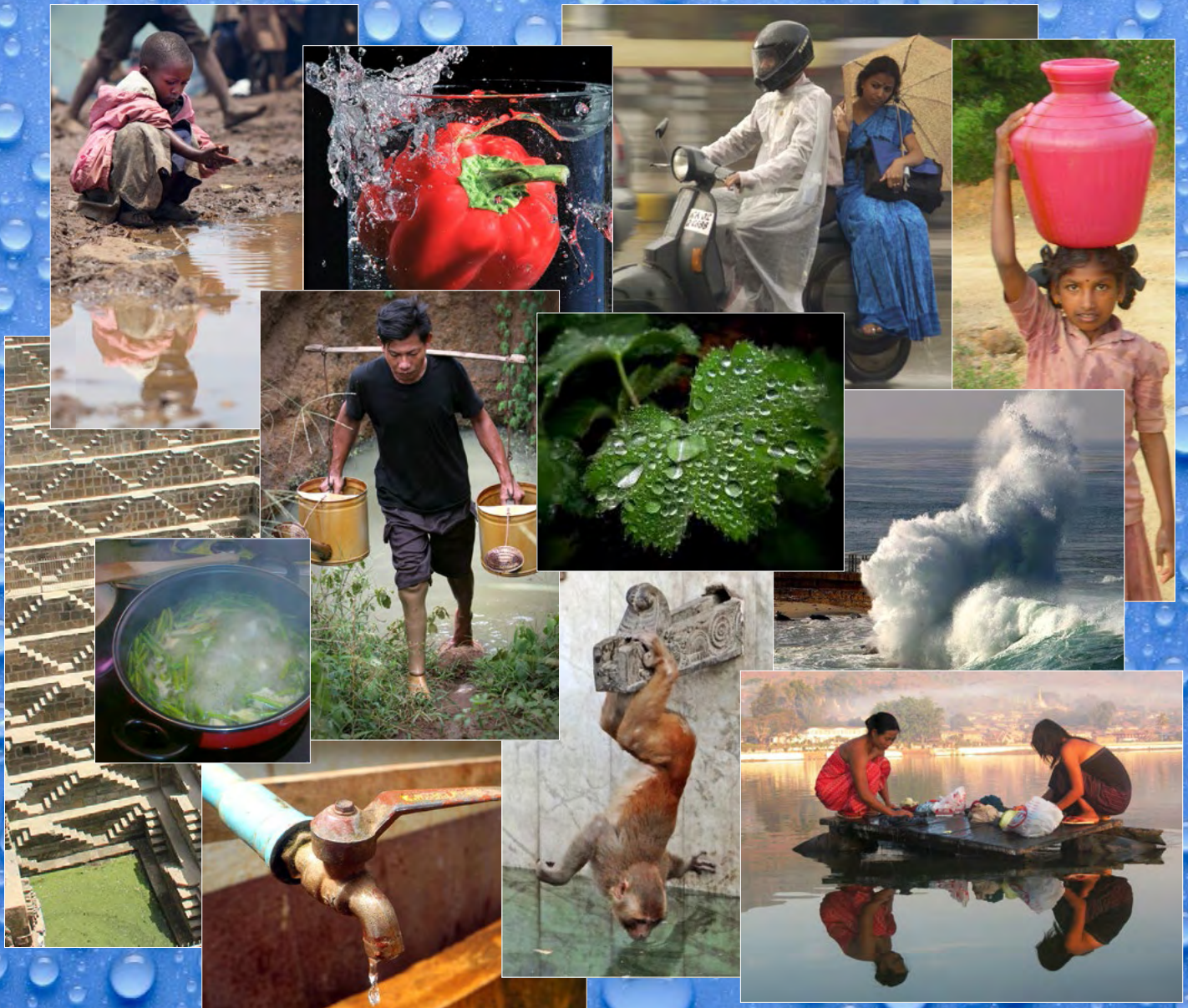




JOURNAL OF THE ASIA EDUCATION
TEACHERS' ASSOCIATION

ASIA

Volume 43, No 1 March 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.

AETA Executive

President / Treasurer	Jenny Curtis
Vice President	Paul(ine) Sheppard
Secretary	Judy Pilch
Editor	Diane Dunlop

AETA Committee Members

Dr Susan Bliss	Christine Cigana
Terry Haddow	Paul McCartan
Julie O'Keeffe	Marcia Rouen
Cec White – Adviser and Assistant to Executive (co-opted member)	

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.

Please send to:

The AETA Journal Editor
GPO Box 2393
Sydney NSW 2001

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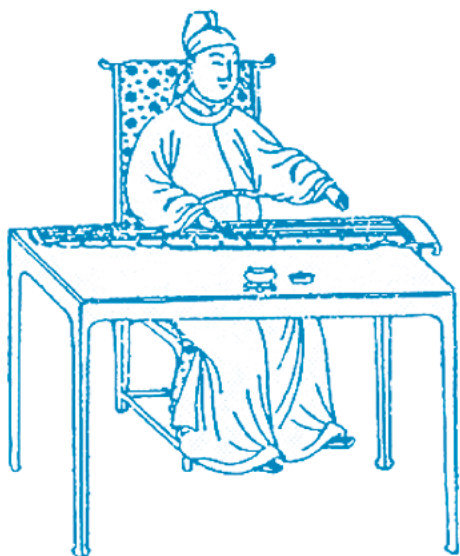


ASIA

Journal of the Asia Education Teachers' Association

Volume 43, No 1 March 2015

From the Editor's Desk	2
Vale Michelle Margaret Cooper.....	3
President's Report (AGM) February 2015.....	5
Editor's Report (AGM) February 2015	7
AETA Financial Statement Calendar Year 2014	8
Asia News by Di Dunlop.....	9
Water – An introduction by Di Dunlop	11
Developing critical thinking skills when viewing images from around the world. – Stages 1 & 2 resource	12
The Monsoons. A Stages 3 & 4 resource for by Jenny Curtis	18
Precipitation varies across India. Integration of Geography Skills by Dr Susan Bliss	25
Vietnamese Water Puppets: A reflection of culture. A Stage 3/4 resource by Di Dunlop	34
Water Scarce India. A Stage 4 resource by Dr Susan Bliss	38
Hindustani Times: India's 'toilet guru' works to flush away open defecation. by ATP, New Delhi. Stages 4 & 5	47
Swallowing the Sea. <i>Global Times – Depth of Field</i>. Stages 4 & 5.....	49
Splash: The Post Modern Frame. Stage 4 Visual Arts by Dapto High School, Visual Arts Faculty	51
Responding to Texts, including picture books and novels. A Stage 3 resource by Julie O'Keeffe.....	65
Water Scarce India: Is irrigation the answer? A Stage 3 Geography resource by Dr Susan Bliss	67
Flood Mitigation in Tokyo, Japan. A unit suitable for Stages 4,5 & 6 Geography by Di Dunlop	78
Spirituality of Water: Indian temple tanks by Dr Susan Bliss	85
The Indian Ocean Tsunami in Sri Lanka. A Stages 4/5 Geography unit by Di Dunlop	91
Loy Krathong: A water festival in Thailand. A Stages 2 & 3 resource by Di Dunlop	100
AETA Membership Form	106
AETA 2015 Study Tour – Turkey	107
Policy for submission of articles to the AETA Journal	108



From the Editor's Desk

As we welcome in the New Year and the Chinese Year of the Sheep, many of us have sadly farewelled a dear friend and an inspirational teacher and colleague, the Amazing Michelle Cooper. [see the President's remembrance of this wonderful woman.]

The focus of this Journal is WATER. It is the essential element for life, yet we do not always treat it with respect. It plays a significant role in everyone's life not just as what we drink and use for sanitation but culturally and religiously.

We have units of work that examine its importance in many countries for farming, industry, the environment and the role it plays in festivals and cultural events.

There is a unit on Monsoons, essential knowledge for studying much of Asia and an examination of Japan's response to flooding in Japan. The cultural significance of water is examined in the Water Puppets of Vietnam, the Loy Krathong Festival in Thailand and Spirituality in India. Water Scarcity is the focus of two units by Dr Susan Bliss and the ten year anniversary of the Indian Ocean Tsunami is remembered with a unit which examines its impact.

We have included a wonderful Visual Arts unit from Dapto High School and a literature piece for Stage 3 students.

As always, I thank the wonderful teachers who are so willing to share their work and experience...Dr Susan Bliss, Julie O'Keeffe, Dr Jenny Curtis and the Visual Arts Department of Dapto High School.

Di Dunlop.

Valuing cultural diversity and promoting intercultural understanding in a networked world



Vale Michelle Margaret Cooper

“I am an art teacher, not an art-ist”.

1962 – 2014



Past executive member (and Treasurer) of AETA; amazing journal contributor of AETA's journal *Asia*; Head Teacher Creative Arts, Dapto and Eagle Vale High Schools.

Michelle Cooper loved creating art, and writing Visual Arts teaching and learning programs, but she loved teaching art even more.

But on December 3, 2014, at just 52 years of age, Michelle transcended into the spirit world from her home surrounded by her husband Ben; daughters Madeleine and Annabel; and her parents and siblings. In sadness, however, for those of us left behind, Michelle left many students, colleagues and friends with a tremendous, and unforgettable legacy.

Michelle, as a classroom teacher, taught her students painting, drawing, ceramics, and photography, as well as art history, and global and regional art over many years. She brought her common sense, fairness, wit and sense of humour into her classroom; she had “life discussions” with her students with not an ounce of angst; encouraged individuality through art and

ensured that her Higher School Certificate students achieved their very best.

Over the years, Michelle inspired hundreds of aspiring artists, playing crucial roles in advising them on the advantages of creativity and self-worth for their own life paths.

Michelle saw the creative arts as imperative learning for all students in the 21st century world and, after reflection and knowing this wonderful woman and friend for so many years, I have summarised her reasons for this below. Michelle advocated that:

Some students come to school, and stay in school, because of the creative and performing arts.

That was particularly the case for students of Michelle's, many of whom needed immediate rewards, positive achievements, a concrete product to ‘show’ others but fostered the skills of collaboration. Michelle provided a classroom forum for developing a passion to learn, grow, improve, and do something productive with one's life. Many students have discovered their talents and interests through Michelle Cooper's Visual Arts classroom.

Students learn positive habits, behaviours and attitudes through the creative and performing arts.

Creating a piece of art from a photograph; practising to get better at an art technique; being persistent and patient, even in the face of adversity, are important skills for growth and improvement. Michelle saw the creative arts as enabling her students to grow in confidence and think positively about themselves and learning. In other words, Michelle advocated that the arts taught habits, behaviours and attitudes that were necessary for success in any field of endeavour.

The creative and performing arts enhances creativity

Michelle saw the creative and performing arts as a wonderful arena for fostering creativity, at all levels, and she viewed this as such an important skill to have in our rapidly changing world.

Vale Michelle Margaret Cooper

The creative and performing arts help students develop critical thinking skills.

Michelle's advocacy of creative and performing arts was no higher than at the discussions held at collegial forums about how her subject area fostered critical thinking, which carried over to "assisting" other subjects in the school timetable, and in life. She believed it was an "inner core" subject!

Aesthetic learning through creative and performing arts is its own reward.

Michelle taught art and through art taught beauty, proportion, and grace. Additionally, she modelled art-making to colleagues and students (and family members), which gave us the same joy as other artists gave to their observers; Michelle just had the ability to make the written word, or the spoken issue, come alive through art and through her art teaching.

Creative and performing arts teaches teamwork!! Students learn respect and understanding.

Finally, it has been through Michelle's teaching that her students have learned how to work together to achieve great things. And as they worked together, she encouraged them to understand and accept, not merely tolerate, difference and diversity of others.

I think her role as an educator is summed up beautifully by a text I received a few weeks ago to pass on to Michelle by one of her former students, a student who had the potential to succeed, and dreamt big – and she has - because Michelle, above all other teachers, gave her the belief, skills and confidence. That text said simply: "Does Michelle know how important she was in me becoming the strong woman that I am today?"

In terms of leadership, Michelle was one of the youngest ever, appointed Head Teacher's in the state;

she always said she only applied for the job so she didn't have to do sport! She was, however, a revered Head of Department at both Eagle Vale and Dapto High Schools; a fine leader of her faculties, and a mentor to others outside her faculty who wanted to learn from a modest master educator. She role-modelled leadership to the very end of her career with student achievement and outcomes, and staff welfare, being at the fore of any battle in which she engaged, but it also included Michelle being a huge advocate of lifelong learning.

Michelle graduated in more recent years with a postgraduate qualification in studies of Asia from the Australian National University, Canberra; an intensive course she decided to do to help a newer member of our executive, to encourage and build confidence in one of her protégés.

And so it comes to her invaluable contribution as a long-term member and executive member of our association. We can look back at the fantastic units of work, and teaching and learning ideas, that Michelle has shared with us all. Her love of Asia reflected much of what she did in the classroom. Creativity for her own work often came from her visits to this region of the world as well.

Moreover, her clear direction for others to follow through her writing, as well as her vision for the achievement of individual learning outcomes for her students means that none of her contributions are likely to date. I urge all members to seek out at least one of Michelle's units and reflect, if you did not know her, she was a fine educator, who is now sorely and lovingly missed but will be always be in our hearts.

Whilst *life cannot be counted in candles*, we are grateful that Michelle Margaret Cooper got to blow out at least a few and she has, therefore given AETA and our membership a legacy of what she stood for, created and shared.

Vale.



President's Report (AGM) February 2015

Dear executive and members of the Asia Education Teachers' Association (AETA),

I have held this position for the last two years and I must say that even though at times it has been challenging both personally and professionally, I have always persisted in the belief that I, like all Executive, am working in a role representing all educators, not just our valued members of AETA, to help and improve the status of studies of Asia within the Australian and global educational systems.

For the uninitiated that thinks our association is a small, non-subject based "tin-pot" organisation, despite forty-two years of amazing service, and are perhaps asking what or who AETA is, let me list just some of the initiatives that we continue to be involved in, or have established over the last couple of years.

1. Quarterly journals with ready to use quality teaching and learning activities K-12 in all Key Learning Areas, addressing Australian Curriculum outcomes and content.
2. Growing online repository of resources for teachers of studies of Asia at www.aeta.org.au.
3. Consistent individual support to all members on specific issues related to teaching and learning.
4. Successful study tours to areas of the Asia region, this year to Turkey. Come along – it will be just great.
5. The Peg White Award, which acknowledges teachers of various levels of experience, who have intercultural understanding and communication as the cornerstone of their belief systems as educators.
6. Membership costs kept to a cost recovery, so the association remains affordable for all.
7. Represented the concerns of the membership regarding Australian Curriculum implementation to ACARA and BOSTES.

So as you can see, AETA remains focussed and very busy. We continue to be run by volunteer teachers and retired educators. It is through our continued actions that AETA, acting on your behalf, has striven at all levels to promote and advance the importance of studies of Asia in Australia and beyond.

In saying this I cannot stress how important it is that for AETA to continue. And to move forward we need the continued support of members. As I have stated, we are here for all educators who strive to include studies of Asia in their teaching and learning, so how about you, teachers and educators, being there for us.

So, if you have been a member of AETA in the past and have not re-joined, please reconsider. If you have never been a member of AETA, but have been curious about our organisation, again please get onto our website and consider joining. We would love to have you join our family.

And finally, if you are a member, all I can say as President is THANKYOU. Thank you very much.

President's Report (AGM) February 2015

To our Executive

Again, you have worked hard for our association and its membership. Thank you from the bottom of my heart, to our Editor of over two decades, Di Dunlop, who “is AETA” in so many ways. Di, particularly this year, has supported me in ways that only a “mum” would, and is deserved of the platinum award for steering the AETA ship. Our core component is still our journal “Asia”, and it is only with Jill Sillar’s creativity and professionalism in desk topping that Di has been able to publish the best journals we have ever had. Every one of them is a piece of art. Thank you so much Jill, on behalf of all members of our association, especially the Executive.

Judy our Secretary (together with her husband John), is simply amazing with her time and is a rock of support and encouragement. Judy, you too are awesome and irreplaceable. Thank you to Paul, who despite a difficult year as well, is still willing to step up to a greater role, a visionary one, to help us move forward. Thank you Paul, for just being there. Then I must thank sincerely Susan, who supports Di and our journal in writing extraordinary teaching and learning sequences for inclusion. This takes an amazing amount of time and thinking, and like all of our Executive, we could not do without Susan’s help. Marcia, our gift from Brisbane, has been AETA’s Minute’s Secretary again this year – a necessary task done with grace and accuracy, but it is Marcia’s wise counsel about Australian Curriculum implementation that we are most grateful for. This ensures that AETA is at the forefront of support for our membership. Thank you so much Marcia.

To Terry and Adrienne, we know where you are, we know we can call on you and we know that you are a part of AETA’s work, so thank you. And finally, to our “youngsters” Ross and Sharon, who are feeling their way into our association as we embark on a determined succession plan, thank you for your time and commitment, and putting your hand up for a voluntary association run by aged personnel! (No offence to the rest of us...just factual.)

Each and every member of our Executive is a vital component of AETA’s ship.
With my love and thanks. Jennifer Curtis



Editor's Report (AGM) February 2015

2014 saw our 42nd year as a professional association bringing teaching resources to teachers of Studies of Asia and intercultural understanding. It has been a long journey that has brought us to on-line journals that continue to be our core mission.

In March, our focus was Indonesia with units for primary teachers as well as History, English and Geography.

June also focussed on Indonesia with Religion, Visual Art, Year 3 Geography, English, History and Stage 4 Geography. It was also in this edition that we began linking each unit to the GLOBAL EDUCATION EMPHASES.....

- Interdependence and Globalisation,
- Identity and Cultural Diversity,
- Social Justice and Human Rights,
- Peace Building and Conflict Resolution, AND
- Sustainable Futures.

This was easy as they have always been central to our goals. This has meant important, additional funding for the Journal. Both the March and June Journals were possible because of the excellent work generated by teachers who travelled on the TEV trip to Indonesia in January 2013.

The September Journal saw further material on Indonesia as well as a new collaboration with the Melbourne Museum who generously allowed us to use their Visual Arts unit and Politics unit from the Afghan Exhibition. There were also History and Geography units.

Our final Journal of the Year examined India. That is vital in this time of growing relationships between our two countries, it is no longer just cricket and curry.

K to 12 was catered for with units on Religion, Business Studies, Literature, Geography and Contemporary Issues such as caste and dowry.

The role of Editor is an extremely rewarding one but it is only possible because of the incredible material that teachers give voluntarily and generously to share with all teachers! My sincere thanks goes to all those who contribute in this way....Dr Susan Bliss, Judy Pilch, Jenny Curtis, Chris Cigana, Ross Mackay, Sharon Moran, David Searle, Julie O'Keeffe, Paul McCarten, Bruce Hill, Anne Southwell, Phillip O'Brien, Dany Alarab, Darren Brailey, Mariane Younis, Tina Ralevska and Dr Eeqbal Hassim and that was just in 2014!

My greatest thanks must go to my friend and travelling companion, Jenny Curtis for her never-ending support, encouragement and her CONTACTS, the Journal just would not happen without her.

Jill Sillar of PTC NSW has made our Journal an outstanding product, what she does with basic typing is just amazing and I thank her for her on-going work.

Last but by no means least, I thank the Executive for the on- going support for me as Editor.

Finally, I believe that the many trips to Asia that Jenny has organised, through TEV, Global Education and A.E.T.A. , have been instrumental in providing the rich material in our Journals. At times she has led these trips under very trying professional and personal circumstances and I would like the Executive to acknowledge the importance of her amazing contribution.

Thank you, Di Dunlop.



AETA Financial Statement

Calendar Year 2014

For period covering 01.01.14

For meeting held 14.02.15

Opening bank balance **10771.67**

Income/receipts

Membership 2014 6953.00

Bank interest 30.91

Journal sales 471.00

Conference/PD activities 350.00

Grants PTC 7500.00

Copyright 9314.39

Sundries (donation) 150.00

Total income **24769.30** **35540.97**

Payments

Direct journal costs

Postage 606.36

PTC Typesetting 9448.65

PTC Journal 2500.00

Other

Bank fees/Merchant fees 419.82

Postage – general 265.25

Insurance 245.22 + 257 = 502.22

Copyright 3933.84

Department of Fair Trading 52.00

Travel/Transport 242.00

Conferences 1076.50

P O Box Renewal 241.00

Fax Stream fee 24.00

Cec USB/Paper 100.00

Gifts (Paul) 104.85

PTC Dinner 140.00

Di (Postage + Toner) 513.00

Total payments **20169.49**

Bank Balance as at 31 December 2014 **15371.48**

Less unpresented cheques 904.25

Less cheques to PTC 10849.75
(journals x 4 10000.00, website 849.75)

Actual balance **3617.48**

Dated 14 February 2015

Jennifer Curtis President/Treasurer



The ancient Chinese canal system, Yangzhou. Source: Wikimedia Commons

- 5. According to UNICEF, there are 76.5 million children living in poverty in the DEVELOPED world, 2.6 million of them have moved there in the last five years.
- 5. In 2008, half the world's population lived in urban areas. By 2030, that is expected to rise to 60%. With that trend and Climate Change, the world's cities will bear the greatest loss of life and economic cost of severe flooding and sea level rise.
- 5. In India, in the state of Kerala, the Government allocates more money to education than any other state. The emphasis on Primary education has led to a literacy rate of 94% and a drop out rate that is close to zero.
- 5. In 2013 there were 8618 dowry deaths reported in India with New Delhi having the highest number.
- 5. By 2023, only three countries will have more billionaires than India [USA, China and Russia.]
- 5. More than 800 million people [11%] of the world's population are chronically hungry. Undernutrition is the underlying cause of almost half of all child deaths, and a quarter of living children are stunted due to inadequate nutrition. Micronutrient deficiencies affect two billion people. The cost of malnutrition in all its forms, is estimated between four and five per cent of Global Gross Domestic Product. Creating healthy and sustainable food systems is the key to overcoming malnutrition. Food production has

tripled since 1945, while average food availability per person has risen by only 40%. Increased production has come at a high environmental cost and has not been enough to end hunger.

- 5. Australia's top trading partners are:

CHINA	\$130 billion
JAPAN	\$74 billion
USA	\$59 billion
SOUTH KOREA	\$33 billion
SINGAPORE	\$27 billion.

The total from Asia is \$395 billion, an increase of 7.5% since 2008. The next closest region is Europe with \$ 96 billion. Our major exports are iron ore, coal, gold, natural gas while our imports are crude petroleum, passenger motor vehicles, refined petroleum and freight transport.[figures in \$US.]

- 5. The Grand Canal in China, which links the Yangtze River with Beijing is 1800 kilometres long was completed in the 12th century and is the longest man-made canal in the world.
- 5. In 2013, the World Health Organization declared New Delhi to have the worst pollution of any city in the World. India has thirteen of the twenty dirtiest cities for pollution: New Delhi, Patna, Gwalior and Raipur the top four in India. It is estimated that in 2012, seven million people died due to air pollution. The WHO suggests 25 micrograms as a safe limit but New Delhi has 153 micrograms. City dwellers have a higher risk of resultant cancer, stroke and heart disease.

Asia News

CITIES WITH GREATEST ANNUAL MEAN PM2.5 MEASUREMENTS

Measure of fine particles PM2.5, which is one of the most dangerous pollutants for human health.



TOP 20 MOST POLLUTED CITIES IN THE WORLD

By Madison Park, CNN

updated 6:03 AM EDT, Thu May 8, 2014

Source: <http://edition.cnn.com/2014/05/08/world/asia/india-pollution-who/>

(CNN) – Air quality in most cities that monitor their pollution levels exceed what the World Health Organization deems as safe.

Delhi has the highest level of the airborne particulate matter, PM2.5 considered most harmful to health, with 153 micrograms. Not far behind is another Indian city, Patna with 149 micrograms. These figures are six times what the WHO considers a “safe” limit – which is 25 micrograms.

Half of the top 20 cities in the world with the highest levels of PM2.5 were in India, according to the pollution data released by the WHO, which included 1,600 cities. Other cities with high levels were located in Pakistan and Bangladesh.

PM2.5 refers to the diameter measured in microns of particulates such as ammonia, carbon, nitrates and sulfate -- which are small enough to pass into the bloodstream and cause diseases such as emphysema and cancer.

The WHO data echoes an earlier study this year which found that air pollution in New Delhi is now worse than Beijing.

No Chinese cities ranked in the top 20 most polluted cities, despite thick, gray smog filling its cities and millions of residents commuting behind surgical masks. Beijing reported 56 micrograms of PM2.5. This year, Chinese leaders have declared “war on pollution.”

Beijing’s emergency measures amid fog of pollution

Delhi has been described as having weak enforcement of pollution controls by India’s Center for Science and Environment, a public interest group.

“Originally designed as compact entities to reduce the length of travel ... (Indian cities) are becoming victims of killer pollution, congestion ... and a crippling car-dependent infrastructure,” according to the group.

And the world’s most polluted city is...

Air pollution has spread by increasing reliance on fossil fuels, coal-fired power plants, cars and the use of biomass for cooking and heating.

Cities with the lowest level of pollution were located in Canada, the United States, Finland, Iceland and Sweden.



Global Education – Learning Emphases

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

WATER – AN INTRODUCTION

Di Dunlop

The provision of safe water to every person in the world is hampered by global challenges including conflict, environmental degradation, population increases, disease and epidemics, urbanization and industrialization. Because water is crucial for life, then water security, water scarcity, wastage and pollution are all issues that need to be addressed. Fifty percent of the world's population live in cities, twenty seven per cent of the urban population in the developing world do not have piped water to their homes.

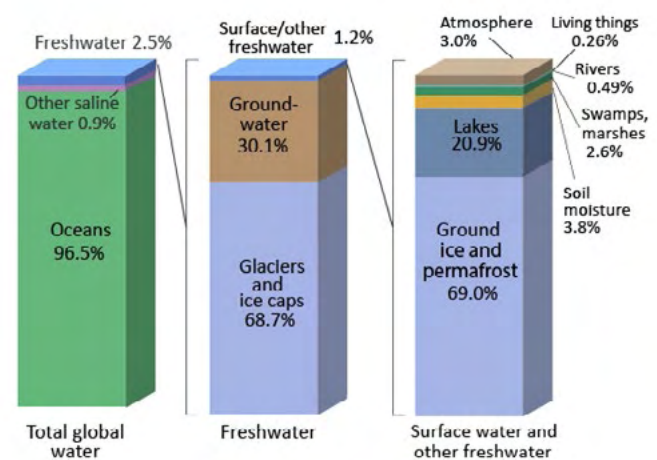
One in six people in the world do not have access to safe drinking water. The leading cause of illness and death in the world is Diarrhoea, caused by inadequate access to both sanitation and water for hygiene and consumption. Every twenty seconds, a child dies as the result of poor sanitation. Two million tonnes of human waste is disposed of in waterways as well as vast amounts of industrial waste that pollutes the usable water supply. In many developing countries, seventy per cent of industrial wastes are dumped, untreated, into rivers that are the water supply for humans.

Fifty per cent of the world's wetlands have disappeared in the last century, the snow and ice of the Himalayas is in decline and these have a devastating impact on the agriculture of South Asia.

Water covers seventy per cent of the surface of the Earth, [97% in saltwater and 3% in freshwater]. Seventy per cent of the fresh water is stored in ice, snow and at the Poles. Water IS a renewable resource if managed properly. Groundwater is the most abundant form of accessible fresh water.

The United Nations Millennium Development Goals address Water Sustainability in Section 7C. The target was, by 2015, to reduce by half, the proportion of the World's population without sustainable access to safe drinking water and basic sanitation. This target was met five years ahead of schedule. Between 1990 and 2012, 2.3 billion people gained access to improved drinking water sources.

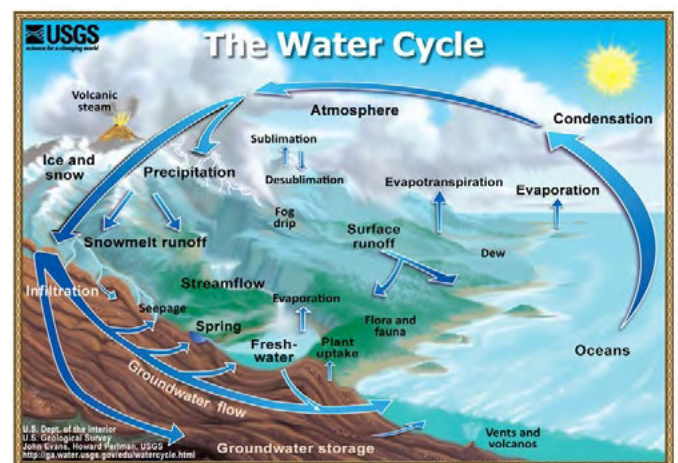
Graph of Distribution of Earth's Water



Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, *Water in Crisis: A Guide to the World's Fresh Water Resources*.
NOTE: Numbers are rounded, so percent summations may not add to 100.

Source: <http://ga.water.usgs.gov/edu/waterdistribution.html>

Diagram of the Water Cycle...Water exists in three forms, solid [ice], liquid and gas



Source: <http://ga.water.usgs.gov/edu/watercyclehi.html>

In this Journal, teachers can examine many aspects of water and the many challenges that the provision of safe water presents to the countries of the world in the twenty first century.



Global Education – Learning Emphases

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



Developing critical thinking skills when viewing images from around the world

Photographs are a fantastic resource for the classroom. They capture students' interest and can be a easy way into learning about distant places and unfamiliar subjects. Photographs have great power to convey information but can also communicate misinformation. Students need to learn to view photographs critically in order to understand the many images they come across in their lives. They need to be aware that photographs can only ever show a part of what is happening at a particular moment in time and involve choices in what is included and what is left out.

If viewed in an unquestioning way, photos can reinforce stereotypes. In particular, people who experience poverty can be viewed only as victims when they often work hard and are innovative, creative and resourceful. Viewing photographs from different sources can help to avoid a singular view of a place, person or issue. It's also important that individual photos are not taken as representative of a place, country or region

Below are focus questions, activities and a selection of water images.

Focus questions

- What is happening in this photo?
- How is water being used in this photo?
- Do you use water this way?
- Is any work being done in this photo? Who is doing it?
- Which photo stands out for you? Why?

- What feelings do you have when you look at the photo?
- Does this photo tell the truth?
- Do you think the people in this photo chose to be in it?
- Who do you think took this photo?
- Why do you think they took it?
- Do you think this photo has been altered?
- What do you think happened before/after this photo was taken?
- How might others see this image differently to me?
- Where could you get more information about the issues raised by this photo?
- How do photos convey meaning?

Activities

Fact and opinion

Students divide their thoughts about the photo into what they know for certain and what they have assumed.

Similarities

Students consider what they might have in common with the person in the photograph. For example they both enjoy swimming, they both need water to drink.

Put yourself in the picture

Students imagine they are the subject of the photographs. They imagine what they are feeling. They consider if they would be happy for their photo to be used in the way this one is.

Developing critical thinking skills when viewing images from around the world

Captioning

Students write a caption to describe a photo. Discuss how the caption can influence how people interpret the photo. Students try to write a caption that would influence the viewer to interpret the photo in a positive way and another in a negative way.

Cropping

Cover part of a photo and ask students to describe or draw what they think is shown in the covered part. Uncover the photo and discuss the differences between their predictions and the photo. How

did only seeing part of the photo change their interpretation of it?

Speech bubbles

Students are given a copy of a photo and draw a speech bubble for each person in the photo. They imagine what each person might be saying and write it in the bubble.

Story

Students write a story about what is happening in the photo they have chosen. They think about any stereotypes that could be associated with the photo and try to challenge these in the story.

Image 1



Image 2



Image 3



Developing critical thinking skills when viewing images from around the world



Image 4



Image 5



Image 6

Developing critical thinking skills when viewing images from around the world



Image 7

Image 8



Image 9

Developing critical thinking skills when viewing images from around the world



Image 10

Image 11



Image 12

Developing critical thinking skills when viewing images from around the world

Image 13



Image 14



Image 15





Global Education – Learning Emphases

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

The Monsoons

A resource for Stages 3&4

by Jenny Curtis

THE SUMMER MONSOON

In spring and summer, the sun heats the large Asian continent and the Indian subcontinent. The air over the land is warmed and rises. This creates a huge area of low pressure. A stream of moist air is drawn in from the Indian and Pacific oceans towards this low-pressure area. It rushes in across the land bringing torrential rain and thunderstorms.

Summer Monsoons begin, breaking the dry spring season, and answering the prayers of millions of farmers. Summer Monsoons are associated with the rainy season in most Asian countries. They bring heavy rains to the western coasts of India, Sri Lanka, South-East Asian nations and the North-East Indian region including Bangladesh, where the winds funnel into the Bay of Bengal.

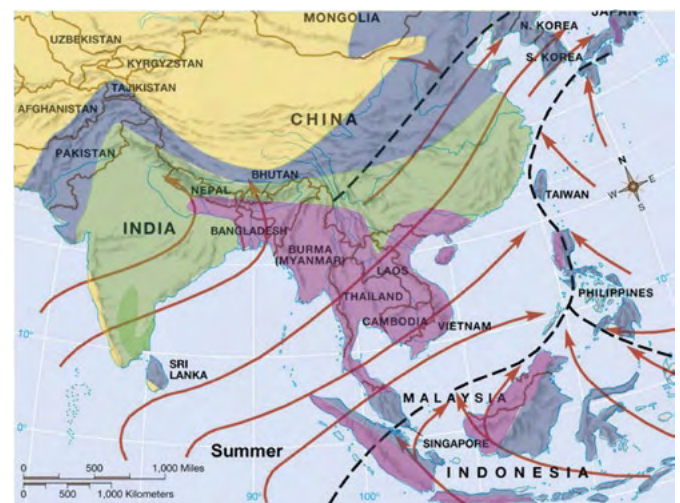
THE WINTER MONSOON

During the winter months, the opposite occurs. Being cut off from the modifying influence of the ocean, the interior of Monsoon Asia becomes extremely cold. Cold air descends. The entire area becomes a high-pressure zone, and cold dry winds blow out over the surrounding area. The wind direction is north-west and north-east, and the temperature of countries near Central Asia falls to below freezing point.

The Winter Monsoon brings rain only to places located behind areas of water, or on the coast. Such places are the western coast of Japan, the eastern coasts of Vietnam, West Malaysia, India, Sri Lanka, and the Indonesian Islands.

Source: Hashim, E. (1987) *Monsoon Asia: A New Geography*. Heinemann Publishers, Hong Kong.

Monsoon Asia: Summer winds and rain (May to Oct) & Summer Monsoon



Monsoon Asia: Winter winds and rain (Nov to April) & Winter Monsoon



Rainfall



Wind direction

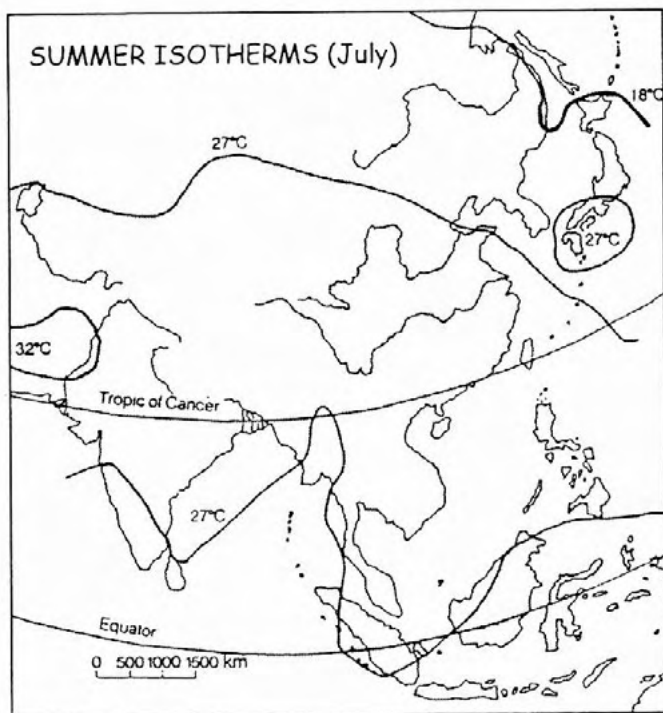


The Monsoons

'Big drops of rain fall and dry up in the dust. A fragrant smell rises from the earth. Another flash of lightning, and another crack of thunder — like the roar of a hungry tiger. It has come! Sheets of water, wave after wave. The people lift their faces to the clouds and let the abundance of water cover them. Men, women and children run, madly celebrating the miracle of the monsoon.'

The Monsoons can mean life or death for many people in Monsoon Asia. The burst of monsoonal rains is eagerly awaited by the farmers. They signify life and the start of the planting season. But at the same time, excessive rains accompanied by strong winds can cause death and disaster.

The Monsoons are vital to all farmers in the region, especially South Asia where the rains are the main source of water for farming. For example, in South India if the Summer monsoonal winds come too early, farmers may have to face floods. If they come too late then drought can result, causing the failure of crops—which affects millions of people.



Monsoon flooding, India. Source: Wikimedia Commons



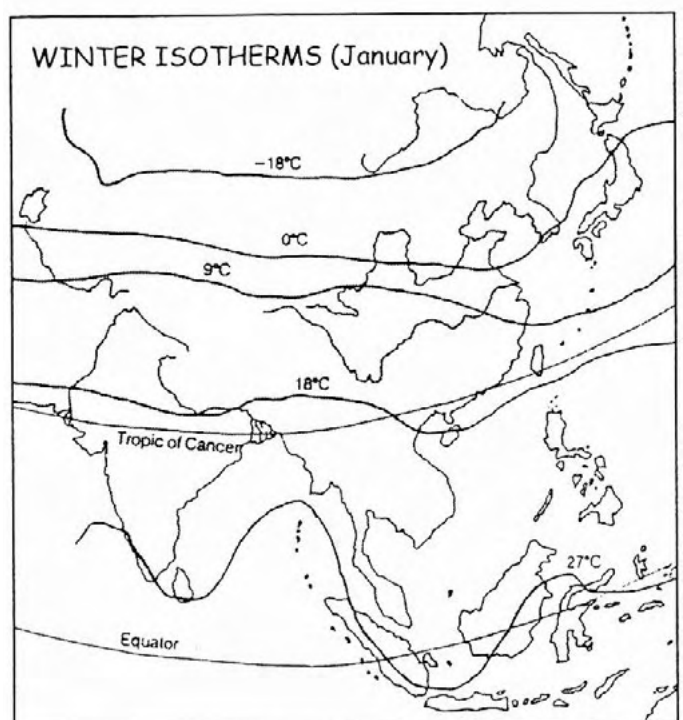
Monsoon flooding, July 2007, Cambodia. Source: Wikimedia Commons

WIND SYSTEMS

The term 'monsoon' comes from the Arabic word *mausim*, meaning a seasonal wind.

In Asia there are two seasonal wind patterns—the summer and the winter. These wind patterns affect rainfall, and temperature patterns.

In Equatorial regions there is no change in the seasons, and temperatures are high all year round. However, the rainfall is still influenced by the monsoonal winds.



The Monsoons

Worksheet one – Map of Asia

Indicate the following information on a map of Asia:

- Show by arrows the direction of the south-west and north east monsoons**
- Locate the main pressure belts (high and low) during the periods of the two monsoons by using appropriate circles.**
- Using the appropriate key, shade two areas in Asia with over 2000 millimetres of annual rainfall and two areas with less than 1000 millimetres of annual rainfall.**
- Select one high rainfall area (i.e. 72 000mm/year) and describe the processes which have contributed to this. Include diagrams to show the relationship between the processes and the surrounding physical environment.**
- Explain why the Thar Desert receives very low rainfall.**



Source: http://d-maps.com/carte.php?num_car=66536&lang=en

ACTIVITY

- 1. Explain the origin and seasonal pattern of the monsoon winds.**
- 2. Discuss the importance of the monsoons to farmers and the agriculture of Asia.**
- 3. Describe the relationship between the Summer and Winter winds and temperature patterns.**

Worksheet two – How to draw a climatic graph

Temperature °C
Precipitation mm

- 1. Draw temperature as a line graph in red pencil.**
 - The temperature scale is along the right-hand side in degrees Celsius ($^{\circ}\text{C}$).**
 - Temperatures are placed as a dot in the centre of each column for each month.**
 - The dots are joined together.**
- 2. Draw rainfall as a column graph in blue.**
 - The precipitation or rainfall scale is along the left-hand side in millimetres (mm).**
 - Rainfall is marked as a line across the column for each month.**
 - The columns are coloured in blue pencil.**

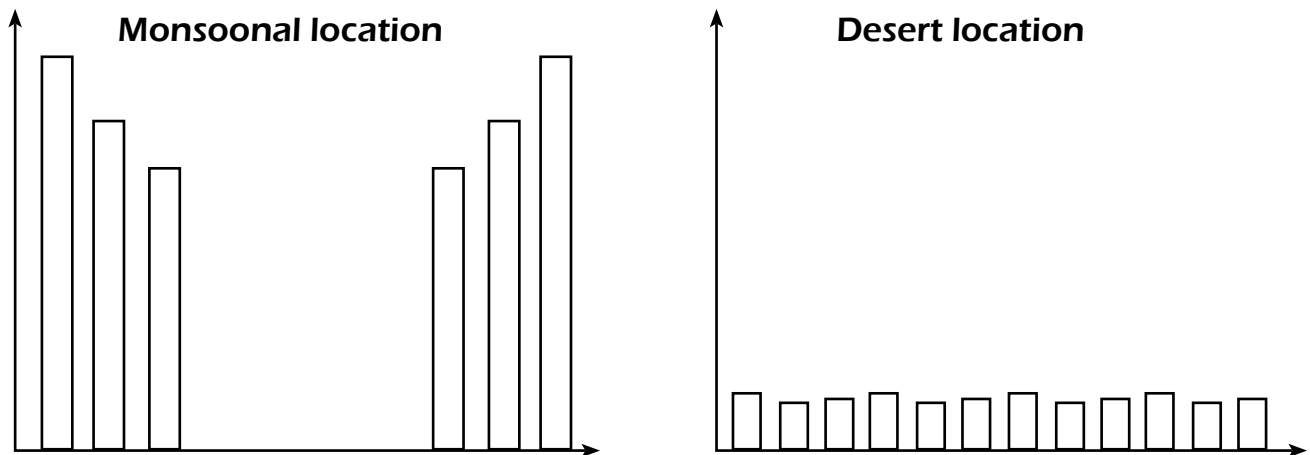
The Monsoons

Worksheet two – Completing a climatic graph

TOTAL PRECIPITATION

Add up the rainfall for each month. (Place this figure in a box marked 'Total Precipitation.')

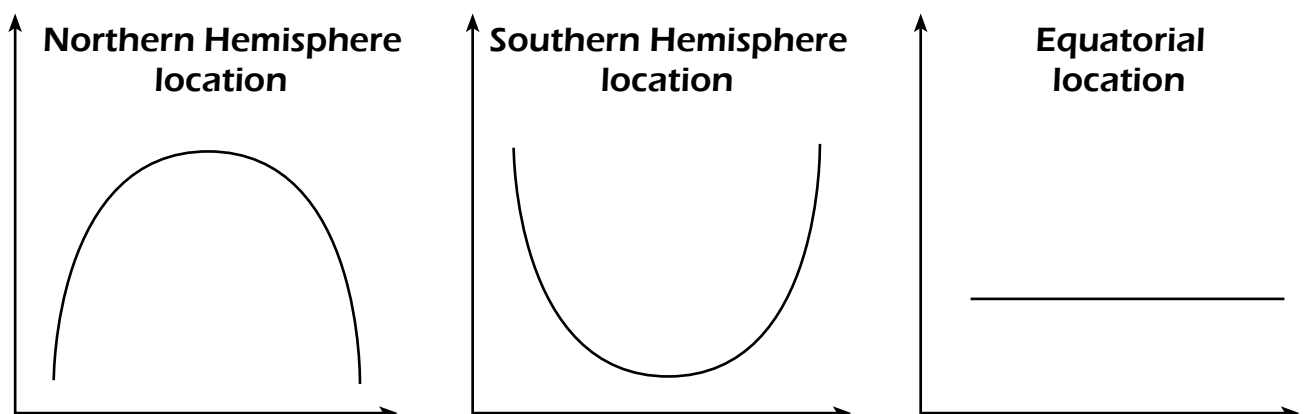
Other information: PRECIPITATION GRAPHS



AVERAGE TEMPERATURE

Average temperature can be calculated by adding up all the monthly temperatures and dividing by twelve (12). Generally this figure is highest when a location is near the Equator.

Other information: TEMPERATURE GRAPHS



TEMPERATURE RANGE

Temperature range is 'highest monthly temperature' minus (–) 'lowest monthly temperature.' (Place this figure in a box marked 'Temperature Range'.

SEASONS

Seasons are written in boxes at the bottom of the graph.

The Monsoons

Worksheet three –

How to interpret a climatic graph

DESCRIBING BALI’S CLIMATE:

Describing average monthly temperatures	
°Celcius	Description
above 30	very hot
20 to 30	hot
10 to 20	warm
0 to 10	cool
-10 to 0	cold
below -10	very cold

Describing total precipitation figures	
Annual rainfall	Description
over 1500	very high
1000 to 1500	high
500 to 1000	moderate
250 to 500	low
below 250	very low



Describing annual temperature range	
°Celcius	Description
below 5	small
5 to 15	moderate
15 to 30	large
above 30	very large

Left:Ullun Temple, Bali. Below: Wading in monsoonal floodwaters

USING THE INFORMATION ABOVE, FILL IN THE BLANKS:

Bali’s annual temperature range can be described as
 It is °Celcius.

Bali can be described as having a average monthly temperature. It is °C. This is because it is located

Bali’s total precipitation is millimetres. This can be decribed as
 It is °C.



THE MONSOONS

Worksheet four – Rivers: The lifeblood of Asia

INTRODUCTORY ACTIVITY USING ICT

Introduce the idea of life on a river by asking students to list stories that takes place on a river:

The Story of Ping (Stage 4)

Read this story which takes place on a river. Explain that Ping is a duck which lives on a riverboat, and the story is about an adventure he has. Focus on what life on a river is like in Asia. <http://www.amazon.com/gp/product/0140502416/103-6760645-0321400/n=283155>

Life along the Ganges River (Stage 6)

List the characteristics of river life. What are the advantages and disadvantages of living along a river? Record the responses for comparison at a later date.

Ganges River	'Indian Summer' in National Geographic Adventure magazine http://www.nationalgeographic.com/adventure/0209/life.html
Mekong River	'Laos by Riverboat' in National Geographic Adventure magazine http://www.nationalgeographic.com/adventure/0406/photo_index.html
Yangtze River	Encarta Photo Gallery (click on 'multimedia') http://encarta.msn.com/encyclopedia_761573429/Yangtze.html

	How do people affect the river?	How does the river affect people?
GANGES RIVER		
MEKONG RIVER		
YANGTZE RIVER		

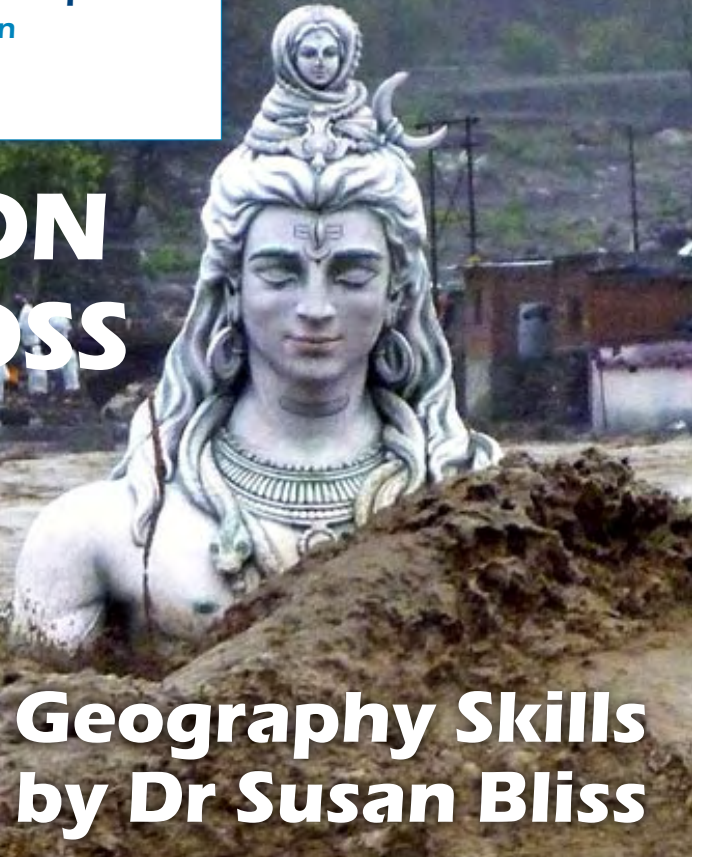


Global Education – Learning Emphases

- Interdependence and globalisation
- Identity and cultural diversity
- Sustainable futures

PRECIPITATION VARIES ACROSS INDIA

Integration of Geography Skills by Dr Susan Bliss



A submerged Hindu Lord Shiva stands in the flooded Ganges River in Rishikesh, in the northern Indian state of Uttarakhand on 18th June 2013. Torrential monsoon rains caused havoc leading to flash floods and landslides. The death toll climbed to over 1,000 pilgrims bound for Himalayan shrines. (AP Photo).

Source: <http://www.theatlantic.com/infocus/2013/06/early-monsoon-rains-flood-northern-india/100537/>

Figure 1: Climate, land area and population distribution in India

Climate	Land area %	Population %
Tropical monsoon	2.5%	4.3%
Tropical wet and dry	31.6%	35.5%
Semi-arid	17.4%	20.4%
Arid/desert	10.3%	5.2%
Temperate with dry winters	31.5%	34%
Alpine/highland	6.6%	0.6%

Adapted from source: <http://www.india.climateemps.com/>

Activities:

- What two climates cover the largest land area in India?
- Rank in order from largest to smallest the population percent and the climate in which people live.
- Estimate the percentage of India that is dry all year or experiences a dry season.
- Explain why water resources (rivers, lakes, groundwater) and water harvesting methods (refer to figure 4 in this article) are important for the survival of Indians.



PRECIPITATION VARIES ACROSS INDIA

Figure 2: Precipitation varies across India according to location

This site also contains climate statistics and graphs for all the following 42 places.

Location	Latitude	Longitude	Altitude Metres	Temp °Celsius	Precipitation Millimetres
Agra	27°10'N	78°2'E	169	26	695
Ahmedabad	23°4'N	72°38'E	56	27	789
Akola	20°42'N	77°2'E	282	28	841
Allahabad	25°27'N	81°44'E	98	26	1027
Amritsar	31°38'N	74°52'E	234	23	760
Bangalore	12°58'N	77°35'E	923	24	905
Belgaum (Sambre)	15°51'N	74°37'E	755	24	947
Bhubaneshwar	20°15'N	85°50'E	49	27	1492
Bikaner	28°0'N	73°18'E	224	26	325
Chennai, Tamil Nadu	13°0'N	80°11'E	16	29	1541
Cherrapunji	25°15'N	91°44'E	1300	17	11777
Cherrapunji, Meghalaya	25°15'N	91°44'E	1313	17	11420
Daltonganj	24°3'N	84°4'E	221	26	1205
Darbhangha	26°10'N	85°54'E	50	24	1166
Dibrugarh, Assam	27°28'N	94°55'E	108	23	2758
Dibrugarh/ Mohanbari	27°29'N	95°1'E	111	23	2569
Dumka	24°16'N	87°15'E	149	26	1391
Dwarka	22°22'N	69°5'E	11	27	275
Goa	15°29'N	73°49'E	64	27	2813
Guwahati	26°6'N	91°35'E	72	24	1722
Hyderabad, Andhra Pradesh	17°27'N	78°28'E	535	27	803
Indore, Madhya Pradesh	22°43'N	75°48'E	567	25	1062
Jagdalpur	19°5'N	82°2'E	554	25	1495
Kolkata/ Calcutta	22°32'N	88°20'E	6	27	1800
Kota	25°9'N	75°51'E	279	27	766
Kozhikode	11°15'N	75°47'E	5	28	3063
Leh, Jammu, Kashmir	34°9'N	77°34'E	3514	6	117
Ludhiana	30°52'N	75°56'E	255	24	733
Mangalore, Karnataka	12°52'N	74°51'E	22	27	3479
Mukteswar/ Kumaon	29°28'N	79°39'E	2311	13	1301
Mumbai/ Bombay	18°54'N	72°49'E	11	28	2168
Musulipatnam	16°12'N	81°9'E	10	28	959
Nagpur/ Sonegaon	21°6'N	79°3'E	310	27	1094
New Delhi	28°35'N	77°12'E	216	25	790
Pamban	9°17'N	79°13'E	11	29	912
Pune	18°32'N	73°51'E	558	25	741
Sagar	23°51'N	78°45'E	555	25	1279
Srinagar, Jammu, Kashmir	34°5'N	74°50'E	1587	14	710
Thiruvananthapuram	8°29'N	76°57'E	64	27	1713
Trivandrum, Kerala	8°29'N	76°57'E	64	27	1835
Veraval	20°54'N	70°22'E	12	26	735
Visakhapatnam	17°43'N	83°18'E	4	28	955

Adapted overview – latitude, longitude, average altitude, average temperature and average annual precipitation across India.

Source: <http://www.india.climateemps.com/>.

PRECIPITATION VARIES ACROSS INDIA

Activities:

- Name the highest and lowest place in India.
- Which place has the lowest average temperature? What is its latitude?
- Name two places with high average temperatures. What are their latitudes?
- Temperatures in Sriganganagar in Rajasthan reach 54°C. Bhabanipatna in Odisha recorded the highest maximum temperature in the country in 2014. Using the internet name the five hottest places in India.
- Jaisalmer is also called the 'Golden City' as it stands on yellow sandstone. The city is located in the Indian state of Rajasthan and said to be the driest place in India. Investigate the reasons why it is a popular tourist destination as a photo story.
- Name three places where precipitation is heaviest?
- Cherrapunji in the Indian state of Meghalay is said to be the wettest place on Earth. However, nearby Mawsynram currently holds that record. Using the internet research why you would visit this place and in which season you would visit.
- The global average annual precipitation over land is 715 mmpa. How many places out of 42 in India receive less than this amount?

Jaisalmer



Photograph A: Jaisalmer experiences a dry/desert environment. There are no perennial (permanent) streams and only intermittent streams (water only after rain). Located on top of the hill is Jaisalmer Fort containing the Maharaja Palace (S. Bliss)

Gadisagar



(Gadsisar, Gadi Sagar, Gadisar Talab) (S. Bliss)

Photograph B: Gadisagar is a man-made lake in Jaisalmer. It is not a natural oasis but a water conservation tank built around 1400 BC. The King of Jaisalmer, the Maharawal Ghadasi, was known to travel down from the fort to supervise the digging of the lake. The lake collects precipitation during the monsoon rains which is then distributed to the town.

Another water resource in Jaisalmer is groundwater. However groundwater is only available 37-75 metres below the ground. In some parts it is at a depth of 120 metres. This makes digging for water difficult to impossible.

Water harvesting in India

As a large area of India is arid or semi-arid and the dry monsoon season lacks water. There are a variety of water harvesting techniques used by Indians such as:

- Paar
- Talab/Bandhis
- Saza Kuva
- Johad
- Pat
- Naada/Bandha
- Rapat
- Chandela Tank
- Bundela Tank
- Kunds/Kundis
- Kuis/Beris
- Baoris/Bers
- Jhalaras
- Nadis
- Tobas

Source: <http://www.rainwaterharvesting.org/Rural/traditional1.htm>

Figure 3: Climate statistics for Jaisalmer

Climate data – Jaisalmer, India													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C	21.7	25.1	30.6	36.2	39.6	38.8	35.7	34.0	34.4	34.1	29.0	23.5	31.89
Average low °C	2.6	5.5	11.4	16.9	20.6	22.0	21.5	20.4	19.2	15.2	8.4	3.5	13.93
Precipitation mm	1.5	3.0	2.7	21.0	8.9	15.1	60.1	75.8	17.6	2.4	1.5	2.4	212

Source: WMO

Source adapted: <http://en.wikipedia.org/wiki/Jaisalmer>

PRECIPITATION VARIES ACROSS INDIA

Activities:

- Refer to Figure 3: climate graph and photograph **A** and discuss why Jaisalmer experiences a dry climate.
- Jaisalmer would not be without Gadisarar and the reverse is also true. Explain this statement.
- Research how Jaisalmer forms part of the Thar Desert and explain the different types of desert landforms, especially the sand dunes.
- In groups, research two water harvesting systems in India and their importance to agriculture and food security. Include a photograph.

Climate statistics for Cherrapunji

Cherrapunji has held the record for highest rainfall multiple times in the past.



Source: <http://en.wikipedia.org/wiki/Cherrapunji#mediaviewer/File:Cherrapunji.jpg>

Figure 4: Climate data – Cherrapunji, India

Duwan Sing Syiem View Point, Cherrapunjee



Source: Wikiimedia Commons

Activities:

- Draw a climate graph of Cherrapunji on the template provided (Figure 5).

Figure 5: Climate graph template

[illegible]

Source: http://www.geogspace.edu.au/verve/_resources/2.3.2.2_3_climate_graph_temp_pdf.pdf

Climate data – Cherrapunji, India													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C	15.7	17.3	20.5	21.7	22.4	22.7	22	22.9	22.7	22.7	20.4	17	20.67
Average low °C	5.2	8.9	12.5	14.5	16.1	17.9	18.1	18.2	17.5	15.8	12.3	8.3	13.94
Precipitation mm	11	46	240	938	1,214	2,294	3,272	1,760	1,352	549	72	29	11,777

Source #1: HKO Climate Charts for mean temperatures Source #2: NOAA

Adapted source: <http://en.wikipedia.org/wiki/Cherrapunji>

PRECIPITATION VARIES ACROSS INDIA

Monsoons

Movement of monsoons

- Winter is the dry season: winds blow from the land to the sea.
- Summer is the wet season: winds blow from the sea to the land.

SW Monsoon

The SW monsoon winds are called 'Nairutya Maarut' in India.

- **Rainy season – summer:** Around 1 June the SW Monsoon rains bursts onto the western coast of India (near Thiruvananthapuram in Kerala – south India). By around 15 July it has moved north across India.
- **Dry season – winter:** From around the 1 September the dry monsoon starts withdrawing from India.

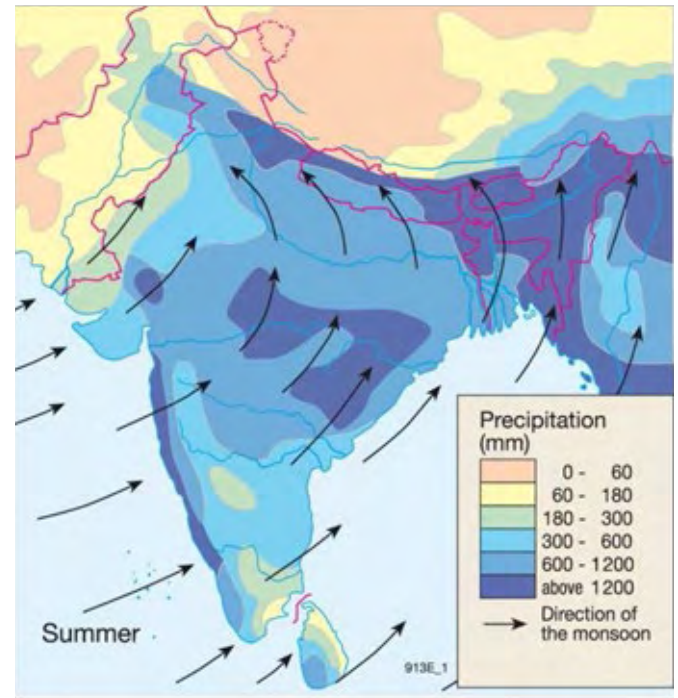
SE Monsoon or Indo-Australian Monsoon

- Monsoon winds blow from the ocean to SE India bringing rain.
- In India and Australia the wet monsoon season occurs in summer and the dry monsoon season in winter. *Just remember we have opposite seasons.* When India is experiencing a wet summer season – Australia is experiencing a dry winter season. Then the reverse occurs.

Activities:

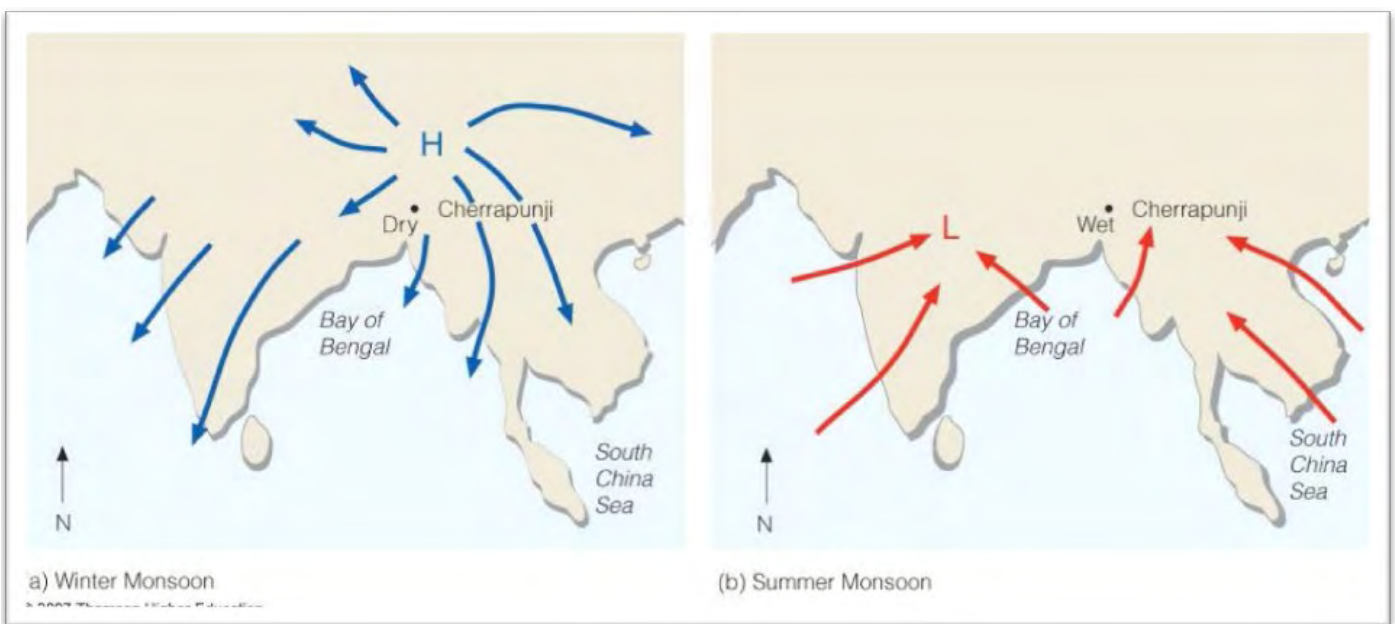
- What does H and L mean? (Figure 6)
- Explain why it is wet in summer
- Discuss the movement of winds in winter

Figure 7: Choropleth map showing the influence of SW monsoon on India



Source: http://www.diercke.de/bilder/omeda/800/10913E_1_Indien_Monsune.jpg

Figure 6: Wet summer and dry winter winds



Source: http://apollo.lsc.vsc.edu/classes/met130/notes/chapter9/graphics/h_l_indian_monsoon.jpg

PRECIPITATION VARIES ACROSS INDIA

Activities:

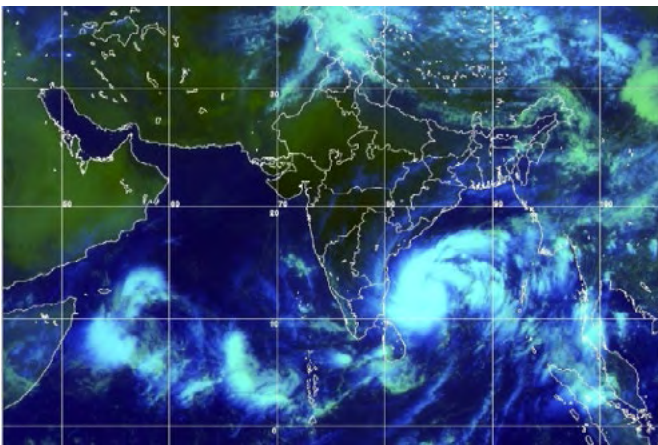
Figure 7 is a choropleth map where areas are coloured to measure precipitation.

- What is the direction of the summer monsoon?
- Refer to an Atlas or the internet and name the states or areas where most precipitation falls.
- Explain why you think the further a place is away from the ocean the less precipitation it receives.

Satellite imagery

Figure 8: Satellite image

Satellite image taken on 18 May 2010 by India's Kalpana-1 satellite: Southwest Monsoon beginning to deliver 'foreign rains' to Sri Lanka.



Source: <http://collidecolumn.wordpress.com/2013/03/24/when-worlds-collide-59-seeking-clarity-in-murky-waters/>

Activities:

- What is a satellite image?
- List the advantages of satellite images for determining weather patterns.
- Explain how the approaching monsoons to SW and SE India is shown on a satellite image.
- Research how satellite imagery contributes to reducing the adverse impacts of heavy rainfall and floods on Indian communities.



Rock shrine, Fakhruddin Gutta, Hyderabad. Source: Wikimedia Commons

Monsoon shown as climate graphs

The impacts of the monsoon is illustrated by a variety of climate graphs showing seasonal precipitation patterns.

The following website contains climate graphs for many Indian cities with suggestions on what season is the best time to travel to these places – <http://www.weather-and-climate.com/average-monthly-precipitation-Rainfall,Hyderabad,India>

A good exercise is to compare Indian climate graphs with other countries. This information is found at this website – <http://www.weather-and-climate.com/>

Figure 9a: Hyderabad in India

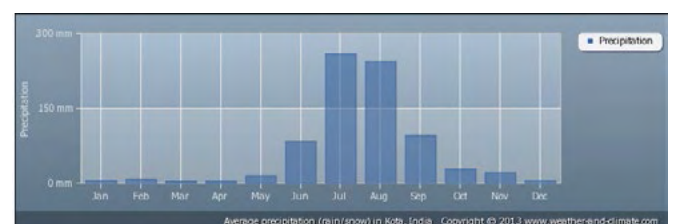


Source: <http://www.weather-and-climate.com/average-monthly-precipitation-Rainfall,Hyderabad,India>

What's the best time to travel to Hyderabad in India?

- On average, temperatures are high.
- Most rainfall occurs between June and October and dry periods between December and February.
- Warmest month is May and coolest month is December.
- August is the wettest month and December the driest month.

Figure 9b: Kota in India



Source: <http://www.weather-and-climate.com/average-monthly-precipitation-Rainfall,Kota,India>

What's the best time to travel to Kota in India?

Here are some facts:

- On average, In order to reduce this temperatures are always high.
- Most rainfall is in July and August and dry periods in January, February, March, April, May, November and December.
- The warmest month is May and coolest month is

PRECIPITATION VARIES ACROSS INDIA

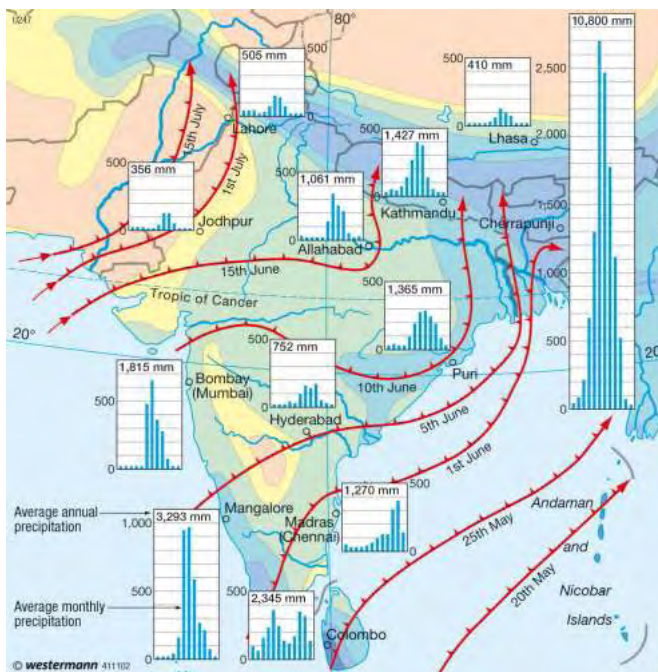
January.

- July is the wettest month and March the driest month.

Activities

- Estimate the total annual precipitation for Hyderabad. (Figure 9a)
- Compare the precipitation received in Hyderabad in August and January.
- In what season does most rain fall in Hyderabad?
- Imagine you are travelling to Hyderabad, explain what months you would choose and why.
- Write True or False for the following statements:
 - Kota receives less precipitation than Hyderabad
 - Both Kota and Hyderabad receive most precipitation in July
 - Hyderabad has a longer wet season than Kota
- Refer to this article (Figure 9) and provide the latitude, longitude, altitude, average temperature and average annual precipitation for both Kota and Hyderabad.

Figure 10: Monsoon movement and



precipitation graphs across India

Source: <http://www.diercke.com/kartenansicht.xtp?artId=978-3-14-100790-9&seite=95&id=17558&kartennr=5>

Activities

- Describe the movement of the SE monsoon rains from 20th May to 15th July.
- What is the difference in average annual

precipitation between Cherrapunji and Jodhpur?

- Explain the relationship between the maximum precipitation received in a month and the movement of the monsoon across India.
- Explain why precipitation is heaviest on the coast of India compared to inland areas.

	Tue 26 night	Wed 27 morn- ing	Wed 27 after- noon	Wed 27 night	Thu 28 morn- ing	Thu 28 after- noon	Thu 28 night	Fri 29 morn- ing	Fri 29 after- noon
Weather Map See all maps									
Metric ☉									
Imperial ☉									
Wind (km/h)	15	10	15	15	15	10	5	10	5
Summary	some clouds	some clouds	some clouds	rain shwrs	clear	some clouds	rain shwrs	clear	some clouds
Rain (mm)	-	-	-	4	-	-	1	-	-
Snow (cm)	-	-	-	-	-	-	-	-	-
Max. Temp (C)	36	37	39	36	37	39	37	37	38
Min. Temp (C)	32	32	38	30	33	38	33	33	38
Wind Chill (C)	32	32	38	30	33	38	33	33	38
Freezing Level (m)	5000	5100	5250	5100	5200	5200	5150	5200	5450
Sunrise	-	5:54	-	-	5:54	-	-	5:54	-
Sunset	-	-	18:44	-	-	18:43	-	-	18:40

Figure 11: Agra's 10 day weather forecast

Source: <http://www.weather-forecast.com/locations/Agra/forecasts/latest>

Activities

- Where is Agra located? Refer to Figure 11
- List the type of information provided on weather for Agra over the next 10 days.
- What days are likely to experience rain?
- Would you describe the weather as hot or cool?
- Agra is the site of the Taj Mahal. Research why it has been listed as a World Heritage Site.
- Investigate the precipitation outlook for India this week – <http://www.monsoondata.org/wx2/prec.html>
- Explain why maps of soil moisture across India are important for the population of 1.2 billion people. – <http://www.monsoondata.org/wx2/soil.html>
- Select five Indian cities and describe their weather forecast – <http://www.weather-forecast.com/countries/India>

PRECIPITATION VARIES ACROSS INDIA

The Western Ghats

The Western Ghats are a mountain range in India which runs north to south parallel to the west coast of India through states such as Kerala. Precipitation varies over the year according to the movement of the Monsoons. However, the Ghats block rainfall to the Deccan Plateau. This is referred to as orographic precipitation.

The Ghats have been labelled as a biological 'hot spot' by UNESCO for its diversity of species.



Western Ghats in dry season 28th May

Source: http://en.wikipedia.org/wiki/Monsoon_of_South_Asia#mediaviewer/File:MatheranPanoramaPointDrySeason.JPGb.



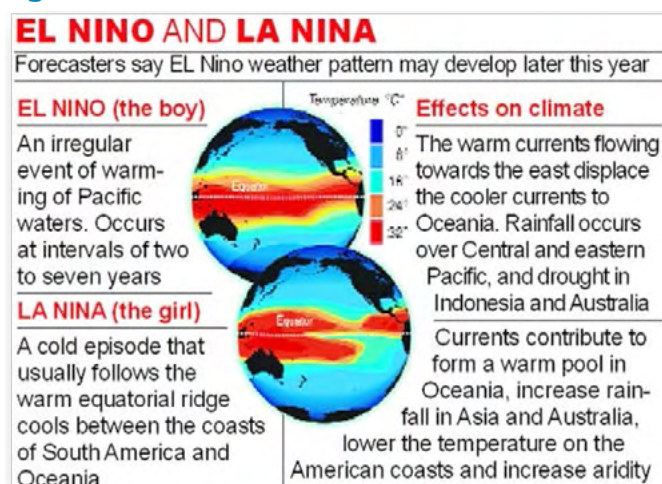
Western Ghats in wet season 28th August

Source: http://en.wikipedia.org/wiki/Monsoon_of_South_Asia#mediaviewer/File:MatheranPanoramaPointMonsoon.JPGb

Activities

- Where are the Western Ghats located?
- Discuss how the landscape changes with the wet and dry monsoons.
- Research how changes in precipitation impacts on agriculture and food security in the Western Ghats

Figure 12: Links between El Nino and India's



monsoon

Source: <http://www.tribuneindia.com/2012/20120813/main5.htm>

Drought affected farmer, India



Source: <http://blogs.worldwatch.org/nourishingtheplanet/reforming-energy-subsidies-could-curb-indias-water-stress/>

India is likely to have below-average monsoon India 2014 says the meteorological department in India due to El Nino.

Activities

- Distinguish between an El Nino and a La Nina weather pattern
- What is the effect of an El Nino on precipitation in India?
- El Nino is generally related to low precipitation which impacts adversely on agriculture. Research this statement in reference to India and its links to hunger and malnutrition.

Predicting rain!

Various attempts have been made to predict rainfall in India since the Great Famine of 1876-78. In order to reduce the damage that occurs, numerous models have been developed to predict monsoonal patterns (e.g. timing and quantity of rain).

Precipitation prediction technology and organisations includes:

- Real time weather forecasts from NOAA/NCEP – <http://www.monsoondata.org/wx2/>.
- Monsoon Mission – http://www.tropmet.res.in/monsoon/files/seasonal_prediction.php
- Indian Meteorological Department – <http://www.imdpune.gov.in/>
- Accuweather – <http://www.accuweather.com/en/in/india-weather>
- Indian satellite studies tropical water cycle – <http://www.natureasia.com/en/nindia/article/10.1038/nindia.2011.147>

PRECIPITATION VARIES ACROSS INDIA

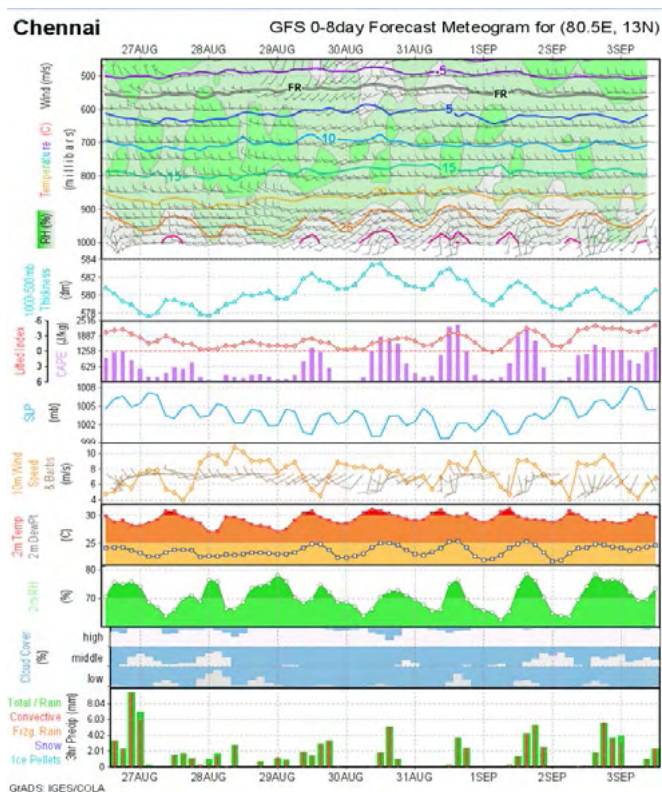
- Australian Bureau of Meteorology Climate models – <http://www.bom.gov.au/climate/ahead/model-summary.shtml>
- Forecast Meteograms – <http://www.monsoondata.org/wx2/meteogram2.html>

Forecast Meteograms

'Meteograms illustrate the forecasted evolution of weather conditions at a single location. Variables displayed include a time/height cross section of tropospheric temperature, winds, and relative humidity, 1000-500mb thickness, atmospheric stability indices, sea level pressure, 10m winds, 2m temperature and dew point, 2m relative humidity, soil moisture, runoff, and precipitation amount.' <http://www.monsoondata.org/wx2/>

Figure 13: Meteogram for Chennai

This information is available for the main Indian cities



Source: <http://www.monsoondata.org/wx2/chengfs.png>

Monsoonal flooding in Chennai, India



Source: Wikimedia Commons

Geofacts

- Rainfall is measured using a rain gauge. Today the amount of precipitation can be estimated by weather radar.
- The monsoon affects northern Australia. Approximately 75% of precipitation in northern Australia falls during the summer monsoon.



VIETNAMESE WATER PUPPETS A REFLECTION OF CULTURE

A Stage 3/4 Resource by Di Dunlop

Water in Stage 4:

- The Economic, cultural, spiritual and aesthetic value of water to a community.
- Describes how water is used by communities for agriculture and recreation.

Watch the YouTube clip 'Vietnamese Water Puppets.'
– <https://www.youtube.com/watch?v=rxIff980XyM>

In Vietnam, rice cultivation in flooded fields [paddies] has been a way of life for at least one thousand years. Rural communities have developed a particular way of using these fields for entertainment. This has evolved into the Vietnamese Water Puppets that can still be seen today, not only in the countryside but, also in the National Theatre in Hanoi. Water Puppetry is a unique variation on the ancient puppet traditions of Asia that include Bunraku in Japan and Wayang Kulit in Indonesia. In Vietnamese, water puppetry is called *mua rỗi nu'oc*, 'puppets that dance on water'. This tradition dates back to the 11th century in the Red River Delta area of Northern Vietnam. The earliest records of water puppets were found on a stone stele



Vietnamese rice fields. Photo: Greg Willis. Source: Wikimedia Commons



*Hanoi Water Puppets – Harvest Festival.
Photo: Greg Willis. Source: Wikimedia Commons*

that was built in 1122 during the Lu Dynasty. Water Puppet performances were held during festivals for harvests and other important occasions within the villages and have a close connection with the material and spiritual life of the people.

The stage for the performance is the water. This is a symbolic link to the rice harvest. During the Show, the water conceals the puppeteer's rods and string mechanisms but also allows for special effects such as waves and splashes. .

The modern puppet show is performed in a four metre square pool in specialised buildings with a side stage for the musicians.

Originally the performances were in the paddy fields with a pagoda built on top to hide the puppeteers who stood in the waist high water. This created ongoing issues such as water-borne diseases, leeches and rheumatism for the puppeteers.

VIETNAMESE WATER PUPPETS



Thang Long Water Puppet Theatre
Photo: Greg Willis. Source: Wikimedia Commons

In Hanoi's National Theatre they wear waders for protection as they perform two shows each night.

The Water Puppets are made from wood and then lacquered in bright colours, often weighing up to fifteen kilograms. Up to eight puppeteers are involved in a show and they stand behind a split bamboo screen, which is decorated to resemble the facade of a pagoda, [an homage to the traditional pagoda in the paddy fields]. Water puppeteers have kept the details of their tricks secret for centuries. The ability to move the very large puppets requires both great strength and dexterity and they often require two people to manipulate them in the water. In the simplest technique, the puppet is fixed to a floating base at one end of a bamboo rod. The base includes a rudder and acts as a fulcrum for the springs that control the upper body.

Each performance is accompanied by a traditional Vietnamese orchestra. This includes drums, wooden bells, cymbals, horns, gongs, bamboo flutes and vocalists. The flute may accompany royalty, while the drums and cymbals may announce a dragon. Singers provide the story being performed by the puppets.



Hanoi Water Puppets – Harvest Festival.
Photo: Greg Willis. Source: Wikimedia Commons

There is continual interaction between the puppets and the musicians during the performance, e.g. a musician may call a word of warning to a puppet that is in danger. Puppets may enter from both sides of the stage, or emerge from the water. During the performance, colourful flags decorate the stage and spotlights create special effects that create a festive atmosphere.

Performances tell stories of day-to-day village life, of legends and history, of buffalo fights and traditional games that provide humour and excitement. Lion dogs spewing spray and dragons spewing smoke cause great amusement for the audience. A typical performance involves up to eighteen short scenes. Each scene is introduced by Teu, a plump bodied, pigtailed rogue who plays the comic or Jester for the audience.



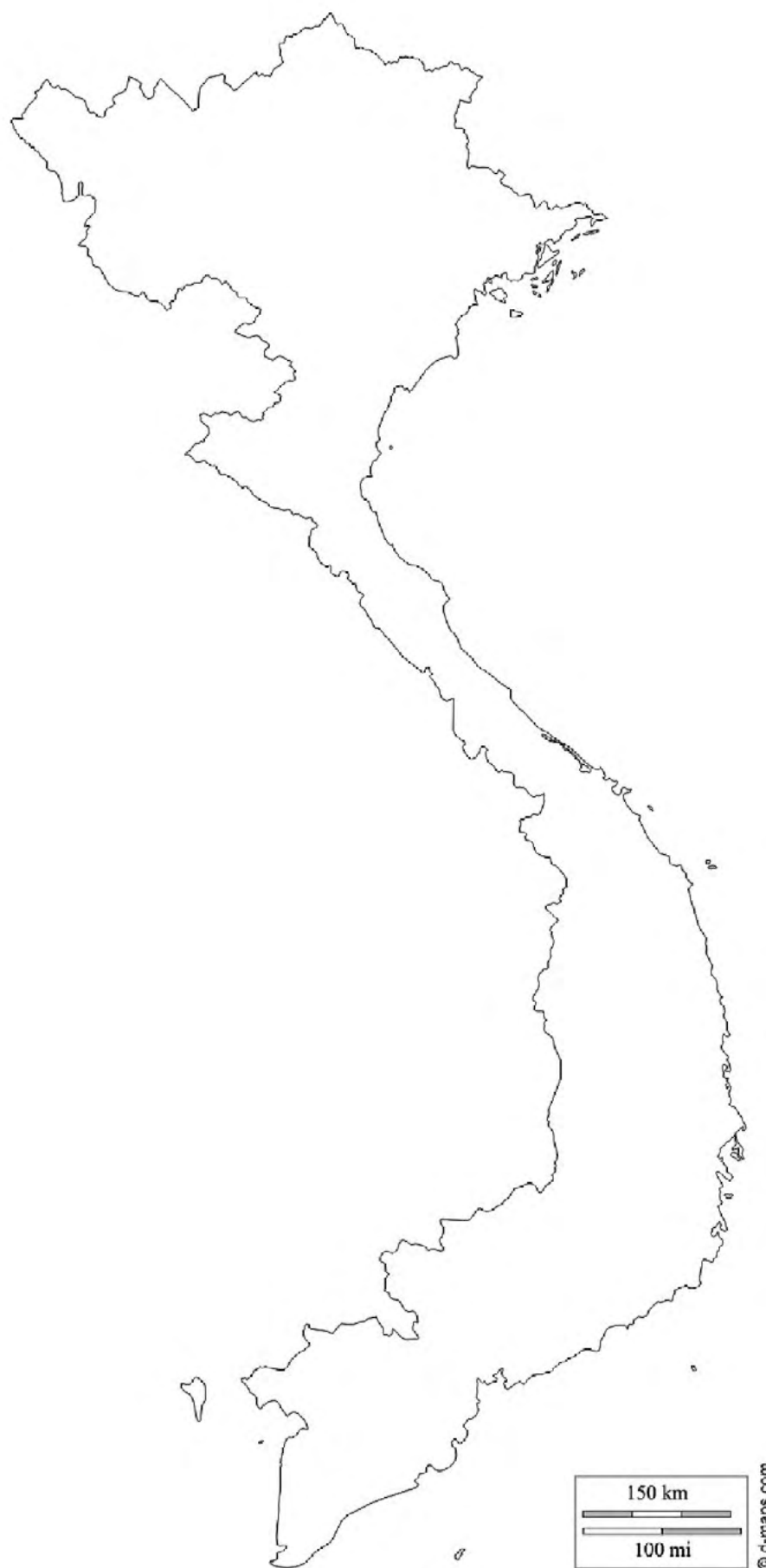
Hanoi Water Puppets – Fairy Dance.
Photo: Greg Willis. Source: Wikimedia Commons

Activities:

- Explain the following terms: paddy, Bunraku, Wayang Kulit, stele, pagoda, lacquer, bamboo, Lion dog.
- On a map of Vietnam mark in and name the following: Hanoi, Red River, Ho Chi Minh City, South China Sea.
- In what religion are pagodas significant?
- What are the basic beliefs of this religion?
- Outline the process of Rice Paddy farming.
- Draw a timeline of the dynasties of Vietnam.
- Research the types of water-borne diseases that might affect the puppeteers.
- Research the five most common characters used in the Water Puppets.
- Explain the symbolism of each of these.
- Research some of the stories that are used by the Water Puppets. Are there any similarities with stories from your culture?
- What type of morality tales are portrayed by the water puppets?

VIETNAMESE WATER PUPPETS

Worksheet one: Map of Vietnam



VIETNAMESE WATER PUPPETS

Worksheet two: Wordsearch

A	W	H	A	N	N	O	I	P	A	D	D	Y
B	A	M	B	O	O	K	J	U	D	H	I	D
U	T	B	E	F	G	I	E	P	X	A	B	Y
D	E	C	L	D	H	J	S	P	C	M	C	N
D	R	A	G	O	N	X	T	E	L	U	Y	A
H	R	M	O	N	V	I	E	T	N	A	M	S
I	E	C	U	L	T	U	R	E	T	V	B	T
S	D	P	O	R	C	H	E	S	T	R	A	Y
M	Q	P	A	G	O	D	A	W	Q	R	L	S

Locate the following word which relate to Vietnamese Water Puppets:

CULTURE

VIETNAM

ORCHESTRA

PUPPET

CYMBAL

DYNASTY

PADDY

DRAGON

JESTER

BUDDHISM

BAMBOO

HANOI

PAGODA

WATER

RED



Shop selling water puppet figure, Vietnam. Photo: Francisco Anzola. Source: Wikimedia Commons



Global Education – Learning Emphases

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

WATER SCARCCE INDIA

A Stage 4 resource by Dr Susan Bliss

Australian Curriculum: Geography
Year 7 – Water in the World

Content Descriptions: The nature of water scarcity
and ways of overcoming it (ACHGK040)

Figure 1: Parched Indian villagers at a large
well in Natwargadh, Gujarat



Source: <http://australianrain.blogspot.com.au/2011/11/scarce-water.html>

Over time, scarce water has threatened the existence of Indian cities and the survival of farming communities. One example is the walled Moghul city of Fatehpur Sikri located near Agra in India. This UNESCO World Heritage Site built in 1571 is located on the banks of a natural lake. The city contained a royal palace, mosque and harem quarters. After only 14 years in 1585, this magnificent city was abandoned due to scarcity of water causing out-migration and abandoned settlements. Today the lake is almost dry and the few wells in the city are too polluted to drink, unless filtered and treated.

Figure 2: Fatehpur Sikri a city abandoned
because of lack of water



(S.Bliss)

Water scarcity and water stress

In 2014 approximately 450 million people living in 29 countries suffered from water shortages. India was one of these countries with TV headlines declaring '*India is facing a Crippling Water Crises*' with depleting groundwater levels, severe droughts and rising mercury levels.

According to the United Nations Environment Programme (UNEP) these countries are suffering from either water stress or water scarcity, both caused by natural and human factors. Water stress differs to water scarcity as:

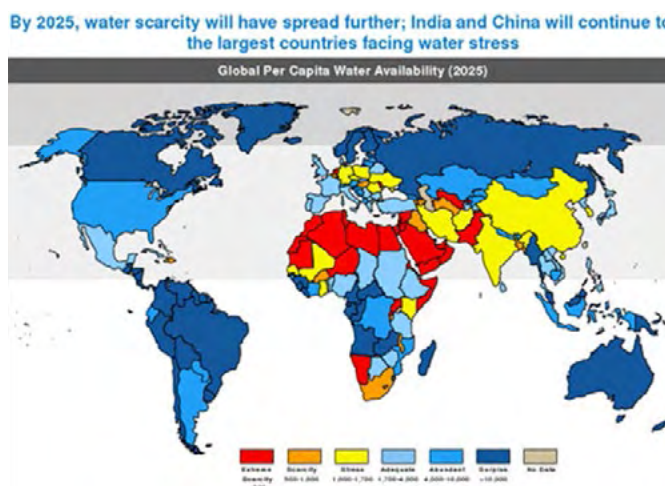
- ♦ **water stress** is the quantity of water per person per year between 1000 m³ and 1700 m³
- ♦ **water scarcity** is the quantity of water per person per year below 1000 m³

WATER SCARCE INDIA

By 2025 the United Nations Environmental Program (UNEP) estimates that 66% of people on Earth will live in water-stressed areas. At this rate by 2050 feeding the global population could require 50% additional water compared with today. Catering for increased demand, water withdrawals are predicted to increase by 50% in developing countries and by 18% in developed countries.

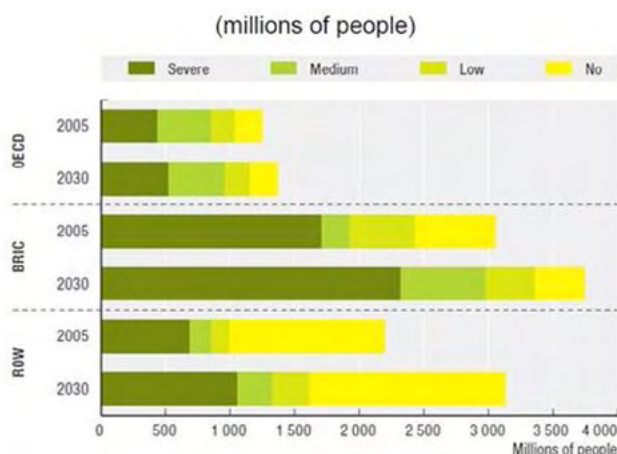
The situation is unlikely to improve with demand set to outpace supply in the next decade. By 2020, India's water demand is around 1,100 million gallons per day (mgd). However the government at present only supplies around 800 mgd.

Figure 3: Water shortages rising across the globe – especially India



Source: <http://www.treehugger.com/clean-water/water-shortages-rising-across-the-globe-but-especially-india.html>

Figure 4: People living in areas of water stress, by level of stress 2005 and 2030



Source: <http://www.marketoracle.co.uk/Article37104.html>

Key: OECD: Organisations for Economic Co-operation and Development (34 countries);
BRIC: Brazil, Russia, India, China;
ROW: Rest of World

Water scarcity across India

Access to water is a human right. Despite this right, lack of access to adequate clean water is both a developing (e.g. India) and developed (e.g. Australia, USA) country problem. India with 17% of the world's population but only 4% of the world's fresh water encounters difficulties satisfying peoples' water needs. Additionally water is unevenly distributed across India with 75% of precipitation falling in about four months (such as during monsoons rains) and precipitation varies from under 100mmpa in the Gobi Desert in northern Rajasthan to over 10,000mmpa at Cherrapunji in the North East Region.

In 2013 India faced a crippling water crises in several Indian states due to unpredictable weather patterns and over-exploitation of groundwater. During 2013 Kerala for the first time declared droughts in 14 districts after a weak monsoon and the Aliyar Dam, the main source of water, ran low.



Aliyar Dam, Tamil Nadu, India. Source: Wikimedia Commons

Water scarcity is not only an urban problem but is replicated across the agricultural sector:

Urban India

Water scarcity is one of India's urban challenges with 22 out of 32 cities experiencing daily shortages. In the city of Jamshedpur the gap between the demand for water and the supply of water is 70%. In Delhi the gap is 24% and Mumbai 17%. In many cases there is sufficient water supplied to cities but a large percentage is lost because of poor maintenance such as leaking pipes and a greater percentage distributed to industry and energy production.

In Delhi, about 30% of the poor population receive less than 30 litres per person per day while 5% of the rich population acquire about 200 litres. Almost 50% of Delhi's population lives in slums where access to clean water and improved sanitation is a

WATER SCARCE INDIA

daily challenge as the water contains high levels of pesticides, heavy metals and e-coli. Only 81% of the households receive piped water and the remainder rely on mobile water tankers. In Tughlaqabad in New Delhi water tankers only transport water every three to four days.

According to a recent World Bank report, '*most major Indian cities will run dry by 2020 unless policy-makers make significant changes in water resource management*'.

Figure 5: Photograph: Rows of water cans used by slum dwellers to store water, can be seen along the roads.



Source: <http://www.aljazeera.com/indepth/inpictures/2014/08/india-delhi-water-crisis-2014829115521403974.html>

Northern India

In northern India, groundwater supplies are being depleted faster than natural processes can replenish them. In 2014 a successful campaign in the northern state of Uttar Pradesh saw the closure of a Coca-Cola bottling plant. Farmers were concerned that groundwater levels had been critically low for more than 10 years and accused the plant of using too much water. This successful campaign came 10 years after another Coca Cola plant in the southern state of Kerala, was closed after residents claimed it was draining and polluting local water supplies. However Coca Cola claims India is one of the five biggest markets in the world and plans to invest about \$5 billion in the country between 2012 and 2020. The Indian people will need to keep an eye on its use of their scarce water supplies.

Over the past decade India has improved the availability and quality of urban drinking water. However, high rates of urban growth and urbanisation has resulted in water scarcity in some poor urban areas. In general remote rural areas have frequently been left out of modern water projects.

Figure 6: Indian states hit by water scarcity in India 2013



Source: <http://hyd-news.blogspot.com/2013/03/the-battle-for-water-indias-food.html>

Water Scarcity and Stress Indexes

The **water scarcity index** describes the relationship between available water in an area and the number of people that can be supported by the water supply. The scarcity index is expressed as the number of people per flow unit (defined as 1 million metres³ per year). The index is divided into water scarcity and water stress:

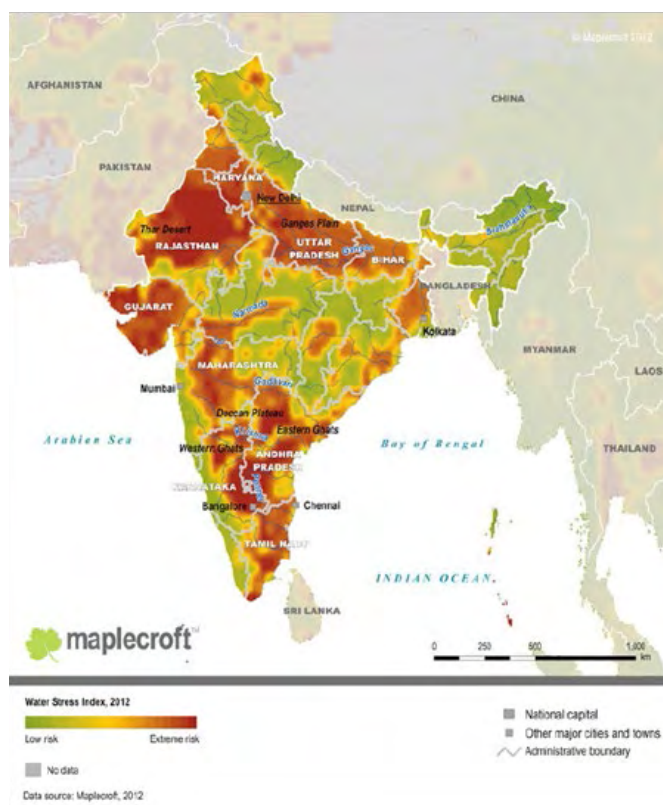
- ♦ **Water scarcity** exists when there are 600-2000 people per flow unit.
- ♦ **Water stress** occurs when there are 100-600 people per flow unit.

The World Resource Institute (WRI) **Global Water Stress** rankings reveals that 37% of countries it assessed experienced 'high' to 'extremely high' water stress. Australia, India, China and USA have been rated as 'high risk' in a study evaluating the vulnerability of 159 countries to water stress. However the **Middle East and North African region (MENA)** are at the highest risk.

India varies from 'low risk' along the west coast to 'extreme risk' in the north and northwest of Delhi where wheat and sugar producing areas are located.

WATER SCARCE INDIA

Figure 7: Water Stress Index across India



Source: <http://reliefweb.int/map/india/water-stress-india-4-may-2012>

Physical and economic water scarcity

A 2012 *Global Monthly Water Scarcity* report analysed water consumption in 405 river basins around the world and found water scarcity impacts on 2.7 billion people for at least one month per year. There are three main reasons for this occurrence such as: physical water scarcity, economic water scarcity and the effects of climate change.

Figure 8: Different types of water scarcity

Physical water scarcity

It is absolute water shortage which occurs when the demand for water is greater than the ability of the land to provide water.

Arid regions are often associated with physical water scarcity due to their low and unreliable rainfall such as the Gobi Desert in India. Physical water scarcity can also result from the over consumption of water resources where populations are rapidly increasing.

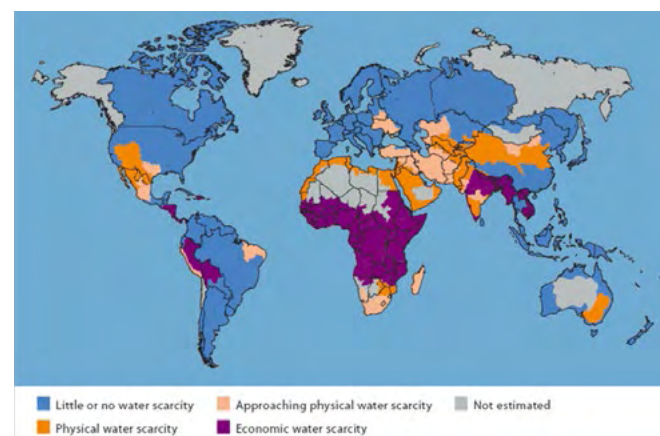
Economic water scarcity

This occurs when the population does not have the monetary means to develop an adequate and reliable supply of water such as an irrigation system and dams. There is also uneven economic water scarcity in India where rich urban areas have water supplied to their home while in poor rural areas women and children walk hours to collect it. Economic water scarcity can be addressed at the local scale with investment in simple infrastructure such as rainwater collection tanks.

Climate change

Has already affected India with an increase in extreme and frequent droughts reducing runoff to rivers and lakes, shrinking water tables and exhausting some aquifers that have been overused. Climate change presents a challenge to water and food security and a severe hurdle to India's development.

Figure 9: Economic and physical water scarcity



Source: http://www.wri.org/sites/default/files/water_scarcity_1.jpg

Role of poor women and water

In India 73% of the population lives in remote rural villages which lack access to safe drinking water or proper sanitation causing high infant mortality rates (IMR) and poor health due to diarrhoea and other water related diseases. In most cases it is the role of women and children to collect water daily.

Indian women can take up to six trips a day to collect water which can average 16 km a day. This practice has resulted in many girls dropping out of school to help carry water. However, a 50 litre Water Wheel can now transport three to five times more water compared to traditional methods such as carrying water on the head.

WATER SCARCE INDIA

Figure 10: Women waiting to fill water containers



Source: <https://worldpulse.com/files/upload/3715/pic06.jpg>

Figure 11: Water Wheel



Source: <http://inhabitat.com/revolutionary-waterwheel-helps-women-transport-water-more-efficiently-in-india/>

Causes of water scarcity

In 2014 a study warned India about acute water scarcity by the year 2040 because of a clash of necessities – demand for drinking water versus demand for cooling systems in power generation. Increases in population and energy are expected to lead to this clash scenario.

As India receives abundant precipitation water scarcity is mainly attributed to human factors such as:

- *insufficient water* as a result of *population growth*
- *urbanisation* and *industrialisation* creating an expanding demand for water
- energy generation
- *climate change* such as the movement of El Nino and drier monsoon seasons
- *unusable water* estimated between 700 and 1,200 billion m³
- *corruption* in implementing effective water management programs
- dwindling groundwater supplies as over 80% of water requirements is met by groundwater resources which have been overexploited causing a fall in water tables and water shortages. In India there are over 25 million water aquifers with only 40,000 monitored causing depletion of groundwater at a rate greater than nature can replenish.
- *over-irrigation* as 75% of water resources are wasted from over irrigation of farms. In dry areas it has caused infertile saline soils. Today many farmers use drip irrigation to conserve water.

Figure 12: Water availability and water use for India



Source: <http://growingblue.com/the-growing-blue-tool/>

WATER SCARCE INDIA

- *disappearing water* due to evaporation and leaking infrastructure instead of conserving water by rainwater harvesting and farm ponds in dry areas
- *poor water quality* due to insufficient investment in water-treatment facilities. Water pollution makes water undrinkable as it contains fertilisers, pesticides and heavy metals (Refer to article on the Ganges River)
- *insufficient public investment* such as water pipes to homes and improved sanitation facilities
- *increasing water footprint* as India develops economically

The World Health Organisation reports that 97 million Indians lack access to safe drinking water, while 21% of the country's communicable diseases are transferred by the use of unclean water.

India – water crises ahead?

It is alarming that India ranks 65 out of 79 countries in the Global Hunger Index and the Global Food Security Index (GFSI) estimates 19% of the population are undernourished with 25% comprising of children. With a population of 1.2 billion people (2014) and increasing to 9.7 billion (2050) extra pressure will be placed on scarce water resources otherwise people will die from hunger or suffer malnutrition.

India's demand for water is predicted to increase by 22% by 2025. On the other hand India's water availability per capita is anticipated to decline to 1,240 m³ per person per year by 2025, close to the 1,000 m³ referred to as 'water scarce'.

As Indians become wealthier they traditionally will use more energy and consume more products – creating even greater impact on the world's water resources.

Sustainable water projects

Currently the world, including India, is on the dangerous path to escalating water scarcity due to unsustainable water use. Planning for population growth and economic expansion requires sustainable water projects. In the 2013 Asian Development Bank Outlook Report, it noted that 'India's water prospects are hazardous'.... 'An immediate program of investment, regulation, and law enforcement is necessary'.

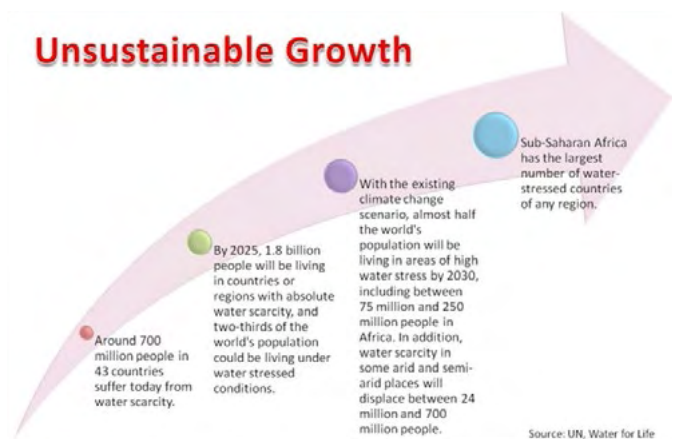
India declared 2013 Water Conservation Year and suggested strategies include:

- Drip irrigation
- System of Rice Intensification (SRI)

- Water conservation methods e.g. rainwater harvesting
- Replacing faulty pipes and pumps
- National Action Plan on Climate Change
- Conserve groundwater
- Increase price of water to reduce misuse
- Levelling land and building small dams in streams (called check dams).

A mixture of strategies is essential otherwise India faces a bleak future of becoming water scarce and food insecure. This could result in political instability, water and food conflicts, and poor human wellbeing.

Figure 13: Water scarcity – unsustainable growth



Source: <http://greencleanguide.com/2011/07/19/water-scarcity-and-india/>

Implementation of sustainable strategies

Water in 2050 promotes a Sustainable Blue Path. 'By *wasting less, polluting less, reusing more, managing effectively and becoming more efficient in all uses of water – individual, collective, agricultural and industrial – we can achieve higher water productivity levels (economic output per drop) and reduce water stress. Continued evolution of technology and infrastructure improvements will enhance water supply capacity for cities and industries while helping deliver clean drinking water and sanitation services to rural populations and the urban poor*' (<http://growingblue.com/water-in-2050/>). The Sustainable Blue Path aims to help ensure a better world for today's generation.

For India to be water secure, requires long-term access to water that is affordable, equitable, efficient and sustainable. Industrial, agricultural and domestic water reform is necessary for this to be achieved.

WATER SCARCE INDIA



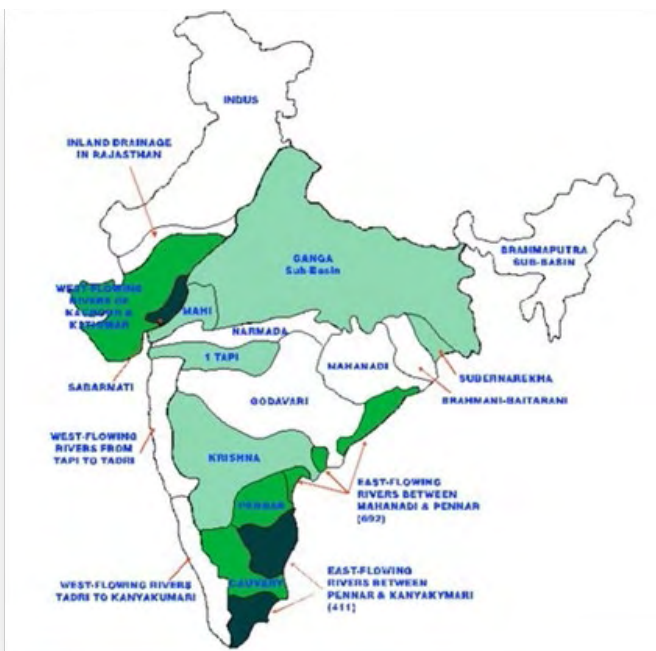
Young girls carrying water, India. Source: Wikimedia Commons

Creating mass awareness that water conservation is an immediate necessity, India's twelfth five-year plan (2012–17) focused on aquifer mapping, watershed development and more efficient irrigation. The National Water Mission promotes conservation and envisages more equitable distribution of water resources across and within States through integrated water resources management.

Aimed to reduce water shortages in parts of India the **Indian Rivers Inter-link** project proposes to join the majority of India's rivers by canals. The project consist of two components:

- northern Himalayan River Development
- southern Peninsular River Development

Figure 14: Indian Rivers Inter-link Program – moves water from water surplus to water deficit areas



Source: <http://sharjeelahmed.wordpress.com/2013/03/28/what-is-the-idea-behind-the-water-linking-project-a-hot-topic-during-the-nda-regime-what-are-its-economic-and-ecologic-implications-a/>

Key: White regions: little to zero water scarcity;
Darker regions: greater water scarcity.

Figure 15: Aims of the Indian Rivers Inter-link Program Project



Source: <http://sharjeelahmed.wordpress.com/2013/03/28/what-is-the-idea-behind-the-water-linking-project-a-hot-topic-during-the-nda-regime-what-are-its-economic-and-ecologic-implications-a/>

Key: Red lines indicate the links envisaged

Showing the way

Andhra Pradesh introduced a self-regulatory water use program for farmers which resulted in falling water consumption

Water ATMs in two villages in arid Rajasthan provide people with all day access to water at the swipe of a card - 20 litres for 5 rupees. These kiosks with reverse osmosis (RO) plants provide safe drinking water to 22,000 people who can avoid poor health from dirty water.

Figure 16: Photograph: Women accessing clean water via technology

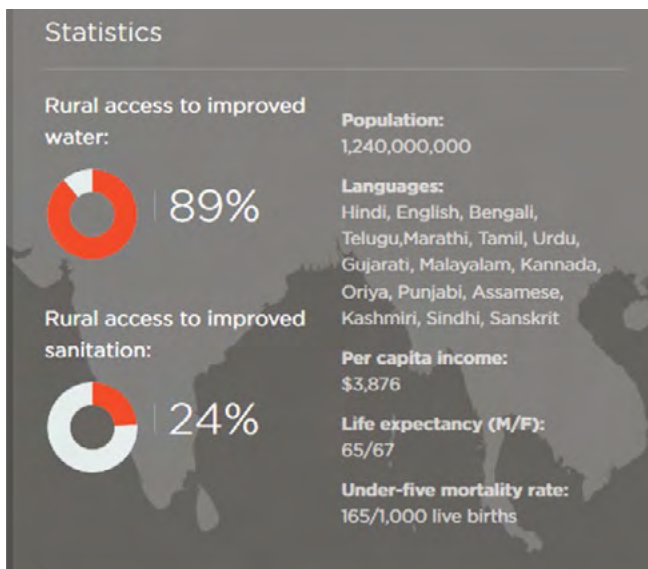


Source: <http://www.ryot.org/two-districts-india-access-clean-water-atms/798493>

WATER SCARCE INDIA

- **Pani Panchayat** watershed management plan has improved water levels in aquifers and ensured equitable water distribution to communities through the use of tankers. The principle of the scheme is that every family member is allocated 1,000 m³ of water per head per year and no water intensive crops can be grown. Incentives have been provided to construct check dams for water harvesting. As a result there has been improved agricultural output and ground water levels.
- **Mumbai cure:** Tiny black crystals called Bio Sanitisers have the ability to disinfect waste water. Treating kitchen water to be used to flush toilets ensures a supply of drinking water during water shortages.
- **Non-government organisations** (NGO) work to improve human wellbeing across India as there is a wide disparity in access to safe water and sanitation in rural areas. The NGO, Water For People-India has made a difference to the lives of many Indians living in rural areas. The organisation trains water and sanitation committees (WATSAN) to operate and maintain water systems on a sustainable basis.

Figure 17: Water For People- India



Source: <http://www.waterforpeople.org/making-a-difference/india>

GeoActivities

Knowledge and understanding

1. Describe how water is important to the survival of places.
2. Distinguish between water scarcity and water stress.
3. Explain why water scarcity is said to be both a global and Indian problem.

4. List water scarcity problems in Indian cities.
5. Explain how in the case of Coca Cola, active citizenship resulted in more sustainable use of water sources.
6. India varies from low risk water stress to high risk. Explain this statement.
7. Describe the role of women in collecting water and how technology could improve their lives.
8. In groups investigate why India could be facing a future water crises. Present investigation as a mind map.
9. Discuss how sustainable water projects could improve the future wellbeing of Indian people. Present answer using web 2.0 tools.

Inquiry and skills

10. Refer to Figure 1 and the notes: Explain the causes of water scarcity in India as an oral report.
11. Refer to Figure 3: Compare water scarcity in India with China, Australia and Middle East and North Africa (MENA) countries.
12. Refer to Figure 4::
 - a. List the countries labelled BRIC.
 - b. Compare the levels of water stress in 2030 in BRIC countries with wealthy OECD countries.
 - c. Explain the reasons for water stress changes from 2005–2030 in BRIC countries.
13. Refer to Figure 6 and notes:
 - a. List three northern states and two southern states that experienced water scarcity in 2013.
 - b. How did water scarcity affect the generally well watered Kerala in 2013?
14. Refer to Figure 7: Describe the spatial distribution of the water stress index across India. Include state names in your answer.
15. Refer to Figure 8:
 - a. Distinguish between physical and economic water scarcity.
 - b. Explain how climate change is already impacting on water sources in India.
16. Refer to Figure 9: Describe the location of physical and economic water scarcity in India.
17. Refer to Figure 12:
 - a. What is India's world rank in three water withdrawal activities?
 - b. Using the internet investigate what is meant by 'net virtual water import' and 'water footprint per capita'.

WATER SCARCE INDIA

18. Refer to Figure 13: Explain what is meant by unsustainable growth.
19. Refer to Figure 14: List two regions where there is little to zero water scarcity and two regions with the greatest water scarcity.
20. Refer to Figure 15: In groups explain the aim of the Indian Rivers Interlink Program and how it aims to reduce water scarcity across India.
21. Refer to Figure 17:
 - a. What percentage of rural dwellers lack access to improved water and improved sanitation?
 - b. Explain why poor rural areas lack the same facilities as rich urban areas.
22. Research the UNICEF Turns on Taps during World Water Month. Explain the UNICEF project and how the network operates using modern technology – <http://www.triplepundit.com/2013/03/unicef-turns-taps-during-world-water-month/>

Geoinfo

- In 2012 a hospital in New Delhi did not receive water for four days
- In 2013 the New Delhi government forced 35 Five-star hotels to cut down water consumption
- The 10 largest water users (in volume) are India, China, the United States, Pakistan, Japan, Thailand, Indonesia, Bangladesh, Mexico and the Russian Federation – <http://www.marketoracle.co.uk/Article37104.html>
- The highest rates of groundwater depletion are in some of the world's major agricultural centres: Northwest India, Northeast China, Northeast Pakistan, California's central valley and Midwestern United States – <http://www.marketoracle.co.uk/Article37104.html>

Geolinks

- Water scarcity in India – <http://greencleanguide.com/2011/07/19/water-scarcity-and-india/>
- Water Stress Index – <http://www.flutrackers.com/forum/showthread.php?t=186789>
- Water Project – <http://thewaterproject.org/water-in-crisis-india>
- Water.org – <http://water.org/country/india/>
- India's Water Future 2025–2050 – http://www.iwmi.cgiar.org/Publications/IWMI_Research_Reports/PDF/PUB123/RR123.pdf

YouTube

- Water Scarcity – <https://www.youtube.com/watch?v=XGgYTcPzxE>

https://www.youtube.com/watch?v=uCFA_PphSXI

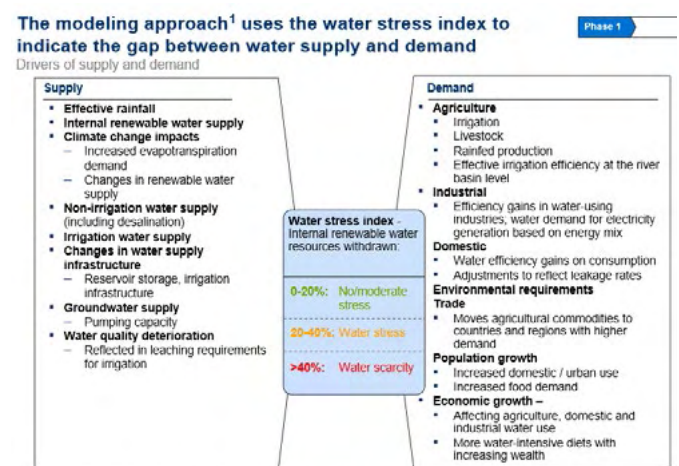
- Recharge: A Story of Water Scarcity – https://www.youtube.com/watch?v=uCFA_PphSXI
- The Roots of India's Water Crisis – <https://www.youtube.com/watch?v=x8kqq1f14vg>
- Water Crisis in Uttar Pradesh, India – <https://www.youtube.com/watch?v=jHpYRj3-W28>
- Water is India: positive changes – http://www.unicef.org/india/media_8098.htm

Teacher resources

Sustaining growth via water productivity: 2030–2050

Source: http://growingblue.com/wp-content/uploads/2011/05/IFPRI_VEOLIA_STUDY_2011.pdf

Water stress index – gap between water supply and water demand

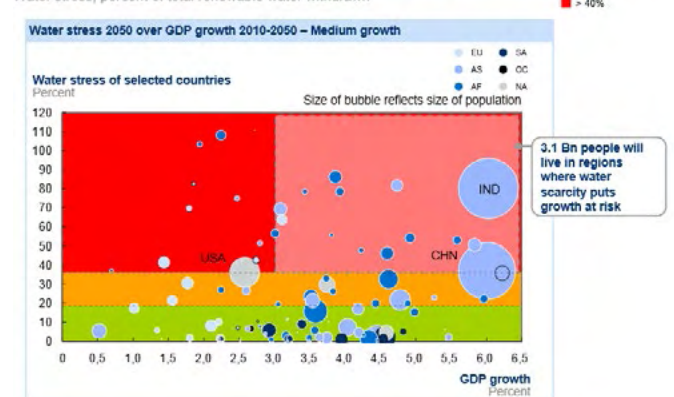


Source: http://growingblue.com/wp-content/uploads/2011/05/IFPRI_VEOLIA_STUDY_2011.pdf

Water stress will pose a threat to India

For China and India and many other rapidly-developing countries, water stress will pose a risk to growth

Water stress, percent of total renewable water withdrawn



Source: http://growingblue.com/wp-content/uploads/2011/05/IFPRI_VEOLIA_STUDY_2011.pdf, page 17



Global Education – Learning Emphases

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

Stages 4 & 5

hindustantimes

India's 'toilet guru' works to flush away open defecation

Agence France Presse, Delhi Thursday, October 2, 2014

Surrounded by latrines and soap dispensers, sanitation charity founder Bindeshwar Pathak is most at home in the toilet, which he vows to build in every impoverished home in India.

Affectionately known as India's "toilet guru", 71-year-old Pathak has spent four decades working to improve sanitation in a country where half of the population relieve themselves in the open air.

Inspired by Mahatma Gandhi, a champion of cleanliness, Pathak has more recently been spurred on by new Prime Minister Narendra Modi who wants to make India free of open defecation by 2019.

"India has the technology and the methodology. What we lack is infrastructure," Pathak said of Modi's vision, as he took AFP on a tour of cheap, eco-friendly toilets that his New Delhi-based charity has developed.

"We also need funds to the tune of \$42.3 billion considering each toilet will cost about \$320," he said, making quick calculations on a piece of paper.

"We can't claim to be the next superpower when we don't even have something as basic as a toilet for everyone," he said ahead of Thursday's national holiday to celebrate the birthday of India's independence hero Gandhi.

National hygiene drive

Modi is due to launch a national cleanliness drive on Thursday, after pledging in August to ensure all households have toilets in the next five years.

From top ministers to lowly officials, all are expected to turn up to work on Thursday to clean up their government buildings - including their toilets - many of which stink of stale urine and are littered with rubbish and spit.

"This mission... aspires to realise Gandhi-ji's dream of a clean India," Modi said recently after pledging during the May election campaign to build "toilets first, temples later".

"Together we can make a big difference," the Hindu nationalist said.

Unicef estimates that almost 594 million - or nearly 50% of India's population - defecate in the open, with the situation acute in dirt-poor rural areas.

Some 300 million women and girls are forced to squat outside normally under the cover of darkness, exposed not only to the risks of disease and bacterial infection, but also harassment and assault by men.

India's 'toilet guru' works to flush away open defecation

The issue was thrown into the spotlight in late May when two girls, aged 12 and 14, were allegedly attacked as they went into the fields to relieve themselves. Police are investigating if they were gang-raped before being lynched.

Two-pit toilet technology

Pathak, the founder of sanitation charity Sulabh International, has already constructed 1.3 million toilets for households using his cheap, two-pit technology.

When one pit is filled, it is covered, and the other pit is used. Within two years, the waste in the covered pit dries up, ridding itself of pathogens and ready for use as fertiliser.

Such toilets use less than a gallon of water per flush compared to 2.6 gallons (10 litres) for conventional latrines and do not require attachment to underground sewer lines, which are nonexistent in most villages.

Pit toilets also eliminate the need for the degrading task of manually removing toilet waste by workers who are seen as the "ultimate untouchables" in caste-ridden India.

Pathak is determined to banish the need for such "manual scavengers", who often scoop out excrement with their hands into wicker baskets, a campaign also pushed by Gandhi before his death in 1948.

Himself an upper-class Brahmin, Pathak recounted how he was made to consume cow dung and urine as part of a "purification ritual" after he touched a woman, who used to clean latrines, as a 10-year-old boy.

"This moment has stayed with me," he said.

Pathak's charity has also harnessed "bio-gas" produced from human waste which is used to generate electricity to power the charity's offices. The gas has also been bottled for use as fuel for cooking.

Despite his achievements, Pathak said his task is far from complete, and he was determined to change cultural and social attitudes against toilets. Many people in India consider toilets unhygienic and prefer to squat in the open, believing it is more sanitary to leave waste far from your home.

"Many people (also) find toilets stifling," said Pathak. "We tell them that you can keep the top of the toilet uncovered if you want to have a feel of defecating in the open."

Source : <http://www.hindustantimes.com/india-news/india-s-toilet-guru-works-to-fl>.

Discussion Points for "Toilet Guru to flush away open defecation::

- Reasons for the lack of infrastructure
- Who should pay for such infrastructure?
- Appropriate technology – "Two Pit Technology". Advantage / Sustainability
- Caste issues – "Untouchable cleaners"
- Use of Biogas
- Social issues



Global Education – Learning Emphases

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

SWALLOWING THE SEA

Global Times – Depth of Field
Friday 26 September 2014

Above: A worker rests on a newly built dam as construction continues nearby in Panjin, Liaoning Province, on September 6. Photo: CFP

As rapid economic development results in construction projects around the country, China's coastlines are also being transformed, prompting words of warning from environmentalists.

Filling in the sea to create artificial extensions of coastlines, as well as "sea farms" are among the most damaging projects for the marine environment, they said.

The ongoing construction of Dalian's new airport on reclaimed land recently caused significant debate amid claims the project did not go through the proper environmental assessment process and that the environment in tidal areas was altered.



A chemical plant operates behind dried up land near the shore in Panjin, Liaoning Province, on September 6. Photo: CFP

A recent report by local Chinese environmental NGOs found that wetlands on the Bohai Sea and the Yellow Sea have almost been wiped out, due to the construction of ports, airports, industrial parks, tourist attraction projects and various sea farms.

These projects have also wreaked havoc on migratory bird species, according to the environmentalists. China's coastline is one of the eight major routes for migrating birds. Every fall, birds migrate from Siberia southward to the equator, and the wet areas on China's coastline serve as their "fuel" stopover. In the spring, they come back north, also relying on replenishment along China's coastline.



High-rise buildings stand near intertidal mud zones in Zhuanghe, Liaoning Province, on September 7. Photo: CFP

SWALLOWING THE SEA

However, Feng Yongfeng, head of environmental organisation Nature University, wrote that more than 90 percent of intertidal mud zones have already disappeared due to various construction projects, seriously endangering the migrant birds, which may become exhausted or starve to death during their migrations.

Global Times

Source: <http://www.globaltimes.cn/content/883435.shtml>

“Swallowing the Sea”–

Some questions.

- In what ways are China’s coastlines being changed?
- What are the environmental concerns?
- What is a “sea farm”?
- Explain the impact on the environment of the building of the airport at Dalian.
- Explain the importance of “wetlands”.
- What impact is there for bird species?

Top: Birds rest on the beach as sand is pumped from below the sea. Photo CFP

Right: The beach receives salt from salt farms in Dongying, Shandong Province, on September 10. Photo: CFP

Below: Throngs of birds at a sea cucumber farm in Panjin, on September 3. Photo: CFP





- Interdependence and globalisation
- Identity and cultural diversity

SPLASH

The Post Modern Frame

Stage 4 Visual Arts

**Dapto High School, Visual Arts Faculty
(Michelle Cooper, Jenny Chappell
and Doerinda Gardener)**

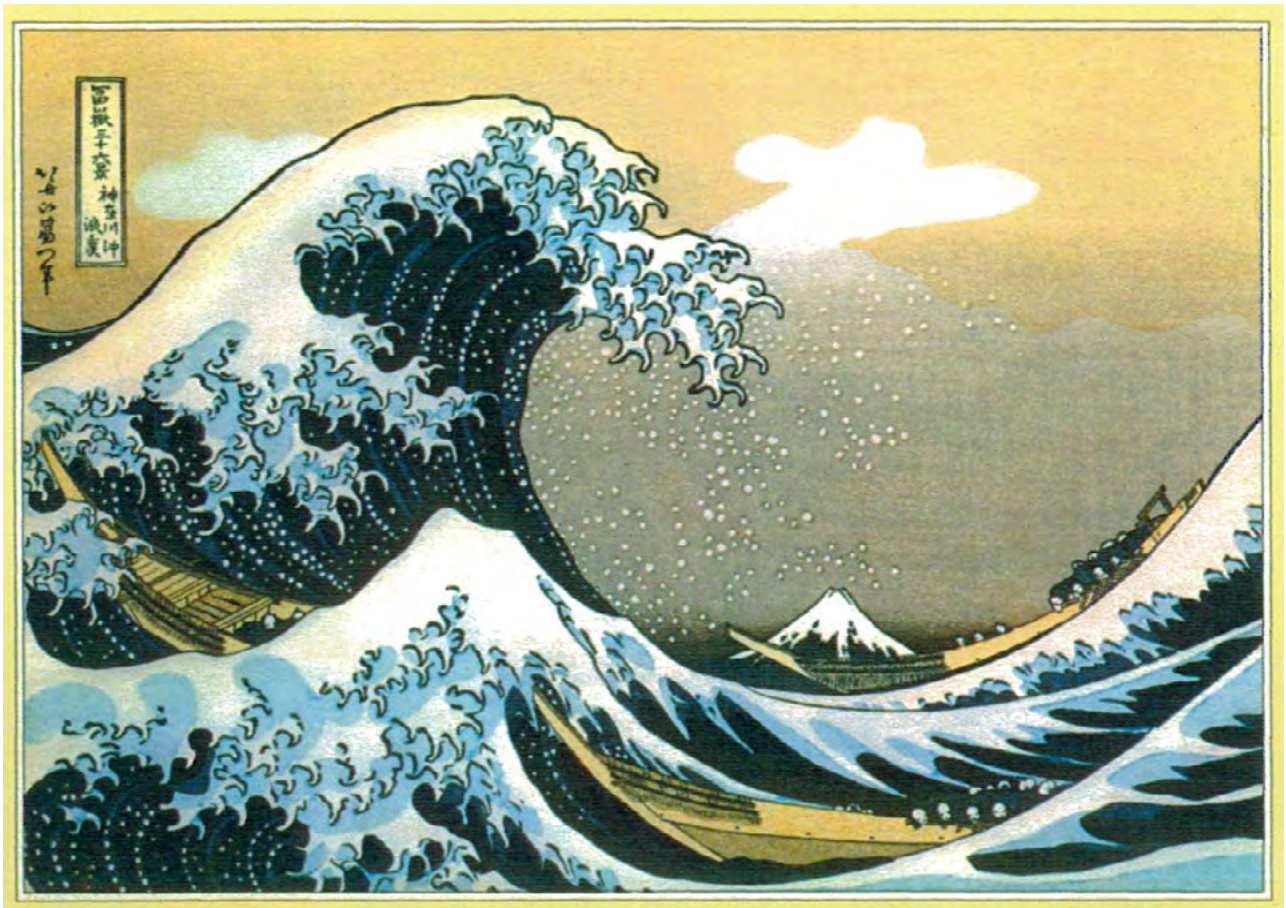
The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit by Dapto High School, Visual Arts Faculty

Program name: Splash		Number of Lessons: 3 x fortnight x 1.5 terms
Program Focus: A post-modern and cultural exploration of the contemporary art practice of appropriation, to make artworks and visual hybrids that communicate new ideas about the world through wit, irony and humour. A study of post-modern artists working with appropriation to create new meanings in artworks, and studying how culture can be explored in these works.		
Forms: Drawing, Collage, Painting		
Frames: Post-Modern and Cultural		
Conceptual Framework: World-Artwork-Audience – Artist		
Outcomes: Artmaking		Outcomes: Critical/ Historical
<ol style="list-style-type: none"> 1. Uses a range of strategies to explore different artmaking conventions and procedures to make artworks 2. Explores the function of and relationships between the artist-artwork-world-audience 5. Investigates ways to develop meaning in their artworks 6. Selects different materials and techniques to make artworks 		<ol style="list-style-type: none"> 4.8 Explores the function of and relationships between artist-artwork-world-audience 4.10 Recognises that art criticism and art history construct meanings
<ul style="list-style-type: none"> • Title page design 4.1. Graphic Design and Colour theory. VAPD • 2D extended work appropriating Hokusai's 'The Great Wave' 4. 1, 4.2, 4.5, 4.6 • Assignment: 'Found @ the beach' Relief sculpture using found objects from the beach. 4.2, 4.5 • BOW – Exhibition. 2D works to be mounted and titled. Artist statement, detailing conceptual development, material practice and resolution of 2D artworks. 4.2 		<ul style="list-style-type: none"> • Hokusai Study 4.8, 4.10 • Post Modern Study: 'The Wave' works by Hokusai, Sharpe and Onus 4.10 • Written explanation of 'Found @ the beach' sculpture. 4.8 • Evaluative comments written in VAPD. 4.8 • Place the work of Hokusai, Sharp and Onus into cultural context - time and place. Describe the differences in each artists work and how their culture has been depicted in their work. 4.10

The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit

Teaching, Learning and Assessment Practices	
Artmaking	Critical and Historical Studies
<p>1. Graphic Design and Colour Theory</p> <ul style="list-style-type: none"> – Revise lettering rules (guiding lines, spacing). – View lettering in advertisements and posters etc that integrate text into the design. – Discuss/ revise harmonious and complementary colour schemes. View artworks that use these schemes. <p>2.</p> <ul style="list-style-type: none"> – Develop a design for a title page, ‘Splash into Year 8’ that integrates the text into image, – Paint with a pre-determined colour scheme of harmonious or complementary colours and tones. <p>5.</p> <ul style="list-style-type: none"> – Develop ideas about the placement of ‘The Wave’ into students own cultural context. – Consider symbols that could be included, representing the students own time and place – Investigate how to incorporate the meaning of what’s happening in Hokusai’s Wave, to students own artmaking. – Discuss how to appropriate the original composition, – Complete a 2D artwork – Present for exhibition with a title and artist statement, detailing conceptual development, material practice and resolution about the completed 2D work. <p>7a. Assignment: ‘Found @ the beach’. Relief sculpture using found objects from the beach. Arrange the objects in such a way to make the audience discover the patterns and textures seen at the beach. Glue/ attach objects to a piece of 30x30cm solid board.</p>	<p>3.</p> <ul style="list-style-type: none"> – View Hokusai’s work The Great Wave. – Complete concept map and description in V APD <p>4. Explore the ‘The Wave’ works of Sharpe and Onus, investigating the use of appropriation and what has been re-contextualised.</p> <ul style="list-style-type: none"> – Discuss Post-Modern Frame and annotate examples <p>6.</p> <ul style="list-style-type: none"> – Place the work of Hokusai, Sharp and Onus into cultural context; time and place. – Describe the differences in each artists work and how their culture has been depicted in their work <p>7b. Assignment: Written explanation of ‘Found @ the beach’ sculpture. Title the work and write an explanation of artmaking practice. Describe the reaction of a selection of three people to the work.</p> <p>8. In VAPD, write evaluative comments for each page.</p>

The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit



Katsushika Hokusai, *The Great Wave Off Kanagawa* (1831)

Colour woodcut (25.4 cm x 37.1 cm)



Lin Onus, *Michael and I are just slipping down to the pub for a minute* (1992)
Gouache on illustration board (38 x 50 cm)



Martin Sharpe, *Wave* (1991)
Acrylic on canvas (90 x 90 cm)

The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit

Student examples of 2D extended work appropriating Hokusai's *The Great Wave*. Reference program *Splash*



The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit

Student examples of 2D extended work appropriating Hokusai's *The Great Wave*. Reference program *Splash*



The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit

Student examples of 2D extended work appropriating Hokusai's *The Great Wave*. Reference program *Splash*



The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit

Student examples of 2D extended work appropriating Hokusai's *The Great Wave*. Reference program *Splash*



The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit

Relief sculpture using recycled objects *Found @ the Beach.*



The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit

The Post-Modern Frame – Appropriation

A single artwork can have many different meanings. It can be seen from many different points of view. One way of viewing and understanding artworks is looking at the work through various 'Frames'...frames of reference. They help give the audience ideas about what the artist was trying to achieve.

The Frames help connect the ideas about the artwork, the artist, the world at the time the artwork was made, and of course the audience.

You will use aspects of the Post-Modern frame to study the artworks of the Japanese artist, Hokusai and Australian artists, Martin Sharpe and Lin Onus.

Post-Modern artists often try to challenge their audiences by using unexpected materials and questioning what art is. They like their audience to question what the world is about and what is accepted as art. Post-Modern artists use appropriation and re-contextualised images and ideas in their works, changing the context and the meaning.

Look closely at the works by:

- Japanese artist, Katsushika Hokusai
- Australian artist, Martin Sharpe
- Indigenous Australian artist, Lin Onus

In your VAPD:

- Paste a copy of each artwork.
- Underline the title of each artwork.
- Circle the date each artwork was completed.
- Annotate each artwork with arrows to indicate three changes that have been made by Sharpe and Onus in their appropriations of Hokusai's artwork. (e.g. The curling froth at the top of the waves)
- Formulate a table that explains the change in context/possible meaning of each of the three annotations.(eg 1. The pointed froth at the top of wave in Hokusai's print is drawn with sharp angles, similar to hands approaching the fisherman. Sharpe has changed the menacing style of this huge wave into a more comic, fun filled wave, suggestive of a cartoon.)
- Write a paragraph which demonstrates your understanding of how appropriation has been used by the artists Martin Sharpe and Lin Onus.
- In your writing make use of the following wordbank:

reworked	symbols	repositioned
shapes	composition	idea
lines	borrowed	changes
appropriated	concept	used



Beach sculpture Spurn Point Sculpture of welder made from flotsam and jetsam on beach. Source: http://commons.wikimedia.org/wiki/File:Beach_sculpture_Spurn_Point_-_geograph.org.uk_-_484378.jpg

Year 8 Homework Assignment

'Found @ the beach' – found object relief sculpture

- As part of your 'Splash' unit of work, you are to complete an assignment at home that takes the form of a relief sculpture.
- You will also document your artmaking practice on A4 paper, which will later be glued into your VAPD.

Materials:

3mm craftwood/mdf type of board. 30cm x 30cm
Wood/craft glue or other means of securing objects to a board.
Found objects.
Lots of imagination

Concept (your ideas)

You will need to gather non-living natural or man-made objects to use as the materials for making the relief on your board.

Compose (arrange) the objects in an abstract way to make the audience re-discover the patterns and textures that could be observed on a visit to the beach.

Try to stick to a theme. For example if you choose to use man-made materials, they could be coloured pieces of plastic, bottle lids or even parts of things to cover the board, (parklands, kiosks and picnic areas near the beach are all good sources of materials)

The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit

WARNING. WARNING.

- Do not collect anything that is living or has been a living object, or contains any living creature. (shells containing creatures, green seaweed etc). We do not want to harm any creatures or end up with smelly artworks.
- Be aware of the environment, do not damage or harm it in anyway

A: Artmaking Practice

To be able to hang your work for assessment, think how you will be able to achieve this before you begin.

It might be that you drill two holes into the board near the top corners before you begin, or when you've completed your artwork and thread these with some wire or string.

To create high and low relief on your board, you will need to attach/glue on materials of differing thicknesses, or create layers of materials to build up differing thicknesses. You can cut up objects into different shapes and sizes, twist, twirl, scrunch and flatten things to create interesting texture, shapes and patterns.

Aim to cover the entire board surface.

You may use paint over your sculpture, but this is OPTIONAL.

Bring your work in ready to hang and make sure all the objects are securely fastened to the board.

B: Documentation of your Artmaking Practice

Using A4 paper (to be pasted into your VAPD, so don't write on both sides), document the following, preferably presented typed:

Conceptual Development (your ideas):

1. Describe your composition as if you were explaining it to someone who doesn't understand what it is about. Include a diagram of the design.

2. Where did you get the inspiration for your composition from?
3. Describe the particular focus you had when you were forming your ideas, (eg. Capturing the circular patterns the foam makes as it washes onto the sand)

Material Practice

4. Describe the materials you used and why you chose them for your composition.
5. Explain how/where you collected the materials, (including the 30 x 30 cm board)
6. List the procedure you used to compose the objects and then how you attached them to the board. What difficulties were encountered, and how were they overcome?
7. Explain why you chose to paint or not paint your relief sculpture.

Resolution:

8. Write a title for your work which gives the audience some clue to what it was you were trying to express in your artwork. Explain why you chose this title.
9. Does your work look well finished (resolved) and have an interesting appearance? Why/why not?
10. What could you have done to improve your work?
11. Ask three people (audience) for a verbal 'critique' on your work. Record their reactions and opinions.

Assessment:

In this assessment task you will be assessed on the following Visual Art outcomes:

- 4.2 Explores the function of and relationships between the artist-artwork-world-audience
- 4.5 Investigates ways to develop meaning in their artworks
- 4.8 Explores the function of and relationships between artist-artwork-world-audience



Flotsam and jetsam on a beach. Source: Wikimedia Commons

The Post Modern Frame – Splash: A Stage 4 Visual Arts Unit

Assessment Criteria – Artmaking	Mark Range
Relief sculpture is resolved and presented in a professional and creative way. There is demonstrated, accomplished technical and creative skill. Tasks/skills have been thoughtfully explored.	A 17–20
Relief sculpture is becoming resolved and is adequate for the time frame. Technical accomplishment and creative skills are developing. Reasonable evidence of task/skills being explored.	B 13–16
Relief sculpture is partially resolved, limited technical and creative accomplishment. Some evidence of exploration of task/skill.	C 9–12
Relief sculpture is unresolved, with some technical and creative skills evident. Little evidence of exploration of task/skill exploration.	D 5–8
Relief sculpture is unfinished with little or no technical or creative skills evident. Minimal evidence of task/skill exploration.	E 1–4

Assessment Criteria – Critical and Historical Studies	Mark Range
Documentation of artmaking practice is resolved and presented in a professional way. Relevant aspects of the task are comprehensively explored. Points of view are logical and thoroughly reasoned.	A 17–20
Documentation of artmaking practice is completed and well presented. Relevant aspects of the task are mostly explored. Points of view are logical and well reasoned.	B 13–16
Documentation of artmaking practice is unevenly resolved and presented Aspects of the task are approached in a superficial way. Points of view are obvious, with little explanation.	C 9–12
Documentation of artmaking practice is unresolved. Little evidence of task exploration.	D 5–8
Documentation of artmaking practice is unfinished. Minimal evidence of task exploration.	E 1–4



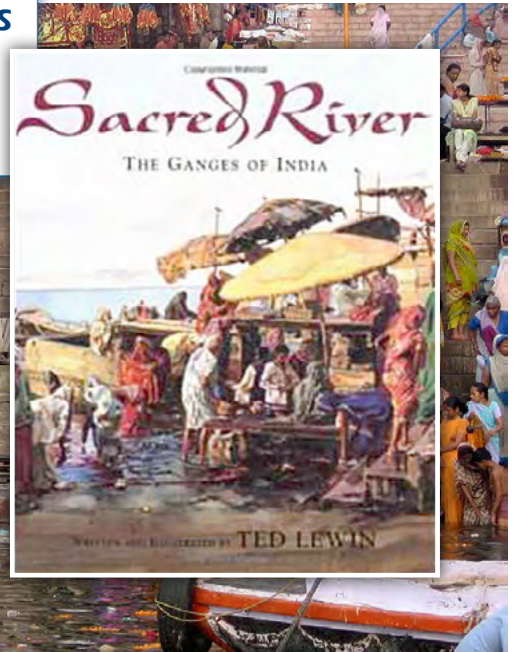
Flotsam and jetsam on a beach. Source: Wikimedia Commons



Global Education – Learning Emphases

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

Responding to text, including picture books and novels



A Stage 3 resource by Julie O 'Keeffe based on the book *Sacred River* by Ted Lewin

- Introduce students to this book by opening it wide so both front and back covers can be seen all together. Encourage students to think about where this river might be, what the people are doing, who the people could be, and possible names of the river.
- Discuss student understanding of the word 'sacred'. Share examples of places they have visited that are regarded as sacred. What was it about the place that made it sacred?
- Talk about how a river could be sacred.
- Open to the inside of the book and observe the map of India and the route of the Ganges River. Use an atlas for more detailed location of the Himalayas and the Bay of Bengal. Introduce geographical terminology such as delta and source when talking about the beginning and end of the river.
- Cover the written text on each page. Show students each page of the book, initially allowing them to see only the illustrations. Talk about and record their impressions of life along the river. What are people doing? What happens at different times of the day? Who is at the river? What kinds of buildings can be seen along the river?
- Comment on the illustrations, and the story they tell about people and the river.
- Allocate a page of the book to pairs or small groups of students to write their own text to go with the story told in the illustration. Re-read the book with students reading their text to go with the illustrations.
- Reveal and read Ted Lewin's text. Talk about his story of the river. Compare his story with the students' stories.
- Locate the metaphors and similes. Look at the illustrations and comment on their relationship to the text.
- Write the metaphors and similes onto individual cards. Discuss the effect they have on the reader and talk about why Ted Lewin has used so many in this story.
- Draw your own illustrations for one metaphor and one simile.



Ganges River boatman, Varanasi, India. Photo: J. Curtis

Responding to text, including picture books and novels

- Identify the adjectives, verbs and adverbs in the text. Talk about how they contribute to the mood created on the river
- Take on the role of the boatman. Develop a sequence of dialogue that could describe his experiences of a day on the river.
- Vocabulary — find the meanings of the following words, either from the text or from a dictionary: pilgrim, ghats, maharaja, pyre, monsoon, purify, offerings, minaret, gunwales, sari, submerge, cremation, faithful, salvation, pilgrimage.
- After studying the text and the illustrations, students talk about what they think the river means to the people who visit it.
- When students have shared their impressions and understandings about the Ganges, read the factual text at the beginning of the book. Use this factual information to complement student views.
- Discuss — ‘The Ganges fell from Heaven, and her fall was softened by the long locks of the god Shiva’.
- Link this thought with the idea of sacred.
- Talk about rivers students have visited in Australia. Compare the views of the river and the uses of

the rivers. Record the differences and similarities by creating artworks using pastels or water colour paints.

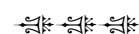
- Look at artworks representing rivers. Compare with Ted Lewin’s images of the Ganges. Google search images using the words ‘the Ganges River at Varanasi’.

- YouTube videos of the Ganges:

Ganges River, India by Vinh Nguyen –
https://www.youtube.com/watch?v=DYx3FUujRqY&feature=player_detailpage&x-yt-ts=1422579428&x-yt-cl=85114404

River of Faith: A film about the Kumbh Mela 2013 by Namit Arora –
https://www.youtube.com/watch?v=cQNoimABjMQ&x-yt-ts=1422579428&feature=player_detailpage&x-yt-cl=85114404#t=7

Note: Teachers need to be aware that some video clips available on YouTube may contain images of corpses.



Sacred River by Ted Lewin. Clarion Books.
ISBN 0-395-69846-4



Saris drying on the ghat, Varanasi, India. 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

WATER SCARCE INDIA

Is irrigation the answer?

**A Stage 4 Geography resource
by Dr Susan Bliss**

WATER SCARCE INDIA – is irrigation the answer?

Australian Curriculum: Content Descriptions

Year 7 Unit 1: The nature of water scarcity and ways of overcoming it (ACHGK040)

Year 7 Unit 2: The influence of accessibility to services and facilities (e.g. irrigation) on the liveability of places (ACHGK044)

Year 9 Unit 1: Challenges to food production, including shortage of fresh water (ACHGK063)

Year 10 Unit 1: The human-induced environmental changes that challenge sustainability (ACHGK070) e.g. over-irrigation leading to water logging, salinity and declining groundwater levels

Year 10 Unit 2: The reasons for and consequences of spatial variations in human wellbeing on a regional scale within India (ACHGK079) e.g. scarcity of water and the availability of irrigation impacts on human wellbeing.

Irrigation refers to the application of water to the land from rivers, canals, reservoirs, ponds, tanks and wells in order to grow crops or pastures for cattle. Agriculture accounts for 70% of water withdrawn from rivers and aquifers, and irrigated crops are up to 2.5 times more productive compared to rain-fed agriculture. Approximately 68% of the world's irrigated area is located in Asia with large areas located along the Ganges, Indus and Yangtze Rivers. In developing countries irrigation increases crop yields between 100% and 400%.

Approximately 60% of cultivated land in India is dependent on monsoon rains in summer which consists of heavy rain over a long period of time. Precipitation is concentrated over a few summer months and is unevenly distributed across the country.

In the 16th century, Man Sagar Lake (Jaipur, Rajasthan) was created by the constructing of a dam across the Darbhawati River. The goal of the construction was to store water to overcome frequent droughts resulting in famine. Today approximately 90% of precipitation falls in the monsoon summer which contributes to the lake's water storage. At the outlet of the dam, canals provide irrigation to farms.

Figure 1: Jal Mahal or 'Water Palace' is located in the Man Sagar Lake (S. Bliss)



OVERDEPENDENCE ON UNRELIABLE MONSOON CLIMATE

The Indian Monsoon or **Indian Summer Monsoon Rainfall (ISMR)** is Earth's most productive wet season. **When the monsoon rains bring little precipitation, gross domestic product (GDP) falls by 2-3%.**

This results in a decline in agriculture causing India to import food and as a consequence sends global food prices spiralling upwards. It is imperative India improves its capacity to store and transport water to feed 9.7 billion people by 2050 such as more effective irrigation projects as well as the 'National Monsoon Mission' aimed to develop a dynamic climate model to better forecast future weather patterns.

India's average precipitation is only 1000mmpa and is not distributed uniformly across the country. For example the arid region of Rajasthan receives less than 250mmpa of precipitation necessitating the use of irrigation to grow crops. As precipitation is highly variable over time and place it has led to droughts resulting in crop failure and famine. In some Indian regions lack of adequate precipitation tends to occur about every 6 years leading to crop failure and exodus of people.

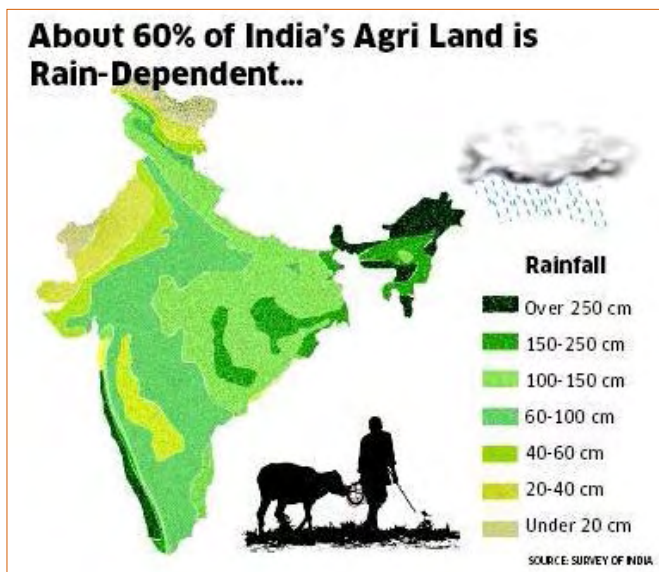
Since the 1970s Green Revolution **high yielding varieties (HYV)** of rice and wheat requires large quantities of water as well as fertilisers and pesticides. This caused a drain on above the ground (e.g. rivers) and below the ground (groundwater) water sources. However over-exploitation of groundwater resulted in a decline in the water level, seawater intruding into coastal aquifers and drying up of shallow wells.

The Punjab (as western state) currently receives 550 mmpa of precipitation but requires about 1,500 mmpa of rain to grow rice and wheat. It makes up the water deficit through irrigation and groundwater. Many advocate that this is unsustainable as rice should be grown in the more rain abundant areas.

WATER SCARCE INDIA – is irrigation the answer?



Figure 2 and Figure3: Dependence on precipitation to grow crops



Rainfall distribution in India .Source: <http://economictimes.indiatimes.com/opinion/special-report/how-to-solve-the-problems-of-indias-rain-dependent-agricultural-land/articleshow/8845170.cms>



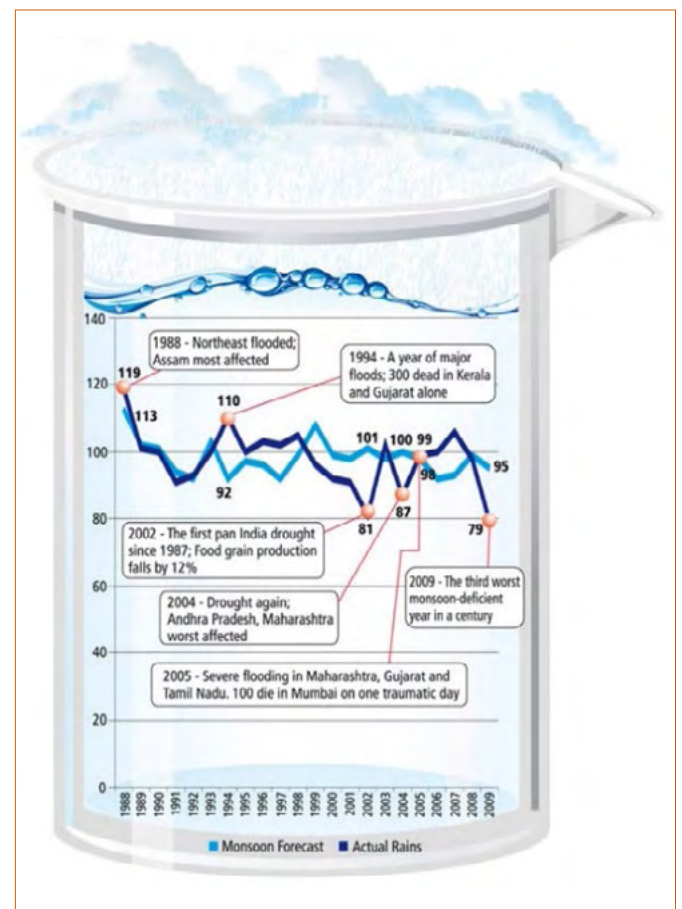
Names of Indian states Source: <http://www.geocurrents.info/place/southeast-asia/new-maps-of-india-and-of-the-indian-economy>

Figure 4: Dependence on the monsoon – advance of the monsoon in 2014



Source: http://static.financialexpress.com/pic/uploadedImages/bigImages/B_Id_472970.jpg

Figure 5: Relationship between monsoons and actual precipitation



Source: <http://valueofdissent.wordpress.com/2012/04/28/when-india-sneezes-the-worlds-agricultural-markets-catch-a-cold/>

* Remember convert cm to mm of rainfall

WATER SCARCE INDIA – is irrigation the answer?

Indian Ocean Dipole (IOD)

The **Indian Ocean Dipole (IOD)** also known as the Indian Nino determines the quantity of precipitation received across India. The IOD is the changing sea-surface temperatures (SSTs) from the west to east of the Indian Ocean. The IOD varies:

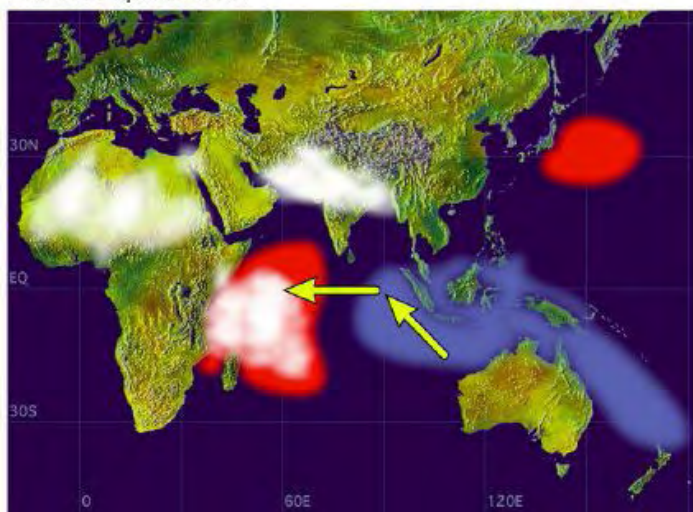
- **Positive IOD:** the western Indian Ocean becomes warmer (red colour on map) and the rain from the monsoon increases over India.

- **Negative IOD:** the western Indian Ocean becomes cooler (blue colour on map) and rain from the monsoon decreases over India.
- **Neutral IOD:** means the SSTs in the west and east Indian Ocean are the same and this causes average to normal monsoon in India.

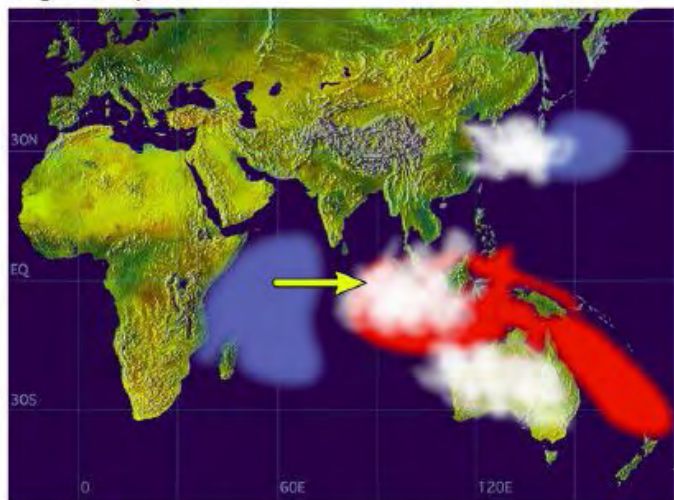
Recent studies shows that the IOD has a more significant effect on precipitation patterns in south-east Australia than the El Niño-Southern Oscillation (ENSO) in the Pacific Ocean.

Figure 6: Indian Ocean Dipole phases - positive and negative

Positive Dipole Mode



Negative Dipole Mode



Source: <http://valueofdissent.wordpress.com/2012/04/28/when-india-sneezes-the-worlds-agricultural-markets-catch-a-cold/>

Figure 7: Why does India needs irrigation?

Inland water resources are unevenly distributed across India. The five states – Orissa, Tamil Nadu, Andhra Pradesh, Karnataka and West Bengal, account for more than 50% of inland water bodies

Irregular distribution of precipitation throughout the year – areas experience floods and droughts

Sandy **soils** require more water than clay soils

Crops such as millet and barley generally require less water compared to rabi crops like wheat, sugarcane, cotton and tobacco. Certain crops require larger quantities of water such as high yielding variety (HYV) rice species

- Uncertainty of the **timing** of the monsoon rains
- **Quantity** of rain distributed by Monsoon rains varies at different places across India
- During an **El Nino** less rain brought by the monsoons

El Nino brings droughts to India.
Movement of the **Indian Ocean Dipole**

Photograph: Young boy carrying water across the Thar Desert in Rajasthan (S. Bliss)

WATER SCARCE INDIA – is irrigation the answer?

Udaipur – The Venice of the East

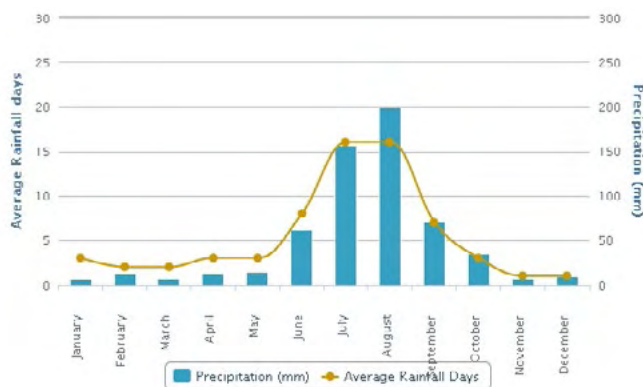
Udaipur is a city in the state of Rajasthan in western India. It is frequently referred to as the 'Venice of the East' as it is located on scenic Lake Pichola. However, the water in the lake disappears during droughts such as in 1998 and 2005 (see photograph).

Lake Pichola was created in 1362 by building dams to provide drinking water and irrigation to the city and the surrounding farm lands. The Sisarma stream contributes to the water in the lake. The stream is a tributary of the Kotra River that flows down from the Aravalli Mountains. Surrounding the lake are palaces, temples, bathing ghats and settlements. The site has become a popular tourist destination.

The lake also suffers from water pollution from a variety of sources such as:

- untreated sewage disposal
- uncontrolled mining contributing to deforestation. This has led to soil erosion and sedimentation of the lake
- dumping of waste
- lack of citizen participation in sustainable management projects

Figure 8: Average precipitation for Udaipur



Source: <http://www.worldweatheronline.com/Udaipur-weather-averages/Rajasthan/IN.aspx>

Figure 9: Photograph: Pichola Lake in Udaipur experiencing a drought (S. Bliss).



Activities:

Knowledge and understanding

- What is meant by irrigation?
- Explain the acronyms: GDP, IOD, ISMR
- Name one advantage and one disadvantage of high yielding varieties of crops
- Describe a monsoon climate
- Discuss the problems of the unreliable arrival of the monsoons on the Indian economy and people.

Inquiry and skills

Refer to Figures 2 and 3:

- List the states receiving more than 2500mm pa
- Name two states receiving under 400mm pa
- Which states require irrigation to grow crops
- Discuss how to solve the problems of India's rain dependent agricultural land

Refer to figure 4:

- Explain the normal movement of the monsoon from Sri Lanka to Rajasthan
- Compare the actual advance of the monsoon in 2014 with the normal (average) on 9-10 June.
- Discuss how variations in the arrival of the monsoon impacts on agriculture and people

Refer to Figure 5: What years did India experience droughts and what were their impacts?

Refer to Figure 7: In groups discuss the reasons for irrigation in India. Present findings as an oral report.

Refer to Figure 8:

- Estimate average annual precipitation
- Describe when most rain falls and the cause.

Figures 9 and 10:

- Discuss the changes to Lake Pichola over time
- List the water issues facing Udaipur

Owing to India's almost entire dependence upon the monsoon rains the country is vulnerable to crop failures, which often deepen into famine. Explain how El Nino and the Indian Ocean Dipole changes monsoons.

Figure 10: Lake Pichola with water



Source: <http://cache.graphicslib.viator.com/graphicslib/thumbs674x446/5353/SITours/sunset-boat-cruise-on-lake-pichola-in-udaipur-with-private-transport-in-udaipur-121619.jpg>

WATER SCARCE INDIA – is irrigation the answer?

IRRIGATION AND AGRICULTURAL PRODUCTIVITY

Irrigation became the main source of water in many Indian states which contributed to:

- an increase in agricultural productivity (e.g. producing one crop a year to two crops a year)
- the expansion of land under cultivation

In India only 48% of cultivated land is irrigated. However this percentage varies across states from the high percentages in Punjab (98%), Haryana (88%) and Uttar Pradesh (76%) to the low percentage in Assam (5%). Irrigation has contributed to a few states like Uttar Pradesh (20%) and Punjab (12%) producing the largest percentages of agricultural production in India. However productivity is not only affected by irrigation but also fertility of soils and skills of farmers.

Figure 11: India – irrigation and agriculture (area production, yields)

Year	Area under Cultivation (million hectares)	Production (million tonnes)	Yield (tonnes per hectare)	Area under Irrigation (% of total area under cultivation)
2000–01	121	196	1.6	43.4
2005–06	121	208	1.7	45.5
2010–11	125	241	1.9	48.3

Source: <http://www.indiaspend.com/sectors/how-up-beats-maharashtra-gujarat-in-agriculture-productivity>



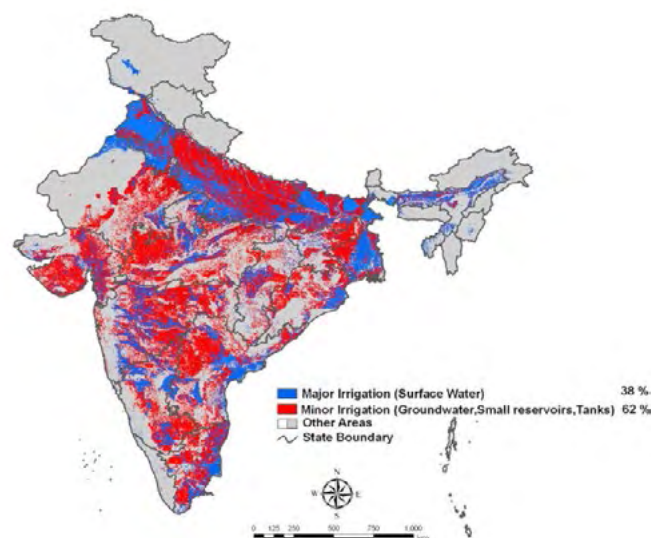
Irrigation canal, Canaldoddaghatta, India. Source: Wikimedia Commons

Figure 12: State Irrigation Coverage and Productivity

State	Agricultural Production (million tonnes)	Percent of cultivated area under irrigation
Punjab	27.3	98.1
Haryana	15.6	87.6
Uttar Pradesh	46.7	75.9
Andhra Pradesh	20.4	63.9
Bihar	12.2	63.4
Tamil Nadu	7.1	63.1
West Bengal	16.3	48.2
Gujarat	6.4	44.7
Madhya Pradesh	13.9	44.5
Uttarakhand	1.7	42.9
Orissa	7.4	33.6
Karnataka	11.2	28.5
Chhattisgarh	5.1	27.6
Rajasthan	16.6	26.4
Maharashtra	11.4	16.8
Jharkhand	1.7	5.4
Assam	4.1	4.9
Other States	6.3	NA
All India	234.4	48.3

Source: http://en.wikipedia.org/wiki/Irrigation_in_India

Figure 13: Irrigated areas of India based on International Water Management Institute's Global Irrigated Areas Map at 500m resolution (IWMI GIAM 500-m).



Source: <http://www.iwmi.org/info/GMI-DOC/GIAM-India-Stats.pdf>, page 15

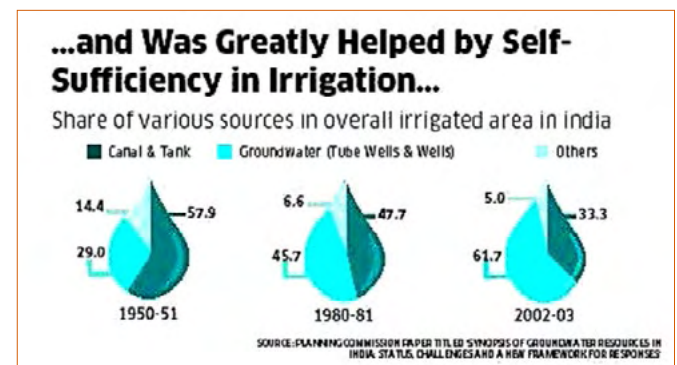
WATER SCARCE INDIA – is irrigation the answer?

Types of irrigation systems in India

Irrigation projects in India are classified into minor, medium and major schemes. These projects vary according to landforms, population demands and costs.

Up until the 1960s canals were the major source of irrigation but by the 1970s wells and tube wells became the most popular. Canals are more popular where there is low relief and deep fertile soils and less popular where it is difficult to dig such as in rocky and uneven landforms. In Uttar Pradesh and in Rajasthan canals constitute an important source of irrigation. They account for about 28% of irrigated area in Rajasthan.

Figure 14: Irrigation sources 1950-2003



Source: <http://economictimes.indiatimes.com/opinion/special-report/how-to-solve-the-problems-of-indias-rain-dependent-agricultural-land/articleshow/8845170.cms?curpg=3>

Figure 15: Types of irrigation practiced across India

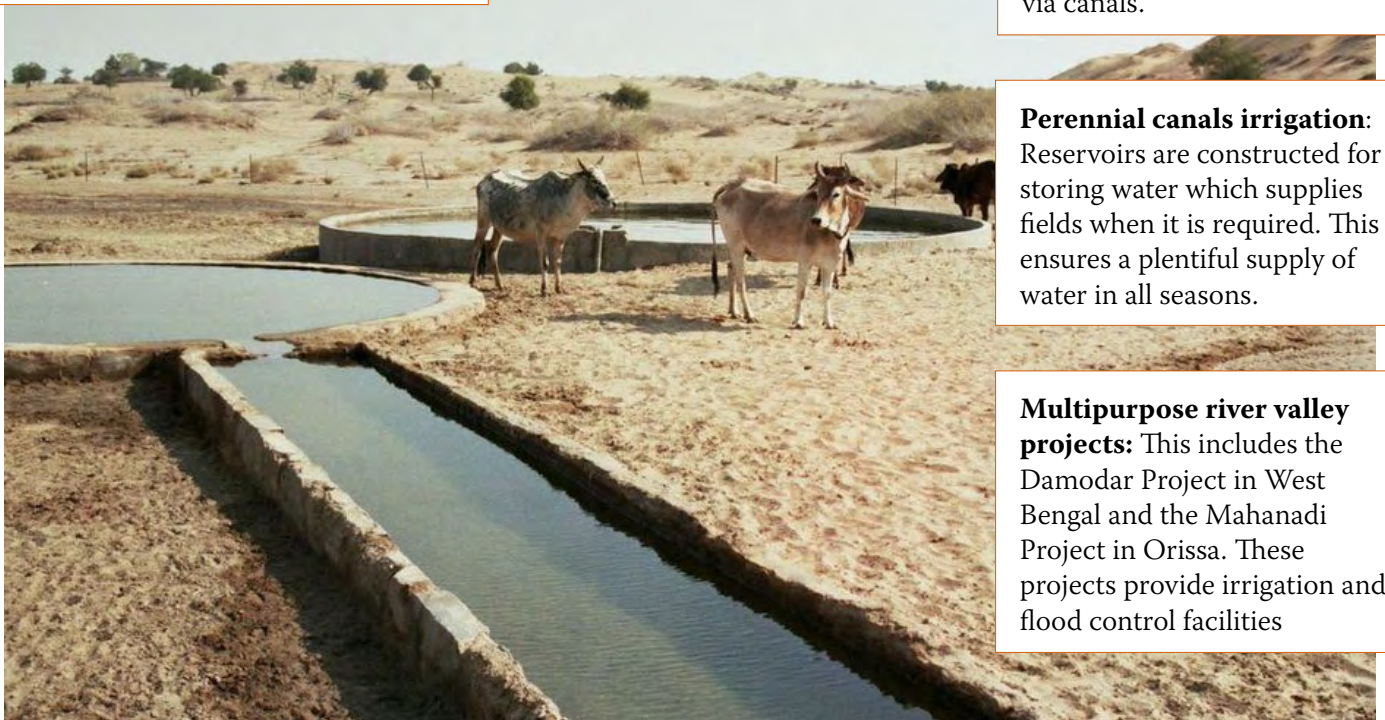
Well water irrigation: This includes shallow, deep, tube and artesian wells. Wells are mainly found in Uttar Pradesh, Bihar and Tamil Nadu.

Tank water irrigation: Mainly found in northern India where water is carried from the tanks via canals to the fields

Inundation irrigation: Supplies water to fields when a river is flooded. The flood water is carried to the field via canals.

Perennial canals irrigation: Reservoirs are constructed for storing water which supplies fields when it is required. This ensures a plentiful supply of water in all seasons.

Multipurpose river valley projects: This includes the Damodar Project in West Bengal and the Mahanadi Project in Orissa. These projects provide irrigation and flood control facilities

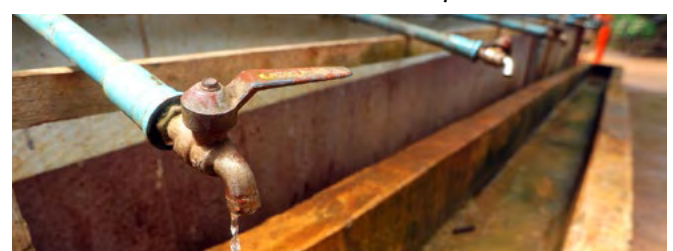


Photograph: Irrigation for cattle in Rajasthan (S. Bliss)

Canals have been built in many Indian states, such as Andhra Pradesh, Punjab, Tamil Nadu, Uttar Pradesh and Rajasthan. The **Indira Gandhi Canal** is one of the biggest canal projects in India. In northwest Rajasthan the Canal provides irrigation to agriculture and drinking water to communities. As a result the human wellbeing of the inhabitants living in this dry environment has improved.

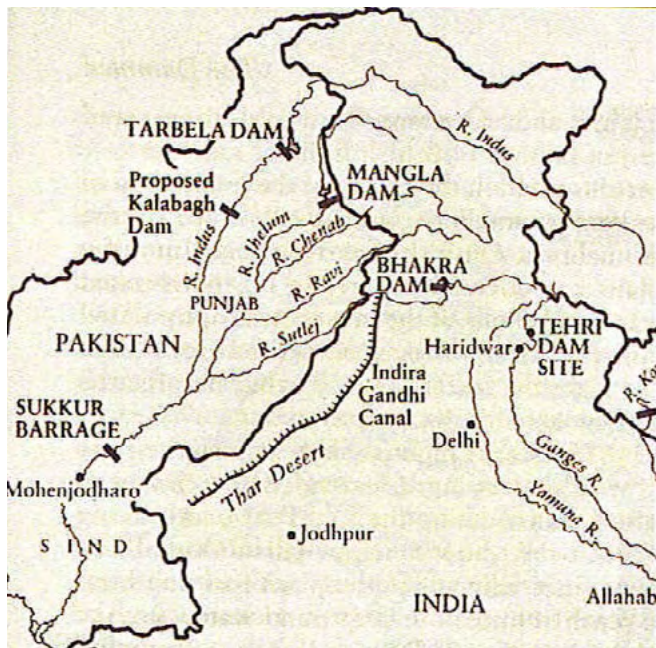
Irrigation has contributed to revegetating the Thar Desert and as a result reduced **desertification** in

some areas. On the negative side excessive irrigation has caused soils to become water logged. A rise in the water table has increased soil salinity.



WATER SCARCE INDIA – is irrigation the answer?

Figure 16a and 16b: Indira Gandhi canal map and photograph



Map of canal. Source: <http://setyourenvironment.blogspot.com.au/2012/09/indira-gandhi-canal.html>



Photograph of Indira Gandhi canal. Source: <http://setyourenvironment.blogspot.com.au/2012/09/indira-gandhi-canal.html>

Salinity from over-irrigation

Salinity is the presence of salt in the land's surface in rocks, or soil or dissolved in river or groundwater. There are one billion hectares of salt affected soil across 100 countries around the world. The world is losing over 3 acres of fertile land every minute due to salinity. Approximately 50% of the irrigated land in the semi-arid and arid regions of the world suffers some type of soil salinity. Salinity is pronounced in arid-semi-arid regions in India.

There are two main types of salinity – dryland salinity and irrigation salinity. **Irrigation salinity** occurs

when excessive water from irrigation causes the groundwater table to rise, bringing salts to the top layer of soils where crops get nutrients. This leads to stunted or dead plants. When the surface water evaporates, the land becomes encrusted with salt and leaves unproductive agricultural land.

Salinisation of soils, surface water and groundwater creates economic and social problems for rural and urban communities.. Salinity leads to a decline in biodiversity, damage to infrastructure and the loss of productive farming land.

Preventing and reversing salinity is an expensive and slow process. There are many techniques used to reverse the impacts of salinity such as:

- preventing the loss of native vegetation
- constructing sub-surface drainage systems
- user-pays systems for irrigation water
- planting salt tolerant, deep rooted plants
- banning the construction of dams in salinity prone areas.

Figure 17: Heavily salted soils in India compared to other countries

Heavily salted	
Salinity affects as much as one-quarter of the irrigated land in some countries:	
Country	Percentage salinated
Mexico	10
India	11
Pakistan	21
China	23
United states	28

Source: <http://www.fao.org/docrep/u8480e/u8480e0c.htm>

Figure 18: Salinity in Rajasthan (S. Bliss)



WATER SCARCE INDIA – is irrigation the answer?

Figure 19: Formation of saline soils from over-irrigation



Source: <http://www.fao.org/docrep/u8480e/u8480e0c.htm>

Activities:

Knowledge and understanding

- What are the advantages of irrigation?
- List the different types of irrigation systems in India
- Inquiry and skills.
- Discuss how India has the potential to increase water available for irrigation

Inquiry and skills

Refer to Figures 11 and 12:

- Describe the changes to the area under irrigation and its impacts on agricultural production and yields
- List the agricultural production and percentage of cultivated area under irrigation for Uttar Pradesh, Punjab, Rajasthan and Assam.

Refer to Figure 13: Where are most major irrigation projects from surface water located?

Refer to Figure 14: Explain the changes of irrigation from canals from 1950 to 2002

Refer to Figure 15: In groups discuss the different types of irrigation systems used across India. Include electronic photographs

Refer to Figure 16: Describe the Indira Gandhi Canal and its benefits to Indian people living in Rajasthan

Refer to Figures 17, 18 and 18:

- What are the causes of salinity?
- What are the impacts of salinity?
- How does over-irrigation contribute to salinity?
- Suggest strategies to reduce impacts of salinity in water and soils.

The United Nations defines desertification as a process of *'land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.'*

In India inappropriate irrigation, overgrazing, deforestation, population pressure, and poverty have contributed to desertification. If desertification is not stopped it is anticipated global food yields will decline, leading to starvation, malnutrition and potential famine Research desertification in India and how irrigation has contributed to its growth as well as its decline. Present as an oral report. <http://www.agriculturesnetwork.org/magazines/india> – Combating Desertification Dec 20, 2012; <http://indiatoday.intoday.in/story/desertification-affects-quarter-of-indias-land/1/367345.html>; http://www.moef.nic.in/sites/default/files/desert_atlas.pdf

RAINWATER HARVESTING

Rainwater harvesting is the accumulation of rainwater for reuse before it infiltrates into the ground or runs off into rivers. The harvested water is used as drinking water for people and animals and used for irrigation.

In Tamil Nadu rainwater harvesting is compulsory to avoid ground water depletion and in Rajasthan rainwater harvesting has traditionally been practiced by people living in the Thar Desert.

India's ground water authority wants households to adopt rooftop, rainwater harvesting systems, but the effort has done little to thwart the water crisis in the capital, Delhi.

Figure 20: Rainwater harvesting



Source: <http://www.aljazeera.com/indepth/inpictures/2014/08/india-delhi-water-crisis-2014829115521403974.html>

WATER SCARCE INDIA – is irrigation the answer?

There are a variety of water harvesting techniques used by Indians such as:

- | | |
|------------------|------------------|
| 1. Paar | 9. Bundela Tank |
| 2. Talab/Bandhis | 10. Kunds/Kundis |
| 3. Saza Kuva | 11. Kuis/Beris |
| 4. Johad | 12. Baoris/Bers |
| 5. Pat | 13. Jhalaras |
| 6. Naada/Bandha | 14. Nadis |
| 7. Rapat | 15. Tobas |
| 8. Chandela Tank | |

Figure 21: Paar system

Rainwater flows from the catchment and in the process percolates into the sandy soil. In order to access the percolated water kuis or beris are dug in the storage area.



Source: <http://www.rainwaterharvesting.org/Rural/traditional1.htm>

Figure 22: Talab /Bandhis are reservoirs

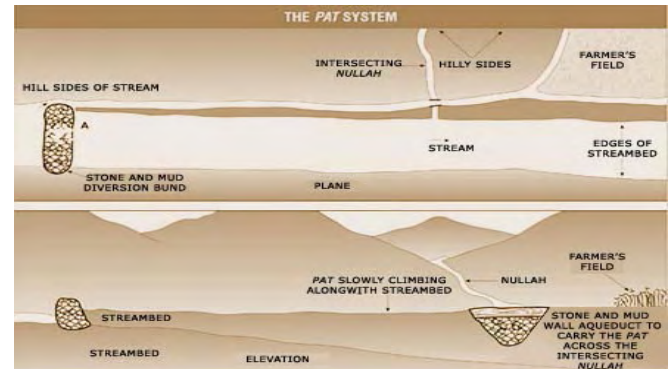
They may be natural, such as the ponds at Tikamgarh in the Bundelkhand region or man-made, such the lakes in Udaipur. When the water in these reservoirs dries up just a few days after the monsoon, the pond beds are cultivated



Source: <http://www.rainwaterharvesting.org/Rural/traditional1.htm>

Figure 23: Pat

Bhitada village, Jhabua district of Madhya Pradesh divert water from swift-flowing hill streams into irrigation channels called pats.



Source: <http://www.rainwaterharvesting.org/Rural/traditional1.htm>

Figure 24: Kunds / Kundis

A kund or kundi looks like an upturned cup nestling in a saucer. These structures harvest rainwater for drinking, and dot the sandier tracts of the Thar Desert in western Rajasthan and some areas in Gujarat.



Source: <http://www.rainwaterharvesting.org/Rural/traditional1.htm>

Surangam's in India

In Kasarago there are about 500 surangams. *Unlike the Qanat, the surangam is a horizontal flowing well. Qanat is a vertical well with tunnel at its bottom designed on the basis of simple law of gravity. While the distance of Qanat is counted in miles, the surangams are 3 to 300 mts only. Where the access shafts are made for digging of the tunnel the vertical shafts are made for facilitating air circulation inside the surangam. While Qanat diggers are a class by themselves surangam is only a handicraft of some thrifty intelligent farmers to find water for their family as well as their field. Qanats are excavated in desert environment unlike surangam. An experienced digger of wells can easily dig a horizontal well. In Indian forests the tribal people are seen extracting water from*

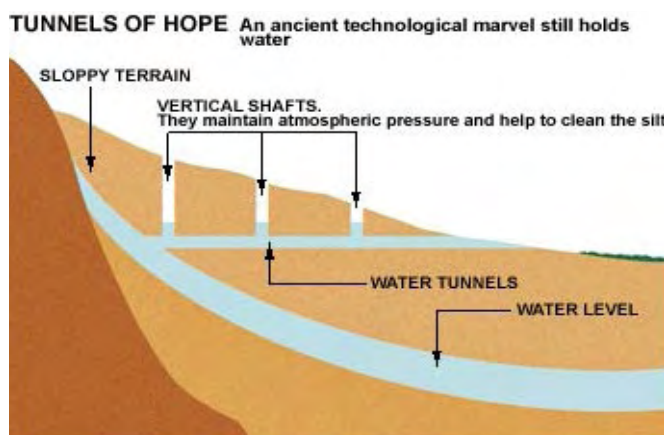
WATER SCARCE INDIA – is irrigation the answer?

the aquifers with the help of short bamboos. Hollow bamboo is inserted on the tube- like structure made out by piercing a strong stick. Only these fundamental principles are applied in Surangam.

Source: <http://www.boloji.com/index.cfm?md=Content&sd=Articles&ArticleID=8956#sthash.mpmCHecR.dpuf>

Figure 25: Underground irrigation channels to use the scarce groundwater for irrigation.

System still exists in Kerala and in few districts in Madhya Pradesh. In Kerala's Kasargod district there are around 400 karez, known as surangams



Source: <http://www.indiaenvironmentportal.org.in/files/images/20020531/30.jpg>

Figure 26. Inside a surangam



Source: <http://www.boloji.com/articlephotosvankarannair/a8956-2.png>

AGRICULTURE IN RAJASTHAN REQUIRES IRRIGATION

Rajasthan covers 342,000 km² of land which makes it the largest state in India. The state experiences an arid climate receiving only 250mm of precipitation. Most rain falls during the summer monsoons (July, August).

Approximately 23% of the Rajasthan economy is produced by the agricultural sector. The Narmada River in the south, Punjab Rivers in the north, and Agra Canals from Haryana and Uttar Pradesh provide water to Rajasthan. North-west Rajasthan is irrigated by the Indira Gandhi Canal.

‘The total cultivated area of the state encompasses about 20 million hectares and out of this only 20% of the land is irrigated. Ground water level is available only at a depth of 30 to 61m. Rajasthan farmers have to depend on different sources of irrigation that include tube wells, wells and tanks.

The regions that are highly irrigated or receive abundant water supply are utilized for the cultivation of improved high-yielding varieties of rice.

Some places of Rajasthan that has black soil nurture the growth of major cash crops like Cotton. In some regions Tobacco is also grown.

Apart from this crops an assortment of fruits and vegetables are also grown in Rajasthan in the local gardens and some fertile regions. These fruits include Oranges, Guavas, Lemon, Pomegranates and Mangoes.

Rajasthan soil is also suited for the growth of some spice plants, especially red, hot chillies. These chillies give Rajasthan its distinct flavour.

Source: <http://www.mapsofindia.com/maps/rajasthan/rajasthanagriculture.htm>

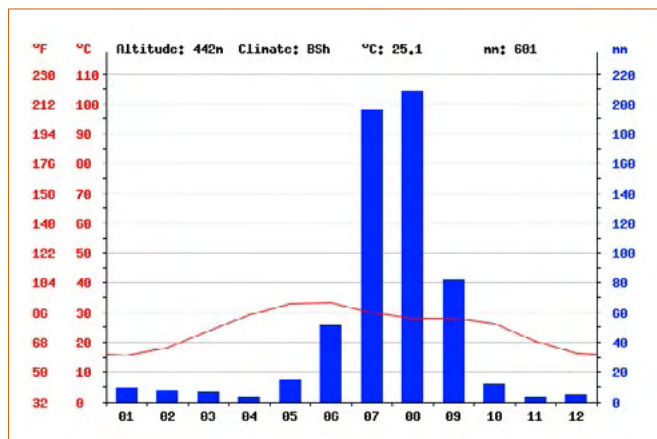
Figure 27a: Map of climate zones across India



Source: http://www.viajaporindia.com/imagenes/en_consejos/clima-india.gif

WATER SCARCE INDIA – is irrigation the answer?

Figure 27b: Climate graph of Jaipur



Source: <http://images.climate-data.org/location/3888/climate-graph.png>

Figure 28: Wells supply irrigation in Rajasthan (S. Bliss)



Figure 29: Water pumps used for collecting drinking water in Rajasthan (S. Bliss)



Figure 30: Agriculture in Rajasthan dependent on irrigation



Source: <http://www.mapsofindia.com/maps/rajasthan/rajasthanagriculture.htm>

Irrigation potential

In 2014 only 97 million hectares was under irrigation which the government aims to increase by 10% to reduce the farmers' reliance on the monsoon.

In order for agriculture to grow at the targeted rate of 4% per year there needs to be:

- an increase in the area of irrigated land
- growing crops that require minimal water or have adapted to drought conditions
- creation of water-storage facilities such as dams and reservoirs
- recycling and reusing waste water for industrial uses
- ensuring efficiency in the management of water use in irrigation such as drip irrigation
- adoption of the latest technologies such as desalination in coastal areas
- solar powered micro irrigation systems (saves greenhouse gases and water)
- contour farming, mulching and mixed cropping and terracing steep slopes

Agriculture may become more resilient to changes in precipitation because of the extra area under irrigation but the monsoon will continue to play a major role in supporting farmers' income and replenishing reservoirs.

WATER SCARCE INDIA – is irrigation the answer?

Construction of infrastructure

The construction of dams and irrigation canals as well as rainwater harvesting has contributed to an increase in agricultural area and productivity as well as controlling floods and preventing the impacts of droughts from variations in monsoons, impacts of El Nino..

Today there are conflicts between water for irrigation and water for environmental needs. For example in the Krishna Basin in India the environmental flows are frequently insufficient to supply basic water needs. Sugar cane required irrigation from groundwater. If sugarcane is irrigated for biofuel there will be an increase in withdrawal of water from rivers, this will result in environmental degradation and less water for essential food crops.

The future requires improvements in the distribution and management of water sources and recycling of wastewater

Figure 31: El Nino may occur in 2015 in India



Source: <http://m.financialexpress.com/news/el-nino-may-impact-india-sfy-2015-gdp-inflation-reports/1244532>

Geoinfo

Without irrigation your choice of food would be restricted as irrigation contributes to 40% of global food production.

Activities:

Knowledge and understanding

- What is rainwater harvesting?
- In groups refer to the list of 15 rain harvesting techniques. Research two of these techniques not included in Figures 21–24. Present as an oral report with an electronic photograph illustrating how it operates.

Inquiry and skills

Refer to Figures 21-24: Compare two different types of water harvesting techniques.

Refer to Figures 25-26: Discuss how a surangam operates and its advantages to local communities

Refer to Figure 27a and 27b:

- What is the climate zone of Rajasthan
- Describe the precipitation pattern of Jaipur
- Refer to Figure 30:
- What types of crops can be grown in arid Rajasthan with the aid of irrigation.
- How does irrigation impact on human wellbeing?

Discuss how India could increase agricultural production by reducing its reliance on the monsoon. Suggest strategies to improve available water for people and their crops. Present findings using Web 2.0 tools.

India's ability to sustainably manage its water resources will determine future economic growth and human wellbeing. Discuss this statement.

Geolinks

Dams in India –

http://en.wikipedia.org/wiki/Category:Dams_in_India

Canals in India –

http://en.wikipedia.org/wiki/Category:Canals_in_India

Reservoirs in India –

http://en.wikipedia.org/wiki/Category:Reservoirs_in_India

Irrigation in Andhra Pradesh – http://en.wikipedia.org/wiki/Category:Irrigation_in_Andhra_Pradesh

Irrigation in Telangana – http://en.wikipedia.org/wiki/Category:Irrigation_in_Telangana

Sacred tanks – http://www.cpreecenviis.nic.in/Database/Sacred_waterbodies_928.aspx

Irrigation garden, Kerala, India –

http://www.globalwaterforum.org/wp-content/uploads/2012/07/1-IMG_0084.jpg

List of major irrigation projects in India –

<http://appscmaterial.blogspot.com.au/2010/06/major-irrigation-projects-in-india.html>

Global map of irrigated areas – http://www.uni-frankfurt.de/45217825/poster_gmia_v4_lowres.pdf

Using technology locate the Indira Gandhi canal – <http://mapcarta.com/14885172>

YouTube:

Ancient methods of irrigation in India –

<http://www.youtube.com/watch?v=YRHBz4gWstg>

Solar water pumps and drip irrigation technology, Rajasthan – http://www.youtube.com/watch?v=tb3Bzn_8arA

India: The impact of intensified irrigation –

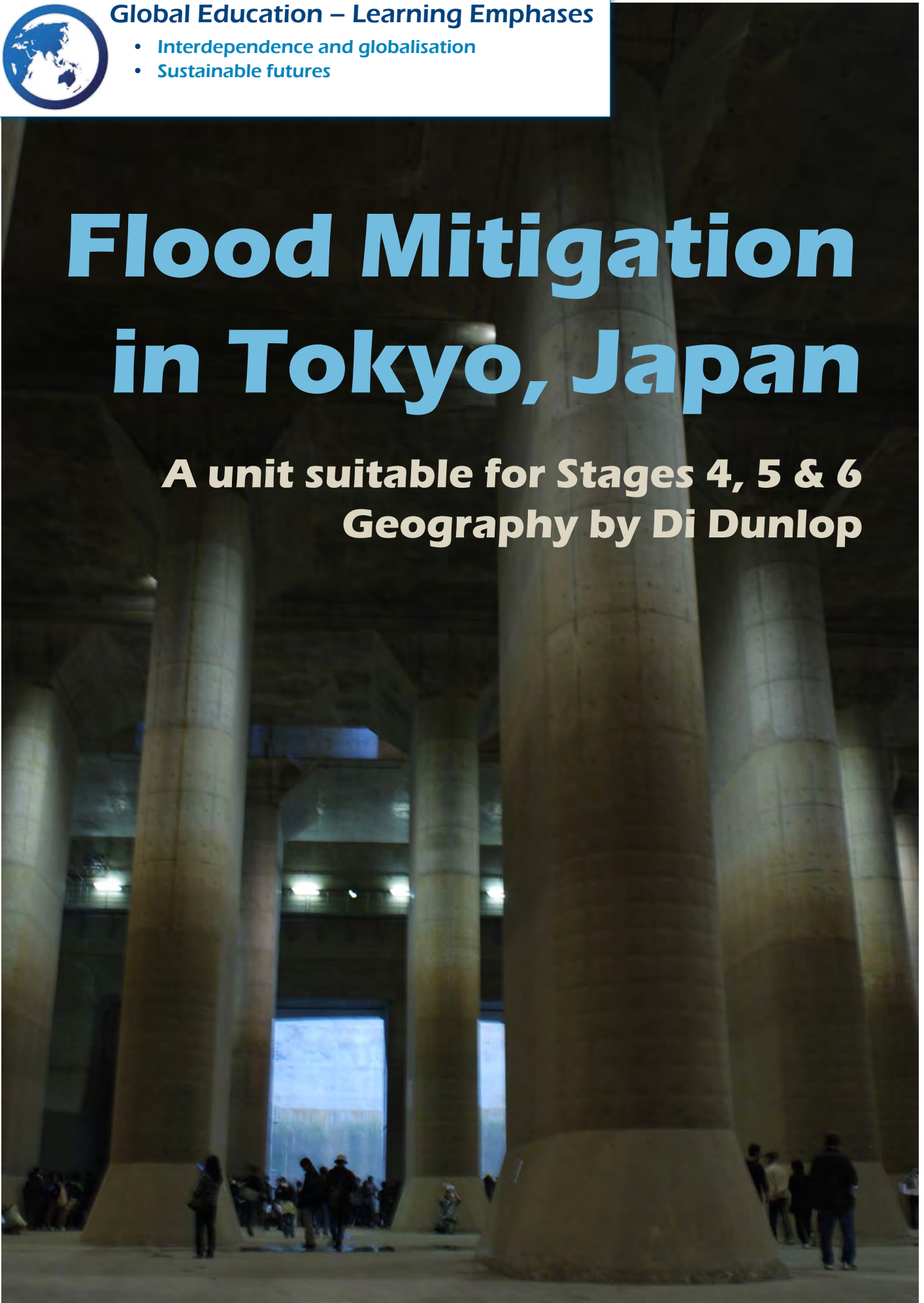
<http://www.youtube.com/watch?v=w619cpXEAH4>



- Interdependence and globalisation
- Sustainable futures

Flood Mitigation in Tokyo, Japan

**A unit suitable for Stages 4, 5 & 6
Geography by Di Dunlop**



The cathedral-like Tokyo metropolitan area underground flood discharge tunnel, excursion 2008. Source: Wikimedia Commons

Flood Mitigation in Tokyo, Japan

.This unit is a result of a programme on the ABC 'Catalyst' – <http://www.abc.net.au/catalyst/stories/4112766.htm>

Tokyo is Japan's capital city and is home to some 35 million people[The Greater Tokyo Area], this is 28% of the total population of Japan. The Region is located on an alluvial floodplain with Tokyo Bay on one side[1.5 .million Tokyo residents live below sea level]. There are eight major rivers that flow through the Tokyo Basin including the Sumida River: the whole area is prone to flooding.

Flooding is a major concern for many reasons:

- four season weather cycle which includes typhoons,
- frequency of earthquakes which can trigger tsunamis,
- change in rainfall patterns are due to climate change[total precipitation is decreasing, but the amount falling at any one time is increasing],
- rising sea level is an issue for such low-lying land,
- 'heat island' effect of the vast Tokyo urban area,
- increasing temperatures,
- increased frequency of droughts,
- water table is decreasing and causing land subsidence, and
- water use is expected to increase.

Japan has a long history of managing river diversions and flooding. Tokugawa Ieyasu [the Shogun who united Japan in 1600] ordered river diversions including one to the ocean instead of flowing through Tokyo[it took three generations to complete it, it was finished by his grandson, Iemitsu.]

In 1947, Typhoon Kathleen devastated parts of Tokyo when the Tonegawa broke its banks [31,000 homes were destroyed and 1,100 people died]. During the 1950's and 1960's there were heavy typhoons and wet



Typhoon Kathleen, 1947 at Koiwa. Source: Wikimedia Commons



A worker points to the wall of a section of the Furukawa reservoir project being built in central Tokyo on 7 Aug 2014. When completed in 2016, the 3.3-km-long subterranean reservoir will be able to hold 135,000 cu. meters of water, enough to fill 54 Olympic-size swimming pools. Source: Japan Times (http://www.japantimes.co.jp/life/2014/08/17/environment/tokyo-combats-flood-threats-second-mammoth-reservoir/#.VNA73SxK_KE)

seasons that destroyed much of the city. At the same time, huge amounts of groundwater were extracted due to the rapid industrialisation and urbanisation of the Tokyo Region. The area sank between 60 and 70 cms that only increased the fear of flooding. From 1949 onwards, Japan introduced laws to deal with flood control, erosion and emergencies that resulted.

The Tokyo Waterworks has incorporated policies on climate change and the implementation of mitigation measures. They have built solar-powered water filtration plants, hydraulic power stations run by renewable energy sources and reduced leakages from the system.

To cope with the floods and 'guerrilla storms,' the Government has built a coordinated, massive structure under the city. Tokyo is criss-crossed by many canals and rivers and the channel walls are now concrete and each has massive levees on either side. The First Sluice Gate was built in 1924, but much larger ones have now been built to cope with the 50% increase in rainstorms in the last century. These storms can deliver 100mm in an hour [Tokyo's Average Annual Rainfall is 1,530mm.] The discharge from these rivers and canals has doubled in the last one hundred years. Locks have been built to assist in diversion and flood mitigation as there is much less land to absorb the water as a result of urbanisation.

The key to flood mitigation working in Tokyo is the Metropolitan Outer Area Underground Discharge Channel, the largest stormwater-drain in the world. It aims to reduce the damage caused by regular flooding by diverting river overflow by underground tunnels. It took thirteen years to build at a cost of \$3 billion. This engineering wonder is the length of two football fields and breaks the momentum of the water as it flows down from the channels. The Edo River overflows

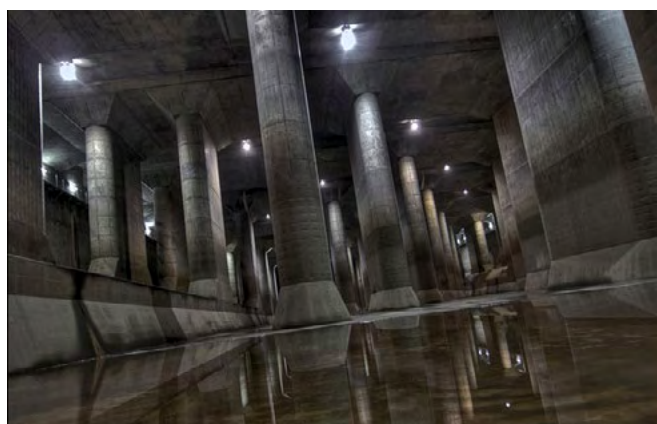
Flood Mitigation in Tokyo, Japan



Nerve center: Tetsuya Shimazu, an official in the Tokyo Metropolitan Government's rivers department, mans the consoles in its emergency operations room. PHOTO: TOMOKO OTAKE, Japan Times (http://www.japantimes.co.jp/life/2011/10/16/general/unseen-fight-to-save-tokyo-from-floods/#.VNA6qixK_KE)

up to twelve times a year [2013]. There are 6.3 km of tunnels underground and connect five watercourses to the main river that overflows into five giant cylinders that create an underground river fifty metres below the city. This system is powered by turbines and the stream flows at 200 cubic metres per second. Since its construction, the flood damage in Tokyo has fallen by 50%. From 2014, Japan intends to spend 1 trillion yen on nation-wide disaster prevention including the strengthening of levees. This massive project was completed in 2009 but the first parts were started in 1920.

A useful source is the Paper delivered by TOSHIYUKI ADACHI [Director of the River Planning Division,



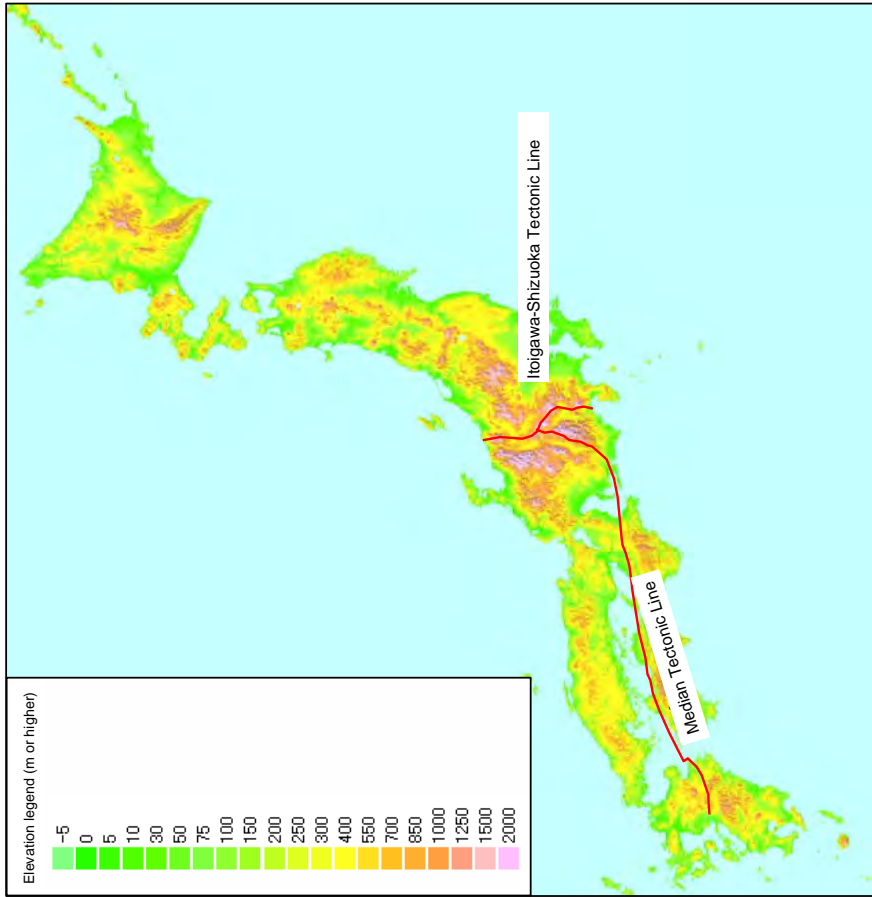
The massive pillars of the Tokyo metropolitan area underground flood discharge tunnel. Source: Wikimedia Commons

River Bureau, Ministry of Land, Infrastructure, Transport and Tourism] at the Fifth U.S-JAPAN Conference on Flood Control and Water Resource Management in June, 2009. (www.mlit.go.jp/river/basic_info/english/pdf/con_090.pdf)

ACTIVITIES

- Find a map of Honshu and mark in Tokyo, Tokyo Bay, Sumida River. Shade in the alluvial plain.
- Explain the following words and terms: levee, alluvial plain, tsunami, heat island, groundwater, typhoon, industrialisation, urbanisation, guerilla storms, flood mitigation, climate change.
- Explain why flooding is an issue for the city of Tokyo.
- Outline the steps that have been taken in the past to deal with the regular flooding.
- Why are these measures no longer sufficient?
- Outline and discuss the reasons for these changes to the environment.
- Research Cyclone Kathleen and describe the changes that were implemented as a result.
- Explain why the Metropolitan Outer Area Underground Discharge Channel was needed.
- What role do levees play in the infrastructure to minimise flood damage.

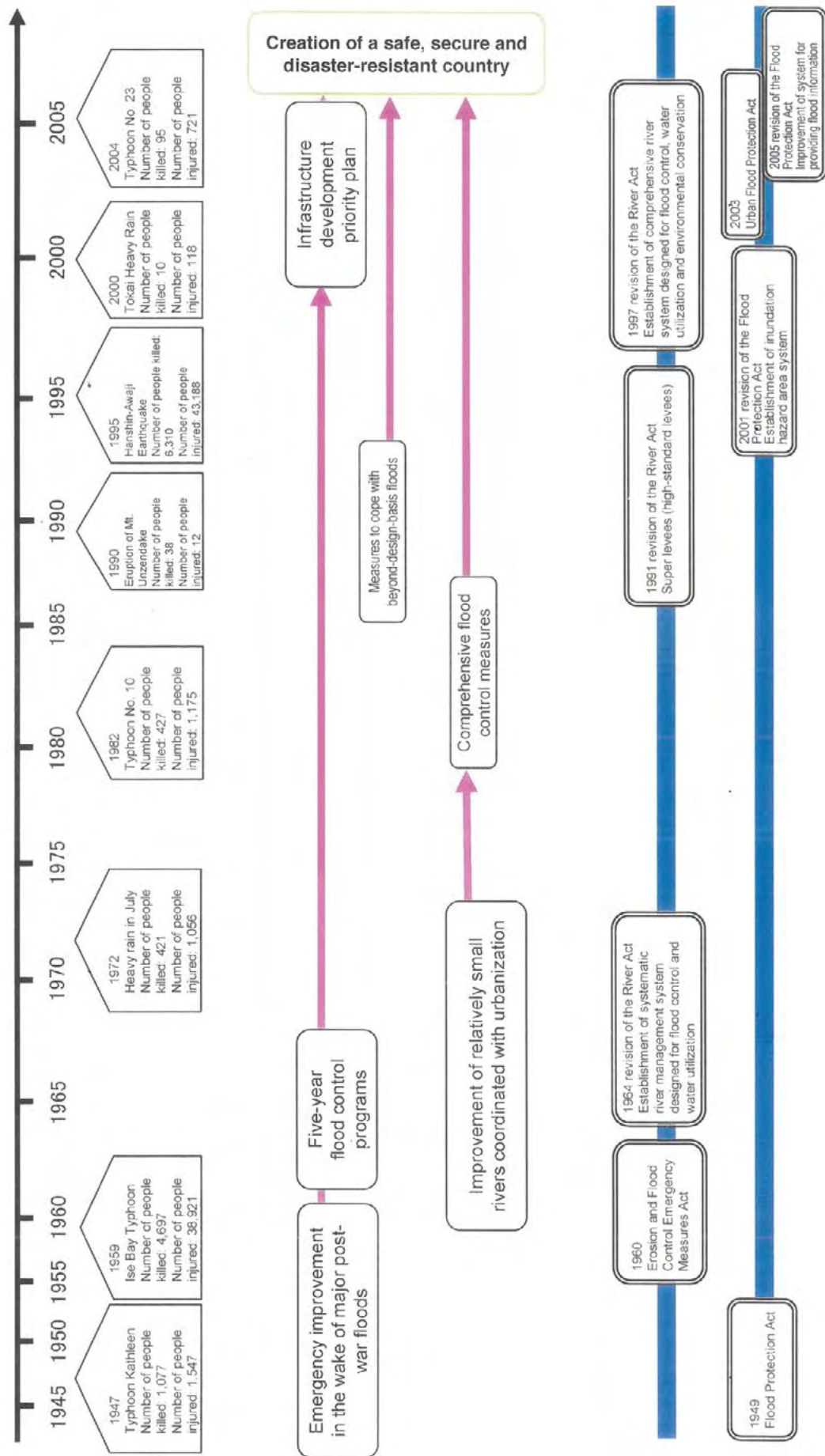
①Topography	Long and slim archipelago about 2,000 km long in the north-south direction
②Four main islands	The four main islands separated by straits, and many smaller islands
③Backbone mountain ranges	Mountain ranges running longitudinally at the center of Japan roughly divides the country into two halves.
④Tectonic lines	The Median Tectonic Line and the Itoigawa-Shizuoka Tectonic Line run north to south across the Honshu island.
⑤Plains	Small plains along the coastlines (about 14% of the total land area)
⑥Soft ground	Most of the large cities in Japan are located on weak ground.
⑦Earthquake	About 10% of all earthquakes in the world occur in or around Japan.
⑧Heavy rain	Rainy weather (mean annual precipitation: 1,714 mm, which is about two times as much as that in the European countries); steep rivers
⑨Snow	About 60% of the country is located in snowy cold regions (annual cumulative snowfall: more than 4 m in many cities).



※ Snowy region: The average of maximum snow depths in February is 50 cm or more.
Cold region: The average of mean temperatures in January is 0°C or lower.

Flood Mitigation in Tokyo, Japan

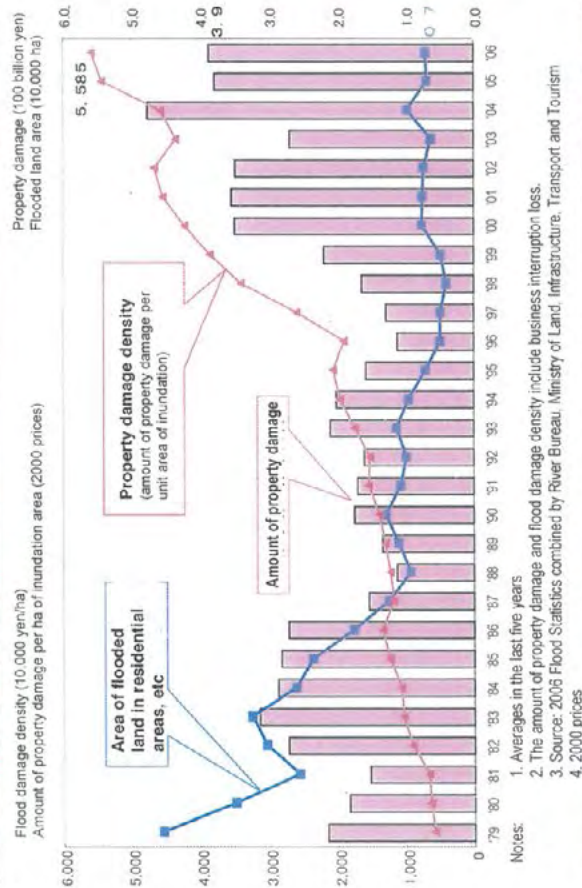
History of river improvement



Characteristics of flood damage in recent years

The area of inundation has decreased, but the amount of flood damage shows an increasing trend.

The amount of flood damage is on the increase.
—Although the area of inundation had been on a slightly increasing trend in recent years, mainly because of the urbanization of flood-prone areas and the increase in flood-vulnerable property, the amount of damage has been showing a tendency to increase.

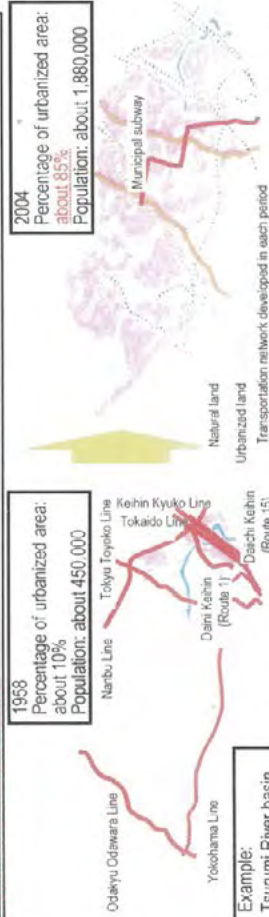


If submerged in water, even if only once, electronic appliances are rendered useless.

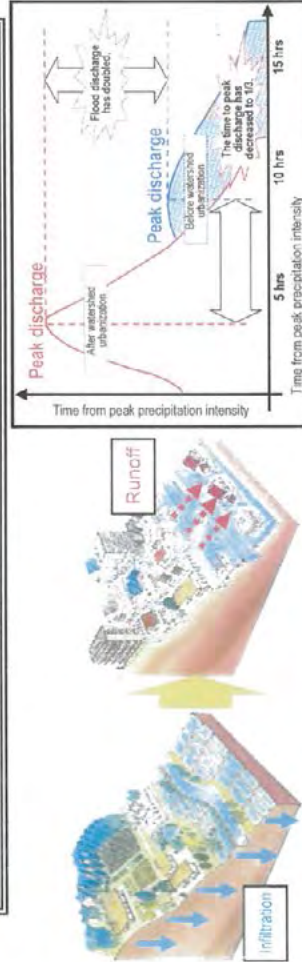
Having absorbed water, insulation materials have become useless.

Watershed urbanization causes flood risk to increase.

As a result of railway and arterial road network construction, which began around 1960, watersheds today are crisscrossed with railways and roads. The resultant urbanization has caused the water retention and detention functions of the watersheds to decline.



As runoff increases, the time to peak runoff decreases.



Increasingly intensive land use (e.g., subways, underground streets) has given rise to new types of inundation damage such as flooding of underground spaces.



Fukuoka municipal subway (July, 2003)



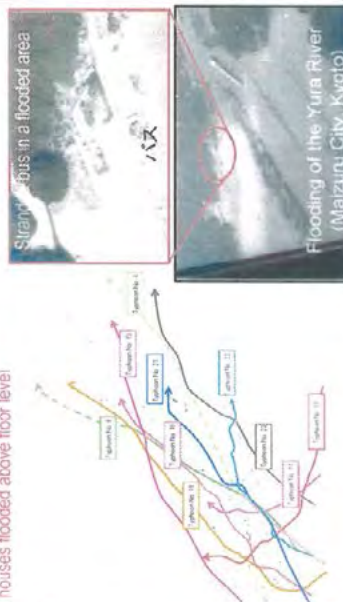
Tokyo Metro's Azabu Juban Station (October, 2004)

Consecutive occurrence of major flood and mass-movement disasters

2004

▶ **Fukui Heavy Rain:** 4 052 houses flooded above floor level, 9 674 houses flooded below floor level, etc

▶ **Typhoon No. 23:** 43 people killed, 13 041 houses flooded above floor level



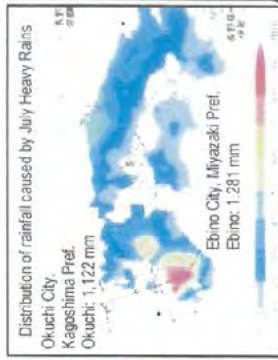
2006

A strong bai-u front in July remained stationary over a large area including the Kyushu and Hokuriku regions, and the heavy rains induced by this front caused floods in many areas.

◆ **July Heavy Rains:** 5 people killed, 899 houses flooded above floor level, 2,674 houses flooded below floor level

Sendai River
(Satsuma-cho Kagoshima)

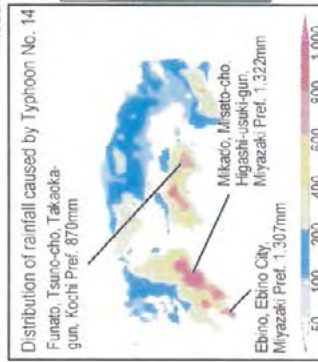
Debris flow in the
Shimodenakama area
(Hishikari-cho, Kagoshima)



Ebino City, Miyazaki Pref.
Ebino: 1,281 mm

2005

◆Typhoon No. 14: Kyushu region: 19 people killed, 3 people missing, 3,950 houses flooded above floor level, 5,085 houses flooded below floor level
Chugoku region: 4 people killed, 1,678 houses flooded above floor level, 2,969 houses flooded below floor level



Distribution of rainfall caused by Typhoon No. 14
Funato, Tsuno-cho, Takaoka-
gun, Kochi Pref. 870mm



Flooding of the Oyodo River
(Miyazaki City, Miyazaki)

2007

The Midori and other rivers flooded to cause tremendous inundation damage in many areas. Two times as much as the monthly average were recorded in many areas.

◆ The Indian and other tribes located to cause tremendous inundation damage in many areas.



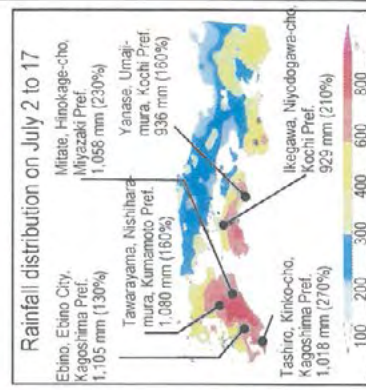
Flooding of the Midori River (Kosa-machi, Kumamoto)



Flood flow in the Midori River
(Kosa-machi, Kumamoto)



Debris flow in the Futagawa area
(Tarumizu City, Kagoshima)



Rainfall distribution on July 2 to 17



Global Education – Learning Emphases

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

SPIRITUALITY OF WATER

INDIAN TEMPLE TANKS

**Year 7 Water in the World –
A Stage 4 Geography resource
by Dr Susan Bliss**

SPIRITUALITY OF WATER: Indian temple tanks

Figure 1: Photograph of World Heritage Stepwell. Rani ki Vav (Queen's Stepwell), Patan, Gujarat



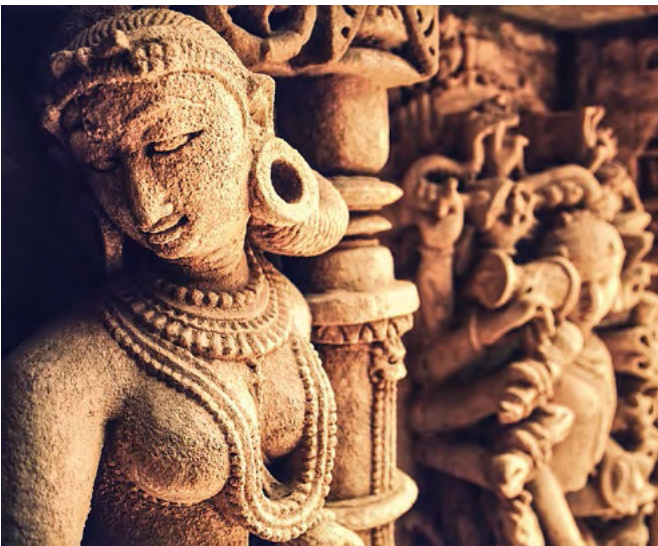
(Samir S. Patel) Source: http://archive.archaeology.org/1105/features/india_gujarat_stepwells_ran_ki_vav.html

Content Descriptions

The economic, cultural, spiritual and aesthetic value of water for people, including peoples of the Asia region (ACHGK041)

Water is central to the lives of people living in India as it provides essential **services** such as irrigation for crops, drinking water, hydro-electricity and transport as well as supports aquatic ecosystems. When meandering rivers drop alluvium on the plains during floods, they produce fertile soils which contributes to an increase in agricultural productivity and extra crops to feed the 1.2 billion people. However these floods cause death, landslides and damage to properties.

In India water not only delivers essential services but also offers important **spiritual** and **cultural** values. As it has the power to create or destroy life, Indian religions and customs have been woven around rivers,



The detailed sculptural reliefs of Rani Ki Vav, Patan, Gujarat.
Source: Wikimedia Commons

lakes, ponds and sacred tanks, especially the purifying and cleansing quality of the Ganges River to the Hindu religion.

'In India, water is given much importance starting from the period of Rigveda...'The Rigvedic called the waters Goddesses as they quenched the thirst of their cattle'.... 'They are mothers, or young wives; they flow in channels to the sea, but they are also celestial. The waters bestow long life, wealth and immortality. They clean and purify the worshipper, even from moral sins such as telling lies, cursing and violence. The Atharva Veda also praises water as a purifier.'

Source: <http://orissa.gov.in/e-magazine/Journal/journalvol1/pdf/orhj-13.pdf>



Surya Kund, Sun Temple, Modhera. Source: Wikimedia Commons

Temple tanks

Water has played a central role in Indian religious rituals and as a result many places of worship have water bodies associated with them. *'The temple tanks are revered no less than the temple itself. Their waters are believed to cleanse all sins. In fact, devotees are required to wash their hands and feet in the temple tank before entering the temple. The waters are also used to perform the daily ritual bath of the temple deity. Annual float festivals are conducted in the tanks, when the idol of the deity is floated around the tank on a decorated raft.'*

Source: [http://ecoheritage.cpreec.org/innerpageof.php?\\$mFJyBfKPkEB](http://ecoheritage.cpreec.org/innerpageof.php?$mFJyBfKPkEB)

SPIRITUALITY OF WATER: Indian temple tanks

The hundreds of tanks across India are used for ritual cleansing and are alleged to contain sacred water from the Ganges River. In southern India most temple tanks are referred to as Shiva Ganga as the temple tanks are purported to be connected to the Ganges River in northern India.

Figure 2: Map showing the distribution of sacred tanks across India



Type and number of sacred water bodies by state

State	Local term for temple tank	No. of tanks listed
Andhra Pradesh	Kalyani , Temple Tank, Pushkairni	13
Arunachal Pradesh	Kund	1
Assam	Pukhuri	5
Bihar	Sarovar, Temple Tank	1
Delhi	Baoli	9
Gujarat	Vav, Vaav, Kund, Sarovar	11
Haryana	Baoli, Holy water bodies, Sarovar	9
Himachal Pradesh	Kund	2
Jharkhand	Sarovar, Holy water bodies	1
Karnataka	Kalyani, Temple Tank	20
Kerala	Temple Tank	24
Madhya Pradesh	Kund	10
Maharashtra	Temple Tank, Kund	68
Manipur	Sacred Ponds	1
Meghalaya	Sacred Tanks, Lake	3
Odisha	Temple Tank, Sarovar	7
Puducherry	Kovil Kulam	1
Punjab	Kund / Sarovar	5
Rajasthan	Baori, Baoli, Baudi, Bawdi	9
Sikkim	Lake	3
Tamil Nadu	Kovil Kulam, Temple Tank	116
Tripura	Sacred Ponds	2
Uttar Pradesh	Kund, Bowli	31
Uttarakhand	Kund	7
West Bengal	Kund	5

Source: http://www.cpreencnis.nic.in/Database/Sacred_waterbodies_928.aspx

Figure 3: Aesthetic and cultural values - Stepwell carvings – Bundi, Rajasthan



Source: <http://design-flute.com/wp-content/uploads/2007/09/venu-salsa11.gif>

World Heritage List- aesthetic, spiritual and cultural values

Temple tanks are found in square, rectangular and stepped designs. A stepwell is a deep well with steps going down to the well's water level. Stepwells have been constructed since the 3rd millennium BC and



Above ground view of the entrance to Rani-ki-Vav (the Queens Stepwell), Patan, Gujarat. Source: Wikimedia Commons

SPIRITUALITY OF WATER: Indian temple tanks

have evolved from a pit in sandy soil to an elaborate multi-storey construction. In Gujarat and Rajasthan, the step wells were decorated with sculptures (**Refer to Figure 3**).

In 2014 the Rani-ki-Vav (the Queen's Stepwell) at Patan, Gujarat (India) **was placed on the World Heritage List**. The Stepwell *'is located on the banks of the Saraswati River and was built as a memorial to a king in the 11th century AD. Designed as an inverted temple highlighting the sanctity of water, it is divided into seven levels of stairs with sculptural panels of high artistic quality; more than 500 principle sculptures and over a thousand minor ones combine religious, mythological and secular imagery. The fourth level is the deepest and leads into a rectangular tank 9.5 metres by 9.4 metres, and to a depth of 23 metres. The well is located at the westernmost end of the property and consists of a shaft, 10 metres in diameter and 30 metres deep'*.

Source: <http://whc.unesco.org/en/list/922/>



Ritual bathing in the Mahamaham tank at Kumbakonam, Tamil Nadu.

Source: Wikimedia Commons

Multi-purposes values

Sacred tanks form an important part of Indian temples. They are generally fed by precipitation and/or groundwater. These temple tanks have inlets which funnel excess precipitation, during the monsoon summer, to runoff into the tanks.

Temple tanks are treated with respect as they provide **service, spiritual** and **cultural** values such as:

- serving the temple's ritual needs – pilgrims bath in the tank to cleanse themselves before going into the temple.
- acting as percolation tanks that recharge groundwater
- reducing runoff and soil erosion
- restricting use of water unless there is a drought
- serving as places for cultural celebrations and social interactions for local people

- maintaining aquatic species. Some sacred tanks support fish, which help sustain the cleanliness of the tank. Fish consume algae which would otherwise turn the water cloudy.
- curing several diseases –some pilgrims dip in these water to cure their diseases

Many of these **aesthetically** beautiful sacred tanks (**Figures 1, 3, 4b**) have become tourist attractions and are **economically** important for local businesses. Every 12 years Hindus take a holy dip in the Mahamaham tank in Kumbakonam in Tamil Nadu. The Brahma Sarovar Tank at Kurukshetra (**Figure 4a**) has annual celebrations with a ceremony of floating lamps on water and the Banganga tank in Mumbai (**Figure 5**) is a popular tourist site.

Aesthetic, cultural and spiritual values of sacred tanks

Some of the tanks are significant either on account of their shape, size, beauty or religious sacredness.

Figure 4a: The Brahma Sarovar Tank at Kurukshetra



Source: http://en.wikipedia.org/wiki/Brahma_Sarovar#mediaviewer/File:BrahmSarovar.jpg

This is one of the holiest tanks in India. It is dedicated to Lord Shiva and is believed that Lord Brahma created the universe from this place.

Figure 4b: The Harmandir Sahib Tank



Source: http://en.wikipedia.org/wiki/Harmandir_Sahib#mediaviewer/File:Golden-Temple-Jan-07.jpg

SPIRITUALITY OF WATER: Indian temple tanks

The **Harmandir Sahib Tank** referred to as the 'Golden Temple', is a prominent Sikh Gurdwara located in the city of Amritsar, Punjab, India.

Decline and deterioration of sacred tanks

Most of the ancient temple tanks are no longer used, some have become structurally unsound while others have become **sinks** for sewage and garbage. Overuse of water extraction has led to many of them drying up, inlets have been blocked by construction activities, and population pressure resulted in some drained and used for other purposes. For example in Bangalore, the Dharmambudhi tank has been drained for the Majestic Bus Station.

The Banganga Tank (Walkeshwar Temple) in Mumbai is threatened by water pollution promoting community clean-up activities each year for the Banganga Festival of Music. This annual activity is organised by the Maharashtra Tourism Development Corporation (MTDC).

Figure 5: Water pollution in the Banganga Tank



Source: <http://www.kemmannu.com/index.php?action=topstory&type=6062>

'The Banganga tank at Walkeshwar temple on Malabar Hill is slowly depleting, resulting in the death of aquatic life as well as birds that frequented the waterbody. This tank, whose water was once considered therapeutic, is currently lying in a state of neglect, surrounded by garbage. Residents of the area have noticed that species like the Mallard duck, black swan, mute swan and tortoise, which had made the tank their home are dwindling in numbers. The older residents believe this is due to sudden reduction in the tank's water level this summer.'

'The water level has mysteriously reduced in the tank. Out of 150 ducks, nearly 50 have died. Some are either eaten by cats or succumb to diseases. We used to call an NGO who would treat the ducks for free,' said Yogendra Prabhu, a resident.

' Source: <http://timesofindia.indiatimes.com/city/mumbai/Depleting-Banganga-killing-aquatic-life/articleshow/8593788.cms>

Geofacts

- Stagnant waters include kundas, ponds, lakes, well, tanks and pits.
- Many of India's stepwells were abandoned when the English declared them unsanitary. Recently some have been restored.
- Water collected from seven rivers (Ganga, Yamuna, Godavari, Saraswati, Narmada, Sindhu and Kaveri) are placed in a ritualistic pot, then used during worship.

Activities

Knowledge and understanding

1. Water is the servant and master of humans. Explain this statement.
2. Describe the **spiritual** and **cultural** values of temple tanks in India.
3. Discuss the multi-purposes of sacred tanks in India.
4. Describe the **aesthetic** value of sacred tanks
5. Explain why many of the sacred tanks are declining in importance and are structurally deteriorating. Suggest strategies to reduce this trend.
6. What are the economic, service, sink and spiritual values of sacred tanks? Present answer in a three column table.

Inquiry and skills

7. Refer to **Figure 1**: Photograph called the Queen's Stepwell in Gujarat. Explain why this stepwell was listed as a World Heritage Cultural Site in 2014. Research how this special cultural site will be sustainably managed as an oral report.
8. Refer to **Figure 2**:
 - Which state has the largest number of sacred temple tanks?
 - Where are most temple tanks located? – north or south India?
9. Refer to **Figure 4**. Using technology design an annotated collage of ten water tanks. Describe their location and significance.
10. Refer to **Figure 5**: In groups research the Banganga Tank (Walkeshwar Temple) in Mumbai and present an essay on '*Heritage in a Concrete Jungle*'. Include its spiritual significance, environmental threats and clean-up activities. Include annotated photographs.

SPIRITUALITY OF WATER: Indian temple tanks

Geolinks

- Concept and origin of sacred tanks – <http://orissa.gov.in/e-magazine/Journal/journalvol11/pdf/orhj-13.pdf>
- Slideshow of the Islamic Stepwells of Gujarat, India – http://archive.archaeology.org/1105/web/india_slideshow.html
- World Heritage site – Rani-ki-Vav (the Queen's Stepwell) at Patan, Gujarat (India) – <http://whc.unesco.org/en/news/1157>; <http://whc.unesco.org/en/list/922>
- Banganga Tank (Walkeshwar Temple) – http://en.wikipedia.org/wiki/Banganga_Tank; http://en.wikipedia.org/wiki/Walkeshwar_Temple; http://goindia.about.com/od/mumbai/ss/Mumbai-Architecture_19.htm;

- <http://www.mumbaimania.in/2008/08/banganga-tank-heritage-in-concrete.html>;
- <http://www.ixigo.com/banganga-tank-mumbai-india-ne-1314120>;
- <http://www.kemmannu.com/index.php?action=topstory&type=6062>;
- http://www.newworldencyclopedia.org/entry/Banganga_Tank
- Cultural and spiritual value of rivers in Indian context – <http://archive.riversymposium.com/index.php?element=B2B+SWARUP.pdf>

YouTube

The Banganga Tank, a sacred place for the Hindus – <https://www.youtube.com/watch?v=TPtzMeqZ1So>
“Err-bane” Truth – Dharmambudhi Tank – <https://www.youtube.com/watch?v=f5zKPovja5I>



The striking geometric design of Chand Baori, Abhaneri, India. 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

THE INDIAN OCEAN TSUNAMI IN SRI LANKA

**A Stage 4 & 5 Geography Unit
by Di Dunlop**

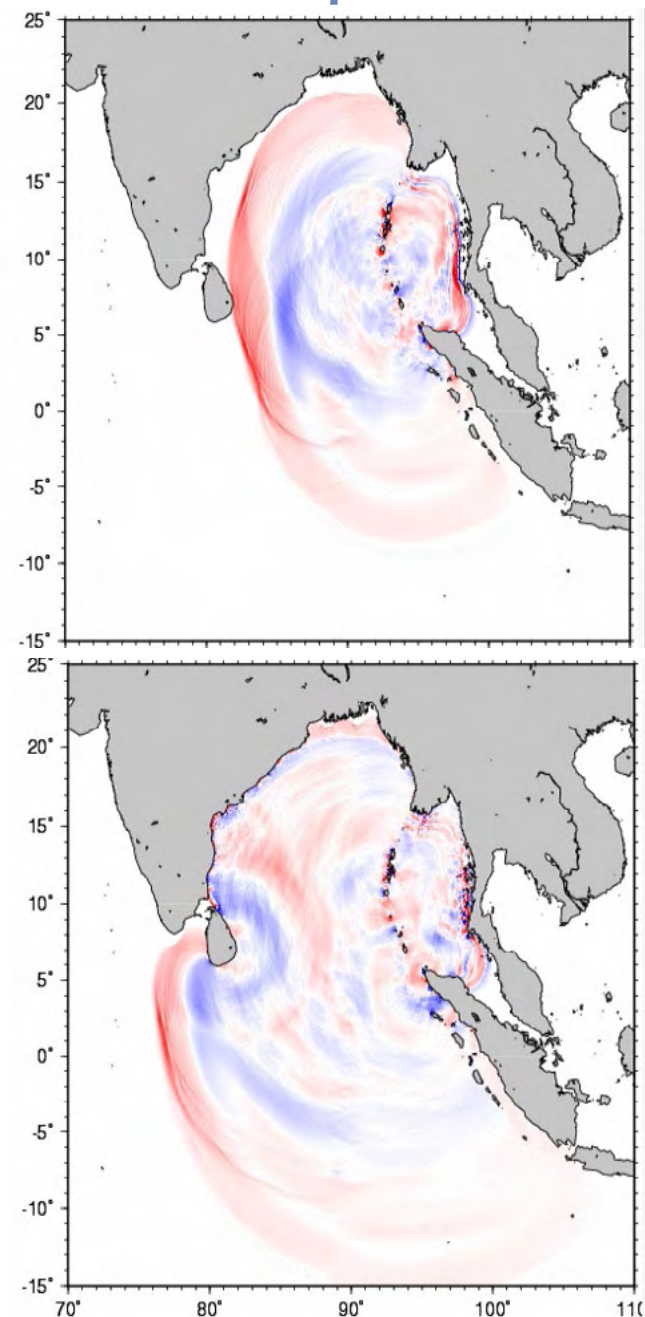
EDITOR'S NOTE: It is now ten years since the Indian Ocean Tsunami struck Indonesia, Thailand, India, The Maldives and Sri Lanka. I visited Sri Lanka eighteen months after the tragedy and the devastation was still evident. Along the Southern coast, it seemed that the only thing that withstood the impact of the waves was the coconut palms that were able to bend with the waves. Thousands of buildings were destroyed with only their concrete foundations remaining. The pale blue UN tents stood where whole villages had been washed away. This is a case study of the destructive nature of WATER.

The Indian Ocean Tsunami in Sri Lanka

On 26th December, 2004, a massive earthquake, magnitude 9 struck the island of Sumatra in Indonesia. The violent movement of the Earth's tectonic plates displaced an enormous amount of water sending powerful shock waves in all directions. It was the largest magnitude earthquake in forty years and had the energy of 10,000 Hiroshima type bombs.

A TSUNAMI resulted from this massive quake and it affected lives and property as far away as Africa. The tsunami wrapped itself around the western coast of Sri Lanka at an estimated speed of 900 kph. All parts of the Indian Ocean were affected within eight hours. The power of the tsunami was so great in the north that it broke through the peninsula at Jaffna and Mannar.

2004 Tsunami impact zones



Source: <http://www.tsunami2004.net/tsunami-2004-maps/>

Resources:

Excellent website: Tsunami2004.net

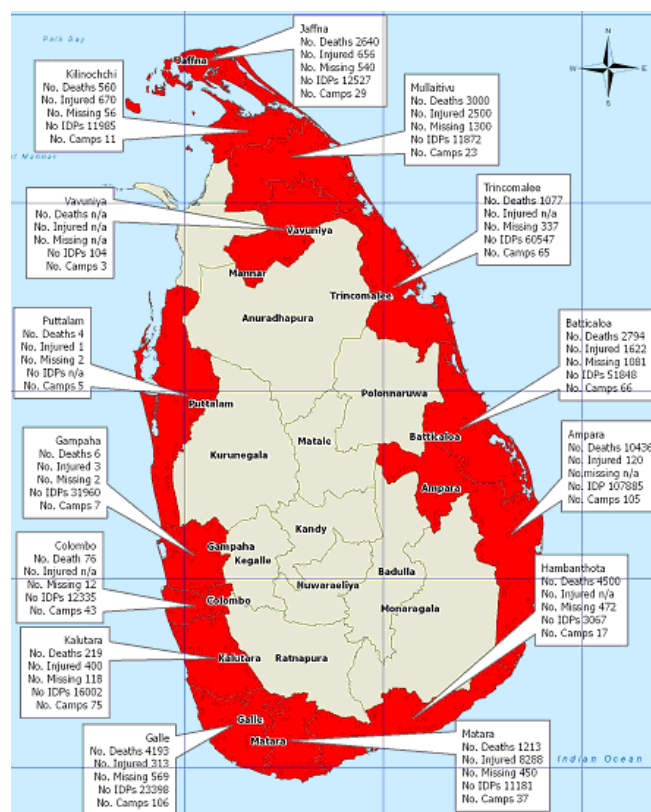
Documentary: "Tsunami, the Day the Wave Struck." National Geographic, 2005 on The Discovery Channel.

Excellent website: dea.org.au – Doctors for the environment in Australia...A Personal Story.

The death toll was up to 37,000 in Sri Lanka alone, 27,000 were fishermen. The coastal areas suffered the greatest damage especially where there had been extensive forest clearing. Massive damage to infrastructure occurred affecting roads and railways. [2,500 km of roads and railways were damaged.] On the west coast a train was pushed off the tracks and 1500 train passengers died. Whole villages were destroyed along with businesses, shops and schools. Nearly 100,000 homes were destroyed affecting 150,000 people. Sixty two thousand wells were destroyed leaving hundreds of thousands of people without fresh drinking water.

Massive damage occurred to the natural habitat including mangroves and coral reefs as well as salt intrusion and siltation. Coastal sand dunes and mangroves helped to save many areas as the mangroves helped to diffuse the force of the waves.

Map: Affected areas of Sri Lanka



Source: http://practicalaction.org/south_asia_tsunami_impact

The Indian Ocean Tsunami in Sri Lanka



Holland House of Hope. Source: weeshuissrilanka.nl

The Aftermath of the Tsunami in Sri Lanka

Cultural practices in Sri Lanka played a significant role in how the people dealt with the tragedy. It was reported that within 24 hours every survivor had food and shelter of some kind[compare this with Hurricane Katrina in New Orleans].

Thousands of children were made orphans and many areas commenced orphanage projects almost immediately. In the town of Habaraduwa, 12km S.E. of Galle the “Holland House of Hope” was set up by some interested Dutch travellers; the land was donated by a local hotel owner and temporary buildings were ready four weeks after the tragedy. All of the construction work was initially done voluntarily by young students on holidays. This facility is now an integral part of the village and its life. Go to the website – weeshuissrilanka.nl

The annual report has all the information you need to see the work being done.

Another remarkable story surrounding the aftermath of the Tsunami is about the British brothers who are now building more orphanages in Sri Lanka. They were in fact orphaned by the Tsunami while travelling with their parents in Sri Lanka.



See www.gandysflipflops.com/orphans-for-orphans and <http://www.telegraph.co.uk/news/earth/environment/9843925/Orphans-of-the-2004-Asian-tsunami.html>

A Post Tsunami Housing Project was set up to build and restore some of the 70,000 homes that were damaged. It aimed to promote the use of cost-effective environmentally friendly technologies and adopt participatory and inclusive planning and design. Such technologies included energy efficient brick kilns, filler slab technology and clay tile roofing. During the project, 1000 construction tradesmen were trained and 175 houses were built.

Plans to resettle whole communities further inland were often very unpopular as many were as much as ten kilometres inland from the coast [for fishermen this was a problem as transport is inadequate]. The Government issued an edict for a no-build ‘buffer zone’ along the coast and there was little available land along the coast for such reconstruction. There was a need to assess the impact of rapid changes to habitats and avoid settlements in environmentally sensitive areas



Tsunami housing project, Galle Sri Lanka. Source: www.gmsl.lk

Experts pressed for ‘natural barrier protection’ such as sand dune stabilization, wetland management and mangrove renewal and the need for the use of the “Precautionary Principle”.

The initial demand for construction timber was huge and sourcing and paying for it was a major concern.

Before 2004, Sri Lanka had no early warning system or disaster preparedness programmes. In May 2005, the Disaster Management Act established a National Council to oversee such events.

Activities:

- What is a Tsunami and why does it occur?
- Explain why this Tsunami was so devastating.
- Draw and label a diagram of what happened to the Earth when the Earthquake occurred.
- On a map of Sri Lanka, mark in and name the areas that were affected by the Tsunami. Label the major cities affected and the bodies of water.

The Indian Ocean Tsunami in Sri Lanka

- Draw up a table to show the countries that were affected. Draw up columns for the name of the country, capital city, type of government, major religion/s, GDP.
- Examine the impact on a community when so many fishermen were lost. [Seafood was the major source of protein for these communities.]
- Why were coconut trees able to survive such devastating waves?
- Examine the problems caused by the destruction of wells across the south of the country.
- Explain the significance of mangroves and sand dunes in protecting the coastline against the ravages of a tsunami.
- Investigate the religious and cultural practices of the people of Southern Sri Lanka and discuss the impact of these on how victims of the disaster were assisted.
- Go to the websites mentioned above and outline the major points you discovered.
- How do you think that you would have reacted if you had been there and lost your parents?
- Investigate the role that the Australian Government played after the Earthquake and Tsunami.
- Did you know that Australia donated \$42 million for relief in Sri Lanka.
- Imagine you had been in Sri Lanka when the Tsunami hit. What do you think would have been your reactions?
- Write a short newspaper article or a piece for a blog describing what it was like on the coast that day.
- Many young people have volunteered to go to these areas and help. Why do you feel that so many have done this and would you do it? Why/why not?
- What is the “Precautionary Principle”?
- Research the development of the Early Warning System. Is it effective?
- Investigate the impact that the Tsunami had on the Civil War that was raging at the time.



Aftermath of the 2004 Tsunami. Source: www.theguardian.com

The Indian Ocean Tsunami in Sri Lanka

Photo gallery – 2004 Tsunami in Sri Lanka



Left: Galle Naval Base Source: abc.net.au



Above: Fishing vessels carried inland by the tsunami, Sri Lanka
Source: www.un.org



Left: The famous Galle Cricketground, post tsunami
Source: www.sinhaya.com

Right: Aerial view of Galle, showing inundation
Source: www.ukfgsrilanka.co.uk



The Indian Ocean Tsunami in Sri Lanka



Left: Stranded boat on the main road to Galle Sri Lanka
Source: www.theguardian.com

Right: Homeless children, Sri Lanka
Source: erthdata.nasa.gov



Left: The remains of a Buddhist Shrine, Galle Sri Lanka
Source: www.barnabys.blogs.com



Left: A car and debris, Galle Sri Lanka
Source: www.southasia.oneworld.net

The Indian Ocean Tsunami in Sri Lanka



Left: Upturned buses litter the roads, Sri Lanka
Source: www.dailymail.co.uk



Right: Sri Lanka military personnel assist with clean up and body retrieval post tsunami
Source: www.ukfgsrilanka.co.uk



Left: Devestation in commercial precinct, Sri Lanka
Source: www.ukfgsrilanka.co.uk/wp-content/gallery/tsunami-devastation/t4.jpg



Right: Temporary accomodation, Holland House of Hope, Sri Lanka
Source: www.ukfgsrilanka.co.uk

The Indian Ocean Tsunami in Sri Lanka



Left: Coastal inundation at Maddampegama Sri Lanka
Source: www.sauer-thompson.com



Right: Grief-stricken woman, Sri Lanka
Source: www.ukfgsrilanka.co.uk



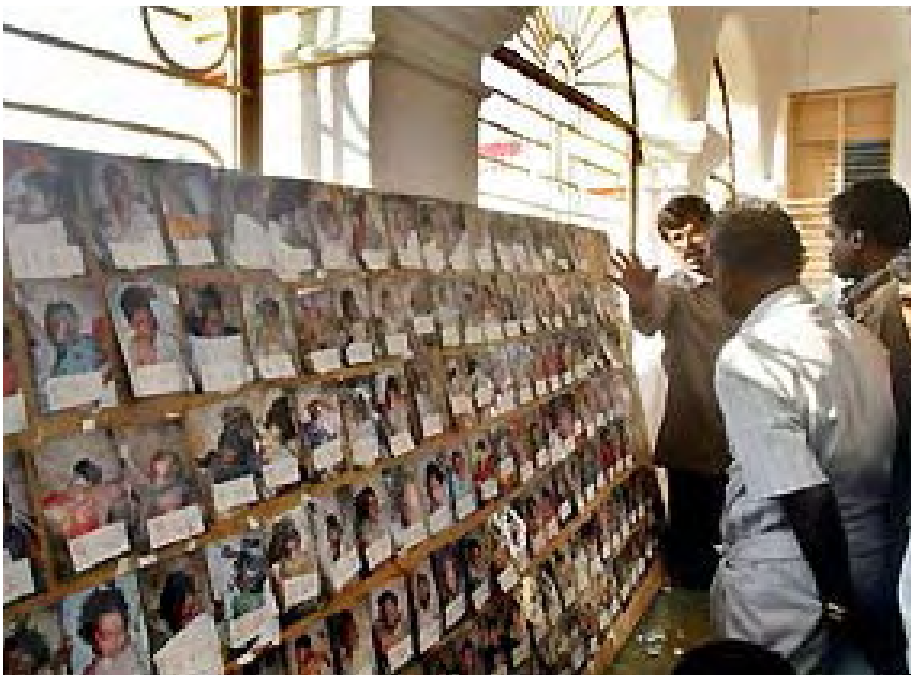
Left: Railway carriages in which many perished, Sri Lanka
Source: www.window2nature.wordpress.com



Right: Resort swimming pool, Kogala Beach, Sri Lanka
Source: www.vanhulsenbeek.com

The Indian Ocean Tsunami in Sri Lanka

Right: Twisted railway line, Sri Lanka
Source: www.agentcoop.wordpress.com



Left: Photos of unidentified victims at a church in Galle, Sri Lanka
Source: www.news.bbc.co.uk



Above: Streets made impassable by tsunami debris, Sri Lanka
Source: www.tsunami2004insrilanka.blogspot.com

Left: Rebuilding Mullaitivu's Church after the tsunami, Sri Lanka
Source: sangam.org



Global Education – Learning Emphases

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

LOY KRATHONG: A water festival in Thailand

A Stage 2 & 3 resource by Di Dunlop

The story of Loy Krathong

The full moon day of the 12th lunar month (usually mid November) is the celebration of Loy Krathong, one of Thailand's most popular annual festivals.

The rainy season has ended and the rivers and canals are full to overflowing. For farmers the strenuous labour of ploughing and planting rice for the previous three months from dawn to dusk is now over. They have only a few short weeks to wait for the harvest and the time is filled with feasts and festivals, the main one being Loy Krathong. "Loy" means to float, and "Krathong" is a leaf cup usually made with a banana leaf. This floating leaf cup is decorated with flowers, incense, candles and often a small coin.

In Thai folklore four goddesses personify the elements of nature: Mae Pra Toranee (Mother Earth), Mae Pra Pai (Goddess of the wind), Mae Pra Plerng (Goddess of fire) and Mae Kong Ka (Mother Water). The festival of Loy Krathong gives thanks to Mae Kong Ka for her bounty in "providing water not only for drinking and washing, but also for the essential means of livelihood of most Thais: agriculture, fishing and transport. At the same time Loy Krathong is a request for Mae Kong Ka's forgiveness for having used and polluted the water. Many people believe that as their krathong floats away they have been forgiven by the Goddess of Water and that they have symbolically washed away their sins of the past year.

Loy Krathong is inseparable in Thai people's minds from the legend of a lady of the Sukhothai court some 700 years ago called Nang Nopamas (Lady Nopamas)

who created a very beautiful krathong in the shape of a lotus flower and presented it to King Pra Ruang (1238 AD) in honour of the three day royal ceremonies held to observe the festival. The king was so impressed with the exquisite beauty of this krathong that he praised Nang Nopamas profusely and ordered that on future occasions the lotus shaped krathong be made after the fashion of Nang Nopamas' handiwork.

In the evening, when the full moon begins to rise, people carry their krathongs to the banks of the waterways. After the candles and incense sticks have been lit, the krathong is gently pushed away onto the



Water fountain depicting Mae Pra Toranee. Source: Wikimedia Commons

LOY KRATHONG: A water festival in Thailand

surface of the water. It is a magical time as the rivers and canals in Thailand glitter with the tiny candles of the colourful krathongs.

In the past, it was called Loi Krathong as Chong Pa Rieng – floating lantern of royal ceremony. It is a Brahman festival to worship Gods – Siva, Vishnu, and Brahma. When Thai people adopted Buddhism, they adapted this ceremony to honor the Buddhas cremated bone – the original Buddha at the second heaven ruler. They floated lanterns to worship the footprint of the Buddha on Nammathanati River beach in India.

Loy Krathong – A personal story

My name is Ging and I am a girl of twelve. I live in Bangkok, the capital of Thailand, with my parents and my brother Gam, who is ten. Today Garn and I have come home with very little homework to do. Our teachers know we don't have much time since it is Loy Krathong Day.

Loy Krathong is my favourite festival. It takes place on the full moon night of the twelfth lunar month, which generally falls in the second half of November. Loy means 'to float*' and krathong means leaf cups'. So this is the festival of floating leaf cups with lighted candles in them on rivers and canals.

Garn's favourite festival is Songkran, the water festival, which is gay and a lot of fun. But I prefer Loy Krathong because it is so much gentler and prettier, with the beautiful moon in the sky and hundreds of lights in the water.

You may wonder what the meaning of Loy Krathong is. To tell the truth, we are not very sure ourselves why we celebrate it. Some people believe that it is to ask



Boy with offering. Source: Wikimedia Commons

the pardon of the goddess of the water for having made the rivers and canals dirty throughout the year. Others say that it is an act of worshipping Buddhas footprint, which he left on the shores of the Nammada River. But one thing we do know is that it is an old festival, six or seven hundred years old, and it has been a joyful celebration for everyone for as long as that.

Anyway, the origins aren't really important to me. The important thing is to have a nice krathong of my own. So here I am, sitting with my old nanny, with lots of banana leaves and other things needed for making krathong. My old nanny, who up to this year has always made a krathong for me, says that I must now make one myself. So I will try to make a krathong you have first to cut two round pieces out of a banana leaf. My hands are not very steady with a knife and I have wasted several leaves before cutting two perfectly round pieces. With the two circles one on top of the other, I make a five-cornered cup, fastening each seam with a sharp bamboo pin. I am quite pleased with my cup really, but Nanny takes one look at it, sighs, and says that it will never float properly since it is lopsided. So she gives in and makes me another cup, decorating the edgess with strips of banana leaf sewn on with needle and cotton. She lets me stick jasmine and everlasting flowers along the edges, and then we stuff the centre of the krathong with small pieces of banana trunk. We cover these with a piece of leaf, and in the middle we put incense sticks, one slim candle and three gardenias, which smell heavenly!

My krathong is now finished but as we still have lots of banana leaves left over, Nanny says she will quickly make some simple cups for the cook to put steamed fish soufflé in. I want her to make some tiny square ones for



Making a Loi Krathong. Source: Wikimedia Commons

LOY KRATHONG: A water festival in Thailand



Families floating krathong rafts during the Loi Krathong festival in Chiang Mai, Thailand Source: Wikimedia Commons

the delicious nut pudding, but she says firmly that she has quite enough to do!

Now Garn comes bouncing in with an enormous krathong made of bright green tissue paper in the shape of a house. He has just bought it from the corner shop and is so pleased with it. But I am sure it will catch fire as soon as he lights the candles in it. As usual he's got a large supply of fireworks and some bangers which I hate. But, as Nanny says, boys will be boys, I suppose.

Soon our friends and relations come. As our house is on a canal, we invite our cousins and friends to come and float their krathong with us. With so many guests tonight, dinner is filled with lively conversation.

After dinner we go out to our *sala*, the little wooden house built on the edge of the canal. The table in the *sala* is covered with krathongs of all shaped and sizes. I see some traditional krathong like my own, but many people, like Garn, want to be different. Nid, my friend from across the street, has a beautiful white lotus made of lily leaves. Garn's best friend has carved a barge out of a banana tree and decorated it with flags and tassels. But the sweetest one of all is a simple boat made from a piece of coconut husk belonging to

Oy, our cook's two-year-old daughter. She can hardly talk yet, but she knows the Loy Krathong song: 'Loy, loy! krathong! Loy, loy krathong! Let's all come, loy krathong...'

While we all join Oy in the singing, the moon has risen in the clear, cloudless sky. Now it is time to float our krathong. Garn runs to the bank and sets his on the water. I make a wish as I carefully set mine on the water. My dear Aunt Charu, who has been studying in Europe for over a year, come home soon! It is said that if the light in your krathong lasts until the krathong disappears, your wish will come true. So I keep my eyes on my krathong, which drifts further and further, its little light still shimmering, until it disappears from view. 'Oh! My wish will come true! Aunt Charu will come home soon!'

While I am still dreaming of Aunt Charu, a sudden 'Bang, bang' startles me. Garn and his friends have started the fireworks. We are lucky this year to have a lot of 'falling rain', a special kind of firework which comes in earthen-ware pots from Chiang Mai, our northern capital. When all the fireworks are lit at once the whole garden looks like a fairyland. But soon the boys' supply runs out and the place becomes dark and peaceful again.

LOY KRATHONG: A water festival in Thailand

The moon is now high, just over the pointed roof of our sala, which casts a beautiful silhouette on the lawn. The water on the canal looks silvery, dotted with little flickering lights. Music is heard, faintly, from afar. I stand up and walk towards the house. I think I will write to Aunt Charu tonight to tell her all about Loy Krathong this year.

Activities

Read the Fact Sheet and the Personal Story and answer the following questions.

- What is Loy Krathong ?
- When is it held? Why?
- On a map mark in and name the countries in which it is celebrated. Mark in the cities mentioned in this unit.
- What is Songkrau and what is its purpose?
- What is done with the Krathong? Why?
- Read the personal story and play the wonderword.

- Go to www.thaibis.com and make a krathong.
- Investigate DIWALI (see Asia Journal Vol 42, No.4 Diwali in India) and complete a compare/contrast table with LOY KRATHONG.
- Make a Loy Krathong Lantern using the instructions on the following worksheet.
- What is the purpose of incense?
- Explain why you think people build houses on canals.
- Investigate the ways people make their living on a canal.
- When do you make wishes in your culture?
- Research the origin and uses of fireworks.
- Discuss the impact on the canals and rivers when Loy Krathong are made from Styrofoam and not banana leaves.
- Research the beliefs of Buddhism in Thailand.
- Imagine you were in Thailand when Loy Krathong was celebrated. Write a letter to a friend explaining what you saw and how it affected you.



The morning after the Loy Krathong festival, Thailand. Source: Wikimedia Commons

LOY KRATHONG: A water festival in Thailand

Worksheet one – Loy Krathong wonderword

Y	B	A	N	A	N	A	N	O
E	U	D	N	E	I	R	F	G
A	D	S	P	R	I	V	E	R
R	D	I	N	C	E	N	S	E
C	H	R	Q	O	P	K	T	E
B	A	N	G	K	O	K	I	N
O	O	N	T	U	W	M	V	N
A	X	Y	D	V	L	E	A	F
T	L	O	Y	L	S	A	L	A
S	K	R	O	W	E	R	I	F

Bangkok
Festival
River
Buddha
Leaf
Boat

Banana
Incense
Candle
Green
Fireworks
Friend

Moon
Sala
Year
Loy
Boy
Kin

LOY KRATHONG: A water festival in Thailand

Worksheet two – How to make a Loy Krathong lantern

To build your own Loy Krathong lantern, follow these steps:

Supplies:

- 1 piece of 42cm x 15cm tissue or rice paper
- 2 strips of cardboard 42cm x 3cm
- 1 piece of string, about 30cm long
- 1 wooden craft stick, about 30cm long
- Glitter and cutouts for decoration
- Glue, Scissors and Stapler

Instructions:

1. Decorate one 42cm x 15cm piece of tissue or rice paper with glitter, cutouts, drawings or verses of your choice.
2. Glue the two strips of cardboard to the tissue paper – one at the bottom and one at the top.
3. Form the tissue paper into a cylinder and staple along the seam.
4. Tie the string to the wooden stick, leaving about 15cm of string on either side.
5. Staple both ends of the string to opposite ends of the top of the cylinder.
6. Hang and enjoy!



Source: <http://www.wmu.com/index.php?q=blog/children/misc/loy-krathong-lantern>



Fire lanterns rise skyward during the Loy Krathong festival Thailand. Source: Wikimedia Commons



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21 September – 3 October 2015

The Asia Education Teachers' Association invites teachers and their families to participate in a wonderful study tour of Turkey. The tour will incorporate the very best that there is to see in this country and will take place during the September/October school holiday period this year. The study tour includes lectures, and a comprehensive tour of Istanbul and greater Turkey, including Cappadocia, Ephesus, Konya and Gallipoli. This tour is an easy option for teachers visiting west Asia for the first time and would like the company of experienced educators who tour this region on a regular basis. It will incorporate options, both for independent colleagues, and those who would prefer a more structured tour.

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The study tour to Turkey focuses on the HSIE, Creative Arts and English Key Learning Areas. Teachers will be able to use their first-hand experience of this country to develop teaching and learning programs related to the new BOSTES syllabuses and in particular the cross-curriculum priority area: Asia and Australia's engagement with Asia.

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Hotels are a minimum of three stars – standard, clean and with western bathrooms.

Tour coordinator

The tour co-ordinator has lead study tours to Turkey, and Asia more generally, on many occasions and is supported by local community personnel and organisations.

Cost

The total tour price will be \$2500. This amount includes single room accommodation (twin/double/triple share are discounted on request), taxes, breakfasts, tours and tour guides, domestic transport, resources for teaching, pre-tour information. International airfares are additional. Participants can arrange airfares themselves and be picked up at Ataturk International Airport, Istanbul, on 21 September 2015, or can join the tour co-ordinator and come as a group (Budget on maximum \$2000 for a return airfare.

Travel and medical insurance, whilst compulsory for this tour, is not included.

To receive further information in March 2015, including a comprehensive itinerary about AETA's study tour to Turkey, and a participants timeline for payment, please complete the details below, scan and email – secretary@aeta.org.au, fax 02 9506 3350, or post to AETA GPO Box 2393, Sydney NSW 2001.

AETA Teachers' Study Tour – Turkey 21 September – 3 October 2015

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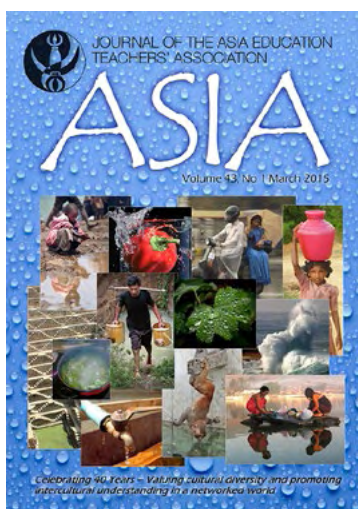
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