



ISSN: 0976-3376

Available Online at <http://www.journalajst.com>

ASIAN JOURNAL OF
SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol.07, Issue, 03, pp.2578-2584, March, 2016

RESEARCH ARTICLE

HIGHER SECONDARY STUDENTS AWARENESS ON CLIMATE CHANGE IN NADIA DISTRICT

*Dr. Mridula Das and Rabindra Nath Pandit

Department of B.Ed, Kalna College, Kalna, Burdwan, West Bengal 713409, India

ARTICLE INFO

Article History:

Received 26th December, 2015
Received in revised form
14th January, 2016
Accepted 22nd February, 2016
Published online 31st March, 2016

Key words:

Environmental Awareness,
Climate change,
Environmental Education,
Statistical techniques.

ABSTRACT

Climate change is the change of surface temperature, precipitation patterns winds, ocean currents and other measures of earth's climate. We observed over the one to two centuries some phenomenon of earth global surface temperature rising, global sea level rising, snow cover decreasing etc. Both natural and anthropogenic causes are the responsible for this changes. Natural causes are continental drift, Galactic variation, orbital variations, obliquity, Eccentricity, Precession, sun spot, solar activity etc. Anthropogenic causes mainly are greenhouse gas emissions from using fossil fuel, industrialization, transport and communication, deforestation etc. The combination of natural and anthropogenic causes leads to a set of affects (e.g. global warming, ozone layer depletion, changes in socio economic condition) and consequences (e.g. disruption in agriculture, sea level rise, increase in the frequency of draughts/floods). Climatologist used different models to predict the future climate change. It is projected that the global surface temperature will increase nearly 1 to 60 c from 2000 to 2100. The precipitation pattern will also increase in subpolar latitudes during winter, decreases rainfall in midlatitudes particularly in summer. The situation is alarming and different organisation and country have attempt to prevent this changes. The present study was aims to investigate the concept of awareness in climate change of higher secondary school students of Nadia District. Concept and attitude of environment awareness in climate change was measured by questionnaire. The data were analyzed with the help of statistical techniques like mean, Standard deviation and t-value. The result of Analysis shows that, there exists significant difference in awareness on climate change among higher secondary school student. Science students are more aware than commerce and arts students in climate change.

Copyright © 2016 Mridula Das and Rabindra Nath Pandit. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Climate is an average condition of weather over the long term. For the millions of years the earth's climate has warmed and cooled, since long before we appeared on the earth. Ocean temperature, ocean currents, wind pattern, earth revolution and different factors influences the climatic pattern and seasonal variation. There is no doubt that human action has significantly increased the atmospheric concentration over the last 100 years. National Academies of Science (2005), The National Research Council (2011) and the International Panel on Climatic Change (IPCC, 2007) have shown that global climate has warmed and human activities (mainly green house gas emissions) are responsible for most of the warming since middle 1900s (GSA, 2013). According to UNFCCC, climate change is "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable the periods" (UNFCCC, Geneva).

Environmental education is a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems and which has the knowledge, attitudes, commitments and skills to work individually and collectively towards the solution of current problems and prevention of new ones. Environmental education and training plays an important role worldwide in enabling the integration of the principles of sustainable development into international, national and local policies and programmes for the environment and for education. They also influence how the three pillars of sustainable development-biophysical, economic and social are understood and implemented. This requires a reorientation of educational systems, policies and practices to provide citizens with appropriate knowledge, skills and ethical commitment to engage critically in decision-making and action on current and emerging environmental and development problems.

We can see the climate change as

- A process of studying the implication climate variation.
- A phenomena caused by natural and anthropogenic process.

*Corresponding author: Dr. Mridula Das

Department of B.Ed, Kalna College, Kalna, Burdwan, West Bengal
713409, India

- An issue which's impacts on nature and quality of life.
- A problem with wide-ranging social and economic implication.

Causes of climate change- In the past, the climate has changed as a result of natural causes. The natural causes are

- a. Precession and Orbital variation
- b. Obliquity and Eccentricity
- c. Volcanic activity and Sun spot and solar activity
- d. Galactic variation and Orogeny
- e. Ocean variability and Epirogeny

Human Impacts on the Atmosphere

There is no doubt that human activities affect the working of the atmosphere in various ways in many cases with possible effects on climatic regimes.

Direct Stmospheric Input

- Gas emissions- carbon di-oxide, methane, chlorofluorocarbon, nitrous oxide, krypton 85, water vapour, miscellaneous trace gases.
- Aerosol generation.
- Thermal pollution.

Changes to land sufaces

- Albedo change-Dust addition,to ice caps,deforestation
- Extention of irrigation

Alteration to the oceans

- Current alteration by constructing straits.
- Diversions of fresh water into oceans.

Green house effect: The factor which is most responsible for the climate change is the "green house effect". It is related to the gases which keep the earth warm and these gases are called "green house gases". The most green house gases are carbon di oxide, methane, nitrous oxide, Chlorofluoro carbon, tropospheric ozone, water vapour. All the gases without CFCs occur naturally in the atmosphere and without their green house properties the earth's 's mean temperature would be about 330c lower than at present.

The Green house gases: We know that the main green house gases are carbon di oxide,methane,chlorofluoro carbon,water vapour.

Carbon di oxide (CO₂): The most important green house gas is carbon di oxide. This gas have been increased by human actions and its concentration have risen by 25 percent over the last 100 years, with about half of this increase occuring in the past 25 years. Burning of fossil fuel, cement manufacture, land use changes, deforestation, land clearing, agriculture are the major sources of the carbon di oxide. North America and Europe are the largest sources of this gases (Middleton, 1995).

Methane (CH₄): Methane is another green house gases. Today its amont is double its pre-industrial concentration. About ¼ of all methane emissions are come from domestic animals such as

dairy cows, goats, pigs, buffaloes, camels, horses and sheep. Methane is also emitted from paddy fields, land fields and other waste drums.

Nitrous oxide (N₂O): Nitrous oxide emitted from the fertilizer that are used for crop cultivation. Emissions depends on the type of fertilizer and the method using of fertilizer. Land use conversion is another sources of these kind of gases.

Chlorofluoro carbon (CFCs): Chlorofluoro carbons (CFCs) and other Halo carbons do not occur naturally. These are wholly created by anthropogenic causes. In 1930s, we fast know about this gases. This gas is used as aerosel propellants, foam blowing and refrigerants, and their release in the atmosphere has been inadvertent. National Regulation regulated the use of CFCs in aerosel sprays during a time of economic recessions in the developed worlds. As a result, the emissions fall in the late 1970s and early 1980s. Aerosel propellants accounted for almost 70 percent of the market for CFCs in the mid 1970s, by the late 1980s refrigerants and foam blowing accounted for 60 percent of the market. CFCs are more than thousands times effective than carbon di oxide. There are eight halo carbon, including the most abundant CFC-11 and CFC-12. These green house gases creates globai warming. Global warming is the main cause of the changing climate pattern and it affects all the other factors for the particular climate pattern and climate change. Human activities add the green house gases to the atmosphere and it strengthens the green house effect and causes a significant warming trend.

Global warming and climate change: There no doubt that earth has been warmer over the last century. According to the reports of the Intergovernmental Panel on Climatic Change (IPCC), World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), the average surface temperature of the earth has increased during the twentieth century by about 0.60+ _ 0.20c .

Predicting Impacts: Theoretical numerical models known as general circulation models or GCMs are used to predict the changes of climate pattern such as winds, temperature, precipitation, evapotranspiration etc. IPCC predicted that the average global temperature will increase ranging from 1.40c to 5.80c by the year 2100. The increasing temperature could alter the precipitation levels and make some areas wetter and other drier. Its also affect the agricultural pattern, could increase the frequency and strength of storm systems, leading to more powerful and destructive hurricanes and subsequent flooding. It is very difficult to predict the the future climate change as well as impacts by the GCMs. The models are slow to run, costly to use and their result are only approximate. They can predict changes in climatic condition on continental scales, but prediction at finer resolution are impossible at present. Recent observed global warming is significantly less than that simulated by climatic models. verage surface temperature of the earth over the past 20 years (1993-2012) has risen at a rate of 0.14+ _ 0.140c per decade. This rate is significantly slower than that predicted by the climat models. Human behaviour is also unpredictable and for this reason the projections of future climate change is very difficult. Society can take immediate action for using fossil fuel (taking to alternete carbon free or carbon nutral sources of energy to meet its energy demand), dramatiacally increases its energy efficiency and stabilizes the

growing global population with one or two decades. This action can slow down the green house gas emissions and lowering the rate of climate change.

Consequences of global warming: In the third assessment report of IPCC it is clearly mentioned that global warming creates risks and problematic situation for the global environment. Research by NOAA indicates that the effects of global warming are already irreversible. Rising sea levels, glacier retreat, arctic shrinkage and altered patterns of agriculture are direct consequences and extreme weather events, an expansion of tropical diseases, changing in the timing of seasonal pattern in ecosystems, and drastic economic impact are secondary effects.

Receding glaciers: In many parts of the world the mountainous glaciers are retreating. In Alaska around 500 cubic miles of ice have been lost in the last 50 years. In Europe, since 1800, half of the European alpine glaciers have disappeared and it is thought that by the end of the century half of those left, will have gone. The total surface area of glaciers of the world has decreased by 50% since the end of the 19th century. The rate of glacier retreat are currently increasing in the Andes, Alps, Himalayas, Rocky mountains and North Cascades.

Sea level rise: The sea level is also rising due to global warming. IPCC report shows that the sea level has risen about 4 to 14 cm. Under the IPCC Special Report on Emission Scenario (SRES), by the mid 2090s global sea level will reach 0.22 to 0.44m above 1990 levels, and is currently rising at about 4mm per year. The sea level has risen at an average rate of 1.7mm per year since 1900, and about 3mm per year since 1993. Rising sea level lead to the destruction of lives, property and ecosystems equivalent to about 80% of the GDP of Bangladesh.

Sea surface temperature rise: The impacts of global warming also shown in the sea surface temperature (SST). The global sea surface temperature has risen by 0.10^oC from the surface to a depth of 700m. The temperature of the Antarctic southern ocean rose by 0.17^oC between the 1950s and the 1980s nearly twice the rate for the world's ocean as a whole.

Flooding: In June 2001, The Environment Agency Sustainable Development Unit said "Major floods that have only happened before every 100 years on average may now start to happen every 10 or 20 years. The flood season may become longer and there will be flooding in places where there has never been any before". 13 largest city out of 15 are on coastal plains-with rising sea levels they may have to do a lot of work on their defences to prevent disaster.

Changes in ocean currents: The oceans play a crucial role in regulating the earth's climate. Water is 1000 times denser than air and it stores heat four times that of air. Changes in the temperature could disrupt the ocean currents, slowing or shutting them down. Recent observations have shown that since 1950 there has been a decrease of 20% in the flow of cold water in the Faero Bank channel between Greenland and Scotland.

Effects on ecosystem: There are many species in the world which do not tolerate an average temperature only a few degrees higher than the current temperature. Coral organisms are very sensitive and a little higher temperature than the average current temperature could damage them. So it is clear that global warming affects the ecosystem very much.

Acid rain: Acid rain is formed when industrial emissions of gases including sulphur dioxide, nitrogen oxides and hydrogen chloride combine with water droplets in the atmosphere. Depending on the amount of CO₂ and sulphur (S) present the pH of the ensuing rainfall can be in the range 4.5-5.6. This acid rainfall has effects on soil, plants and animals, water etc.

Responses to global climate change: Most countries have accepted the need to make some effort to prevent, or at least to slow down its pace, by reducing greenhouse gas emissions. For this reason the Montreal Protocol was signed in 1987 and amended in 1990. At the 2005 G-8 conference in Scotland, the G-8 partners agreed on a plan of action to speed the development and deployment of clean sustainable energy, technologies to achieve the combined goals of addressing climate change, reducing harmful air pollution and improving energy security throughout the world.

G-8 conference-emphasis should be given to

- We should change the way of use the energy by improving efficiency in power generation, transportation, buildings and applications.
- We should use nuclear power, clean coal technology, clean diesel and machine, renewable energy, bio-energy and more efficient power grids.
- Strengthen research and development of hydrogen powered vehicles, that emit only water not fumes.
- Finance the transition to cleaner energy through strengthened the world bank and National policies.
- Manage the impact of climate change through strong funding of climate change science.
- Combat illegal logging by working with poor countries struggling to enforce their own forest management laws.

How can we Prevent Climate Change?

Make Our Lifestyle Greener

Everything we do in our day to day lives emits CO₂ into the atmosphere. That means that even making small changes in what we do, or how we do it, can have a positive impact in preventing the onset of climate change. Collectively we can make a difference. Here are a few tips:

- Holidays: don't fly, take a train or alternative transport method
- Shopping: minimise the number of shopping trips you take by planning ahead and writing a list
- Nightlife: walk to your local facilities rather than taking the car
- Sport: try cycling, walking or running to get from A to B

Change Our Habits at Work

Don't leave your good environmental habits at home - take them into the office too. Take public transport to work or walk

rather than take your car, or share car journeys with colleagues. Turn off appliances, equipment and lights off when you've finished using them, and, importantly, shut down your computer rather than just logging off. And for the things you can't change - speak to the person who can to see if your employers have a green and environmental policy in place.

Educate Future Generations

Preventing climate change in the future is down to the actions and opinions of future generations - meaning now is the time to start educating our children about climate change and its effects. This can be done at school, by parents and every simply through leading by example. If you have children, get them involved in making your lives greener. Give them the responsibility to make sure lights and plugs are turned off in their rooms each time, get them involved in recycling and other green initiatives, rewarding them for their good work.

Get Involved In The Fight Against Climate Change

If you want to take your green ambitions to the next level, find out about climate change events, at a local and a national stage, which you're interested in. There are plenty of fundraising and awareness-raising events you can get involved with, or simply sign your name on one of the many environmentally themed Downing Street petitions - see petitions.pm.gov.uk.

Control of climate change awareness through education:

- Climate change topic included in curriculum
- Seminar and Symposium
- Workshop and meeting
- Newspaper and Cinema
- Television and Radio
- Awareness programmes on climate change and Exhibition
- Awareness camp and Debate on climate change
- Media and leaflet

Area of study

Nadia district Bengaliis a district of the state of West Bengal, in eastern India. It borders Bangladesh to the east, North 24 Parganas and Hooghly districts to the south, Bardhaman district to the west, and Murshidabad district to the north. Nadia is situated between 22°53" and 24°11" North latitude and 88°09" and 88°48" East longitude and about 390027 Sq Kms. in Area, this District is linear in shape with orientation of North-South. The District is Approximately 46 ft. above the mean sea level. The Tropic of Cancer divides the district in two parts. According to the 2011 census Nadia district has a population of 5,168,488, roughly equal to the United Arab Emirates or the US state of Colorado. This gives it a ranking of 18th in India (out of a total of 640). The district has a population density of 1,316 inhabitants per square kilometre (3,410/sq mi). Its population growth rate over the decade 2001-2011 was 12.24%. Nadia has a sex ratio of 947 females for every 1000 males, and a literacy rate of 75.58%.

Objectives

- To know the level of knowledge and compare environmental awareness on climate change among higher

secondary students of Arts and science group, Arts and commerce group, Science and commerce group

- To study students understanding of the concept of climate change.
- To study the general environmental awareness in climate change and environmental practices among the higher secondary students.
- To know the level of attitude towards environmental awareness on climate change of higher secondary students.

Hypothesis

- There is no significant difference in awareness on climate change among higher secondary students of Arts and Science group.
- There is no significant difference in awareness on climate change among higher secondary students of Commerce and Science group.
- There is no significant difference in awareness on climate change among higher secondary students of Arts and Commerce group.
- There is no significant difference in awareness on climate change and intelligence of the higher secondary student.

METHODOLOGY

The following steps and procedure adopted in conducting the study.

Research Design

In this study we used the descriptive method. The student needed an average 40 minutes to finish it. The data was used only for the purpose of this study.

Selection of sample

360 students school students at higher secondary level from 7 schools of Nadia district, West Bengal was selected for this study. Sample distribution is given below.

Group	Boys	Girls	Total
Arts	60	60	120
Science	60	60	120
Commerce	60	60	120
Total	180	180	360

Instrument: Data were collected with a quantitative data collection technique. Students answered the test paper questions. The test comprised 40 multiple choice questions. The questionnaire covered with awareness on climate change related issues.

Reliability and Validity of the Tool: For reliability of the tool, we used Test-retest method. Retest was taken after 20 days and the correlation is 0.861 ($r=0.861$). At the initial stage we choose 45 items for the questionnaire. After content validation 40 items are drafted.

Statistical Calculation: The data were analysed with the help of suitable statistical techniques like Mean, Standard Deviation and t-ratio.

RESULTS

Findings from Table and Graphical Presentation

- Science boys’ students are more aware on climate change than Science girls’ students.
- Arts boys’ students are more aware on climate change than Arts girls’ students.

- Science students have greatest awareness in climate change in higher secondary level.
- Mean awareness in climate change varies from 46.40 to 60.71.
- Percentage awareness in climate change varies from 58.0% to 75.9%.

Table 1. Mean, standard deviation, standard error and t-value for awareness on climate change in higher secondary level

Group	Sum	Mean	Percentage of awareness	SD	SE	t	p	Remark
Arts- girls	2784	46.4	58.00%	14.64	1.89	1.417	0.159	At the 0.05 level two means are significantly different
Arts- boys	3013	50.21	62.8%	14.86	1.91			
Commerce-girls	3200	53.33	66.6%	16.97	2.14	1.156	0.249	At the 0.05 level two means are significantly different
Commerce-boys	3409	56.81	71.00%	16.01	2.06			
Science-girls	3438	57.30	71.6%	15.24	1.97	1.277	0.203	At the 0.05 level two means are significantly different
Science-boys	3643	60.71	75.9%	14.02	1.81			

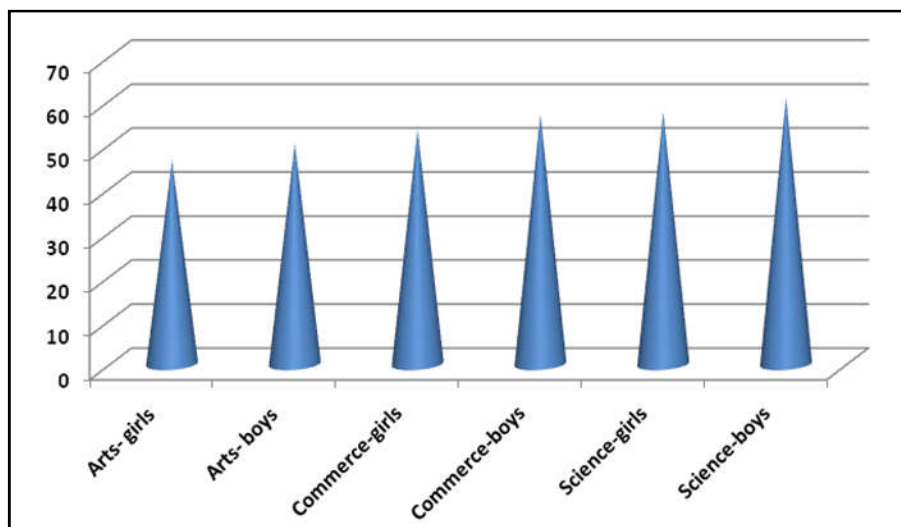


Figure 1. (Cone diagram) Mean awareness on climate change of higher secondary students

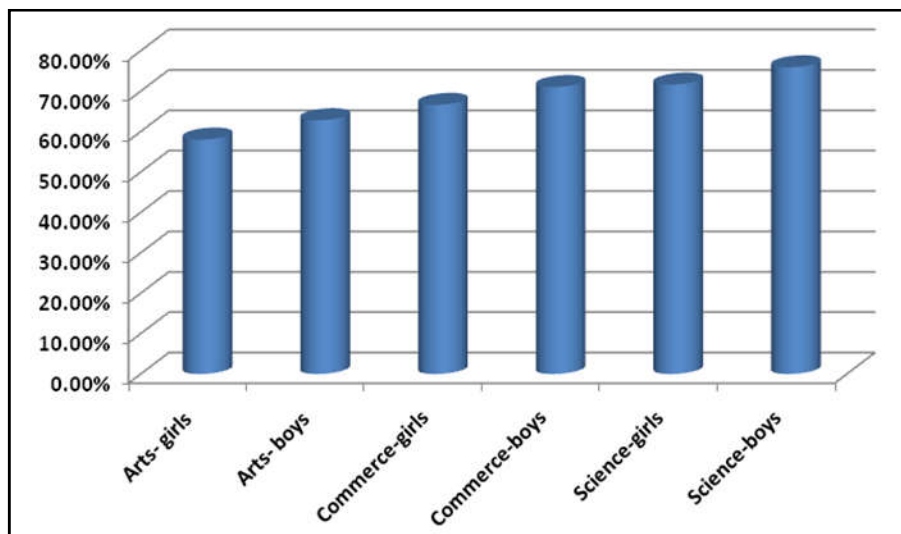


Figure 2. (Cylinder diagram) %Awareness on climate change of higher secondary students

- Commerce boys’ students are more aware on climate change than Commerce girls’ students.
- Arts girls’ students have least awareness on climate change.

Conclusion

Present study shows that there exist significant relationship between the awareness of climate change and intelligence of

higher secondary students. There may be many reasons behind it and those reasons can also find out by the researcher. The study also reveals that there exist significant differences between awareness of climate change among higher secondary student belonging to Arts, Science and Commerce group. Science students are more aware in climate change than arts and commerce students in Nadia district All these conclusions are sufficient to prove the need to study the related to awareness on climate change. Environmental education is essential need for school curriculum to increase the environmental awareness in climate change.

Limitation of the study

- The study was limited to a few schools.
- The sample of the study was restricted to 360 students only.
- The research was limited only to Nadia District of West Bengal due to shortage of the time.
- The reliability of the awareness in climate change scale was determined only by test-retest method due to shortage of time
- Only the content validity of the scale was determined.
- The difference in the mean score of in climate change awareness was found out only by t-test.

Suggestions for future study

- The scale of awareness in climate change can be standardized on the basis of large samples.
- A similar study can be conducted by including larger samples from various schools of West Bengal or other state of India.
- This work will be applicable on different college and university students.
- Other independent variable like age, cast and religion etc. will be considered for future study.
- The study can be conducted upon common people not only the pupils.

REFERENCES

- "2010 Resident Population Data". U.S. Census Bureau. Retrieved 30 September 2011. "Colorado 5,029,196"
- "District Census 2011". Census2011.co.in. 2011. Retrieved 30 September 2011.
- Adedayo, A., and Olawepo, J. A. (1997). Integration of environmental Education in Social Science Curricula at the secondary school level in Nigeria: problems and prospects. *Environmental Education Research*, 3 (1), 83 – 93.
- Bachelet, D., R. Neilson, J.M. Lenihan, R.J. Drapek 2001. "Climate Change Effects on Vegetation Distribution and Carbon Budget in the United States". *Ecosystems* 4 (3): 164–185.
- Bailey, J. 2006. *Dictionary of Ecology and the Environment*, University press, Hyderabad, P-47.
- Ballantyne, R., and Packer, J. 1996. Teaching and learning in environmental education: Developing environmental conceptions. *Journal of Environmental Education*, 27 (2), 25 – 33.
- Ballantyne, R., and Packer, J. 2009. Introducing a fifth pedagogy: experience-based strategies for facilitating learning in natural environments. *Environmental Education Research*, 15 (2), 243 – 262.
- Birks, HH (March 2003). "The importance of plant macrofossils in the reconstruction of Lateglacial vegetation and climate: examples from Scotland, western Norway, and Minnesota, USA". *Quaternary Science Reviews* 22 (5–7): 453–473.
- Bolscho, D., and Hauenschild, K. 2008. From environmental education to Education for Sustainable Development in Germany. *Environmental Education Research*, 12 (1), 7 – 18.
- Brown, C. J., Fulton, E. A., Hobday, A. J., Matear, R. J., Possingham, H. P., Bulman, C., Christensen, V., Forrest, R. E., Gehrke, P. C., Gribble, N. A., Griffiths, S. P., Lozano-Montes, H., Martin, J. M., Metcalf, S., Okey, T. A., Watson, R. and Richardson, A. J. (April 2010). "Effects of climate-driven primary production change on marine food webs: Implications for fisheries and conservation". *Global Change Biology* 16 (4): 1194–1212.
- Brown, C. J., Fulton, E. A., Hobday, A. J., Matear, R. J., Possingham, H. P., Bulman, C., Christensen, V., Forrest, R. E., Gehrke, P. C., Gribble, N. A., Griffiths, S. P., Lozano-Montes, H., Martin, J. M., Metcalf, S., Okey, T. A., Watson, R. and Richardson, A. J. (April 2010). "Effects of climate-driven primary production change on marine food webs: Implications for fisheries and conservation". *Global Change Biology*, 16 (4): 1194–1212.
- Ernst, J. 2009. Influences on US middle school teachers' use of environment-based education. *Environmental Education Research*, 15 (1), 71 – 92.
- Ernst, J. 2009. Influences on US middle school teachers' use of environment-based education. *Environmental Education Research*, 15 (1), 71 – 92.
- Ernst, J. A., and Monroe, M. 2004. The effects of environment-based education on students' critical thinking. *Environmental Education Research*, 10, 507 – 522.
- Esa, N. 2010. Environmental knowledge, attitudes and practices of student teachers. *International Research in Geographical and Environmental Education*, 19 (1), 39 – 50.
- Fyfe, J. C., Gillett, P., Zwiers, F.W. Over estimated global warming over the past 20 years. The Geological Society of America, 2013 Climate Change.
- Harvey, M. 1989. The relationship between children's experiences with vegetation on school grounds and their environmental attitudes. *Journal of Environmental Education*, 21 (2), 89 – 90.
- Jensen, B. and Schnack, K. 1997. The action competence approach in environmental education. *Environmental Education Research*, 3 (2), 163 – 178.
- Johnson Pynn, J. S., and Johnson, L. R. 2005. Success and Challenges in East African Conservation Education. *Journal of Environmental Education*, 36 (2), 25 – 39.
- Klein, E. S., and E Merritt 1994. Environmental Education as a Model for Constructivist Teaching. *Journal of Environmental Education*, 25 (3), 14 – 21.
- Middleton Nick. 1995. *The Global Casino: An introduction to environmental Issues*. Edward Arnold, London, P-100-113.
- Mridula Das, "The Environmental awareness of water pollution of higher secondary school students with reference to their Intelligence", SSCE Publication No. 7, 17th October, 2013, 289-294 pages, ISBN 978-81-922902-6-3

- Mridula Das, The environmental awareness in Soil Pollution of higher secondary school students according to their Intelligence, ISBN 978-81-928047-2-9, Sandhya Prakashani, 356-361 Pages, 2013.
- NRC, 2010. *Advancing the Science of Climate Change*. National Research Council. The National Academies Press, Washington, DC, USA.
- Oppenheimer, Clive, 2003. "Climatic, environmental and human consequences of the largest known historic eruption: Tambora volcano (Indonesia) 1815". *Progress in Physical Geography* 27 (2): 230.
- Ruddiman, W. F. 2003. "The anthropogenic greenhouse era began thousands of years ago". *Climate Change* 61 (3): 261–293.
- Schneider, Stephen, H., Lane, Lare Jamica., An overview of "Dagerious" Climate Change, Stanford University, Stanford, California.
- Tiwari, M., Khuble, K., Tiwari, A. 2007. Environmental studies, I.K. International publishing House pvt. Ltd. New Delhi, P-167-180.
- US Directorate of Intelligence. "Country Comparison:Population". Retrieved 1 October 2011. "United Arab Emirates 5,148,664"
- USGCRP, 2009. *Global Climate Change Impacts in the United States*. Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.
- Werritty, A., 2001. Living with uncertainty: climate change, river flow and water resources management in Scotland. *Sci. Total Environ.*, 294, 29–40.
- Whittington, H. and S.W. Gundry, 1998: Global climate change and hydroelectric resources. *Eng. Sci. Ed. J.*, 7, 29-34.
- Witherick, M., Ross, S., Small, J. 2001 A Modern Dictionary of Geography, Arnold, London, P-44-45.
