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# Test for Measuring the Knowledge in Biodiversity of Secondary School Students

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### Abstract:

Biodiversity is the totality of the genes species and ecosystems in a region or the world. Biodiversity conservation and sustainable use with equitable sharing of benefits derived from its natural services are the basis of human well-being. Knowledge in Biodiversity helps to attain sustainable development. Knowledge is a system of facts, concepts, laws, relations, unifying themes (generalizations), hypotheses, theories, prognoses, scientific picture of the world, related to the structure and functions of the Biosphere and to interaction of society with nature. The present tool is meant to measure the Knowledge in Biodiversity of secondary school students. It mainly measures the Knowledge in Biodiversity conservation, its importance, present status, threats, conservation strategies, and sustainable development. The test was constructed and standardized after considering suggestions from experts in the concerned field. The final test consists of 30 objective type questions with their options in the field of Biodiversity. Each item on the Biodiversity Knowledge Test was with four choices and the correct answer for each item on the test carries one mark. The test proves the validity and reliability.

Keywords: Biodiversity, Knowledge

### 1. Introduction

Varity is the key word to describe the planet Earth. Varity adds to the beauty and sustainability of the world. Planet Earth takes respect for their rituals, culture, traditions etc associated with Biodiversity and its carryover through generations. Ecosystem services of biodiversity shape the development path of a country, region, or locality. But now, across the planet Biodiversity is being eroded and ecosystem services degraded. According to the Red List of Threatened Animals, 44 plant species are critically endangered, 113 endangered and 87 vulnerable. Amongst animals, 18 are critically endangered, 54 endangered and 143 are vulnerable. Ten species are Lower Risk conservation dependent, while 99 are Lower Risk near threatened. India ranks second in terms of the number of threatened mammals, while India is sixth in terms of countries with the most threatened birds.

Efforts to maintain and enrich the diversity of biological resources are urgently required to local, national and international levels. The combination of maintaining the maximum possible cultural diversity and greater possible scientific endeavor seem their most sensible approach. Novel perspectives, new financial mechanisms and new policies are needed to be applied at the level of responsibilities to overall human well-being and secure biotic heritage. Rapid change in large scale human and biological process is leading people's action to over exploitation of limited natural resources. It has been creating serious problems on ecological, economic, ethical and aesthetic importance of Biodiversity.

Teaching Biodiversity has been practiced some hundred years ago, but due to low baseline level knowledge (Leather and Quicke,2009) it had becoming a challenging educational a task at least Since Conference of Rio in 1992 (Gaston and Spincer,2004;Weelie and Wals,2002) and it has been emphasized again at Conference of Bonn in 2008.From an educational point of view, however biodiversity Is a rather ill-defined abstract and complex construct (Van Weelie and Wals,2002) which has to be transformed in to small entities to enhance a sustained learning and understanding, especially in the context of high schools. The most common entity used by conservation groups are species (Van Weelie and Wals,2002).Therefore, basic knowledge about animal species, their identification and life history has been targeted as a fundamental aspects for learning and understanding biodiversity (Gaston and Spicer, 2004; Lindemann and Matthies,2005; Randler and Bogner,2002).This is true for plant species identification skills too (Tessier,2003),but baseline knowledge seemed to have declined significantly in recent decades (Leather and Quicker,2009).

# 2. Rationale for the Selection of the Variable

Conservation of Biodiversity is essential for human existence as they offer a variety of products and services to mankind. Humans depend on the Biodiversity for food, clothing, shelter, health care, entertainment, etc. Many species are on the verge of extinction or are slowly becoming rare due to anthropogenic interventions such as habitat destruction, poaching, pollution, introduction of exotic species and overexploitation. Biodiversity is our treasure and it is our responsibility to conserve them for future generation. Protecting Biodiversity will in turn help to moderate climate change and to adapt to its unavoidable consequences. The conservation and sustainable use of biodiversity offers resilience to climate variability and natural disasters. Biodiversity improves the capacity of asocial-ecological system both to withstand from climate or economic shocks and to rebuild and renew itself after words. Very few policy and decision makers are aware of this important contribution of Biodiversity. As a part of the conservation of Biodiversity 2010 was celebrated as International Year of Biodiversity and take the slogan as "Save Our Earth". Several measures were adopted by International Union for the Conservation of Nature and Natural resources (IUCN), World Wild Fund for Nature (WWF), Centre for Biodiversity Conservation (CBC), Kerala State Biodiversity Board (KSBB) and various non-governmental organizations (NGO's) etc for the conservation of Biodiversity. United Nations Development Program (UNDP) is supporting the programme of work of the Conventions on Biological Diversity (CBD) on protected areas by linking protected area management more tightly to the development agenda. This investment in Protected Areas largely financed by the Global Environment Facility (GEF) has led to the creation of 127 new protected areas covering 10.02 million hectares, while an additional 8.60 million hectares are being established.

The biodiversity education programs help the students to acquaint with the local biodiversity problems, and create an interest, motivation and action. It also increases the student's knowledge, interest and skills in order to protect and conserve local natural resources and biodiversity. There is need for extend teaching and learning activities in to the immediate environment(natural/built) of the students beyond the classroom for inculcating a culture of biodiversity conservation (Weelie and Wals, 2002).

### 3. Theoretical Overview

# 3.1. Biodiversity

Biodiversity is expressed as the variety and variability of all plants, animals and other organisms that exist on Earth.

# 3.2. Types of Biodiversity

- Genetic diversity: It is concerned with the variation in genes within a particular species.
- Species diversity: It refers to the variety of living organisms on earth. Species differ from one another markedly in their genetic makeup and do not interbreed in nature.
- Ecosystem diversity: This refers to the different types of habitats.

### 3.3. Uses of Biodiversity

All forms of life-human, animal and plant are so clearly interlinked that any disturbance in one gives rise to imbalance in the other. All life on Earth is interdependent and man is only a strand in this delicate web of relationships. The greater the diversity of wild species, the greater is the opportunity for the production of new verities. Wildlife act as 'Biological indicators', i.e., they warn us about any potentially dangerous change as they are highly sensitive to environmental changes.

The medicinal utilities of a variety of species are yet to be identified. The greater the variety of wildlife we conserve, the more will be able to learn from them.

# 3.4. Threats to Biodiversity

99% of threatened species are at risk from human activities.

Habitat loss and degradation are the leading threats. They affect 86% of all threatened birds, 86% of the threatened mammals assessed and 88% of the threatened amphibians.

Introductions of alien species. Some of the worst include cats and rats, green crabs, zebra mussels, the African tulip tree and the brown tree snake. Introductions of alien species can happen deliberately or unintentionally, for example, by organisms "hitch-hiking" in containers, ships, cars or soil.

Over-exploitation. Resource extraction, hunting, and fishing for food, pets, and medicine threatens many species.

Pollution and diseases.

Human-induced climate change is increasingly recognized as a crucial threat. Climate change is altering migratory species patterns, causing coral bleaching, etc.

# 3.5. Causes for the Loss of Biodiversity

Causes for the loss of variation in flora and fauna are generally been grouped in to two categories: natural and manmade. The natural causes include Floods, earthquakes, landslides, natural competition between species, lack of pollination and diseases. The most serious man made threat to biological diversity are the deliberate destruction of the ecosystem, especially in the tropics and disappearance of habitats, in the wake of developmental activities like industrialization, urbanization, mining destruction of dams, deforestation, grazing, over-exploitation, fire, etc. India- a country of mega diversity .India is one of the richest nations in terms of biological diversity.

India is among the world's top twelve mega diverse nations. India stands quite high in the total number of living species. India's biodiversity is shown in absolute numbers of species and the proportion they represent of the world total in the table overleaf.

# 3.6. Conservation of Biodiversity

Conservation of biological diversity is essential for the survival of the human race. The advantages of biodiversity conservation are:

- It leads to the conservation of essential ecological diversity and life support systems.
- It leads to the preservation of genetic diversity of plants and animals for better species growth.
- It leads to the maintenance of samples of unchanged biotic community in their natural form for breeding and study purposes.

# 3.7. International Law and Biodiversity Conservation

At the international area, many conservations have been made to protect the biological diversity, they include,

- The Ramsar Conservation on Wetlands, 1971
- Convention for the Protection of World Cultural and Natural Heritage, 1972
- Convention on International Trade of Endangered Species of Wildlife Fauna and Flora (CITES), 1973
- Convention on the Conservation of European Wildlife and Natural Habitat, 1979
- World Conservation Strategy, 1980
- Convention on Biological Diversity, 1992

# 3.8. Sustainable Development

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs."

# 4. Methodology

# 4.1. Preparation of the Test for Measuring Knowledge in Biodiversity

The test for measuring the knowledge in Biodiversity for secondary school students, which was developed by the investigator was standardized provide due importance given to content on Biodiversity. Care was taken to include the basic essential concepts under the heading Biodiversity, in the development of the test. Considering the merits of the multiple choice questions, all the questions were prepared as multiple choices.

### 4.1.1. Planning

In planning stage, the investigator referred the NCERT Biology text books at secondary level, and also various books on Biodiversity Conservation and Environmental Biology, Journal articles, and tests for measuring Knowledge in Biodiversity related to conservation aspects. Details of the Tests reviewed for measuring the Knowledge in Biodiversity by the investigator with this purpose are given in Table1.

Sl. No:	Author	Year	Name of the Tool	Components	
1.	Lekha	2005	Environmental Awareness Test	<ul> <li>General Knowledge</li> <li>Air Pollution</li> <li>Water Pollution</li> <li>Land and soil Pollution</li> <li>Noise Pollution</li> </ul>	
2.	Rout and Agarwal	2006	Environmental Awareness Test	<ul> <li>Population stabilization</li> <li>Integrated land use planning</li> <li>Healthy crop land and grass land, wood land and revegetation of marginal lands</li> <li>Conservation of Biological Diversity</li> <li>Control of water and air pollution</li> <li>Development of non-polluting renewable energy systems</li> <li>Recycling of wastes and residues</li> <li>Human settlement</li> </ul>	

3.	Ajith Kumar	2006	Test of Environment Awareness	<ul> <li>Nature and Natural resources</li> <li>Adaptation and ecological relationship</li> <li>Health and hygiene</li> <li>Pollution</li> <li>Forest Conservation</li> <li>Wildlife</li> <li>Land usage</li> <li>Population</li> </ul>
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Table 1: Details of the Tests reviewed for measuring the Knowledge in Biodiversity

# 4.1.2. Preparation of Test for Knowledge in Biodiversity

Ninety test items were prepared and were scrutinized by a team of experts in the field. Some items were deleted; some others were reedited in the light of the expert opinion. The number of items in the draft test was thus reduced to eighty four.

By reviewing Knowledge tests and from theory, the investigator found out the major concepts in Biodiversity Conservation, such as: Basic concepts of Biodiversity, Importance of Biodiversity, Threats to Biodiversity, and Conservation Strategies to Biodiversity and Sustainable Development. By considering these as the basis, ninety test items were prepared and were scrutinized by a team of experts in the field. Some items were deleted; some others were re- edited in the light of the expert opinion. The number of items in the draft test was thus reduced to eighty four. Final test with 30 objective type multiple choice items with four options for the Test for Knowledge in Biodiversity. The weightage given to the components are given in Table 2.

SI. No:	Content areas	Item No.	Total No. of Items	%
1.	Major Concepts of Biodiversity	1, 5, 6, 26, 28	5	16.67
2.	Importance of Biodiversity	2, 3, 10, 21, 24	5	16.67
3.	Threats to Biodiversity	4, 14, 15, 19, 22, 29, 30	7	23.33
4.	Conservation Strategies	7, 8, 9, 11, 12, 16, 17, 18, 23, 25, 27	11	36.66
5.	Sustainable Development	1, 20	2	6.67
	Total	30	100	

Table 2: Content area-wise Distribution of the items in the final Test for measuring the Knowledge in Biodiversity

Sample items for each of the five content areas are given below:

- (i) Major Concepts of Biodiversity
  - Eg: What is Biodiversity?
  - Diversity seen in the Living beings
  - Totality of flora in the world
  - Totality of fauna in the world
  - Study of living beings
- (ii) Importance of Biodiversity
  - Eg: Which is the International Biodiversity Day?
  - April 22
  - May 22
  - June 5

• March 21

# (iii) Threats to Biodiversity

Eg: Which of the following is the major reason for Biodiversity Depletion?

- Pollution
- Habitat Destruction
- Population Explosion
- Invasive non-Native Species

# (iv) Conservation Strategies

Eg: Which is the latest method of Biodiversity Conservation?

- Frozen Zoo
- Tissue Culture
- Cloning
- Wild life Sanctuaries

# (v) Sustainable Development

- Eg: What is Sustainable Development?
- Development without the use of natural recourses
- Development with the minimum use of natural resources and conserving nature
- Development with the maximum utilization of natural resources
- Development along with the destruction of nature

More weightage was given to the content area 'Conservation strategies', next higher weightage given to 'Threats to Biodiversity' next to that equal weightage was given to content areas viz; 'Major concepts of Biodiversity' and 'Importance of Biodiversity, under the assumption that students are aware about the concept of Biodiversity and Importance of Biodiversity to some extent.

### 4.1.3. Scoring Scheme

Each item on the Test for Knowledge in Biodiversity was with four choices and the correct answer for each item on the test carries one mark. Therefore the maximum mark is 30 and minimum mark is zero on the Test.

### 4.1.4. Pilot Test

To know about the time needed for answering the questions and test the clarity in the item construction, a pilot test was administered to thirty pupils comprising of fifteen boys and fifteen girls at secondary school level. All necessary instructions were given in detail before administering the test. After the pilot test, the test items of the draft were limited to thirty and were printed along with necessary instructions. Separate response sheets were also used.

### 4.1.5. Try out of the Test

The draft test was administered on a sample of 425 students studying in secondary school classes. In selecting the sample, a sincere effort was made to get correct data by administering the test. After the prescribed time limit, the response sheets and test booklets were collected back. The response sheets were scored with help of the previously prepared scoring key.

### 4.1.6. Item Analysis

The response sheets of the 425 students were scored. For a correct response, one score was allotted and for an incorrect answer no score was given. Incomplete response sheets were deleted and thus 388 answer sheets were obtained for analysis. The number was again reduced to 370 by rejecting 12 answer sheets (by rejecting every 22nd answer sheet). Two extreme groups were separated from the sample of 370, the students who scored the highest and who scored the lowest. Thus the upper 100 (27% of the total group) answer sheets having highest scores and the lower 100 answer sheets having lowest scores were selected. The number of pupils marking the correct answer for an item in the high achieving and low achieving groups was counted. Discrimination power was calculated using the formula and the difficulty index was calculated using the formula where U' is the number of correct responses in the upper group, L is the number of correct responses in the lower group and N is the number of subjects in the groups.

### 4.1.7. Finalization of the Test

Items having the difficulty index ranges between 0.60 and 0.40 and above were selected. But few items having the DI 0.30 and the discriminating power between 0.20 and 0.30 were also chosen in order to give due importance to all areas. 30 items were thus selected for the final test.

### 4.1.8. Validity of the Test

Validity of the test in the accuracy which test measures what it is, intended to measure. If a test measures only what it is intended to measure, the test is said to be valid. The validity of the test was established by correlating the test scores with school marks. The validity coefficient was computed by Pearson's Product Moment Method, and has got validity (r=0.816, N=80) when calculated on a sample of eighty students.

### 4.1.9. Reliability of the test

Reliability of a test is trustworthiness or its consistency. The concept of reliability underlines the errors of measurement of a single score, whereby we can predict the range of fluctuations likely to occur in single individual scores as a result of irrelevant factors (Anastasi, 1961. The reliability of test for measuring the knowledge in Biodiversity was found out by test-retest method with a time interval of 10 days for thirty students. The coefficient of correlation between the scores of two tests was calculated using Pearson's product moment method. Coefficient of correlation was found to be 0.77 (N=30) which shows that the test is reliable to measure Knowledge in biodiversity of Secondary School Students.

# 5. Test for Measuring the Knowledge in Biodiversity of Secondary School Students

# 5.1. Instructions

A few questions aiming at the understanding of Knowledge in Biodiversity of Secondary School Students. Read each question carefully and answer should be marked on the answer sheet provided along with it.

- 1. What is Biodiversity?
  - Diversity seen in the living organism
  - Some of flora in the world
  - Some of fauna in the world
  - Study of living things
  - Which is the International Biodiversity Day?
  - April 22

2.

4.

5.

7.

8.

10.

- May 22
- June 5
- March 21
- 3. What is HIPPO?
  - An animal in the Northern region of Africa
  - Organization for Biodiversity Conservation
  - List of factors of Biodiversity depletion
  - None of these
  - Which of the following is the major reason for Biodiversity depletion?
  - Pollution
    - Population Explosion
    - Habitat destruction
  - Invasive non-native species
    - Approximate number of existing and identified organism in the world?
  - 50 crores existing and 9 crore identified
  - 50,000 existing and 50,000identified
  - Below 1 lakh exiting and 70,000 identified
  - 100 crores existing and 1.7 crores identified
- 6. Among the exiting living beings which is the most affluent species?
  - Birds
  - Bacteria
  - Plants
  - Insects
  - What I GREEN PEACE?
  - Endangered Bird
  - The book that describes the Nature
  - World famous environmental organization
  - An organization for world peace
  - What is the latest method of Biodiversity Conservation?
  - Frozen zoo
  - Tissue culture
  - Cloning
  - Wild life sanctuary
- 9. What is SPCA?
  - List of endangered species
  - List of newly identified species
  - An organization for prevention of cruelty towards animal
  - An organization for prevention of cruelty towards plants
  - In which among the following countries is the lion share of forests lie?
  - Brazil
    - China
    - India
    - Australia

- 11. Which of the following place in which Periyar Tiger Reserve located?
  - Eravikulam
  - Thekkady
  - Silent Valley
  - Thiruvananthapuram
- 12. For which animal conservation the year 2011 give importance to?
  - Nilgiri Tahr
  - Bat
  - Owl
  - Elephant
- 13. What is sustainable Development?
  - Development without using natural resources
  - Development with minimum utilization of natural resources and by conserving them
  - Development with maximum utilization of natural resources.
  - Development along with the destruction of nature
- 14. Which of the following is the harmful effect of technological development?
  - Pesticide
  - E- Wastes
  - Invasive non-native species
  - Forest fire
- 15. Which tree I extinct along with the extinction of 'Dodo' Bird?
  - Teak
  - Bamboo
  - Mango tree
  - Calvarias
- 16. Which of the following place in which, organisms are conserved in natural habitat?
  - Botanical Garden
  - Gene Bank
  - Wild life sanctuaries
  - Zoological garden
  - Which of the following animal has not entered in to the Red Data Book?
  - Lion Tailed Macaque
  - Civet
  - Pig

17.

- Nilgiri Tahr
- 18. What is the aim of celebrating 'Earth our'?
  - Wetland Conservation
  - Forest Conservation
  - Environmental Conservation
  - Energy Conservation
- 19. What I meant for 'Kyoto Protocol'?
  - Prevention of ozone depletion
  - Conservation of Mangrove forest
  - Prevention of cruelty towards animals
  - Prevention of Biodiversity depletion
- 20. Which of the following is not a Genetically Modified Food?
  - Golden Rice
  - B T Soya bean
  - Mango
  - BT brinjal
- 21. Which of the place in which more number of native species and facing habitat destruction?
  - National Park
  - Ecological hotspots
  - Zoo
  - Biosphere reserve

- 22. Which I the world famous book that deal with the disastrous effect of DDT?
  - God of Small things
  - Silent spring
  - My Experiments with Truth
  - Red Data Book

23.

- What I the thickness of plastic, which is banned by Pollution Control Board?
- Below 30 micron
- Below 25 micron
- Below 10 micron
- Below 50 micron
- 24. Who is the author of the book 'The Book of Indian Birds'?
  - Dr. M.S. Swaminathan
  - Salim Ali
  - Menakha Gandhi
  - Sugathakumari
- 25. Who is the leader of 'NARMADA BACHAVO ANDOLAN'?
  - Sugathakumari
    - Menakha Gandhi
  - MedhaPatkar
  - Arundhadhi Roy
- 26. Which is the world largest Mangrove Forest?
  - Sunder ban
  - Anamudi Shola
  - Pampadum shoal
  - Silent Valley
  - Which country is the venue for Ramsar convention meant the Wetland conservation?
  - India
  - Italy
  - Holland
  - Iran

27.

28.

30.

- Which is the State Bird of Kerala?
- Peacock
- Crow
- Hornbil
- Parrot
- 29. Which is the animal being extinct as a result of over use of cell phone by people?
  - Polar beer
  - Tibetan Antilop
  - Civet
  - Nilgiri Tahr
  - Which is the animal getting extinct due to hunting for getting of best kind of wool?
  - Champdany
  - Gorilla
  - Lion Tailed Macaque
  - Nilgiri Tahr.

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