Current Environmental Issues and Challenges

---------- EDITORS ----------

Dr. Vilas V. Patil
Dr. Praveen G. Saptarshi
Dr. Digvijay S. Kumbhar
Mr. Agastirishi B. Toradmal
Dr. Ashok Kumar Verma

Nature Light Publications

ISBN- 978-81- 954002-9-4

Title	: Current Environmental Issues and Challenges
Editor Name:	Dr. Vilas V. Patil Dr. Praveen G. Saptarshi Dr. Digvijay S. Kumbhar Mr. Agastirishi B. Toradmal Dr. Ashok Kumar Verma
Publishing Agency	**:** Nature Light Publications, Pune
Publisher Address	Mrs. Pragati P. Patil 309, West 11, Manjari VSI Road, Manjari Bk, Haveli, Pune, 412307 Phone: +91 9922489040 / 8625060096
Printed By	Milan Digital Printers. Shop No.6 Business Square, Tilak Road, Sadashiv Peth, Pune - 411030
Edition Details	: Ist
ISBN	: 978-81- 954002-9-4
Copyright	: © Agastirishi B. Toradmal
Publication Date	: 15/07/2022

Price: 700/-

BIODIVERSITY: SURVEY, MONITORING AND EVALUATION METHODS

[1]Dr.D.S. Kumbhar, [1]Ms. T.C. Kulkarni, [1]Mr. A.B. Toradmal, [2]Mr. S.M. Gojare
[1]Dada Patil Mahavidyalaya, Karjat. Dist. Ahmednagar (MS) 414402
[2]Rajarshi Chh. Shahu College, Kolhapur (MS) 416003

I. INTRODUCTION:

Biodiversity (Animal, Plants and Microorganisms) have multidimensional role in the sustainable development of ecosystem or environment. As human is the dominant factor of ecosystem as he is altering anything according to his interest. Anthropogenic activities are the principal cause directly relates to biodiversity disturbance all over the world in large extent. Among various causes of biodiversity loss, anthropogenic activities are at first rank. Destruction of habitat, agricultural expansion at the banks of river and lakes, sand mining, unplanned tourism, deforestation, construction of roads and railway lines through forests and Grasslands, Quick expansion in industrial areas are some of the prominent anthropogenic practices responsible for biodiversity loss. Scientific study of biodiversity includes survey, monitoring and evaluating the threats and restoration of ecosystem.

The success of every survey programme is depends upon being clear about what you want to do and why; i.e. your objectives. It is therefore very important to define what monitoring is and how surveys relate to monitoring. Survey and monitoring consider for wide range of objectives, viz. quality of sampling site, to measure species abundance, richness, diversity, evenness, habitat trends, Environmental impact assessment (EIA) studies, preparation of Government and Non-Governmental Organization (NGOs) reports and to assess compliance with international conservation agreements.

The term survey defines the collection of spatial and/or temporal data about a species, a community, ecosystem or a habitat. Survey includes a predetermined set of questions regarding the sample. There are two principal kinds of survey, online survey and survey by questionnaire. Monitoring is often loosely regarded as a programme of repeated survey, based on qualitative or quantitative observations. The monitoring programme and methods selected for monitoring must be focussed and fit for their purpose and it should not attempt to describe the general ecology of the site.

II. SURVEY AND MONITORING:

Steps involved in a monitoring programme:

1. Identify the features that should be monitored on the site
2. Select attributes for each feature
3. Define limits or targets for attribute
4. Select methods for monitoring each attribute
5. Repeat for other attributes of the feature
6. Devise sampling strategy where necessary
7. Collect data

ISBN-978-81- 954002-9-4

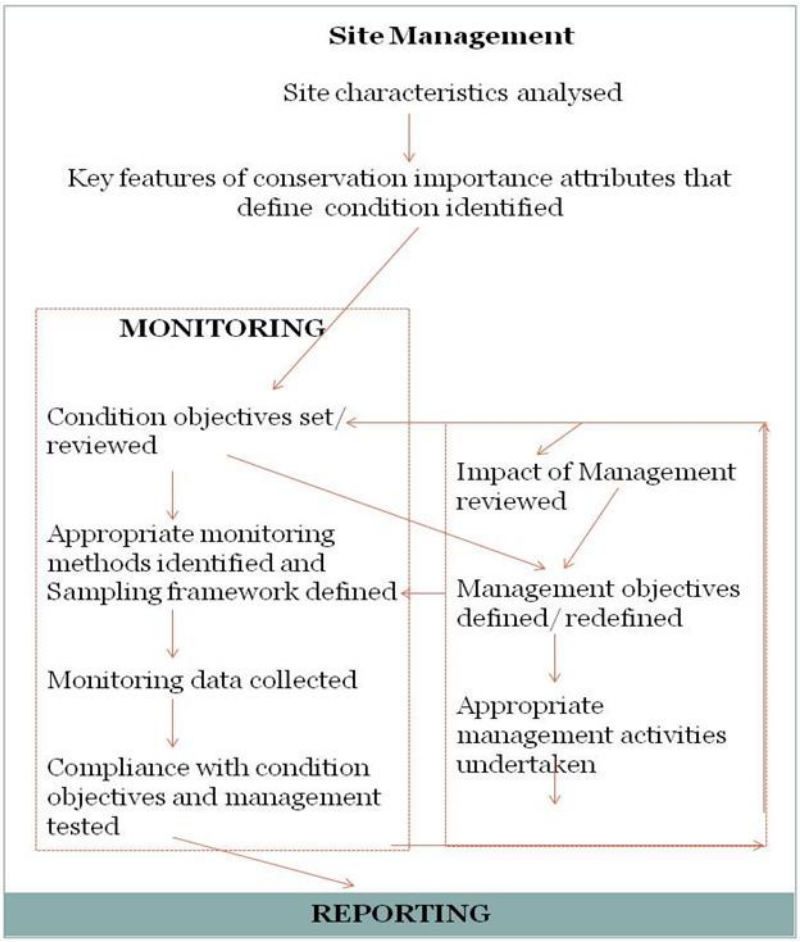

Figure: 1. A schematic view showing the relationship between site management and monitoring.

8. Analyse data
9. Determine whether attributes achieve targets set
10. Once all attributes have been assessed, determine feature condition
11. Repeat for other features
12. Act on findings if features not in acceptable condition

A CHECKLIST OF CONTEMPLATION FOCUSSED DURING THE PREPARATION OF A MONITORING PROGRAMME:

1. Setting Objectives for the Monitoring Programme

What features of conservation interest are to be monitored and evaluated?

What is the objective for each feature under study? What attributes define condition in these features and what are their acceptable limits?

How often should monitoring be carried out?

What are the operational and/or management objectives for the site?

ISBN-978-81- 954002-9-4

Is there any external factor that may have significant impacts on the site?
What type of monitoring has been undertaken, and are baseline surveys required?
Should the site be subdivided into monitoring units?

2. Selection of methods for Monitoring each attribute:

Is the method likely to damage the environment?
Are samples required?
Will the method selected for survey and monitoring provide the accurate measurement?
Can the selected method measures the attribute across an appropriate range of conditions?
Is the method prone to substantial measurement error?

1. Designing a Sampling Strategy:

Has the method been thoroughly tested or require any preliminary survey?
Is the method sufficiently precise?
Should sample locations be permanent or not?
When should the data be collected?
How will consistency be assured?

2. Reviewing the Monitoring programme:

Are there sufficient long-term resources available?
Are personnel sufficiently trained and experienced?
Are licences required?
Is specialist equipment required and available?
Are there health and safety issues to consider?

3. Data Recording and Storage:

How will data be recorded in the field?
How will the data be stored?
Who will hold and manage the data?

4. Data Analysis, Interpretation and Review:

Who will carry out the analysis and when?
How will the data be analysed?
Which will be the appropriate statistical tests to analyse the data?
Is of the data transformation required before statistical analysis?

ATTRIBUTES THAT SHOULD BE CONDERED TO DEFINE THE CONDITION OF HABITATS AND SPECIES:

HABITAT ATTRIBUTES	SPECIES ATTRIBUTES
Quantity area	Quantity presence/absence range population size

ISBN-978-81- 954002-9-4

	frequency number/density and cover
Quality: Physical attributes geological (e.g. presence of bare rock, open land or deep peat) water (e.g. presence of open water or deep water table)	Population dynamics recruitment mortality emigration and immigration
Quality: composition communities richness or diversity typical, keystone or indicator species presence–absence frequency number or density cover biomass	Population structure age sex ratio fragmentation or isolation genetic diversity
Quality: structure inter-habitat (landscape) scale (e.g. fragmentation, habitat mosaics) intra-habitat scale macro-scale horizontal (e.g. plant community mosaics) vertical (e.g. ground-, shrub- and tree-layer topography) micro-scale horizontal (e.g. patches of short and tall vegetation) vertical (e.g. within-layer topography)	Habitat requirements favourable Conservation status is dependent on the availability of sufficient habitat. physical vegetation type and structural attributes availability of suitable micro-habitats abundance and availability of prey species
Quality: dynamics succession reproduction or regeneration cyclic change and patch dynamics Quality: function physical and biochemical (e.g. soil stabilisation, carbon sinks) ecosystem (e.g. net producer)	-------

ISBN-978-81- 954002-9-4

DATA COLLECTION:

The data collection begins after formulation of research problem and research design planned out. Data collection is nothing but collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the outcomes. Data can be collected on any formulated topic for any purpose, meaning that it is used in everything from scientific research and finance to business management and retail.

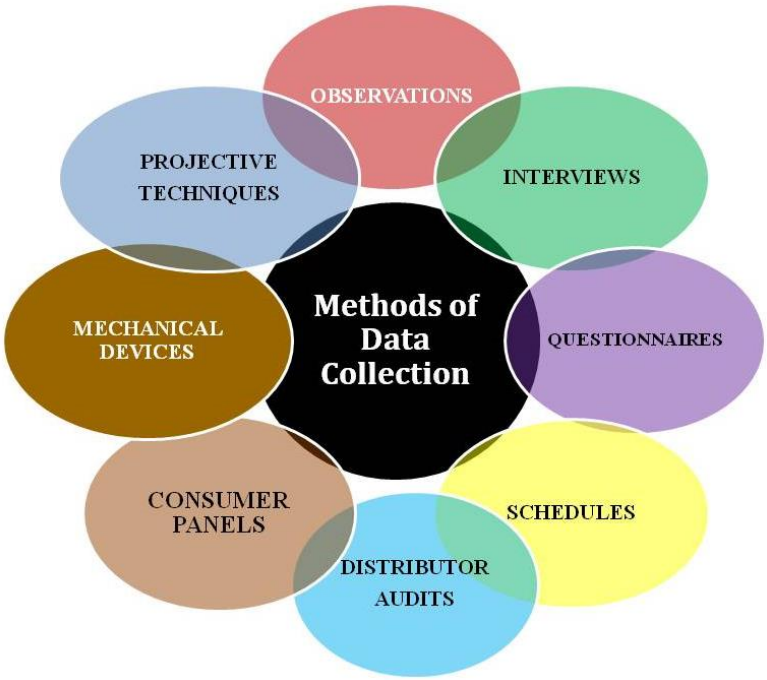

Fig. 2: Methods of Data Collection

DATA PROCESSING:

Data processing is the collection and manipulation of data to produce meaningful information. Data processing is a form of information processing, which is the modification of information in any manner detectable by an observer.

Six stages of Data Processing:

1. Data Collection
2. Data Preparation
3. Data input
4. Data Processing
5. Data Output/ interpretation
6. Data Storage

ISBN-978-81- 954002-9-4

III. METHODS OF DATA EVALUATION:

The diversity work will not be completed until the data collected is analysed with diversity indices. Some of the diversity indices, used for quantitative data analysis are as follows.

Number of taxa (*S*): Number of species in a community.

Total number of individuals (*n*): Total number of individuals of all species found.

Dominance (D) = 1-Simpson Index. It is used to identify dominant species in the community. Values ranges from 0 indicates all taxa are equally present to 1 represent one taxon dominates the community completely.

$$D = \sum_i \left(\frac{n_i}{n}\right)^2$$

Where,

n_i - Number of individuals of taxon *i*.

n – Total number of individuals of all taxon.

Simpson index (1-*D*): Simpson index measures 'evenness' of the species found in community. Its value ranges from 0 to 1.

$$Simpson\ index = 1 - \sum_i \left(\frac{n_i}{n}\right)^2$$

Where,

n_i - Number of individuals of taxon *i*.

n – Total number of individuals of all taxon.

Shannon Diversity Index (*H*):

It considers both numbers of individuals as well as number of species in a community. Its value ranges from 0 for community with only one species to higher value for community with many species each with many or few individuals. It is calculated as follows

$$H = -\sum \frac{n_i}{n} ln \frac{n_i}{n}$$

Brillouin's Index: $HB = \frac{\ln(n!) - \sum_i \ln(n_i!)}{n}$

Menhinick's richness index: $\frac{S}{\sqrt{n}}$

ISBN-978-81- 954002-9-4

Margalef's richness index: $(S-1)\ /\ \ln(n)$

Berger-Parker dominance: It is simply the number of individuals in the dominant taxon. It is calculated as

$$d = \frac{N_{max}}{N}$$

Fisher's alpha: It is a parametric index of diversity and assumes that the species abundance follows the log series of distribution among the taxa. It is calculated as follows

$$S = a * \ln(1 - n)\ /a$$

Where,

S - Number of taxa.

n - Number of individuals.

a - Fisher's alpha.

IV. SUMMARY AND CONCLUSION:

Monitoring and evaluation for biodiversity has been aimed at gathering of data to enable detection of changes in the status, security and utilization of biological diversity for the purpose of improving the effectiveness of management of that biodiversity. Monitoring and evaluation are two sides of the same coin and require adequate resources, including budget and institutional capacity, clear institutional responsibilities and reporting mechanisms. It is important to build incentives and capacity to collect, use and maintain data for monitoring and evaluation. The information gathered through Monitoring and Evaluation activities is useful both for assessing the impacts of the individual project and to provide input into the design and implementation of future biodiversity projects and ongoing biodiversity management programmes.

V. REFERENCES:

Global Environment Division. Guidelines for Monitoring and Evaluation for Biodiversity roject. June 1998.

Maria Raquel Kanieski, Solon Jonas Longhi and Philipe Ricardo Casemiro Soares (2018). Methods for Biodiversity Assessment: Case Study in an Area of Atlantic Forest in Southern Brazil. http://dx.doi.org/10.5772/intechopen.71824

Biodiversity Assessment Initiatives. Guide for Decision Makers. Zurich, September, 2018.

David Hill, Matthew Fasham, Graham Tucker, Michael Shewry, Philip Shaw (2005).

ISBN-978-81- 954002-9-4

Handbook of Biodiversity Methods: Survey, Evaluation and Monitoring. Cambridge University Press, Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo.

J. Eymann, J. Degreef, Ch. Häuser, J.C. Monje, Y. Samyn and D. VandenSpiegel (2010) Manual on Field recording techniques and protocols for All Taxa Biodiversity Inventories and Monitoring. Volume 8 Part 1. ABC Taxa.

ISBN-978-81- 954002-9-4