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Ecological studies on mammalian resources of Bagdara sanctuary, Sidhi (M.P.)

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Abstract
For a millennium, man and wild animals have evolved together on this planet, called Earth. All life on earth is one and all living things are inextricably interlinked (food chains) forming ecosystems. Destruction of wild life may cause upset in the ecological balance or equilibrium resulting in severe consequences. Thus, protection of every animal species is of great importance to the quality of life and to the survival of man himself. By rendering the planet uninhabitable for animals, we will not be able to avoid extinction ourselves.
To ensure the maintenance of viable population of tiger in M.P. for scientific, economic, aesthetic, cultural and ecological values. To preserve for all times the areas of such biological importance as a national heritage for the benefit, education and enjoyment of the people. Ecological monitoring and research activities should be extended.

Keywords: ecological, mammalian, Bagdara sanctuary, Sidhi

1. Introduction
The geographical extent of Bagdara sanctuary, Sidhi (M.P.) India constitutes one of the uniques biological regions of the world. Rapid implementation of modern civilisation is fast changing the land cover and land use in the country resulting in serious implications for the biodiversity of the region. Recent developments in remote sensing technology and geographic information systems allow the use of landscape ecology and special analysis approach to the problems of deforestation and biodiversity conservation. Forest fragmentation, land use changes, forest loss and the socio-economic changes can be evaluated by modeling of deforestation and analysis of the consequences of land cover and land use changes which are manifesting subsequently as climatic changes are taken later into consideration.
The status of the area can be determined by making a search on the ecological history of the area. For this purpose the geographic information system and remote sensing can be of great help. Evaluation of biodiversity of particular groups of animals like the amphibian, reptilian, avian and mammalian community studies along with problems and action plan for future conversion of the ecosystem into an ecofriendly type can also be attempted. In recent years this significant aspect has been taken into consideration and protected areas have been identified on this basis for introducing the rare, threatened and endangered species, removing them from the threatened environment and lodgning them in the identified ecofriendly environment. It is desirable that such assessment of biodiversity implications are based on transparent objective methodology.
This can be practised by professional ecologists to decentralise species into an otherwise favourable environment. By combining available information on habitat transformation and decreasing populations of the respective threatened species, an assessment can be evolved as to how the development processes are affecting the biodiversity values. Such assessments are being attempted recently in the Indian continent in the high altitude grassland ecosystems and maintain forest ecosystems. The recent principle of maintaining "forest gene banks" as a new approach for in-site conservation of genetic resources is emerging as a new technique which may be most effective than zoological parks or sanctuaries. The hot spots of genetic variation of a few important medicinal plants and other endangered and threatened plant species in the subcontinent seems now practicable in carefully identified suitable areas. This new idea is yet to be formalised and tested before implementation.
Survey of literature reveals that negligible amount of work has been done on this aspect in Bagdara Sanctuary, Sidhi (M.P.) and the resources managers were primarily dependent on case studies done elsewhere.
Recently, Abramowitz, 1991; Akhtar, 1944; Baroda, 1991; Bista, 1977; Chattopadhay and Konar, 1985; Chauhan, 1993; Dixon & Hufschimidt, 1986; Gaston *et al.* 1981; Hinton and Fry, 1923; Kerbs and Davies, 1993; Laurie, 1982; Martin, 1977; Nicholson, 1933; Panwar, 1982; Simpson, 1945; Teas, *et al.* 1978 and Woodbury, 1954) [1-17] studied the zoogeography, ecology and bionomics of smaller mammals.

2. Materials and Methods
Boundaries
Boundary description of the sanctuary is as under - North - Mirzapur and Sonbhadra district of U.P., East - Sonbhadra district of U.P., South - Son River, West Mirzapur district of U.P. and Rewa district of M.P.

Location
One of the largest forest sanctuary in the Distt. the forest boasts of one of the most beautiful rich and picturesque forests in M.P., though one of the least known forest at the same time.

The nature has gifted to this area with somewhat virgin landscape which are sight-worthy especially during winters, just after the rainy seasons. It is situated in the Sidhi districts of Madhya Pradesh at the latitudes 24°30' N and 24°42' N and longitudes 82°20' E to 82°42' E. There are several range in this forest covering Sidhi. District Sidhi includes total 7 blocks.

Table 1: Summary of blocks and compartments of Bagdara sanctuary, Sidhi (M.P.)

S. No.	Block Name	Compartment number	Total Compartment	Area (Hect.)
1.	Newari	1 to 5	05	1181.800
2.	Bellan	6 to 19	14	3540.656
3.	Tamai	20 to 33	14	3993.136
4.	Junhawal	34 to 42	09	2342.896
5.	Harma	43 to 73	31	7750.336
6.	Baheri	74 to 76	03	730.432
7.	Bicchi	77 to 89	13	3555.504
	Total		89	23104.760 Hec. or 231.047 sq. km.

Terrain and Geology

Topography is rugged and terrain is tough. The altitude varies from 460 m to 1024 m above MSL Domarpat is the highest point. The diversity of the terrain is matched by that of geological formation. Phyllites and shists closely associated with limestone are widely scattered. Soils are deep in the proximity of rivers, fairly deep and well drained in the lower slopes and shallow on the higher reaches and steep slopes, bare rocky outcrops are also characteristic features of this area.

The picturesque hill ranges of Vindhyas and Mahadevs Series which include valley and Sal plateaus, locally called PAT are one of the life-line of the forest. The climate of the tract is typically monsoonal with three well defined seasons. The winter (from mid- October to the end of February), the summer (from March to mid- June), and the rains (from mid June to mid October).

The mean annual rainfall is 1173 mm coming mostly in the rainy season. The temperature ranges from a maximum of 44°C in May and June to around 5°C in winter. The area lies in the catchment of Son and Bellan rivers which origins from respectively Sonhat and Ramgarh range of the place.

Bagdara Sanctuary

The sanctuary of the area have long history of management, primarily managed for commercial purposes, like timber and bomboo harvesting, firewood and other NTEP collection. The forests in the past were managed as Shikar gahas of the rulers and were irregularly and unscientifically exploited as and when thought necessary under the Darbar orders for supplementing the state revenue. Protection of forest was more by convention than by law.

No details regarding the management of forest during the period from the years of the first reservation of the forest in 1883 till the enactment of "Kanoon Jangal Riyasat Rewa, Baghelkhand, 1927" are available. Regular bamboo and timber felling series were formed for the first time during 1939 and in the year 1946-1947 onwards 3 year bamboo felling cycle was adopted. From 1957-58 onwards all the sal and mixed forest were worked under C.W.R. and the system was applied uniformly for all the sal areas, irrespective of whether there was demand for small sized timber or not.

Work plan including methodology and time schedule

A Retrospective Bagdara Sanctuary, Distt. Sidhi (M.P.)

Topography: Including variation in ecological nitches.

1. Available Faunistic and Floristic Information.
2. Special review of animal resources specially mammals.
3. Mammalian diversity and potentials.

3. Results and Discussion

The present studies have been taken in order to understand the ecology of various mammalian affecting the population and effect of various factors which are related to their development. It is a common practice that animals respond to a certain factor, such as temperature, humidity, rainfall, wind and light etc. The animals show particular distribution in relation to the conditions of the environment or when it makes the adjustment that enables it to feel environment better. Some of the important ecological factors have been discussed here specially abiotic factors like temperature, humidity, rainfall, wind speed and light.

Temperature

Temperature is an important factor in considering the ecology of certain places. It may be said to be responsible for distribution and growth of the animals. Temperature controls the chemical process going on in the body of the organisms and thus has a universal influence. Temperature also plays an important role indirectly influencing other ecological factors.

Change in temperature directly affects the metabolism of the animals of course an animal can survive in superminimal temperatures but the optimum rate of the metabolism is usually much closed to the maximum than the minimum. This fact comes with the observation on the metabolism of mammalia that they grow to maturity more early in the summer than in the winter season.

All the mammals studied during the course of present investigation have ability to survive in a wide range of temperature and they are able to live from the temperature 12^0C to 50^0C. They have been recorded to possess optimum ranges of activity through which temperature are favourable beyond this they become too rapid or greatly excited and if temperature becomes too extreme finally die.

Animals exposed to low temperature may die off chilling before their protoplasm actually freezes formation of ice crystals in the body of an insect usually results in death. At low temperature death may be brought about by direct mechanical injury, water loss through changes in permeability or precipitation of proteins and other irreversible chemical changes. There appears to be little chemical change or modification in the protoplasm at low temperature, the only change is that it slows down the metabolism and finally it causes death of the animal, this is probably due to increase in viscosity and ice information.

Water

Water is the life of all living organisms. It is chief constituent of body fluid of plants as well as animals. The ground water is the mixture of highly polymerized type (H_2O), $(H_2O)_2$ and $(H_2O)_3$ etc. Besides polymerized water is further complicated by the occurrence of hydrogen and oxygen, in water molecute. As a medium in which the animals may live, it offers many advantages. It has bouncy and thermal stability and is an universal solvent. Its pressure and viscocity vary with depth and temperature. The high specific heat of water is a unique and biologically important property. Aquatic habitats are thermally quite stable because water changes the temperature comparatively slowly. No other liquid is capable of dissolving so many substances as the water and acts as carrier for great variety of substances. The remarkable solvent capacity of water gives it advantage as a medium in which the animals may live. There is a relation between temperature and the solvent capacity of the water. In general large quantities and qualities of solids can be dissolved at a high temperature and more of the gases at lower temperature. The dissolved solids are of great value because they furnish materials for nutrition.

Water forms a large proportion of mammalian tissues and survival depends upon the ability to maintain the balance of water in the body. The body content of mammals varies from about 50 to 90% of the body weight, but since this includes skin, with relatively high water content, the content of the living tissues is higher than this, Reduction of the water content ultimately leads to death, some dies when their water content falls from about 75 to 60%. Inorganic salts are also important in the tissues and not only their absolute levels, but their relative concentrations may be important. Together, salts and water produce osmotic effects which will affect the distribution of water. Hence it is essential that the salts and water content of the tissues is regulated so as to maintain an optimal balance.

The situation in the tissues is in turn related to that in the cytoplasm and work on salt and water regulation in mammals has been concerned with the bold. The experimental mammals were found to loose water by evaporation from the general body surface and the respiratory spiracles as well as by urine. If they are to survive these losses must be kept to a minimum and must be offset by water gained from other sources.

The main source of water is the rains. Sidhi enjoys the good rains. It generally comes during last week of June every year and continued to mid of October; after that winter rains have also been recorded. Though, sufficient rains have been observed, sometimes water logging complaints have been recorded during rainy season in this region, while it is found scare city of even drinking water during summer months. For the last five yeas the ground water level has been noticed to go down and every year. There is a big river Sone in the experimental area and irrigation is and canals totally depended upon tube wells.

As the experimental area has sufficient rains, so no water problem has been noticed during the course of the present investigation. They preferred clear and moist weather for their oviposition, development and other activities, much better than other climatic conditions.

Humidity

Humidity is also one of the most important factors which may affect the metabolism and hence the rate of development of animals. During the present investigation it has been found that incubation period is reduced with the increase of humidity, similarity rate of oviposition increases at high humidities. The low metabolic rates at low humidities implied by these differences may result from an increased water loss leading to a generally low water content. The development is fastest at about 70% relative humidity, being slower at lower and higher humidities.

The time of survival at different relative humidities, depends largely on the ability to maintain its water content. If this falls too low the dies, although there are some exceptions to this. If, as in the egg and larva is unable to replenish its water the duration of survival is inversely proportional to the rate of water loss and hence, roughly, to the saturation deficit, the more permeable the skin, the lower the saturation deficit at which they will die. When mamalia can replace the water which it loses, it can usually withstand extremes of humidity. Thus there is no range outside which the can not survive as there is with temperature. But there may be mortality at low humidities even with an ample supply of water, possibly because the energy expended in maintaining the water content exerts a metabolic strain on the animal.

Mammals have also been observed to prefer range of humidity due to differences in its water content. Some animals make directed movements towards the area of high humidity and others perform avoidance reactions when they pass out of the favorable zone.

Under experimental conditions, it was noticed that there was a critical point at about 60 percent relative humidity, below which the development and growth of the declined rapidly and mortally was high at 80 percent of humidity.

Light

Light energy influences almost all the aspects of plant and animals like directly or indirectly. Thus it controls the structure, form, shape, physiology, growth, reproduction, development, local distribution etc. Of the plant and animals. The radiant energy from the sun is the basic requirement for the existence of life on the earth. The source of energy is of fundamental importance to the photosynthetic production of food by plants and as mentioned the heat budget of the world is dependent on solar radiation. Although we generally, think only in terms of visible light, the sun emits other radiations of different wave lengths-cosmic rays, gamma rays, x-ray, ultra violet rays, infra red rays, heat waves, spark discharges, radar waves, radio waves and slow electro-magnetic waves.

Visible light is only a small fraction of the radiation spectrum and contains the frequency of wavelength ranges from 390 to 700 millimicrons (m/u). It is made up of a series of colors from violet through indigo, blue, green yellow, orange and red, all constituting the visible spectrum. Thus, light energy reaches the earth as electromagnetic waves of solar radiation with tremendous velocity and supplies most of the warmth the earth receives from the sun and also supplies the main source of energy which is utilized in photosynthesis of plants, oriented and rhythmic behavior of animals, bioluminescence periodicity's of occurrence and periods of inactivity. Unlike temperature, light is a non-lethal ecological factor and it has a specific direction in its flow.

Light energy varies with different Media. The transparency of air and water is important in regulating the amount and quantity of light that may be available in particular habitats. Fore example, the intensity of light reaching the earth's surface varies with the angle of incidence, degree of latitude and altitude, season, time of day, amount absorbed and dispersed by atmosphere and a number of climatic and topographical factors such as fog, clouds, suspended water drops, and dust particles.

The angle of contact differs with the differentiating latitude. The latitude determines the relation of a plant to the general incidence of light from Sun. Sidhi is situated near the equator hence enjoys much more brighter days and greater penetration of lights.

The seasonal differences affect the light with the change in position of sun, seasonal changes have been recorded. Sidhi is situated near to the tropic of Cancer. Due to its position it gets vertical sun rays for much more longer time during different seasons.

The diurnal differences are caused by the daily Journey of the sun from East to west. It results in its rise in the sky from horizon to the meridian for a chosen location and a succeeding drop across the sky to the western horizon. Therefore, the angle of contact of light with the plants changes during the day and reaching its maximum at noon; but declines in both times morning and evening. The excessive absorption of light by animals is always harmful and most of the animals avoid light. Thus, animals have also been to get hidden during strong light, under the habitat.

Direct effect of the light

Light is an essential factor in the formation of chlorophyll pigment in green plants. It has a very strong influence of the number and position of chloroplasts. The upper part of leaves which receive full sunshine has larger number of chloroplasts which are arranged in line with the direction of light. During photosynthesis, the green plants synthesize their carbohydrate food from water and CO_2 in the presence of sunlight. Thus, during photosynthesis, the solar radiant energy is transformed into the chemical or molecular energy which remains stored in chemical bonds of carbohydrates and this chemical energy is utilized by other cholorophyllous and non-chlorophyllous parts of the plants, all animals, bacteria and viruses in their different life activities. One of the most obvious familiar properties of the plants is the synthesis of food with the sunlight. Natural sun rays falling on the green leaves enables the plants to synthesize the food materials with the help of CO_2 and water; Light exerts profound influence upon a whole series of biological phenomenon.

Direct effect of light on the plants

Light affects opening and closing of stomata, influence the permeability of plasma membrane and has heating effect. All these in turn affect transpiration which in turn affects absorption of water. Light affects respiration of plants indirectly, as in the presence of light the respiratory substrates are synthesized.

Effect of light on the animals

Light affects divergent aspects of animals life. It influences cellular metabolism, growth, pigmentation, locomotion, reproduction, ontogenic development and also controls the periodicity and biological clocks of animals. But when light is given directly in excess to protoplasm, it causes injury by drying or breaking down the compounds which are essential for life. Light retards the growth of animals and plants and they are adopted so as to be protected from it by shielding of growing regions the formation of pigments etc.

The mammals though live in strong light in open fields, but they have some protective devices, which enables them to survive. The possible pigmentation of the body protects themselves from the injurious direct effect of light by hiding. This is the reason why most of the mammals are nocturnal in habit. However, they were found much protected from light and injuries due to direct excessive light could not be ascertained during this experiments.

Soil

Soil is the placenta and top most layer of earth crust. The soil influence the seed germination and vegetative growth. The ecosystem starts with the primary producers, which constitute about ninety percent of the biomass of all living being on the earth. The primary producers are plants, which have the capacity to trap solar energy and convert it into chemical energy which in terms from the food for the consumers. The plants which provide food to all, are also dependent for their own food on the soil. We have to study relationship of plants as well as animals with the soil which are helping its existence directly or indirectly.

The soil of Distt. Sidhi (M.P.) derives its origin from the rocks of upper Vindhyan system, which are more or less horizontal alternating between stratification of hard and soft bands of sand stone, lime stone and shales. The recent upper system is deposited over the lower Vindyan system, composed of marine calcareous sand stone and undulated shales of argillaceous nature.

4. Acknowledgement

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