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Biodiversity Conservation in Sri Lanka

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During the last decade and half the conservation of “biodiversity” has become a major concern, but is riddled with controversies and contradictions. This is because of the poor understanding of the term “biodiversity”. The need and the mechanism to conserve “biodiversity” could be achieved only by understanding what “biodiversity” means in the present context. An assessment of our efforts to conserve “biodiversity” would then be possible only if the terminology is properly understood. If not the indicators for such an assessment would be wrong.

What is “Biodiversity”?

Way back towards the end of the 1970's, the ‘Conservation’ community and various NGOs were discussing the merits of protecting nature, while ensuring that the communities, as a result would not be deprived of the so called ‘benefits’ of development. The way nature and nature products were exploited in the name of providing ‘development benefits’ came under the magnifying glass. It was noted that the exploitation of ‘natural products’ were often done by the developed country organizations. These organizations exploited ‘nature products’ by bringing them into the market. The market product was a refined ‘attractive’ product that required ‘technological transformation’. For example ‘drugs’ were brought out through technological transformations as ‘tablets’, ‘concentrates’, ‘lotions’, etc. The uses of these products were much easier than the ‘original substance’, which involved collection from the wild, preparation through expert hands, etc.

The products have entered the economic mainstream and even become, as in Sri Lanka, major foreign exchange earning sources. In this process, it was also noted that the ‘raw material’ was often taken away from the country, transformed technologically and brought into the market and the profits are reaped by the ‘Agency’ of the developed country. This general aspect was seen to apply across almost all the ‘nature products’. In the meantime, greater awareness of the environment was also building in the world community. Development in information transformation and ability to travel across nations were also becoming easier and ‘cheaper’. Many people were traveling across borders as ‘Tourists’, and are seeking to enjoy the traits of the remaining naturalness in many of the developing nations. This mode of enjoyment, education, also brings pressures upon the resource base, through impacts of “over visitation” and ‘development demands’. The conflict between ‘tourism’ and “nature conservation” was also an emerging subject during these years.

The NGOs and conservation community demanded “justice” and “fair play” in these developments. In 1981, the IUCN (The World Conservation Union) along with other NGOs brought to light the plight of ‘biological diversity’ conservation and its exploitation. Soon it was recognized that any justice to the recognized difference is beyond the scope of NGOs, and it needs international ‘agreements’ and trust. As a result of this realization, UNEP took over the mandate to negotiate an ‘International Convention’ on the subject.

Things moved through numerous directions and discussions were filled with open disagreements and grave concerns. Walter Rosen of the National Academy of Science, USA, coined the Word ‘Biodiversity’ from the two words “Biological Diversity” as a need for a conference in 1985. As it was a coined word, it is referred to as a ‘pseudocognate’. The word caught the imagination of the world, and O.E. Wilson

through his publication “The Diversity of Life” made it popular. Thus the use of the word became universal, but not ‘legal’.

The meaning of ‘biodiversity’ evolved to reflect something much more than “biological diversity”.

“Biodiversity is one of many terms, which whilst applied widely in biology, remain inconsistently or at times inadequately defined. However, the problem is perhaps amplified in this case, because the term has usage in other spheres (legal, media, political, etc.). It will be difficult, perhaps impossible, to put an end to the element of confusion which results. Nonetheless, whether viewed as an abstract biological concept, which can or cannot be operationalized, or as something scientifically less neutral, it has served to draw attention to and provide fresh perspectives on a number of scientific concepts” (Kevin J. Gaston).

In this background, it will be appropriate here to attempt to understand the term ‘biodiversity’. The best way is to seek a link between ‘biological diversity’ (the original words) and the present word ‘biodiversity’. After many years of been involved in the subject, I have come up with the following which helps us to recognize and understand the word Biodiversity.

“Biodiversity Gives DEPTH and WIDTH to Biological Diversity”

How does Biodiversity give DEPTH to Biological Diversity”?

The definition of biological diversity given in the Convention on Biological Diversity – Art 2, recognizes all living organisms, their processes, at the broad ecosystem level (Ecosystem diversity), species occupying these ecosystems as “species diversity”, and finally the variability within species as brought about by “Genetic Diversity”. Thus from the broad ecosystem – through species we go to the molecular genetic diversity. This DEPTH of the subjects opens immense areas of study and concerns.

Next ‘Biodiversity gives WIDTH to Biological Diversity’

The study of biological diversity other than from the conventional biology, areas such as agricultural related research, the areas of trade, and economics, the indigenous knowledge and practices are all part of the WIDTH. There is in the real sense ‘Nothing Outside’ biodiversity. This wide all-inclusive nature is the more popular aspect of biodiversity. It is therefore not surprising that in 1993 – we had the word ‘Bio piracy’ coined to reflect the unethical, exploitation of the biological diversity. So is the term ‘Bio-prospecting’ and many other ‘bio’ – linked words.

The word biodiversity has become an all en-composing term with implications in every aspects of study and management. It has become a need for all persons concerned to understand this complexity. In the core of this word is thus:

- a. The components of biological diversity as given by Article 2 of the Convention on Biological Diversity. i.e “diversity within species, between species and of ecosystems”, which is interpreted in common jargon as Genetic diversity, species diversity and ecosystems diversity
- b. The aspects of “sustainable use” of biological diversity

It is with this background that we should look at the “Biodiversity conservation in Sri Lanka”. What have we achieved in terms of biodiversity conservation is going to be a very difficult question to answer. If we are sincere we should be ready to differentiate the “wildlife” and “Nature” conservation efforts of the past and look at our efforts since the emergence of the subject of “biodiversity” to truly asses our success or failure. The result is most surprising, but limited space prevents me from considering all these aspects. **I would touch upon the efforts on “species diversity”, and the efforts to protect them through the “insitu” mechanism, i.e. declarations of Protected Areas.** To enable this analysis it is necessary understand “biodiversity conservation”.

Biodiversity Conservation – Probing in the Dark

Conventional conservation as understood by the professionals in conservation has four components – use, protection, regulations and management. The need to conserve arises out of the recognition of the value of “use” of nature. This use can be extractive or non extractive. Either way, the value, along with the degree of use brings about a possible pressure or impact that could become destructive. It is at this point that the need to ensure nature's continuity becomes necessary and thus the involvement to ensure a reduction in the pressures or impacts i.e conservation. Conserving nature is a contrast to conserving archaeological artifacts or constructed heritage. In this format our efforts is to prevent the archaeological artifact from been effected by the elements of nature i.e deterioration, change etc. Such an action is thus against “nature”, and as such cannot be the format for conservation of nature whose inherent character is change. Our effort in biological diversity conservation is thus to ensure that what is natural remains natural within its “natural process”. To do this it is inherent that we have to know “what is the natural process”.

Even with all the advances in science and technology, it is this very aspect that has remained far from us. In fact the history of human actions clearly shows that our attitudes of the past where we assumed superiority over nature have been clearly demonstrated to be wrong. Rather than getting closer to getting to know the “natural process” we have actually fallen behind in leaps and bounds. It was a great surprise to all in biology to recognize that the basic species composition of nature remained largely undocumented. We were told that only about 10% is documented, thus 90 % remaining undocumented. What this means for conservation is that any action is based on the knowledge of mere 10% of species and their assemblages and not of the major species composition. This raises fundamental questions of action – what makes us assume that what we do for the known species is right for the unknown species? Are we sure that our actions based on the known is not effecting negatively on the unknown? The summary of this startling revelation is that conservationist has been groping in the dark. Any success of the actions that were often based on “single species” needs could have resulted in many unknown species going extinct. Of course we can take cover in the fact that “what is not known does not exist, so why be concerned”. This attitude can no longer prevail in the aspect of Biodiversity conservation. It is for this reason that the four components of conservation were replaced with three – Save, Study and Use. “Study” replaces the two elements regulation and management. It should become obvious that one cannot regulate or manage something that is unknown. **What thus becomes priority is to know – i.e study.**

Secondly, it came to light that the “species” conservation approach has tremendous limitations and as indicated above is probably “anti-nature”. This however does not undermine the great success we had in limited species targeted conservation efforts of the past. But that is only on the basis of the “known” species and in the frame work of “wildlife” and not in the framework of biodiversity. An obvious change of approach is therefore seen in the present light of biodiversity emphasis. **This has come about by the general acceptances of three very significant “process” in conservation i.e. “Ecosystems approach”, “Adaptive management” and “Peoples participation”.**

Ecosystems management takes in to consideration the broad diversity level for conservation and in it is also the resulting expansion of numerous basic attitudinal and end result objective changes. These are summarized in the Table 1. The approach also expands the horizon of involvement in institutions, space and time (Figure 1) and is conceptually different (Figure 2) from traditional conservation.

Adaptive management on the other hand is based on the fact of available information, the need to act in this critical state, and thus be pro active in conservation. It provides for the manager a “mind-set” strength to act with available information through a learning curve to enable the ultimate result to be achieved, in a series of incremental actions. It thus becomes inherent that that adaptive management is linked with “monitoring” (Figure 3). Adaptive management emphasizes the need to develop management plans and implement them. It calls on the managers to do this with the available information and not to wait for

information. That information need is thus one aspect of the plan of action to be incorporated to the plan of action at the evaluating stage. It removes the present constraint on the managers of “been frightened of making mistakes” and of changing the mind-set of inaction due to lack of information. These are major factors of positive impetus for an effective manager. The manager thus becomes a “researcher” or at least a facilitator of research which generates information from actions through the implementation of the plan of action. At the end of each cycle – five, three or one year – the plan becomes more realistic and achievable.

People’s participation has been in the wildlife conservation domain for a long time. But with conservation often considered as “protection”, this had low priority in many situations. The majority of conservationists in Sri Lanka, despite the global and historic records of conservation in the country were fundamentally promoting “protection” and not conservation.

This is probably due to the historic developments of wildlife conservation in the country over the past 100-150 years. Sri Lanka’s record in wildlife conservation in the recent past evolved through the concerns for “Game”. Regulating “game hunting” and setting aside reserves for such regulated game hunting, was the beginning of the present wildlife conservation in Sri Lanka. The public agitation for fauna and flora (mainly fauna) was also to achieve these ends. It is for this reason that the Game Protection Society was established (it is today the Wildlife and Nature Protection Society of Sri Lanka). The agitations promoted the establishment of the two game reserves in the country at Wilpattu and Yala which are National Parks today. The establishment of Game reserves, and regulated hunting permitted in them, ensured the people’s participation as “trackers”. These “trackers” were members of the adjacent community who “tracked” down the game for the permit holders. However with the consolidation of the Protected Area network through the Fauna and Flora Protection Ordinance the role became more than showing the locations for game hunting but also showing animals for visitors wanting to see animals. As hunting by permits got discontinued and the visitation became the major activity to National parks, the role of the “trackers” continued. With time this responsibility was distanced from the immediate community and became a role of the recruited “Wildlife Guards” to the Department of Wildlife Conservation. Thus the community link broke off. It was brought back with “Volunteer Guide” scheme but this too has now been for the masses and not the community as such. In the Forest Department with the declaration of the Sinharaja Wilderness Heritage Reserve, guides were from the immediate village- Kudawa, and thus this community involvement continues to date.

These approaches and philosophy is today given by the subject of “Conservation Biology”, a discipline that evolved about the same time as the concern for biodiversity began – the 80’s. The parallel evolution of the mechanisms to achieve the conservation of biological diversity in the new “biodiversity” framework must be the practice of today.

The Dilemma of Species Identification

Ever since the shortened pseudocognate “biodiversity” for “biological diversity” came into the vocabulary, the numbers of animals and plants have become of great interest to scientists searching for new species and the laymen alike. The UN sponsored Millennium Ecosystem Assessment Synthesis Report that came out in April 2005, has the following under the “important uncertainties hindering decision-making”:-

“There is no complete inventory of species and limited information on the actual distributions of many important plant and animal species” (p169).

Ten years before in 1995 UNEP published the “Global Biodiversity Assessment”. In which it says: -
“The species is the basic unit of classification and the most practical and commonly used currency when

referring to biodiversity” (Heywood, page 9). **Thus it becomes clear that the “species” number is the most important numerical in recognizing the “rich biological diversity” of a country.**

The definition of the species and its identification has remained a problem in sciences. The assessment of biological diversity of the globe and in a country has been hampered by the absence of this precise definition. However, this is overshadowed by far greater problem, which is that, it is still not known to within a factor of ten how many species (under what ever definition or method of identification) there are on the planet or in any given country.

The numbers of species of the biological diversity in Sri Lanka, specially with respect to the larger more obvious groups were considered almost complete in the 60’ and 70’. This was not unusual, as it was the general trend in the world too. Interest in the science of Describing (circumscription), Identification, Nomenclature (giving names) and Classification, referred to as Taxonomy was a dieing science in every academic institution. While the teaching and researching in taxonomy dwindled, the number of species in each taxonomic group was taken to be that which was identified by scientists during the early part of the century. For Sri Lanka, foreign scientists did these identifications, as the science was accessible in the most instances to these expatriates. Specimens (Types) been the basis for such identifications were collected and lodged in numerous museums abroad. The countries biological diversity remained fairly static for many parts of the century till around 1992.

In the early 80s my interest in Taxonomy was kindled by Late P.B.Karunaratne who joined us in many studies. Having to document the species present in the Accelerated Mahaweli Project Area, we found Karu to be an encyclopedia of information. Karu had retired as the Assistant Entomological Curator of the National Museums. He had an excellent knowledge of species identification in the field. It was such an interesting exercise to put a name to what we were seen in the field. We were soon realizing that there were more species without names than that were named.

I would never forget the day we set out to Aruwakkalu to identify frogs with Rev Pinto, and Lalith Jayawickrema. When we got there it rained and the area was an orchestra of amphibian sounds. Armed with big “poly bags” we set out in the night to do a collection. We bagged a considerable number of different kinds of frogs and toads- numerous shapes and sizes. Been tired we tied up the bag and went to sleep looking forward for an exciting morning of species identification. The morning was of course a total disappointment, during the night the frogs had managed to get out of the bag, and we had an empty bag in the morning. **The list of species for Aruwakkalu still remains uncharted.**

Our interest to ensure that the Sinharaja Rainforest should be protected for ever, forced us to work on the species composition of the fauna in 1981. The George Rajapakse Committee (1976) had concluded that “there was not enough scientific evidence to prove the numerous claims of uniqueness of the Sinharaja Forest”. Work on the species composition of plants was already ongoing, and as such with assistance from the Smithsonian Institute, March for Conservation initiated a research programme in Sinharaja to document the “uniqueness of the fauna of Sinharaja”. After four years of work we were able to compile a preliminary list, which we know influenced the basis for its World Heritage Designation. **The number of species thus clearly showed to be a very important aspect in conservation and brought prestige to the country.**

But this species number was based on the available literature of the time. For instance the Amphibians were identified using the keys provided by Kirthisinghe in his publication “Amphibians of Ceylon” published in 1957. A few more additions to this was done by Bogert & Sennayake in 1966. The number of amphibians stood at 39 species. Thus the number of Amphibian species for Sinharaja (mainly the west) was only 20. We did suspect many “new” species but was unable to identify them as there was no competent amphibian taxonomist in the country, and it was still not a big issue. Collection of

specimens for identification was granted by Forest Department and Wildlife found no offence in the process. **All this changed in the late 80s and specimen collection become a major issue in the 90s.**

The renewed interest in “biological diversity” through the popularization of it by “biodiversity”, rekindled the dying science of taxonomy. This was further supported by the new trends in “molecular methodologies” for identification of species. Novel techniques involving DNA (Genetic material of organisms) sequencing gave an impetus to the re examination of many known groups of organism with surprising new discoveries. This fate did not spare the fauna of Sri Lanka too.

The intensive study of the vast collection however has brought to light the sad realization that we have in the last few decades has been responsible for the extinction of 17 known species of Sri Lankan frogs. Based on a global survey made for the IUCN’s *Red List* in 2004, this represents almost half of all amphibian species that have become extinct worldwide, showing that urgent conservation measures are needed to save the remaining threatened species in Sri Lanka. Amongst the 65 species of tree frogs now known from Sri Lanka, the researchers have found that 17 species are extinct, 7 critically endangered and 19 endangered, showing that further extinctions may be imminent. The most urgent need is to save the remaining rainforest habitats in which these unique animals live. This need is underlined in a paper presented by David Gower, of the Natural History Museum in London, and others, who analysed DNA from Sri Lankan caecilians (limbless amphibians). Until then, it was thought that there were only three species in the island: the DNA analysis showed, however, that there was in fact a fourth (as yet unnamed) species, which was recognized only from its DNA. This suggests that many such “cryptic” species may yet remain to be discovered.

Based on the available information the publication “Natural Resources of Sri Lanka –conditions and trends” (NARESA, 1991) brought to light that;

“Sri Lanka has greater biodiversity per unit area than any other country in Asia (Figure 10.4.) It is one of eleven areas in the tropics identified by the Committee on Research Priorities in Tropical biology (NAS, 1980 as demanding special attention because of its high levels of biological diversity, endemism and its vulnerability to habitat destruction” (page 222).

This revealing information was used extensively to highlight the importance of biodiversity in Sri Lanka. It also raised many questions, and would not stand for long if the verification of species numbers in other countries proceeds forward while we fell back.

The enhanced interest in biodiversity also set the stage to provide recognition to the “smaller lesser known” fauna of the country. The large fauna – elephants, leopards, deer etc were documented, and looked after by the numerous conservation plans of action. However, the smaller fauna / flora received little attention till the early 90s. The change of attitude meant that these needed to be recognized for conservation.

A problem faced by the conservation planners in Sri Lanka is that they often do not know what to conserve, except for large animals, which are obviously threatened, for example the elephant by the human –elephant conflict. In the case of many groups of smaller animals such as frogs, a lack of exploration has meant that we have only a vague idea of how many species there are, what their habitats are, and whether or not they are threatened. Without this information, it is impossible to implement conservation measures. **If you don’t know that a species exists, or where it lives, how can you conserve it?**

This interest was however not without obstacles and problems. The increased interest in “biodiversity” also enhanced the sense of “protection” among the growing numbers of “conservationists”. While lauding

about the “richness” and high “endemicity” of species in the country, they were critical of the scientists who were making collections for Taxonomic purposes. The effect of these critiques resulted in the Department of Wildlife Conservation issuing permits only for the collection of THREE specimens for study- a totally unscientific decision and something that was counter productive to the cause of species identification and science. In the midst of these general trends there was still some ray of hope as strong representations enabled some to indulge in serious taxonomic studies. The Department and the workers were of course severely criticized and considered as violating the Fauna and Flora Protection Ordinance and even slandered as “biopirates”. These critics have no moral right to quote the information about the richness of Sri Lanka’s biodiversity heritage that has been documented so far (With out an apology to the DWLC and the scientific community).

This also gives credibility for regular faunal surveys at reasonable gaps (depend on the species groups) and strong monitoring of status, at least based on “indicator species” to ensure that our actions will not result in many more extinctions. Further the need for proper “biorepositories” in the country to ensure closer monitoring by our own scientists. We need the conservation fraternity in the country to recognize the need for biological faunal surveys and taxonomic research.

Protected Areas – alias ecosystems

The biodiversity interest also kindled the need to protect what was left in the world. A direction for this was taken by the recognition of “Biodiversity Hotspots”. The identification of these “biodiversity Hotspots” was based on Extent of original (pre agricultural) habitat, Extent of present habitat, Geographic patterns of plant species diversity, Geographic patterns of plant species endemism, Estimated “total of plant species eliminated or on verge of extinction”, Diversity in other taxonomic groups, if known, Human population growth, Deforestation rates.

It is quite evident from these that four out of the eight have to do with the level of destruction or threats to the biological diversity. It is only four indicators that speak of the uniqueness, and that too is mostly of the flora/ plants. The implication of this recognition is the need to act fast and decisively to prevent areas containing “70% natural habitat, and at least 0.5% (i.e. about 1,500) of the world’s plant species” from further destruction. The recognition of ‘hotspots’ therefore has both good and bad connotations, **meaning that we have a lot of biodiversity but have not cared for it very well.**

An analysis of the protected areas of the country adds to the fact that our past commitments for conservation had little emphasis on the elements of “biodiversity” as reflected today.

The world’s first recognized sanctuary for animals was declared in the 3rd Century BC, and is still a protected area. The declaration by a decree of King Devanampiyatissa was a result of embracing Buddhism and renouncing the killing of animals – a practice no doubt was present among the nobles of the time. Thus it had nothing to do with the present Biodiversity thinking. We are of course proud about this heritage, for which we have no inventory of species present, other than the larger fauna and some trees. What was protected? And what are we protecting? Thus remain a mystery. On the other hand, it has “cultural” and “religious” values in the setting as an ecosystem. Thus it fits with the “use” component of biodiversity conservation.

Historically one can see that our efforts have been along the paths of the conventional conservation efforts. At the turn of the century we see that legislations for “wildlife” conservation was brought in for the prevention of the ‘wanton destruction’ of game (Table). Game hunting was the prime reason for the establishment of protected reserves in the country. These were consolidated in 1937, in the Fauna and Flora Protection Ordinance No 2. , and a verification of their principle reasons clearly indicate that very few match the current biodiversity priorities. The absence of any such high status wildlife reserves in the wet zone Mid and low country clearly indicate the priority of the time. All such forests were earmarked as

sources for timber and not of any biodiversity value. In 1959 the value of rainforest as sources of timber is well established from the non implementation of the recommendation made by Committee that was set up to recommend future directions for wildlife conservation (Sessional Paper 59). In their recommendations Sinharaja Forest Reserve was recommended to be declared as a National Park. But this never happened as its priority was timber and not biodiversity. Ironically in 1989, it received the status of a World Heritage Reserve for its unique value of flora and fauna, and for it been the only large patch of forest that contained some unlogged area. As a general fact it must be recognized today that when we recognized the value of biological diversity in “endemics”, their home ground was already destroyed. It is not surprising then that we come up with 21 extinct species of amphibians from Morningside (east of Sinharaja), many from the direct result of forest destruction. This statistic becomes possible only as given earlier due to the inventory and studies those were done through specimen collection. The question that we should ask is how much more species would we have sent to extinction in the resulting destruction of rainforests in the Wet Zone? The forest cover that remains is estimated to be a mere 3% of the total land area or 9 % of the Wet Zone area.

Most of the present PA systems in the wildlife (biodiversity) sector today were not declared for its value of unique fauna and flora or systems. If one picks out the ones that may have been considered this way we have for example Hakgala SNR, Peak Wilderness Sanctuary, Ritigala SNR, Waasgomuwa NP, Horton Plains NP etc, and the few bird sanctuaries. The rest of the major PAs were declared primarily as “game reserves” to be converted to National Parks, Nature Reserves or Sanctuaries. The most striking recent factor in this declaration is the contribution made by “Development” towards PA declarations. Most of the recent PAs since around the late 1960 have come about as a result of development programmes – Gal Oya NP, Minneriya Complex, Kaudulla, Flood Plains NP, Somawathiya NP, Madura Oya NP, Victoria Randenigal Rantambe Sanctuary and Nature Reserve, Uda walawe NP etc to name a few. It must therefore be recognized that “development” though often considered detrimental to conservation has also made some contribution too. It is with this background that one needs to ensure that “sustainable Development” that which takes into consideration of the environment is ensured as the potential for a better conservation culture exists in it.

The reality needs therefore to be recognized our PA system is not reflecting the biological diversity values as such nor are we seriously considering to make it reflect it. For this to become a reality a radical change is needed in responsibilities, legislations and management of our natural resources from the prevailing system. This need was recognized and publicized in the late 1980s, but shifting turfs is not an easy task in this country. What we see instead is that the institution that had no concern for the fauna in the forests but only the trees – the Forest Department, has with time changed to become an additional champion of “biodiversity” conservation – The Department of Forest Conservation. Not seeing in the forests any more the value of trees, they have come to embrace the value of biodiversity, and is duplicating the role of the Wildlife Conservation Department, that was separated from them in 1949. The irony is that they even publicize “ecotourism” and elephants in their packages. This is all good for biological diversity conservation in the narrow sense of species and ecosystems. To not have “all the eggs in the same basket” may be a good idea but have them in two baskets is also a burden and can Sri Lanka afford that cost?

We are also seeing an interesting “ball play” with respect to species identification and ownership of collections. The desire to duplicate roles as happening on the ground with biodiversity reserves seems to have bugged the permitting agencies (Wildlife) to function as a “repositories”. Unable to assure the maintenance of the “living repositories”, one wonders why the institution is harping to take over the role of the National Repository – the Colombo National Museum. The conventional argument has always been that the Colombo National Museum has never been upto standard to maintain its role and function as the National Repository of faunal collections of the country, and as such should not be allowed to have collections, in the interest of science. This is not a good argument as all present organization in the biodiversity areana has similar if not worse records of the past. Duplication is not a good idea, unless we can justify with a good cost benefit analysis.

Biodiversity has kindled the egos of many, and as it involves almost every discipline it has also become a field for all to join and play. This however should not end up “with too many cooks” as our ultimate goal would only become a reality of playing together recognizing each others role better. Sanity should prevail ultimately, with a rational approach that may need a radical rethinking of the custodians of biodiversity.

Table 1: Comparison of Traditional Management and Ecosystem Management

| Traditional Management | Ecosystem Management |
|--|--|
| Emphasis on commodities and natural resource extraction | Emphasis on balance between commodities, amenities, and ecological integrity |
| Equilibrium perspective | Nonequilibrium perspective |
| Ecological stability | Dynamics, resilience |
| Climax communities | Shifting mosaics |
| Reductionism | Holism |
| Prescription; command and control management | Uncertainty and flexibility; adaptive management |
| Site specificity | Attention to context |
| Solutions imposed by resource management agencies | Solution developed through discussions among stakeholders |
| Optimization; problem simplification; search for best single best answer | Multiple solutions to complex problems |
| Confrontation; single-issue polarization; public seen as adversary | Consensus building; multiple issues; public invited as partners |

Table 2: Wildlife conservation ordinances and acts

| Act | Description |
|------------------|--|
| 1. 1891, No. 10 | An Ordinance to prevent the wanton destruction of elephants, buffaloes and other game |
| 2. 1891, No. 11 | An Ordinance to re-adjust the customs duties leviable on fire- arms and to impose an export duty on certain hides and horns’ |
| 3. 1893, No. 6 | To prevent the wanton destruction of non-indigenous birds, beats and fishes |
| 4. 1894 | Proclamation – Prohibiting the export of hides of sambur and deer for a period of five years. |
| 5. 1899 | Extension of the 1894 proclamation indefinitely |
| 6. 1902, No. 11 | The Game Protection Act |
| 7. 1905, No. 14 | Fishes (Dynamite) Act |
| 8. 1906, No. 10 | Wild Bird Protection Act |
| 9. 1908, No.19 | Dried Meat Ordinance |
| 10. 1908, No. 31 | ‘Amendments to the laws relating to fire-arms’ |
| 11. 1901, No. 1 | Consolidation of existing laws relating to protection of game, wild beasts, etc. |
| 12. 1937, No. 2 | Fauna and Flora Protection Ordinance |
| 13. 1944, No. 12 | Ordinance – Amendments |

14. 1949, No. 38 Fauna and Flora Protection (Amendment)
 15. 1964, No. 44 Amendment to above Act
 16. 1970, No. 1 Amendment to above Act
 17. 1994 Amendment to the above Act
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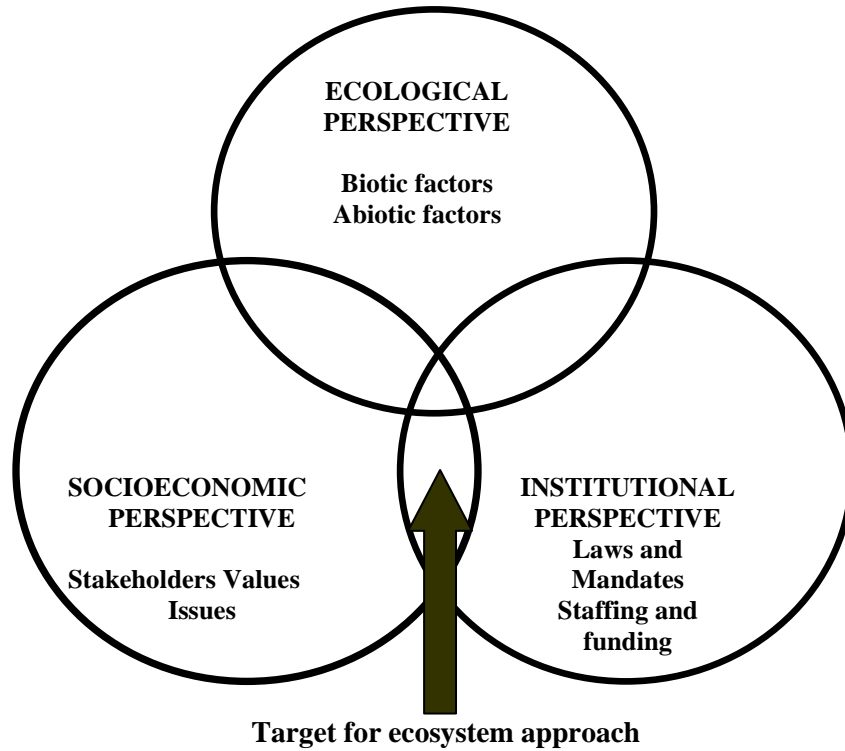


Figure 1: Conceptual basis for ecosystem management

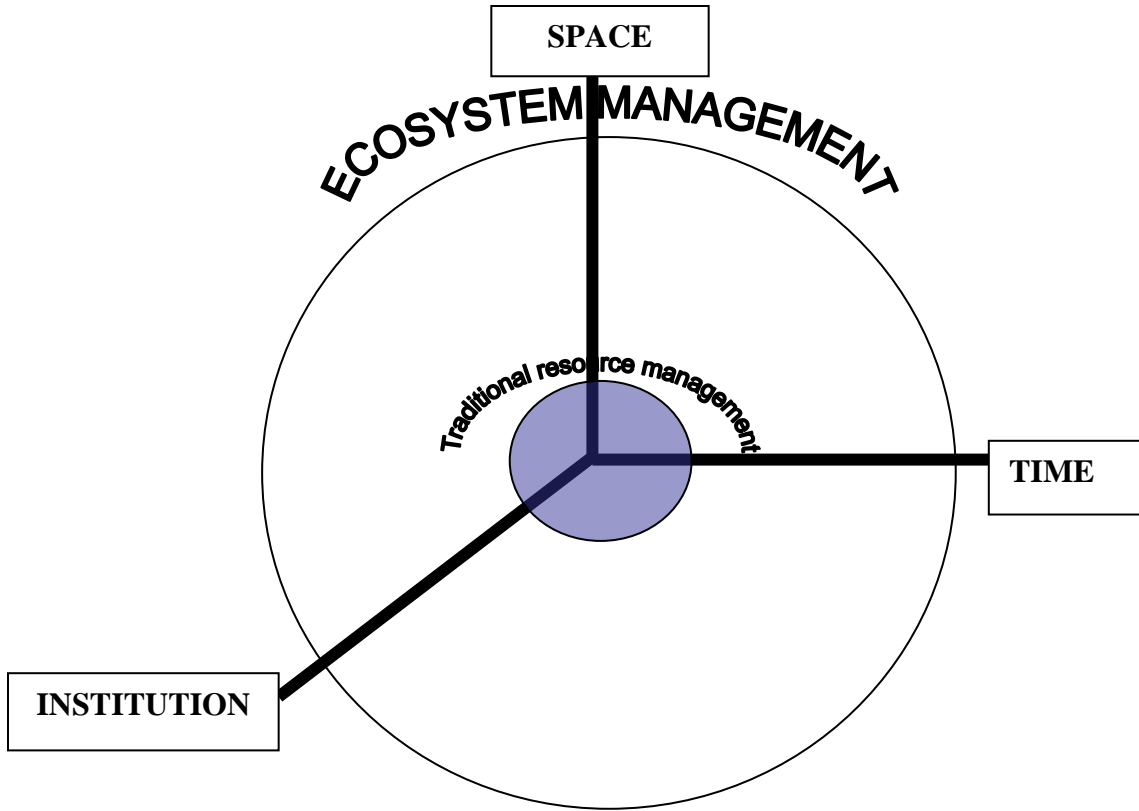


Figure 2: Ecosystem management is an expansion of traditional management

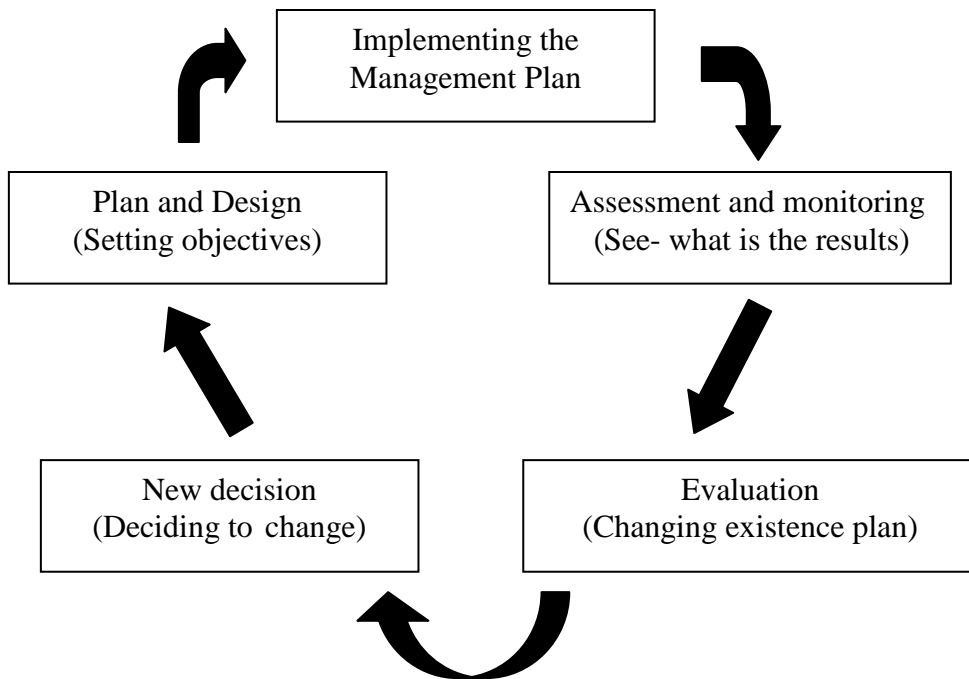


Figure 3: Adaptive management cycle