Recommending a set of guidelines for a Green Community Development following the roadmap of Land Ethic

Submitted by
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CERTIFICATE

This is to certify that the dissertation work titled **"Recommending a set of guidelines for a Green Community Development following the roadmap of Land Ethic"** is a bonafide work of Ms. Jatina R. Thakkar, under my guidance, submitted as Semester 14 subject for the award of "Degree of Masters in Environmental Architecture" during the term of December 2012-2013 through YCMOU.

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DECLARATION

I, Jatina R. Thakkar, hereby declare that this dissertation entitled **"Recommending a set of guidelines for a Green Community Development following the road map of Land Ethic"** is the outcome of my own research study undertaken under the guidance of Ar. Vinit Mirkar, Professor at IES (Indian Education Society) College of Architecture, Mumbai. It has not previously formed the basis for the award of any degree, diploma, or certificate of this Institute or of any other institute or university. I have duly acknowledged all the sources used by me in the preparation of this dissertation.

Ms. Jatina R. Thakkar
Date: - 05 / 01 / 2013

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ABSTRACT

The Biophilia Hypothesis suggests that there is an instinctive bond between human beings and other living systems. I find myself no different from this hypothesis. Being a part of an urban city, my primary curiosity lies in exploring ways that can make possible the bondage between human beings and other living systems in a city like Mumbai. Moreover, looking at the pace at which the urban development is taking place, especially in a developing country like India, ecology and environment seems to be at stake. All due attention is given to achieving targets for economic growth and increased standard of living (measured in terms of Gross Domestic Growth – GDP). Standard of living is measured in terms of consumption patterns and high life styles, but the underlying essence of living - the quality of life – is somehow missing. This gives an image of an introvert way of thinking, i.e., these goals seem to be purely human centered. It is true that the human element cannot be ignored, nevertheless the thought process vitally need to become extrovert. An extrovert thinking invites the external element within the premise of the human element i.e. it extends its concerns to the outdoor environmental air quality. This viewpoint has inspired me to opt for this kind of study.

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Chapter 1 Introduction

1.1 Background of the Study

1.1.1. Urbanization refers to a process whereby the building intensity of a high density human population increases or the number of people living in an urban area increase. Globally, this process has been on the rise for centuries; however, it has accelerated since the Industrial Revolution and was boosted again especially during the second half of the 20th century. The urbanization process was fueled mainly by migration from rural areas. The process usually comes to its end when urban population reaches a level of 80 to 90 percent of the total population of a country. Most developed countries reached this stage during the 20th century. Currently, at the beginning of the 21st century, urbanization is on the rise in most developing and less developed countries[1]

1.1.2. In case of Mumbai, history recounts the growth of a collection of seven islands on the west coast of India, till it became the commercial capital of the nation and one of the most populous cities in the world. Mumbai moved forward to industrialization through a continual process of urbanization. This kind of growth is common place for developing countries like India. Not only Mumbai but many other Indian Tier I cities like Bangalore, Chennai, Delhi are currently going under a phase of rapid urbanization. Other Tier II and Tier III cities are also on a similar path. Table 1- (1) below gives the classification of Tier I, Tier II and Tier III cities in India.

Table 1-(1):- Classification of cities based on Real Estate Market[2]

	Cities	**Characteristics**
Tier I	Bangalore, Mumbai	Fairly well-established real estate market. Demand drivers quite pronounced
Tier II	Hyderabad, Chennai, Pune, Kolkata	Growing real estate markets. Experiencing heightened demand and investments
Tier III	Chandigarh, Ludhiana, Jaipur, Goa, Nagpur, Jaipur (to name a few)	Real estate markets yet to establish. Perceived to have substantial potential demand

1.1.3. Urbanization has put India on the global map. This in turn is leading to further development and also a substantial economic growth. Besides, India has also entered the Millennium Development Declaration (which mentions about Millennium Development Goals - Annexure I) to achieve coverage and fully comply with the targets in respect of poverty alleviation, transformation and renewal of slum areas and water, sanitation and shelter for all residents. In doing so, the already fragile environment is being impacted.

[1] Shaul Krakover, *Urbanization*, www.eoearth.org, October 31, 2011

[2] India Reports 2008, *Growth Potential: Tier II and Tier III Cities in India,* A Chillibreeze Publication, Updated December 2008

Although, these targets are mingled with a goal of ensuring environmental sustainability (Goal No. 7, refer Annexure 1), very poor results seems to have been achieved to that effect. For instance, as indicated in Figure 1-(1), the natural course of Mithi River is encroached upon by the Airport runway and forced to take turns four times along its course of flow, failing to serve its very own purpose of smooth and efficient storm water runoff. The expansion of the airport definitely raised the economic status of Mumbai (and eventually India) and generated thousands of employment. At the same time, the deluge of 26th July 2005 damaged a bulk of life and property.[3] The Natu Committee's report in 1975 and the BRIMSTOWAD report of 1993 are substantive and exhaustive reports. But their processing in the Municipal Corporation appears to have been handled more or less just in a routine manner.[4]

Figure 1-(1):- Google Map showing the Mithi River, Mumbai
Source: Kaushik Das Gupta, *Mithi is a river, not real estate,* www.downtoearth.org.in, April 15, 2010

Being irreversible, very little can be done to reduce the harm once caused directly or indirectly to the natural environment. The natural environment therefore needs to be safeguarded by means of mitigation and prevention strategies. But this first involves the very basic deed of being sensitive and attentive towards it.

1.1.4. Rural Development Minister Jairam Ramesh said at an Organization for Economic Cooperation and Development meet in New Delhi, "India needs to be obsessed with high

[3] There has yet been no formal survey of the sufferings & losses of the people and the public agencies. But the indications are that the losses have been huge. More than 20,000 cars, 2,500 BEST buses and a very large number of two wheelers / three wheelers were damaged. 24,000 animal carcasses had to be disposed of. Though exact assessment of the loss to the private property is not forth coming but guess can be made, as 2 lakh tons of garbage mostly comprising of personal household belongings, furniture, food stuff and electronic gadgets was required to be thrown off. Gravity of the situation can also be deciphered from the amount of bleaching powder and disinfectants spread and number of persons required to be treated. It is reported that 24 metric tons of bleaching powder and 2 metric tons of phenol had to be sprayed for disinfection and 3 lakh patients had to be treated. 450 persons lost lives during flooding and 248 thereafter. Railways, electricity supply stations & telecommunication equipment also suffered extensive damages. More than 1 lakh houses suffered from submergence at different scales. There is no count of the personal inconvenience and sufferings. These are some of the findings of Fact finding committee on Mumbai Floods.

[4] Fact finding committee on Mumbai Floods, Final Report, (Volume 1), March 2006

economic growth as we have to address the issue of inclusive development but should also try to marry it with sustainable development". He said India needed eight percent growth since the country had to provide jobs to 100 million people who would enter the workforce in the next decade and hence, could not moderate growth to address the issue of sustainability. "We need a balance of both," he said. According to the minister, India is still groping to find institutional mechanisms to ensure sustainability in development while protecting vital ecological resources like water, forests and land. Mr. Ramesh said the challenge before the government would be to demonstrate that sustainability would take along development process and not be a drag on economic growth. He agreed that the government's sustainability efforts had not succeeded much. "We have ecological poverty in many parts of the country where water bodies and forest resources have depleted. We have failed to link sustainability with public health and livelihood issues," said Mr. Ramesh. The solution, he said, was to build community-based institutions as an alternative to the heavy hand of the government and market forces. As an overview, this does indicate that India is conscious about the need to merge sustainability with economic growth. But a lot more needs to be achieved towards this effect.

- One of the tools developed by experts and adapted by the construction industry to that effect is the system of rating building according to how much 'green' it claims to be, commonly known as the Green Building Rating Systems. Green buildings main intention is sustainability, both in terms of finance as well as natural resources. Nevertheless, opting for a Green Buildings is a voluntary affair and hence, the impact seems insignificant when seen at a macro level.

1.1.5. In an interview during the UN Conference of biodiversity in Hyderabad, Ms. Naoko Ishii (Global Environment Facility Chief) makes a mention that the global ecosystem is very important and has a value and we need to find a way to value it in order to check its extinction. She said efforts should be made to integrate the ecosystem evaluation process into the government policy-making decisions. "We have to put value to the nature and we have to mainstream those in the decision making system and national budget, development planning and also day-to-day decisions," she said, noting that countries like India are already doing it in some way.

- Ms. Ishii mentions that the ecosystem evaluation process needs to be an integrated element, and not an afterthought, of a decision making process to be acted upon by the government. However, the main question that arises to me is that how can this be done? Will it suffice to look into decisions only on a broader or a macro level? How can we tackle the issues of sustainability in development planning? Can present-day sustainability tools such as the rating systems be combined within the decision making systems?

1.2 Need of the Study

Two essential reports and its finding as stated below underpin the need of a study of this kind and they are:-

- Millennium Ecosystem Assessment Report[5]

[5] Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*.Island Press, Washington, DC.

- Expect the Unexpected: Building business value in a changing world[6]

1.2.1. Millennium Ecosystem Assessment Report

1.2.1.1. The Millennium Ecosystem Assessment was carried out between 2001 and 2005 to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being. The MA responds to government requests for information received through four international conventions—the Convention on Biological Diversity, the United Nations Convention to Combat Desertification, the Ramsar Convention on Wetlands, and the Convention on Migratory Species—and is designed to also meet needs of other stakeholders, including the business community, the health sector, nongovernmental organizations, and indigenous peoples. The sub-global assessments also aimed to meet the needs of users in the regions where they were undertaken.

1.2.1.2. Everyone in the world depends completely on Earth's ecosystems and the services they provide, such as food, water, disease management, climate regulation, spiritual fulfillment, and aesthetic enjoyment. Over the past 50 years, humans have changed these ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel. This transformation of the planet has contributed to substantial net gains in human well-being and economic development. But not all regions and groups of people have benefited from this process—in fact, many have been harmed. Moreover, the full costs associated with these gains are only now becoming apparent. The assessment focuses on the linkages between ecosystems and human well-being and, in particular, on "ecosystem services." An ecosystem is a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit.

1.2.1.3. Four Main Findings

The report presents four major findings of the Millennium Ecosystem Assessment on the problems to be addressed and the actions needed to enhance the conservation and sustainable use of ecosystems.

- **Finding 1** # Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth.

[6] KPMG INTERNATIONAL, *Expect the Unexpected: Building business value in a changing world*, Switzerland, February 2012, www.kpmg.com

- The amount of water impounded behind dams quadrupled since 1960, and three to six times as much water is held in reservoirs as in natural rivers. Water withdrawals from rivers and lakes doubled since 1960; most water use (70% worldwide) is for agriculture.
- The distribution of species on Earth is becoming more homogenous; in other words, the set of species in any one region of the world is becoming more similar to the set in other regions primarily as a result of introductions of species, both intentionally and inadvertently in association with increased travel and shipping.
- Between 1960 and 2000, the demand for ecosystem services grew significantly as world population doubled to 6 billion people and the global economy increased more than sixfold. To meet this demand, food production increased by roughly two-and-a half times, water use doubled, wood harvests for pulp and paper production tripled, installed hydropower capacity doubled, and timber production increased by more than half.
- The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people. These problems, unless addressed, will substantially diminish the benefits that future generations obtain from ecosystems.

- **Finding 2** # The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people. These problems, unless addressed, will substantially diminish the benefits that future generations obtain from ecosystems.
  - Both renewable resources such as ecosystem services and nonrenewable resources such as mineral deposits, some soil nutrients, and fossil fuels are capital assets. Yet traditional national accounts do not include measures of resource depletion or of the degradation of these resources. As a result, a country could cut its forests and deplete its fisheries, and this would show only as a positive gain in GDP (a measure of current economic well-being) without registering the corresponding decline in assets (wealth) that is the more appropriate measure of future economic wellbeing.
  - Although the value of food production in 2000 was only about 3% of gross world product, the agricultural labor force accounts for approximately 22% of the world's population, half the world's total labor force, and 24% of GDP in countries with per capita incomes of less than $765 (the low-income developing countries, as defined by the World Bank).These gains have been achieved, however, at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes in ecosystems, the exacerbation of poverty for some people, and growing inequities and disparities across groups of people.

- **Finding 3** # The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals.
  - The most important direct drivers of change in ecosystems are habitat change (land use change and physical modification of rivers or water withdrawal from rivers), overexploitation, invasive alien species, pollution, and climate change. These direct drivers are often synergistic. For example, in some locations land use change can result in greater nutrient loading (if the land is converted to high-intensity agriculture), increased emissions of greenhouse gases (if forest is cleared), and increased numbers of invasive species (due to the disturbed habitat).
  - The eight Millennium Development Goals adopted by the United Nations in 2000 aim to improve human well-being by reducing poverty, hunger, child and maternal mortality, by

ensuring education for all, by controlling and managing diseases, by tackling gender disparity, by ensuring environmental sustainability, and by pursuing global partnerships. Under each of the MDGs, countries have agreed to targets to be achieved by 2015. Many of the regions facing the greatest challenges in achieving these targets coincide with regions facing the greatest problems of ecosystem degradation.

- The goal of environmental sustainability, including access to safe drinking water (Goal 7, Targets 9, 10, and 11), cannot be achieved as long as most ecosystem services are being degraded. Progress toward three other MDGs is particularly dependent on sound ecosystem management.

- **Finding 4** # The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that the MA has considered, but these involve significant changes in policies, institutions, and practices that are not currently under way. Many options exist to conserve or enhance specific ecosystem services in ways that reduce negative trade-offs or that provide positive synergies with other ecosystem services.
  - Past actions to slow or reverse the degradation of ecosystems have yielded significant benefits, but these improvements have generally not kept pace with growing pressures and demands. Although most ecosystem services assessed in the MA are being degraded, the extent of that degradation would have been much greater without responses implemented in past decades. For example, more than 100,000 protected areas (including strictly protected areas such as national parks as well as areas managed for the sustainable use of natural ecosystems, including timber or wildlife harvest) covering about 11.7% of the terrestrial surface have now been established, and these play an important role in the conservation of biodiversity and ecosystem services (although important gaps in the distribution of protected areas remain, particularly in marine and freshwater systems). Technological advances have also helped lessen the increase in pressure on ecosystems caused per unit increase in demand for ecosystem services.
  - Ecosystem degradation can rarely be reversed without actions that address the negative effects or enhance the positive effects of one or more of the five indirect drivers of change: population change (including growth and migration), change in economic activity (including economic growth, disparities in wealth, and trade patterns), sociopolitical factors (including factors ranging from the presence of conflict to public participation in decision- making), cultural factors, and technological change. Collectively these factors influence the level of production and consumption of ecosystem services and the sustainability of the production. Both economic growth and population growth lead to increased consumption of ecosystem services, although the harmful environmental impacts of any particular level of consumption depend on the efficiency of the technologies used to produce the service. Too often, actions to slow ecosystem degradation do not address these indirect drivers. For example, forest management is influenced more strongly by actions outside the forest sector, such as trade policies and institutions, macroeconomic policies, and policies in other sectors such as agriculture, infrastructure, energy, and mining, than by those within it.
    - An effective set of responses to ensure the sustainable management of ecosystems must address the indirect and drivers just described and must overcome barriers related to:
    - Inappropriate institutional and governance arrangements, including the presence of corruption and weak systems of regulation and accountability.
    - Market failures and the misalignment of economic incentives.
    - Social and behavioral factors, including the lack of political and economic power of some groups (such as poor people, women, and indigenous peoples) that are particularly dependent on ecosystem services or harmed by their degradation.

- Underinvestment in the development and diffusion of technologies that could increase the efficiency of use of ecosystem services and could reduce the harmful impacts of various drivers of ecosystem change.
- Insufficient knowledge (as well as the poor use of existing knowledge) concerning ecosystem services and management, policy, technological, behavioral, and institutional responses that could enhance benefits from these services while conserving resources.

1.2.2. Expect the Unexpected: Building business value in a changing world

According to KPMG International's report 'Global sustainability mega-forces will affect the future of every business. The report says:-

1.2.2.1. For 20 years or more the world has recognized that the way we do business has serious impacts on the world around us. Now it is increasingly clear that the state of the world around us affects the way we do business. The resources on which business relies are becoming more difficult to access and more costly. Increasing strain on infrastructure and natural systems is likely as patterns of economic growth and wealth change. Physical assets and supply chains will be affected by the unpredictable results of a changing climate. And businesses can expect an ever more complex web of sustainability legislation and fiscal instruments.

1.2.2.2. But this is not the whole story. The central challenge of our age – decoupling human progress from resource use and environmental decline – can also be one of the biggest sources of future success for business. In the report – *Expect the Unexpected: Building business value in a changing world*, KPMG's network of firms analyzes a system of ten sustainability mega-forces that will impact each and every business over the next 20 years. These forces do not act alone in predictable ways. They are interconnected. They interact.

1.2.2.3. It is important for business leaders to understand this system of forces; assess the implications for their own organizations; and devise strategies for managing the risks and harnessing the opportunities. We can never know the future. But it is good business sense to be prepared for the possibilities: to expect the unexpected. According to the report, over the next 20 years businesses will be exposed to hundreds of environmental and social changes that will bring both risks and opportunities in the search for sustainable growth. For this report dozens of forecasts have been analyzed to identify the changes that will have the greatest effects on business. The result is a set of ten global sustainability mega-forces that we believe will impact every business over the next two decades. They are:

i) **Climate Change**: the one global mega-force that directly impacts all others discussed in this report. Predictions of annual output losses from climate change range between 1 percent per year, if strong and early action is taken, to at least 5 percent a year if policymakers fail to act.

ii) **Energy & Fuel:** fossil fuel markets are likely to become more volatile and unpredictable because of higher global energy demand; changes in the geographical pattern of consumption; supply and production uncertainties; and increasing regulatory interventions related to climate change.

iii) **Material Resource Scarcity:** as developing countries industrialize rapidly, global demand for material resources is predicted to increase dramatically. Business is likely to face increasing trade restrictions and intense global competition for a wide range of material resources that become less easily available. Scarcity also creates opportunities to develop substitute materials or to recover materials from waste.

iv) **Water Scarcity:** it is predicted that by 2030, the global demand for freshwater will exceed supply by 40 per cent. Businesses may be vulnerable to water shortages, declines in water quality, water price volatility, and to reputational challenges. Growth could be compromised and conflicts over water supplies may create a security risk to business operations.

v) **Population Growth:** global population is predicted to be 8.4 billion by 2032 in a moderate growth scenario. This growth will place intense pressures on ecosystems and the supply of natural resources such as food, water, energy and materials.3 Businesses can expect supply challenges and price volatility as a result. This is a threat, but there are also opportunities to grow commerce, create jobs, and to innovate to address the needs of growing populations.

vi) **Wealth:** the global middle class (defined by the OECD as individuals with disposable income of between US$10 and US$100 per capita per day) is predicted to grow 172 percent between 2010 and 2030. The challenge for businesses is to serve this new middle class market at a time when resources are likely to be scarcer and more price-volatile. The advantages many companies experienced in the last two decades from "cheap labor" in developing nations are likely to be eroded by the growth and power of the global middle class.

vii) **Urbanization:** in 2009, for the first time ever, more people lived in cities than in the countryside.6 By 2030 all developing regions including Asia and Africa are expected to have the majority of their inhabitants living in urban areas; virtually all Population Growth over the next 30 years will be in cities. These cities will require extensive improvements in infrastructure including construction, water and sanitation, electricity, waste, transport, health, public safety and internet and cell phone connectivity.

viii) **Food Security:** in the next two decades the global food production system will come under increasing pressure from mega-forces including Population Growth, Water Scarcity and Deforestation. Global food prices are predicted to raise 70–90 percent by 2030. In water-scarce regions, agricultural producers are likely to have to

compete for supplies with other water-intensive industries such as electric utilities and mining, and with consumers.

ix) **Ecosystem Decline:** historically, the main business risk of declining biodiversity and ecosystem services has been to corporate reputations. However, as global ecosystems show increasing signs of breakdown and stress, more companies are realizing how dependent their operations are on the critical services these ecosystems provide. The decline in ecosystems is making natural resources scarcer, more expensive and less diverse; increasing the costs of water and escalating the damage caused by invasive species to sectors including agriculture, fishing, food and beverages, pharmaceuticals and tourism.

x) **Deforestation:** Forests are big business. Wood products contributed $100 billion per year to the global economy from 2003–2007 and the value of non-wood forest products (mostly food) was estimated at US$18.5 billion in 2005. Yet forest areas are predicted to decline by 13 percent from 2005 to 2030, mostly in South Asia and Africa. The timber industry and downstream sectors such as pulp and paper are vulnerable to potential regulation to slow or reverse deforestation. Companies may also find themselves under increasing pressure from customers to prove that their products are sustainable. Opportunities may arise through market mechanisms and incentives to reduce the rate of deforestation.

1.3 Hypothesis

"We abuse the land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."
-Aldo Leopold

"The principles of Land Ethic establishes a roadmap which focuses on a Green community development"

1.4 Goal

"Recommending a set of guidelines for a Green community development following the roadmap of Land Ethic"

1.5 Objective

The objective of the study is:-

i) To understand the deliberation and principles of "The Land Ethic" from an essay *A Sand County Almanac* written by Aldo Leopold.

ii) To formulate a structure/model using selected Land Ethic keywords and members to demonstrate the Community Concept of Land Ethic.

iii) Co-relating the Land Ethic Model with Ecosystem Services as a derivation and generating an Ecosystem Services Diagram.

iv) To study the present-day tool of sustainable development i.e. the Green Rating Systems (BREEAM, Pearl and IGBC) for community development in relation to the principles of Land Ethic Model and Ecosystem Services.

v) To make a comparative study of these Green Rating Systems on the basis of Land Ethic Model.

vi) To recommend a set of green guidelines in relation to the Land Ethic Model for a cluster / community development and to schematically illustrate the same.

1.6 Scope & Limitation

1.6.1. Scope:-

The Scope of this study is:-

i) To understand the principles of "The Land Ethic" from the book *A Sand County Almanac* written by Aldo Leopold.

ii) To analysis 3 Green Rating Systems (BREEAM, Pearl and IGBC) for community development in relation to Land Ethic principles and ecosystem services

iii) To recommend a set of green guidelines for community development on basis of Land Ethic principles.

1.6.2. Limitations:-

The Limitations of this study are:-

i) This study is only limited to those environmental components (i.e. soils, waters and plants/animals) mentioned in Leopold's Land Ethic. Other aspects such as energy, economy and so on are not considered as a part of the review process.

ii) The study is limited only to Leopold's Land Ethic. Similar other theories are not considered under the purview of this study and analysis.

iii) The study involves and is limited to the study of Green Rating Systems for community development and their analysis in terms of the principles of Land Ethic.

iv) The source of information for the understanding of the principles of Land Ethic is merely the documents, papers and web-sites available from internet database.

1.7 Structure of the Report

Chapter 1, as seen, explains the background and need for such a study. It introduces the hypothesis, goal and objectives of the research undertaken. It further goes to explain the research questions and the research methodology for each of them.

Chapter 2 is on literature review. It looks at a brief introduction to Aldo Leopold and an understanding on his book A Sand County Almanac. It further continues to explain his essay – The Land Ethic and ends up with a conclusion.

Chapter 3 elucidates extracts from the Land Ethic. It identifies the Land Ethic members and keywords, formulates a Land Ethic Model and its relation to Ecosystem Services and its matrix. This ends up with a conclusion on the same.

Chapter 4 gives a brief introduction to the history of Green Building Rating Systems, purpose and meaning of green buildings and ends with a brief conclusion stating about the three community rating systems

Chapter 5 is on analysis between BREEAM Community Rating System and the Land Ethic Model. It starts with a brief introduction on BREEAM Rating System and ends up with score boards and charts derived out of the analysis and finally the conclusion.

Chapter 6 is on analysis between Pearl Community Rating System and the Land Ethic Model. It starts with a brief introduction on Pearl Rating System and ends up with score boards and charts derived out of the analysis and finally the conclusion.

Chapter 7 is on analysis between IGBC Green Townships Rating System and the Land Ethic Model. It starts with a brief introduction on IGBC Rating System and ends up with score boards and charts derived out of the analysis and finally the conclusion.

Chapter 8 shows a comparative analysis of the three rating systems – BREEAM, Pearl and IGBC. The comparison is done in two ways – 1 on basis of credit issues, 2 in terms of Land Ethic. Conclusion is drawn out of this analysis towards the end.

Chapter 9 recommends a set of guidelines for a community type development underpinning the members and keywords of Land Ethic. It ends up with illustrations on the set of recommended guidelines.

1.8 Research Questions & Methodology

Table 2-(1) gives an explanation of specific research questions for every research question and the respective methodology that is followed during the process of this study.

Table 2-(1):- Research Objectives, Specific research questions & respective Research Methodology

SN	Research Objective	Specific Research Questions	Research Methodology
1	To understand the deliberation and principles of "The Land Ethic" from an essay A Sand County Almanac written by Aldo Leopold. (Chapter 2)	a) Who was Aldo Leopold? b) What is his book A Sand County Almanac all about? c) What is the crux of this book?	1) Articles, papers, various web-sites etc. available from the net database will be studied. 2) Use of such data base would be easier to comprehend and easily available from the net database.
2	To formulate a structure/model using selected Land Ethic keywords and members to demonstrate the Community Concept of Land Ethic. (Chapter 3)	d) Which are the keywords and members that best explain the concept of Land Ethic? e) How to formulate a model to explain the Land Ethic principle?	3) From the reading, important key words and the underlying idea about Leopold's Land Ethic are to be comprehended and extracted. 4) The keywords are to be used to formulate a model to explain the crux of Land Ethic. 5) Such a model will form the basis of scrutiny for further study.
3	Co-relating the Land Ethic Model with Ecosystem Services as a derivation and generating an Ecosystem Services Diagram (Chapter 3)	f) What are the probable stances that may be regarded as derivations of the Land Ethic Model? g) How can the Land Ethic Model be related to Ecosystem Services?	6) The derivation of the formulated model in the form of Ecosystem Services is to be understood and explained. 7) The co-relation of the Land Ethic Model with ecosystem services is to be understood.
4	To study the present-day tool of sustainable	h) What is Green Rating Systems?	8) After an understanding of the principles of

	development i.e. the Green Rating Systems (BREEAM, Pearl and IGBC) for community development in relation to the principles of Land Ethic Model and Ecosystem Services. (Chapter 4, 5, 6 & 7)	i) How and why the concept of Green Rating Systems came to existence? j) What is the purpose of Green Rating Systems? k) How the Green Rating Systems for community development relates to the Land Ethic Model in terms of each issue considered in the respective systems? l) What are the derivations of the issues of Green rating systems in the form of Ecosystem Services?	Land Ethic and translating those principles in the form of a model, the study moves on to understand the Green Building Rating Systems for community development. 9) Since, the focus of this study is on cluster type development, selection of 2 international and 1 Indian rating systems dealing with large scale or community development is to be made. 10) Here the endeavor is to first understand the various aspects / issues that are dealt with in each of the rating systems. 11) Analysis each aspect / issue in relation to the formulated land ethic model with respect to their 1) Key requirements and 2) Scoring. 12) Arrive to conclusion for the same.
5	To make a comparative study of these Green Rating Systems on the basis of Land Ethic Model. (Chapter 8)	m) What are the issues comparisons for each of the said rating systems? n) What are the issues comparisons for each rating systems in relation to the Land Ethic? o) What is a cumulative conclusion of comparison all the	13) The next stride would be making a comparative study of the selected rating systems in the following 2 ways:- 1) In terms of the issues dealt with. 2) In terms of the Land Ethic keyword.

		above rating systems?	14) Arrive to conclusion for the same.
6	To recommend a set of green guidelines in relation to the Land Ethic Model for a community development. (Chapter 9)	p) What is a community development? q) What are the probable options in a cluster or a community development? r) What is the roadmap for recommendation of the green set of guidelines for cluster / community development? s) What is the recommended set of guidelines for a community development? How and where can those be applied?	15) Drive the concept of community development. 16) Analyze a different perspective for the application of community development for an urban civilization. 17) Create a roadmap on basis of the conclusion drawn from the comparative study for recommendation of guidelines. 18) Recommending a set of guidelines.

Chapter 2. Literature Review

2.1. Introduction to Aldo Leopold[1]

This section is extracted from the selected essays written by the most prominent Leopold scholars—Nina Leopold Bradley, Curt Meine, Susan Flader and J. Baird Callicott—on different aspects of Aldo Leopold's legacy for presentation at a 1999 conference that examined and celebrated Leopold's work on the 50th anniversary of the publication of *A Sand County Almanac.*

2.1.1. Aldo Leopold's expertise

2.1.1.1. Aldo Leopold (also referred to as Leopold) was a forester and wildlife ecologist who wrote *A Sand County Almanac*, a collection of essays about the natural world and conservation. The book was published posthumously in 1949. *A Sand County Almanac* went on to become one of the key texts of the environment movement. Leopold is closely identified with "The Land Ethic," the final essay in the Almanac, in which he argued that people are part of the "land community," and so bear moral responsibilities that extend beyond the realm of the human to include the non-human parts of that community.

2.1.1.2. For readers, reviewers and scholars, Aldo Leopold displays as many facets as there are perspectives. Consider the variety of fields that can and do legitimately claim Leopold as an important figure in their development: forestry, wildlife ecology and management, outdoor recreation, range management, sustainable agriculture, wilderness protection, conservation biology, restoration ecology, environmental history, environmental ethics, environmental law, environmental policy, environmental education, literature, among others. Leopold remains a compelling figure and *A Sand County Almanac* an irresistible focal point, in part because all these perspectives were integrated tightly in his personality and prose. There are, in a sense, many Leopolds.

2.1.1.3. One key factor set Leopold apart even within the pantheon of environmental prophets: he coupled the inspiration of his prose, thought and activism with the authority of his experience. Leopold, unlike the others, wrote from a varied professional background in on-the-ground forestry, range management, wildlife management, wilderness protection and restoration work. He was a respected figure in each of the fields and could speak to all his professional colleagues in their own languages. And so, Leopold served another posthumous function: as an all-around, acceptable and accessible "conservation hero," able to appeal to a broad range of

[1] Cynthia Barakatt, Craig Maier , *Aldo Leopold's Legacy,* U.S. Fish and Wildlife Service, February 11, 2009, www.eoearth.org

conservation factions – at least as long as the deeper tensions within conservation lay dormant.

2.1.1.4. Throughout his career, Aldo Leopold was a consummate professional, extremely efficiency-oriented during his years in the Forest Service and fascinated by the intricacies of administrative procedures and standards. And yes, we get a sense from one of his earliest publications that he was not wholly satisfied with the Forest Service model of governmental administration. Shortly after he had become supervisor of the Carson National Forest in New Mexico at age 25, he was stricken with an illness that nearly led to his death and required more than a year of recuperation. During this time, he addressed a letter "to the forest officers of the Carson" reflecting on their responsibilities. The problem that concerned him was how to measure success in forest administration. Was success simply a matter of efficiently following prescribed policies and procedures, or was there something else? My measure," Leopold wrote, "is *the effect on the forest*." Even at the start of his career he was concerned about the *ends* of administration, what was happening to the land, not only the procedures or *means*.

2.1.2. About the Almanac

2.1.2.1. When did that voice first emerge, and how did it find its full expression in the *Almanac*? *A Sand County* Almanac was the product of the last 10 years of Leopold's life. Leopold would work some earlier materials into his evolving manuscript, but he began to sound the new tone in his essay-writing only after two hunting trips, in 1936 and 1937, to Mexico's Sierra Madre Occidental. After the first trip, Leopold prepared an essay he called "The Thick-Billed Parrot of Chihuahua," published in the ornithological journal *The Condor* in early 1937 (it would eventually appear in the *Almanac* as "Guacamaja"). Shortly thereafter, Leopold composed "Marshland Elegy," his moody reflection on Wisconsin's cranes and wetlands. *American Forests* published it later in 1937.

2.1.2.2. These ne1w expressions reflected a new turn in Leopold's work. Increasingly in the late 1930s, Leopold found himself teaching and writing toward a non-professional audience. In 1938, he published the first in an ongoing series of popular essays on wildlife conservation for the Wisconsin Agriculturist and Farmer, and in 19940, he wrote two more essays about Mexico and the Arizona, "Song of the Gavilan" and "Escudilla." Leopold was not yet thinking about collecting these essay into a book. However, he was encouraged by the positive response of friends and colleagues and continued to write in this new vein.

2.1.2.3. The voice of Aldo Leopold in A Sand County Almanac, then, was late in its development. It first emerged in the late 1930s, just as Leopold was fully integrating his conservation ideas (a phase culminating in 1939 with publication of his essay "A Biotic View of Land" in the Journal of Forestry). The Aldo Leopold that most of the world knows, admires and criticizes is really the late Leopold, and then only a part of that. It was, of course, one of the ironies of Leopold's life that he would not live to

see A Sand County Almanac published or know its influence. Indeed, he would never even know his book by that title, which was assigned posthumously; his name and the book title became paired only after Leopold's death in 1948.

2.1.2.4. A Sand County Almanac helped to stimulate environmental literacy among the American public; conversely, readership of A Sand County Almanac and recognition of Leopold's contributions grew along with that increasing awareness. This mutually reinforcing process can be traced back to the earliest reviews of the book. The book was widely reviewed both locally and nationally, both by readers familiar with Leopold and those learning of him for the first time. Because of the confluence of events, many reviews served in essence as obituaries for Leopold, as reviewers used the occasion to reflect upon Leopold's legacy. The reviews of the day thus provide a fair portrait of the state of his public persona.

2.2. "A Sand County Almanac, 1948" – Book Summary

This segment of the study represents a snapshot of Aldo Leopold's legendary book 'The Sand County Almanac' which talks about his renowned essay "The Land Ethic". Understanding the fundamental principles of "The Land Ethic" prepares a roadmap for this study and also underpins the formulation of design guidelines for cluster/community development as per the objectives of this study. An overview of his book, as seen below, gives the researcher an understanding about the author's motivation and evolution process of his essay "The Land Ethic".

2.2.1. Summary of the book[2]:

This monument of modern environmental thought is composed of three parts, each of which is divided into independent essays.

2.2.1.1. Forward

He begins with a statement describing the opposition of two camps, defined by how they prioritize nature vs. progress. Then he presents three concepts central to the book: (1) Land is a community. (2) Land is to be loved and respected. (3) Land yields a cultural harvest.

2.2.1.2. Part I: A Sand County Almanac

Preface

In this section of his book, Leopold takes the reader on a tour in nature through his accurate description about his observations and experiences in nature all around him and all through the year. Based on his encounter in every month of the year he describes specific events and activities occurring in nature. The oak, geese, fish, prairie, rivers, man are few of the players whose activities are been captured in this section. These writings

[2] David Lahti, Aldo Leopold A Sand County Almanac, 1948, http://qcpages.qc.edu/Biology/LahtiSites/greatlit/contempus/leopold/sandcounty.htm, 2005

portray the author's skills of observation and sensitivity towards his natural surroundings as well as his inclination towards the subject. This part of the book forms a canvas on which the colors of "The Land Ethic" are painted.

- "January" (January Thaw)

He follows a skunk trail, noting signs of other creatures (vole, hawk, rabbit, owl) and their doings along the way, noting that each sees the world in terms of utility to itself.

- "February" (Good Oak)

Meditations on a great oak killed by lightning. While sawing it down, he considers the years represented by its rings, referring to events that impacted nature: helpful and harmful human interventions, droughts, cold winters, extinctions. The list is sobering and troubling overall. He draws connections between the study of history and the way the saw, wedge, and axe work on wood.

- "March" (The Geese Return)

Thoughts on geese in migration, communicating, foraging on corn.

- "April" (Come High Water, Draba, Bur Oak, Sky Dance)

Diverse meditations: on a flooding river; a tiny plant called Draba; bur oaks as the vanguard of the forest into the prairie, and now monuments to the prairies since we have prevented the fires that kept the land in grass; and the flight song and display of the woodcock, along with many unanswered questions about its ecology and behavior

- "May" (Back from the Argentine)

On the migratory return of the upland plover (sandpiper) in the agricultural countryside.

- "June" (The Alder Fork-- A Fishing Idyl)

An engaging tale, full of description and enthusiasm, of a fly-fishing episode involving the catch of three trout.

- "July" (Great Possessions, Prairie Birthday)

A chronicle of the dawn awakening of animals, in the context of property-- so many of them proclaim and defend territories. We are just one of them. The territories of all the species are superimposed on each other as "worlds". In the next section he tells of the "flower birthdays", or first blooms of native flowers, of which we are nearly all ignorant. Siphium, a prairie flower, faces extirpation by the mower, but no one knows enough about history or botany to care. We grieve for what we know, so since we don't know the flora we unknowingly and unnecessarily allow "progress" to destroy it.

- "August" (The Green Pasture)

A river, like a temperamental painter, occasionally gets in the mood to turn a section of its bank into a beautiful, textured work of art.

- "September" (The Choral Copse)

On the beautifully unpredictable morning song of the quail, just when most birds have slowed or even ceased singing for the season.

- "October" (Smoky Gold, Too Early, Red Lanterns)

A grouse hunt with wonderful distractions and good examples of nature loremastery. Then a musing on the benefits and character traits associated with getting up early. Finally, a description of following streams and red-leaved blackberries to hunt partridge.

- "November" (If I Were the Wind, Axe-in-Hand, A Mighty Fortress)

On the strong autumn wind. Then a commentary on the power an axe provides one, and how one's use of it reveals a philosophy and biases. He tells us of his own biases,

especially the reasons why he likes particular tree species. Finally, he divulges a collection of lessons gathered from his wood lot, on a common theme: the many wildlife-related benefits of tree diseases.

- "December" (Home Range, Pines Above the Snow, 65290)

He follows clues of animal movements to deduce their home ranges and habits. Then he explores the lifestyle and interactions of the pine. He concludes with an account of the life of one banded chickadee, with observations on the preferences and survival strategies of chickadees in general.

2.2.1.3. Part II: Sketches Here and There

Preface

In this portion of the book, Leopold takes the reader one step deeper into the events and occurrences of nature. He talks about the consequences and effects that various human actions caused on the realms of nature. His continuous and dedicated observations (as could be understood in Part I of his book) enabled the author to develop a deep understanding about the entire process and ultimately draw its implications in the form of his essay "The Land Ethic".

- "Wisconsin" (Marshland Elegy, The Sand Counties, Odyssey, On a Monument to the Pigeon, Flambeau)
  -A portrayal of the beauty and significance of the crane and its marsh, and of the ignorance and tragedy of their destruction in the name of progress and prosperity.
  -The sand counties are poor by human reckoning, but certain plants and animals of great worth prefer living there, for various reasons.
  -A wonderful journey of an atom through centuries of biotic and geologic exchange: a demonstration of element cycling.
  -An encomium on the extinct passenger pigeon, and a consideration of its lifestyle; and, stepping back, the aspects of humanity that set us as one of the beasts, and the aspects that set us above them. [Excellently balanced view.]
  -A look at a once wilderness-surrounded river: the wonders of being on such a river, and the subtle consequences of the development of it.
- "Illinois and Iowa" (Illinois Bus Ride, Red Legs Kicking)
  -A depressing glimpse of how oblivious people are of nature, and the effects when agricultural and other economic values are the only ones recognized in the Illinois land.
  -Brief description of vivid memories of successful boyhood bird hunts.
- "Arizona and New Mexico" (On Top, Thinking Like a Mountain, Escudilla)
  -A description of the culture and nature of Arizona's "White Mountain" plateau, decades ago as he remembers it.
  -Exhortation to take the broadest and longest view of the value of nature and its elements, such as the wolf-- not valued by deer or man, but beneficial for both in the long run. This is thinking like a mountain. [An excellent piece.]
  -The mystique and far-reaching presence of a mountain, and the giant grizzly that gave it much of its identity. The grizzly was killed in the name of progress, and the mountain became less for it.

- "Chihuahua and Sonora" (Guacamaja, The Green Lagoons, Song of the Gavilan)
  -The concept of an inexpressible essence, or "numenon" of a place, and an example: the thick-billed parrot of the Sierra Madre.
  -A colorful and spirited account of a camping experience among the lazy waters, mesquites, and gamebirds of the Colorado Delta.
  -A portrayal of a river and its fruitful bank, providing insights into the values associated with the hunt, followed by a criticism of the scientific attitude that, if nature is an orchestra, studies the instruments and ignores their harmony.
- "Oregon and Utah" (Cheat Takes Over)
  -Cheatgrass as an illustration of the widespread, unfortunate, largely ignored effects of invasive species.
- "Manitoba" (Clandeboye)
  -The historical sense and fauna of the marsh, an ecosystem we tend to overlook and convert.

2.2.1.4. Part III: The Upshot

Preface

This section of the book is the climax which has various colors such as Conservation Esthetic, Wildlife, Wilderness and the most significant of all "The Land Ethic". Various other aspects related to the principles of Land Ethic (which can be understood in the next segment of this chapter) are been highlighted in this section by the author. The values as indicated in this section in "The Land Ethic" forms the basis of the researchers' investigation and analysis of this study.

- "Conservation Esthetic"
  Outdoor recreation is popular and diverse. Our enthusiasm for it is basically esthetic and not economic. The challenge is to delineate the different and sometimes contradictory values we seek, and figure out how to foster them:
  i) Trophies, whether direct removal of something from nature, or indirect which does not subtract from nature. In the direct case, mass use tends to require artificialization (as in fish and game management), which decreases the value of the trophy and can deplete non-focal entities of interest to others.
  ii) Solitude, which becomes more diluted and scarce with both its popularity and the actions of governments and organizations to promote it.
  iii) "Fresh air and change of scene", which, unlike the last component, is not negatively affected by mass use.
  iv) Perception of nature, which is non-consumptive and non-diluting. It is enhanced by knowledge, and actions to promote it constitute the only creative developments in recreational engineering.
  v) Husbandry, a value not yet appreciated v ery widely in America but one that is rewarding and in some places practiced with great enthusiasm.

  None of these components are to be denigrated in their place; nevertheless one hopes that people will develop from the coarser, possessive ones to the more refined ones that do not deplete the resources they value. People should not stay trophy-recreationists, but develop appetites for isolation, perception, and

husbandry. [Excellent ideas on the values and pitfalls of outdoor recreation, and a prioritization of values that reflects a nature-respecting and stewardly ethic.]

- "Wildlife in American Culture"
  There are cultural values in customs and experiences that connect us to wild things: i.e., national heritage, ecological awareness, and sportsmanly ethical restraint are the three forms. Often, and increasingly, these values are compromised when hunters and fishermen are are taken in by increased mechanization and gadgetry, and by commercialism. Game-cropping is one practice that, although a compromise, may mitigate some of the value destruction. Amateur wildlife research should be hailed as a new recreation that has no disvalue and retains cultural values.
- "Wilderness" (The Remnants, Wilderness for Recreation, Wilderness for Science Wilderness for Wildlife, Defenders of Wilderness)
  Wilderness is where we came from, and is still important to us but is disappearing. He makes a list of some of the vanished ecosystems of North America, and some whose remnants should be preserved. Wilderness has recreation value-- not mechanized enjoyment, but a preservation of older, now unnecessary means of travel and kinds of experiences that contrast with ordinary life. Wilderness also provides an opportunity to learn how "healthy land" works. Our conservation efforts almost always seem to be aimed at symptoms rather than causes of "sick land"; what we really need is a norm for healthy land, which is what wilderness can provide. Wilderness is also important, and today not extensive enough, for the preservation of wildlife, especially for ranging big mammals like carnivores and bears. The best hope for wilderness is a "militant minority of wilderness-minded men".
- "The Land Ethic" (The Ethical Sequence, The Community Concept, The Ecological Conscience, Substitutes for a Land Ethic, The Land Ethic, Land Health and the A-B Cleavage, The Outlook)
  Ethics has grown more comprehensive, in terms of the entities that deserve moral consideration, over the course of Western history. [This is Darwin's expanding circle idea]. An understanding of ecology and evolution leads an honest person to realize that humans are part of the natural community. A genuine response to this knowledge includes an extension of our moral sympathies to other entities besides humans. The land is essentially the community in which we live, and the community is the theater for ethical action. We need to cultivate an ecological conscience, a way of looking at the land that is something other than utilitarian or resource-seeking. So far, even though conservationists often do have an ecological conscience, conservation in the sociopolitical sphere has dealt with the land solely as a resource, which is the reason why conservation does not accomplish very much. We have tried to substitute a land ethic with an economical or commodity-minded, top-down policy, where the government is expected to do all the conservation and the only good reasons are economic ones. The only way for conservation of the land to succeed, however, is if individual landowners have a new ethical perspective that includes the land. Landowner decisions are made within their ethical frameworks. Education can help broaden this framework, but so far our ecological education has tended to be poor. We teach the troublesome concept of the "balance of nature",

instead of the truer idea of an integrated and complex tangle of interactions, assembled into a trophic (who eats whom) hierarchy of the Land Pyramid. We should teach that the land is an ecological unit, an energy circuit. In sum, although we must consider economic expediency in all of our actions, we also must consider (for it is right to do so) our moral obligations with respect to the stability, integrity, and beauty of the natural community of which we are a part.

2.3. The Essay - The Land Ethic

→ This segment talks about the crux of this study – Aldo Leopold's essay "The Land Ethic". The essay is described through the following sub-sections:-

- The Ethical Sequence
- The Community Concept
- The Ecological Conscience
- Substitutes for a Land Ethic
- Land Pyramid
- Land Health and A-B Cleavage
- The Outlook

→ After investigation of this segment, the researcher has chosen few 'land ethic keywords'. The elements on which Leopold's Land Ethic are been extended to are chosen as 'land ethic members'. A base model (Refer Chapter 3) is generated using the chosen Land Ethic 'keywords' and 'members'. The base model conceptually represents the idea of "The Land Ethic" and also forms a basis for the analysis of green community rating systems.

2.3.1. The Ethical Sequence

We grieve only for what we know
(-July: Prairie Birthday)

2.3.1.1. Leopold defines ethic in two terms: "ecologically and philosophically. An ethic, ecologically, is a limitation on freedom of action in the struggle for existence. An ethic, philosophically, is a differentiation of social from anti-social conduct. These are two definitions of one thing".

"I have purposely presented the land ethic as a product of social evolution because nothing as important as an ethic is ever 'written'…..It evolves in the minds of the thinking community".
-"The Land Ethic" 1949 ASCA 225

→ Similar to Leopold's definition to land ethic, in his book 'Ecological Ethics: An Introduction', Patrick Curry introduces this new approach know as 'Ecological Ethics'[3].

[3] Patrick Curry, in *Ecological Ethics* (2011) for the first time provides a comprehensive introduction to the much needed departure from the ethos of human domination of the human habitat. From the beginning to the end, this book is about

In summary, a fully ecocentric ecological ethic is one in which human domination of nature is superseded, not by self-serving or merely condescending care, but by a sense of partnership between humanity and the human habitat, as summarized in the book's postscript:

"The only truly sustainable human culture is one based on ecological sustainability. That in turn requires ecocentrism, for a way of life that recognizes only human needs and values will never be sustainable. Only a nonhuman nature whose flourishing in its own way is permitted, indeed encouraged, will suffice. It won't flourish if it is only allowed to do so within the narrow range of ways that suit us alone. So that in turn requires us to respect and love nature, and recognize its intrinsic value as a whole. However paradoxical it may seem, the conclusion is clear: any philosophy concerned only with humans fails both humanity and the rest of life."[4]

→ A similarity is evident between the new 'Ecological Ethic' and Leopold's "The Land Ethic'. Ecological Ethic urges humanity to establish a sense of partnership with the human habitat. Likewise, The Land Ethic urges man to count himself as a part of the land community.

2.3.1.2. Leopold views the evolution of ethics as: "The first ethic dealt with the relation between individuals; the Mosaic Decalogue[5] is an example. Later accretions dealt with the relation between the individual and society. The Golden Rule[6] tries to integrate the individual to society; democracy to integrate social organization to the individual. There is yet no ethic dealing with man's relation to land and to the animals and plants which grow upon it. Land, like Odysseus' slave-girls, is still a property. The land-relation is still strictly economic, entailing privileges but not obligations. The extension of ethics to this third element in human environment is an evolutionary possibility and an ecological necessity. It is the third step in a sequence. The first two have already been taken".[7]

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the urgent need to embrace an ecocentric ethic, in which humans are embedded within the human habitat, to supersede the anthropocentric ethic whereby humans are viewed as separate from, and superior to, the non-human habitat in which they live. According to Curry, there are three levels of *green ethics*:

- Light Green (or environmentalism) - A superficially green ethic that remains mostly anthropocentric in that natural resources must be managed and conserved primarily for the benefit of humans.
- Green (or mid-green) - An extension of the light green ethic in which non-human animals must be treated with care while humans retain the right to use them for their sustenance, comfort, and leisure.
- Dark Green (or deep green) - A fully ecocentric ethic that overcomes any hierarchical relationship between humans, other animals, and non-living nature; humans belong in the ecological web together with all the other living and non-living elements.

http://www.pelicanweb.org/solisustvcurrybookreview

[4] http://www.pelicanweb.org/solisustvcurrybookreview

[5] The Ten Commandments or precepts given by God to Moses on Mount Sinai, and originally written on two tables of stone. (http://www.wordnik.com/words/Decalogue)

[6] The Golden Rule or ethic of reciprocity is a maxim, ethical code, or morality that essentially states either of the following:

- (Positive form of Golden Rule): One should treat others as one would like others to treat oneself
- (Negative form of Golden Rule): One should not treat others in ways that one would not like to be treated.

[7] http://www.uky.edu/OtherOrgs/AppalFor/Readings/ReadingLandEthics.pdf, http://www.uky.edu, University of Kentucky, United States

→ Let us briefly understand various theories of Ethics that are evolved in history. Ethics is the branch of philosophy that examines the question of what actions are morally right or wrong and why. There has been a very wide range of views on the question among different civilizations and among different philosophers.[8] Few of them are illustrated below:-

i) The epic poems that stand at the beginning of many world literatures portray a set of values that suit the strong leader of a small tribe. Valor and success are the principle qualities of a hero, and are generally not constrained by moral considerations. Revenge and vendetta are appropriate activities for heroes.

ii) Socrates defends as ethical theory that it is better to suffer injustice than to do it. That is because the doing of evil damages the soul, which is the highest part of humans.

iii) Aristotle's ethics is based on the ideal of *eudaimonia*, variously translated as "happiness," "prosperity," "flourishing," or "success." A "great-souled" citizen who lives a life of virtue can expect to achieve *eudaimonia*, which Aristotle argues is the highest good for man. Aristotle gives a significant role in moral life the virtues, fixed habits of behavior that lead to good outcomes; the main virtues are courage, justice, prudence and temperance. The highest form of life is, however, purely intellectual activity.

iv) The Bible describes God as intensely concerned about human acts. He commands obedience to moral rules, such as the Ten Commandments and punishes transgressions of them. Jesus said that all the commandments of the law could be summarized in the two rules, "Love God and love your neighbor" (Bibical Ethics).

v) In the Middle Ages, Thomas Aquinas developed a synthesis of Biblical and Aristotelian ethics called natural law theory, according to which the nature of humans determines what is right and wrong. For example, murder is wrong because life is essential to humans so depriving someone of it is inherently an evil. Education is needed for humans, and is their right, because their intellectual nature requires developing (Natural Law Ethics).

vi) Immanuel Kant, in the 18th century, argued that right and wrong are founded on duty, which issues a Categorical Imperative (it may be defined as a way of evaluating motivations for action) to us, a command that, of its nature, ought to be obeyed. An action is only truly moral if done from a sense of duty, and the most valuable thing is a human will that has decided to act rightly. To decide what duty requires, Kant proposes the principle of universalizability: correct moral rules are those we could will everyone to adopt (Kantian Ethics).

vii) In 19th century Britain, Jeremy Bentham and John Stuart Mill advocated utilitarianism, the view that right actions are those that are likely to result in the greatest happiness of the greatest number. Utilitarianism remains popular in the twenty-first century (Utilitarianism).

[8] http://en.wikipedia.org/wiki/History_of_ethics

viii) The early twentieth century saw many debates on metaethics, that is, philosophical theory on the nature of ethics.

→ The present day land-relation appears to have gone beyond from a simple economic connect to a complex connect in terms of GDP (Gross Domestic Product). Gross domestic product (GDP) is the market value of all officially recognized final goods and services produced within a country in a given period of time. GDP per capita is often considered an indicator of a country's standard of living. It is an intermingled web of attributes such as consumption, investment, imports, exports, salaries and much more.[9]

→ Community instincts and united thinking apparently have the potential to formulate some ethical mode of guidance considering the new and complicated ecological scenarios. In one way, this is well illustrated by present-day efforts and interest shown in green building rating systems. Currently the rating systems possibly fall in the category of soft law[10]. Translation of this from a soft law to hard law, completely or partially, will cause a substantial progress of ethical sequence.

2.3.2. The Community Concept

"The old prairie lived by the diversity of its plants and animals, all of which were useful because the sum total of their co-operations and competitions achieved continuity. But the wheat farmer was a builder of categories to him only wheat and oxen were useful".
(-Wisconsin: Odyssey).

2.3.2.1. Leopold explains that 'all ethics as far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts. His instincts prompt him to compete for his place in that community, but his ethics prompt him also to co-operate. The land ethic simply enlarges the boundaries of the community to include soils, waters, plants and animals, or collectively: the land.'

→ Leopold's Land Ethic focuses on the three biotic elements – soils, waters, plants and animals – upon whom the ethical behavior needs to be extended. The fourth biotic component who is needed to extend ethical behavior is – man (individual). In other words, soils, waters, plants and animals and ultimately the man become the core members of Land Ethic. Hence, they are selected as Land Ethic members for the purpose of the study and analysis.

2.3.2.2. He further proceeds explaining, "This sound simple: do we not already sing our love for and obligation to the land of the free and the home of the brave? Yes, but

[9] http://en.wikipedia.org/wiki/Gross_domestic_product

[10] The term "soft law" refers to quasi-legal instruments which do not have any legally binding force, or whose binding force is somewhat "weaker" than the binding force of traditional law, often contrasted with soft law by being referred to as "hard law". Traditionally, the term "soft law" is associated with international law, although more recently it has been transferred to other branches of domestic law as well. The term soft law covers elements of action plans such as Agenda 21. http://en.wikipedia.org/wiki/Soft_law

just what and whom we love? Certainly not the soil, which we are sending helter-skelter downriver. Certainly not the waters, which we assume have no function except to turn turbines, float barges, and carry off sewage. Certainly not the plants, of which we exterminate whole communities without batting an eye. Certainly not the animals, of which we have already extirpated many of the largest and most beautiful species. A land ethic of course cannot prevent the alteration, management and use of these "resources", but it does affirm their right to continued existence, and at least in spots, their continued existence in a natural state.'

→ Nevertheless, it is evident that Leopold is not in opposition to the use or modification of land for human purpose and needs. What he considers hostile is the manner in which the alteration is carried out by man. He considers that the alteration takes place with a single focus of economic benefits as a target which overlooks the value of those very components which lead to the benefits desired.

"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect".
(- Forward)

2.3.2.3. Leopold explains the crux - a land ethic changes the role of HOMO SAPIENS from conqueror of the land-community to plain members and citizens of it. It implies respect for his fellow-members, and also respect for the community as such.That man is, in fact, only a member of a biotic team is shown by an ecological interpretation of history. Many historical events hitherto explained solely in terms of human enterprise, were actually biotic interactions between people and land. The characteristics of the land determined the facts quite as potently as the characteristics of the men who lived on it.

→ This section indicates one of the keywords – 'Community' - the underlying message of the principle of Land Ethic. Leopold entails saying that mankind should consider him as a part of the land-community and not something which is different or superior to it.

2.3.3. The Ecological Conscience

There are two spiritual dangers in not owing a farm. One is the danger of supposing that breakfast comes from the grocery and the other that heat comes from the furnace
(-February: Good Oak)

2.3.3.1. According to Leopold, "Conservation is a state of harmony between men and land". His experience says, "Despite nearly a century of propaganda, conservation still proceeds at a snail's pace; progress still continues largely of letterhead pieties and convention oratory. On the back forty we still slip two steps backward for each forward stride. The usual answer to this dilemma is "more conservation education". No one will debate this, but is it certain that only the

volume of education needs stepping up? Is something lacking in the content as well? It is difficult to give a fair summary of its content in a brief form, but, the content is substantially this: obey the law, vote right, join some organizations and practice what conservation is profitable on your own land; the government will do the rest".

2.3.3.2. Is this formula too easy to accomplish anything worth-while? It defines no right or wrong, assigns no obligations, calls for no sacrifice, and implies no change in the current philosophy of values. In respect of land-use, it urges only enlightened self-interest. Just how far will such education take us? An example will perhaps yield a partial answer.

> By 1930 it had become clear to all except the ecologically blind that southwestern Wisconsin's topsoil was slipping seaward. In 1933 the farmers were told that if they would adopt certain remedial practices for five years, the public would donate CCC (Civilian Conservation Crops) labor to install them, plus the necessary machinery and materials. The offer was widely accepted, but the practices were widely forgotten when the five-year contract period was up. The farmers continued only those practices that yielded immediate and visible economic gains for themselves.

This led to the idea that maybe farmers would learn more quickly if they themselves wrote the rules. Accordingly the Wisconsin Legislature in 1937 passed the Soil Conservation District Law. This said to farmers, in effect: we, the public, will furnish you free technical services and loan you specialized machinery, if you will write your own rules for land use. Each county may write its own rules, and these will have the force of law. Nearly all the counties promptly organized to accept the proffered help, but after a decade of operation, no county has yet written a single rule. There has been visible progress in such practices as strip-cropping, pasture renovation and soil liming, but none in fencing woodlots against grazing, and now in excluding plow and cow from steep slopes. The farmers, in short, have selected those remedial practices which were profitable anyhow, and ignored those which were profitable to the community, but not clearly profitable to themselves.

→ As seen in the above illustration, the current development and growth, too, suggest itself with the prime focus on achieving economic targets to reach a considerable GDP level. One cannot deny the fact that GDP is a vital achievement to strive for at a national level, for a global acclaim. Nevertheless sustainability issues and ecological considerations are taken as an add-on activity to be performed. And sometimes as a tool for earning reputation and applauds.

> When one asks why no rules have been written, one is told that the community is not yet ready to support them; education must precede rules. But the education actually in progress makes no mention of obligations to land over and above those dictated by self-interest. The net result is that we have more education but less soil, fewer healthy woods, and as many floods as in 1037.
>
> The puzzling aspect of such situations is that the existence of obligations over and above self-interest is taken for granted in such rural community enterprises as the betterment of road, schools, churches and baseball teams. Their existence is not taken for granted, nor as yet seriously discussed, in bettering the behavior of the water that falls on the land, or in preserving of the beauty or diversity of the farm landscape. Land-use ethics are still governed wholly by economic self-interest, just as social ethics were a century ago.

To sum up: we asked the farmer to do what he conveniently could to save his soil and he has done just that, and only that. The farmer, who clears the woods off a 75 percent of slope, turns his cows into the clearing and dumps its rainfall, rocks and soil into the community creek, is still a respected member of society. If he puts lime on his fields and plants his crops on contours, he is still entitled to all the privileges and emoluments of his Soil Conservation District. The District is beautiful piece of social machinery, but it is coughing along on two cylinders because we have been too timid and too anxious for quick success, to tell the farmer the true magnitude of his obligations. Obligations have no meaning without conscience and the problem we face is the extension of the social conscience from people to land.

2.3.3.3. No important change in ethics was ever accomplished without an internal change in our intellectual emphasis, loyalties, affections and convictions. The proof that conservation has not yet touched these foundations of conduct lies in the fact that philosophy and religion have not yet heard of it. In our attempt to make conservation easy, we have made it trivial.

A conservationist is one who is humbly aware that with each stroke he is writing his signature on the face of his hand.
(-November: Axe-in-Hand)

In general, the trend of the evidence indicates that in land, just as in the human body, the symptoms may lie in one organ and the cause in the other. The practices we now call conservation are, to a large extent local alleviations of biotic pain. They are necessary, but they must not be confused with cures. The art of land doctoring is being practiced with vigor, but the science of land health is yet to be born.
(-"Wilderness")

→ The premise 'Ecological Conscience' is been selected as another keyword for the study. The pace at which the current development is taking place, there seems to be an urgent necessity to pay due attention to the modifications caused to the natural state of the land. If not so, we may not be left with any pristine land available for mankind to cherish. For this reason, every development taking place needs to be 'ecologically conscience' in all phases of its development.

→ Also, Loepold claims that the science of land health is not born. In other words, he believes that there is not enough or absolutely no knowledge about the factual science of land health and its implications. As a result, a concern for land health and its relative tonic is not formulated. What is the strength of the land or how dynamic is the land or what is the physical condition and fitness of the land not in piecemeal, but holistically might be one of the ways to understand the concept of Leopold's Land Health. 'Land Health' is been considered as a keyword for the purpose of this study.

→ As explained in his above maxim, Leopold compares land to a human body. Similar to a human body, for land too, the causes and effects may not necessarily lie at the same place. Also, the effect may travel unfathomable distance away from the original point of cause. This most of the time happens in an unpredictable manner. To sum

up, Leopold uses a human body as a figure of speech to explain his thought of a land as an organism. From here comes another Land Ethic keyword 'Land Organism'.

2.3.4. Substitutes for a Land Ethic

2.3.4.1. Here, Leopold, through his ecological knowledge and observations, attempts to explain the manner in which man regards and treats the ecological members. Man has made a bifurcation of these members into 2 categories – economic and non-economic. Those members which fetch economic benefit to mankind are considered valuable and those which do not seemingly fetch any economic benefit are considered not so valuable. However, Leopold suggests that no matter in which category the members fall, all of them hold significant importance (though in their own simple ways) in the biotic community on the whole and therefore, deserve survival.

2.3.4.2. He mentions, "One basic weakness in a conservation system based wholly on economic motives is that most members of the land community have no economic value. Wildflowers and songbirds are examples. Of the 22,000 higher plants and animals native to Wisconsin, it is doubtful whether more than 5 percent can be sold, fed, eaten or otherwise put to economic use. Yet these creatures are members of the biotic community and if its stability depends on its integrity, they are entitled to continuance".

2.3.4.3. "When one of these non-economic categories is threatened and if we happen to love it, we invent subterfuges to give it economic importance. At the beginning of the century songbirds was supposed to be disappearing. Ornithologists jumped to the rescue with some distinctly shaky evidence to the effect that insects would eat us up if birds failed to control them. The evidence had to be economic in order to be valid. We have no land ethic yet, but we have at least drawn nearer the point of admitting that birds should continue as a matter of biotic right, regardless of the presence or absence of economic advantage to us".

→ Seemingly this shows that until any consequences are witnessed by mankind, there will not be an effort towards the protection and conservation of the members of the biotic community.

2.3.4.4. "A parallel situation exists in respect of predatory mammals, raptorial birds and fish-eating birds. Time was when biologists some-what overworked the evidence that these creatures preserve the health of game by killing weaklings or that they control rodents for the farmer, or that they prey only on "worthless" species. Here again, the evidence had to be economic in order to be valid. It is only in recent years that we hear the most honest argument that predators are members of the community and that no special interest has the right to exterminate them for the sake of a benefit, real or fancied, to it".

2.3.4.5. With further instances, Leopold explains, "Some species of trees have been "read-out of the party" by economics-minded forester because they grow too slowly or have too low a sale value to pay as timber crops; white cedar, tamarack, cepress, beech and hemlock are examples. In Europe, where forestry is ecologically more advanced, the non-commercial tree species are recognized as members of the native forest community, to be preserved as such within reason. Moreover some (like breech) have been found to have a valuable function in building up soil fertility. The interdependence of the forest and its constituent tree species, ground flora and fauna is taken for granted."

→ This illustrates how due to the presence of some species of trees (like breech, as mentioned above) benefit the other members of the community (such as the other trees, ground flora and fauna). And all this holistically comprises of a health forest ecosystem.

Wilderness is the raw material out of which man has hammered the artifact called civilization
(-"Wilderness")

2.3.4.6. Leopold further goes to explain, "Lack of economic value is sometimes a character not only of species or groups, but the entire biotic communities: marshes, bogs, dunes and desserts are examples. Our formula in such cases is to relegate their conservation to government as refuges, monuments or parks. The difficulty is that these communities are usually interspersed with some valuable private lands; the government cannot possibly own or control such scattered parcels. The net effect is that we have relegated some of them to ultimate extinction over large areas. If the private owner were ecologically minded, he would be proud to be the custodian of a reasonable proportion of such areas, which add diversity and beauty to his farm and to his community".

→ The private owners in the present day are synonyms to entities such as developers, government bodies, institutions, NGO's (not for profit organizations) and similar other organizations who are responsible and are a part of present-day development. In addition, this team also comprises of researchers, scientists, consultants, educators and other related stakeholders. In other words, all these members seem to be entitled to enact according to the rules guided in the Land Ethic.

2.3.4.7. Nevertheless the question arises: what is the ultimate magnitude of the enterprise? Will the tax base carry its eventual ramification? At what point will governmental conservation, like the mastodon, become handicapped by its own dimensions? The answer, if there is any, seems to be in a land ethic or some other force which assigns more obligation to the private land owner. Industrial landowners and users, especially lumbermen and stockmen, are inclined to wail long and loudly about the extension of government ownership and regulation to land, but (with notable exceptions) they show little disposition to develop the only visible alternative: the voluntary practice of conservation on their own lands.

2.3.4.8. When the private landowner is asked to perform some unprofitable act for the good of the community, he today assents only with outstretched palm. If the act costs him cash this is fair and proper, but when it costs only fore-thought, open mindedness or time, the issue is at least debatable. The overwhelming growth of land-use subsidies in recent years must be ascribed, in large part, to the government's own agencies, the agricultural colleges and the extension services. No ethical obligation toward land is taught in these institutions.

2.3.4.9. To sum up: a system of conservation based solely on economic self-interest is hopelessly lopsided. It tends to ignore and thus eventually to eliminate, many elements in the land community that lack commercial value, but that are essential to its healthy functioning. It assumes, falsely, that the economic parts of the biotic clock will function without the uneconomic parts. It tends to relegate to government many functions eventually too large, too complex or too widely dispersed to be performed by government. An ethical obligation on the part of the private owner is the only visible remedy for these situations.

→ The underlying statement here is that the entire responsibility of ethical obligation and extension to the land does not lie on the shoulders of the authorities or the government alone. It even lies on the hand of other individuals by opting for measures of conservation and preservation of the natural resources. Conservation, hence, forms another keyword.

2.3.5. The Land Pyramid

2.3.5.1. The author, in this section of his essay, attempts to explain the concept of – the land (biotic) pyramid (as also studied in ecology). He describes the function and process related to land as a biotic mechanism through the concepts of the land pyramid. He recommends the importance of understanding this biotic mechanism to be able to extend our ethical actions towards it.

2.3.5.2. "An ethic to supplement and guide the economic relation to land presupposes the existence of some mental image of land as a biotic mechanism. We can be ethical only in relation to something we can see, feel, understand, love, or otherwise have faith in", claims Leopold. "The image commonly employed in conservation education is 'the balance of nature". For reasons too lengthy to detail here, this figure of speech fails to describe accurately what little we know about the land mechanism. A much truer image is the one employed in ecology: the biotic pyramid. I shall first sketch the pyramid as a symbol of land, and later some of its implications in terms of land –use".

2.3.5.3. "Plants absorb energy from the sun. This energy flows through a circuit called the biota, which may be represented by a pyramid consisting of layers. The bottom layer is the soil. A plant layer rests on the soil, an insect layer on the plants, a bird and

rodent layer on the insects, and so on up through various animal groups to the apex layer, which consists of the larger carnivores".

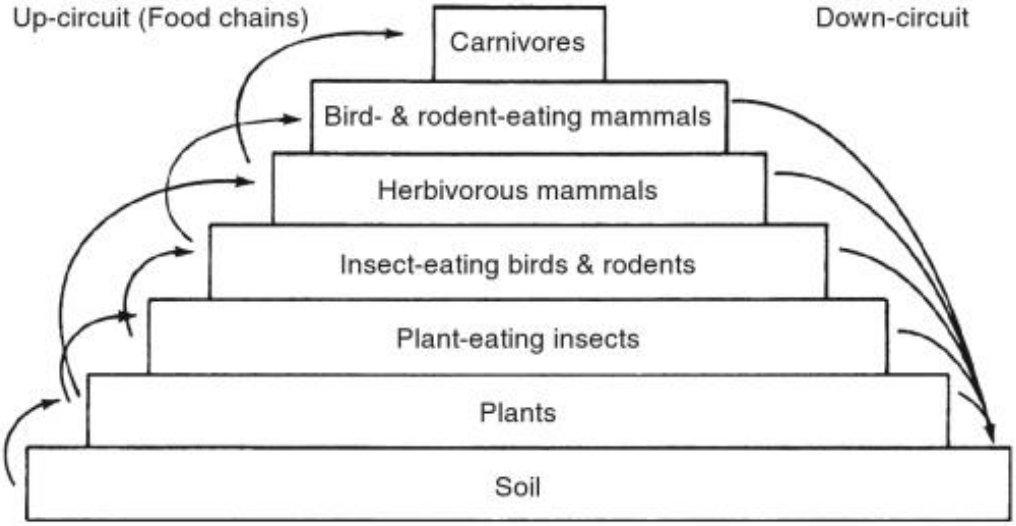


Figure 1-(2):- :- Leopold's drawing of a biotic pyramid – "A Biotic View of Land'
Source: Thomas J. Sauer, John Norman, Mannava V. K. Sivakumar, Sustaining Soil Productivity in Response to Global Climate Change: Science, Policy, and Ethics, books.google.co.in/

2.3.5.4. "The species of a layer are alike not in where they came from, or in what they look like, but rather in what they eat. Each successive layer depends on those below it for food and often for other services, and each in turn furnishes food and services to those above. Proceeding upward, each successive layer decreases in numerical abundance. Thus, for every carnivore there is hundreds of his prey, thousands of their prey, millions of insects and uncountable plants. The pyramidal form of the system reflects this numerical progression from apex to base. Man shares an intermediate layer with the bears, raccoons, and squirrels which eat both meat and vegetables". Figure 1-(2) illustrates Leopold's idea about the Land Pyramid and the circulation of energy through the biotic system.

→ Leopold makes a mention about a very important phenomenon known as 'services'. A 'service' may be defined as the action of helping or doing work for someone[11]. Services cannot be quantified and hence, is intangible. Each successive layer of the pyramid is interconnected through the exchange of such 'services'. Currently, these services are termed as 'Ecosystem Services". Ecosystem Services may be a very vital and useful tool to analyze and establish a threshold for the development processes. Chapter 3 gives a brief understanding on ecosystem services.

2.3.5.5. "The lines of dependency for food and other services are called food chains. Thus soil-oak-deer- Indian is a chain that has now been largely converted to soil-corn-cow-farmer. Each species, including ourselves, is a link in many chains. The deer eats a

[11] http://oxforddictionaries.com/definition/english/service

hundred plants other than oak, and the cow a hundred plants other than corn. Both, then, are links in a hundred chains. The pyramid is a tangle of chains so complex as to seem disorderly, yet the stability of the systems proves it to be a highly organized structure. Its functioning depends on the co-operation and competition of its diverse parts.

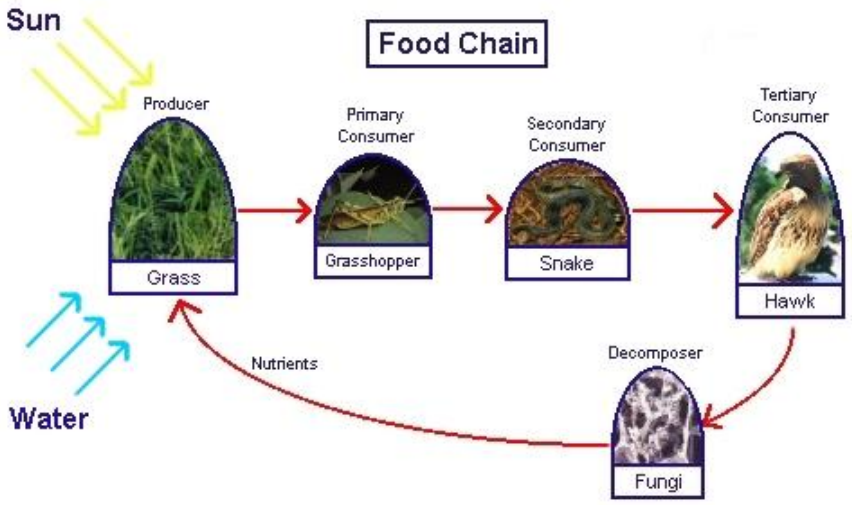


Figure 2-(2):- Food Chain
Source: http://ejad.best.vwh.net/java/population/facts_foodchain

→ The diagram seen above represents a simple food chain. The diagram demonstrates the flow of energy starting from the bottom layer of the pyramid (that is the soils and the plants), moving ahead (upward) in the pyramid and then returning back to the lowest level of the pyramid, that is - the soil. All the energy flows occur in the same pattern – circle or cyclic. Therefore, 'the land pyramid' is combined with the phenomenon of food chain and hence, is the keyword 'Land Pyramid / Cycle'.

2.3.5.6. "In the beginning, the pyramid of life was low and squat; the food chains short and simple. Evolution has added layer after layer, link after link. Man is one of thousands of accretions to the height and complexity of the pyramid. Science has given us many doubts, but it has given us at least one certainty - the trend of evolution is to elaborate and diversify the biota".

→ The diversification of biota happens due to the wide spread traverse of species from one place to another. Man has constantly changed the land through civilization and development. He has modified the land forms through land reclamation, cutting and trimming of hills, deforestation and so on. The biota in and around such altered land forms eventually attain stability through the process known as 'ecological succession'[12]. Such ecological successions which are consequences of man-made

[12] Ecological succession is the observed process of change in the species structure of an ecological community over time. The community begins with relatively few pioneering plants and animals and develops through increasing complexity until it becomes stable or self-perpetuating as a climax community. It is a phenomenon or process by which an ecological

changes have got many added man-made layer within its mechanism and therefore many additional links making the pyramid more complex.

2.3.5.7. "Land, then, is not merely soil; it is a fountain of energy flowing through a circuit of soils, plants, and animals. Food chains are the living channels which conduct energy upward; death and decay return it to the soil. [as is illustrated in Figure 2-(2) above] The circuit is not closed; some energy is dissipated in decay, some is added by absorption from the air, some is stored in soils, peats, and long- lived forests, but it is a sustained circuit, like a slowly augmented resolving fund of life. There is always a net loss by downhill wash, but this is normally small and offset by the decay of rocks. It is deposited in the ocean and, in the course of geological time, raised to form new lands and new pyramids".

2.3.5.8. "When a change occurs in one part of the circuit, many other parts must adjust them to it. Change does not necessarily obstruct or divert the flow of energy; evolution is a long series of self-induced changes, the net result of which has been to elaborate the flow mechanism and to lengthen the circuit. Evolutionary changes, however, are usually slow and local Man's invention of tools has enabled him to make changes of unprecedented violence, rapidity and scope".

"Civilization has so cluttered this elemental man-earth relationship with gadgets and middlemen that awareness of it is growing dim. We fancy that industry supports us forgetting what supports industry".
Source: www.goodreads.com

2.3.5.9. "One change is in the composition of floras and faunas. The larger predators are lopped off the apex of the pyramid; food chains, for the first time in history; become shorter rather than longer. Domesticated species from other lands are substituted for wild ones, and wild ones are moved to new habitats. In this worldwide pooling of faunas and floras, some species get out of bounds as pests and diseases, others are extinguished. Such effects are seldom intended or foreseen; they represent unpredicted and often untraceable readjustments in the structure. Agricultural science is largely a race between the emergence of new pests and the emergence of new techniques for their control".

→ Leopold claims that the changes caused to the structure (structure means the characteristic numbers, as well as the characteristic kinds and functions, of the component species) by the modern gadgets been used by man bring about changes which are not fathomable. Neither does man hold the capacity or capability to predict the probable changes. Nor does he demonstrate his will or effort to analyze such changes. Nevertheless, the structure silently readjusts itself to the new changes, which goes un-noticed to man.

[12]Community undergoes more or less orderly and predictable changes following disturbance or initial colonization of new habitat. *Source: http://en.wikipedia.org/wiki/Ecological succession*

→ However, this was the scenario up till the time when the structure was able to change itself silently. Now the scenario has changed. The changes that occur in this structure do not adjust it silently and hence man slowly understands the signals given by this structure. Climate change, global warming, species extinction, rising sea level, ozone depletion, increased number of droughts, floods and diseases are few of such signals.

2.3.5.10. "Another change touches the flow of energy through plants and animals and its return to the soil. Fertility is the ability of soil to receive, store, and release energy. Agriculture, by overdrafts on the soil or by too radical a substitution of domestic for native species in the superstructure, may derange the channels of flow or deplete storage. Soils depleted of their storage, or of the organic matter which anchors it, wash away faster than they form. This is erosion".

→ Through the practice of agriculture (for the need to increase food production) and uncontrolled deforestation (for the need to generate more and more land to support the increasing population), nature loses its most valuable element – soil. Soil forms the bottom layer of Leopold's land pyramid on which all the above layers depend upon.

"The destruction of soil is the most fundamental kind of economic loss which the human race can suffer".
(-"Erosion and Prosperity (1921) EAL76)

2.3.5.11. "Waters, like soil, are part of the energy circuit. Industry, by polluting waters or obstructing them with dams, may exclude the plants and animals necessary to keep energy in circulation. Transportation brings about another basic change: the plants or animals grown in one region are now consumed and returned to the soil in another. Transportation taps the energy stored in rocks, and in the air, and uses it elsewhere; thus we fertilize the garden with nitrogen gleaned by the guano birds from the fishes of seas on the other side of the Equator. Thus the formerly localized and self-contained circuits are pooled on a world-wide scale".

→ The world is getting closer through various modern means of transportation which, at the same time is causing hybridization of the natural habitat.

2.3.5.12. "This thumbnail sketch of land as an energy circuit conveys three basic ideas:

i. That land is not merely soil.
ii. That the native plants and animals kept the energy circuit open; others may or may not.
iii. Those man-made changes are of a different order than evolutionary changes, and have effects more comprehensive than is intended or foreseen".

2.3.5.13. "These ideas, collectively, raise two basic issues. Can the land adjust itself to the new order? Can the desired alterations be accomplished with less violence? Biota seems to differ in their capacity to sustain violent conversion. Some large animals are lost, swamps forests have become meadows or plow land; many new plants and animals are introduced, some of which escape as pests; the remaining natives are greatly changed in distribution and abundance. Yet the soil is still there and with the help of imported nutrients, still fertile; the waters flow normally; the new structure seems to function and to persist. There is no visible stoppage or derangement of the circuit. No matter how violent the alterations, the pyramid, so far, have developed some new *modus vivendi* which preserves its habitability for man and for most of the other natives".

2.3.5.14. This almost world-wide display of disorganization in the land seems to be similar to disease in an animal, except that it never culminates in complete disorganization or death. The land recovers, but at some reduced level of complexity and with a reduced carrying capacity for people, plants, and animals. Many biota currently regarded as "Lands of opportunity" are in fact already subsisting on exploitative agriculture i.e., they have already exceeded their sustained carrying capacity.

2.3.5.15. The combined evidence of history and ecology seems to support one general deduction - the less violent the man made changes, the greater the probability of successful readjustment in the pyramid. Violence, in turn, varies with human population density; a dense population requires a more violent conversion. This deduction runs counter to our current philosophy, which assumes that because a small increase in density enriched human life, that an indefinite increase will enrich it indefinitely. Ecology knows of no density relationship that holds for indefinitely wide limits. All gains from density are subject to a law of diminishing returns.

"The modern dogma is comfort at any cost".
Source: www.goodreads.com

2.3.6. Land Health and A-B Cleavage

2.3.6.1. "A land ethic, then, reflects the existence of an ecological conscience and this in turn reflects a conviction of individual responsibility for the health of the land. Land Health is the capacity of the land for self renewal. Conservation is our effort to understand and preserve this capacity".

2.3.6.2. "Conservationists are notorious for their dissensions. Superficially these seem to add up to mere confusion, but a more careful scrutiny reveals a single plane of cleavage common to many specialized fields. In each field one group (A) regards the land as soil, and its function as commodity production; another group (B) regards the land as a biota, and its function as something broader".

i. "In my own field, forestry, group A is quite content to grow trees like cabbages, with cellulose as the basic forest commodity. It feels no inhibition against violence; its ideology is agronomic".

ii. "Group B, on the other hand, sees forestry as fundamentally different from agronomy because it employs natural species, and manages a natural environment rather than creating an artificial one. Group B prefers natural reproduction on principle. It worries on biotic as well as economic grounds about the loss of species like chestnut, and the threatened Ioss of the white pines. It worries about a whole series of secondary forest functions: wildlife, recreation, watersheds, and wilderness areas. To my mind, Group B feels the stirrings of an ecological conscience".

Table 1 below refers to the difference between group (A) and group (B) type of people.[13]

Table 1-(2):- A versus B Cleavage

Agronomic[14] (A)	**Biophiliac[15] (B)**	**Perspectives**
Economic	Ecological	Sciences
Rational	Emotional	Qualities of knowing
Narrow, quantitative	Wider, qualitative	Approaches
Isolated focus on money	Relations of sources to sinks	Methods

→ Leopold advocates saying that the civilized society is a mixture of two types of groups – one (A) who looks on the biotic community with a rational attitude and the other (B) who regards it with an emotional perspective. Group A favors to go by the calculations of quantities and profits achieved – a byproduct of the brain (rational intelligence). Group B prefers to gain profits by caring and preserving the natural resources and its functions - a byproduct of the heart (emotional intelligence).

"Ethical behavior is doing the right thing when no one else is watching – even when doing the wrong thing is legal"
Source: www.goodreads.com

→ However, Leopold's Land Ethic suggests both the Group (A) and Group (B) to work in collaboration, as a community to apply logics of both the types of intelligence towards the biotic community. The outcome will turn out to be manifold.

2.3.6.3. "In this idea of cleavages, we see repeated the same basic paradoxes: man the conqueror versus man the biotic citizen; science the sharpener of his sword versus

[13] http://myweb.rollins.edu/jsiry/LeopoldTasteBison.html

[14] Agronomy is the science and technology of producing and using plants for food, fuel, fiber, and reclamation. Agronomy encompasses work in the areas of plant genetics, plant physiology, meteorology, and soil science. http://en.wikipedia.org/wiki/Agronomy#Soil_conservation

[15] The biophilia hypothesis suggests that there is an instinctive bond between human beings and other living systems. Edward O. Wilson introduced and popularized the hypothesis in his book, Biophilia (1984).[1] He defines biophilia as "the urge to affiliate with other forms of life". The term "biophilia" literally means "love of life or living systems." It was first used by Erich Fromm to describe a psychological orientation of being attracted to all that is alive and vital. http://en.wikipedia.org/wiki/Biophilia_hypothesis

science the searchlight on his universe, land the slave and servant versus land the collective organism". Thus, Leopold very cleverly explains the intrinsic contradictions of man, science and land.

2.3.7. The Outlook

2.3.7.1. "It is inconceivable to me that an ethical relation to land can exist without love, respect, and admiration for land and a high regard for its value. By value, I of course mean something far broader than mere economic value; I mean value in the philosophical sense".

→ One of the ways to estimate the value is through the ecosystem services that the land provides.

i. The Millennium Ecosystem Assessment (MA) was carried out between 2001 and 2005 to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being. The assessment focuses on the linkages between ecosystems and human well-being and, in particular, on "ecosystem services." An ecosystem is a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit. The MA examines how changes in ecosystem services influence human well-being. Human well-being is assumed to have multiple constituents, including the basic material for a good life, such as secure and adequate livelihoods, enough food at all times, shelter, clothing, and access to goods; health, including feeling well and having a healthy physical environment, such as clean air and access to clean water; good social relations, including social cohesion, mutual respect, and the ability to help others and provide for children; security, including secure access to natural and other resources, personal safety, and security from natural and human-made disasters; and freedom of choice and action, including the opportunity to achieve what an individual values doing and being. Freedom of choice and action is influenced by other constituents of well-being (as well as by other factors, notably education) and is also a precondition for achieving other components of well-being, particularly with respect to equity and fairness[16].

2.3.7.2. "Perhaps the most serious obstacle impeding the evolution of a land ethic is the fact that our educational and economic system is headed away from, rather than toward, an intense consciousness of land. Your true modern is separated from the land by many middlemen, and by innumerable physical gadgets. He has no vital relation to it; to him it is the space between cities on which crops grow. Turn him loose for a day

[16] Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*, Island Press, Washington, DC.

on the land and if the spot does not happen to be a golf links or a "scenic" area, he is bored stiff. If crops could be raised by hydroponics instead of farming, it would suit him very well. Synthetic substitutes for wood, leather, wool, and other natural land products suit him better than the originals. In short, land is something he has "outgrown."

"One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either harden his shell or make believe that the consequences of science are none of his business or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise".

-Aldo Leopold: A Sand county Almanac
Source: www.goodreads.com

2.3.7.3. "Almost equally serious as an obstacle to a land ethic is the attitude of the farmer for whom the land is still an adversary, or a taskmaster that keeps him in slavery. Theoretically, the mechanization of farming ought to cut the farmer's chains, but whether it really does is debatable".

2.3.7.4. "One of the requisites for an ecological comprehension of land is an understanding of ecology, and this is by no means co-extensive with "education", in fact, much higher education seems deliberately to avoid ecological concepts. An understanding of ecology does not necessarily originate in courses bearing ecological labels; it is quite as likely to be labeled geography, botany; agronomy; history, or economics. This is as it should be, but whatever the label, ecological training is scarce".

→ Leopold opined that the education system does not consider necessary to teach the crux of ecology and consequently there is very little wealth of ecological knowledge available. There is no adequate knowledge of ecological concepts available now, what shall be transferred to the future? Education brings awareness and due to lack of knowledge available, there cannot be an awareness or understanding about the changes happening in them. Subsequently, conservation measures are either not into consideration at all or there is very little conservation that actually happens.

i. In a recent conference on biodiversity in Hyderabad, India became the first champion of the Hyderabad pledge to announce US $50 million (Rs. 250 corer) to strengthen biodiversity institutions within India and abroad on Tuesday (17th October, 2012). Does this really suffice? Can money save biodiversity? It has to be studied under field conditions. Biodiversity journals don't get that much impact factor. It is very difficult to find people working in this field that can identify the plants in their natural habitat and prepare a list of existing biodiversity due to more and more emphasis being given to functional sciences or molecular biology or applied sciences which will yield immediate or future positive outcome for the humanity. Biodiversity does the same but needs to be recognized. The Nagoya Protocol has accelerated domestic contribution to save biodiversity. How biodiversity could be saved if we have no experts of Alage, Fungi, Bryophytes, Pteridophytes,

> Gymnosperms and Angiosperms in the world. Do we have a dozen experts in these fields all over the world what to talk of India. All over world its fashion to study molecular biology and morphology and anatomy and taxonomy have be relegated to the back seat. It's time to revive these disciplines[17].

"Conservation, without a keen realization of its vital conflicts, fails to rate as authentic human drama. It falls to the level of a mere utopian dream"
-Green fire Aldo Leopold and a Land Ethic for our Time, www.aldoleopold.org/freenfire

→ Therefore, ecological education and awareness in today's scenario is a very vital and inevitable tool which requires being a part of the planning, development and operational system. System includes a wide array of stakeholders such as the developers, government authorities, educational institutes, finance and business institutes, manufacturers, suppliers as well as the end users/consumers. Therefore, 'Education/Awareness' is been selected as another keyword as a part of this study.

"The problem, then, is how to bring about a striving for harmony with land among a people many of whom have forgotten there is any such thing as land, among which education and culture have become almost synonymous with landlessness. This is the problem of conservation education".
Source: www.goodreads.com

2.3.7.5. "The case for a land ethic would appear hopeless but for the minority which is in obvious revolt against these "modern' trends. The "key-log" which must be moved to release the evolutionary process for an ethic is simply this: quit thinking about decent land-use as solely an economic problem. Examine each question in terms of what is ethically and esthetically right, as well as what is economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise".

→ Leopold does not deny the fact that economic growth is an essential accomplishment which the humans need to strive for, for his survival. He is seemingly in opposition to considering purely economic gains as the sole motto of any land-use. He insists that the process of land-use require being in accordance to the concepts of ethics and esthetics. Actions and strategies which tend to preserve the integrity, stability and beauty of the biotic community are considered to be appropriate.

→ Sustainable development is one of the ways through which appropriate actions for the preservation of integrity, stability and beauty of the biotic community are propagated. The General Assembly of United Nations adapted a Declaration in the form of United Nations Millennium Declaration which ultimately turned into 8

[17] Ashwani Kumar(Botanist), *Biodiversity conservation is a global issue but has to be tackled at local level*, ww.science20.com, October 17th 2012

Millennium Development Goals out of which Goal 7 stands to 'Ensure Environmental Sustainability'. (Refer Annexure I)

→ Despite its fundamental importance, biodiversity continues to be lost. It is against this backdrop that the Parties to the Convention on Biological Diversity, in 2010 in Nagoya, Japan, adopted the Strategic Plan for Biodiversity 2011-2020 with the purpose of inspiring broad-based action in support of biodiversity over the next decade by all countries and stakeholders. The Strategic Plan is comprised of a shared vision, a mission, strategic goals and 20 ambitious yet achievable targets, collectively known as the Aichi Targets[18]. (Refer Annexure 2)

"Ethical behavior is doing the right thing when no one else is watching – even when doing the wrong thing is legal"
Source: www.goodreads.com

2.3.7.6. Of course, it goes without saying that economic feasibility limits the tether of what can or cannot be done for land. It always has and it always will. The fallacy the economic determinists have tied around our collective necks and which we now need to cast off, is the belief that economics determines all land - use. This is simply not true. An innumerable host of actions and attitudes, comprising perhaps the bulk of all land relations, is determined by the land-users' tastes and predilections, rather than by their purses. The bulk of all land relations hinges on investments of time, forethought, skill, and faith rather than on investments of cash. As a land-user thinketh, so is he.

→ Leopold admits that, in practice the extension of ethics to the land community depends on the taste and preferences of the land users and doing that is a time consuming affair. It also calls for proactive measures and a careful thought process in combination with skills, technology and above all uttermost faith in all the doings. Nevertheless, the popularity, awareness and adaptation of green building rating systems indicate the trend of change in the present user's mindset. However, a different approach needs to be adapted in order to achieve more in a better and assured manner.

"Cease being intimidated by the argument that a right action is impossible because it does not yield maximum profit or that a wrong action is to be condoned because it pays".
Source: www.goodreads.com

"A conservationist is one who is humbly aware that with each stroke (of the axe) he is writing his signature on the face of the land".
Source: www.goodreads.com

[18] Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets, *"Living in Harmony with Nature"*, Secretariat of the Convention on Biological Diversity, Montreal

2.3.7.7. "The evolution of a land ethic is an intellectual as well as emotional process. Conservation is paved with good intentions which prove to be futile or even dangerous because they are devoid of critical understanding either of the land or of economic land-use. I think it is a truism that as the ethical frontier advance from the individual to the community, its intellectual content increases. The mechanism of operation is the same for any ethic: social approbation for right actions: social disapproval for wrong actions. By and large, our present problem is one of attitudes and implements. We are remodeling the Alhambra with a steam shovel, and we are proud of our yardage. We shall hardly relinquish the shovel, which after all has many good points, but we are in need of gentler and more objective criteria for its successful use".

"Cease being intimidated by the argument that a right action is impossible because it does not yield maximum profit or that a wrong action is to be condoned because it pays".
Source: www.goodreads.com

→ Leopold hints by saying that modernization of man's life styles and his standard of living is equipped by the use of members of biotic community. His achievements and desires always keep on adding and he will never give up on this trend. However, what he needs to do is work with prudence and foresight formulating a clear set of overarching vision on a holistic basis. One of the ways, as Leopold suggests, is through conservation. But he opines saying that the act of conservation requires a thorough understanding of not only economic land-use, but also of the land itself. We may not have comprehended reasonably well in either of the fields, but an endeavor to that effect is the need of the time. Concluding, Conservation/Preservation is selected as a land ethic keyword for the purpose of this study. Also, for a conservation practice to be productive, a better understanding and practice of land use is essential and hence, this is chosen as a keyword for the purpose of the study.

2.4. Land Ethic's Current Practices

2.4.1. Aldo Leopold Foundation

The five children of Aldo and Estella Leopold established the Aldo Leopold Foundation as a not-for-profit conservation organization in 1982, thus fostering the Land Ethic through the legacy of Aldo Leopold.[19]

2.4.1.1. Mission

The Aldo Leopold Foundation's mission is to weave a land ethic into the fabric of the society; to advance the understanding, stewardship and restoration of land health; and to cultivate leadership for conservation.

[19] http://www.aldoleopold.org/About/foundation.shtml

2.4.1.2. About the Foundation

i) The Aldo Leopold Foundation is a not-for-profit, donor-supported organization based at the Aldo Leopold Legacy Center in Baraboo, Wisconsin. The foundation's mission is to inspire an ethical relationship between people and land through the legacy of Aldo Leopold. Leopold regarded a land ethic as a product of social evolution. "Nothing so important as an ethic is ever 'written,'" he explained. "It evolves 'in the minds of a thinking community.'" The foundation's membership forms a modern day "thinking community," and the foundation's programs create opportunities for rich, diverse, and productive dialogue with members and others about humanity's relationships to land, allowing the idea of a land ethic to unfold in myriad ways.

ii) The Aldo Leopold Foundation owns and manages the original Aldo Leopold Shack and 300 surrounding acres, in addition to several other parcels. It also manages much of the remainder of the 1,800-acre Leopold Memorial Reserve. The foundation is committed to the ongoing restoration of the Leopold Shack and Farm, where, in 1935, Aldo Leopold and his family undertook a revolutionary experiment in returning health to a worn out farm. Celebrated in Leopold's classic *A Sand County Almanac*, the transformed land now supports vibrant forests, wetlands, and prairie and draws visitors from around the world. First published in 1949, *A Sand County Almanac* has sold over two million copies in ten languages.

iii) The foundation's headquarters are located in the Leopold Center, located less than a mile from the Leopold Shack and Farm. Opened in 2007, the Leopold Center was built using pines the Leopold family planted in the 1930s and '40s and implements a wide spectrum of green building techniques and technologies. The Leopold Center begins to demonstrate the many ecological, economic, and cultural harvests we may begin to reap when we commit to caring for land.

iv) As the primary advocate and interpreter of the Leopold legacy, the foundation manages the original Leopold farm and now-famous Shack, serves as the executor of Leopold's literary estate, encourages scholarship on Leopold, and serves as a clearinghouse for information regarding Leopold, his work, and his ideas.

v) The foundation's land stewardship initiatives work with neighbors and others to foster an understanding of the total land community. Science and Stewardship programs encourage ecological and ethical use of private and public land, promoting an understanding of the total land community. Education programs serve 5,000 - 7,000 visitors on-site each year, in addition to many thousands more served through this website, our Green Fire film, and other outreach programming, including a clearinghouse of Leopold teaching tools for educators.

vi) Leopold's words have stirred many to a personal ecological awareness. The foundation's goal is to share the legacy of Aldo Leopold and to awaken an ecological conscience in the people of our nation. As long as we care about people, land, and the connections between them, we have hope for sustainable ecosystems, sustainable economies, and sustainable communities.

2.5. Conclusion

Following are the conclusions drawn on the basis of this literature review:-

2.5.1. A Sand County Almanac

A skim through summary of the book 'A Sand County Almanac" demonstrates the dedication and perseverance of the author, Aldo Leopold which led to the evolution of the essay "The Land Ethic". The wisdom of Land Ethic is an outcome of an entire life-time journey which holds well even today.

2.5.2. Land Ethic's community concept:

Leopold's basic premise of the Land Ethic urges mankind to extend an ethical aptitude towards land, which he himself belongs to. Man is expected to bring rational insights (for economic gains) and emotional insights (for extension of ethics) together in all his endeavors. The ecosystem supplies mankind with numerable services; known as ecosystem services (seen in the next chapter) for its survival and hence, preservation and conservation of the same becomes highly vital.

2.5.3. Land Ethic members and keywords

On the basis of the above literature review, following Land Ethic members and keywords are selected for the purpose of this study. The selected members and keywords are articulated in form of a model; know as 'Land Ethic Model' (seen in the next chapter). This model illustrates the principles of Land Ethic.

2.1.3.1. Land Ethic Members:-

1) Soils
2) Waters
3) Plants/animals
4) Man

2.1.3.2. Land Ethic Keywords:-

1) Community
2) Land Health
3) Land Pyramid / Cycle
4) Land Organism
5) Ecological Conscience
6) Land Use/Policy
7) Conservation / Preservation / Recreation
8) Education / Awareness / Social Interaction

Chapter 3. Land Ethic Extracts

3.1. The Land Ethic Members & Keywords

On basis of literature review, following are the Land Ethic members and keywords that are selected for the purpose of this study.[1]

- Land Ethic Members:-

i) Soils
ii) Waters
iii) Plants/animals
iv) Man

- Land Ethic Keywords:-

v) Community
vi) Land Health
vii) Land Pyramid / Cycle
viii) Land Organism
ix) Ecological Conscience
x) Land Use/Policy
xi) Conservation / Preservation / Recreation
xii) Education / Awareness / Social Interaction

3.1.1. Basis for selection of Land Ethic members & keywords

3.1.1.1. Leopold explains that "all ethics as far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts. His instincts prompt him to compete for his place in that community, but his ethics prompt him also to co-operate. The land ethic simply enlarges the boundaries of the community to include soils, waters, plants and animals, or collectively: the land".

→ This evidently identifies the members of Land Ethic as – soils; waters; plants and animals. The core actor here who is needed to exhibit ethical behavior towards these members of Land Ethic is visibly - the man. All these members are interwoven to form a community to which the principles of Land Ethic are to be applied.

3.1.1.2. "Civilization has so cluttered this elemental man-earth relationship with gadgets and middlemen that awareness of it is growing dim. We fancy that industry supports us forgetting what supports industry".[2]

"Wilderness is the raw material out of which man has hammered the artifact called civilization"
(-"Wilderness")

[1] This section explains the concept of Land Ethic beneath two different terms - members and keywords. However, for ease of communication in the next sections, all the words are clubbed under the banner of 'keyword'.
[2] www.goodreads.com

→ Man gradually moved towards worldly progress known as civilization. The game still continues but has now evolved as a process known as urbanization.

→ The pace at which the current development is taking place, there seems to be an urgent necessity to pay due attention to the modifications caused to the natural state of the land. If not so, we may not be left with any pristine land available for mankind to cherish. For this reason, every development taking place needs to be 'Ecologically Conscience' in all phases of its development.

3.1.1.3. According to Leopold, "Conservation is a state of harmony between men and land". His exposure in the field says, "Despite nearly a century of propaganda, conservation still proceeds at a snail's pace; progress still continues largely of letterhead pieties and convention oratory. On the back forty we still slip two steps backward for each forward stride. The usual answer to this dilemma is "more conservation education". No one will debate this, but is it certain that only the volume of education needs stepping up? Is something lacking in the content as well?"

"A conservationist is one who is humbly aware that with each stroke he is writing his signature on the face of his hand".

(-November: Axe-in-Hand)

→ These premises may be interwoven by saying that while moving forward towards civilization (and now urbanization); it is required of mankind to be conscious about ecology from which he borrows many services. To enable ecology to be able to serve the mankind, it needs to be conserved again by mankind himself. This is how civilization, ecological conscious and conservation all need to be carried hand in hand by mankind for his sustained progress.

3.1.1.4. "In general, the trend of the evidence indicates that in land, just as in the human body, the symptoms may lie in one organ and the cause in the other. The practices we now call conservation are, to a large extent local alleviations of biotic pain. They are necessary, but they must not be confused with cures. The art of land doctoring is being practiced with vigor, but the science of land health is yet to be born".

(-"Wilderness")

→ As explained in his above maxim, Leopold compares land to a human body. Similar to a human body, for land too, the causes and effects may not necessarily lie at the same place. Also, the effect may travel unfathomable distance away from the original point of cause. This most of the time happens in an unpredictable manner. To sum up, Leopold uses a human body as a figure of speech to explain his thought of a land as an organism.

3.1.1.5. "Plants absorb energy from the sun. This energy flows through a circuit called the biota, which may be represented by a pyramid consisting of layers. The bottom layer is the soil. A plant layer rests on the soil, an insect layer on the plants, a bird and rodent layer on the insects, and so on up through various animal groups to the apex layer, which consists of the larger carnivores.

"Land, then, is not merely soil; it is a fountain of energy flowing through a circuit of soils, plants, and animals. Food chains are the living channels which conduct energy upward; death and decay return it to the soil. The circuit is not dosed; some energy is dissipated in decay, some is added by absorption from the air, some is stored in soils, peats, and long- lived forests, but it is a sustained circuit, like a slowly augmented resolving fund of life. There is always a net loss by downhill wash, but this is normally small and offset by the decay of rocks. It is deposited in the ocean and, in the course of geological time, raised to form new lands and new pyramids". Leopold's concept of 'land pyramid', thus explained.

3.1.1.6. In a food chain, the flow of energy starts from the bottom layer of the pyramid (that is the soils and the plants), moving ahead (upward) in the pyramid and then returning back to the lowest level of the pyramid, that is - the soil. All the energy flows occur in the same pattern – circle or cyclic. Therefore, 'the land pyramid' is combined with the phenomenon of food chain.

3.1.1.7. Leopold's perspective on the concept of 'Land Health' (conversely Land Sickness), Land Organism', 'Land Use' and 'Conservation/Preservation' can be understood below[3]:

3.1.1.8. Central to this human-harmony-with-land paradigm of conservation, Leopold articulated a new conservation concept that he called "land health." It is different from and complementary to another concept with which it is often conflated, biological integrity. A biotic community has integrity if all of its native species are present in their characteristic numbers interacting in their natural ways. An ecosystem is healthy if it produces biomass, recruits, retains, and cycles nutrients, holds the soil, modulates water flow, and maintains other ecosystem processes—whether these processes are carried out by native or exotic, or wild or domestic species.

3.1.1.9. Leopold more fully developed the concept of land health in a 1941 essay titled, "Wilderness as a Land Laboratory." There, the primary argument for wilderness preservation is not recreation, not sublime, awe-inspiring scenery, nor even habitat for threatened species, although all of these rationales for wilderness set-asides, especially the last one, remained important to him. By 1941, Leopold had become so focused on private-lands conservation in the middle, rural, humanly inhabited and economically exploited landscape that, to him then, the most important reason for wilderness preservation was to provide "a base-datum of normality, a picture of how healthy land maintains itself as an organism."

3.1.1.10. The basic idea is that untrammeled areas provide the benchmark of healthy ecosystems—normal rates of primary production, normal ratios of nutrient gains and losses, normal disturbance regimes, normal population cycles of

[3] Cynthia Barakatt, Craig Maier , *Aldo Leopold's Legacy*, U.S. Fish and Wildlife Service, www.eoearth.org, February 11, 2009

component species, and so on and so forth. With these control areas, we can compare similar areas that we exploit in various ways—on which we practice forestry, agriculture and other land uses, large and small—and to which we introduce, intentionally or inadvertently, non-native species. From this perspective, the areas targeted for wilderness designation should not be confined to scenic hinterlands, but also should include unspoiled examples of every type of ecosystem—grasslands as well as montane meadows and wetlands as well as painted deserts.

3.1.1.11. "Wilderness as a Land Laboratory" most fully characterizes not land health but land sickness. "When soil loses fertility or washes away faster than it forms, when water systems exhibit abnormal floods and shortages, the land is sick." In addition to these symptoms of land sickness, Leopold adds "the disappearance of plant and animal species without visible causes, despite efforts to protect them, and the eruption of others as pests, despite efforts to control them." In "Conservation: In Whole or in Part?" written in 1944 but unpublished until recently, Leopold more positively and generally characterized land health as follows, ""The land consists of soil, water, plants, and animals, but health is more than a sufficiency of these components. It is a state of vigorous self-renewal in each of them, and in all collectively." He also added qualitative as well as quantitative "deteriorations in land crops," and the outbreak of exotic diseases, parasites and pests to the catalog of land-sickness symptoms. Further, in this essay, Leopold hypothesizes a casual relationship between the diversity and complexity of the biotic sectors of ecosystems and their healthy functioning.

3.1.1.12. Leopold's most sustained treatment of this topic is found in two essays written in themed-1940s and published for the first time in 1999—"Biotic Land-Use" and "The Land-health Concept and Conservation." In the latter, he defines land health as "the capacity for self-renewal in the biota,' and adds, "a general tendency towards the shortening of species lists and of foods chains, and a worldwide dominance of plants and animal weeds" to the catalog of land-sickness symptoms. Perhaps most important, Leopold manages to unite the two goals of conservation toward which he seemed alternatively inclined:

i) Biological integrity - the preservation of the full complement of the native components of biotic communities in their characteristic numbers; and
ii) Ecosystem health, the preservation of the normal functioning of ecological processes. "It is necessary to suppose" he wrote, "that a high degree of interdependence exists between the capacity for self-renewal [or land health] and the integrity of the native communities." But how is the preservation of biological integrity possible anywhere except in wilderness areas where man is a visitor who does not remain, where the community of life is untrammeled by man and his works? Leopold acknowledged "that we must alter the distribution of species before we understand the consequences of doing so." His suggested solution in "The Land-health Concept and Conservation" was four-fold.
    - First, though reductions in numbers are inevitable, extirpate no native species. Reductions are reversible; extinction is forever.

- Second, eschew violence in the form of large-scale earth moving, such as dams and drainage ditches, and in the form of synthetic chemicals. Here, as in the 'The Land Pyramid' section of "The Land Ethic" from "A Sand County Almanac," Leopold recommended a kinder, gentler approach to land use and modification. That implied a preference for biotic as opposed to mechanical techniques—preventing streambank erosion, for example by using re-vegetation rather than concrete revetments, or controlling pests by fostering their natural enemies rather than using pesticides.
- Third, inculcate a sense of responsibility in landowners for the integrity of the biota on which the health of the land depends.
- Finally, try to limit the population of human members of the biotic community no less than that of other members.

3.1.1.13. In "Biotic Land-Use," Leopold offered a less rigorous necessary condition for land health that is more consistent with contemporary thinking. There, he first equated land health with land stability: "Soil, the repository of food between its successive trips through the chains, tends to wash downhill, but this downhill movement is slow, and in healthy land, is offset by the decomposition of rocks. Some animals likewise accomplish an uphill movement of food.

> "Stability is the continuity of this organized circulatory system. Land is stable when its food chains are so organized as to be able to circulate the same food [i.e., what a contemporary ecologist would call nutrients] an indefinite number of times."

3.1.1.14. Amazingly, in "Biotic Land-Use," Leopold anticipated even this recent turn in contemporary ecology. He wrote: "At this point I digress to refute the notion, unhappily cultivated by ecologists, that the land mechanism has a kind of Dresden china delicacy and falls to pieces at a loud noise. The whole history of civilization shows land to be tough. Lands differ in toughness, but even the most sensitive took several generations of violence to spoil."

3.1.1.15. Finally, in "Biotic Land-Use," Leopold crafted yet another definition of conservation, "The term land includes soils, water systems, and wild and tame plants and animals. Conservation is the attempt to understand the interactions of these components of land and to guide their collective behavior under human dominance."

3.1.2. The Land Ethic Model

→ The Land Ethic Model is drafted to highlight the interrelation between the Land Ethic members and keywords seen above. The model also indicates the community concept as projected in Land Ethic. The key member who is expected to play a major role in Land Ethic is man through his rational and emotional intelligence. The model explains how man is expected to act and carry out the process of civilization (or urbanization) yet cherish the intrinsic qualities of pristine land. Refer Land Ethic Model 1-(3).

There is yet another aspect which the Land Ethic model brings to surface – the ecosystem services. The next section gives an overview on the derivations in the form of ecosystem services that man benefits from the land ecosystem.

3.2. Ecosystem Services & Matrix

3.2.1. Introduction to Ecosystem Services

3.2.1.1. Leopold states that, "The species of a layer are alike not in where they came from, or in what they look like, but rather in what they eat. Each successive layer depends on those below it for food and often for other services, and each in turn furnishes food and services to those above. Proceeding upward, each successive layer decreases in numerical abundance. Thus, for every carnivore there is hundreds of his prey, thousands of their prey, millions of insects and uncountable plants. The pyramidal form of the system reflects this numerical progression from apex to base. Man shares an intermediate layer with the bears, raccoons, and squirrels which eat both meat and vegetables".

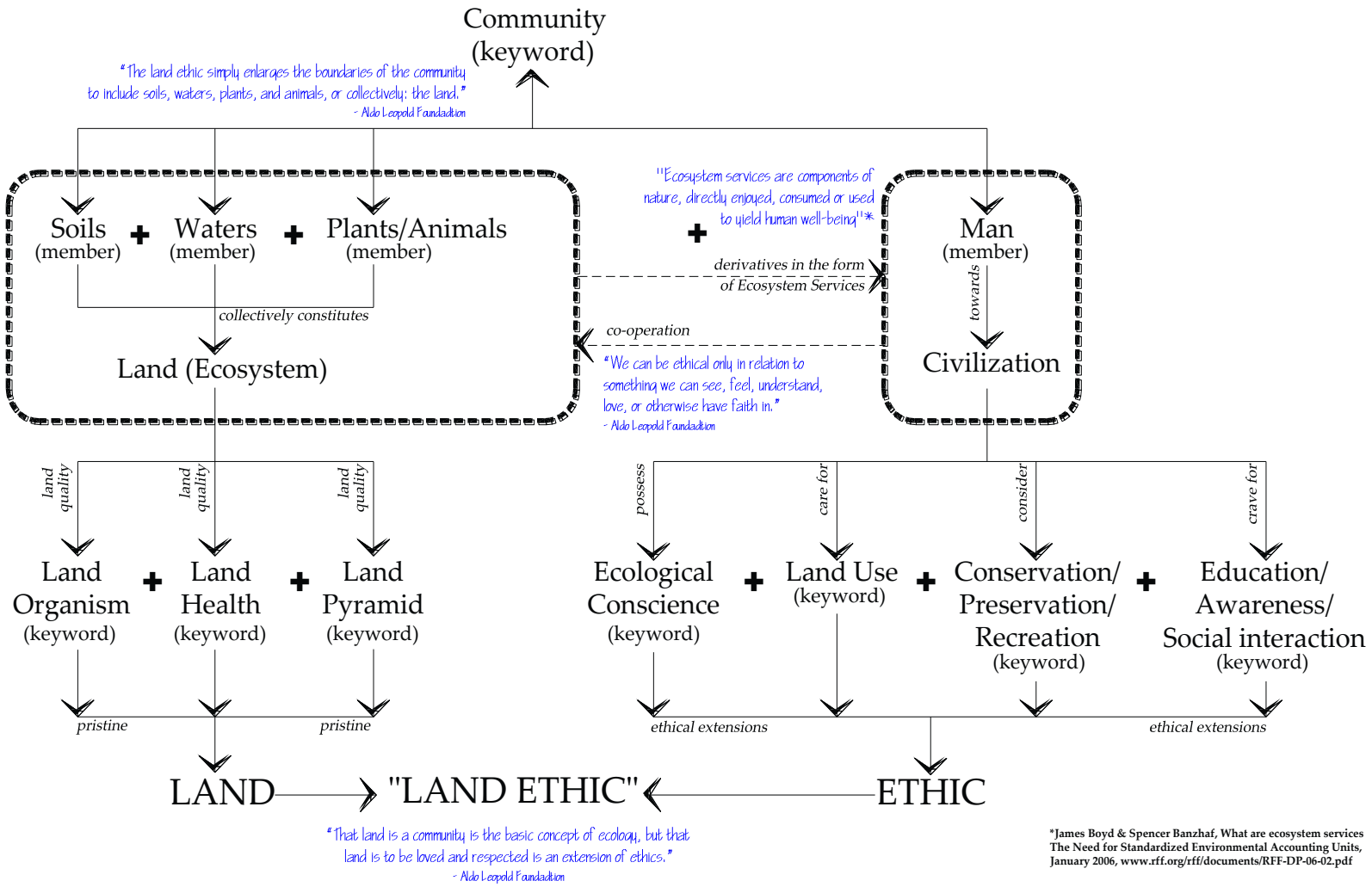
→ Leopold makes a mention about a very important phenomenon known as 'services'. A 'service' may be defined as the action of helping or doing work for someone[4]. Services cannot be quantified and hence, is intangible. Each successive layer of the pyramid is interconnected through the exchange of such 'services'. Currently, these services are termed as 'Ecosystem Services". Ecosystem Services are a very vital and useful tool to analyze and establish a threshold for development processes.

→ In Chapter 1, we got an overview of four main findings of Millennium Ecosystem Assessment, 2005 to assess the consequences of ecosystem change for human well-being. This section illustrates about the types of ecosystem services and examples for each of them.

3.2.1.2. [5]Ecosystem services are the benefits people obtain from ecosystems. These include provisioning, regulating, and cultural services that directly affect people and the supporting services needed to maintain other services. Many of the services listed here are highly interlinked. (Primary production, photosynthesis, nutrient cycling, and water cycling, for example, all involve different aspects of the same biological processes.

[4] http://oxforddictionaries.com/definition/english/service

[5] Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*, Island Press, Washington, DC.



Land Ethic Model 1-(3):- Conceptual explanation of Land Ethic (Source: Self)

3.2.2. Provisioning Services

These are the products obtained from ecosystems, including:

i) **Food** - This includes the vast range of food products derived from plants, animals, and microbes.
ii) **Fiber** - Materials included here are wood, jute, cotton, hemp, silk, and wool.
iii) **Fuel** - Wood, dung, and other biological materials serve as sources of energy.
iv) **Genetic resources** - This includes the genes and genetic information used for animal and plant breeding and biotechnology.
v) **Biochemicals**, **natural medicines**, and **pharmaceuticals** - Many medicines, biocides, food additives such as alginates, and biological materials are derived from ecosystems.
vi) **Ornamental resources** - Animal and plant products, such as skins, shells, and flowers, are used as ornaments, and whole plants are used for landscaping and ornaments.
vii) **Fresh water** - People obtain fresh water from ecosystems and thus the supply of fresh water can be considered a provisioning service.
viii) **Fresh water** in rivers is also a source of energy. Because water is required for other life to exist, however, it could also be considered a supporting service.

3.2.3. Regulating Services

These are the benefits obtained from the regulation of ecosystem processes, including:

i) **Air quality regulation** - Ecosystems both contribute chemicals to and extract chemicals from the atmosphere, influencing many aspects of air quality.
ii) **Climate regulation** - Ecosystems influence climate both locally and globally. At a local scale, for example, changes in land cover can affect both temperature and precipitation. At the global scale, ecosystems play an important role in climate by either sequestering or emitting greenhouse gases.
iii) **Water regulation** - The timing and magnitude of runoff, flooding, and aquifer recharge can be strongly influenced by changes in land cover, including, in particular, alterations that change the water storage potential of the system, such as the conversion of wetlands or the replacement of forests with croplands or croplands with urban areas.
iv) **Erosion regulation** - Vegetative cover plays an important role in soil retention and the prevention of landslides.
v) **Water purification** and **waste treatment** - Ecosystems can be a source of impurities (for instance, in fresh water) but also can help filter out and decompose organic wastes introduced into inland waters and coastal and marine ecosystems and can assimilate and detoxify compounds through soil and subsoil processes.
vi) **Disease regulation** - Changes in ecosystems can directly change the abundance of human pathogens, such as cholera, and can alter the abundance of disease vectors, such as mosquitoes.
vii) **Pest regulation** - Ecosystem changes affect the prevalence of crop and livestock pests and diseases.
viii) **Pollination** - Ecosystem changes affect the distribution, abundance, and effectiveness of pollinators.

ix) **Natural hazard regulation** - The presence of coastal ecosystems such as mangroves and coral reefs can reduce the damage caused by hurricanes or large waves.

3.2.4. Cultural Services

These are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences, including:

i) **Cultural diversity** - The diversity of ecosystems is one factor influencing the diversity of cultures.
ii) **Spiritual** and **religious values** -. Many religions attach spiritual and religious values to ecosystems or their components.
iii) **Knowledge systems** (**traditional** and **formal**) - Ecosystems influence the types of knowledge systems developed by different cultures.
iv) **Educational values** - Ecosystems and their components and processes provide the basis for both formal and informal education in many societies.
v) **Inspiration** - Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising.
vi) **Aesthetic values** - Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations.
vii) **Social relations** - Ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies.
viii) **Sense of place** - Many people value the "sense of place" that is associated with recognized features of their environment, including aspects of the ecosystem.
ix) **Cultural heritage values** - Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species.
x) **Recreation** and **ecotourism** - People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

3.2.5. Supporting Services

Supporting services are those that are necessary for the production of all other ecosystem services. They differ from provisioning, regulating, and cultural services in that their impacts on people are often indirect or occur over a very long time, whereas changes in the other categories have relatively direct and short-term impacts on people. (Some services, like erosion regulation, can be categorized as both a supporting and a regulating service, depending on the time scale and immediacy of their impact on people.) These services include:

i) **Soil Formation** - Because many provisioning services depend on soil fertility, the rate of soil formation influences human well-being in many ways.
ii) **Photosynthesis** - Photosynthesis produces oxygen necessary for most living organisms.
iii) **Primary production** - The assimilation or accumulation of energy and nutrients by organisms.

iv) **Nutrient cycling** - Approximately 20 nutrients essential for life, including nitrogen and phosphorus, cycle through ecosystems and are maintained at different concentrations in different parts of ecosystems.
v) **Water cycling** - Water cycles through ecosystems and is essential for living organisms.

3.2.6. Ecosystem Services and their alterations[6]

Human use of all ecosystem services is growing rapidly. Approximately 60% (15 out of 24) of the ecosystem services evaluated in this assessment (including 70% of regulating and cultural services) are being degraded or used unsustainably. The observed impact of human use on ecosystem services is broadly explained in Annexure 3. Figure 1-(3) explains the relation of ecosystem services and human well-being.

3.2.6.1. Provisioning Services: The quantity of provisioning ecosystem services such as food, water, and timber used by humans increased rapidly, often more rapidly than population growth although generally slower than economic growth, during the second half of the twentieth century. And it continues to grow. In a number of cases, provisioning services are being used at unsustainable rates.

The growing human use has been made possible by a combination of substantial increases in the absolute amount of some services produced by ecosystems and an increase in the fraction used by humans. World population doubled between 1960 and 2000, from 3 billion to 6 billion people, and the global economy increased more than sixfold. During this time, food production increased by roughly two-and-a-half times (a 160% increase in food production between 1961 and 2003), water use doubled, wood harvests for pulp and paper tripled, and timber production increased by nearly 60%.(Food production increased fourfold in developing countries over this period.)

3.2.6.2. Regulating Services: Humans have substantially altered regulating services such as disease and climate regulation by modifying the ecosystem providing the service and in the case of waste processing services, by exceeding the capabilities of ecosystems to provide the service.

Most changes to regulating services are inadvertent results of actions taken to enhance the supply of provisioning services. Humans have substantially modified the climate regulation service of ecosystems—first through land use changes that contributed to increases in the amount of carbon dioxide and other greenhouse gases such as methane and nitrous oxide in the atmosphere and more recently by increasing the sequestration of carbon dioxide (although ecosystems remain a net source of methane and nitrous oxide). Modifications of ecosystems have altered patterns of disease by increasing or decreasing habitat for certain diseases or their vectors (such as dams and irrigation canals that provide habitat for schistosomiasis) or by bringing human populations into closer contact with various disease organisms. Changes to ecosystems have contributed to a significant rise in the number of floods and major wildfires on all continents since the 1940s. Ecosystems serve an important role in detoxifying wastes introduced into the environment, but there are intrinsic limits to that waste processing capability. For example, aquatic ecosystems "cleanse" on average 80% of their global incident nitrogen loading, but this intrinsic self purification capacity varies widely and is being reduced by the loss of wetlands.

3.2.6.3. Cultural Services: Although the use of cultural services has continued to grow, the capability of ecosystems to provide cultural benefits has been significantly diminished in the past century.

Human cultures are strongly influenced by ecosystems, and ecosystem change can have a significant impact on cultural identity and social stability. Human cultures, knowledge systems, religions, heritage values, social interactions, and the linked amenity services (such as aesthetic enjoyment, recreation, artistic and spiritual

[6] Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*, Island Press, Washington, DC.

fulfillment, and intellectual development) have always been influenced and shaped by the nature of the ecosystem and ecosystem conditions. Many of these benefits are being degraded, either through changes to ecosystems (a recent rapid decline in the numbers of sacred groves and other such protected areas, for example) or through societal changes (such as the loss of languages or of traditional knowledge) that reduce people's recognition or appreciation of those cultural benefits. Rapid loss of culturally valued ecosystems and landscapes can contribute to social disruptions and societal marginalization. And there has been a decline in the quantity and quality of aesthetically pleasing natural landscapes.

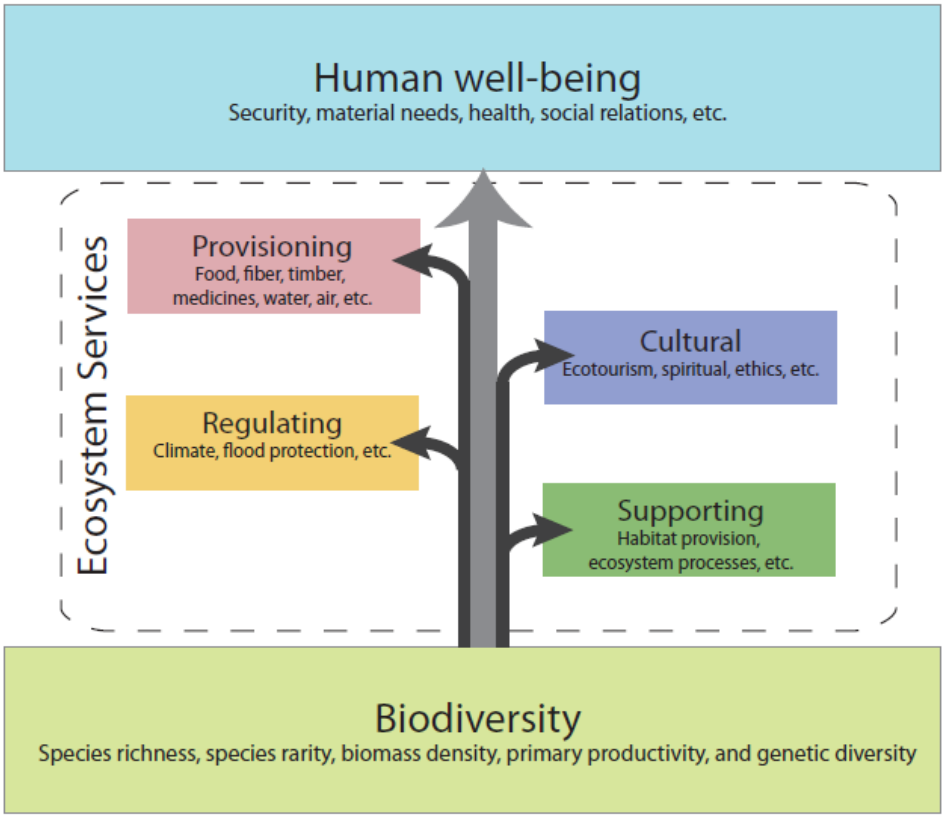


Figure 1-(3):- Relation of Ecosystem Services and human well-being

3.2.7. Ecosystem Services and Land Ethic

→ Ecosystem Services:-

Evidently, ecosystem services are derivations from the land (also considered as an ecosystem) itself. Land according to Leopold's Land Ethic comprises of soils, waters, plants and animals. Consequently, there exists an inter-relation between these Land Ethic members and ecosystem services. [Ecosystem Services Matrix Refer Table 1-(3)]

→ Ecosystem Services Matrix:-

Ecosystem Services Matrix is a correlation matrix to explain the role of each Land Ethic member in the provision of various ecosystem services. It emphasizes the direct and indirect role of members for the various ecosystem services. Thus, this correlation also explains the community concept of Land Ethic. For instance, if plants are needed to provide regulating ecosystem service of photosynthesis and primary production, a fertile, nutrient rich soil and fresh sub-soil water is needed for a healthy and sustained growth of plants. Also, a continued assistance of soil and water is needed for the plants to continue to grow. Similar correlations are indicated for each ecosystem services (Refer Diagrams 1-(3), 2-(3), 3-(3), 4-(3) and 5-(3))

Table 1-(1):- Ecosystem Services Matrix

SN	Ecosystem Service	Provisioning		Regulating		Cultural		Supporting	
		Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
1	Food	Pl, Ani	So, Wa						
2	Fiber	Pl, Ani	So, Wa						
3	Fuel	Pl, Ani	So, Wa						
4	Genetic resources	Pl, Ani	So, Wa						
5	Biochemical	Pl, Ani	So, Wa						
6	Natural medicines	Pl, Ani	So, Wa						
7	Pharmaceuticals	Pl, Ani	So, Wa						
8	Ornamental resources	Pl, Ani	So, Wa						
9	Fresh water	Wa	Pl, So						
10	Air quality regulation			Pl	So, Wa				
11	Climate regulation			Pl	So, Wa				
12	Water regulation			So, Pl	Wa				
13	Erosion regulation			Pl	So, Wa				
14	Water purification			So, Pl	Wa				
15	Waste treatment			So	Wa, Pl				
16	Disease regulation			Pl, So, Wa					
17	Pest regulation			Pl, Ani	So, Wa				
18	Pollination			Ani	So, Wa				
19	Natural hazard regulation			Pl	So, Wa				
20	Cultural diversity					Pl, So, Wa			
21	Spiritual values					Pl, So, Wa			
22	Religious values					Pl, So, Wa			
23	Knowledge systems (traditional and formal)					Pl, So, Wa			
24	Educational values					Pl, So, Wa			
25	Inspiration					Pl, So, Wa			
26	Aesthetic values					Pl, Ani	So, Wa		

27	Social relations					Pl, So	Wa		
28	Sense of place					Pl, So, Wa			
29	Cultural heritage values					Pl, So, Wa			
30	Recreation					Pl, Wa	So, Wa		
31	Ecotourism					Pl, Wa	So		
32	Soil Formation							Pl, Org	Wa
33	Photosynthesis							Pl	So, Wa
34	Primary production							Pl	So, Wa
35	Nutrient cycling							Wa	So, Pl
36	Water cycling							Wa	So, Pl
37	Erosion Regulation							Pl	So, Wa

Source: Self

Legend:-
Soil = So, Water = Wa, Plants = Pl, Organisms = Org, FW = Fresh Water, Animals = Ani

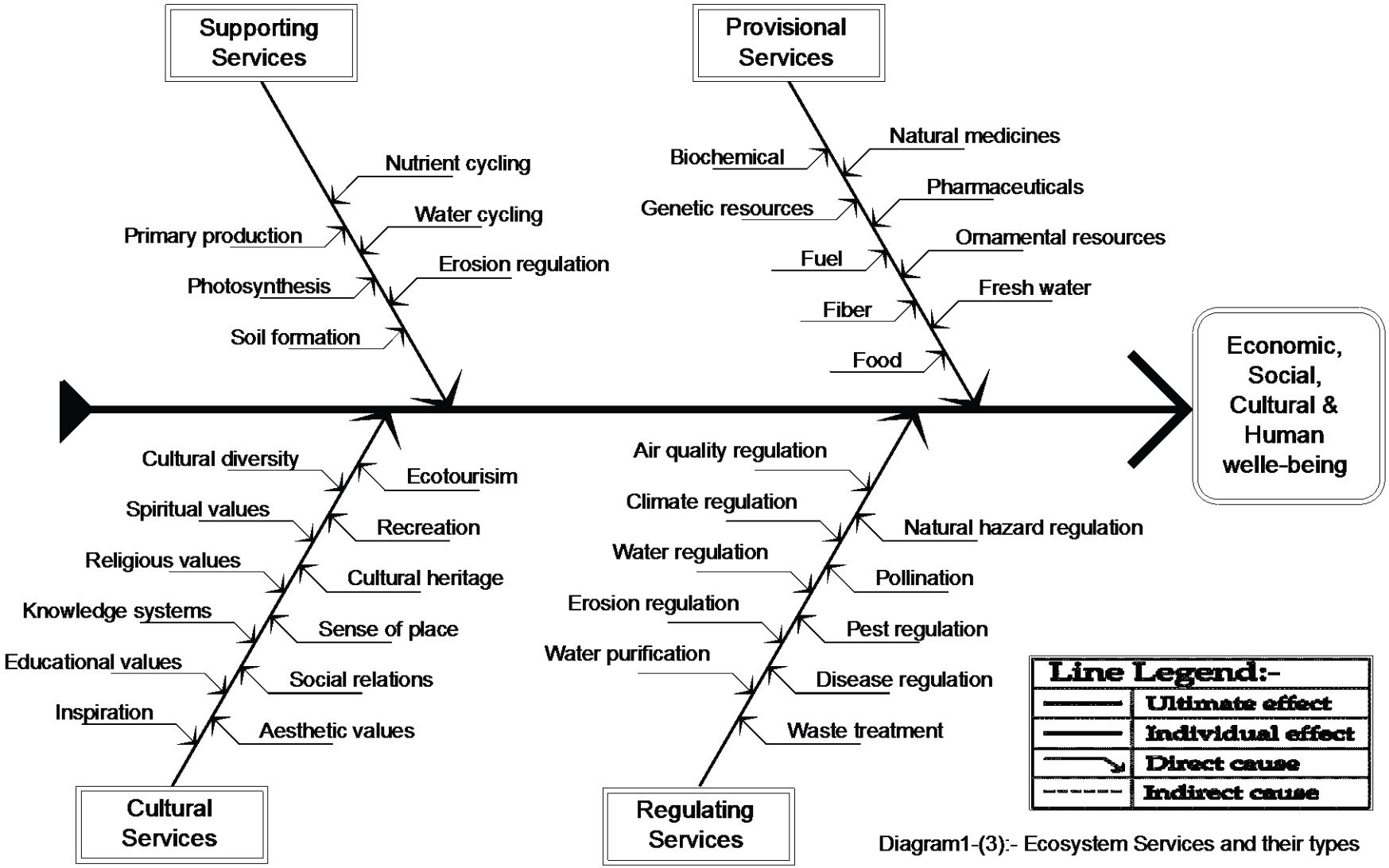


Diagram1-(3):- Ecosystem Services and their types

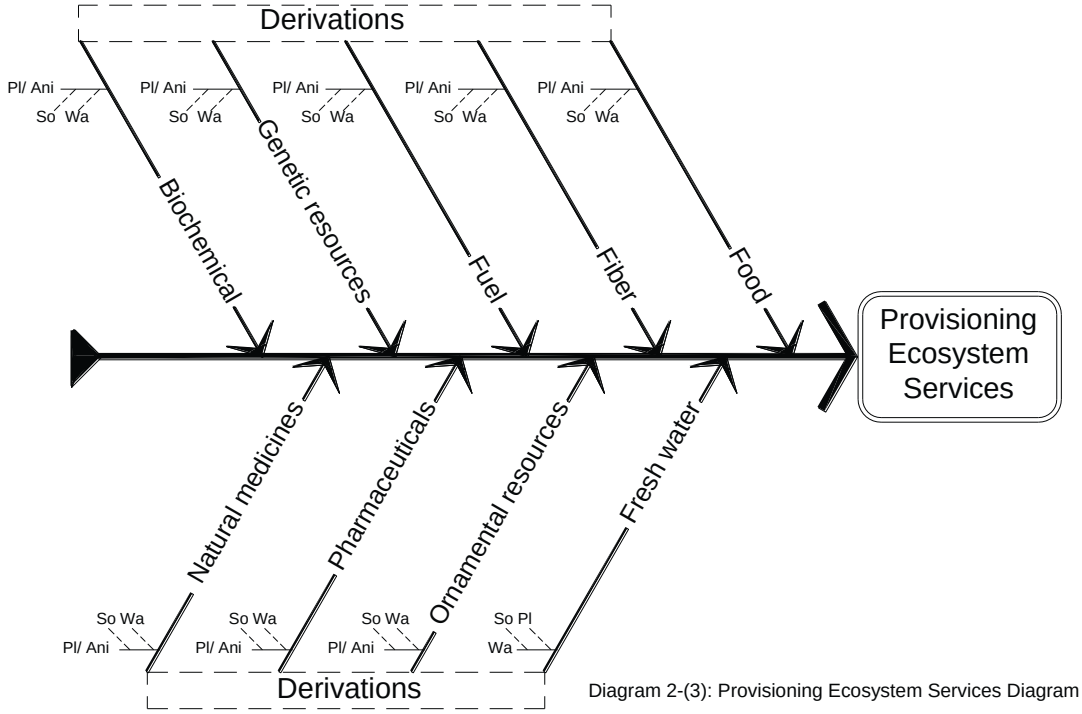


Diagram 2-(3): Provisioning Ecosystem Services Diagram

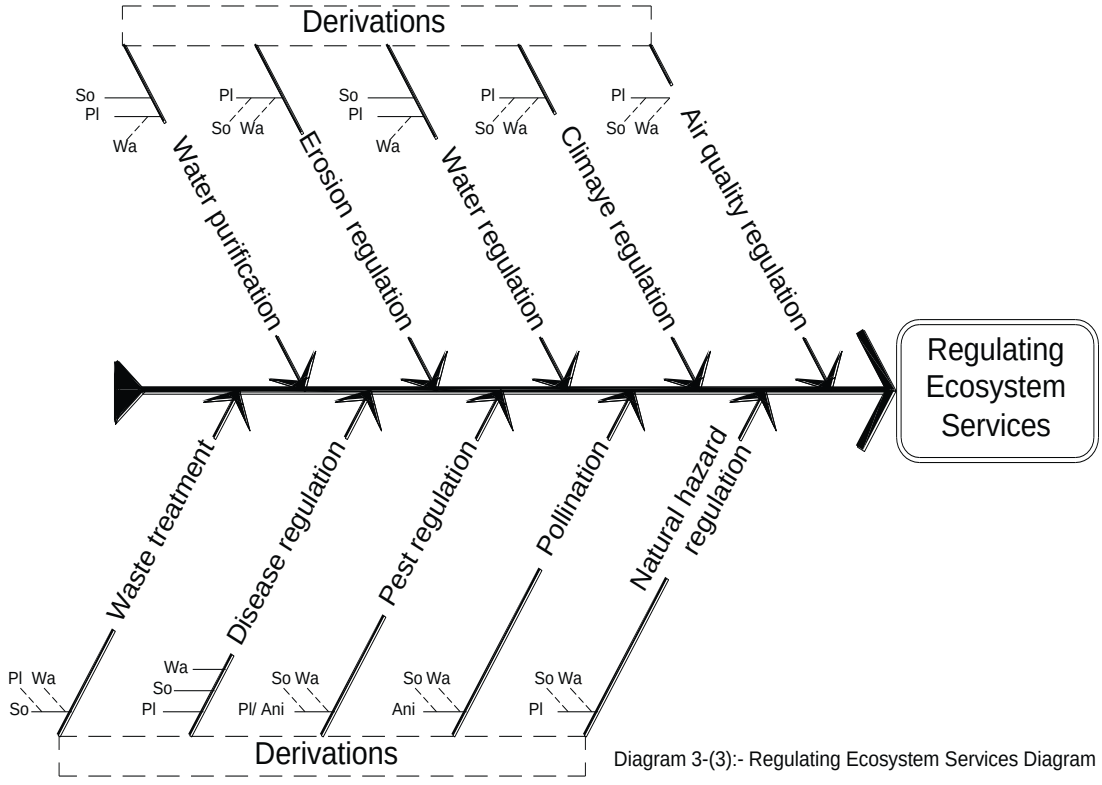


Diagram 3-(3):- Regulating Ecosystem Services Diagram

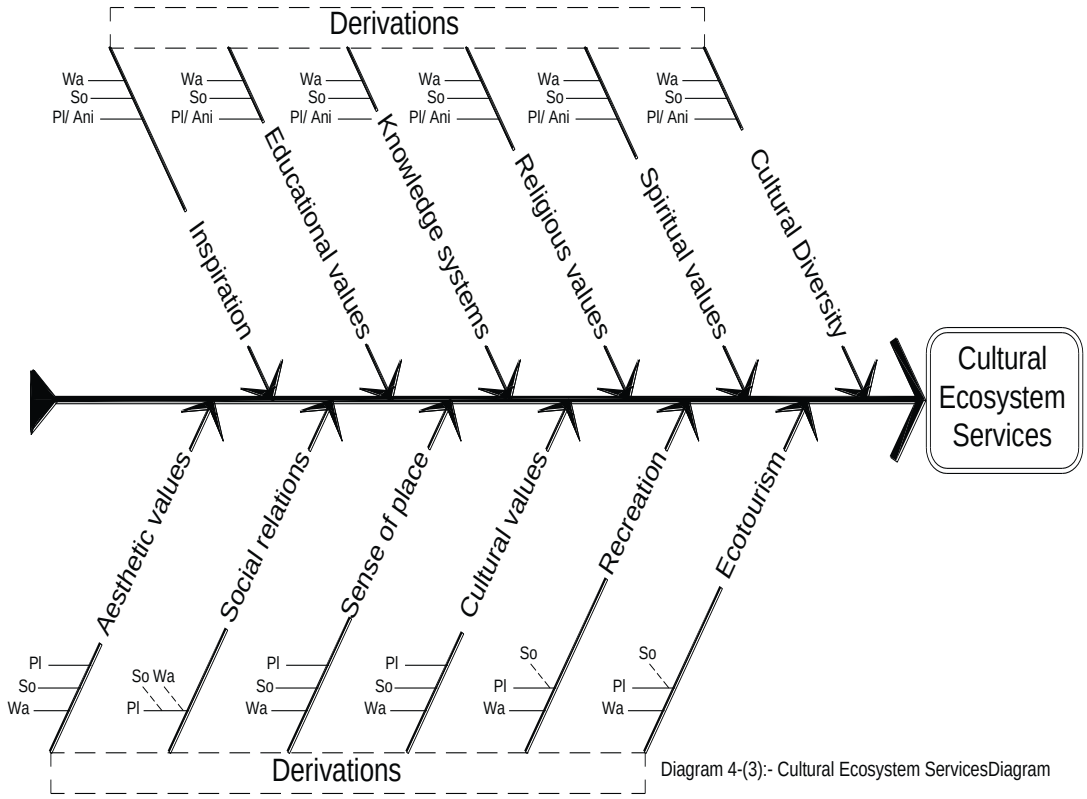


Diagram 4-(3):- Cultural Ecosystem ServicesDiagram

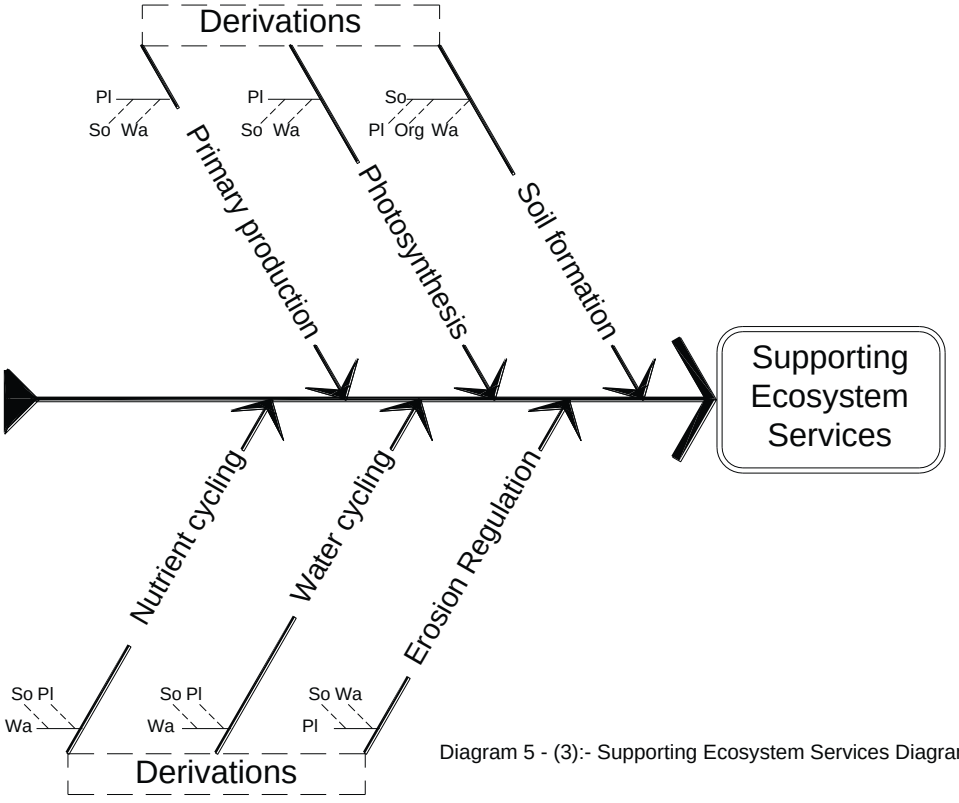


Diagram 5 - (3):- Supporting Ecosystem Services Diagram

3.2.8. Additional Ecosystem Services

Few additional ecosystem services are named as under[7]:-

1. Construction material
2. Regulating climate
3. Cleansing water and air
4. Maintaining the gaseous composition of the atmosphere
5. Maintaining soils
6. Storing and cycling nutrients
7. Absorbing and detoxifying pollutants
8. Providing beauty, inspiration, and recreation
9. Energy
10. Industrial products
11. Cycling and filtration processes such as:-
    i) detoxification,
    ii) decomposition of waste,
    iii) renewal of soil fertility,
    iv) purification of air and water)
12. Maintenance of coastal and river channel stability
13. Substitution of one species for another when environments change
14. Weather moderation
15. Water cycle regulation (flood mitigation, droughts and salinity)
16. Cultural , intellectual and spiritual inspiration
17. Existence value
18. Scientific discovery
19. Serenity

Moreover, other supplementary ecosystem services may be listed as under[8]:-

1. Ground water recharge
2. Wildlife Habitat
3. Thermal regulation
4. Biodiversity
5. Economic value
6. Security
7. Biomass
8. Climatic changes
9. Pattern of seasons
10. Pollution control
11. Shade
12. Noise reduction

[7] Charles Darwin University, *ENV509 what are ecosystem service*, Last updated: February 21, 2012, http://learnline.cdu.edu.au.
[8] Self

3.3. Broad findings and Conclusions

A gist of broad findings and conclusions from the above extracts are as follows:-

3.3.1. Symptoms or benchmarks of a healthy ecosystem

Following indicate few symptoms or benchmarks for a healthy ecosystem:-

- it produces biomass
- recruits, retains, and cycles nutrients,
- holds the soil,
- modulates water flow, and
- maintains other ecosystem processes—whether these processes are carried out by native or exotic, or wild or domestic species.
- normal rates of primary production,
- normal ratios of nutrient gains and losses,
- normal disturbance regimes,
- normal population cycles of component species

3.3.2. Land sickness characteristics

Conversely, land sickness characterizes as follows:-

- when soil loses fertility or washes away faster than it forms,
- when water systems exhibit abnormal floods and shortages,
- the disappearance of plant and animal species without visible causes, despite efforts to protect them,
- the eruption of others as pests, despite efforts to control them.
- qualitative as well as quantitative "deteriorations in land crops," and the outbreak of exotic diseases, parasites and pests

3.3.3. Pre-requisites for land use

Following are certain pre-requisites for undertaking land use activities:-

- preservation of wilderness to provide "a base-datum of normality, a picture of how healthy land maintains itself as an organism."
- land health which equates with land stability. land is stable when its food chains are so organized as to be able to circulate the same food an indefinite number of times.
- soil, the repository of food between its successive trips through the chains, tends to wash downhill, but this downhill movement is slow, and in healthy land, is offset by the decomposition of rocks.
- the term land includes soils, water systems, and wild and tame plants and animals. Conservation is the attempt to understand the interactions of these components of land and to guide their collective behavior under human dominance. [See Chart 1-(3) & 2-(3)]

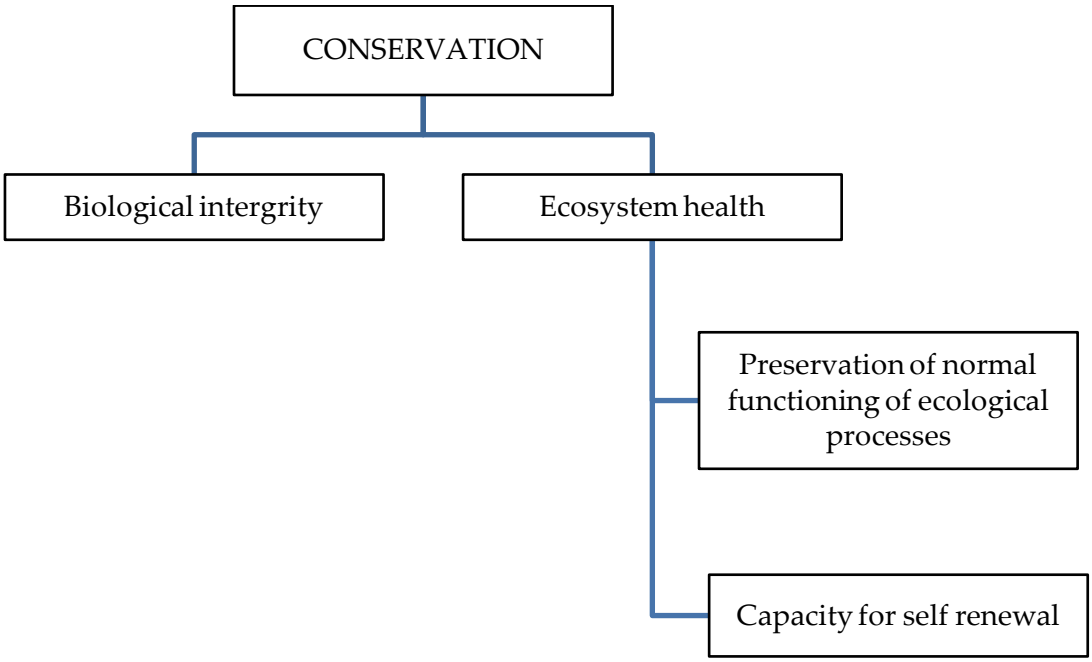


Chart 1-(3):- Leopold's two goals of conservation
Source: Self

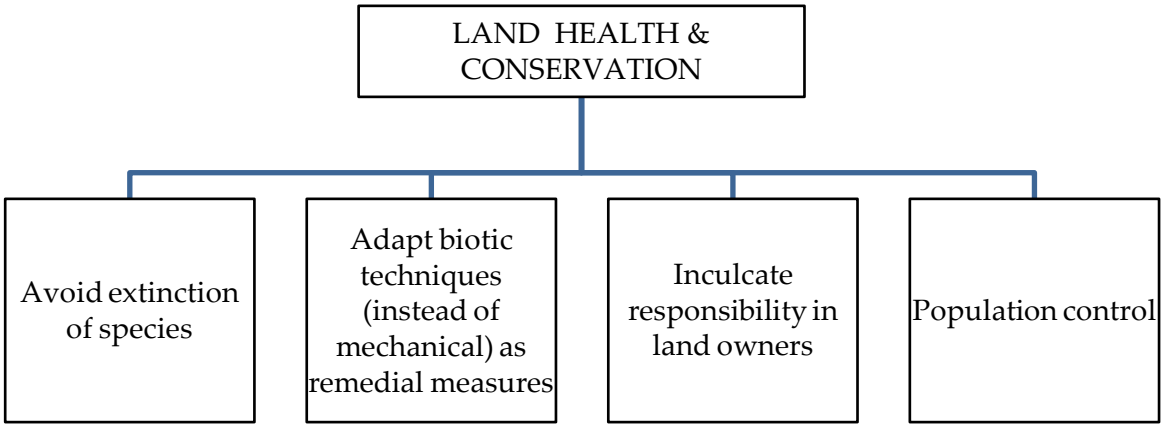


Chart 2-(3):- Leopold's solution towards Land Health & Conservation
Source: Self

Chapter 4 Green Rating Systems

This chapter presents an overview on the green building movement in the United States and its subsequent advent in India. The adaptation of this system has proved beneficial to the environment to some extent. Moreover, due to these rating systems, environment, ecology and its related concerns are at least being noticed by many. Eventually, the application of green rating systems has scaled up from building level to community level (i.e. from a single development to a large scale development).

4.1. Start of Green Building Movement[1]

4.1.1. Green building movement in the U.S.

This movement in the U.S. can be associated with the rise in environmental awareness among the general public as well as the governmental response to the environmental movements in the form of policy initiatives. The description of the U.S green building movement has been divided into four milestones as shown in the Figure 1-(4). These divisions are based on the major environmental and building policy initiatives during the history of green building movement in the U.S.

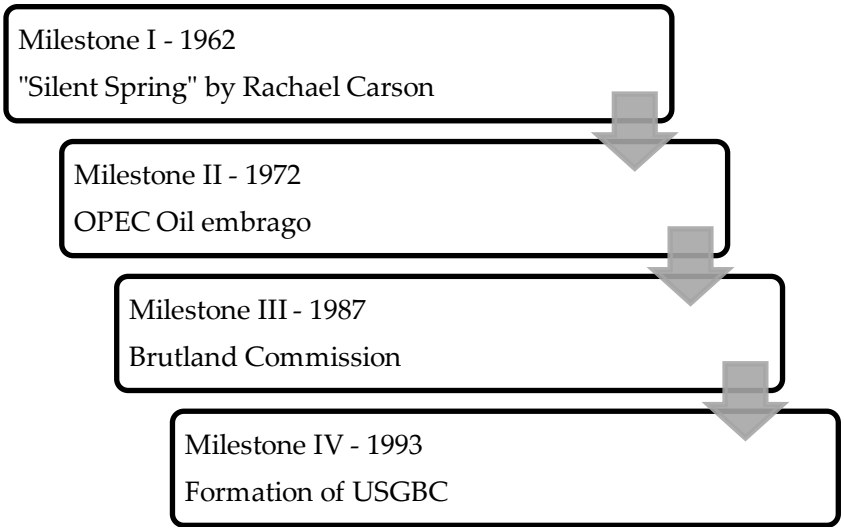


Figure 1-(4):- Milestones that triggered green building movement in the U.S. (Potbhare, 2008)

4.1.1.1. Milestone 1: "Silent Spring" by Rachael Carson in 1962:

[1] Source:- Sinem Korkmaz, Duygu Erten, Matt Syal, Varun Potbhare, *A Review of Green Building Movement Timelines in Developed and Developing Countries to Build an International Adoption Framework*, Fifth International Conference on Construction in the 21st Century (CITC-V), "Collaboration and Integration in Engineering, Management and Technology" May 20-22, 2009, Istanbul, Turkey

The start of the green building movement in the U.S. can be primarily associated with book named "Silent Spring" authored by Rachael Carson. The book had started a nationwide debate on the unrestricted use of the Dichloro-Diphenyl-Trichloroethane (DDT) and other pesticides by the government. This debate had united the environmentalist across the country, which had further led to the celebration of the First Earth Day on April 22, 1970. The public awareness created by this book can be referred to as the first nationwide environmental movement in the history of U.S.

On the international front, the first Earth Summit was held in 1972 in Stockholm, Sweden. It is generally considered as the primary defining event in the international environmentalism and was initiated by the developed world to address the environmental effects of industrialization. 113 countries had participated in this Earth Summit and it was decided to meet every 10 years to review the progress. The conference had some successes which include 26 principles of the Declaration of the UN Conference on the Human Development, an action plan on the Human Environment and an Environment Fund (ENR 2007).

4.1.1.2. Milestone II: OPEC oil embargo of 1972:

The oil embargo laid by the Organization of Petroleum Exporting Countries (OPEC) on the U.S. had affected every citizen of the country and had brought the issues concerning the conservation of the limited non-renewable natural resources into limelight. The embargo had lasted only for six months but it had created an environment of crisis in terms of energy security and the hostility of the U.S. to OPEC nations. The government had issued many immediate measures such as tax benefits for the development of alternative sources of energy, regulating speed limits to 55 mph on highways, and had asked the public to reduce the unwanted usage of oil in their daily life.

4.1.1.3. Milestone III – Brundtland Commission of 1987:

Due to the failure of any policy formulation in the Earth Summit that met in Nairobi in 1982, the U.N. General Assembly had created the World Commission on Environment and Development in 1983 under the leadership of the first woman prime minister Dr. Gro Harlem Brundtland. The primary mission of the commission was to address the growing concerns about the accelerating deterioration of the human environment and natural resources. This commission is now famously know as the "Brundtland Commission" and was responsible for defining sustainable development in their report "Our Common Future" in 1987.

4.1.1.4. Milestone IV – Formation of USGBC in 1993:

All the international developments that took place in the milestone III had initiated a lot of debate within the environmental groups in the U.S (BDC 2003). To address sustainability, the U.S. government decided to target the construction sector, as it was one of the major consumers of the energy resources, contributors to the green house gas emissions and also was a direct medium of public interaction (Bhatnagar 1999, Bondareva 2005, Dalal-Clayton et al. 1994, Kibert

2005, Landman 1999). Formation of U.S. Green Building Council (USGBC) was one of the major events occurring during this phase.

4.1.2. Green building movement in India

The Indian green building movement can be mainly associated with the government initiatives to encourage sustainability in the society and the acceptance of the green building guidelines by the corporate sector (Bhatnagar 1999). Unlike U.S., where the government policies were based on the public pressure through the environmental movements, major policy decisions by the Indian government were in response to the international events such as the OPEC oil embargo, the Brundtland Commission or the Second Earth Summit (Bondareva 2005). The green building movement in India has been divided into three main phases as shown in Figure 2-(4).

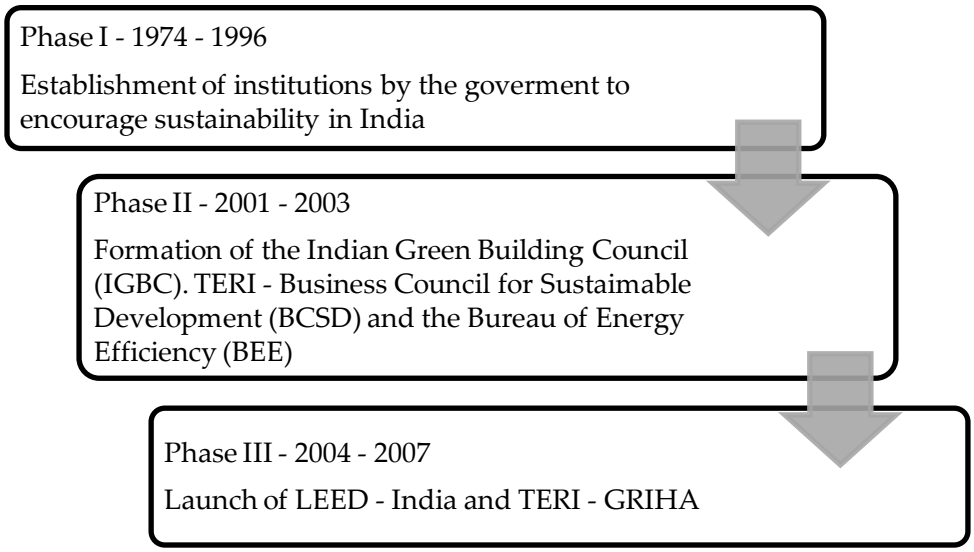


Figure 2-(4):- Indian green building movement (Potbhare, 2008)

4.1.2.1. **Phase I (1974 – 1996): Establishment of institutions by the government to encourage sustainability in India:** In this first phase, capacity building measures were taken by the government to encourage sustainability in the Indian society. These capacity building measures can be associated as the governmental response to the energy crisis that had been triggered due to the OPEC oil embargo of 1972 (Bhatnagar 1999, IGBC 2007, TERI 2007). The timeline of the events occurring during this phase is as follows (Bhatnagar 1999, TERI 2007):

i) The Energy and Resources Institute (TERI) was established. The primary mission of the institute was to address the problems in the field of energy, environment, and the future patterns of development (1974);
ii) Establishment of National Hydro Electric Power Corporation (1975);
iii) Establishment of National Institute of Ecology to enhance environment and conservation through education and research (1976);

iv) Environmental (Protection) Act was passed in the Parliament (1986);
v) The Indian Parliament initiated a voluntary eco-labeling program known as the "Eco-Mark" at the initiation of the Ministry of Environment and Forest (MoEF) and Central Pollution Control Board (CPCB) and the Government of India declared that 14th December of every year will be recognized as the "National Energy Conservation Day" (1991); Construction Industry Development Council was formed as a nodal agency between the government and the construction industry to address the issues of education, environmental awareness, law enforcement in the construction sector (1996).

4.1.2.2. **Phase II (2001 – 2003): Formation of major policy making and supporting organizations (Bhatnagar 1999, IGBC 2007, TERI 2007):** This phase marks the formation of the Indian Green Building Council (IGBC), TERI – Business Council for Sustainable Development (BCSD), and the Bureau of Energy Efficiency (BEE). These institutions have been responsible for accelerating the adoption of green building guidelines in the country (Bhatnagar 1999). This phase also marks the first platinum rating award by USGBC to CII- Green Business Center under the LEED-NC (IGBC 2007). Following is the timeline of the events occurring during this phase:

i) Indian Green Building Council was formed. The membership of this council represented the government, corporate sectors, architects, product manufacturers, institutions, etc. (2001);
ii) The Three Country Energy Efficiency Project as started by UN. The primary aim of the project was to provide the technical assistance for developing financial intermediation mechanisms for energy efficiency in India / TERI - Business Council for Sustainable Development (BCSD) was initiated as a partner of World Business Council for Sustainable Development. TERI BCSD is responsible for TERI- Green Rating for Integrated Habitat Assessment / Bureau of Energy Efficiency (BEE) was formed. BEE is an autonomous organization, with the mission to improve the energy efficiency of the country (2002);
iii) CII Godrej Green Business Center was awarded Platinum Rating by U.S. Green Building Council under LEED (2003).

4.1.2.3. **Phase III (2004 – 2007): Launch of LEED- India and TERI – GRIHA (IGBC 2007, TERI 2007):** In this phase two green building guidelines, TERI-GRIHA in 2005 and LEED-India in 2007 were launched in the Indian society. The rapid developments in the field of green building guidelines can also be attributed to the international pressure on the Indian government to address sustainability in the Indian society and the rapid acceptance of LEED- NC within the Indian corporate sectors. Also in this phase the first ever Indian Green Build Conference was held in 2005 with an objective to create awareness, bring together stakeholders and provide platform for sharing knowledge and best practices in the green building sector. Following is the timeline of the developments happening in this phase:

i) USGBC signed the LEED licensing agreement with India during its fourth Green Build conference at Georgia / ITC Green Centre Project, Gurgaon was awarded

with platinum rating under LEED. ITC Green Centre is now the largest platinum rated building in the world. India thus had 2 of the 7 platinum rated buildings around the world (2004);

ii) The TERI GRIHA rating system was launched with the aim to achieve efficient resource utilization, enhanced resource efficiency and improved quality of life in buildings / The first Indian Green Build conference was organized by IGBC in September 2005 at Delhi (2005);

iii) LEED for New Construction v. 1.0 was released by IGBC / The Government of India introduced Energy Conservation Codes with the help of BEE for commercial buildings (2007).

4.2. About Green Building

4.2.1. What is Green Building?

4.2.1.1. Green building is the practice of increasing the efficiency with which buildings use resources — energy, water, and materials — thereby reducing a building's impact on human health and the environment through better sitting, design, construction, operation, maintenance, and deconstruction. This practice can also be referred to as sustainable design or green architecture. Green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by efficiently using energy, water, and other resources, protecting occupant health, improving employee productivity in commercial buildings, and reducing waste, pollution, and environmental degradation. Sustainability is a related concept that is integral to green building. Effectively using the concepts of sustainability while building will lead to reduced operating costs, improved occupant health, and reduced environmental impact.[2] Green buildings emit fewer greenhouse gases, consume less energy, use less water, and offer occupants healthier environments than do typical buildings. Green buildings use salvaged, recycled or low carbon materials; they support rainwater harvesting, bicycle commuting, solar heating, natural ventilation, and/or many other environmentally friendly practices.[3]

4.2.1.2. Building standards have been around since several years have changed a great deal over time. Initially, policies were implemented to ensure the safety and adequate sanitary conditions for occupants and the public (from fire, electrical problems, sewage disposal, etc.) while more recently; emphasis has been placed on energy efficiency and sustainable buildings. The process for green buildings is ongoing and the movement has been a gradual process with much of it still evolving. Federal, state and local governments are grappling with ideas regarding building policies and the potential benefits to not only the people that use them

[2] C. Michael Hogan, Green Building, 31st August, 2009, www.eoearth.org

[3]Conference on Promoting Green Building Rating Systems in Africa, About the Conference, http://www.unhabitat.org/content

but the environment in which the buildings exist. This is the intent and cause behind the concept of rating systems.

4.2.1.3. United Nations' conferences in Rio (Brazil) and Johannesburg (South Africa) brought the issue of sustainability to the forefront in international circles. Subsequently the organization has defined goals that buildings should seek to achieve in order to obtain green building recognition. These six Green Building Policy goals are as under:

i) Increase in reliability
ii) Increase in indoor air quality
iii) Decrease in natural resource use
iv) Considerable decrease of energy costs over the lifetime of the building
v) Improving comfort due to improved energy efficiency in buildings.
vi) Rise of employment as a result of increased activity in energy improvements in buildings.

These benefits will theoretically take care of any type of increase (typically 3-5%) in construction costs and making improvements will have a direct positive impact upon life-cycle costs.[4]

4.2.2. Causes for Green Rating Systems

4.2.2.1. The origins of this movement is firmly embedded in the growing concern on Global Warming and the increasing accumulation of Green House Gases (GHGs) in the atmosphere, which has been well accepted to have dire environmental consequences. Moreover, the hard facts pointing to the fast dwindling energy resources from traditional sources like fossil fuels, has made markets and individuals sit up and recognize the fact that our habitat cannot be taken for granted anymore. It is now a well proven fact that the built environment and construction sector is as much a contributor to the global warming phenomenon as are emissions from factories, transportation modes and other such factors. Fortunately, the Green Building movement is an affirmative step towards tackling climate crisis and the good news is that the stake holders in the building and construction sector worldwide have started acting on it.[5]

4.2.2.2. Sustainability, the guiding philosophy behind the Green Building movement, was an integral part of ancient civilizations world over as indeed in ancient India. Abundant use of sustainable design concepts such as orientation of building to effectively use sunlight, use of perforated screens for cooling ambient air, smart use of water bodies for evaporative cooling and recharging water tables have been established norms of ancient architecture. These principles were scaled up from building unit level and applied to entire cities and towns in the ancient civilizations.

[4] Ben Hedin, Jordan Abbott, *Green Building Standards*, www.eoearth.org, May 17, 2010

[5] Shweta Kakkar, Charu Chadha,Tanaji Chakrabarti & Anshuman Bhusari, India Green Buildings Anthology, Jones Lang LaSalle Meghraj Property Consultants Pvt. Ltd.

4.2.2.3. In the industrial era, as far back as the mid 19th century, the western world had already used passive systems to control air quality in the Crystal Palace in London. The more contemporary Green Building movement can be dated to 1990, when the Building Research Establishment Environmental Assessment Method (BREEAM) was instituted in the UK, the first formal international rating system for Green Buildings. In April 1993, the US Green Building Council was formed with a goal to develop industry standard design guidelines, policy positions, conferences and educational tools that support the adoption of sustainable design and building practices. The turning point in the history of Green Building movement was the convention held in June 1993 "Architecture at the Crossroads: Designing a Sustainable Future" at the World Congress of Architects in Chicago where the issue of sustainability in buildings was first recognized widely. The watershed was the formulation of Leadership in Energy and Environmental Design green rating system (LEED). The LEED Version 1.0 Pilot Program was launched at the USGBC Membership Summit in August 1998. 12 Projects completed the application process and were recognized as the first LEED Certified Pilot Projects in March 2000.

4.2.2.4. The growth thereafter has been remarkable, both in terms of the spread of the Green Building movement worldwide as well the development of alternative systems for rating Green Buildings in various countries that embarked on this mission. Today many countries have adopted some form of a formal Green Building rating system or other. Annexure 4 is a compilation of the various rating systems being followed across countries.[6]

4.3. Conclusion

Following conclusions explain the motive behind selecting the Green rating systems to carry out this study:-

i) From the above literature review, it is evident that the Green Building Rating Systems are one of the tools used to show concerns for the environment including the Land. Many aspects of ecology and environment are been considered and analyzed by many countries in order to formulate the respective rating systems to be suitable in their own country.

ii) As the report of JLLM on India Green Buildings Anthology rightly mentions that sustainability - the guiding philosophy behind the Green Building movement was an integral part of ancient civilizations world over as indeed in ancient India. And these principles were scaled up from building unit level and applied to entire cities and towns in the ancient civilizations. Similarly, the applications of green rating systems

[6] Shweta Kakkar, Charu Chadha,Tanaji Chakrabarti & Anshuman Bhusari, India Green Buildings Anthology, Jones Lang LaSalle Meghraj Property Consultants Pvt. Ltd.

have gradually scaled up from a building unit level to the community level. For instance, the Star Green Community Rating System is recently launched (in the year 2012) in Australia. Formulating certain green strategies for a community development is certain to have a larger impact at a local level which would lead to collective impact at a macro level.

iii) Today, the same ancient principles are been revitalized but it has taken a different form and a different approach. The ancient civilizations adapted these principles with ease and were by default in their planning considerations. These features are missing in today's civilization. Hence, now it is seen as a set of awarded norms and guidelines which are applicable on voluntary basis. This is one of the motives to select the study of green building rating systems. The provoking question here is – can the guidelines of these rating systems be integrated in the land use decision making process?

iv) The target area of this study is community development. Community development involves a larger piece of land and thus accounts for more green and sustainable spaces. Therefore, guidelines for community green rating systems are been studied in relation to the Land Ethic principles.

v) Following are the Community Green Rating systems evaluated for the study:-
   a) BREEAM (Building Research Establishment Environmental Assessment Method) – based in UK and the first rating system of the world, established in 1990.
   b) Pearl – based in Abu Dhabi and the first program of its kind that is tailored to the Middle East region, established in 2010.
   c) IGBC (Indian Green Building Council) – first rating program developed in India, established in 2001.

Chapter 5 BREEAM Community Rating System

5.1. Introduction

5.1.1. What is BREEAM?

In BREEAM (Building Research Establishment Environmental Assessment Method) Communities the environmental assessment method is expanded to more holistically approach sustainability with consideration of the social and economic impacts of development. BREEAM (based in UK) is the world's foremost environmental assessment method and rating system for buildings, with 200,000 buildings with certified BREEAM assessment ratings and over a million registered for assessment since it was first launched in 1990. BREEAM sets the standard for best practice in sustainable building design, construction and operation and has become one of the most comprehensive and widely recognized measures of a building's environmental performance.

A BREEAM assessment uses recognized measures of performance, which are set against established benchmarks, to evaluate a building's specification, design, construction and use. The measures used represent a broad range of categories and criteria from energy to ecology. They include aspects related to energy and water use, the internal environment (health and well-being), pollution, transport, materials, waste, ecology and management processes.

5.1.2. Aims of BREEAM

BREEAM aims to ensure that its standards provide social and economic benefits whilst mitigating the impacts of the built environment. In doing so, BREEAM enables developments to be recognized according to their sustainability benefits and stimulates demand for sustainable developments.

5.1.3. BREEAM Communities & Rating Systems?

BREEAM Communities helps master planning professionals, developers and planners to improve and measure the sustainability of new developments at the neighborhood scale. Extending the established BREEAM methodology to the master planning stage, BREEAM Communities ensures environmental, social and economic opportunities are considered at the earliest stages of the design process – when the potential benefits are greatest and the costs are lowest. As an independent standard BREEAM Communities offers a credible, easily understood measure of the sustainability of large-scale development proposals. Table 1-(5) gives a brief outline of BREEAM Communities Categories, aims and respective weightings. Table 2-(5) below elaborates each issue with its aim and weighting points.

Table 1-(5):- BREEAM Communities 2012 Category, Aims and Weightings

SN	Category	Aim	Points
1	Governance	To ensure community involvement and leadership in running the development	8

2	Social and Economic well-being	Local Economy : To create a healthy economy (employment opportunities and thriving business)	5
		Social Wellbeing: To ensure a socially cohesive community.	17
		Environmental Conditions: To minimize the impacts of environmental conditions on the health and wellbeing of occupants	25
3	Resource and Energy	To reduce carbon emissions and ensure wise use of natural resources	31
4	Land Use and Ecology	To improve ecological biodiversity	18
5	Transport and Movement	To create an efficient and safe system for movement	15
	Total		**119**

Table 2-(5):- BREEAM Communities 2012 steps, weighting, assessment issues and aim[1]

SN	Identifier	Issue Name	Points	Aim
	Governance (GO) – 8 points			
1	GO01	Consultation Plan	1	To ensure the needs, ideas and knowledge of the community are used to improve the quality and acceptability of the development throughout the design and construction process.
2	GO02	Consultation and engagement	2	To ensure the needs, ideas and knowledge of the community are used to improve the quality and acceptability of the development throughout the design process.
3	GO03	Design Review	2	To ensure that the master plan's design supports a vibrant, healthy, functional and inclusive development.
4	GO04	Community management of facilities	3	To support communities in active involvement in developing, managing and/or owning selected facilities.
	Social and economic wellbeing – Local economy (SE) – 5 points			
5	SE01	Economic Impact	2	To increase economic wellbeing in the wider area by ensuring that the development attracts inward investment, creates jobs and complements and enhances existing economic activity in the local area.
6	SE17	Labor and skills	3	To ensure that the development contributes to the local area by enhancing,

[1] BREEAM Communities, Code for a sustainable built environment, Technical Manual: SD202 Version: 2012 Issue: 0.0 Issue Date: 23/08/2012, www.breeam.org

				diversifying or adding employment opportunities and/or skills training.
	Social and economic wellbeing – Environmental conditions (SE) – 17 points			
7	SE03	Flood risk assessment	2	To ensure that sites and developments take due account of flood risk and, where it is present, take appropriate measures to reduce the risk of flooding to the development and the surrounding areas.
8	SE04	Noise Pollution	3	To ensure that the development is designed to mitigate the impacts of noise. This includes mitigation from existing sources of noise, reducing potential noise conflicts between future site occupants, and protecting nearby noise-sensitive areas from noise sources associated with the new development.
9	SE08	Microclimate	3	To ensure the development provides a comfortable outdoor environment through the control of general climatic conditions
10	SE10	Adapting to climate change	3	To ensure the development is resilient to the known and predicted impacts of climate change.
11	SE13	Flood risk management	3	To avoid, reduce and delay the discharge of rainfall to public sewers and watercourses, thereby minimizing the risk of localized flooding on and off site, watercourse pollution and other environmental damage.
12	SE16	Light Pollution	3	To ensure that lighting on the development site is designed to reduce light pollution.
	Social and economic wellbeing - Social wellbeing (SE) - 25 points			
13	SE02	Demographic needs and priorities	1	To ensure that the development plans for the provision of housing, services, facilities and amenities on the basis of local demographic trends and priorities.
14	SE05	Housing provision	2	To minimize social inequalities and foster a socially inclusive community by ensuring appropriate housing provision within the development.
15	SE06	Delivery of services, facilities and amenities	7	To ensure essential facilities are provided and that they are located within a reasonable and safe walking distance.

16	SE07	Public realm	2	To encourage social interaction by creating comfortable and vibrant spaces in the public realm.
17	SE09	Utilities	3	To provide easy access to site service and communications infrastructure, with minimal disruption and need for reconstruction, and to allow for future growth in services.
18	SE11	Green infrastructure	4	To ensure access to high quality space in the natural environment and/or urban green infrastructure for all.
19	SE12	Local parking	1	To ensure parking is appropriate for the expected users and well integrated into the development.
20	SE14	Local vernacular	2	To ensure that the development relates to local character whilst reinforcing its own identity.
21	SE15	Inclusive design	3	To create an inclusive community by encouraging the construction of a built environment that optimizes accessibility for as many current and future residents as possible.
	Recourses and Energy (RE) – 31 points			
22	RE01	Energy strategy	11	To recognize and encourage developments designed to minimize operational energy demand, consumption and carbon dioxide emissions.
23	RE02	Existing buildings and infrastructure	2	To take account of the embodied carbon in existing buildings and infrastructure and to promote their re-use where possible.
24	RE03	Water strategy	1	To ensure that the development is designed to minimize water demand through efficiency and appropriate supply-side options taking full account of current and predicted future availability of water in the area.
25	RE04	Sustainable buildings	6	To increase the sustainability of all buildings within the development.
26	RE05	Low impact materials	6	To reduce the environmental impact of construction of the public realm through the use of low impact materials.
27	RE06	Resource efficiency	4	To promote resource efficiency by reducing waste during construction and

				throughout the life cycle of the development.
28	RE07	Transport carbon emissions	1	To reduce pollution associated with car use and provide viable alternatives to car ownership.
	Land use and ecology (LE) – 18 points			
29	LE01	Ecology strategy	1	To ensure that the development maintains or enhances biodiversity and protects existing natural habitats.
30	LE02	Land use	3	To encourage the use of previously developed and/or contaminated land and avoid land which has not been previously disturbed.
31	LE03	Water pollution	3	To ensure that measures are put in place to protect the local watercourse from pollution and other environmental damage.
32	LE04	Enhancement of ecological value	3	To ensure that the ecological value of the development is maximized through enhancement.
33	LE05	Landscape	5	To ensure that the character of the landscape is respected and, where possible, enhanced through the location of features and design appropriate to the local environment.
34	LE06	Rainwater harvesting	3	To ensure that surface water run-off space is used effectively to minimize water demand.
	Transport and movement (TM) – 15 points			
35	TM01	Transport assessment	2	To ensure transport and movement strategies reduce the impact of the development upon the existing transport infrastructure and improve environmental and social sustainability through transport.
36	TM02	Safe and appealing streets	4	To create safe and appealing spaces that encourages human interaction and a positive sense of place.
37	TM03	Cycling network	1	To promote cycling as a leisure activity and as an alternative to vehicle use by providing a safe and efficient cycle network.
38	TM04	Access to public	4	To ensure the availability of frequent and convenient public transport links to fixed

		transport		public transport nodes (train, bus, tram or tube) and local centers.
39	TM05	Cycling facilities	2	To promote cycling by ensuring the adequate provision of cyclist facilities.
40	TM06	Public transport facilities	2	To encourage frequent use of public transport throughout the year by providing safe and comfortable transport facilities.
	Innovation (Inn)			
41	Inn	Innovation		To support innovation within the design, planning and construction industry through the recognition of sustainability related benefits which are not rewarded by standard BREEAM issues.

5.2. BREEAM versus Land Ethic Analysis

5.2.1. BREEAM Assessment Criteria

→ Out of the total 41assessment issues (efforts) including innovation under BREEAM communities [refer Table 3-(5)], only 22 numbers of issues (efforts) are been considered suitable for the Land Ethic assessment.

→ The study has not included BREEAM issues such as materials. There is a wide range of materials (right from construction to finishing stage) that are involved in a development of a project and which may have multifarious and intangible environmental impacts. Being complex to comprehend, this issue is not been considered in the scope of assessment.

→ The study has not included BREEAM issues such as vehicular transport, transport networks and carbon emissions. These have direct environment impacts on air (causing air pollution) and natural resources (such as petroleum). Air pollution has a cascading effect on Land Ethic members such as soils, waters and plants/animals. Also, there is a resultant effect on the land organism, land health and land pyramid. These intermingled effects are not considered in the scope of this assessment.

Table 3-(5):- Assessment Checklist

Category	Checklist considered	Checklist not considered
Governance (GO)	Consultation Plan	Design Review
	Consultation and engagement	
	Community management of facilities	
Social and economic wellbeing – Local economy (SE)		Economic Impact
		Labour and skills

Social and economic wellbeing – Environmental conditions (SE)	Flood risk assessment	Noise Pollution
	Microclimate	Light Pollution
	Adapting to climate change	
	Flood risk management	
Social and economic wellbeing - Social wellbeing (SE)	Public realm	Demographic needs and priorities
	Green infrastructure	Housing provision
	Local vernacular	Delivery of services, facilities and amenities
	Inclusive design	Utilities
		Local parking
Recourses and Energy (RE)	Energy strategy	Existing buildings and infrastructure
	Water strategy	Low impact materials
	Sustainable buildings	Transport carbon emissions
	Resource efficiency	
Land use and ecology (LE)	Ecology strategy	
	Land use	
	Water pollution	
	Enhancement of ecological value	
	Landscape	
	Rainwater harvesting	
Transport and movement (TM)	Safe and appealing streets	Transport assessment
		Cycling network
		Access to public transport
		Cycling facilities
		Public transport facilities
Total*	**22 nos.**	**18 nos.**

*Total number of issues is 41 (including Innovation which is not considered for analysis)

Source: Self

5.2.2. BREEAM Review

This section gives a brief overview about each BREEAM issue and the various sub-issues that are required for the fulfilment of a particular issue. A study of these issues and sub-issues aids in categorizing each of them under appropriate Land Ethic members and keywords. Each issue is then evaluated for the derivations in terms of ecosystem services that it seemingly serves (formulated in the form of table respectively)

The review is as follows:-

1	GO 01: Consultation Plan

Aim

To ensure the needs, ideas and knowledge of the community are used to improve the quality and acceptability of the development throughout the design and construction process.

(1) The Members of the local community and appropriate stakeholders may include:-
- Actual/intended occupants (if known)
- if the site is near one or more existing communities, representative consultation groups from the existing communities
- If the site is a new development and there are no existing community representatives, representatives are sought from surrounding communities or from a similar type/size of project
- Potential users of any on-site or shared facilities (e.g. operators of clubs and community groups)
- Representatives from the local authority
- Local or national historic/heritage, ecology, cultural, residents, business groups, etc. (over and above any requirements relating to statutory consultees)
- Specialist service and maintenance contractors/representatives where the known building functions have particular technical requirements in complex environments (e.g. buildings containing laboratories).

(2) The consultation includes matters such as:
- impacts of the development upon the surrounding community in construction and following completion (including the protection of areas of historic/heritage value)
- design quality
- management, maintenance or operational issues
- opportunities for shared use of facilities and infrastructure with the existing or adjacent community.

This seems to establish a link between places and/ communities not only at micro level but also at macro level.

Table 4-(5):- BREEAM - GO 01 Consultation Plan

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Knowledge systems • Educational values • Social relations • Sense of place

Source: Self

2	GO 02: Consultation and engagement

Aim

To ensure the needs, ideas and knowledge of the community are used to improve the quality and acceptability of the development throughout the design process.

(1) Influence and/or alteration to the design plan can be demonstrated as a result of the consultation process. A full justification should be provided in the situation where outcomes of the consultation have not influenced the design.
(2) Good practice consultation methods: Good practice consultation should include that the local community and stakeholders have been:
   - informed about the proposal (e.g. public notices and adverts) consulted for opinion on the development brief
   - involved in developing a range of options in a timely manner
   - asked to select their preferred option from a range of schemes
   - involved in the preparation of their preferred proposal (e.g. through workshops or participative processes).
   - involved in the production of guidelines for the development of this proposal.

Table 5-(5):- BREEAM - GO 02: Consultation and engagement

Land Ethic 'Members/Keyword'	Derivations
Land Use	Cultural services:- • Knowledge systems • Educational values • Social relations • Sense of place

Source: Self

3	GO 04: Community management of facilities

Aim

To support communities in active involvement in developing, managing and/or owning selected facilities.

(1) Good practice consultation should include that the local community and stakeholders have been:
   - informed about the proposal (e.g. public notices and adverts)
   - consulted for opinion on the development brief
   - involved in developing a range of options in a timely manner
   - asked to select their preferred option from a range of schemes
   - involved in the preparation of their preferred proposal (e.g. through workshops or participative processes).
   - involved in the production of guidelines for the development of this proposal.

Table 6-(5):- BREEAM - GO 04: - Community management of facilities

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Knowledge systems • Educational values • Social relations • Sense of place
Education/Awareness/Social Interaction	

Source: Self

4	SE 03: Flood Risk Assessment

Aim

To ensure that sites and developments take due account of flood risk and, where it is present, take appropriate measures to reduce the risk of flooding to the development and the surrounding areas.

(1) A site specific flood risk assessment is carried out in accordance with current best practice and planning policy, and includes as a minimum:
- risk and consequences of flooding from all sources, on the site and from the site to the surrounding area, and how the risks will be managed
- changes in flood risk due to climate change
- consultation with appropriate statutory bodies
- knowledge of possible flood risk held within the local community (including the local authority's strategic flood risk assessment).

(2) Sources of flooding include:
- Streams and Rivers: Flooding that can take place from flows that are not contained within the channel due to high levels of rainfall in the catchment.
- Coastal or Estuarine: Flooding that can occur from the sea due to a particularly high tide or surge, or combination of both.
- Groundwater: Where the water table rises to such a height where flooding occurs. Most common in low-lying areas underlain by permeable ground (aquifers), usually due to extended periods of wet weather.
- Sewers and highway drains: Combined, foul or surface water sewers and highway drains that are temporarily over-loaded due to excessive rainfall or due to blockage.
- Surface water: The net rainfall falling on a surface (on or off the site) which acts as runoff which has not infiltrated into the ground or entered into a drainage system.
- Infrastructure failure: canals, reservoirs, industrial processes, burst water mains, blocked or undersized sewers or failed pumping stations.

(3) Allowance for climate change:
- An allowance for climate change should be made in accordance with current best practice and planning policy. This should be applied to both the pre and post development flood risk. Climate change allowances will be dependent on the site's context and location.

(4) Flood protection
- To meet the requirements to implement measures to protect or defend the site from flooding, the design need not be restricted to flood defences. A site can be protected from flood water using various methods including solutions such as use of topography, attenuation and storage of flood waters. This can ensure that flood water is kept away from the development. These types of solutions may be appropriate in some instances. However, assurances must be made that the solutions do not create issues further downstream and will not inconvenience the local area. It is the responsibility of the relevant professional to determine the most appropriate solution for the development.

(5) Flood risk
- In order to have a compliant Flood Risk Assessment, it must look at the risk of flooding from all sources.

(6) Where there is a medium or high risk of flooding from any part of the development (in accordance with current best practice and planning policy), the development has been designed to minimize flood risk onsite and offsite using current best practice and planning policy as follows:
- development is avoided in areas of the development site that are susceptible to flooding
- where the above is not practical essential infrastructure is situated in areas of the site that are at the lowest risk from flooding
- in areas where risk from flooding cannot be avoided measures are taken to defend or protect the development from flooding without increasing the flood risk in upstream and downstream areas
- any residual risks are safely and appropriately managed and resilient measures are incorporated into building designs to the satisfaction of the relevant statutory body
- the planned ground level of the buildings and access to the buildings and the site are designed (or zoned) so they are at least 600mm above the design flood level of the flood zone in which the assessed development is located.
- an emergency plan is established in the event of flooding.

(7) Downgrade flood risk due to flood defences: A site's flood risk may be downgraded to a lower flood risk category as a result of flood defence installations. This may occur in the following circumstances:
- where permanent new flood defences are planned (mentioned in formal planning documents with budgets allocated) to minimize the risk of flooding to the site and its locality
- where the development is located on a site benefiting from existing maintained flood defences.
- the flood risk assessment clearly demonstrates that the residual risks have been identified and will be managed appropriately.

Table 7-(5):- BREEAM SE 03: Flood Risk Assessment

Land Ethic Members/Keyword'	**Derivations**
Water	Provisioning services:- • Fresh water Regulating services:- • Water regulation • Water purification • Disease regulation • Natural hazard regulation
Ecological Conscience	Regulating services:- • Water regulation • Water purification • Disease regulation

	• Natural hazard regulation Supporting services:- • Nutrient cycling • Water cycling • Erosion regulation
Conservation / Preservation/ Recreation	Provisioning services:- • (conservation of) fresh water Regulating services:- • Air quality regulation • Climate regulation

Source: Self

5	SE 08: Microclimate

Aim

To ensure the development provides a comfortable outdoor environment through the control of general climatic conditions

(1) Seasonal tailoring/adaptation: The main summertime requirements of a space are likely to be provision of shade, cooling, air movement and prevention of glare. In winter conditions the focus will be on protection from wind and rain.
An example of seasonal microclimate adaptation would be the use of deciduous trees in a public square to provide summer shade. These would then lose their leaves in winter allowing natural light to the square, improving visual comfort.

(2) A microclimatic simulation/study shows the effect of urban morphology on the external microclimate of the development and surrounding area.

(3) The development is designed to minimize adverse conditions, including negative microclimatic factors.

(4) Microclimatic factors: The following factors should be considered:
- temperature/thermal comfort
- solar exposure (sky view and shadowing)
- air movement and wind speed
- dust and pollution
- acoustic environment.
- A microclimatic simulation/study shows the effect of urban morphology on the external micro-climate of the development and surrounding area.
- The development is designed to minimize adverse conditions, including negative microclimatic factors.
- An appropriate and diverse range of favourable microclimatic conditions have been provided throughout the development to cater for a wide range of personal preferences.
- The design of public space optimizes microclimatic conditions at all times of the year.
- The location and design of pedestrian/cycling routes takes full account of microclimatic conditions.
- Controlling the impact of the urban heat island effect (mitigation or utilization, depending on the individual situation) at the micro scale is concerned with the

thermal comfort of the people in those spaces and is a different issue from the consideration of the overall impact of the urban heat island effect from the development as a whole.

- Wind movement and solar exposure will also be key factors for affecting thermal comfort.
- The extent of solar shadowing will have an impact on thermal comfort whilst natural light conditions play an important role in visual comfort. Daylight penetration and illumination of spaces will need to be balanced with the prevention of glare.
- The flow of air through a development is an important factor in thermal comfort and air quality. Additionally, wind movement around buildings can aid natural ventilation but also contribute to heat loss. Building form and relationships should be designed to minimize funnelling, vortexes and other adverse wind conditions.
- The acoustic environment of a space influences physical comfort and while there are large differences in acoustic preferences due to age, gender, cultural background, etc, in general, people express a preference for natural sounds over artificial sounds.
- This issue aims to encourage the use of careful design to enhance microclimatic conditions for the benefit of the health and economy of the community. Design of the microclimate to maximize use of solar heat gain/natural light/ventilation in order to reduce energy use is covered in RE 01 – Energy strategy. Tools used to analyze the current site conditions and effects of different design strategies may be the same for both issues and with careful planning the measures employed may be relevant and beneficial for both microclimate and energy efficiency.

Table 8-(5):- BREEAM - SE 08: Microclimate

Land Ethic 'Members/Keyword'	**Derivations**
Plants / Animals	Provisioning services:- • Genetic resources • Ornamental values Regulating services:- • Air quality regulation • Climate regulation • Erosion regulation • Pollination Supporting services:- • Soil formation • Photosynthesis • Primary production
Land Health	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation

	• Water purification • Disease regulation • Pest regulation • Natural hazard regulation
Land Use	The entire above mentioned ecosystem services may be acquired through an intelligent land use plan.

Source: Self

6	SE 10: Adapting to climate change

Aim

To ensure the development is resilient to the known and predicted impacts of climate change.

(1) Evidence has been used from the local authority and statutory bodies to understand the known and predicted impacts of climate change for the site.
(2) The master plan takes account of evidence of the impacts of climate change on the site and demonstrates in the design plans how the risks will be managed.
(3) The master plan takes account of evidence of the impacts of climate change on the site and demonstrates in the design plans how the risks will be reduced.
(4) Impacts of climate change considered should include:
    - increased temperatures (including the heat island effect)
    - flood risk
    - increased weather volatility
    - impacts on water resources
    - changes in ground conditions.
(5) 'Win-win measures': These measures deliver benefits in addition to climate change adaptability. This could include:
    - Reducing more than one impact of climate change. For example, helping to reduce the heat island effect whilst also reducing flood risk.
    - Reducing the contribution of the development to climate change. For example, reducing the need for electric cooling and therefore reducing carbon emissions.
    - Providing additional sustainability, economic or wellbeing benefits. For example, using drainage techniques that may also increasing biodiversity or improving water quality.

Table 9-(5):- BREEAM - SE 10: Adapting to climate change

Land Ethic 'Members/Keyword'	Derivations
Land Organism	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Water purification • Waste treatment • Disease regulation
Land Health	

	• Pest regulation • Natural hazard regulation Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling
Ecological Conscience	Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling
Land Use	Provisioning services:- • Food • Fibre • Fuel • Genetic resources • Bio-chemicals • Natural medicines • Pharmaceuticals • Ornamental resources • Fresh water
Conservation / Preservation / Recreation	Provisioning services:- • (conservation of) fresh water Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Water purification Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling

Source: Self

7	SE 13: Flood risk management

Aim

To avoid, reduce and delay the discharge of rainfall to public sewers and watercourses, thereby minimizing the risk of localized flooding on and off site, watercourse pollution and other environmental damage.

(1) An appropriately qualified professional is appointed to carry out the calculations and provide design criteria for all elements regarding the surface water run-off drainage system in a report.
(2) The peak rate of surface water run-off over the development lifetime, allowing for climate change, is no greater for the developed site than it was for the pre-development site. This should comply at the 1 year and 100 year return period events.
(3) Any additional volume of rainwater discharge predicted to be caused by the new development for a 1 in 100 year event of 6 hour duration (including an allowance for climate change) should be reduced as far as possible using infiltration and/or other SuDs techniques.
(4) Where flooding of property would not occur in the event of local drainage system failure (caused either by extreme rainfall, a lack of maintenance or accidental damage/blockage).
(5) The appropriately qualified professional's report should contain all information necessary to demonstrate compliance with the peak rate of run-off requirements. The report should include:
    - areas of permeable and impermeable surfaces on the site pre- and post-development
    - details of the permeability characteristics of the site pre- and post-development (e.g. infiltration tests etc where appropriate)
    - peak rates of run-off (l/s) calculations for the 1 year and 100 year events, pre- and post-development, including an allowance for climate change over the development lifetime
    - detailed documentary evidence showing the design methods used to reduce the peak rate of run-off to pre-development rates.
    - the pre-development volume of run-off (m3) for the 100 year 6 hour event
    - the additional volume of run-off (m3) for the 100 year 6 hour event caused by the development without mitigation measures
    - the additional volume of run-off (m3) with the proposed mitigation
    - information to demonstrate that the hierarchical approach to reducing the additional volume of run-off was followed
    - information on the calculation methods used
    - summary results.
(6) Calculating the volume of runoff: Refer to Chapter 4, Section 4.5.5 of The SuDS Manual (CIRIA C697, 2007) for guidance on calculating the additional volume of run-off caused by the development.
(7) Calculating the peak rate of run off for greenfield sites: Greenfield sites of less than 50 ha: The calculation of greenfield run-off rates must be in accordance with IH Report 124, Flood estimation for small catchments (Marshall and Bayliss, 1994). The pro-rata method on the size of catchment detailed in Table 4.2 in The SuDS Manual, CIRIA C697 (2007) must be followed.
(8) Greenfield sites of 50 ha to 200 ha: The calculation of greenfield run-off rates must be in accordance with IH Report 124, Flood estimation for small catchments (Marshall and Bayliss, 1994). Greenfield sites of more than 200 ha: The calculation of greenfield

run-off rates must be in accordance with the Flood Estimation Handbook (Centre for Ecology & Hydrology, 1999) and any subsequent updates. Where the Flood Estimation Handbook is not considered appropriate for the development IH Report 124 can be used.

(9) Calculating the peak rate of run off for brownfield sites: If the existing drainage is known and is fully operational then it should be modelled using best practice simulation modelling, to determine the 1 year and 100 year peak flow rates at discharge points (without allowing surcharge of the system above cover levels to drive greater flow rates through the discharge points). If the system is not known, then the brownfield run-off should be calculated using the greenfield run-off models described above but with a Soil Type 5.

(10) One or more components built to manage surface water run-off to prevent flooding and pollution, including:

- wet ponds
- infiltration basins
- detention basins
- swales
- reed beds
- pervious (porous or permeable) paving
- soakaways
- rainwater harvesting
- filter strips
- filter drains and trenches with or without perforated pipes
- green roofs
- underground attenuation storage.

Table 10-(5):- BREEAM SE 13: Flood risk management

Land Ethic 'Members/Keyword'	**Derivations**
Water	Provisioning services:- • Fresh water Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Water purification Supporting services:- • Nutrient cycling • Water cycling • Erosion regulation

Source: Self

8	SE 07: Public Realm

Aim

To encourage social interaction by creating comfortable and vibrant spaces in the public realm.

(1) The public realm is designed to allow multiple uses for different development users, including children, the elderly and disabled people with regard taken to safety, comfort, disturbance and security.

(2) The design of the public realm takes account of the role it plays in terms of connectivity into and throughout the development.
(3) An assessment is undertaken to determine the appropriateness of using some streets in the development as shared street space or home zones.
(4) Where the assessment has identified appropriate streets for shared spaces, design plans indicate where these spaces will be developed in the site. Appropriate levels of signage and surface treatments/landscaping will be used to clearly define these areas.
(5) Evidence from microclimate studies are used to influence the design of social spaces. Benches and other seating areas are located in places with consideration of the sun, shade, wind and rain.

Table 11-(5):- BREEAM - SE 07: Public Realm

Land Ethic 'Members/Keyword'	Derivations
Plants / Animals	Regulating services:- • Air quality regulation • Climate regulation Supporting services:- • Photosynthesis • Primary production • Nutrient cycling • Water cycling
Land Use	Creation of vibrant and comfortable spaces in the public realm is a thoughtful discretion of a land use process.
Education / Awareness / Social Interaction	Cultural services:- • Spiritual values • Knowledge systems • Educational values • Inspiration • Aesthetic values • Social relations • Sense of place • Recreation

Source: Self

9	SE 11: Green Infrastructure

Aim

To ensure access to high quality space in the natural environment and/or urban green infrastructure for all.

(1) The Community concept here is highlighted in the following way:-
- Consultation to take place with the local authority, existing residents and potential users of the development to understand the desired uses, design, quantity and location of accessible and natural green space.

(2) Not only community involvement is been considered, but also the management for maintenance of post occupancy along with financial arrangement is also given due care:-

There is a management strategy in place or the developer can confirm it will be in place to provide long-term maintenance of the green space. This can be through any of the options below:

- the developer sets up a residents' association with funding arrangements,
- the developer or owners hand over the title to new areas of open space to the local authority, usually with a commuted sum with which the local authority can fund future maintenance,
- the local authority or developer makes an arrangement with a suitable third party for long-term maintenance.

(3) The Accessible Natural Green Space Standards are maintained and operated by Natural England. They require:

- an accessible natural green space of at least 2 hectares in size, no more than 300 meters (5 minutes' walk) from home
- at least one accessible 20 hectare site within two kilometers of home
- one accessible 100 hectare site within five kilometers of home
- one accessible 500 hectare site within ten kilometers of home
- one hectare of statutory Local Nature Reserves per thousand population.

(4) A green infrastructure plan is developed as a part of the masterplan. A summary of the consultation responses and any constraints restricting the provision of accessible and natural green-space are explained in this document.

(5) The master plan is designed to allow all residents to be within walking distance of green space via a safe and convenient pedestrian route.

(6) The green infrastructure plan sets out the provision of the desired uses and design set out in consultation. Any deviation from consultation responses is reasonably justified.

(7) In urban areas, the Accessible Natural Green Space Standard is achieved.

(8) The green infrastructure plan sets out the provision of the desired quantity and location set out in consultation. Any deviation from consultation responses is reasonably justified.

(9) The 2012 review, 'Microeconomic Evidence for the Benefits of Investment in the Environment' published by Natural England provides evidence for the economic and social benefits of green infrastructure. These benefits include: economic growth, health and productivity, attractiveness, housing/property values, climate change mitigation and adaptation, air quality improvement, noise reduction, tourist and recreation attraction, community cohesion, and economic and social dynamism.

Table 12-(5):- BREEAM - SE 11: Green Infrastructure

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural values:- • Spiritual values • Knowledge systems • Educational values

	• Inspiration • Aesthetic values • Social relations • Sense of place • Recreation
Ecological Conscience	Regulating services:- • Air quality regulation • Climate regulation • Erosion regulation • Water purification • Waste treatment • Disease regulation • Pest regulation • Pollination • Natural hazard regulation
Land Use	Economic and social benefits of green infrastructure include: economic growth, health and productivity, attractiveness, housing/property values, climate change mitigation and adaptation, air quality improvement, noise reduction, tourist and recreation attraction, community cohesion, and economic and social dynamism.
Conservation / Preservation / Recreation	Provisioning services:- • Genetic resources • Natural medicines • Ornamental resources • Fresh water Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling

Source: Self

10	SE 14 - Local Vernacular

Aim:

To ensure that the development relates to local character whilst reinforcing its own identity.

(1) Consultation to take place between the local authority, developer, community representatives and other stakeholders. As a minimum the consultation considers the following:
- building materials
- building colour
- architectural style

- building heights and forms
- continuity between building detail in the development and the surrounding area
- continuity between the buildings within the development
- the ability of residents to personalise their own dwelling.

(2) Further, steps have been taken to reinforce the local identity in a number of aspects. This may include, but is not limited to:

- use of local materials
- use of local building forms, heights and architectural features
- inclusion or retention of historic features/associations (e.g. retaining archaeological foundations, etc.)
- use of local or regional plant species throughout the development
- use of public art
- involving the community in the design of community focal points and open spaces etc.

Table 13-(5):- BREEAM - SE 14 - Local Vernacular

Land Ethic 'Members/Keyword'	Derivations
Ecological Conscious	Provisioning services:- • Genetic resources • Natural medicines • Ornamental resources • Fresh water Cultural values:- • Spiritual values • Knowledge systems • Educational values • Inspiration • Aesthetic values • Social relations • Sense of place • Recreation

Source: Self

11	SE 15: Inclusive Design

Aim

To create an inclusive community by encouraging the construction of a built environment that optimizes accessibility for as many current and future residents as possible.

(1) Inclusive design and management strategy: Sets objectives to ensure inclusion and access in the design of the external and internal environment. This includes (but is not limited to):

- transport interchanges
- transport methods
- housing and buildings
- public realm

- open spaces
- sports and recreation spaces
- highways
- footpaths and cycle ways
- emergency egress strategies where these will also be affected by the proposals so far developed.

Table 14-(5):- BREEAM - SE 15: Inclusive Design

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Cultural diversity • Knowledge systems • Social relations • Inspiration • Sense of place • Recreation
Education / Awareness / Social Interaction	

Source: Self

12	RE 01: Energy Strategy

Aim

To recognize and encourage developments designed to minimize operational energy demand, consumption and carbon dioxide emissions.

(1) Recommendations for reducing energy use and associated emissions beyond baseline levels through implementation of energy efficient measures including:
- site layout
- use of topography
- shading
- solar orientation
- use of day lighting
- wind management
- use of natural ventilation.

(2) Biofuels: Given the current uncertainty over their impact on biodiversity, global food production and greenhouse gas savings, plus the ease of interchangeability between fossil fuels, BREEAM does not recognize or reward building systems fuelled by first generation biofuels manufactured from feedstock's e.g. biofuels manufactured from sugars, seeds, grain, animal fats etc. BREEAM will recognize systems using second generation biofuels (biofuels from lignocelluloses biomass feedstock using advanced technical processes) or biofuels manufactured from biodegradable waste materials e.g. biogas, or locally and sustainably sourced solid biofuels e.g. woodchip, wood pellets where these are not interchangeable with fossil fuels or first generation biofuels.

→ What are first generation bio-fuels?[2]

First generation biofuels are made from the sugars and vegetable oils found in arable crops, which can be easily extracted using conventional technology. In comparison, second

[2] http://en.wikipedia.org/wiki/Secondgenerationbiofuels#Greenhousegasemissions

generation biofuels are made from lignocellulosic biomass or woody crops, agricultural residues or waste, which makes it harder to extract the required fuel.
First generation bioethanol is produced by fermenting plant-derived sugars to ethanol, using a similar process to that used in beer and wine-making. This requires the use of 'food' crops, such as sugar cane, corn, wheat, and sugar beet. These crops are required for food, so, if too much biofuel is made from them, food prices could rise and shortages might be experienced in some countries. Corn, wheat, and sugar beet also require high agricultural inputs in the form of fertilizers, which limit the greenhouse gas reductions that can be achieved. Biodiesel produced by transesterification from rapeseed oil, palm oil, or other plant oils is also considered a first generation biofuel.

→ What are second generation bio-fuels?[3]

Second generation biofuels, also known as advanced biofuels, are fuels that can be manufactured from various types of biomass. Biomass is a wide-ranging term meaning any source of organic carbon that is renewed rapidly as part of the carbon cycle. Biomass is derived from plant materials but can also include animal materials. Second generation biofuel technologies have been developed because first generation biofuels manufacture has important limitations. First generation biofuel processes are useful but limited in most cases: there is a threshold above which they cannot produce enough biofuel without threatening food supplies and biodiversity. Many first generation biofuels depend on subsidies and are not cost competitive with existing fossil fuels such as oil, and some of them produce only limited greenhouse gas emissions savings. When taking emissions from production and transport into account, life cycle assessment from first generation biofuels frequently approach those of traditional fossil fuels. Second generation biofuels can help solve these problems and can supply a larger proportion of our fuel supply sustainably, affordably, and with greater environmental benefits. The goal of second generation biofuel processes is to extend the amount of biofuel that can be produced sustainably by using biomass consisting of the residual non-food parts of current crops, such as stems, leaves and husks that are left behind once the food crop has been extracted, as well as other crops that are not used for food purposes (non food crops), such as switchgrass, grass, jatropha, whole crop maize, miscanthus and cereals that bear little grain, and also industry waste such as woodchips, skins and pulp from fruit pressing, etc.

Table 15-(5):- BREEAM - RE 01: Energy Strategy

Land Ethic 'Members/Keyword'	Derivations
Soil	Supporting services:- • Soil formation • Erosion regulation
Plants / Animals	Provisioning services:- • Food • Fibre • Fuel • Genetic resources • biochemical

[3] http://en.wikipedia.org/wiki/Secondgenerationbiofuels#Greenhousegasemissions

	• Natural medicines • Pharmaceuticals
Land Pyramid	Regulating services:- • Waste treatment Supporting services:- • Soil formation • Nutrient cycling • Water cycling
Land Use	Provisioning services:- • Food By making use of organic wastes from plants and feedstock to generate fuel, a considerable amount of waste is avoided from entering into the land fill, thus preventing the deterioration of valuable good quality land.

Source: Self

13	RE 03: Water Strategy

Aim

To ensure that the development is designed to minimize water demand through efficiency and appropriate supply-side options taking full account of current and predicted future availability of water in the area.

(1) The development engages overall water consumption targets for the development taking account of:
   - the current availability of water and demands in the area
   - the future predicted availability taking climate change into account
   - the predicted water demand for the area resulting from growth and climate change.

(2) Allowance for climate change: The water strategy needs to take climate change into account. Allowance must be made for impacts on precipitation levels, increased evaporative losses and changing use patterns arising from climate change in accordance with current planning guidance.

(3) Water efficiency is considered in the selection of tree, scrub and herbaceous planting specifications and any associated irrigation systems.

(4) A strategy is prepared to manage water demand on the development site to meet the above consumption targets. The strategy includes:
   - actions to minimize the predicted use on the development; and maintain this in future
   - ownership and maintenance of any shared facilities
   - design options to reduce the water demand in landscaping, any other predicted water use and on-site collection/storage opportunities
   - targets for water use in residential and non-domestic buildings in the development site.

Table 16-(5):- BREEAM - RE 03: Water Strategy

Land Ethic 'Members/Keyword'	Derivations
Water	Provisioning services:- • (conservation of) Fresh water Regulating services:- • Climate regulation • Water regulation Supporting services:- • Nutrient cycling • Water cycling
Plants / Animals	Provisioning services:- • (conservation of) Fresh water Supporting services:- • Photosynthesis • Primary production • Nutrient cycling • Water cycling
Land Use	Estimation of the present and future demands of water considering the factor of climate change needs to be provisioned in the land use planning itself (for instance: in case of a proposed STP – sewerage treatment plant – the design and space planning of the STP is made flexible to be able to accommodate the future rise of demands with little modifications).
Conservation / Preservation / Recreation	Provisioning services:- • (conservation of) Fresh water Supporting services:- • Nutrient cycling • Water cycling

Source: Self

14	RE 04: Sustainable Buildings

Aim

To increase the sustainability of all buildings within the development.

(1) The developer and design team have committed to designing the buildings on site to comply with recognized industry best practice standards in sustainable design for one or more of the following key issues: energy, water, and waste, embodied impacts of materials, and occupant health and wellbeing.

BREEAM awards points or 'Credits' and groups the environmental impacts for Sustainable Buildings as follows[4]:-

i) Energy: operational energy and carbon dioxide (CO2)

[4] http://www.breeam.org/filelibrary/BREEAM_Brochure.pdf

ii) Management: management policy, commissioning, site management and procurement
iii) Health and Wellbeing: indoor and external issues (noise, light, air, quality etc)
iv) Transport: transport-related CO2 and location related factors
v) Water consumption and efficiency
vi) Materials: embodied impacts of building materials, including lifecycle impacts like embodied carbon dioxide
vii) Waste: construction resource efficiency and operational waste management and minimization
viii) Pollution: external air and water pollution
ix) Land Use: type of site and building footprint
x) Ecology: ecological value, conservation and enhancement of the site

Table 17-(5):- BREEAM - RE 04 Sustainable Buildings

Land Ethic 'Members/Keyword'	Derivations
Soils	Regulating services:- • Waste treatment Supporting services:- • Erosion regulation
Waters	Provisioning services:- • (conservation of) fresh water Regulating services:- • Water purification
Land Pyramid	Regulating services:- • Waste treatment Supporting services:- • Nutrient cycling • Water cycling
Conservation / Preservation / Recreation	Cultural services:- • Knowledge systems • Educational values • Sense of place

Source: Self

15	RE 06: Resource efficiency

Aim

To promote resource efficiency by reducing waste during construction and throughout the life cycle of the development.

(1) Diversion from landfill:

Diversion from landfill includes:

- reusing the material on site (in-situ or for new applications)
- reusing the material on other sites
- salvaging or reclaiming the material for reuse
- returning material to the supplier via a 'take-back' scheme

- recovery of the material from site by an approved waste management contractor to be recycled or sent for energy recovery.

→ Some of the environmental impacts due to landfill are as under[5]:-

(a) Groundwater contamination through leachate
(b) Surface water contamination through runoff
(c) Air contamination due to gases, litter, dust, bad odour
(d) Other problems due to rodents, pests, fire, bird menace, slope failure, erosion etc.

→ Biofuels[6]:

Biofuels are non-fossil fuels. They are energy carriers that store the energy derived from organic materials (biomass), including plant materials and animal waste.
They may be solid, such as fuel wood, charcoal and wood pellets; liquid, such as ethanol, biodiesel and pyrolysis oils; or gaseous, such as biogas. First-generation biofuels are currently produced from food crops such as sugar cane and rapeseed. They include bioethanol (made from sugars and starch) and biodiesel (made from vegetable oil). Second-generation biofuels are under development and will be derived from non-food plant matter such as crop residues and agricultural or municipal wastes. They include bioethanol made from cellulosic materials such as straw or wood.

Table 18-(5):- BREEAM - RE 06: Resource efficiency

Land Ethic 'Members/Keyword'	Derivations
Soils	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Disease regulation • Pest regulation Supporting services:- • Soil formation • Nutrient cycling • Water cycling
Education / Awareness / Social Interaction	Cultural services:- • Knowledge systems • Educational values • Sense of place

Source: Self

16	LE 01: Ecology Strategy

Aim

To ensure that the development maintains or enhances biodiversity and protects existing natural habitats.

[5] http://www.urbanindia.nic.in/publicinfo/swm/chap17.pdf
[6] http://www.greenfacts.org/glossary/abc/bio-fuels.htm

(1) Ecology strategy: This strategy should include consideration of the issues set out in the IEEM EcIA Guidelines including but not limited to identifying actions to address/achieve:
   - protection, enhancement and creation of local ecological habitats and the processes that sustain them (including water supply and quality; nutrient cycling; shelter; ecosystem hierarchies etc.);
   - opportunities for maximizing the presence of flora and fauna species on and/or near to the site;
   - protection, enhancement and creation of wildlife movement/migration routes;
   - potential damage/disturbance arising from the proposed development and its ongoing use;
   - the optimal balance between ecological, social and economic benefits of the proposed development and predicted damage/disturbance;
   - protection and enhancement of existing ecological features

(2) An ecological impact assessment (EcIA) has been undertaken by a suitably qualified ecologist to identify:
   - valued ecological resources (including those off-site that may be affected by the development)
   - potential impacts from the development.

(3) The ecological impact assessment takes account of any local knowledge of ecological issues through a process of consultation (see 'GO - 02 Consultation and engagement').

(4) An ecology strategy covering the construction and operation phases has been drawn up by a suitably qualified ecologist to avoid damage to any ecological features on or near site. The strategy is based on the findings of the EcIA.

(5) Where it is unavoidable that damage to an ecological feature will occur, a mitigation plan and/or compensation plan has been agreed by the appropriate statutory body to ensure there is no net loss of any of the ecologically valuable features.

(6) The suitably qualified ecologist confirms that the masterplan conforms to the ecology strategy and there will be no net loss of ecological value on the site, or where this is unavoidable, appropriate mitigation and/or compensation has been allowed for in accordance with the agreed ecology strategy.

(7) The developer confirms that all significant ecological features will be preserved and protected during development works.

(8) The ecology strategy outlines a plan (agreed by the appropriate statutory body) to ensure there is a net gain in biodiversity.

(9) Ecological impact assessment: This is usually required for planning applications for large scale developments and forms part of the environmental impact assessment. Guidance on producing an EcIA is available on the Institute of Ecology and Environmental Management (IEEM) website at: http://www.ieem.net/ecia/.

Table 19-(5):- BREEAM - LE 01: Ecology Strategy

Land Ethic 'Members/Keyword'	Derivations
Land Organism	Regulating services:- • Air quality regulation

	• Climate regulation • Water regulation • Erosion regulation • Pollination • Natural hazard regulation
Land Health	Regulation services:- • Waste treatment • Pollination • Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling
Ecological Conscience	Provisioning services:- • Food • Fibre • Fuel • Genetic resources • Natural medicines • Ornamental values • Fresh water
Conservation / Preservation / Recreation	Cultural services:- • Cultural diversity • Religious values • Knowledge systems • Educational values • Inspiration • Aesthetic values • Sense of place • Cultural heritage values

Source: Self

17	LE 02: Land Use

Aim

To encourage the use of previously developed and/or contaminated land and avoid land which has not been previously disturbed.

(1) Where the preliminary investigation has identified potential land contamination issues, a contaminated land specialist has performed a site investigation and risk assessment to determine the presence and levels of any contamination affecting the site and make recommendations on any remediation required.
(2) SuRF-UK 'Frame-work for Assessing the Sustainability of Soil and Groundwater Remediation'.

(3) Master plan site layout and design: Where contamination is affecting certain areas of a site, this can be recognized in the master plan site layout and design. Examples of this approach include:
- matching land-use with ground conditions, e.g. locate most vulnerable receptors and land-uses away from most contaminated areas
- considering the feasibility of locating basement parking within ground conditions that require intervention, e.g. avoid excavating clean soil to create basements while at the same time remediating other soils in-situ
- considering the location of sustainable drainage systems (SUDS), e.g. locating SUDS percolation areas in areas of clean soil to prevent leaching of contaminated materials
- considering the use of vapour membranes in buildings rather than excavating and disposing of large volumes of soil

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- considering the feasibility of locating basement parking within ground conditions that require intervention, e.g. avoid excavating clean soil to create basements while at the same time remediating other soils in-situ
- considering the location of sustainable drainage systems (SUDS), e.g. locating SUDS percolation areas in areas of clean soil to prevent leaching of contaminated materials
- considering the use of vapour membranes in buildings rather than excavating and disposing of large volumes of soil

→ The following literature further elaborates on how this issue is dealt with in the context of 'Land use' and 'soil':-

- In Part 2A the legal definition of 'contaminated land' is[7]:

"Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that -

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being, or is likely to be, caused."

→ A key element of the Part 2A regime is the pollutant linkage concept: -
Source – Pathway – Receptor

(a) the source is the contamination in, on or under the land

(b) the pathway is the route by which the contamination reaches the receptor

(c) the receptor is defined as living organisms, ecological systems or property that has been harmed. (Defra Circular 1/2006)

→ All 3 elements (source, pathway, and receptor) of the pollutant linkage need to be identified in order to classify land as "contaminated" under the regime.

[7] Developer's Guide to Potentially Contaminated Land, Sensitive End Uses and the Risk Assessment Process, http://www.gateshead.gov.uk/BuildingandDevelopment/Planning/LandContamination.aspx

→ The term 'land affected by contamination' also refers to "the actual or suspected presence of substances in, on or under the land may cause risks to people, properties, human activities or the environment, regardless of whether or not the land meets the statutory definition in Part 2A."

→ The principle difference is that under the planning system risks have to be assessed based upon the new or intended use (notably sensitive end uses) of the land rather than the existing use, upon which risks are based in the Part 2A regime.

(5) Land uses considered to be sensitive include:

- All residential development (Including single dwellings)
- Allotments
- Schools
- Nurseries
- Playgrounds
- Hospitals
- Care Homes

Table 20-(5):- BREEAM - LE 02: Land Use

Land Ethic 'Members/Keyword'	Derivations
Soils	Provisioning services:- • Fresh water Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Water purification Supporting services:- • Soil formation • Nutrient cycling • Water cycling
Land Organism	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Water purification • Waste treatment • Disease regulation • Pest regulation
Land Health	Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling • Erosion regulation

Source: Self

18	LE 03: Water pollution

Aim

To ensure that measures are put in place to protect the local watercourse from pollution and other environmental damage.

(1) Measures are put in place to avoid any potential water pollution during construction in accordance with the following Environment Agency pollution prevention guidelines (PPGs): PPG 1, PPG 5 and PPG 6.
(2) Where an appropriately qualified professional designs a system to ensure that the run-off from all hard surfaces shall receive an appropriate level of treatment in accordance with the SuDS Manual to minimize the risk of pollution. Note: The SuDS Manual best practice recommendations should be followed where there is a risk to groundwater from infiltration (for example, contaminated land or developments with high risk of pollution incidents).
(3) Where the building has chemical/liquid gas storage areas, shut-off valves are fitted to the site drainage system to prevent the escape of chemicals to natural watercourses (in the event of a spillage, leak or bunding failure).
(4) Specification of oil/petrol separators (or equivalent systems) in surface water drainage systems, where there is a high risk of contamination or spillage of substances such as petrol and oil (see compliance notes for a list of areas).
(5) 5mm discharge for minimizing watercourse pollution: A range of SuDS techniques can be used to prevent discharge from the site for rainfall depths of up to 5 mm; however, end-of-pipe solutions, such as ponds and basins, will only be deemed to comply where the principal run-off control to prevent discharge from the first 5 mm of a rainfall event is achieved using source control and site control methods. Green roofs and permeable surfaces can be deemed to comply with this criterion for the rain that falls onto their surface. However, evidence is still required to demonstrate that the 5 mm rainfall from all other hard surfaces on site is being dealt with, to allow this credit to be awarded.
(6) The appropriately qualified professional confirms that there will be no discharge from the developed site for rainfall depths up to 5mm.

Table 21:- BREEAM - LE 03: Water pollution

Land Ethic 'Members/Keyword'	Derivations
Waters	Provisioning services:- • Fresh water Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Waste treatment • Disease regulation • Pest regulation • Natural hazard regulation Supporting services:-

	• Soil formation • Nutrient cycling • Water cycling
Land Organism	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Waste treatment • Disease regulation • Pest regulation • Natural hazard regulation
Land Health	Supporting services:- • Soil formation • Nutrient cycling • Water cycling

Source: Self

19	LE 04: Enhancement of Ecological Value

Aim

To ensure that the ecological value of the development is maximized through enhancement.

(1) The ecological plans are integrated within a green infrastructure plan (or similar strategy) to maximize the following (when appropriate):amenity and social provision
   - occupier/user health and wellbeing
   - conservation (heritage and archaeology)
   - adaptation to climate change
   - aesthetic value of green spaces on and near to the site.

(2) Green infrastructure plan: A document outlining (or section of another document, such as the design and access statement) outlining:
   - the location, type and size of green infrastructure
   - links to the enhancement of ecological value
   - links to the landscape design of green space.

(3) The master plan enhances ecological value through the creation of appropriate new habitats or through the increase in scale of existing habitats on the site in accordance with the recommendations of the suitably qualified ecologist and appropriate statutory or wildlife bodies.

(4) The master plan enhances ecological value through the protection, enhancement and/or creation of wildlife corridors on the site linking established and/or new wildlife habitats on or adjacent to the site. These proposals should be developed in accordance with the recommendations of the suitably qualified ecologist and appropriate statutory or wildlife bodies.

(5) Development is usually seen as being detrimental to the ecological value of the site. This is often the case but enhancement can also be implemented. Where damage is necessary and unavoidable its effects can be offset to some extent through enhancement in other areas of the site. The steps to be taken will depend on the

nature of the site and the surrounding areas, and independent specialised advice should be sought in this respect.

Table 22-(5):- BREEAM - LE 04: Enhancement of Ecological Value

Land Ethic 'Members/Keyword'	**Derivations**
Plants / Animals	Provisioning services:- • Food • Fibre • Fuel • Genetic resources • Natural medicines • Pharmaceuticals • Ornamental resources • Fresh water
Land Organism	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Water purification • Waste treatment • Disease regulation • Pest regulation • Pollination • Natural hazard regulation
Land Health	Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling • Erosion regulation
Ecological Conscience	Cultural services:- • Cultural values • Spiritual values • Knowledge systems • Educational values • Inspiration • Aesthetic values • Sense of place • Recreation
Land Use	Ability to enhance ecological values and its ecosystem services depend tremendously on the efficiency of land use plan.
Conservation/ Preservation /	Provisioning services:-

Recreation	• Genetic resources • Natural medicines • Pharmaceuticals • Fresh water Supporting services:- • Soil formation • Nutrient cycling • Water cycling Cultural services:- • Spiritual values • Knowledge systems • Educational values • Inspiration • Aesthetic values • Sense of place • Recreation

Source: Self

20	LE 05: Landscape

Aim

To ensure that the character of the landscape is respected and, where possible, enhanced through the location of features and design appropriate to the local environment.

(1) Water efficiency is considered in the selection of tree, scrub and herbaceous planting specifications and any associated irrigation systems. This is informed by the water strategy in 'RE 03 - Water strategy'.
(2) At least 80% of tree and scrub and herbaceous planting consists of appropriate locally native specifies
(3) There is a commitment to prepare and implement a landscape management and maintenance plan to ensure the long-term achievement of the ecology objectives and their maintenance during occupation. The plan should allow for planned maintenance and protection. It should also establish appropriate and enforceable responsibilities for management and maintenance that have been agreed and set out in accordance with the ecology strategy under LE 01 – Ecology strategy.
(4) The proposed landscape design has been developed with reference to the community needs outlined in consultation for 'SE 07 – Public realm'.
(5) Existing landscape features and landmarks considered important will be preserved in the new development.
(6) The proposed landscape design has been assessed by an independent design review panel to ensure the design achieves environmental, social and aesthetic outcomes (see 'GO 03 – Design review).
(7) The suitably qualified ecologist confirms that the detailed landscaping and planting design and site specific protection measures conform with the ecology strategy prepared under 'LE 01 – Ecology strategy'.

(8) At least 60% of tree and scrub and herbaceous planting consists of appropriate native specifies (or other ecologically appropriate species where recommended by the suitably qualified ecologist to take account of the nature of the site conditions).
(9) A commitment is made to appoint an ecology clerk of works to ensure the ecological strategy is implemented throughout the construction phase.

Table 23-(5):- BREEAM - LE 05: Landscape

Land Ethic 'Members/Keyword'	Derivations
Water	Provisioning services:- • Fresh water Regulating services:- • Water regulation • Water purification Supporting services:- • Nutrient cycling • Water cycling
Plants / Animals	Provisioning services:- • Food • Fibre • Fuel • Genetic resources • Natural medicines • Pharmaceuticals • Ornamental values Supporting services:- • Photosynthesis • Primary production
Ecological Conscience	Cultural services:- • Spiritual values • Inspiration • Aesthetic values • Sense of place • Recreation
Conservation / Preservation / Recreation	Provisioning services:- • Genetic resources • Natural medicines • Pharmaceuticals • Fresh water Supporting services:- • Soil formation • Nutrient cycling • Water cycling
Education / Awareness / Social Interaction	Cultural services:- • Spiritual values • Knowledge systems

	• Educational values • Inspiration • Aesthetic values • Social relations • Sense of place • Recreation

Source: Self

21	LE 06: Rainwater Harvesting

Aim

To ensure that surface water run-off space is used effectively to minimize water demand.

(1) Where 5% to 25% of the total hard surface for the site (roof plus hard-standing) is designed to allow the harvesting of rain water for re-use.
(2) Any rainwater collection system is designed in accordance with BS 8515:2009 (to ensure both the demand and yield for the building will be considered when sizing the tank) and the collection area measured in accordance with BS EN 12056-3:2000.
(3) Where 26% to 50% of the total hard surface for the site (roof plus hard-standing) is designed to allow the harvesting of rain water for re-use.
(4) Use of rainwater: The percentage of collected rainwater must be used to meet (in part) toilet flushing demand and / or washing machines within buildings. Only once demand from these fitting has been satisfied should rainwater be used for irrigation of planting and landscaping demand.
(5) Calculation of roof collection area: The total area of impervious roof surfaces shall be used to calculate the available roof collection area. A calculation method for roof collection area is described in BS EN 12056-3: 2000.
(6) Master plan drawings and / or example specifications confirming:
    - total roof areas, hard-standing areas
    - total roof area draining into rainwater collection systems
    - total hard-standing draining into rainwater collection systems
    - sum totals for all hard surface areas (roof and hard standing) draining into rain-water collection systems.

Table 24:- BREEAM - LE 06: Rainwater Harvesting

Land Ethic 'Members/Keyword'	Derivations
Water	Provisioning services:- • Fresh water Regulating services:- • Water regulation • Water purification Supporting services:- • Nutrient cycling • Water cycling
Land Pyramid	Regulating services:- • Waste treatment

	Supporting services:- • Nutrient cycling • Water cycling
Land Use	Regulating services:- • Erosion regulation • Natural hazard regulation
Conservation / Preservation / Recreation	Provisioning services:- • Genetic resources • Natural medicines • Pharmaceuticals • Fresh water Supporting services:- • Soil formation • Nutrient cycling • Water cycling

Source: Self

22	TM02 - Safe and appealing streets

Aim

To create safe and appealing spaces that encourages human interaction and a positive sense of place.

(1) The transport assessment or statement and travel plans are used to inform the objectives for the design of streets.
(2) A context appraisal is carried out to determine the appropriate layout of streets in relation to the existing or planned buildings and/or open space.
(3) A movement framework is developed to determine the layout and design of streets that will promote sustainable modes of movement and transport through travel plans.
(4) Street layouts and the design of pedestrian and cycle routes are safe and secure by incorporating the following:
    - in residential areas, all streets and open spaces will be overlooked by multiple dwellings
    - all access points and routes through the site will be well lit, direct and overlooked
    - pedestrian crossings are designed to ensure safety for all users
    - a clear distinction is made between public, semi-public and private external spaces.
(5) Design measures are incorporated into the master plan to ensure safety with regard to large vehicles and pedestrian and cyclist movement. As a minimum, vehicle delivery areas are not accessed through parking areas and do not cross or share pedestrian and cyclist routes.
(6) The landscape design strategy enhances pedestrian routes through design and the provision of attractive landscaping.

(7) Pedestrian routes allow easy navigation around the development using key features and existing neighbourhoods to aid navigation. As a minimum, the following is achieved:
   - new routes into the development are a continuation of existing routes from the surrounding area
   - routes connect residential areas to, and between, community focal points in the development and surrounding area.

(8) The Movement framework should include consideration of:
   - a hierarchy of sustainable transport (pedestrians, cyclists, public transport users, specialist vehicles and other motor traffic)
   - the form of the surrounding environment (buildings, landscape and activities)
   - connection and permeability of street networks.

Table 25-(5):- BREEAM - TM02 - Safe and appealing streets

Land Ethic 'Members/Keyword'	Derivations
Land Use	Regulating services:- • Air quality regulation • Climate regulation
Education / Awareness / Social Interaction	Cultural services:- • Spiritual values • Knowledge systems • Educational values • Inspiration • Aesthetic values • Social relations • Sense of place • Recreation

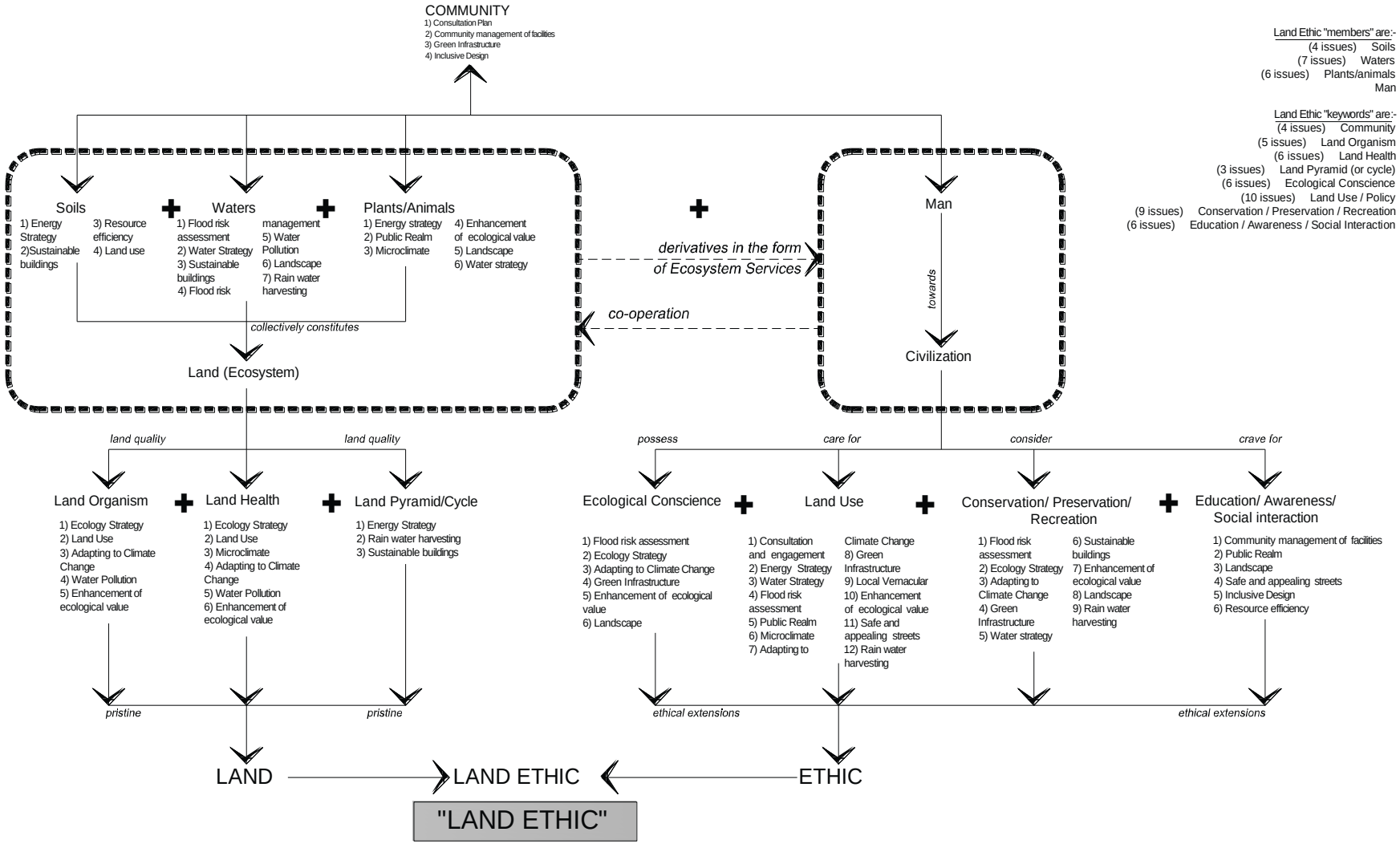
Source: Self

5.3. BREEAM versus Land Ethic Model:-

→ Deriving the BREEAM Land Ethic Model:-

The BREEAM Land Ethic Model 1-(5) is derived after an analysis of each BREEAM issue and the individual sub issues that are considered for the achievement of credit points. On basis of the issues and sub-issues, they are being assigned under the appropriate category of Land Ethic members and keywords. A total in terms of (a) the number of issues (or efforts) involved and (b) in terms of the credit points is arrived at (called as scoreboards).

These scoreboards are useful in a comparative analysis of the three rating systems (as seen in Chapter 8).



Land Ethic Model 1-(5):- BREEAM Land Ethic Model

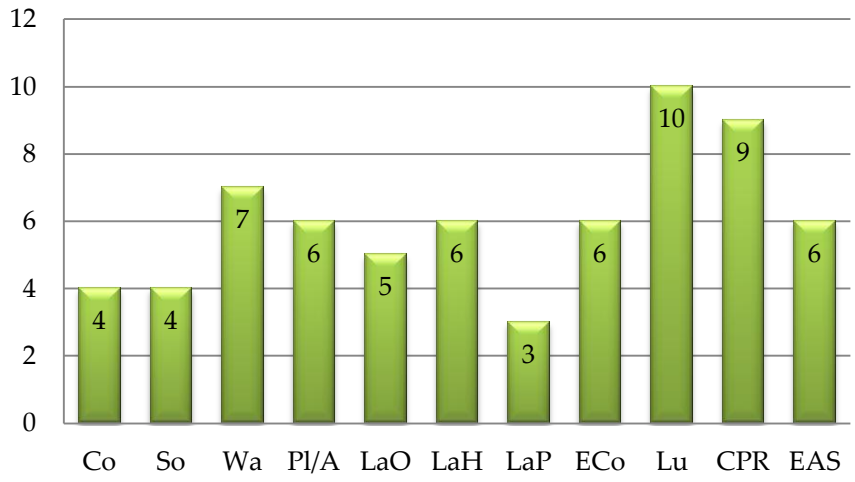
5.4. BREEAM Scoreboards & Conclusion

→ The results of Land Ethic Model is tabulated as a chart [refer Chart 1-(5)] for a better understanding of the analysis. Scores are derived from this table with are indicated in the form for bar charts for a quick comprehension of the same [refer Bar Chart 1-(5) & Bar Chart 2-(5)]

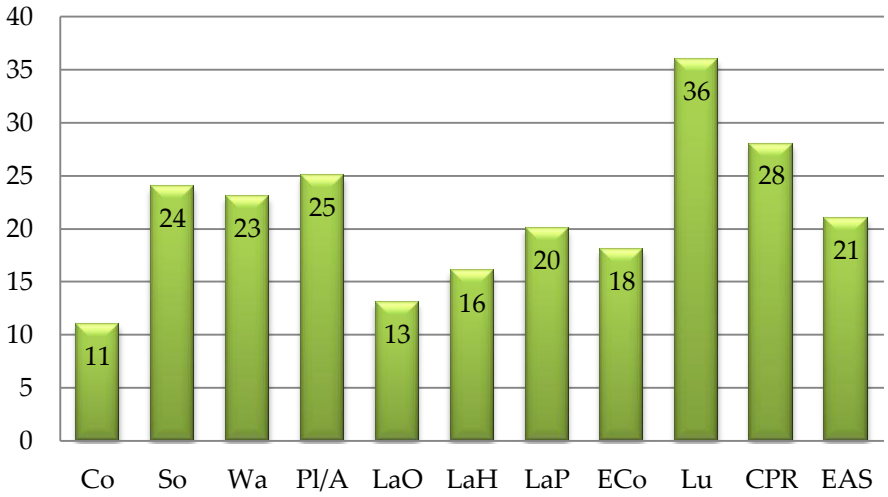
Chart 1-(5):- Scoreboards for BREEAM issues and Land Ethic keywords

SNo	Issues	Co	So	Wa	Pl/A	LaO	LaH	LaP	ECo	Lu	CPR	EAS	**Sb C**
1	Consultation Plan	1											**1**
2	Consultation and engagement									2			**1**
3	Community management of facilities	3										3	**2**
4	Flood risk assessment			2					2		2		**3**
5	Microclimate				3		3			3			**3**
6	Adapting to climate change					3	3		3	3	3		**5**
7	Flood risk management			3									**1**
8	Public realm				2					2		2	**3**
9	Green infrastructure	4							4	4	4		**4**
10	Local vernacular												
11	Inclusive design	3										3	**2**
12	Energy strategy		11		11			11		11			**4**
13	Water strategy			1	1					1	1		**4**
14	Sustainable Buildings		6	6				6			6		**4**
15	Resource efficiency		4									4	**2**
16	Ecology strategy					1	1		1		1		**4**
17	Land use		3			3	3						**3**
18	Water pollution			3		3	3						**3**
19	Enhancement of ecological value				3	3	3		3	3	3		**6**
20	Landscape			5	5				5		5	5	**5**
21	Rainwater harvesting			3				3		3	3		**4**
22	Safe and appealing streets									4		4	**2**
	Sb A	**4**	**4**	**7**	**6**	**5**	**6**	**3**	**6**	**10**	**9**	**6**	**Nos.**
	Sb B	**11**	**24**	**23**	**25**	**13**	**16**	**20**	**18**	**36**	**28**	**21**	

Source: Self



Bar Chart 1-(5):- Scoreboard A for Land Ethic 'keywords"
Source: Self



Bar Chart 2-(5):- Scoreboard B for Land Ethic 'keywords"
Source: Self

Legend:-

Community	Co	Land Pyramid (or cycle)	LaP	Scoreboard A	Sb A
Soils	So	Ecological Conscience	ECo	Scoreboard B	Sb B
Waters	Wa	Land Use	Lu	Scoreboard C	Sb C
Plants/animals	Pl/A	Conservation / Preservation / Recreation	CPR		
Land Organism	LaO	Education / Awareness / Social Interaction	EAS		
Land Health	LaH				
Scoreboard A represents total numbers of issues (efforts) credited to each Land Ethic keyword					
Scoreboard B represents total weighting (in points) as per BREEAM credited to each Land Ethic keyword					
Scoreboard C represents total numbers of Land Ethic Keyword credited to each issue.					

Chapter 6. Pearl Community Rating System

6.1. Introduction

6.1.1. What is ESTIDAMA

Estidama, which means 'sustainability' in Arabic, is the initiative which will transform Abu Dhabi into a model of sustainable urbanization. Its aim is to create more sustainable communities, cities and global enterprises and to balance the four pillars of Estidama: environmental, economic, cultural and social.
The aspirations of Estidama are incorporated into Plan 2030 and other Urban Planning Council (UPC) policies such as the Development Code. Estidama began two years ago and is the first program of its kind that is tailored to the Middle East region. In the immediate term, Estidama is focused on the rapidly changing built environment. It is in this area that the UPC is making significant strides to influence projects under design, development or construction within the Emirate of Abu Dhabi. One of Estidama's key initiatives is the Pearl Rating System.

6.1.2. The Pearl Rating System for ESTIDAMA

The Pearl Rating System for Estidama aims to address the sustainability of a given development throughout its lifecycle from design through construction to operation. The Pearl Rating System provides design guidance and detailed requirements for rating a project's potential performance in relation to the four pillars of Estidama.
The Pearl Rating System is organized into seven categories that are fundamental to more sustainable development. These form the heart of the Pearl Rating System:

1) Integrated Development Process: Encouraging cross-disciplinary teamwork to deliver environmental and quality management throughout the life of the project.
2) Natural Systems: Conserving, preserving and restoring the region's critical natural environments and habitats.
3) Livable Communities: Improving the quality and connectivity of outdoor and indoor spaces.
4) Precious Water: Reducing water demand and encouraging efficient distribution and alternative water sources.
5) Resourceful Energy: Targeting energy conservation through passive design measures, reduced demand, energy efficiency and renewable sources.
6) Stewarding Materials: Ensuring consideration of the 'whole-of-life' cycle when selecting and specifying materials.
7) Innovating Practice: encouraging innovation in building design and construction to facilitate market and industry transformation.

6.1.3. Section Weightings

The number of credit points available in a given section determines the weighting of that section as mentioned in Table 1-(6) and Table 2-(6) below.

Table 1-(6):- Pearl Maximum Credit Points Available for each Section

Credit Selection	Maximum Credit Points
IDP – Integrated Development Process	10
NS – Natural Systems	14
LC – Livable Communities	38
PW – Precious Water	37
RE – Resourceful Energy	42
SM – Stewarding Materials	18
IP – Innovating Practice	3
Total	159*

* Total: Excludes Innovating Practice credit points which are offered as bonus credits.

Table 2-(6):- Pearl Community Rating System Checklist[1]

Credit	Project Checklist	Intent	Points
Integrated Development Process - IDP			**10**
IDP-R1	Integrated Development Strategy	To ensure new development adopts an Integrated Development Process (IDP) as a way of attaining greater synergy between project systems resulting in high performance communities.	Required
IDP-R2	Sustainable Building Guidelines	To ensure that the design and construction of buildings will contribute to the overall community's sustainability objectives and targets.	Required
IDP-R3	Community-Dedicated Infrastructure Basic Commissioning	To ensure that the infrastructure systems perform as designed, thereby protecting occupant health and providing ongoing efficiency.	Required
IDP-1	Life Cycle Costing	To enable effective long-term decisions about infrastructure design and construction in order to maximize efficiency over the whole life of the development.	4
IDP-2	Guest Worker Accommodation	To promote fair labor practices in construction.	2
IDP-3	Construction Environmental Management	To reduce the environmental impacts associated with construction practices.	2
IDP-4	Sustainability Awareness	To promote the efficient ongoing operation of the community by enabling site residents, workers and visitors to	2

[1] Pearl Community Rating System: Design & Construction, Version 1.0, April 2010, Emirate of Abu Dhabi

		appreciate, understand and therefore contribute to responsible resource use in the community.	
Natural Systems - NS			**14**
NR-R1	Natural Systems Assessment	To ensure that before the design process begins, the environmental baseline conditions surrounding, connected to and on the site are considered and assessed.	Required
NR-R2	Natural Systems Protection	To protect significant and valuable natural systems assets identified in NS-R1, Natural Systems Assessment.	Required
NR-R3	Natural Systems Design and Management Strategy	To minimize demand for resources, promote soil protection and enhancement and ensure the long term survival and management of landscaped / habitat areas.	Required
NR-1	Reuse of Land	To encourage new developments to reuse land that has already been built on and infill existing urban areas rather than using undisturbed land.	2
NR-2	Remediation of Contaminated Land	To encourage and reward the remediation of land for building development.	2
NR-3	Ecological Enhancement	To enhance the ecological value of the site.	2
NR-4	Habitat Creation and Restoration	To restore or re-create a habitat that is connected to other similar habitats and is self sustaining.	6
NR-5	Food Systems	To create a more localized approach to food with sustainable food production and resident access to high-quality foods.	2
Livable Communities - LC			**35**
LC-R1	Plan 2030	To ensure that all new development supports the vision for the Emirate of Abu Dhabi, as defined by the applicable Plan 2030, and/or Development Code, and/ or Area Plan.	Required
LC-R2	Urban Systems Assessment	To ensure that, before the design process begins, a thorough understanding of the urban systems influencing the site are considered and assessed.	Required
LC-R3	Provision of Amenities and Facilities	To ensure that a neighborhood's cultural amenities and community facilities are accessible to the greater population, affording social connectivity, interaction and shared public benefit of community resources.	Required
LC-R4	Outdoor Thermal Comfort Strategy	To increase outdoor thermal comfort during transition months and reduce thermal discomfort during summer	Required

		months in public spaces and walkways.	
LC-R5	Minimum Pearl Rated Buildings Within Communities	To reward development that has a high proportion of buildings achieving minimum pearl building ratings.	Required
LC-1	Transit Supportive Practices	To optimize public transportation investment through development practices that facilitates higher use of transit facilities.	2
LC-2	Neighborhood Connectivity	To achieve a high level of pedestrian/cycle and vehicular connections within the neighborhood and with existing and potential future surrounding developments.	3
LC-3	Open Space Network	To create an interconnected network of parks and open space, differing in size, character and purpose to support a variety of human activities and natural systems.	3
LC-4	Accessible Community Facilities	To promote clustering and sharing of community facilities to enable easy access to be achieved.	2
LC-5	Housing Diversity	To encourage a diverse mix of residential properties in neighborhoods.	2
LC-6	Community Walkability	To improve public health, enhance mobility, reduce reliance on automobiles and improve the vitality of the community through an enhanced pedestrian environment.	4
LC-7	Active Urban Environments	To encourage active lifestyles by providing building occupants and users with recreational public open spaces.	1
LC-8	Travel Plan	To reduce single occupancy vehicle use by managing the demand for travel and by maximizing the availability of alternatives to traveling by car.	1
LC-9	Improved Outdoor Thermal Comfort	To improve outdoor thermal comfort during transition months and further reduces thermal discomfort during summer months in public spaces and walkways.	4
LC-10	Regionally Responsive Planning	To reflect the unique climatic, social and historical influences of the site and region in the community plan.	2
LC-11	Pearl Rated Buildings Within Communities	To reward development that has a significant proportion of buildings achieving high pearl building ratings.	10
LC-12	Safe and Secure Community	To provide a safe and secure environment for the community's occupants and	1

		visitors.	
Precious Water - PW			**37**
PW-R1	Community Water Strategy	To develop and integrate a comprehensive water strategy during the early stages of design with the goal of minimizing the overall water consumption and establishing a project water balance.	Required
PW-R2	Building Water Guidelines	To focus the design and development team on promoting water conservation in buildings within the community.	Required
PW-R3	Water Monitoring and Leak Detection	To reduce loss of water associated with leaks, system degradation, or failure.	Required
PW-1.1	Community Water Use Reduction: Landscaping	To encourage water efficient public realm landscape design through plant selection, irrigation technologies and management, and the use of recycled water.	14
PW-1.2	Community Water Use Reduction: Heat Rejection	To reduce potable water use for heat rejection by promoting the use of recycled water and / or alternatives to water based heat rejection.	5
PW-1.3	Community Water Use Reduction: Water Features	To reduce potable water use in exterior water features by minimizing evaporative loss and through the use of recycled water.	4
PW-2	Storm water Management	To minimize peak stormwater discharge and protect the stormwater drainage system and receiving water bodies from pollutant loading during and after storm events.	6
PW-3	Water Efficient Buildings & Plots	To promote reductions in the water consumption of buildings and associated plots within the community as well as limit the size and burden on the community infrastructure.	8
Resourceful Energy - RE			**42**
RE-R1	Community Energy Strategy	To focus the design and development team on energy conservation through demand reduction and efficient generation and distribution, while making informed decisions about the implications of renewable energy strategies.	Required
RE-R2	Building Energy Guidelines	To focus the design and development team on promoting energy conservation in buildings within the community.	Required
RE-R3	Energy Monitoring and Reporting	To ensure the provision of metering facilities to monitor the performance of infrastructure systems, enabling future improvements and understanding of	Required

		energy use within the community.	
RE-1	Community Strategies for Passive Cooling	To improve outdoor microclimates through early community design and land use decisions.	6
RE-2	Urban Heat Reduction	To improve outdoor microclimates through the reduction of urban heat buildup.	2
RE-3.1	Efficient Infrastructure: Lighting	To reduce the energy consumption and carbon emissions associated with infrastructure lighting including, road, public, traffic and signage.	6
RE-3.2	Efficient Infrastructure: District Cooling	To promote the use of high efficiency district cooling systems.	6
RE-3.3	Efficient Infrastructure: Smart Grid Technology	To reduce peak electricity demand and increase efficiency of electric energy delivery through intelligent design of the community's electric supply and demand systems.	4
RE-4.1	Renewable Energy: Onsite	To promote the use of onsite renewable energy to reduce transmission losses, curb peak power demand, and reduce reliance on fossil fuel based power generation.	8
RE-4.2	Renewable Energy: Offsite	To create demand for large-scale renewable energy generation facilities, reducing reliance on fossil fuel based power generation.	3
RE-5	Energy Efficient Buildings	To promote the reduction of energy consumption of buildings within the community to help decrease the carbon emissions associated with the development as well as limit the size and burden on the community infrastructure.	7
Stewarding Materials - SM			**18**
SM-R1	CCA Treated Timber Elimination	To minimize toxic effects of chromate copper arsenate (CCA) treated timber on people and the environment.	Required
SM-R2	Basic Construction Waste Management	To reduce the long-term environmental impacts associated with construction waste collection, transport and disposal.	Required
SM-R3	Basic Operational Waste Management	To reduce the long-term environmental impacts associated with operational waste collection, transport and disposal.	Required
SM-1	Modular Pavement and Hardscape Cover	To minimize waste associated with upgrades or maintenance of public realm and right of way through the use of modular pavement and hardscape cover.	1

SM-2	Regional Materials	To encourage the selection of materials that has reduced transport impacts and promotes regional economies.	2
SM-3	Recycled Materials	To increase the demand for recycled materials and therefore reduce the amount of waste going to disposal.	5
SM-4	Reused or Certified Timber	To encourage the use of timber sourced from legal and sustainable sources.	3
SM-5	Improved Construction Waste Management	To further reduce the long-term environmental impacts associated with construction waste collection, transport and disposal.	2
SM-6	Improved Operational Waste Management	To further reduce the long-term environmental impacts associated with operational waste collection, transport and disposal.	2
SM-7	Organic Waste Management	To encourage the recovery and reuse of organic waste from the development's operations including landscaping and food waste.	2
SM-8	Hazardous Waste Management	To ensure the safe handling of hazardous waste in order to minimize pollution to the ground, water and air.	1
Innovating Practice - IP			3
IP-1	Showcase of Regional & Cultural Practices	Develop designs that showcase cultural and regional practices, while contributing to the environmental performance of the community.	1
IP-2	Innovating Practice	To promote designs that result in a significant positive impact in relation to any of the four pillars of Estidama.	2
	Project Total	Project total possible points	159*

*Total: Excludes Innovating Practice credit points which are offered as bonus credits.

6.2. Pearl versus Land Ethic Analysis

6.2.1. Pearl Assessment Criteria

→ Out of the total 64 assessment issues, including innovation (efforts) under Pearl communities [refer Table 3-(6)], only 47 numbers of issues (efforts) are been considered suitable for the Land Ethic assessment.

→ The study has not included Pearl issues such as materials. There is a wide range of materials (right from construction to finishing stage) that are involved in a development of a project and which may have multifarious and intangible environmental impacts. Being complex to comprehend, this issue is not been considered in the scope of assessment.

→ The study has not included Pearl issues related to life cycle costing, travel plan and carbon emissions. These have direct environment impacts on air (causing air pollution) and natural resources (such as petroleum). Air pollution has a cascading effect on Land Ethic members such as soils, waters and plants/animals. Also, there is a resultant effect on the land organism, land health and land pyramid. These intermingled effects are not considered in the scope of this assessment.

Table 3-(6):- Pearl Assessment checklist

Category	**Checklist considered**	**Checklist not considered**
Integrated Development Process - IDP (6)+(1)	Integrated Development Strategy	Life Cycle Costing
	Sustainable Building Guidelines	
	Community-Dedicated Infrastructure Basic Commissioning	
	Guest Worker Accommodation	
	Construction Environmental Management	
	Sustainability Awareness	
Natural Systems – NS (8)+(0)	Natural Systems Assessment	
	Natural Systems Protection	
	Natural Systems Design and Management Strategy	
	Reuse of Land	
	Remediation of Contaminated Land	
	Ecological Enhancement	
	Habitat Creation and Restoration	
	Food Systems	
Livable Communities – LC (12)+(5)	Plan 2030	Minimum Pearl Rated Buildings Within Communities
	Urban Systems Assessment	Transit Supportive Practices
	Provision of Amenities and Facilities	Accessible Community Facilities
	Outdoor Thermal Comfort Strategy	Travel Plan
	Neighborhood Connectivity	Pearl Rated Buildings Within Communities
	Open Space Network	
	Housing Diversity	
	Community Walkability	
	Active Urban Environments	
	Improved Outdoor Thermal Comfort	
	Regionally Responsive Planning	
	Safe and Secure Community	
Precious Water – PW (8)+(0)	Community Water Strategy	
	Building Water Guidelines	
	Water Monitoring and Leak	

	Detection	
	Community Water Use Reduction: Landscaping	
	Community Water Use Reduction: Heat Rejection	
	Community Water Use Reduction: Water Features	
	Storm water Management	
	Water Efficient Buildings	
Resourceful Energy – RE (4)+(7)	Community Energy Strategy	Energy Monitoring and Reporting
	Building Energy Guidelines	Efficient Infrastructure: Lighting
	Community Strategies for Passive Cooling	Efficient Infrastructure: District Cooling
	Urban Heat Reduction	Efficient Infrastructure: Smart Grid Technology
		Renewable Energy: Onsite
		Renewable Energy: Offsite
		Energy Efficient Buildings
Stewarding Materials – SM (9)+(2)	Basic Construction Waste Management	CCA Treated Timber Elimination
	Basic Operational Waste Management	Modular Pavement and Hardscape Cover
	Regional Materials	
	Recycled Materials	
	Reused or Certified Timber	
	Improved Construction Waste Management	
	Improved Operational Waste Management	
	Organic Waste Management	
	Hazardous Waste Management	
Total	**47 nos.**	**15 nos.**

*Total number of issues is 64 (including Innovation which is not considered for analysis)

6.2.2. Pearl Review

This section gives a brief overview about each BREEAM issue and the various sub-issues that are required for the fulfillment of a particular issue. A study of these issues and sub-issues aids in categorizing each of them under appropriate Land Ethic members and keywords. Each issue is then evaluated for the derivations in terms of ecosystem services that it seemingly serves (formulated in the form of table respectively)
The review is as follows:-

1 IDP-R1: Integrated Development Strategy

Intent:

To ensure new development adopts an Integrated Development Process (IDP) as a way of attaining greater synergy between project systems resulting in high performance communities.

(1) The Credit Requirements under this category are as under:-
   i) Demonstrate that the design and development team and development process are organized and programmed to gain full benefit from an integrated development approach, from project inception through to final delivery.
   ii) Develop an implementation strategy to facilitate an effective transition between project stages (e.g. from master planning to construction to operation) and project packages (e.g. infrastructure to buildings), to ensure that the initial vision, objectives and targets are carried through to completion.

(2) The submissions for this credit include the necessary documents and narratives describing the following:-
   i) Team structure
   ii) Design milestones and workshops
   iii) Methodology for involvement of various stakeholders such as
      a) Construction team
      b) Commissioning agent
      c) Potential building owners
      d) Operators and relevant regulatory authorities
      e) Permit agencies
   iv) Initial vision, objectives and targets set.
   v) Implementation strategy for achieving transition between project stages and project packages.

Table 4-(6):- Pearl - IDP-R1 Integrated Development Strategy

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Educational values • Inspiration • Social relations • Sense of place

Source: - Self

2 IDP-R2: Sustainable Building Guidelines

Intent:

To ensure that the design and construction of buildings will contribute to the overall community's sustainability objectives and targets.

(1) The Credit Requirements under this category are as under:-
   i) Develop Sustainable Building Guidelines to formally communicate the requirements for the project in relation to sustainable design, construction and operation to new

buildings design and development teams and Existing buildings' managers/operators.

ii) Some of the key highlights of the guideline are:
   a) Sustainability vision and objectives for the project.
   b) A summary of targets for the project.
   c) Technical guidance towards achieving the set targets.

Table 5-(6):- Pearl - IDP-R2 Sustainable Building Guidelines

Land Ethic 'Members/Keyword'	Derivations
Education/ Awareness/Social Interaction	Cultural services:- • Educational values • Inspiration • Social relations • Sense of place

Source: - Self

3	IDP-R3: Community-Dedicated Infrastructure Basic Commissioning

Intent:

To ensure that the infrastructure systems perform as designed, thereby protecting occupant health and providing ongoing efficiency.

(1) The Credit Requirements under this category are as under:-
   a) One or more independent commissioning agent(s) is/are engaged as part of the project design team throughout the design stages to verify performance of community-dedicated energy, water and waste infrastructure.
   b) Comprehensive commissioning specifications and requirements to be commissioned by independent commissioning specialist including verification and review of the commissioning report.

Table 6-(6):- Pearl IDP-R3 Community-Dedicated Infrastructure Basic Commissioning

Land Ethic 'Members/Keyword'	Derivations
Community	Involvement of all the stakeholders in the project (like a community) right from the inception stage benefits the project. Setting common targets and common and intermingled course of actions for the community aids in the success of the project.

Source: - Self

4	IDP-2: Guest Worker Accommodation

Intent:

To promote fair labor practices in construction.

(1) The Credit Requirements under this category are as under:-
   i) Develop and implement a Construction Guest Worker Accommodation Plan.
   ii) The said Plan to address aspects such as:

a) Accommodation facilities for all construction guest workers.
b) Dedicated and adequate areas for:
    - food preparation
    - personal hygiene,
    - religious services
    - healthcare
    - recreation,
    - entertainment

(2) An ongoing maintenance plan of guest worker housing facilities.
(3) Inspection schedules and auditing mechanisms for the facilities.
(4) Formation of a Workers' Representative Committee and the development of a Workers' Social & Welfare Program to address the following issues at a minimum:
    - Health, safety and security;
    - House rules;
    - Drugs and alcohol awareness;
    - Education programs;
    - Recreation activities; and
    - Transport within, to and from the housing facilities outside working hours.

Table 7-(6):- Pearl - IDP-2 Guest Worker Accommodation

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Educational values • Inspiration • Social relations • Sense of place • Recreation
Ecological Conscience	Regulating services:- • Air quality regulation • Water regulations • Erosion regulation
Education/ Awareness/Social Interaction	Cultural services:- • Educational values • Spiritual values • Social relations

Source: - Self

→ What is Corporate Social Responsibility (CSR)?[2]

1) Corporate initiative to assess and take responsibility for the company's effects on the environment and impact on social welfare. The term generally applies to company efforts that go beyond what may be required by regulators or environmental protection groups.
2) Corporate social responsibility may also be referred to as "corporate citizenship" and can involve incurring short-term costs that do not provide an immediate financial benefit to the company, but instead promote positive social and

[2] http://www.investopedia.com/terms/c/corp-social-responsibility

environmental change.
Companies have a lot of power in the community and in the national economy. They control a lot of assets, and may have billions in cash at their disposal for socially conscious investments and programs. Many large corporations are devoting real time and money to environmental sustainability programs, alternative energy / cleantech, and various social welfare initiatives to benefit employees, customers, and the community at large.

→ The CSR Policy should normally cover following core elements:[3]

1) Care for all Stakeholders
2) Ethical functioning
3) Respect for Workers' Rights and Welfare
4) Respect for Human Rights
5) Respect for Environment
6) Activities for Social and Inclusive Development

5	IDP-3: Construction Environmental Management

Intent:

To reduce the environmental impacts associated with construction practices.

(1) The Credit Requirements under this category are as under:-

i) Constructional Environmental Management Plan (CEMP) to be prepared in accordance with Environment Agency Abu Dhabi's (EAD) Construction Environmental Management Plan Technical Guidance Document.

(2) Definition of Constructional Environmental Management Plan (CEMP):-

The CEMP is a site-specific plan developed to ensure that appropriate environmental management practices are followed during the construction phase of a project.

(3) Objectives of Constructional Environmental Management Plan (CEMP):-

The intent of the CEMP is as follows:

- Provide effective, site-specific, and implementable procedures and mitigation measures to monitor and control environmental impacts throughout the construction phase of the project
- Ensure that construction activities do not adversely impact amenity, traffic, or the environment in the surrounding area.
- The main goals of the CEMP are to specify the roles and responsibilities of personnel involved with all aspects of the construction activities; identify potential environmental impacts and the mitigation measures that will be used to address them; establish procedures for audits, monitoring, and inspections; and specify training, recordkeeping, and documentation requirements (Refer Annexure 5 for the recommended format for the CEMP)[4].

Table 8-(6):- Pearl - IDP 3 Construction Environmental Management

[3] Ministry of Corporate Affairs, GOI,*CORPORATE SOCIAL RESPONSIBILITYVOLUNTARY GUIDELINES 2009*, India Corporate Week, Dec 14-21, 2009, http://www.mca.gov.in/Ministry/latestnews/CSR_Voluntary_Guidelines_24dec2009.pdf

[4] Technical Guidance Document for Construction Environmental Management Plan (CEMP), April , 2010, Environment Agency, Abhu Dhabi, https://www.ead.ae/_data/global/pdf

Land Ethic 'Members/Keyword'	Derivations
Ecological Conscience	Provisioning services:- • Fresh water Regulating services:- • Air quality regulation • Water regulations • Erosion regulation • Disease regulation Supporting services:- • Nutrient cycling • Water cycling

Source: - Self

6 IDP-4: Sustainability Awareness

Intent:

To promote the efficient ongoing operation of the community by enabling site residents, workers and visitors to appreciate, understand and therefore contribute to responsible resource use in the community.

(1) The Credit Requirements under this category are as under:-
   i) Sustainability Awareness Strategy to be developed addressing the education of site users on the following topics as a minimum:-
      a) Ecological features of the site, their ecological value within the local, regional and global context and ways for site users to preserve/protect these features;
      b) Energy and water efficiency measures in buildings and on site and how residents and other users' behavior affect performance.
      c) Information on material used in the community, their environmental and social benefits.
      d) Waste and recycling policies and the use of green waste.
      e) Location of nearby amenities and community facilities.
      f) Alternative transportation offered to site users including locations of nearby public transport, shuttle service, car-pooling and on-site bicycle facilities.

(2) Use of the following communication mechanisms for the same:
      a) Static Communication: educational kiosks, interpretative signs, displays and information packs;
      b) Ongoing Communication: continually updated information through digital display, internet and/or newsletter with information on performance measures such as ongoing energy and water consumption or generation of energy from renewable sources.

Table 9-(6):- Pearl - IDP-4 Sustainability Awareness

Land Ethic 'Members/Keyword'	Derivations
Education/ Awareness/Social Interaction	Cultural services:- • Educational values • Inspiration

	• Social relations • Sense of place

Source: - Self

7	NS-R1: Natural Systems Assessment

Intent:

To ensure that before the design process begins, the environmental baseline conditions surrounding, connected to and on the site are considered and assessed.

(1) The Credit Requirements under this category are as under:-

i) An assessment of the natural systems (NS) has been carried out at the:
   a) Project site
   b) Area of probable impact surrounding the project site
   c) Sub-regional and
   d) Regional scale

ii) Identify opportunities, constraints and carrying capacity associated with the development

iii) Key performance indicators (KPIs) to be prepared to guide the design of the development, based on the results of the opportunities and constraints analysis.

iv) The NS assessment is to cover the following environmental components, as a minimum:
   a) Topography;
   b) Geology / geomorphology;
   c) Soils and geotechnical attributes;
   d) Hydrology and groundwater;
   e) Waste and contamination;
   f) Coastal conditions;
   g) Microclimate (such as prevailing winds, solar orientation and solar shading);
   h) Priority species, habitats and ecosystems (both onsite and those influenced by the site);
   i) Flora and fauna (including wildlife corridors, seasonal uses);
   j) Archaeological features.

v) The NS assessment to illustrate the inter-relationships between environmental components and identify the carrying capacity of the site based on the following:-
   a) Significant Habitats – Assets which are of significant importance (internationally, nationally, regionally and/or locally, including:-
      - Priority Habitats - habitats identified having exceptional value and are highly threatened such as intertidal mudflats, mangrove, vegetated sandy beaches, marine (seagrass, coral) and so on.
      - Priority Species – protect species (flora or fauna) or species determined to be critically endangered (by national and international competent authorities).
   b) Valuable Assets - Any valuable assets, such as features of ecological value, including healthy native trees or shrubs.

vi) The assessment is to identify and map areas to be:

- protected;
- used as mitigation areas;
- enhanced;
- remediated; and/or
- allocated for habitat creation or restoration beyond mitigation and/or
- compensation requirements.

vii) KPIs are to include indicators and targets:

- relating to the following, as a minimum:
- Soil;
- Flora;
- Fauna;
- Microclimate;
- Topography and views;
- Drainage;
- Other targets relating to mitigation of identified environmental constraints; and
- Area of site to be protected, maintained, created or restored.

Table 10-(6):- Pearl - NS-R1 Natural Systems Assessment

Land Ethic 'Members/Keyword'	**Derivations**
Ecological Conscience	Cultural services:- • Knowledge systems • Educational values • Inspiration • Sense of place

Source: - Self

8	**NS-R2: Natural Systems Protection**

Intent:

To protect significant and valuable natural systems assets identified in NS-R1, Natural Systems Assessment.

(1) The Credit Requirements under this category are as under:-

i) Significant or valuable natural system assets (as identified in NS-R1), are adequately protected or that the impacts are either mitigated or compensated.

ii) This credit illustrates 3 types of strategies:

a) Strategy 1 – Protection:

- Each and every significant asset identified in NS-R1 is retained and protected from damage and destruction sufficient to maintain its structure and function.

b) Strategy 2 – Onsite Mitigation:

- Applies to sites where onsite mitigation is required due to the impracticality of protection.

- Each and every significant asset identified in NS-R1 is retained on-site and protected from damage and destruction sufficiently to maintain its existing structure and function.
- Mitigate for impacts through on-site re-establishment of habitat, using similar species diversity as the lost habitat at an area replacement ratio of 2:1.
- Provide for an ecological corridor between the protected habitat area (significant assets) and the mitigation area
- Provide confirmation of the appointment of a management and maintenance organization (with a contract running for at least 5 years) for the project site, if management not to be undertaken by the local municipality.

c) Strategy 3 – Offsite Compensation:

- Applies to sites where offsite compensation is required, due to the impracticality of protection or mitigation
- Compensate for impacts (for the loss of up to 30% of significant assets and 50% of valuable assets) through off-site re-establishment of habitat, using similar species diversity as the lost habitat at an area replacement ratio of 2:1.
- The habitat to be created in the compensation site must be:
  - a similar type to the habitat lost at the development site;
  - of a type appropriate to the compensation site location; and
  - ideally be located in an area surrounded and connected to a similar habitat.

Table 11-(6):- Pearl - NS-R2 Natural Systems Protection

Land Ethic 'Members/Keyword'	Derivations
Land Use	Integrating mitigation measures for protection of natural systems in land use plan benefits in protection of natural systems holistically.
Ecological Conscious Conservation / Preservation/ Recreation	All ecosystem services collectively:- • Provisioning services • Regulating services • Cultural services • Supporting services

Source: - Self

9	NS-R3: Natural Systems Design and Management Strategy

Intent:

To minimize demand for resources, promote soil protection and enhancement and ensure the long term survival and management of landscaped / habitat areas.

(1) The Credit Requirements under this category are as under:-

i) A Natural Systems (NS) design and management strategy has to be prepared that promotes the following whilst ensuring the long term survival and management of the landscape and habitat areas within the site:
   a) Soil protection and enhancement;
   b) Low maintenance requirements; and
   c) Low demand for resources.

ii) The NS design and management strategy must cover all landscape areas, including the management of:
   a) protected, mitigated or compensated assets identified under NS-R2 as a minimum,
   b) any areas of ecological enhancement as identified under NS-3;
   c) any areas of habitat creation and restoration as identified under NS-4; and
   d) any areas identified for food production as identified under NS-5.

(2) The Credit Submission under this category are as under:-

iii) Details of soft and hard landscaped areas;

iv) Details and justification of plant selection (ensuring that only native and adaptive drought and saline tolerant species are specified for habitat areas);

v) Details of strategy for soil testing, protection, enhancement and maintenance;

vi) Irrigation strategy;

vii) Details of landscape maintenance procedures including fertilizer, herbicide and pesticide application;

viii) Details of specific establishment, maintenance and protection requirements for sensitive areas and

ix) Details of monitoring requirements.

Table 12-(6):- Pearl - NS-R3 Natural Design Systems and Management Strategy

Land Ethic 'Members/Keyword'	Derivations
Soils	Regulating services:- • Erosion regulation Supporting services:- • Soil formation • Nutrient cycling • Water cycling
Land Organism	Regulating services:- • Water purification • Waste treatment • Pollination Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling
Land Health	Regulating services:- • Air quality regulation • Climate regulation

	• Water regulation Supporting services:- • Nutrient cycling • Water cycling
Ecological Conscience	Cultural systems:- • Cultural diversity • Spiritual values • Religious values • Knowledge systems • Educational values • Inspiration • Aesthetic values
Conservation / Preservation/ Recreation	Provisioning services:- • Food • Fuel • Genetic resources

Source: - Self

10	NS-1: Reuse of Land

Intent:

To encourage new developments to reuse land that has already been built on and infill existing urban areas rather than using undisturbed land.

(1) The Credit Requirements under this category are as under:-

i) At least 75% of the site area has been previously developed.

a) Previously developed land is classified as any land that is or was occupied by a permanent structure, or impervious surfaces such as hardscape and/or parking areas, including the land up to the plot boundary of the permanent structure and any associated fixed surface infrastructure. It excludes any land occupied by agriculture or forestry and any parks or recreation grounds.

Table 13-(6):- Pearl - NS-1 Reuse of Land

Land Ethic 'Members/Keyword'	Derivations
Soils	Reuse of land aids in protection and preservation of undisturbed land, its soil fertility and its natural drainage systems.
Land Use	Appropriate land use planning helps to escape from the development of untouched land, both at a local and at a city level.
Conservation / Preservation/ Recreation	Provisioning services:- • Genetic resources • Ornamental values • Fresh water Supporting services:- • Soil formation

	• Nutrient cycling • Erosion regulation

Source: - Self

11	NS-2: Remediation of Contaminated Land

Intent:

To encourage and reward the remediation of land for building development.

(1) The Credit Requirements under this category are as under:-

i) An investigative analysis is to be undertaken for sites that are contaminated and proposed for development.

ii) Illustrate adequate remedial steps that will be taken to decontaminate or safely encapsulate the site prior to construction.

iii) The remediation strategy must be suitable for the proposed land use.

iv) Engage a person or organization responsible for overseeing the decontamination operation (from commencement to completion).

Table 14-(6):- Pearl - NS-2 Remediation of Contaminated Land

Land Ethic 'Members/Keyword'	Derivations
Land Health	Regulating services:- • Air quality regulation • Water regulation • Erosion regulation • Water purification • Disease regulation • Pest regulation • Natural hazard regulation

Source: - Self

12	NS-3: Ecological Enhancement

Intent:

To enhance the ecological value of the site.

(1) The Credit Requirements under this category are as under:-

i) Enhancement of the ecological value of the site to be by achieved by planting native or adaptive species.

a) About 50% to 70% plants specified for planting on the site to comprise native and adaptive drought and/or saline tolerant species, including a minimum of 5 to 10 different types of species (with a proven track record to survive and thrive in an environment similar to the proposed site).

Table 15-(6):- Pearl - NS-3 Ecological Enhancement

Land Ethic 'Members/Keyword'	Derivations
Land Organism	Regulating services:-

	• Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Water purification • Waste treatment • Disease regulation • Pest regulation • Pollination • Natural hazard regulation
Ecological Conscience	Cultural services:- • Cultural diversity • Spiritual values • Religious values • Knowledge systems • Educational values
Land Use	Enhancement of ecological values needs a proper integrated land use philosophy, for which ethics towards ecology is mandatory.
Conservation / Preservation/ Recreation	Provisioning services:- • Food • Fiber fuel • Genetic resources • Bio-chemicals • Natural medicines • Pharmaceuticals • Ornamental resources • Fresh water Cultural services:- • Cultural diversity • Religious values • Knowledge systems • Educational values • Recreation • Ecotourism

Source: - Self

13	NS- 4: Habitat Creation and Restoration

Intent:

To restore or re-create a habitat that is connected to other similar habitats and is self sustaining.

(1) The Credit Requirements under this category are as under:-

i) Illustrate measurable strategies to increase the ecological value of the site by creating habitat or restoring pre-existing or degraded remnant natural areas on the site.

ii) The creation of habitat must use native or adaptive drought and / or saline tolerant species.
iii) Where there is no suitable area onsite for restoration or habitat creation, suitable offsite areas may be used to meet this credit.
iv) For onsite habitat creation or restoration:
    a. Demonstrate habitat creation / restoration equivalent to the minimum habitat size for effective habitat function or two (2) times the Minimum Landscape Area, whichever is the greater.
v) For offsite habitat creation or restoration:
    b. Demonstrate habitat creation / restoration equivalent to four (4) times the area of the Minimum Landscape Area.
vi) The off-site habitat creation or restoration area is:
    c. Located within the Emirate of Abu Dhabi;
    d. A degraded habitat;
    e. Located in an area surrounded and connected to a similar habitat to that being created; and
    f. Located outside an area allocated for development within a 2030 plan.
vii) In addition to the above, demonstrate that through collaboration with neighboring land owner(s), ecological corridors are to be created linking the habitat creation / restoration site to similar habitat types located near but beyond the site. Ecological corridors are to be minimum 40m width and landscaped with native and adaptive species.
viii) Where possible, the habitat type to be created is to be located in one area of the site and be connected to the same or similar habitat type either within the site or adjacent to the site.
ix) The habitat creation or restoration strategy is to include the following:
    a. The existing condition of the habitat creation / restoration area and the impacts that have caused or are continuing to cause the degradation or loss of habitat on the site;
    b. The habitat to be created or restored, including justification for the habitat type;
    c. Plans illustrating the location of the habitat creation / restoration area in relation to other areas of the same or similar habitat type and a description of the existing or proposed connections between them (where applicable);
    d. A description of the structure and function of the habitat type, including interrelationships between topography, soil, microclimate, light and shade, flora and fauna and minimum habitat size for effective habitat function;
    e. A strategy for re-creation of the structure and function of the habitat type, linked to a series of KPIs providing the measurement tool for monitoring success of habitat creation or restoration of the site. These are to be based on the KPIs established in NS-R1 and are to include the following as a minimum:
        - Soil,
        - Flora,
        - Fauna,
        - Microclimate,
        - Topography
        - Drainage, and
        - Minimum habitat size for effective habitat function
    f. Plant palette to be used;

g. The methodology for habitat creation or restoration, including grading, soil restoration and seeding or planting of the site and the proposed strategies to mitigate the existing degrading factors; and
h. A 10 year monitoring and management strategy, including monitoring of soil conditions, health, species diversity and abundance and protection requirements.

Table 16-(6):- Pearl - NS- 4 Habitat Creation and Restoration

Land Ethic 'Members/Keyword'	Derivations
Land Organism	Creating a habitat[5] by itself may be considered as a holistic approach towards demonstration of Land Ethic. Such a habitat itself may possibly become a niche for all ecosystem services.
Land Health	
Ecological Conscience	
Conservation / Preservation/ Recreation	

Source: - Self

14 NS-5: Food Systems

Intent:

To create a more localized approach to food with sustainable food production and resident access to high-quality foods.

(1) The Credit Requirements under this category are as under:-
   i) An appropriate site, based on the Environment Agency Abu Dhabi (EAD) Soil Survey and / or local hydrological, soil and microclimatic conditions, has been allocated for food production.
   ii) Food production may be in the form of agricultural production or community garden, or similar.
   iii) A strategy to be prepared for the establishment and long-term management of the site.
   iv) A public space has been allocated for food sale, distribution or exchange and celebration.
   v) A strategy for the use of the public space which identifies the following, as a minimum:
      a) The source of local food crops to be sold or used for celebration purposes at the public space.
      b) The ownership, management strategy and program for use of the public space; and Strategy for educational awareness associated with local food production.

[5] A **habitat** is that geographical unit that effectively supports the survival and reproduction of a given species or of individuals of a given species; the composite of other organisms as well as abiotic factors therein describe the geographical unit. Other organisms include the plants, animals, fungi, bacteria, viruses and protozoans that also live in a given habitat. Abiotic factors include soil types, water availability, temperature, sunlight, air quality and geometric aspects of landforms that facilitate resting, foraging, nesting, mating, metabolic functions and other activities. Source:- http://www.eoearth.org/article/Habitat

Table 17-(6):- Pearl – NS 5 Food Systems

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Knowledge systems • Educational values • Social relations • Sense of place • Recreation
Plants / Animals	Provisioning services:- • Food • Fiber • Fuel • Natural medicines • Ornamental resources • Fresh water Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Pollination Supporting services:- • Photosynthesis • Primary production • Nutrient cycling • Water cycling
Ecological Conscience	Regulating services:- • Cultural systems • Spiritual values • Knowledge systems • Educational values
Land Use	Designation of cropland area for in-house food production needs to be an objective in the land use planning.
Conservation / Preservation/ Recreation	Provisioning services:- • Food • Fiber • Fuel • Genetic resources • Natural medicines • Ornamental resources • Fresh water Regulating services:- • Cultural systems • Spiritual values

	• Knowledge systems Educational values

Source: - Self

15	LC-R1: Plan 2030

Intent:

To ensure that all new development supports the vision for the Emirate of Abu Dhabi, as defined by the applicable Plan 2030, and/or Development Code, and/ or Area Plan.

(1) The Credit Requirements under this category are as under:-

i) The proposed development is located within an Urban Growth Boundary as identified by UPC's adopted Framework Plans.

ii) The proposed development's Floor Area Ratio (FAR), dwelling units per hectare (du/ha), building height, building mass, transportation and open space networks are consistent with the applicable Plan 2030 and/or Development Code and/or Area Plan.

→ What is Plan 2030?[6]

Plan Abu Dhabi 2030 Urban Structure Framework Plan is prepared by the Abu Dhabi Urban Planning Council and approved by the Abu Dhabi Executive Council. "Plan Abu Dhabi 2030", the Urban Structure Framework Plan, is designed to help Abu Dhabi filter and respond to current and future development needs, establish a planning culture and introduce strong guiding principles for new development. This Urban Structure Framework Plan, "Plan Abu Dhabi 2030", is a conceptual document that distils all ideas, themes and directions explored in a stringent process of review and planning. It articulates the conclusions as a clear vision for Abu Dhabi. This Urban Structure Framework Plan is first and foremost grounded in the cultural and environmental identity of Abu Dhabi. The city's population may grow to three million or it may exceed five million by 2030. Regardless, this Plan presents a practical, flexible and sustainable view of the future. The key directions include:

Sustainability: It is essential to accommodate major new population growth without over development, without unnecessarily tearing buildings down, and by conserving and respecting natural and cultural resources. Oil has brought considerable wealth to the city, but it is a finite resource. Abu Dhabi's future lies in the ability to cautiously use existing wealth, to actively explore renewable energy production, to reduce the consumption of non renewable resources and to educate future generations. Resource efficiency is vital.

A Unique Environment: Planning for careful sensitive growth is prudent so that we preserve the critical natural environment that makes Abu Dhabi unique. It is important to identify and conserve these distinct environmental and cultural amenities first and then determine where new development might best be located, striking a balance between conservation and development. Protected areas can always be sensibly developed at a later date, but it is very difficult to reclaim a damaged environment.

[6] Abu Dhabi Urban Planning Council, Urban Structure Framework Plan, Plan Abu Dhabi 2030, September 2007

An Evolving Culture: New development should be designed at a human scale to ensure the city is still pleasant to live in when the population surpasses three million. There should be a range of housing and services, targeting all income levels. Flexibility and creativity will be key to integrating the traditional way of living and simultaneously accommodating the new lifestyle choices that will emerge in a continually evolving culture.

Identity and Opportunity: Abu Dhabi has the rare opportunity to offer a special combination of features in its urban identity: an authentic and safe but also progressive and open Arab city; a personality garnered from the desert and the sea; a traditional way of life but with the latest 21st century options; and a place of business but also of government and culture. The city should be defined as much by the natural islands and dunes surrounding it as the infrastructure, streets, and homes to be developed.

Excellence and Livability: Abu Dhabi needs to define the quality and quantity of development that is acceptable to the city. It is wise to use explicit development principles to evaluate proposed projects and to not succumb to persuasive marketing. The tenets of comfortable and convenient livability must be pervasive in all development decisions.

Connectivity: Abu Dhabi cannot rely solely in the auto when the population reaches three million. The city will need a multi-layered transportation network to connect the downtown core with new growth nodes and the developed islands. In the same sense, connectivity should be apparent in a hierarchical system of formal and informal open spaces and biologically-significant protected areas.

Table 18:- Pearl - LC-R1: Plan 2030

Land Ethic 'Members/Keyword'	Derivations
Land Use	Cultural services:- • Inspiration • Sense of place Merging the vision of Plan 2030 into the development scheme through a medium of rating systems is an innovative way of heading towards the desired futuristic goals at a regional and national level. This serves a dual purpose of making the land sustainable at both the macro and micro level.

Source: - Self

16	LC-R2: Urban Systems Assessment

Intent:

To ensure that, before the design process begins, a thorough understanding of the urban systems influencing the site are considered and assessed.

(1) The Credit Requirements under this category are as under:-

i) An urban systems assessment has to be carried out for the project site and at the following scales:

a) Local
b) Sub-regional
c) Regional scale

ii) Based on the urban systems analysis, identify opportunities and constraints associated with the development and present them in an Urban Systems Assessment Report.
iii) The urban systems analysis must include a detailed assessment of the following elements, as applicable to the various scales:
    a) Location,
    b) Site Access
    c) Population,
    d) Transport,
    e) Economy and Employment,
    f) Land Use,
    g) Densities,
    h) Built Form,
    i) Access and Mobility,
    j) Culturally significant resources, as identified by Abu Dhabi Authority for Culture and Heritage (ADACH),
    k) Open Space,
    l) Community Facilities,
    m) Infrastructure including Utilities and Services,
    n) Easements and Rights of Ways,
    o) Visual and Landscape, and
    p) Micro-climate.

Table 19-(6):- Pearl - LC-R2 Urban Systems Assessment

Land Ethic 'Members/Keyword'	Derivations
Land Use	Before any sort of mitigation process is formulated, an understanding and assessment of the existing conditions and their implications are essential to be carried out thoroughly and documented in detail. Awarding a credit point for the endeavor of assessment processes demonstrates the concern towards the urban landscape at local, sub-regional and regional scales.

Source: - Self

17	LC-R3: Provision of Amenities and Facilities

Intent:
To ensure that a neighborhood's cultural amenities and community facilities are accessible to the greater population, affording social connectivity, interaction and shared public benefit of community resources.

(1) The Credit Requirements under this category are as under:-
    i) The development to have minimum standards on the provision of community facilities as set out in the UPC (Urban Planning Council) community facility requirements.

ii) The location of amenities and facilities to encourage pedestrian and cycle assess through the provision of a network of primary pedestrian walkways and cycle paths.
iii) All primary pedestrian walkways and cycle tracks to be planned within a 350m radius of all amenities and facilities.

Table 20-(6):- Pearl - LC-R3 Provision of Amenities and Facilities

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Spiritual values • Aesthetic values • Social relations • Sense of place • Recreation
Education/ Awareness/Social Interaction	Through a network of pedestrian walkways and cycle tracks social interaction is encouraged which may aid in exchange of ideas and views; exchange of beliefs and culture is encouraged.

Source: - Self

18	LC-R4: Outdoor Thermal Comfort Strategy

Intent:
To increase outdoor thermal comfort during transition months and reduce thermal discomfort during summer months in public spaces and walkways.

(1) The Credit Requirements under this category are as under:-
i) Outdoor thermal comfort strategy has to be employed to identify priority areas for shading and improve the outdoor microclimate for the community.
ii) The strategy is to consider the following as appropriate within the project's specific context:
a) Orientation;
b) Shading;
c) Selection of high-albedo surfaces;
d) Ventilation;
e) Evaporative cooling;
f) Radiative cooling; and
g) Thermal mass.
h) Identify public realm spaces as priority areas for shading, including all :
• Primary and secondary pedestrian walkways;
• Surface car parking; and
• Applicable public open spaces including the following:
• Plazas;
• Playgrounds;
• Pocket parks;
• Barahas; and
• Other public open spaces.

iii) Identify shade provided by buildings and / or structures on these areas.
iv) Identify types of cover or shade measures to be implemented in the project to achieve the minimum % shading (from 40% up to 90%) of applicable public realm spaces such as:-
   a) Car parking
   b) Public open spaces
   c) Pedestrian Walkways
   d) Cycle Tracks
   e) Playgrounds
v) Additionally,
   a) Where cover is provided by structures such as canopies or other architectural elements, the outer surface of the shading element must have a minimum Solar Reflectance Index (SRI) of 29.
   b) Shade from trees is to be measured at 3 years growth.
   c) Public realm spaces shade requirements excludes active recreational areas such as playing fields and ball courts.

Table 21-(6):- Pearl - LC-R4: Outdoor Thermal Comfort Strategy

Land Ethic 'Members/Keyword'	**Derivations**
Waters	Provisioning services:- • Fresh water Regulating services:- • Water regulation • Water purification • Waste treatment Supporting services:- • Nutrient cycling • Water cycling
Plant / Animals	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Natural hazard regulation Supporting services:- • Photosynthesis • Primary production • Nutrient cycling • Water cycling
Land Health	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Water purification • Disease regulation • Natural hazard regulation

Land Use	Regulating services:- • Air quality regulation • Climate regulation

Source: - Self

19	LC-2: Neighborhood Connectivity

Intent:

To achieve a high level of pedestrian/cycle and vehicular connections within the neighborhood and with existing and potential future surrounding developments.

(1) The Credit Requirements under this category are as under:-

i) A high level of vehicular and pedestrian/cycle connectivity at the neighborhood level through the design of street networks and intersections.

ii) Achieve a minimum average Connectivity Index of 1.5, as outlined in the Abu Dhabi Urban Street Design Manual.

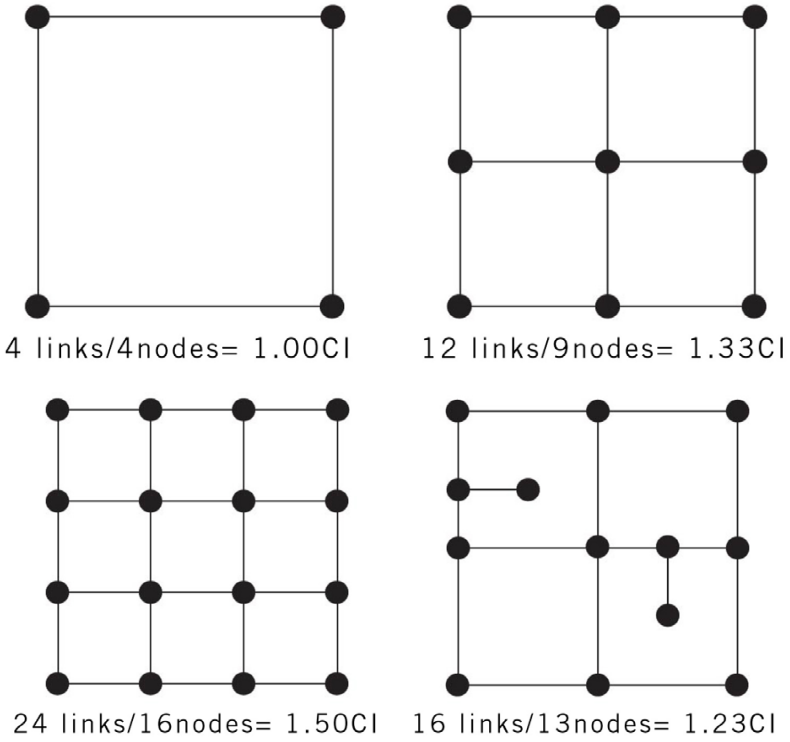


Figure 6-1:- Connectivity Index (CI)
Source:-Abhu Dbahi Urban Street Design manual, Vision 2030, 2010

Table 22-(6):- Pearl - LC-2: Neighborhood Connectivity

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Cultural diversity • Knowledge systems • Educational values • Inspiration

	• Recreation
Land Use	Connectivity (pedestrian, cycle and vehicular) within and with the adjacent development encourages a sense of community living.
Education/ Awareness/Social Interaction	Through a network of pedestrian walkways and cycle tracks social interaction is encouraged which may aid in exchange of ideas and views; exchange of beliefs and culture is encouraged.

Source: - Self

20	LC-3: Open Space Network

Intent:

To create an interconnected network of parks and open space, differing in size, character and purpose to support a variety of human activities and natural systems.

(1) The Credit Requirements under this category are as under:-

i) Provision of an open space and management strategy that illustrates the following:
   a) Compliance with UPC open space standards;
   b) The open space program based on type, hierarchy, character and standards; and
   c) Management strategy.

ii) Propose an accessible interconnected system of open space through the use of greenways and trails.

iii) Suggest the multiple use of open space, with all open spaces serving a minimum of 1 different function, in additions to recreation.

Table 23-(6):- Pearl - LC-R3 Open Space Network

Land Ethic 'Members/Keyword'	Derivations
Land Organism	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Water purification • Disease regulation • Pest regulation • Pollination
Ecological Conscience	Provisioning services:- • Food • Fiber • Fuel • Genetic resources • Natural medicines • Ornamental resources.
Land Use	Interconnected network of parks and open space is achievable through a thoughtful process and

	applications of land use planning.

Source: - Self

21	LC-5: Housing Diversity

Intent:

To encourage a diverse mix of residential properties in neighborhoods.

(1) The Credit Requirements under this category are as under:-

i) The development's proposed housing program results in a minimum housing diversity of at least 0.6.

ii) Product options that support housing diversity are:

a) Small Apartment (studio, 1bed, 2bed)
b) Larger Apartment (3+bed)
c) Small Villa House (2bed,3bed)
d) Larger Villa House (4+bed)
e) Small Townhouse (2bed, 3 bed)
f) Large Townhouse (4+ bed)

iii) The formula for the Housing Diversity Indicator is based on the Simpson Diversity Index and is as follows:

$$\underline{1 - \sum (n/N)2}$$

Where: n = the total number of dwellings in a particular house type

N = the total number of dwellings in all categories

Table 24-(6):- Pearl - LC-5 Housing Diversity

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural values:- • Cultural diversity • Religious values • Knowledge systems • Educational values • Inspiration • Social relations

Source: - Self

22	LC-6: Community Walkability

Intent:

To improve public health, enhance mobility, reduce reliance on automobiles and improve the vitality of the community through an enhanced pedestrian environment.

(1) The Credit Requirements under this category are as under:-

i) Fully connected network of pedestrian routes with a Direct Route Index of less than 1.5, as defined in the UPC Urban Street Design Manual

ii) Compliance with the minimum Urban Heat Reduction Credit RE-2 requirements.

iii) Full compliance with Abu Dhabi Urban Braille Guidelines for all pedestrian routes and community facilities;

iv) Provide a resting place at least every 350m along all primary pedestrian walkways that is 100% shaded.
v) Meet the Universal Design Guidelines contained in the Abu Dhabi Urban Street Design Manual
vi) Provide a resting place at least every 350m along all primary pedestrian walkways that is 100% shaded.

→ Direct Route Index

Direct Route Index is calculated by the following equation:
DRI = d ÷ a
Where:
d = direct path i.e. as the crow flies
a = actual path distance
DRI = Direct Route Index

→ What is Universal Design?[7]

Design techniques that accommodate all people, including pedestrians requiring special mobility consideration, pedestrians pushing strollers and delivery carts and pedestrians that use personal mobility devices.

Table 25-(6):- Pearl - LC-6 Community Walkability

Land Ethic 'Members/Keyword'	Derivations
Community	Regulating systems:- • Air quality regulation • Climate regulation Cultural services:- • Inspiration • Recreation

Source: - Self

23	LC-7: Active Urban Environments

Intent:

To encourage active lifestyles by providing building occupants and users with recreational public open spaces.

(1) The Credit Requirements under this category are as under:-
i) Outdoor spaces have been provided and programmed to encourage activity, including sport and recreation. The spaces must be specifically developed for any of, or any combination of, the following:
a) Landscaped areas for recreation;
b) Playground areas; and/or
c) Sports field areas.
ii) An Active Urban Environment Program which details the programming of spaces for the following types of uses to be developed and implemented:

[7] Abu Dhabi Urban Street Design Manual, 2010

a) Communal;
b) Women and children only; and
c) Men only.

Table 26-(6):- Pearl - LC-7 Active Urban Environments

Land Ethic 'Members/Keyword'	Derivations
Conservation / Preservation/ Recreation	Cultural services:- • Inspirations • Social relations • Sense of place • Recreation

Source: - Self

24	LC-9: Improved Outdoor Thermal Comfort

Intent:
To improve outdoor thermal comfort during transition months and further reduces thermal discomfort during summer months in public spaces and walkways.

(1) The Credit Requirements under this category are as under:-
i) Exemplify that outdoor thermal comfort has been improved in priority realm spaces (beyond the minimum established under credit LC-R4 Outdoor Thermal Comfort Strategy) by increasing the shade measures or adding heat purge strategies.
ii) Exemplify strategies for the promotion of beneficial air movement as a heat purging mechanism.
iii) Strategies may include the following:
a) Suitably sized and positioned openings on opposite sides of courtyards;
b) Wind towers that direct wind to street level;
c) Open vegetated walls that allow air movement and block solar heat;
d) Building down washing;
e) Other passive means to encourage wind ventilation into public realm areas such as green fingers / channels aligned to prevailing wind directions.
iv) Public Realm spaces include:
a) Exterior Surface car parking
b) Public Open Spaces
c) Pedestrian Walkway
d) Cycle Tracks

Table 27-(6):- Pearl - LC-9: Improved Outdoor Thermal Comfort

Land Ethic 'Members/Keyword'	Derivations
Plants / Animals	Regulating services:- • Air quality regulation • Climate regulation • Pollination Supporting services:- • Soil formation

	• Photosynthesis • Primary production • Nutrient cycling • Water cycling • Erosion regulation
Land Health	Regulation services:- • Water regulation • Erosion regulation • Water purification • Waste treatment • Disease regulation • Pest regulation • Pollination Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling • Erosion regulation

Source: - Self

25	LC-10: Regionally Responsive Planning

Intent:

To reflect the unique climatic, social and historical influences of the site and region in the community plan.

(1) The Credit Requirements under this category are as under:-

i) The master plan and detailed design standards have evolved in response to the region's climatic, landscape and historic urban design traditions through the following:

a) Use of climate analysis applying it to the design of streets, sikkak (pathways), barahaat (communal spaces) and open spaces to take advantage of prevailing breezes and shade.

b) The design to be based on a fareej form (housing cluster) surrounding a meydaan (central plaza) associated with a community use.

c) Provide barahaat which are designed to:

- accommodate passive cooling design principles (utilizing prevailing breezes and shading);
- provide a minimum 60% area shaded either by adjacent buildings or shading structures; &
- serve a function, determined by the connecting sikka destination.

Table 28-(6):- Pearl - LC-10: Regionally Responsive Planning

Land Ethic 'Members/Keyword'	Derivations
Land Health	Regulating services:- • Air quality regulation • Climate regulation
Land Use	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation Opting for the principles of passive design strategies in land use planning benefits in obtaining the thermal and visual comfort in the development.
Conservation / Preservation/ Recreation	Cultural services:- • Cultural diversity • Religious values • Knowledge systems • Educational values • Sense of place • Cultural heritage values

Source: - Self

26	LC-12: Safe and Secure Community

Intent:

To provide a safe and secure environment for the community's occupants and visitors.

(1) The Credit Requirements under this category are as under:-

i) Formulate appropriate safety and security risk mitigation for the development

ii) Use the following documents as a means to demonstrate that safety and security has been incorporated into the development's planning and design stages:

→ Safety & Security Risk Assessment;

→ Safety & Security Strategy; and

→ Safety & Security Layout Plan.

Table 29-(6):- Pearl - LC-12 Safe and Secure Community

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Social relations • Sense of place

Source: - Self

27 PW-R1: Community Water Strategy

Intent:

To develop and integrate a comprehensive water strategy during the early stages of design with the goal of minimizing the overall water consumption and establishing a project water balance.

(1) The Credit Requirements under this category are as under:-

i) Overall Strategy:

a) Demonstrate that a water strategy has been developed for the community which covers each of the following public realm items:

- Irrigation;
- Water features;
- District cooling; and
- Storm water.

ii) Community Water Balance:

a) Determine the community-wide water balance between the available building wastewater and public realm irrigation, heat rejection and water feature demands.

iii) Minimum Prescriptive Irrigation Requirements:

a) Demonstrate that the average landscape irrigation requirement for all public realm areas achieve the following:

- All public park landscaping in aggregate does not require more than 10 l/m2/day;
- All streetscape landscaping in aggregate does not require more than 7 l/m2/day; and
- All remaining landscaping in aggregate does not exceed 4 l/m2/day.

Table 30-(6):- Pearl - PW-R1 Community Water Strategy

Land Ethic 'Members/Keyword'	Derivations
Waters	Provisioning services:- • (conservation of) fresh water
Plants / Animals	Cultural services:- • Knowledge systems • Educational values • Sense of place (by using local and indigenous species)

Source: - Self

28 PW-R2: Building Water Guidelines

Intent:

To focus the design and development team on promoting water conservation in buildings within the community.

(1) The Credit Requirements under this category are as under:-

i) Building Guidelines have been developed, based on analysis, which identifies the most efficient measures for reducing the water consumption of buildings within the community.

ii) At a minimum the analysis must cover the following:

a) Fixtures and fittings
- Kitchen taps;
- Bathroom taps;
- Toilets;
- Urinals;
- Bidets;
- Showers; and
- Ablution facilities

b) Appliances
- Dishwashers; and
- Clothes washing machines.

c) Landscaping
- Plant Selection;
- Irrigation; and
- Water Features.

d) Heat Rejection
- District cooling; and
- Onsite heat rejection.

Table 31-(6):- Pearl - PW-R2 Building Water Guidelines

Land Ethic 'Members/Keyword'	Derivations
Waters	Provisioning services:- • Fresh water Regulating services:- • Water regulation Supporting services:- • Soil formation • Nutrient cycling • Water cycling
Plants / Animals	Provisioning services:- • (conservation of) fresh water

Source: - Self

29	PW-R3: Water Monitoring and Leak Detection

Intent:
To reduce loss of water associated with leaks, system degradation, or failure.

(1) The Credit Requirements under this category are as under:-

i) Monitoring:

a) Easily accessible and clearly labeled water meters are to be provided and capable of monitoring the water consumption of, at a minimum, the following major uses (where present):
- Building plots, divided into occupancy type (office, retail, residential, school etc);

- Irrigation (public realm);
- District cooling plants;
- Water Features (public realm); and
- Any other major community water requirements (e.g. water parks etc).

ii) Leak Detection:

b) Water transmission and distribution facilities are to be designed and installed with water meters in order to monitor the water network and be capable of detecting major system-wide leaks.

Table 32-(6):- Pearl - PW-R3 Water Monitoring and Leak Detection

Land Ethic 'Members/Keyword'	Derivations
Waters	Provisioning services:- • Fresh water Regulating services:- • Water regulation Supporting services:- • Soil formation • Nutrient cycling • Water cycling
Conservation / Preservation/ Recreation	Provisioning services:- • (conservation of) fresh water

Source: - Self

30	PW-1.1: Community Water Use Reduction: Landscaping

Intent:

To encourage water efficient public realm landscape design through plant selection, irrigation technologies and management, and the use of recycled water.

(1) The Credit Requirements under this category are as under:-

i) Plant Selection:

a) The average irrigation requirement for all public realm areas to achieve the following:-

- All public parks landscaping in aggregate does not require more than 8 l/m2/day or 6 l/m2/day or 4 l/m2/day.
- All streetscape landscaping in aggregate does not require more than 5 l/m2/day or 3 l/m2/day.
- All remaining landscaping in aggregate does not require more than 2 l/m2/day or 0 l/m2/day

ii) Irrigation System:

a) Water Efficient Irrigation System has to be incorporated into all public realm landscaping.

iii) Irrigation System Management:

a) Irrigation Operation and Maintenance Plan has to be developed.

iv) Recycled Water:

a) The community's irrigation demand can be served using the Exterior Water Allowance.
b) In case, where recycled water is not immediately available to meet all irrigation demands, a recycled water mainline loop has been installed which allows for the future switch from potable to recycled water for exterior irrigation demands when it becomes available.

(2) How to calculate Average Irrigation Demand?
i) The average irrigation requirement of landscaped areas is determined as follows:

$$\text{Average Irrigation Demand} = \frac{I_S}{A_L}$$

IS = Total annual average irrigation demand of softscape area (liters/day)
AL = Landscaped area referring to public parks, streetscape and / or remaining landscape.

ii) Public realm landscaped area refers to the entire site excluding all water features, swimming pool areas and building plots, and is made up of all hardscape and softscape areas.

(3) How to calculate Exterior Water Allowance?
i) The Exterior Water Allowance, EWA, that is available to serve the community's exterior water demand is determined based on the values used within PW-R1 Community Water Strategy as follows:

$$E_{WA} = \sum B_W x E_M$$

Where, BW = Building Water Consumption, EM = Municipal Recycled Water Efficiency

Table 33-(6):- Pearl - PW-1.1 Community Water Use Reduction: Landscaping

Land Ethic 'Members/Keyword'	Derivations
Soils	Regulating services:- • Erosion regulation
Waters	Provisioning services:- • Fresh water Regulating services:- • Water regulation Supporting services:- • Nutrient cycling • Water cycling
Land Pyramid	Supporting services:- • Nutrient cycling • Water cycling (through reuse of water)
Conservation / Preservation/ Recreation	Provisioning services:- • Fresh water

Source: - Self

31 PW-1.2: Community Water Use Reduction: Heat Rejection

Intent:

To reduce potable water use for heat rejection by promoting the use of recycled water and / or alternatives to water based heat rejection.

(1) The Credit Requirements under this category are as under:-

i) In case Water Cooled District Cooling (DC) is present, the network is connected to at least 35% of the community's buildings based on Gross Floor Area (GFA)

ii) Where recycled water is not immediately available to all DC plants, a recycled water mainline loop has to be installed which allows for the future switch from potable to recycled water in DC plants when it becomes available.

Table 34-(6):- Pearl - PW-1.2 Community Water Use Reduction: Heat Rejection

Land Ethic 'Members/Keyword'	Derivations
Waters	Provisioning services:- • (conservation of) Fresh water
Land Pyramid	Supporting services:- • Nutrient cycling • Water cycling (through reuse of water)
Conservation / Preservation/ Recreation	Provisioning services:- • Fresh water

Source: - Self

32 PW-1.3: Community Water Use Reduction: Water Features

Intent:

To reduce potable water use in exterior water features by minimizing evaporative loss and through the use of recycled water.

(1) The Credit Requirements under this category are as under:-

i) The water make-up requirements for all exterior water features in the public realm can be served using the Exterior Water Allowance.

ii) All external swimming pools are supplied with permanently installed retractable pool blankets.

iii) There are no exterior water features or swimming pools within the public realm.

iv) Where recycled water is not immediately available to all water features, demonstrate that a recycled water mainline loop has been installed which allows for the future switch from potable to recycled water for exterior water feature demands when it becomes available.

Table 35-(6):- Table 6-35:- Pearl - PW-1.3 Community Water Use Reduction: Water Features

Land Ethic 'Members/Keyword'	Derivations
Waters	Provisioning services:- • (conservation of) Fresh water
Land Health	Supporting services:-

	• Nutrient cycling • Water cycling (through reuse of water)
Conservation / Preservation/ Recreation	Provisioning services:- • Fresh water

Source: - Self

33	PW-2: Storm Water Management

Intent:

To minimize peak storm water discharge and protect the storm water drainage system and receiving water bodies from pollutant loading during and after storm events.

(1) The Credit Requirements under this category are as under:-

i) Quantity Control:

a) Project has to develop a storm water management system that prioritizes infiltration, sustainable urban drainage systems, and utilizes structural solutions when necessary.

b) The post-development peak runoff rate and quantity from the 2-year 24-hour design storm does not exceed the predevelopment peak runoff rate and quantity through structural methods, or a combination of both structural and non-structural methods or through the use of non-structural methods only.

ii) Quality Control:

a) The proposed storm water management system is capable of collecting and treating a minimum of 90% of storm water and that the treatment process is capable of achieving the following minimum standards for quality control:

- 80% removal of Total Suspended Solids (TSS);
- Minimum 95% removal of litter (gross pollutants, >1mm);
- Minimum 90% removal of hydrocarbons; and
- Use of petrol interceptors or suitable permeable paving for car parks of more than 4 bays

iii) Operation & Maintenance Plan:

a) Illustrate that the Operation & Maintenance Plan (OMP) is in place that shows how all systems will be maintained throughout the life of the development.

b) The plan should include at a minimum:

- Protocol for maintaining regular system checks and maintenance
- Methods for ensuring neighboring developments will not be adversely affected by the project's storm water strategy
- Strategies to prevent onsite erosion

(2) Note:

i) Non-structural storm water management solutions include sustainable urban drainage systems (SUDS) such as ponds, vegetated swales, wetlands etc.

ii) Structural storm water management solutions include engineered structures such as pipes, concrete channels etc.

iii) All water infiltrated through SUDS is considered to be 100% treated, achieving all the required quality control standards

Table 36-(6):- Pearl - PW-2 Storm water Management

Land Ethic 'Members/Keyword'	Derivations
Soils	Regulating services:- • Erosion regulation
Waters	Regulating services:- • Water regulation • Water purification • Natural hazard regulation Supporting services:- • Nutrient cycling • Water cycling
Ecological Conscience	Regulating services:- • Water regulation • Water purification • Natural hazard regulation Supporting services:- • Nutrient cycling • Water cycling

Source: - Self

34 PW-3: Water Efficient Buildings & Plots

Intent:

To promote reductions in the water consumption of buildings and associated plots within the community as well as limit the size and burden on the community infrastructure.

(1) The Credit Requirements under this category are as under:-

i) Set water reduction targets for the interior water use of all buildings within the community using the Pearl Rating System Building and Villa Water Calculator.

ii) Demonstrate that the average Water Reduction Target achieves and improvement ranging from 16% to 40% and above compared to the baseline building performance.

iii) Develop extended guidelines for representative buildings within the community elaborating how the proposed target may be achieved.

iv) Average landscape irrigation demand of all building plots within the community to be 4 liters/m2/day or 2 liters/m2/day.

Table 37-(6):- Pearl - PW-3 Water Efficient Buildings & Plots

Land Ethic 'Members/Keyword'	Derivations
Water	Provisioning services:- • (conservation of) Fresh water
Conservation / Preservation/ Recreation	Provisioning services:- • Fresh water

Source: - Self

35 RE-R1: Community Energy Strategy

Intent:

To focus the design and development team on energy conservation through demand reduction and efficient generation and distribution, while making informed decisions about the implications of renewable energy strategies.

(1) The Credit Requirements under this category are as under:-

i) The energy strategy has to be developed for the community which included analysis of the following at a minimum:

a) Climate analysis and response;
b) Street orientation;
c) Building orientation, massing and layout;
d) Shading strategies;
e) District energy systems; and
f) Renewable energy generation.

Table 38-(6):- Pearl - RE-R1 Community Energy Strategy

Land Ethic 'Members/Keyword'	Derivations
Plants / Animals	Regulating services:- • Air quality regulation • Climate regulation
Land Use	Provisioning services:- • Food By making use of organic wastes from plants and feedstock to generate fuel, a considerable amount of waste is avoided from entering into the land fill, thus preventing the deterioration of valuable good quality land.

Source: - Self

36 RE-R2: Building Energy Guidelines

Intent:

To focus the design and development team on promoting energy conservation in buildings within the community.

(1) The Credit Requirements under this category are as under:-

i) Building guidelines have been developed based on analysis which identifies the most efficient measures for reducing the energy consumption of buildings within the community. The analysis should cover the following at a minimum:

a) Passive design strategies
b) Building orientation;
c) Building glazing ratio;
d) Building envelope parameters; and
e) Shading strategies.

Table 39-(6):- Pearl - RE-R2 Building Energy Guidelines

Land Ethic 'Members/Keyword'	Derivations
Plants / Animals	Regulating services:- • Air quality regulation • Climate regulation
Land Use / Policy	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation Cultural services:- • Knowledge systems • Educational values • Inspiration Opting for the principles of passive design strategies in land use planning benefits in obtaining the thermal and visual comfort in the development.

Source: - Self

37	RE-1: Community Strategies for Passive Cooling

Intent:

To improve outdoor microclimates through early community design and land use decisions.

(1) The Credit Requirements under this category are as under:-

i) The development has to consider, evaluate and incorporate passive cooling strategies to improve the outdoor microclimate and building energy performance.

ii) Conceptual Analysis:

a) A conceptual solar and wind analysis to be undertaken to determine street orientation, block size and shape, building massing and landscaping to promote shading and appropriate wind flows for passive cooling and improved pedestrian comfort.

b) Following strategies may be considered for incorporation into the community design:

- Orientate streets so that more than 65% of the total street length is aligned within 15 degrees of true East-West orientation;
- Arrangement of building mass, height and frontage in a staggered fashion to prevent wind flow becoming stagnant;
- Align streets within 15 degrees of the appropriate prevailing wind direction;
- Provision of linear parks or vegetated corridors parallel to the prevailing wind direction to ventilate urban areas;
- Provision of shelter belts that protect the community from drifting sand;
- Wind towers that direct appropriate winds to street level;
- For sites with waterfront edges: conservation or provision of a green or landscaped edge along 90% of the development's waterfront to cool incoming breezes, along with stepping of building heights away from the waterfront edge to ensure breezes are not obstructed;

- For sites with no waterfront edges: provision of a green or landscaped edge along 90% of the development's prevailing wind boundary to cool incoming breezes.

iii) Advanced Analysis Techniques:
   a) Use of advanced solar and wind analysis techniques (e.g. solar exposure analysis, computational fluid dynamic (CFD) modeling, wind tunnel testing etc) to optimize the performance of the selected strategies. The analysis must consider the effects of solar radiation, wind, air temperature, surface radiant temperature and humidity.

(2) Note:
   i) Conceptual Solar and Wind Analysis should include analysis of how the following vary over an entire year:
      a) Solar altitude and azimuth
      b) Solar radiation
      c) Prevailing wind direction
      d) Wind speed
      e) Wind temperature
      f) Wind humidity

Table 40-(6):- Pearl - RE-1 Community Strategies for Passive Cooling

Land Ethic 'Members/Keyword'	Derivations
Waters	Regulating services:- • Water regulation • Water purification Supporting services:- • Nutrient cycling • Water cycling
Plants / Animals	Regulating services:- • Air quality regulation • Climate regulation • Pest regulation • Pollination • Natural hazard regulation Supporting services:- • Photosynthesis • Primary production • Erosion regulation
Land Organism	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Waste treatment • Disease regulation • Pest regulation • Pollination

	• Natural hazard regulation
Land Health	Supporting services:- • Soil formation • Photosynthesis • Primary production • Nutrient cycling • Water cycling • Erosion regulation
Conservation / Preservation/ Recreation	Provisioning services:- • Food • Fuel • Genetic resources • Natural medicines • Ornamental resources • Fresh water

Source: - Self

38 RE-2: Urban Heat Reduction

Intent:

To improve outdoor microclimates through the reduction of urban heat buildup.

(1) The Credit Requirements under this category are as under:-

i) A combination of the following has to be applied to all community hardscape areas excluding roads:

a) Provide shade such as that from canopies, solar panels, vegetation, building form etc measured at 12pm solar time on the summer solstice; and

b) Use materials with a minimum Solar Reflective Index (SRI) of 29.

(2) Note:

i) Where shading is provided by structures such as canopies or other architectural elements (excluding solar panels), the outer surface of the shading element must have a minimum Solar Reflective Index (SRI) of 29.

ii) Any shading from trees should be measured at 3 years estimated growth.

Table 41-(6):- Pearl - RE-2 Urban Heat Reduction

Land Ethic 'Members/Keyword'	Derivations
Plants / Animals	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Waste treatment • Disease regulation • Pest regulation • Pollination

Source: - Self

39	SM-R2: Basic Construction Waste Management

Intent:

To reduce the long-term environmental impacts associated with construction waste collection, transport and disposal.

(1) The Credit Requirements under this category are as under:-

i) The general contractor working collaboratively with all sub- subcontractors and specialty contractors (e.g. demolition) on the community's infrastructure and public realm works developed a Construction and Demolition Waste Management Plan (CDWMP) prior to the start of construction and demolition activities.

ii) The Plan must identify the materials to be diverted from landfill and indicate whether the materials will be segregated on-site or co-mingled. If materials are planned for salvage, the plan must indicate their planned use.

iii) The contractor has to implement monthly monitoring of the CDWMP.

iv) Achieve a minimum final recycling/salvage rate of 50% of construction and demolition waste (by weight or volume and excluding hazardous waste that must undergo specialized treatment).

Table 42-(6):- Pearl - SM-R2 Basic Construction Waste Management

Land Ethic 'Members/Keyword'	Derivations
Soils	Provisioning services:- • Food By reuse of construction material for subsidiary uses such as roads, pavements etc. the same can be prevented to enter into the land fill, thus preventing the deterioration of valuable good quality land.

Source: - Self

40	SM-R3: Basic Operational Waste Management

Intent:

To reduce the long-term environmental impacts associated with operational waste collection, transport and disposal.

(1) The Credit Requirements under this category are as under:-

i) Operational Waste Management has to be addressed from the concept stage.

ii) The design and development team must address the following as minimum:-

a) Annual estimates of operational waste (in buildings and public realm).

b) Existing and planned waste management infrastructure.

c) Proposed options for diverting waste from landfills and incarnation with a minimum targeted diversion rate of 40% by weight or volume of the total operational waste generated at full occupancy.

d) Provision of adequately sized waste management facilities including:

- Collection and storage facilities for recyclables, general waste and hazardous waste, and

- Treatment facilities (e.g. composting, anaerobic digestion energy from waste) where appropriate; and

e) Adequate vehicular access for waste handling vehicles.

Table 43-(6):- Pearl - SM-R3 Basic Operational Waste Management

Land Ethic 'Members/Keyword'	Derivations
Soils	Provisioning services:- • Food By making use of organic wastes from plants and feedstock to generate fuel, a considerable amount of waste is avoided from entering into the land fill, thus preventing the deterioration of valuable good quality land.
Land Pyramid	Regulation services:- • Waste treatment Supporting services:- • Nutrient cycling • Water cycling

Source: - Self

41	SM-2: Regional Materials

Intent:

To encourage the selection of materials that have reduced transport impacts and promote regional economies.

(1) The Credit Requirements under this category are as under:-

i) Illustrate that the transport distance traveled by materials (representing 10% to 20% of total material cost) is not greater than 500 km from the furthest point of origin to the project site.

ii) Any material sent by airfreight at any point during their transport does not qualify for this credit.

iii) Applies to material used in construction of infrastructure and public realm (including urban furniture).

(2) Note:-

Details of materials including location(s) of extraction/harvest/recovery/manufacture; distance traveled and means of transport to be furnished.

Table 44-(6):- Pearl - SM-2 Regional Materials

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Cultural diversity • Knowledge systems • Educational values • Inspiration • Aesthetic values

	• Sense of place • Cultural heritage values

Source: - Self

42	SM-3: Recycled Materials

Intent:

To increase the demand for recycled materials and therefore reduce the amount of waste going to disposal.

(1) The Credit Requirements under this category are as under:-

i) To demonstrate that recycled materials are used in the development's infrastructure and public realm (including furniture) as follows:

ii) Recycled aggregated:

a) 15% to 30% of all aggregates used are recycled.

iii) Cement Replacement:

a) Use of supplementary cementing materials (SCMs) (including fly ash, ground granulated blast furnace slag (GGBFS) and silica fumes) or the increased use of aggregates or admixtures, that the project has reduced the overall amount of Portland cement used and associated embodied greenhouse gas emissions

iv) Other materials:

a) Any combination of materials with the following characteristics constitutes at least 10% of the Total Material Cost:

- Minimum 30% post-consumer recycled content;
- Minimum of 80% post-industrial content;
- 50% agricultural waste by-product.

Table 45-(6):- Pearl - SM-3 Recycled Materials

Land Ethic 'Members/Keyword'	Derivations
Soils	The recycling of waste materials aids in preventing them entering into landfill sites, thus preserving a valuable resource – land.
Land Pyramid/Cycle	Regulating services:- • Waste treatment Supporting services:- • Nutrient cycling • Water cycling

Source: - Self

43	SM-4: Reused or Certified Timber

Intent:

To encourage the use of timber sourced from legal and sustainable sources.

(1) The Credit Requirements under this category are as under:-

i) A proportion (by cost) of the timber and composite wood products used on the project in relation to public realm and right-of-way works is reused OR certified (with chain of Custody Certification).
ii) All timber is legally sourced and not on the CITES (Convention on International Trade in Endangered Species) list of endangered species.
iii) Following are the certification schemes for timber:
- Forest Stewardship Council (FSC), or
- Program for the Endorsement of Forest Certification scheme (PEFC) or the following national schemes endorsed by PEFC: the Canadian Standards Association, CSA, the Sustainable Forestry Initiative SFI and the Malaysian Timber Certification Scheme MTCS.

Table 46-(6):- Pearl - SM-4 Reused or Certified Timber

Land Ethic 'Members/Keyword'	Derivations
Plants / Animals	Provisioning services:- • Food • Fiber • Fuel • Genetic resources • Biochemicals • Natural medicines • Ornamental resources • Fresh water
Land Pyramid/Cycle	Regulating services:- • Waste treatment Supporting services:- • Nutrient cycling • Water cycling

Source: - Self

44 SM-5: Improved Construction Waste Management

Intent:
To further reduce the long-term environmental impacts associated with construction waste collection, transport and disposal.

(1) The Credit Requirements under this category are as under:-
i) Demonstrate that the Contractor implemented monthly monitoring of the CDWMP and achieved a minimum final recycling/salvage rate of 60% to 70% of construction and demolition waste (by weight or volume).

Table 47-(6):- Pearl - SM-5 Improved Construction Waste Management

Land Ethic 'Members/Keyword'	Derivations
Ecological Conscience	Regulating services:- • Waste treatment • Disease regulation

	• Pest regulation Supporting services:- • Soil formation • Nutrient cycling • Water cycling

Source: - Self

45	SM-6: Improved Operational Waste Management

Intent:

To further reduce the long-term environmental impacts associated with operational waste collection, transport and disposal.

(1) The Credit Requirements under this category are as under:-

i) Develop and implement an Operational Waste Management Plan (OWMP) that includes measures for diverting waste from landfills and incineration to meet the targeted diversion rates of 50% to 60% of the total operational waste generated at full occupancy (by weight or volume).

Table 48-(6):- Pearl - SM-6 Improved Operational Waste Management

Land Ethic 'Members/Keyword'	Derivations
Ecological Conscience	Regulating services:- • Waste treatment • Disease regulation • Pest regulation Supporting services:- • Soil formation • Nutrient cycling • Water cycling

Source: - Self

46	SM-7: Organic Waste Management

Intent:

To encourage the recovery and reuse of organic waste from the development's operations including landscaping and food waste.

(1) The Credit Requirements under this category are as under:-

i) Illustrate the provision of onsite location(s) for the collection and/or composting of organic waste generated onsite.

a) Projects where only the collection and/or treatment of landscaping waste OR food waste is provided.

b) Projects where the collection and/or treatment of both landscaping and food waste are provided.

Table 49-(6):- Pearl - SM-7 Organic Waste Management

Land Ethic 'Members/Keyword'	Derivations
Soils	Regulating services:- • Waste treatment Supporting services:- • Soil formation • Nutrient cycling • Water cycling
Plants / Animals	Regulating services:- • Waste treatment Supporting services:- • Photosynthesis • Primary production • Nutrient cycling • Water cycling • Erosion regulation
Land Pyramid	Regulating services:- • Waste treatment Supporting service:- • Nutrient cycling • Water cycling
Ecological Conscience	Supporting services:- • Soil formation • Nutrient cycling • Water cycling • Erosion regulation

Source: - Self

47	SM-8: Hazardous Waste Management

Intent:

To ensure the safe handling of hazardous waste in order to minimize pollution to the ground, water and air.

(1) The Credit Requirements under this category are as under:-

i) Provision of at least one location point for the safe collection of potentially hazardous consumer waste such as paints, batteries and oil.

Table 50-(6):- Pearl - SM-8 Hazardous Waste Management

Land Ethic 'Members/Keyword'	Derivations
Soils	Regulating services:- • Waste treatment Supporting services:- • Soil formation • Nutrient cycling • Water cycling
Waters	Provisioning services:-

	Fresh water (By negating the probability of water pollution through hazardous wastes entering into the water channels).
Ecological Conscience	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Diseases regulation Supporting services:- • Soil formation • Nutrient cycling • Water cycling • Erosion regulation

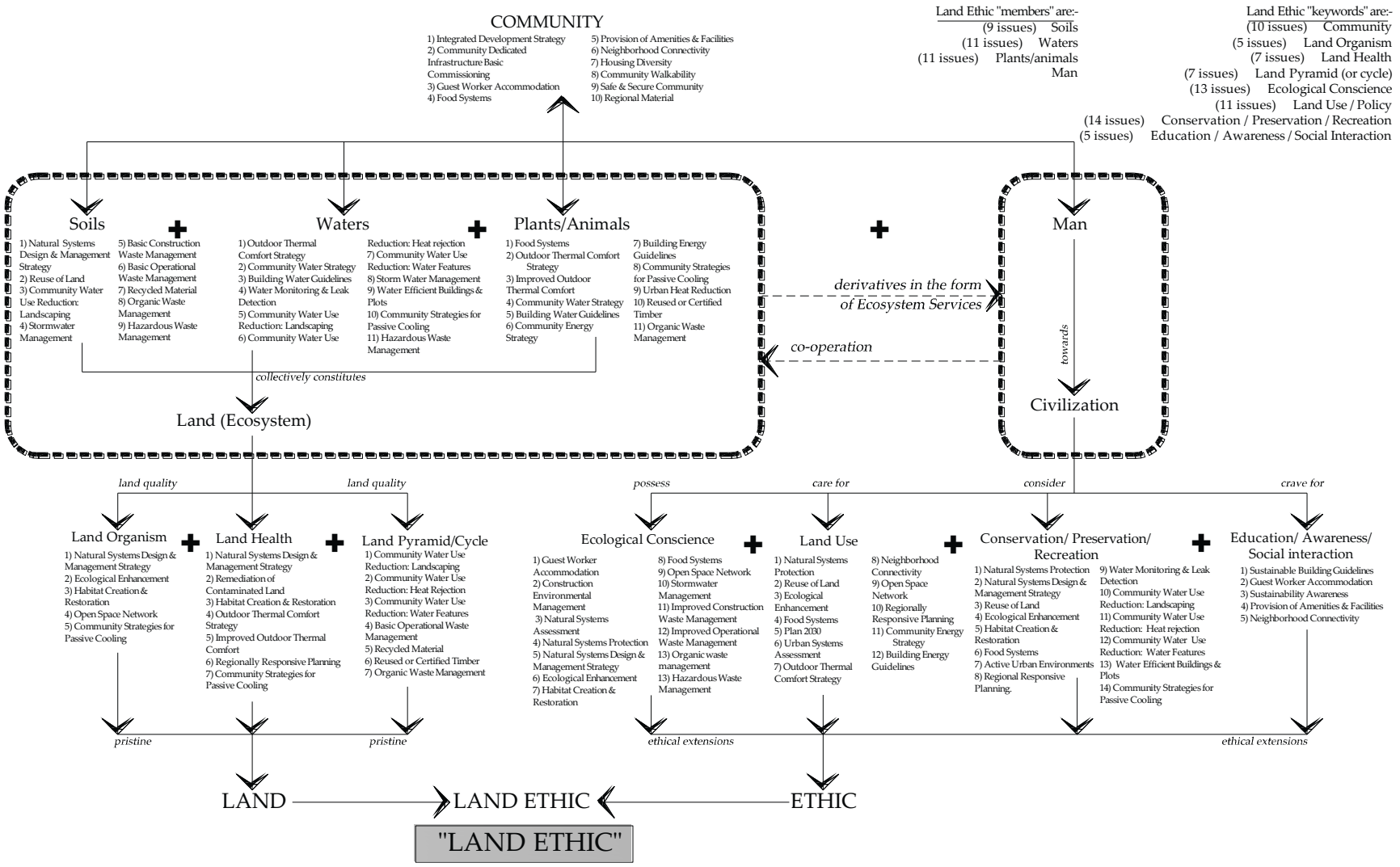
Source: - Self

6.3. Pearl versus Land Ethic Model

→ Deriving the Pearl Land Ethic Model:-

The Pearl Land Ethic Model 1-(6) is derived after an analysis of each Pearl issue and the individual sub issues that are considered for the achievement of credit points. On basis of the issues and sub-issues, they are being assigned under the appropriate category of Land Ethic members and keywords. A total in terms of (a) the number of issues (or efforts) involved and (b) in terms of the credit points is arrived at (called as scoreboards).

These scoreboards are useful in a comparative analysis of the three rating systems (as seen in Chapter 8).



Land Ethic Model 1-(6):- Pearl Land Ethic Model

6.4. Pearl Scoreboards & Conclusion

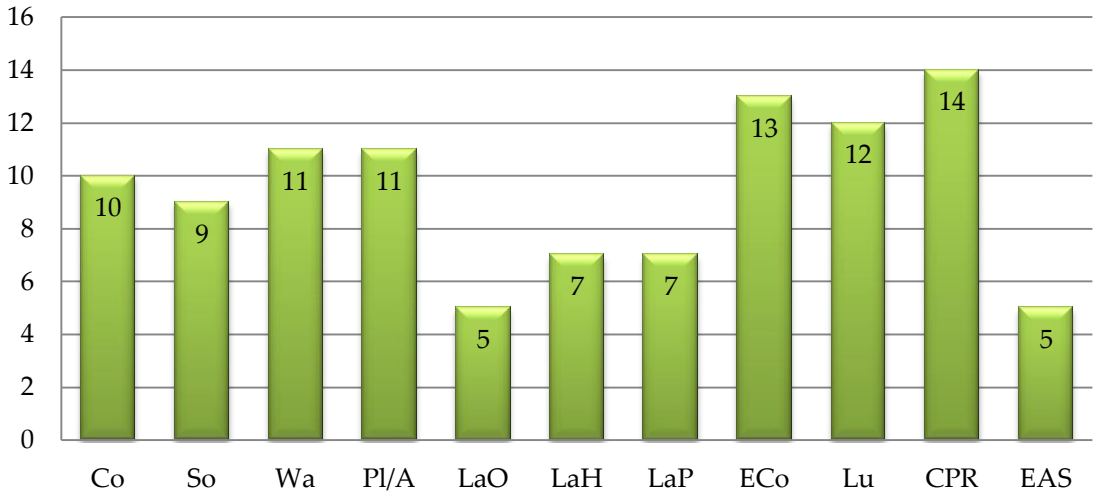
→ The results of Land Ethic Model is tabulated as a chart [refer Chart 1-(6)] for a better understanding of the analysis. Scores are derived from this table with are indicated in the form for bar charts for a quick comprehension of the same [refer Bar Chart 1-(6) & Bar Chart 2-(6)]

Chart 1-(6): Scoreboards for PEARL Community and Land Ethic keywords:-

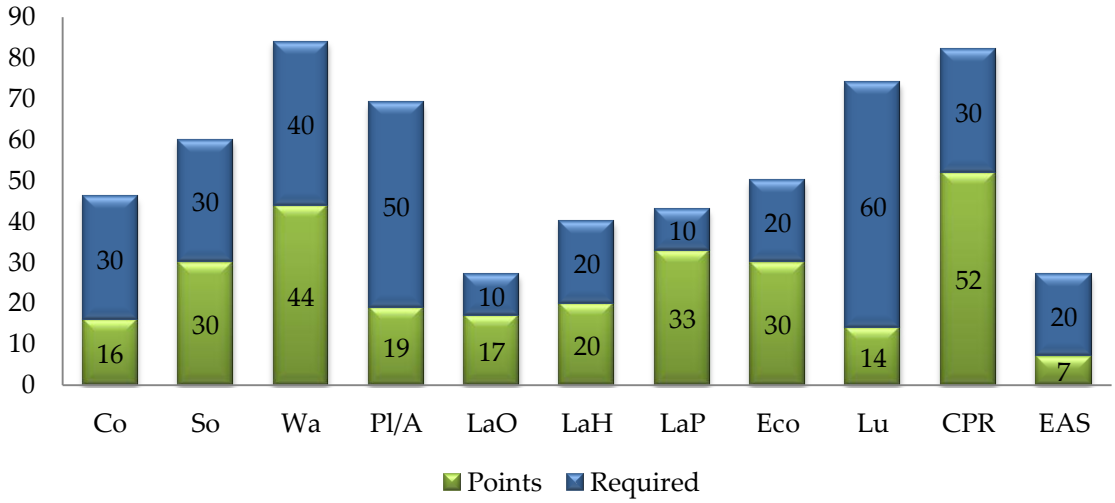
SN	Project Checklist	Co	So	Wa	Pl/A	LaO	LaH	LaP	ECo	Lu	CPR	EAS	Sb-C
1	Integrated Development Strategy	Re											**1**
2	Sustainable Building Guidelines											Re	**1**
3	Community-Dedicated Infrastructure Basic Commissioning	Re											**1**
4	Guest Worker Accommodation	2							2			2	**3**
5	Construction Environmental Management								2				**1**
6	Sustainability Awareness											2	**1**
7	Natural Systems Assessment								Re				**1**
8	Natural Systems Protection									Re	Re		**2**
9	Natural Systems Design and Management Strategy		Re			Re	Re		Re		Re		**5**
10	Reuse of Land		2							2	2		**3**
11	Remediation of Contaminated Land						2						**1**
12	Ecological Enhancement					2			2	2	2		**4**
13	Habitat Creation and Restoration					6	6		6		6		**4**
14	Food Systems	2			2				2	2	2		**5**
15	Plan 2030									Re			**1**
16	Urban Systems Assessment									Re			**1**
17	Provision of Amenities and Facilities	Re										Re	**2**
18	Outdoor Thermal Comfort Strategy			Re	Re		Re			Re			**4**
19	Neighborhood Connectivity	3								3		3	**3**
20	Open Space Network					3			3	3			**3**
21	Housing Diversity	2											**1**
22	Community Walkability	4											**1**

23	Active Urban Environments										1		**1**
24	Improved Outdoor Thermal Comfort				4		4						**2**
25	Regionally Responsive Planning						2			2	2		**3**
26	Safe and Secure Community	1											**1**
27	Community Water Strategy			Re	Re								**2**
28	Building Water Guidelines			Re	Re								**2**
29	Water Monitoring and Leak Detection			Re							Re		**2**
30	Community Water Use Reduction: Landscaping		14	14				14			14		**4**
31	Community Water Use Reduction: Heat Rejection			5				5			5		**3**
32	Community Water Use Reduction: Water Features			4				4			4		**3**
33	Storm water Management		6	6					6				**3**
34	Water Efficient Buildings & Plots			8							8		**2**
35	Community Energy Strategy				Re					Re			**2**
36	Building Energy Guidelines				Re					Re			**2**
37	Community Strategies for Passive Cooling			6	6	6	6				6		**5**
38	Urban Heat Reduction				2								**1**
39	Basic Construction Waste Management		Re										**1**
40	Basic Operational Waste Management		Re					Re					**2**
41	Regional Material	2											**1**
42	Recycled Materials		5					5					**2**
43	Reused or Certified Timber				3			3					**2**
44	Improved Construction Waste Management								2				**1**
45	Improved Operational Waste Management								2				**1**
46	Organic Waste Management		2		2			2	2				**4**
47	Hazardous Waste Management		1	1					1				**3**
	Scoreboard A (numbers)	**10**	**9**	**11**	**11**	**5**	**7**	**7**	**13**	**12**	**14**	**5**	**Nos.**
	Scoreboard B (points)	**16**	**30**	**44**	**19**	**17**	**20**	**33**	**30**	**14**	**52**	**7**	

Source: Self



Bar Chart 1-(6):- Scoreboard A for Land Ethic 'keywords"
Source: Self



Bar Chart 2-(6):- Scoreboard B for Land Ethic 'keywords"
Source: Self

Note:- Here, for the purpose of assessment, each 'required' checklist is given 10 points to project an understanding of its weightage, which is as indicated in blue above.

Legend:-

Community	Co	Land Pyramid (or cycle)	LaP	Scoreboard A	Sb A
Soils	So	Ecological Conscience	ECo	Scoreboard B	Sb B
Waters	Wa	Land Use	Lu	Scoreboard C	Sb C
Plants/animals	Pl/A	Conservation / Preservation / Recreation	CPR		
Land Organism	LaO	Education / Awareness / Social Interaction	EAS		
Land Health	LaH				
Scoreboard A represents total numbers of issues credited to each Land Ethic keyword					
Scoreboard B represents total credit points as per Pearl credited to each Land Ethic keyword					
Scoreboard C represents total numbers of Land Ethic Keyword credited to each project checklist.					

Chapter 7 IGBC – Green Townships Rating System

7.1. Introduction[1]

7.1.1. What is IGBC?

The Indian Green Building Council (IGBC), part of Confederation of Indian Industry (CII) was formed in the year 2001. The vision of the council is to usher in a green building movement in India and facilitate India to become one of the global leaders in green buildings.

7.1.2. What is IGBC Green Townships?

Against this background, Indian Green Building Council (IGBC) has launched 'IGBC Green Townships Rating System'. The rating system is a tool which enables the designer to apply green concepts and criteria, so as to reduce environmental impacts that are measurable. The rating system is designed to address large developments and it is mandatory to include residential development as part of the township. Some typical examples of large scale developments are integrated townships, satellite cities, gated communities, campuses with multiple buildings etc. However, it is to be noted that the rating system is not applicable for individual buildings and land parcels. Refer Table 1-(7) & Table 2-(7) for the checklist.

7.1.3. What is a Township?

A township is a combination of several communities; a community in turn is a combination of several sectors. Several townships form a city. A city typically has an administrative, legal, or historical status based on local law. A township, however, may not fall under the purview of the local government. Township ranges in sizes and land uses. Townships are typically mixed-use in character. However, Townships can be predominantly commercial, industrial or retail but should necessarily comprise of a residential component. At least 25% of the total built-up area (in sq. m.) within the township should be earmarked for residential use, for it to qualify for certification.

Sector can be defined as the basic module of a city. Walkabiltiy, interconnectivity, compactness, diversity are quintessential of a sector. The size of a sector can be defined in terms of comfortable walking distances from the centre to its periphery. Typically, 400 to 800 m is considered as a comfortable walking distance.

A sector should consist of a mix of land uses ranging from commercial to residential. Within the sector, the basic amenities as well as transit stops should be located within comfortable walking distances from various land uses. Sectors

[1] http://www.greenbusinesscentre.com/site/ciigbc/greenbuild

promote walking through a complementary relationship between transportation, land use and urban design character of the place. Compact and mixed-use environment of urban buildings, public spaces and landscapes support walking directly through the built environment and indirectly through human and economic activities associated with adjacent and surrounding land uses.

However, it should be noted that the above definition of the sector predominantly characterizes the residential sector within the township development. The 'IGBC Green Townships Rating System' is designed to address the issues of sprawl, automobile dependency, social and environmental disconnect. Developments are evaluated on the following broad aspects:

1) Environmental planning
2) Land Use planning
3) Resources management
4) Community development

Table 1-(7):- IGBC Green Townships Project Checklist Summary

SN	Category	Points
1	Site Selection & Planning - SSP	40
2	Land Use Planning - LP	44
3	Transportation Planning - TP	40
4	Infrastructure Resource Management - IRM	70
5	Innovation in Design & Technology - IDT	16
	Total Points	210

Table 2-(7):- IGBC Green Townships Project Checklist – Intent & Points[2]

Credit	Project Checklist	Intent	Points
Site Selection & Planning - SSP			40
SSP MR 1	Local Regulations	Ensure that project comply with the required statutory and regulatory codes so as to support the local government in implementing such requirements	Required
SSP MR 2	Avoid Development of Inappropriate Sites	Avoid developments in ecologically sensitive areas and negate the associated environmental impacts	Required
SSP MR 3	Soil Erosion Control Plan	Control soil erosion to preserve the top soil, avoid contamination of air and natural water bodies	Required
SSP Credit 1	Preserve Existing Trees & Water Bodies	Preserve existing trees and water bodies to minimize site disturbance, thereby protecting the habitat	6
SSP Credit 2	Retain Natural Topography	Conserve natural topography by restricting development footprint, thereby minimizing site disturbances and the associated	6

[2] Confederation of Indian Industry, IGBC Green Townships (For Townships and Large Developments) Rating System, Pilot Version November 2010,

		environmental impacts	
SSP Credit 3	Public Landscape Areas	Promote public health and encourage community interaction by providing landscaped areas	6
SSP Credit 4	Redevelopment of Contaminated Areas	Restore and reuse contaminated sites for development to reduce demand for virgin land	6
SSP Credit 5	Local Fruits & Vegetable Produce	Encourage local food production and minimize environmental damage from long distance transportation of food	8
SSP Credit 6	Urban Heat Island Effect	Reduce heat island effect to minimize impacts on urban climate	8
Land Use Planning - LP			44
LP MR 1	Land Use Optimization	Conserve land by encouraging higher development densities, thereby reducing urban sprawl	Required
LP MR 2	Basic Facilities for Construction Workforce	Promote the welfare of construction workforce by providing safe and healthy work conditions	Required
LP MR 3	Basic Amenities within the Community	Locate basic amenities within walkable distances to reduce dependency on automobiles	Required
LP Credit 1	Mixed Use Development	Provide mutually compatible urban developments within the project to create sustainable habitats	10
LP Credit 2	Housing Typologies	Provide a range of housing types to encourage social and economic mix within the society	8
LP Credit 3	Green Buildings	Encourage design and construction of eco-friendly buildings to minimize negative environmental impacts associated with the development	12
LP Credit 4	Employment Opportunities (Post-occupancy)	Provide opportunities of employment within the township to reduce long distance travel	8
LP Credit 5	Social & Cultural Initiatives	Encourage the project to take up social initiatives, within or outside the project boundary, to create a harmonious relationship with the local community	6
Transportation Planning - TP			30
TP MR 1	Long Term Transportation Plan	Encourage long term planning for cohesive transportation system to reduce adverse environmental impacts emanating from future traffic volumes	Required
TP MR 2	Design for Differently Abled	Ensure that public needs of differently abled people are adequately addressed	Required
TP Credit	Public transportation Facilities	Encourage the use of public transportation to reduce fossil fuel consumption & vehicular	6

1.1		emissions, which in turn would minimize health impacts	
TP Credit 1.2	Eco-Friendly Transportation Services	Encourage the use of public transportation to reduce fossil fuel consumption & vehicular emissions, which in turn would minimize health impacts	6
TP Credit 2	Road & Street Network	Provide interconnected road and street network to facilitate transport efficiency and easy connectivity	6
TP Credit 3	Bicycle Lane Network	Reduce automobile dependency for short distance commuting to minimize fuel consumption & vehicular emissions, thereby promoting physical activity and public health	6
TP Credit 4	Pedestrian Network	Encourage safe and comfortable walking experience by providing well designed interconnected pedestrian network	6
Infrastructure Resource Management - IRM			70
IRM MR 1	Rainwater Harvesting, 50%	Harvest rainwater to enhance groundwater table and reduce municipal water demand	Required
IRM MR 2	Segregation of Waste (Post- occupancy)	Reduce disposal of waste in landfills by proper segregation of waste at source, post-occupancy	Required
IRM Credit 1	Rainwater Harvesting, 75%, 95%	Harvest rainwater to enhance the groundwater table and reduce municipal water demand	6
IRM Credit 1	Waste Water Treatment, 100%	Encourage on- site treatment of wastewater to avoid pollution of natural water streams	6
IRM Credit 1	Waste Water Reuse, 75%, 95%	Encourage use of recycled water to reduce demand for municipal water	6
IRM Credit 1	Energy Efficiency in Infrastructural Equipment	Maximize energy efficiency, thereby reducing the environmental impacts resulting from energy use	8
IRM Credit 1	On- site Renewable Energy	Promote the use of on- site renewable energy technologies to reduce the load on grid power	16
IRM Credit 1	Off- site Green Power	Encourage the utilities to buy renewable energy so as to reduce the environmental impacts associated with the energy produced from fossil fuels	12
IRM Credit 1	Construction Waste Reduction (Civil Works)	Avoid construction waste and debris from being sent to landfills and ensure that the recyclable waste is redirected to manufacturing units or reused in appropriates sites	6
IRM Credit 1	Recycled Content (Civil Works)	Encourage the use of recycled content in construction materials to reduce	8

		environmental impacts associated with the use of virgin materials	
IRM Credit 1	Measurement & Verification Plan (Post-occupancy)	Ensure ongoing accountability in energy consumption of infrastructural equipment	2
Innovation in Design & Technology - IDT			16
IDT Credit 1.1	Innovation in Design & Technology	Provide design teams and projects, the opportunity to be awarded points for exceptional performance set by the IGBC Green Townships Rating System and / or innovative performance in Green design that are not specifically addressed by the IGBC Green Townships Rating System.	3
IDT Credit 1.2	Innovation in Design & Technology		3
IDT Credit 1.3	Innovation in Design & Technology		3
IDT Credit 1.4	Innovation in Design & Technology		3
IDT Credit 2	IGBC Accredited Professional	Support and encourage the involvement of IGBC AP accredited professionals in the Green Township projects.	4
	Project Total	**Total possible points (excluding IDT)**	**184**

7.2. IGBC versus Land Ethic Analysis

7.2.1. IGBC Assessment Criteria

→ Out of the total 40 assessment issues (efforts) including innovation under IGBC Green Townships [refer Table 3-(7)], only 26 numbers of issues (efforts) are been considered suitable for the Land Ethic assessment.

→ The study has not included IGBC issues such as materials. There is a wide range of materials (right from construction to finishing stage) that are involved in a development of a project and which may have multifarious and intangible environmental impacts. Being complex to comprehend, this issue is not been considered in the scope of assessment.

→ The study has not included IGBC issues such as vehicular transport, transport networks and carbon emissions. These have direct environment impacts on air (causing air pollution) and natural resources (such as petroleum). Air pollution has a cascading effect on Land Ethic members such as soils, waters and plants/animals. Also, there is a resultant effect on the land organism, land health and land pyramid. These intermingled effects are not considered in the scope of this assessment.

Table 3-(7):- IGBC Assessment Checklist

Category	Checklist considered	Checklist not considered
Site Selection	Local Regulations	

& Planning – SSP (9)+(0)	Avoid Development of Inappropriate Sites	
	Soil Erosion Control Plan	
	Preserve Existing Trees & Water Bodies	
	Retain Natural Topography	
	Public Landscape Areas	
	Redevelopment of Contaminated Areas	
	Local Fruits & Vegetable Produce	
	Urban Heat Island Effect	
Land Use Planning – LP (6)+(2)	Land Use Optimization	Basic Amenities within the Community
	Basic Facilities for Construction Workforce	Employment Opportunities (Post-occupancy)
	Mixed Use Development	
	Housing Typologies	
	Green Buildings	
	Social & Cultural Initiatives	
Transportation Planning – TP (4)+(3)	Design for Differently Abled	Long Term Transportation Plan
	Road & Street Network	Public transportation Facilities
	Bicycle Lane Network	Eco-Friendly Transportation Services
	Pedestrian Network	
Infrastructure Resource Management – IRM (7)+(4)	Rainwater Harvesting, 50%	Energy Efficiency in Infrastructural Equipment
	Segregation of Waste (Post-occupancy)	Off- site Green Power
	Rainwater Harvesting, 75%, 95%	Recycled Content (Civil Works)
	Waste Water Treatment, 100%	Measurement & Verification Plan (Post-occupancy)
	Waste Water Reuse, 75%, 95%	
	On- site Renewable Energy	
	Construction Waste Reduction (Civil Works)	
Total	**26 nos.**	**9 nos.**

*Total number of issues is 40 (including Innovation which is not considered for analysis)

7.2.2. IGBC Review

This section gives a brief overview about each IGBC issue and the various sub-issues that are required for the fulfilment of a particular issue. A study of these issues and sub-issues aids in categorizing each of them under appropriate Land Ethic members and keywords. Each issue is then evaluated for the derivations in terms of ecosystem services that it seemingly serves (formulated in the form of table respectively)

The review is as follows:-

1	SSP MR1 Local Regulation

Intent:
Ensure that project comply with the required statutory and regulatory codes so as to support the local government in implementing such requirements

(1) Compliance Options:
The following measures need to be ensured:
i) Approval of the plan from the government authority
ii) Approvals for all statutory requirements relating to development of the project

Table 4-(7):- IGBC Local Regulation

Land Ethic 'Members/Keywords'	Derivations
Land Use	Provisional services: • Fresh water Regulating services:- • Waste treatment

Source: Self

→ What is the purpose of Local regulations (or building codes)[3]?
iii) A building code, or building control, is a set of rules that specify the minimum acceptable level of safety for constructed objects such as buildings and non-building structures.
iv) The main purpose of building codes are to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures.
v) The building code becomes law of a particular jurisdiction when formally enacted by the appropriate authority.

2	SSP MR2 Avoid Development of Inappropriate Sites

Intent:
Avoid developments in ecologically sensitive areas and negate the associated environmental impacts

(1) Compliance Options:
Do not develop buildings, roads or parking areas on portions of sites that meet any one of the following criteria:
i) Land which is specifically identified as habitat for any species on the threatened or endangered list of Wildlife Institute of India
ii) Within 150 m of any wetland or restrict development from wetlands as per regulations laid by state / central authority, whichever is more stringent

[3] http://en.wikipedia.org/wiki/Building_code

iii) Land whose elevation is lower than the maximum observed flood levels or 100 year flood level, whichever is higher

Table 5-(7):- IGBC Avoid Development of Inappropriate Sites

Land Ethic 'Members/Keyword'	Derivations
Land Organism	Provisioning services:- • Genetic resources Regulating Services:- • Air quality, climate, water, erosion, diseases, pest regulation
Land Health	Regulating services:- • Water purification • Waste treatment • Pollination • Natural hazard regulation Supporting services:- • Nutrient cycling • Water cycling
Ecological Conscience	Cultural services:- • Knowledge systems • Educational values • Inspiration
Land Use	Cultural services:- • Spiritual values • Religious values • Sense of place • Recreation • ecotourism

Source: Self

3	SSP MR3 Soil Erosion Control Plan

Intent:

Control soil erosion to preserve the top soil, avoid contamination of air and natural water bodies

(1) Compliance Options:

Adopt measures listed below to control erosion, during construction and post- occupancy:

i) Implement soil erosion control measures conforming to best management practices highlighted in National Building Code (NBC) of India

ii) For area where the top soil is fertile, remove, stack & protect the top soil from the development areas and reuse for landscaping. For areas where the top soil is not available, provide a detailed narrative justifying the site condition

Table 6-(7):- IGBC Soil Erosion Control Plan

Land Ethic 'Members/Keyword'	Derivations
Soils	Provisioning services:- • Food • Fiber • Fuel • Fresh water Supporting services:- • Nutrient cycling • Water cycling
Conservation/ Preservation/Recreation	Cultural services:- • Cultural diversity • Knowledge systems Supporting services:- • Nutrient cycling • Water cycling • Erosion regulation

Source: Self

4	SSP Credit 1 Preserving Existing Trees & Water Bodies

Intent:

Preserve existing trees and water bodies to minimize site disturbance, thereby protecting the habitat

(1) Compliance Options:
   i) Preserve at least 25% of the existing trees within the project. Wherever preservation is practically not possible, consider transplantation of the trees within the site
   ii) For every tree that is uprooted, plant at least ten new saplings
   iii) In sites having water bodies, protect and restore 100% of the existing water bodies
(2) Documentation Required:
   i) A written commitment from the developer that the water bodies would be maintained for the life of the project

Table 7-(7):- IGBC Preserving Existing Trees & Water Bodies

Land Ethic 'Members/Keyword'	Derivations
Waters	Provisioning services:- • Food • Fresh water • Ornamental resources Regulating services:- • Water regulation • Water purification • Cultural services:- • Spiritual values

	• Aesthetic values • Recreation • Ecotourism
Plants/Animals	Provisioning services:- • Food • Fiber • Fuel • Natural medicines • Pharmaceuticals • Ornamental resources Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Erosion regulation • Pollination • Natural hazard regulation Cultural services:- • Spiritual values • Inspiration • Aesthetic values • Social relations • Sense of place • Recreation • Ecotourism
Land Use	Regulating services:- • Air quality regulation • Climate regulation • Water regulation • Natural hazard regulation Cultural services:- • Spiritual values • Aesthetic values • Social relations • Sense of place • Recreation • Ecotourism
Conservation/ Preservation/Recreation	Provisioning Services:- • Genetic resources • Ornamental resources Cultural services:- • Cultural diversity • Religious values • Knowledge systems • Educational values

	• Cultural heritage values

Source: Self

5	SSP Credit 2 Retain Natural Topography

Intent:

Conserve natural topography by restricting development footprint, thereby minimizing site disturbances and the associated environmental impacts

(1) Compliance Options:

i) Retain at least 25% to 35% of the total site area with natural topography.

Table 8-(7):- IGBC Retain Natural Topography

Land Ethic 'Members/Keyword'	Derivations
Ecological Conscience	Regulating services:- • Erosion regulation • Natural hazard regulation Supporting services:- • Nutrient cycling • Water cycling
Land Use	Regulating services:- • Erosion regulation • Natural hazard regulation

Source: Self

6	SSP Credit 3 Public Landscape Areas

Intent:

Promote public health and encourage community interaction by providing landscaped areas

(1) Compliance Options:

i) Provide public landscaped area to an extent of at least 25% to 35% of the total area of each residential sector (OR) in accordance with the local bye- laws, whichever is stringent.

Table 9-(7):- IGBC Public Landscape Areas

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural values:- • Spiritual values • Religious values • Sense of place • Cultural heritage values
Plants/Animals	Regulating services:- • Air quality regulation • Climate regulation (local) • Erosion regulation • Pollination

	Cultural values:- • Educational values • Inspiration • Aesthetics • Recreation

Source: Self

7	SSP Credit 4 Redevelopment of Contaminated Areas

Intent:

Restore and reuse contaminated sites for development to reduce demand for virgin land

(1) Compliance Options**:**

i) Develop the project on a contaminated site after taking appropriate remediation measures. Percent of contaminated areas to be restored for award of points to be in range of 20% to 30%.

Table 10-(7):- IGBC Redevelopment of Contaminated Areas

Land Ethic 'Members/Keyword'	Derivations
Land Health	Provisioning services:- • Food • Fiber • Fuel Regulating services:- • Water regulation • Water purification Supporting services:- • Soil formation • Erosion regulation

Source: Self

8	SSP Credit 5 Local Fruits & Vegetables Produce

Intent:

Encourage local food production and minimize environmental damage from long distance transportation of food

(1) Compliance Options:

i) Create Growing Spaces for fruit and vegetable requirements to cater to the community needs. Points are awarded for Growing area of 15 sq.mts, 25 sq.mts. and 35 sq. mts. per dwelling units.

(2) Documentation Required:

i) A declaration from the developer that these spaces would be maintained and managed by an authorized entity and no developments will be planned in such areas

Table 11-(7):- IGBC Local Fruits & Vegetables Produce

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Spiritual values • Religious values • Sense of place
Plants/Animals	Provisioning services:- • Food • Fiber • Fuel • Genetic resources • Natural medicines Supporting services:- • Photosynthesis • Primary production
Ecological Conscience	Regulating services:- • Air quality regulation • Climate regulation • Erosion regulation • Water purification
Land Use	Provisioning services:- • Food • Fiber • Fuel • Genetic resources • Natural medicines Supporting services:- • Photosynthesis • Primary production
Conservation/ Preservation/Recreation	Provisioning services:- • Genetic resources • Ornamental resources • Erosion regulation

Source: Self

9	SSP Credit 6 Urban Heat Island Effect

Intent:

Reduce heat island effect to minimize impacts on urban climate

(1) Compliance Options:

i) For footpaths, pathways, roads, surface parking and other non- impervious areas within the township, provide tree cover (within 5 years) or use light colored/ high albedo materials (reflectance of at least 0.3) or open grid pavements. Points for areas under tree cover/ high reflectance material / open grid pavement are awarded for 50%, 75% up to 90% of areas.

Table 12-(7):- IGBC Urban Heat Island Effect

Land Ethic 'Members/Keyword'	Derivations
Plants/Animals	Regulating services:- • Air quality regulation • Climate regulation Additionally, this is beneficial in controlling the thermal properties of a microclimate, thus helping to reduce heat island effect. This also reduces cooling energy loads on a building.

Source: Self

10	LP MR 1 Land Use Optimization

Intent:

Conserve land by encouraging higher development densities, thereby reducing urban sprawl

(1) Compliance Options:

i) Design residential & non- residential developments to meet the FSI/ FAR prescribed by the existing local bye-laws. Wherever permissible under the law, explore opportunities to exceed the required FSI/ FAR

ii) Earmark at least 25% of the total built-up area within the township as residential areas.

Table 13-(7):- IGBC Land Use Optimization

Land Ethic 'Members/Keyword'	Derivations
Land Use	Cultural services:- • Cultural diversity • Social relations • Sense of place The basic intent is to avoid the ground spread of built-up areas in order to preserve untouched or undisturbed land as much as possible.

Source: Self

11	LP MR 2 Basic Facilities for Construction Workforce

Intent:

Promote the welfare of construction workforce by providing safe and healthy work conditions

(1) Compliance Options:

Provide the following on- site basic facilities such as:

i) Adequate housing for workforce during construction

ii) Sanitary measures to meet or exceed the local bye- law requirement

iii) Sewage treatment and disposal arrangements

iv) Medical and emergency facilities

v) Adequate drinking water facilities
vi) Provision of personal protective equipment
vii) Dust suppression measures
viii) Adequate illumination levels in work areas

Ensure that provisions for such facilities are included in the construction contract agreement

Table 14-(7):- IGBC Basic Facilities for Construction Workforce

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Cultural diversity • Social relations • Sense of place • Educational values
Ecological Conscience	Provisioning services:- • Fresh water Regulating services:- • Air quality regulation • Water regulation • Waste treatment • Erosion regulation

Source: Self

12	LP Credit 1 Mixed Use Development

Intent:

Provide mutually compatible urban developments within the project to create sustainable habitats

(1) Compliance Options:
i) Earmark at least 35% of the total built-up area within the township as residential areas (AND)
ii) The mixed use development should include a combination of at least four developments as specified below within the township
- Offices
- Retail
- Institutional
- Hospitals
- Industrial
- Recreational & Cultural

Table 15-(7):- IGBC Mixed Use Development

Land Ethic 'Members/Keyword'	Derivations
Land Use	Cultural services:- • Cultural diversity • Sense of place • Social relations

	• Recreation The intent of mixed use development is to make available the basic amenities for a comfortable and health living within close proximity, thus making itself sustained and convenient.

Source: Self

13	LP Credit 2 Housing Typologies

Intent:

Provide a range of housing types to encourage social and economic mix within the society

(1) Compliance Options:

Provide at least two of the following housing typologies within each sector:

i) High Income Group (HIG)
ii) Middle Income Group (MIG)
iii) Low Income Group (LIG)

(AND)

iv) Earmark residential units for Economically Weaker Sections (EWS) ranging from 15% to 20% of total residential units

Table 16-(7):- IGBC Housing Typologies

Land Ethic 'Members/Keywords'	Derivations
Community	Cultural services:- • Cultural diversity • Sense of place • Social relations A community of mixed class of group gets benefited mutually and enables to generate services and employment within itself.
Land Use	Such type of land use helps create housing for the needy, thus help lessen the housing shortages to some extent.
Education/Awareness/Social Interaction	Different group of people in close proximity may tend to interact, thus enabling transfer of knowledge and culture, spread of education and exchange of ideas (considered from a positive view-point)

Source: Self

14	LP Credit 3 Green Buildings

Intent:

Encourage design and construction of eco- friendly buildings to minimize negative environmental impacts associated with the development.

(1) Compliance Options:

i) Design green buildings within the project with appropriate green building rating systems, such as IGBC and LEED India (e.g., factories, homes, commercial buildings, etc.). Points for percentage of green buildings are awarded for 20% to 30% of total numbers of buildings.

Table 17-(7):- IGBC Green Buildings

Land Ethic 'Members/Keyword'	Derivations
Waters	Provisioning services:- • Fresh water Regulating services:- • Water regulation • Water purification Supporting services:- • Water cycling
Plants/Animals	Provisioning services:- • Genetic resources • Ornamental resources • Climate regulation • Disease regulation • Pest regulation Supporting services:- • Soil formation • Photosynthesis • Primary production Additionally, harbors a biodiversity and serves as a habitat for various birds and insects community.
Ecological Conscience	Regulating services:- • Waste treatment • Pollination Supporting services:- • Soil formation (or conservation) • Erosion regulation
Conservation/Preservation/ Recreation	Green building demonstrates a concern for depleting the natural resources (such as water, fossil fuels, soil) and hence attempts to preserve them during every stage of development. Conversely, it promotes the use of renewable resources such as wind and solar to reduce the burden on already depleting natural resources.

Source: Self

15	LP Credit 3 Social & Cultural Initiatives

Intent:

Encourage the project to take up social initiatives, within or outside the project boundary, to create a harmonious relationship with the local community

(1) Compliance Options:

Build vibrant and inclusive communities by adopting any six of the following initiatives

i) Building of schools for local population
ii) Provisions for clinic, dispensaries, banks etc.,
iii) Training to local farmers on best agricultural practices and latest trends
iv) Vocational training institutes for men and women
v) Local craft and cottage industry
vi) Conserve or restore buildings of historical importance
vii) Adequate public drinking water facilities
viii) Any other social initiatives which would have a positive impact on the local community

Table 18-(7):- IGBC Social & Cultural Initiatives

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Cultural diversity • Religious values • Knowledge systems • Social relations • Sense of place
Conservation/Preservation/Recreation	Cultural services:- • Cultural diversity • Religious values • Knowledge systems This issue involves the conservation of historical or cultural values of a locality. Also, it insists on safeguarding the traditional art and crafts of a particular locality, thus helping the knowledge sharing and transfer of the same.
Education/Awareness/Social Interaction	Cultural services:- • Spiritual values • Educational values • Inspiration • Recreation

Source: Self

16	TP MR 2 Design for Differently Abled

Intent:

Ensure that public needs of differently abled people are adequately addressed

(1) Compliance Options:

Incorporate the following provisions for differently abled people in all public spaces, as applicable:

i) Safe, comfortable and easy access
ii) Uniformity in flooring level/ ramps
iii) Preferred car parking spaces
iv) Restrooms designed for differently abled

Table 19-(7):- IGBC Design for Differently Abled

Land Ethic 'Members/Keyword'	Derivations
Community	Cultural services:- • Social relations (no disparity). This enables easy and uninterrupted movement of the differently abled and makes then independent in their activities.

Source: Self

17	TP Credit 2 Road & Street Network

Intent:

Provide interconnected road and street network to facilitate transport efficiency and easy connectivity

(1) Compliance Options:

i) Meet road and street widths as specified in local bye- laws
ii) All road and streets to facilitate interconnectivity within the township. Design interconnected street network such that roads & streets intersect at intervals as specified in local bye-laws or at least 150 m intervals, whichever is smaller, within and along the boundary of each sector
iii) Develop and maintain streetscape elements such as street plantations, intersection layouts, roundabouts, on- street parking, etc., within the township

Table 20-(7):- IGBC Road & Street Network

Land Ethic 'Members/Keyword'	Derivations
Land Use	Regulating services (through street plantation):- • Air quality regulation • Climate regulation Cultural services:- • Cultural diversity • Social relations • Sense of place

Source: Self

18	TP Credit 3 Bicycle Lane Network

Intent:

Reduce automobile dependency for short distance commuting to minimize fuel consumption & vehicular emissions, thereby promoting physical activity and public health

(1) Compliance Options:
   i) Encourage the use of bicycle as an environment friendly transportation choice.
   ii) Design bicycle lane network to connect to all basic amenities and transit facilities
   iii) Provide bicycle parking and ensure proper illumination for bicycle lanes
   iv) Develop strategies and measures to ensure that lanes are not encroached by vehicular traffic or pedestrians

Table 21-(7):- IGBC Bicycle Lane Network

Land Ethic 'Members/Keyword'	Derivations
Land Use	Cultural services:- • Cultural diversity • Social relations • Sense of place
Conservation/Preservation/Recreation	Cultural services:- • Recreation

Source: Self

19	TP Credit 4 Pedestrian Network

Intent:

Encourage safe and comfortable walking experience by providing well designed interconnected pedestrian network

(1) Compliance Options:
   i) Design pedestrian network between local transit facilities, residential, commercial and other developments
   ii) Provide shades for footpaths and pathways through tree cover for comfortable pedestrian access. This should be achieved within 5 years of plantation
   iii) Provide adequate street lighting to achieve appropriate lux levels for the entire pedestrian network within the township

Table 22-(7):- IGBC Pedestrian Network

Land Ethic 'Members/Keyword'	Derivations
Land Use	Cultural services:- • Cultural diversity • Social relations • Sense of place
Conservation/Preservation/Recreation	A shaded pedestrian pathway provides a comfort level in terms of shade and air quality which is welcoming to the occupants and aids in recreation and

	physical activity.

Source: Self

20, 21	IRM MR 1 Rainwater Harvesting 50% IRM Credit 1 Rainwater Harvesting 75%, 95%

Intent:

Harvest rainwater to enhance groundwater table and reduce municipal water demand

(1) Compliance Options:

i) Provide rainwater harvesting or storage system to capture at least 50% run- off from the roof & non- roof impervious areas considering two year average one day rainfall.

ii) Provide rainwater harvesting or storage system to capture at least 75% to 95% run-off from the roof & non- roof areas considering two year average one day rainfall.

Table 23-(7):- IGBC Rainwater Harvesting 50%, 75%, 95%

Land Ethic 'Members/Keyword'	Derivations
Waters	Provisioning:- • Fresh water Regulating:- • Water regulation • Natural hazard regulation (by way of flood control) Supporting:- • Nutrient cycling • Water cycling
Land Pyramid	Regulating:- • Water regulation Supporting:- • Nutrient cycling • Water cycling Channelizing water back to the soil by ground water recharge, allows to complete the water cycling.
Conservation/Preservation/Recreation	Provisioning:- • Fresh water Allowing water to enter the sub-soil surface without getting much contaminated benefits in the conservation of fresh water, which goes back to the sea, thus progressing towards the water cycle(i.e. the hydrogeochemical cycle)

Source: Self

22	IRM MR 2 Segregation of Waste (Post-occupancy)

Intent:

Reduce disposal of waste in landfills by proper segregation of waste at source, post-occupancy

(1) Compliance Options:

i) Develop a waste management plan for the project and identify methods to segregate and efficiently dispose waste

ii) Place color coded waste bins in all public areas to collect recyclable waste such as organic waste, paper, glass, plastic, cardboard, metal, e-waste, etc., at source of generation

iii) Insist on segregation of waste in residential and commercial buildings for proper collection and disposal

Table 24-(7):- IGBC Segregation of Waste (Post-occupancy)

Land Ethic 'Members/Keyword'	Derivations
Soil	Regulating services:- • Water treatment • Disease regulation Supporting services:- • Nutrient cycling
Land Health	Regulating services:- • Waste treatment • Pest regulation Supporting services:- • Soil formation (in the form of humus)
Land Pyramid / cycle	Regulating services:- • Waste treatment Supporting services:- • Soil formation (in the form of humus) By decomposition of organic matter, the nutrients are supplied back to the soil, thus completing the land cycle of nutrients.

Source: Self

23	IRM Credit 2 Waste Water Treatment, 100%

Intent:

Encourage on- site treatment of wastewater to avoid pollution of natural water streams.

(1) Compliance Options:

i) Provide wastewater treatment infrastructure to treat 100% of the waste water generated within the project. The treatment facility can be centralized or at a sector level, as necessary.

ii) Ensure that the treated wastewater conforms to the quality standards required for respective application

Table 25-(7):- IGBC Waste Water Treatment, 100%

Land Ethic 'Members/Keyword'	Derivations
Water	Provisioning services:- • (conservation of) Fresh water (treating the waste water and putting it to reuse for non-drinking purposes helps conserve fresh water) Adding to the same is the benefit of avoiding pollution of sub-soil water as well as reducing the load on the treatment plants of the local authorities.
Land Health	Regulation services:- • Water purification • Waste treatment Purifying water before it enters into the sub-soil or into a water course enables in maintaining the health of land (by avoiding ground/fresh water pollution and facilitate in the process of water cycling.

Source: Self

24	IRM Credit 3 Waste Water Reuse, 75%, 95%

Intent:
Encourage use of recycled water to reduce demand for municipal water

(1) Compliance Options:
   i) Provide wastewater distribution infrastructure so as to convey at least 75% of the treated wastewater to large turf areas (parks and golf courses, landscaped public areas etc.,), horticulture/ irrigation, construction sites and other areas of non- potable uses within or outside the boundary of the project. Points for wastewater reuse are awarded for 75% and 95% of treated waste water reused.

Table 26-(7):- IGBC Waste Water Reuse, 75%, 95%

Land Ethic 'Members/Keyword'	Derivations
Water	Provisioning services:- • (conservation of) Fresh water (treating the waste water and putting it to reuse for non-drinking purposes helps conserve fresh water) Supporting services:- • Primary production • Nutrient cycling • Water cycling (through reuse in landscaping and irrigation)
Conservation/Preservation/ Recreation	Provisioning services:- • Fresh water Regulating services:-

	• Water purification • Waste treatment

Source: Self

25	IRM Credit 3 On-site Renewable Energy

Intent:

Promote the use of on- site renewable energy technologies to reduce the load on grid power

(1) Compliance Options:

i) Install on- site renewable energy systems such as solar, wind, bio- mass, bio- gas, bio- diesel or any other forms of renewable energy in township. Design and implement the renewable energy measures in areas under the developer's scope. Points for on- site renewable energy are awarded for 10%, 20%, 30% and 40% of renewable energy to total annual energy consumption.

Table 27-(7):- IGBC On-site Renewable Energy

Land Ethic 'Members/Keyword'	Derivations
Soils	Regulating services:- • Waste treatment By the use of wastes such as organic food waste, landscape debris etc. biogas may be generated. Certain procedures may also benefit the soil nutrients by way of creating humus from the organic wastes.
Conservation/Preservation/ Recreation	Supporting services:- • Soil formation By way of reuse of organic waste, the amount of waste entering into the land fill gets reduced thus conserving and preserving land resource.

Source: Self

26	IRM Credit 5 Construction Waste Reduction (Civil Works)

Intent:

Avoid construction waste and debris from being sent to landfills and ensure that the recyclable waste is redirected to manufacturing units or reused in appropriates sites

(1) Compliance Options:

i) Segregate waste generated during construction for subsequent diversion for recycling or reuse

ii) Avoid at least 50% of the waste generated during construction from being sent to landfills and incinerators

iii) Calculate percentage either by weight or volume. Points for waste reduction during construction are awarded for 50% and 75% of waste diverted

Table 28-(7):- IGBC Construction Waste Reduction (Civil Works)

Land Ethic 'Members/Keyword'	Derivations
Soils	Supporting services:- • Soil formation By way of reuse of organic waste, the amount of waste entering into the land fill gets reduced thus conserving and preserving land resource.
Land Health	By avoiding wastes generated from the construction sites to enter into the landfill areas, land contamination is avoided, thus keeping the land healthy.

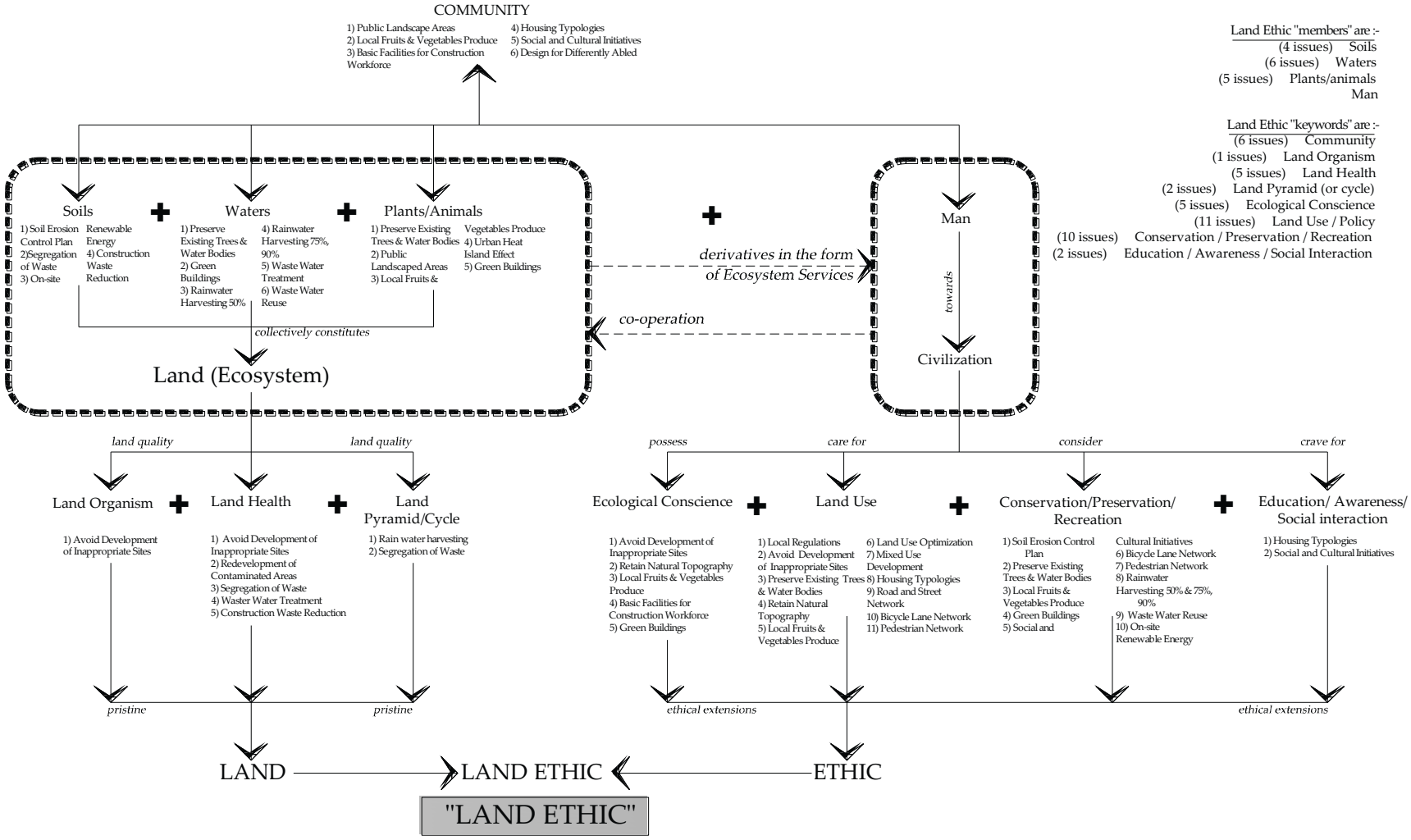
Source: Self

7.3. Pearl versus Land Ethic Model

→ Deriving the Pearl Land Ethic Model:-
The Pearl Land Ethic Model 1-(7) is derived after an analysis of each Pearl issue and the individual sub issues that are considered for the achievement of credit points. On basis of the issues and sub-issues, they are being assigned under the appropriate category of Land Ethic members and keywords. A total in terms of (a) the number of issues (or efforts) involved and (b) in terms of the credit points is arrived at (called as scoreboards). These scoreboards are useful in a comparative analysis of the three rating systems (as seen in Chapter 8).

7.4. IGBC Scoreboards & Conclusion

→ The results of Land Ethic Model is tabulated as a chart [refer Chart 1-(7)] for a better understanding of the analysis. Scores are derived from this table with are indicated in the form for bar charts for a quick comprehension of the same [refer Bar Chart 1-(7) & Bar Chart 2-(7)]



Land Ethic Model 1-(6):- Pearl Land Ethic Model

Chart 1-(7):- Scoreboards for BREEAM issues and Land Ethic keywords

SNo.	Project Checklist	Co	So	Wa	Pl/A	LaO	LaH	LaP	ECo	Lu	CPR	EAS	Sb C
1	Local Regulations									Re			1
2	Avoid Development of Inappropriate Sites					Re	Re		Re	Re			4
3	Soil Erosion Control Plan		Re								Re		2
4	Preserve Existing Trees & Water Bodies			6	6					6	6		4
5	Retain Natural Topography								6	6			2
6	Public Landscape Areas	6			6								2
7	Redevelopment of Contaminated Areas						6						1
8	Local Fruits & Vegetable Produce	8			8				8	8	8		5
9	Urban Heat Island Effect				8								1
10	Land Use Optimization									Re			1
11	Basic Facilities for Construction Workforce	Re							Re				2
12	Mixed Use Development									10			1
13	Housing Typologies	8								8		8	3
14	Green Buildings			12	12				12		12		4
15	Social & Cultural Initiatives	6									6	6	2
16	Design for Differently Abled	Re											1
17	Road & Street Network									6			1
18	Bicycle Lane Network									6	6		2
19	Pedestrian Network									6	6		2
20	Rainwater Harvesting 50%			Re				Re			Re		3
21	Rainwater Harvesting 75%, 95%			6				6			6		3
22	Segregation of Waste (Post- occupancy)		Re				Re	Re					3
23	Waste Water Treatment, 100%			6			6						2
24	Waste Water Reuse, 75%, 95%			6							6		2
25	On- site Renewable Energy		16								16		2
26	Construction Waste Reduction (Civil Works)		6				6						2
	Sb A	**6**	**4**	**5**	**5**	**1**	**5**	**3**	**5**	**11**	**10**	**2**	**Nos.**
	Sb B	**28**	**22**	**36**	**40**	**Re**	**18**	**6**	**26**	**56**	**66**	**14**	

Source: Self

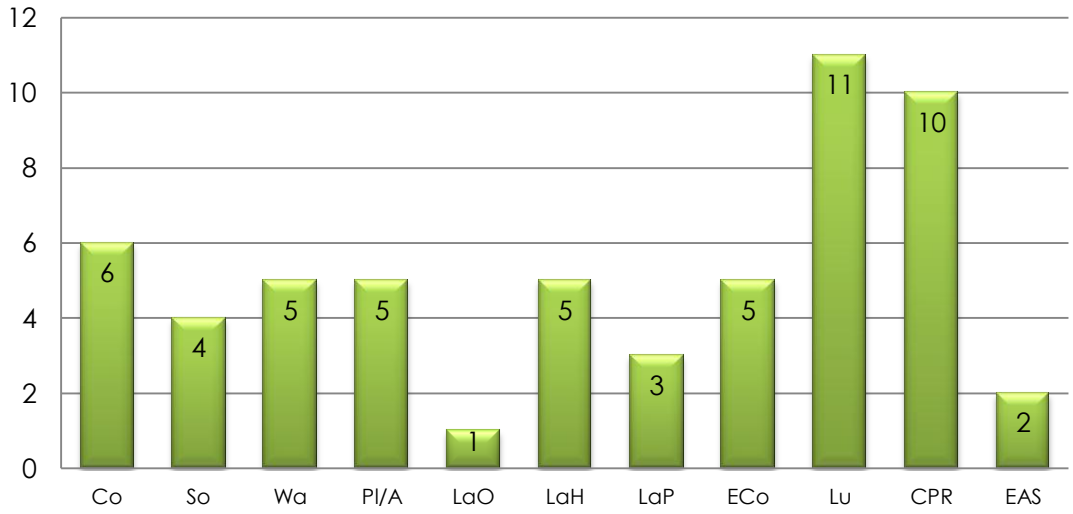


Chart 2-(7):- IGBC Scoreboard A for Land Ethic 'keywords'

Source: Self

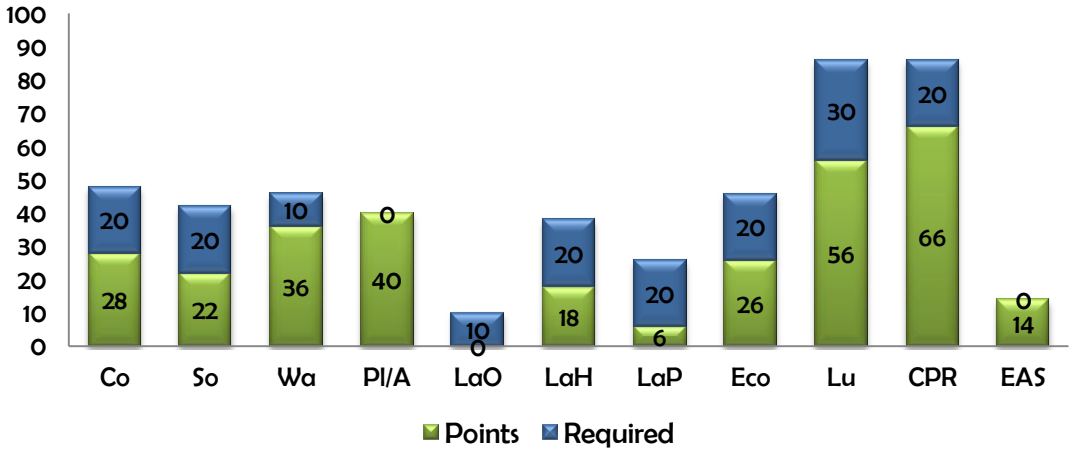


Chart 3-(7):- IGBC Scoreboard B for Land Ethic 'keywords'

Source: Self

Note:- Here, for the purpose of assessment, each 'required' checklist is given 10 points to project an understanding of its weightage, which is as indicated in blue above.

Legend:-

Community	Co	Land Pyramid (or cycle)	LaP	Scoreboard A	Sb A
Soils	So	Ecological Conscience	ECo	Scoreboard B	Sb B
Waters	Wa	Land Use	Lu	Scoreboard C	Sb C
Plants/animals	Pl/A	Conservation / Preservation / Recreation	CPR		
Land Organism	LaO	Education / Awareness / Social Interaction	EAS		
Land Health	LaH				
Scoreboard A represents total numbers of issues credited to each Land Ethic keyword					
Scoreboard B represents total credit points as per Pearl credited to each Land Ethic keyword					
Scoreboard C represents total numbers of Land Ethic Keyword credited to each project checklist.					

Chapter 8. BREEAM, Pearls & IGBC Comparison

8.1. Comparison in terms of Credit points:-

8.1.1. BREEAM, Pearl & IGBC Comparison Table

→ This section illustrates a comparison between the three rating systems – BREEAM, Pearl and IGBC – on basis of their respective issues (efforts) and credit points. [Refer Table 1-(8)]. This analysis will help derive an understanding about:

i) How many issues are dealt with in each of the system?
ii) How many sub issues are to be dealt with under each issue category?
iii) How much significance is given to each issue in terms of credit points?

Table 1-(8):- BREEAM, Pearls & IGBC issues comparison:-

BREEAM COMMUNITIES	PEARL COMMUNITIES	IGBC GREEN TOWNSHIPS
Governance (GO) (6 points)	**Integrated Development Process – IDP (6 points)**	**Site Selection & Planning – SSP (40 points)**
1) Consultation Plan (1 point) 2) Consultation and engagement (2 points) 3) Community management of facilities (3 points)	1) Integrated Development Strategy (R) 2) Sustainable Building Guidelines(R) 3) Community-Dedicated Infrastructure Basic Commissioning (R) 4) Guest Worker Accommodation (2 points) 5) Construction Environmental Management (2 points) 6) Sustainability Awareness (2 points)	1) Local Regulations (R) 2) Avoid Development of Inappropriate Sites (R) 3) Soil Erosion Control Plan (R) 4) Preserve Existing Trees & Water Bodies (6 points) 5) Retain Natural Topography (6 points) 6) Public Landscape Areas (6 points) 7) Redevelopment of Contaminated Areas (6 points) 8) Local Fruits & Vegetable Produce (8 points) 9) Urban Heat Island Effect (8 points)
Social & economic wellbeing – Local economy (SE)	**Natural Systems – NS (14 points)**	**Land Use Planning – LP (36 points)**
Non	7) Natural Systems Assessment (R) 8) Natural Systems Protection (R) 9) Natural Systems Design	10) Land Use Optimization (R) 11) Basic Facilities for Construction Workforce (R)

	and Management Strategy (R) 10) Reuse of Land (2 points) 11) Remediation of Contaminated Land (2 points) 12) Ecological Enhancement (2 points) 13) Habitat Creation and Restoration (6 points) 14) Food Systems (2 points)	12) Mixed Use Development (10 points) 13) Housing Typologies (8 points) 14) Green Buildings (12 points) 15) Social & Cultural Initiatives (6 points)
Social & economic wellbeing – Environmental conditions (SE) (11 points)	**Livable Communities – LC (20 points)**	**Transportation Planning – TP (18 points)**
4) Flood risk assessment (2 points) 5) Microclimate (3 points) 6) Adapting to climate change (3 points) 7) Flood risk management (3 points)	15) Plan 2030 (R) 16) Urban Systems Assessment (R) 17) Provision of Amenities and Facilities (R) 18) Outdoor Thermal Comfort Strategy (R) 19) Neighborhood Connectivity (3points) 20) Open Space Network (3 points) 21) Housing Diversity (2 points) 22) Community Walkability (4 points) 23) Active Urban Environments (1 point) 24) Improved Outdoor Thermal Comfort (4 points) 25) Regionally Responsive Planning (2 points) 26) Safe and Secure Community (1 point)	16) Design for Differently Abled (R) 17) Road & Street Network (6 points) 18) Bicycle Lane Network (6 points) 19) Pedestrian Network (6 points)
Social & economic wellbeing - Social wellbeing (SE) (11 points)	**Precious Water – PW (37 points)**	**Infrastructure Resource Management – IRM (40 points)**
8) Public realm (2 points) 9) Green infrastructure (4 points) 10) Local vernacular (2 points) 11) Inclusive design (3 points)	27) Community Water Strategy (R) 28) Building Water Guidelines (R) 29) Water Monitoring and Leak Detection (R)	20) Rainwater Harvesting, 50% (R) 21) Segregation of Waste (Post- occupancy) (R) 22) Rainwater Harvesting, 75%, 95% (6 points)

	30) Community Water Use Reduction: Landscaping (14 points) 31) Community Water Use Reduction: Heat Rejection (5 points) 32) Community Water Use Reduction: Water Features (4 points) 33) Storm water Management (6 points) 34) Water Efficient Buildings (8 points)	23) Waste Water Treatment, 100% (6 points) 24) Waste Water Reuse, 75%, 95% (6 points) 25) On- site Renewable Energy (16 points) 26) Construction Waste Reduction (Civil Works) (6 points)
Recourses & Energy (RE) (22 points)	**Resourceful Energy – RE (8 points)**	**Innovation in Design & Technology (16 points)**
12) Energy strategy (11 points) 13) Water strategy (1 point) 14) Sustainable buildings (6 points) 15) Resource efficiency (4 points)	35) Community Energy Strategy (R) 36) Building Energy Guidelines (R) 37) Community Strategies for Passive Cooling (6 points) 38) Urban Heat Reduction (2 points)	
Land use & ecology (LE) (18 points)	**Stewarding Materials – SM (15 points)**	
16) Ecology Strategy (1 point) 17) Land use (3 points) 18) Water pollution (3 points) 19) Enhancement of ecological value (3 points) 20) Landscape (5 points) 21) Rainwater harvesting (3 points)	39) Basic Construction Waste Management (R) 40) Basic Operational Waste Management (R) 41) Regional Materials (2 points) 42) Recycled Materials (5 points) 43) Reused or Certified Timber (3 points) 44) Improved Construction Waste Management (2 points) 45) Improved Operation waste management (2 points) 46) Organic Waste Management (2 points) 47) Hazardous Waste Management (1 point)	
Transport & movement (TM) (4 points)	**Innovating Practice (3 points)**	

22) Safe and appealing streets (4 points)		
***Total Points (6 + 11 + 11 + 22 + 18) = 68 points**	**Total Points (6 + 14 + 20 + 37 + 8 + 17) = 102 points**	**Total Points (40 + 36 + 18 + 40) = (134 points)**
Total issues = 22 nos.	**Total issues = 47 nos.**	**Total issues = 26 nos.**

*Total points are points of only those credits which fall under Land Ethic criteria as derived in the Land Ethic Model.
Source: Self

8.1.2. Method formulated for comparison

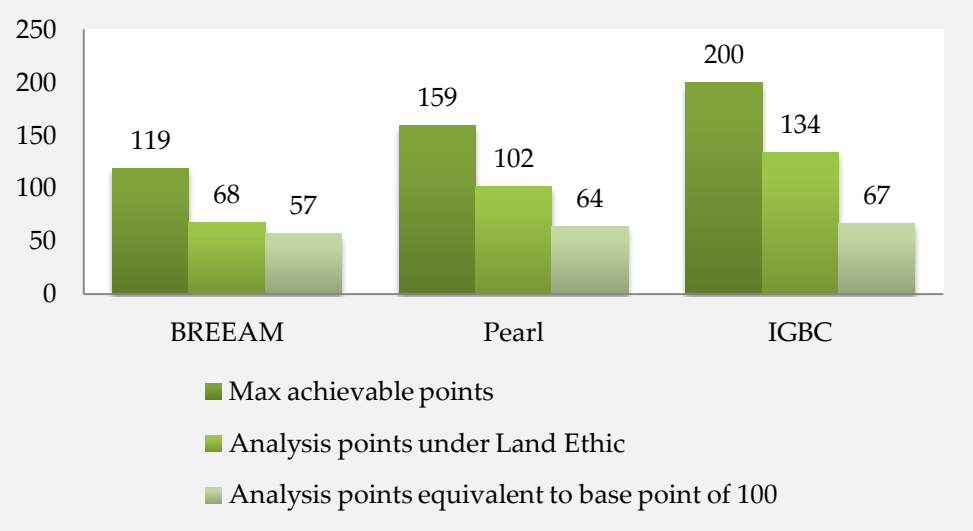
8.1.2.1. Following are the steps undertaken for arriving at a baseline calculation for the purpose of comparison. [Refer Table 2-(8) & Table 3-(8)]

i) Maximum achievable credit points under each rating system are noted.
ii) Total Credit points for those issues that fall under Land Ethic criteria as derived in the Land Ethic Model are calculated.
iii) Equivalent of this total to base point of 100 is then calculated for the purpose of mutual comparison and analysis.

Table 2-(8):- BREEAM, Pearl & IGBC credit point gist:-

	BREEAM	**Pearl**	**IGBC**
Maximum achievable points (A)	119	159	200
Analysis points under Land Ethics (B)	68	102	134
Analysis points equivalent to base point of 100 (C)	**57**	**64**	**67**

Source: Self

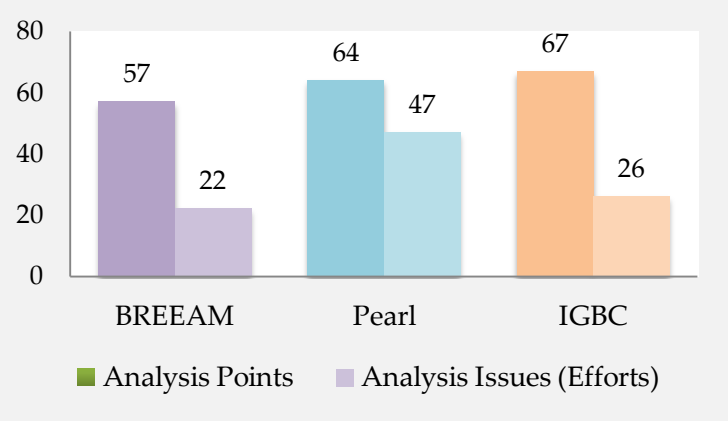


Bar Chart 1-(8):- BREEAM, Pearl & IGBC credit point's gist
Source: Self

Table 3-(8):- BREEAM, Pearl & IGBC analysis points & analysis issues

	BREEAM	Pearl	IGBC
Analysis Points	57	64	67
Analysis Issues (Efforts)	22	47	26

Source: Self



Bar Chart 2-(8):- BREEAM, Pearl & IGBC analysis points v/s analysis issues
Source: Self

8.1.2.2. Observations

Comparing the three systems above, it is observed that [Refer Bar Chart 2-(8)]:-

i) IGBC involves less numbers of issues (hence, less efforts) but fetches more points comparatively.
ii) BREAM is almost equivalent to IGBC in terms of both, the issues and credit points.
iii) Pearl demands more issue compliance (hence, more efforts) but less credit points as compared to those achieved in IGBC.
This illustrates Pearl Rating Systems to be comparatively more arduous to achieve.

8.2. Comparison in terms of Land Ethic keywords

→ This section illustrates a comparison between the three rating systems – BREEAM, Pearl and IGBC – on basis of Land Ethic members and keywords. It gives a snapshot about the total number of issues (efforts) and their respective credit points that each system demands under a particular Land Ethic member or keyword.

8.2.1. Method formulated for comparison:-

i) Total numbers of issues (efforts) under each system for each Land Ethic keyword is calculated.
ii) Total numbers of credit points in the respective issues for each Land Ethic keyword is calculated.
iii) Percentage of both these numbers is derived.
iv) These percentage are given grading – low (L), medium (M), high (H) – for each rating system within every Land Ethic keyword.
v) Each grading is given a sign and a number –

- Low = (-) & (1)
- Medium = (0) & (2)
- High = (+) & (3)

vi) An evaluation matrix as indicated below considering 'points' along X-axis and 'efforts' along Y-axis is formulated.

vii) Final grading (Effort-Points) along with its numbers are derived for each system and is plotted in this matrix. The numbers are not been added but are combined (as Efforts-Points) to arrive a 2 digit numbering for an unbiased analysis (as shown in the Standard Evaluation Matrix

viii) Lastly, a comparison summary [Table 15-(8)] of these grades and numbers for all Land Ethic keywords are tabulated.

ix) A Bar Chart for each keyword is also plotted to the comparative analysis and visual comprehension of the same.

		POINTS (X-axis)		
EFFORTS (Y-axis)		H (+)(3)	M (0)(2)	L (-)(1)
	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 1-(8):- Standard Evaluation Matrix for comparison
Source: Self

8.2.2. Comparison Table, Matrix & Bar Chart

8.2.2.1. Land Ethic Keyword – Community

Table 4-(8): - Land Ethic Keyword - Community Comparison for BREEAM, Pearl & IGBC

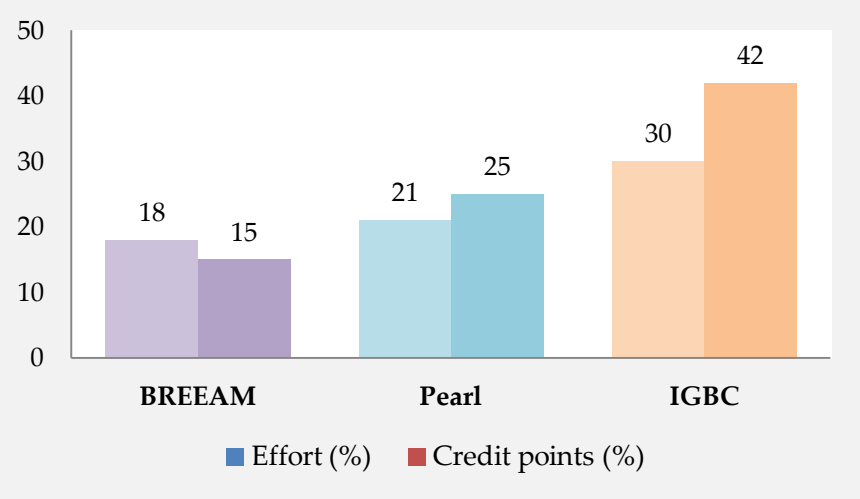
Keyword - COMMUNITY						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Consultation Plan	1	Integrated Development Strategy	R	Public Landscape Areas	6
2	Community management of facilities	2	Community-Dedicated Infrastructure Basic Commissioning	R	Local Fruits & Vegetable Produce	8
3	Green infrastructure	4	Guest Worker Accommodation	2	Basic Facilities for Construction Workforce	R
4	Inclusive design	3	Food Systems	2	Housing Typologies	8
5			Provision of Amenities & Facilities	R	Social & Cultural Initiatives	6

6			Neighborhood Connectivity	3	Design for Differently Abled	R
7			Housing Diversity	2		
8			Community Walkability	4		
9			Safe & Secure Community	1		
10			Regional Material	2		
T	**4 nos.**	**9**	**2R + 8 nos.**	**16**	**2R + 6 nos.**	**28**
%	**18**	**15**	**21**	**25**	**30**	**42**
G	**L**	**L**	**H**	**M**	**M**	**H**
	LL		**HM**		**MH**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS - Community		
		H (+)(3)	M (0)(2)	L (-)(1)
EFFORTS - Community	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 2-(8):- Rating Systems Evaluation Matrix for Land Ethic keyword COMMUNITY
Source: Self



Bar Chart 2-(8):- Efforts v/s Credit points for Land Ethic Member - COMMUNITY
Source: Self

8.2.2.2. Land Ethic Keyword – Soils

Table 5-(8):- Land Ethic Member - Soils Comparison for BREEAM, Pearl & IGBC

Member - SOILS						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Energy strategy	11	Natural Systems Design and Management Strategy	R	Soil Erosion Control Plan	R
2	Sustainable Buildings.	6	Reuse of Land	2	Segregation of Waste (Post- occupancy)	R
3	Resource efficiency	4	Community Water Use Reduction: Landscaping	14	On- site Renewable Energy	16
4	Land use	3	Storm water Management	6	Construction Waste Reduction (Civil Works)	6
5			Basic Construction Waste Management	R		
6			Basic Operational Waste Management	R		
7			Recycled Materials	5		
8			Organic Waste Management	2		
9			Hazardous Waste Management	1		
T	**4 nos.**	**24**	**3R + 6**	**30**	**2R + 2**	**22**
%	**18**	**42**	**19**	**47**	**18**	**33**
G	**L**	**M**	**H**	**H**	**M**	**L**
	LM		**HH**		**ML**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS - Soils		
		H (+)(3)	M (0)(2)	L (-)(1)
EFFORTS - Soils	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 3-(8):- Rating Systems Evaluation Matrix for Land Ethic Member Soils
Source: Self

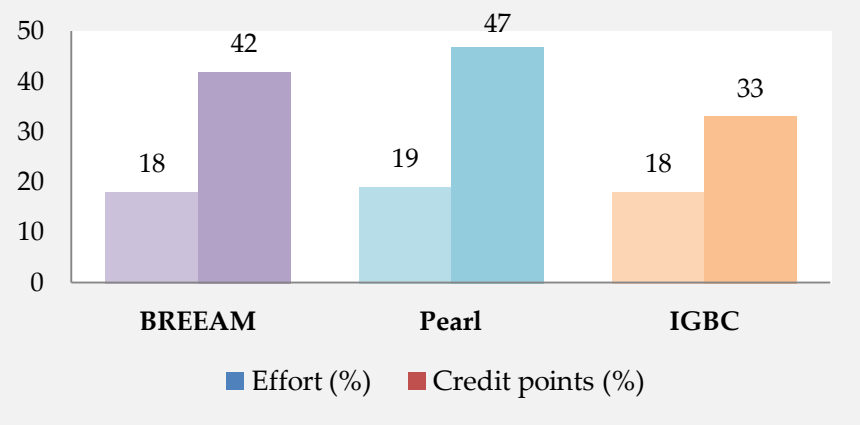


Chart 3-(8):- Efforts v/s Credit points for Land Ethic Member - Soil
Source: Self

8.2.2.3. Land Ethic Keyword – Waters

Table 6-(8):- Land Ethic Member - Waters Comparison for BREEAM, Pearl & IGBC

Member - WATERS						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Flood risk assessment	2	Outdoor Thermal Comfort Strategy	R	Preserve Existing Trees & Water Bodies	6
2	Flood risk management	3	Community Water Strategy	R	Green Buildings	12
3	Water strategy	1	Building Water Guidelines	R	Rainwater Harvesting 50%	R
4	Sustainable Buildings	6	Water Monitoring and Leak Detection	R	Rainwater Harvesting 75%, 95%	6
5	Water pollution	3	Community Water Use Reduction: Landscaping	14	Waste Water Treatment, 100%	6
6	Landscape	5	Community Water Use Reduction: Heat Rejection	5	Waste Water Reuse, 75%, 95%	6
7	Rainwater harvesting	3	Community Water Use Reduction: Water Features	4		
8			Storm water Management	6		
9			Water Efficient Buildings & Plots	8		
10			Community Strategies for Passive Cooling	6		
11			Hazardous Waste Management	1		

T	**7 nos.**	**23**	**4R + 7**	**44**	**1R + 5**	**36**
%	**32**	**40**	**23**	**69**	**23**	**53**
G	**M**	**L**	**H**	**H**	**L**	**M**
	ML		**HH**		**LM**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS - Waters		
		H (+)(3)	M (0)(2)	L (-)(1)
EFFORTS - Waters	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 4-(8):- Rating Systems Evaluation Matrix for Land Ethic Member Waters
Source: Self

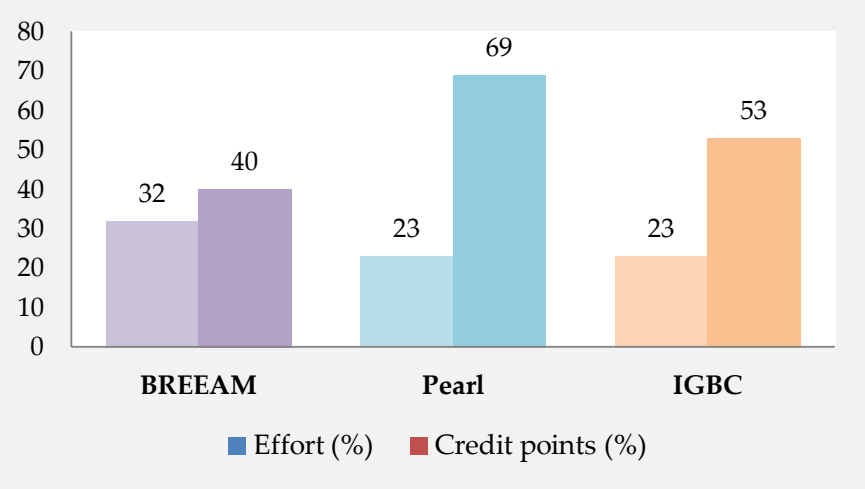


Chart 4-(8):- Efforts v/s Credit points for Land Ethic Member - Waters
Source: Self

8.2.2.4. Land Ethic Keyword – Plants/Animals

Table 7-(8):- Land Ethic Member – Plants/Animals Comparison for BREEAM, Pearl & IGBC:-

Member – PLANTS/ANIMALS						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Microclimate	3	Food Systems	2	Preserve Existing Trees & Water Bodies	6
2	Public realm	2	Outdoor Thermal Comfort Strategy	R	Public Landscape Areas	6

3	Energy strategy	11	Improved Outdoor Thermal Comfort	4	Local Fruits & Vegetable Produce	8
4	Water strategy	1	Community Water Strategy	R	Urban Heat Island Effect	8
5	Enhancement of ecological value	3	Building Water Guidelines	R	Green Buildings	12
6	Landscape	5	Community Energy Strategy	R		
7			Building Energy Guidelines	R		
8			Community Strategies for Passive Cooling	6		
9			Urban Heat Reduction	2		
10			Reused or Certified Timber	3		
11			Organic Waste Management	2		
T	**6 nos.**	**25**	**5R + 6 nos.**	**19**	**5 nos.**	**40**
%	**27**	**44**	**23**	**30**	**19**	**60**
G	**M**	**M**	**H**	**L**	**L**	**H**
	MM		**HL**		**LH**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS – Plants/Animals		
EFFORTS - Plants/Animals		H (+)(3)	M (0)(2)	L (-)(1)
	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 5-(8):- Rating Systems Evaluation Matrix for Land Ethic Member Plants / Animals
Source: Self

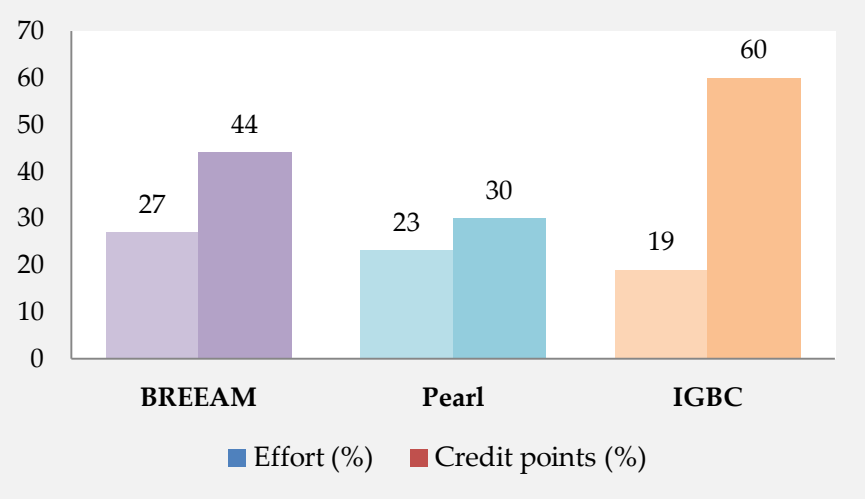


Chart 5-(8):- Efforts v/s Credit points for Land Ethic Member - Plants / Animals
Source: Self

8.2.2.5. Land Ethic Keyword – Land Organism

Table 8-(8):- Land Ethic keyword – Land Organism Comparison for BREEAM, Pearl & IGBC:-

Keyword – LAND ORGANISM						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Adapting to climate change	3	Natural Systems Design and Management Strategy	R	Avoid Development of Inappropriate Sites	R
2	Ecology strategy	1	Ecological Enhancement	2		
3	Land use	3	Habitat Creation and Restoration	6		
4	Water pollution	3	Open Space Network	3		
5	Enhancement of ecological value	3	Community Strategies for Passive Cooling	6		
T	**5 nos.**	**13**	**1R + 4 nos.**	**17**	**1R no.**	**--**
%	**27**	**23**	**11**	**26**		
G	**M**	**M**	**H**	**H**	**L**	**L**
	MM		**HH**		**LL**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

EFFORTS – Land Organism	POINTS – Land Organism			
		H (+)(3)	M (0)(2)	L (-)(1)
	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 6-(8):- Rating Systems Evaluation Matrix for Land Ethic keyword Land Organism
Source: Self

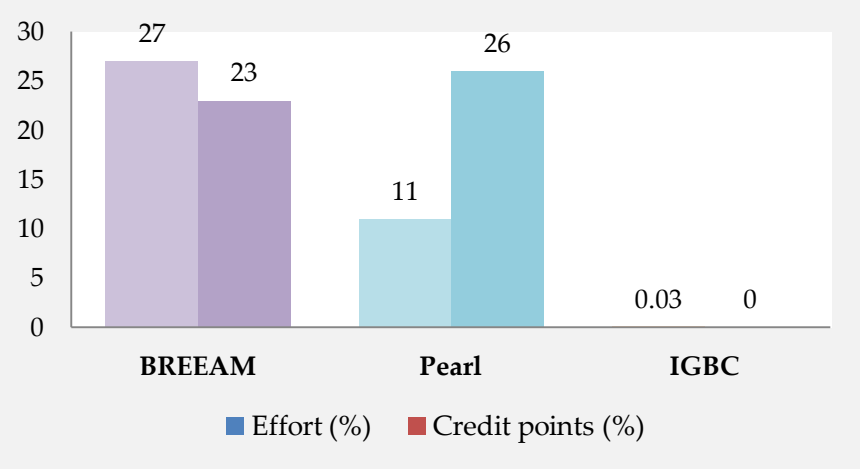


Chart 6-(8):- Efforts v/s Credit points for Land Ethic keyword – Land Organism
Source: Self

8.2.2.6. Land Ethic Keyword – Land Health

Table 9-(8):- Land Ethic keyword – Land Health Comparison for BREEAM, Pearl & IGBC:-

Keyword – LAND HEALTH						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Microclimate	3	Natural Systems Design and Management Strategy	R	Avoid Development of Inappropriate Sites	R
2	Adapting to climate change	3	Remediation of Contaminated Land	2	Redevelopment of Contaminated Areas	6
3	Ecology strategy	1	Habitat Creation and Restoration	6	Segregation of Waste (Post- occupancy)	R
4	Land use	3	Outdoor Thermal Comfort Strategy	R	Waste Water Treatment, 100%	6

5	Water pollution	3	Improved Outdoor Thermal Comfort	4	Construction Waste Reduction (Civil Works)	6
6	Enhancement of ecological value	3	Regionally Responsive Planning	2		
7			Community Strategies for Passive Cooling	6		
T	**6 nos.**	**16**	**2R + 5 nos.**	**20**	**2R + 3 nos.**	**18**
%	**27**	**28**	**15**	**31**	**19**	**27**
G	**M**	**L**	**H**	**H**	**L**	**M**
	ML		**HH**		**LM**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS – Land Health		
		H (+)(3)	M (0)(2)	L (-)(1)
EFFORTS - Land Health	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(023	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 7-(8):- Rating Systems Evaluation Matrix for Land Ethic keyword Land Health
Source: Self

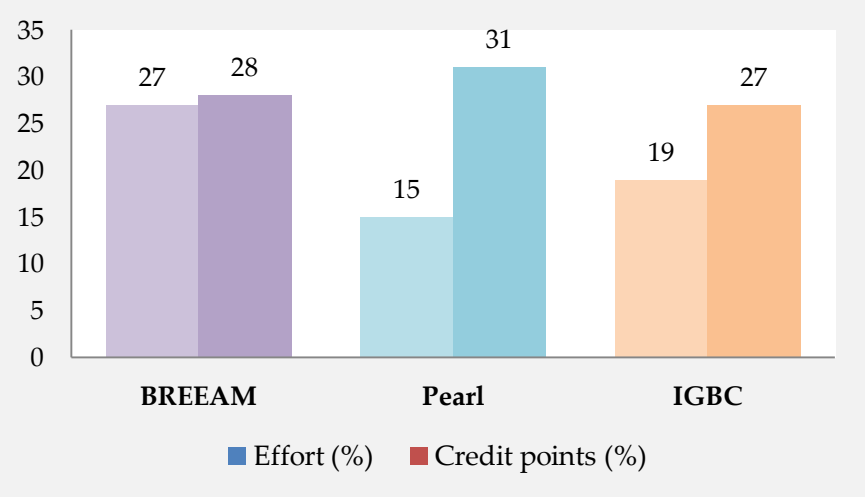


Chart 7-(8):- Efforts v/s Credit points for Land Ethic keyword - Land Health
Source: Self

8.2.2.7. Land Ethic Keyword – Land Pyramid / Cycle

Table 10-(8):- Land Ethic keyword – Land Pyramid / Cycle Comparison for BREEAM, Pearl & IGBC

Keyword – LAND PYRAMID / CYCLE						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Energy strategy	11	Community Water Use Reduction: Landscaping	14	Rainwater Harvesting 50%	R
2	Sustainable Buildings	6	Community Water Use Reduction: Heat Rejection	5	Rainwater Harvesting 75%, 95%	6
3	Rainwater harvesting	3	Community Water Use Reduction: Water Features	4	Segregation of Waste (Post-occupancy)	R
4			Storm water Management	6		
5			Basic Operational Waste Management	R		
6			Recycled Materials	5		
7			Reused or Certified Timber	3		
8			Organic Waste Management	2		
T	**3 nos.**	**20**	**1R + 7 nos.**	**39**	**2R + 1 nos.**	**6**
&	**17**	**35**	**17**	**61**	**11**	**9**
G	**L**	**M**	**H**	**H**	**M**	**L**
	LM		**HH**		**ML**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS – Land Pyramid		
EFFORTS – Land Pyramid		H (+)(3)	M (0)(2)	L (-)(1)
	H (+)(3)	HH (+ +)	HM (+ 0)	HL (+ -)
	M (0)(2)	MH (0 +)	MM (0 0)	ML (0 -)
	L (-)(1)	LH (- +)	LM (- 0)	LL (- -)

Matrix 8-(8):- Rating Systems Evaluation Matrix for Land Ethic keyword Land Pyramid / Cycle
Source: Self

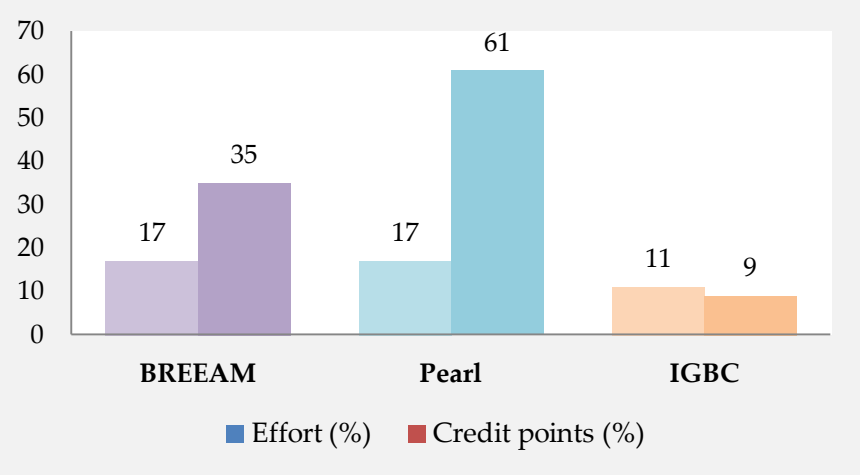


Chart 8-(8):- Efforts v/s Credit points for Land Ethic keyword - Land Pyramid / Cycle
Source: Self

8.2.2.8. Land Ethic Keyword – Ecological Conscious

Table 11:- Land Ethic keyword – Ecological Conscience Comparison for BREEAM, Pearl & IGBC:-

Keyword – ECOLOGICAL CONSCIOUS						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Flood risk assessment	3	Guest Worker Accommodation	2	Avoid Development of Inappropriate Sites	R
2	Adapting to climate change	3	Construction Environmental Management	2	Retain Natural Topography	6
3	Green infrastructure	4	Natural Systems Assessment	R	Local Fruits & Vegetable Produce	8
4	Ecology strategy	1	Natural Systems Protection	R	Basic Facilities for Construction Workforce	R
5	Enhancement of ecological value	3	Natural Systems Design and Management Strategy	R	Green Buildings	12
6	Landscape	5	Ecological Enhancement	2		
7			Habitat Creation and Restoration	6		
8			Food Systems	2		
9			Open Space Network	3		
10			Storm water Management	6		
11			Improved Construction Waste Management	2		
12			Improved Operational Waste Management	2		

13			Organic Waste Management	2		
14			Hazardous Waste Management	1		
T	**6 nos.**	**19**	**3R + 11 nos.**	**30**	**2R + 3 nos.**	**26**
%	**27**	**33**	**30**	**47**	**19**	**39**
G	**M**	**L**	**H**	**H**	**L**	**M**
	ML		**HH**		**LM**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS – Ecological Conscious		
		H (+)(3)	M (0)(2)	L (-)(1)
EFFORTS - Ecological Conscious	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 9-(8):- Rating Systems Evaluation Matrix for Land Ethic keyword Ecological Conscious
Source: Self

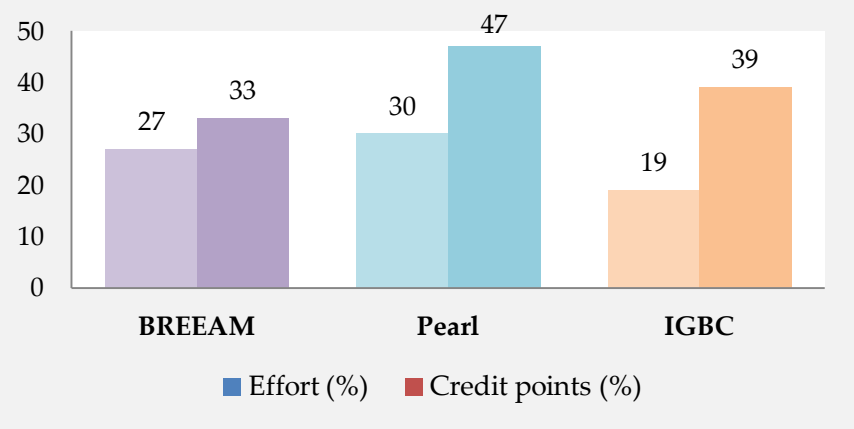


Chart 9-(8):- Efforts v/s Credit points for Land Ethic keyword - Ecological Conscious
Source: Self

8.2.2.9. Land Ethic Keyword – Land Use

Table 12-(8):- Land Ethic keyword – Land Use Comparison for BREEAM, Pearl & IGBC:-

Keyword – LAND USE						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Consultation and	2	Natural systems	R	Local Regulations	R

	engagement		protection			
2	Flood risk assessment	2	Reuse of land	2	Avoid Development of Inappropriate Sites	R
3	Microclimate	3	Ecological enhancement	2	Preserve Existing Trees & Water Bodies	6
4	Adapting to climate change	3	Food systems	2	Retain Natural Topography	6
5	Public realm	2	Plan 2030	R	Local Fruits & Vegetable Produce	8
6	Green infrastructure	4	Urban systems assessment	R	Land Use Optimization	R
7	Local vernacular	2	Outdoor thermal comfort strategy	R	Mixed Use Development	10
8	Energy strategy	11	Neighborhood connectivity	3	Housing Typologies	8
9	Water strategy	1	Open space network	3	Road & Street Network	6
10	Enhancement of ecological value	3	Regionally responsive planning	2	Bicycle Lane Network	6
11	Rainwater harvesting	3	Community energy strategy	R	Pedestrian Network	6
12	Safe and appealing streets	4	Building energy guidelines	R		
T	**12 nos.**	**40**	**6R + 6 nos.**	**14**	**3R + 8 nos.**	**56**
%	**54**	**70**	**26**	**80**	**42**	**84**
G	**M**	**M**	**H**	**L**	**L**	**H**
	MM		**HL**		**LH**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS – Land Use		
		H (+)(3)	M (0)(2)	L (-)(1)
EFFORTS – Land Use	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 10-(8):- Rating Systems Evaluation Matrix for Land Ethic keyword Land Use
Source: Self

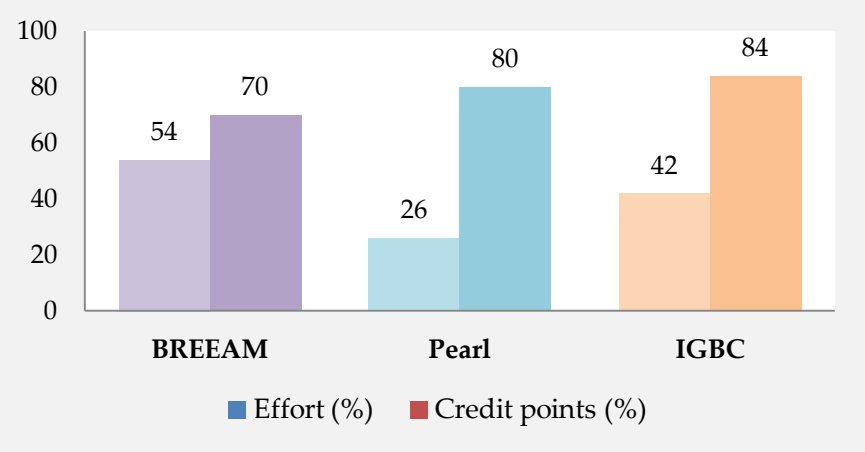


Chart 10-(8):- Efforts v/s Credit points for Land Ethic keyword - Land Use
Source: Self

8.2.2.10. Land Ethic Keyword – Conservation/Preservation/Recreation

Table 13-(8):- Land Ethic keyword – Conservation / Preservation / Recreation Comparison for BREEAM, Pearl & IGBC:-

Keyword – CONSERVATION/PRESERVATION/RECREATION						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Flood risk assessment	2	Natural Systems Protection	R	Soil Erosion Control Plan	R
2	Adapting to climate change	3	Natural Systems Design and Management Strategy	R	Preserve Existing Trees & Water Bodies	6
3	Green infrastructure	4	Reuse of Land	2	Local Fruits & Vegetable Produce	8
4	Water strategy	1	Ecological Enhancement	2	Green Buildings	12
5	Sustainable Buildings	6	Habitat Creation and Restoration	6	Social & Cultural Initiatives	6
6	Ecology strategy	1	Food Systems	2	Bicycle Lane Network	6
7	Enhancement of ecological value	3	Active Urban Environments	1	Pedestrian Network	6
8	Landscape	5	Regionally Responsive Planning	2	Rainwater Harvesting 50%	R
9	Rainwater harvesting	3	Water Monitoring and Leak Detection	R	Rainwater Harvesting 75%,95%	6
10			Community Water Use Reduction: Landscaping	14	Waste Water Reuse, 75%, 95%	6
11			Community Water Use Reduction: Heat	5	On- site Renewable Energy	16

			Rejection			
12			Community Water Use Reduction: Water Features	4		
13			Water Efficient Buildings & Plots	8		
14			Community Strategies for Passive Cooling	6		
T	**9 nos.**	**28**	**3R + 11**	**52**	**2R + 9**	**72**
%	**41**	**49**	**30**	**81**	**42**	**107**
G	**L**	**L**	**H**	**M**	**M**	**H**
	LL		**HM**		**MH**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS – Conservation/Preservation/Recreation (CPR)		
		H (+)(3)	M (0)(2)	L (-)(1)
EFFORTS - CPR	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 11-(8):- Rating Systems Evaluation Matrix for Land Ethic keyword Conservation / Preservation / Recreation
Source: Self

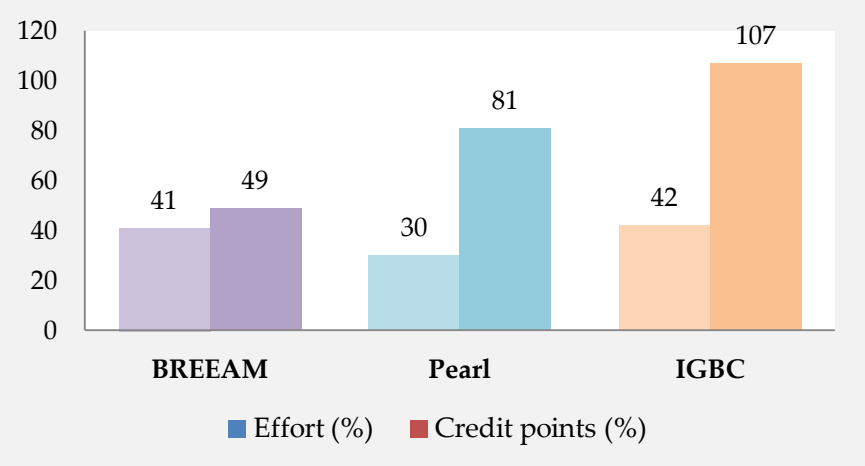


Chart 11-(8):- Efforts v/s Credit points for Land Ethic keyword - Conservation / Preservation / Recreation
Source: Self

8.2.2.11. Land Ethic Keyword – Education/Awareness/Social Interaction

Table 14-(8):- Land Ethic keyword – Education / Awareness / Social Interaction Comparison for BREEAM, Pearl & IGBC:-

Keyword – EDUCATION/ AWARENESS / SOCIAL INTERACTION						
SN	**BREEAM (Efforts)**	**Pt**	**Pearl (Efforts)**	**Pt**	**IGBC (Efforts)**	**Pt**
1	Community management of facilities	3	Sustainable Building Guidelines	R	Housing Typologies	8
2	Public realm	2	Guest Worker Accommodation	2	Social & Cultural Initiatives	6
3	Inclusive design	3	Sustainability Awareness	2		
4	Resource efficiency	4	Provision of Amenities and Facilities	R		
5	Landscape	5	Neighborhood Connectivity	3		
6	Safe and appealing streets	4				
T	**6 nos.**	**21**	**2R + 3**	**7**	**2 nos.**	**14**
%	**27**	**37**	**11**	**11**	**8**	**21**
G	**H**	**H**	**M**	**L**	**L**	**M**
	HH		**ML**		**LM**	

Pt = Points, R = Required, T = Total, % = Percentage, G = Grade, H = High (+), M = Medium (0), L = Low (-)
Source: Self

		POINTS – Education/Awareness/Social Interaction (EAS)		
		H (+)(3)	M (0)(2)	L (-)(1)
EFFORTS - EAS	H (+)(3)	HH (+ +)(33)	HM (+ 0)(32)	HL (+ -)(31)
	M (0)(2)	MH (0 +)(23)	MM (0 0)(22)	ML (0 -)(21)
	L (-)(1)	LH (- +)(13)	LM (- 0)(12)	LL (- -)(11)

Matrix 12-(8):- Rating Systems Evaluation Matrix for Land Ethic keyword Education / Awareness / Social Interaction
Source: Self

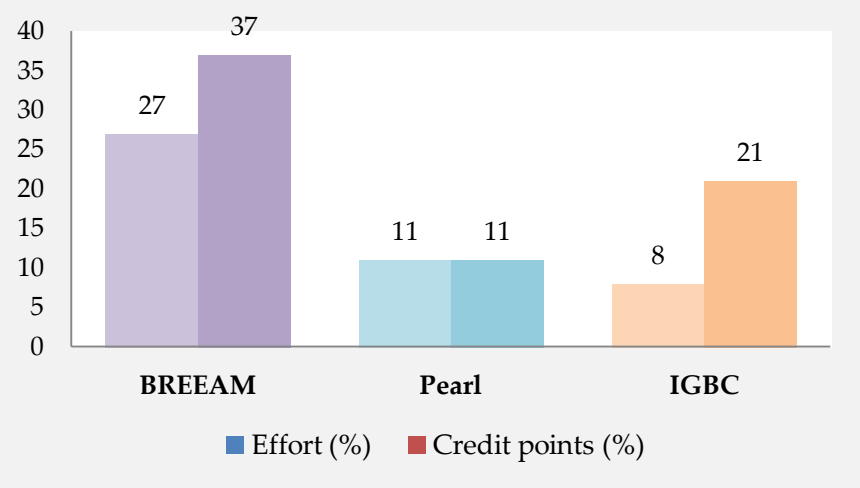


Chart 12-(8):- Efforts v/s Credit points for Land Ethic keyword - Education/Awareness/Social Interaction
Source: Self

8.3. Observations & Conclusions:-

Following are the observations drawn from Table 15-(8):-

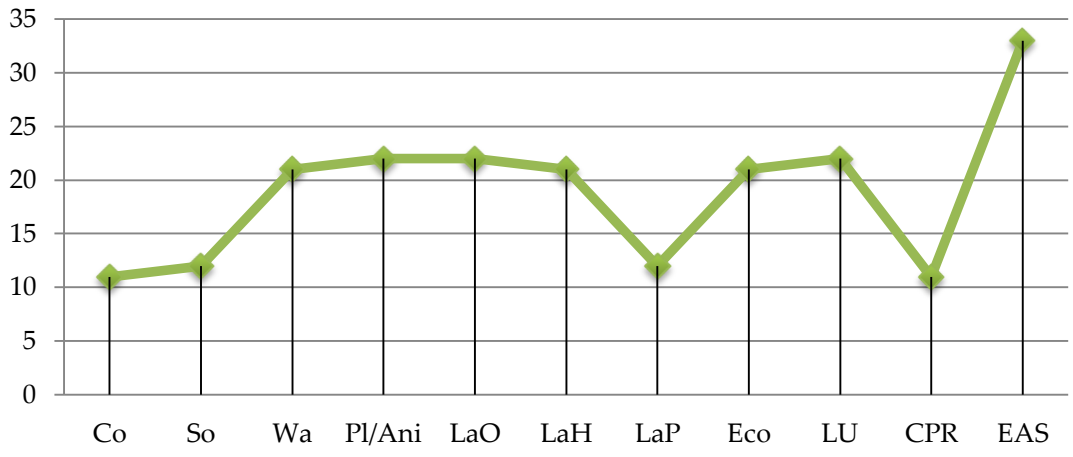
i) In terms of numbers achieved, Pearl is highest, BREEAM is middle and IGBC is last.
ii) Maximum grading achieved (for both efforts and points) by BREEAM for the selected issues are 'medium'.
iii) This denotes that BREEAM demands fairly good amount of efforts towards selected Land Ethic keywords and grants points proportionately.
iv) Maximum grading achieved (for both efforts and points) by Pearl for the selected issues are 'high'.
v) This denotes that Pearl demands very good amount of efforts towards selected Land Ethic keywords and grants points proportionately.
vi) Almost equal grading achieved (for both efforts and points) by IGBC for the selected issues are 'low' and 'medium'.
vii) This denotes that IGBC does not demonstrate a proportionate allotment of points in relation to the efforts.

Table 15-(8):- BREEAM, Pearl & IGBC Grade Comparison

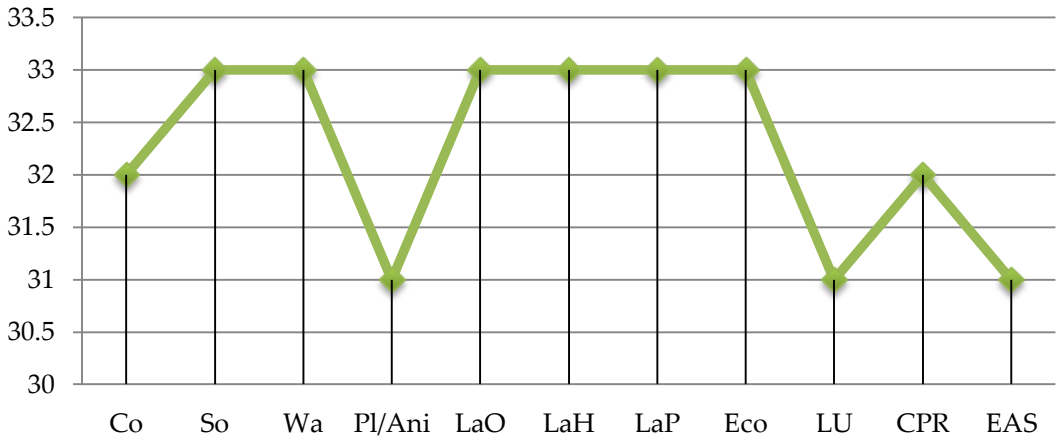
SN	Land Ethic keyword	BREEAM		Nos.	Pearl		Nos.	IGBC		Nos.
1	Community (Co)	LL	(- -)	11	HM	(+ 0)	32	MH	(0 +)	23
2	Soils (So)	LM	(- 0)	12	HH	(+ +)	33	ML	(0 -)	21
3	Waters (Wa)	ML	(0 -)	21	HH	(+ +)	33	LM	(- 0)	12
4	Plants / Animals (Pl/Ani)	MM	(0 0)	22	HL	(+ -)	31	LH	(- +)	13
5	Land Organism (LaO)	MM	(0 0)	22	HH	(+ +)	33	LL	(- -)	11
6	Land Health (LaH)	ML	(0 -)	21	HH	(+ +)	33	LM	(- 0)	12
7	Land Pyramid / Cycle (LaP)	LM	(- 0)	12	HH	(+ +)	33	ML	(0 -)	21
8	Ecological Conscience (ECo)	ML	(0 -)	21	HH	(+ +)	33	LM	(- 0)	12
9	Land Use (LU)	MM	(0 0)	22	HL	(+ -)	31	LH	(- +)	13
10	Conservation/Preservation/Recreation (CPR)	LL	(- -)	11	HM	(+ 0)	32	MH	(0 +)	23
11	Education/Awareness/Social Interaction (EAS)	HH	(+ +)	33	ML	(0 -)	31	LM	(- 0)	12
	Total Numbers			**208**			**354**			**173**

Source: Self

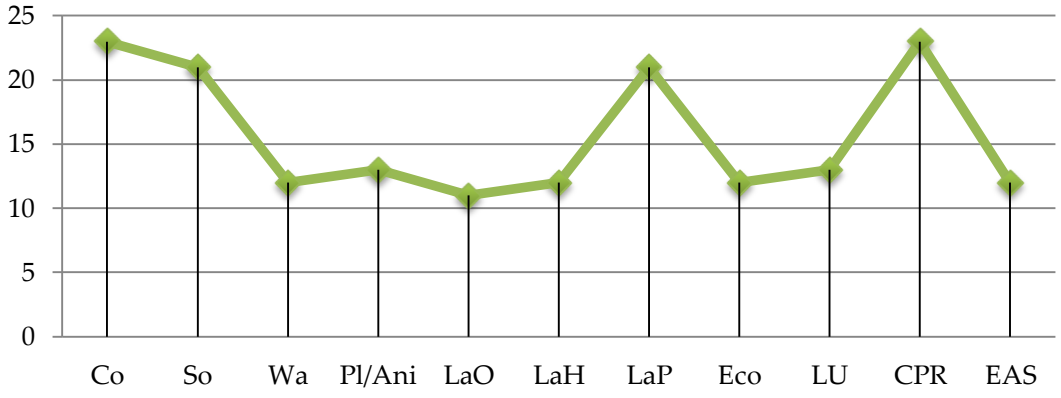
Refer Bar Chart 13-(8), 14-(8) & 15-(8) for a quick glance of numbers (grade) comparison for BREEAM, Pearl & IGBC respectively.



Bar Chart 13-(8):- BREEAM Numbers (Grade) Comparison



Bar Chart 14-(8):- Pearl Numbers (Grade) Comparison



Bar Chart 15-(8):- IGBC Numbers (Grade) Comparison

Chapter 9 Guidelines Recommendation

9.1. Guidelines proposition:-

After a comparison of three varied types rating systems for community development here are some of the guidelines formulated underpinning the principles of Land Ethic. The bases for the formulation of guidelines for rating systems are summarized as under:-

i) The philosophy expressed by Leopold in his essay on The Land Ethic needs to be highlighted and emphasized in the rating systems.
ii) An understanding and use of Land Ethic keywords such as – Land Health, Land Organism and so on will enable the development to be more sensitive and vigilant to the modifications that it causes to the Land.
iii) Every project needs to be conceived with a specific vision, objective and target during the time of its inception.
iv) All the activities, conservation and mitigation measures associated with a particular development needs to be associated with the ecosystem services that are either hampered, terminated and/ enhanced at every stage of development process.

9.2. Guidelines Recommendation:-

Guidelines recommendations are on the following two themes:

i) Land Ethic keywords such as:-
    a) Land Organism
    b) Land Health
    c) Land Pyramid/Cycle
    d) Ecological Conscious
    e) Land Use
    f) Conservation/Preservation
    g) Education/Awareness/Social Interaction
ii) Ecosystem Services :-
    a) A gist of ecosystem services directly and indirectly associated with the Land Ethic Members – Soils, Waters and Plants/Animals – are tabulated.

9.2.1. Theme 1:- Land Ethic keywords

The guidelines for each Land Ethic keyword are formulated considering the Land Ethic members – Soils, Waters and Plants as follows:-

9.2.1.1. Land Organism:-

Intent:-

To understand and identify those ecological aspects of the property that contributes to the Land as an Organism. Prepare an inventory and/ matrix for the same.

Table 1:- Recommended guidelines for Land Organism

SN	Land Organism		
	Soils	**Waters**	**Plants**
1	Understand the natural topography of the property	Identify the water bodies present (if any) on and adjacent to the property	Identify the types of natural / native plant communities occuring on the property
2	Identify the soil type and its associated nutrient properties	Identify the course of water and its type (perennial or occasional)	Identidfy the associated species of fauna (such as birds, butteflies, insects and so on)
3	Identify the fauna associated with the soil type	Identify the water table /channels and probable location of aquifers within the property	Identify the exotic and invasive plants and animal species seen on the property and their frequent occurence
4	Understand the associated soil ecology	Identify ecosystem services rendered by the water channels contributing to Land Organism per se	Identify any endangered or threatened flaura and fauna on the property
5	Identify ecosystem services rendered by the soil ecology contributing to Land Organism per se		Understand the role played by the identified flora and fauna in the local ecology of the property
6			Identify ecosystem services rendered by such flora and fauna contributing to Land Organism per se

9.2.1.2. Land Heath

Intent:-

To understand and identify the symptoms or indicators of a healthy land and the ecosystem. Prepare an inventory and/matrix to explain the same.

Table 2:- Recommended guidelines for Land Organism

SN	Land Health		
	Soils	**Waters**	**Plants**
1	Identify the fertility value of the soil	Investigate the physical and chemical properties of water	Identify the type of biodiversity associated with the native plants on the property

2	Identify the chemical, physical and biological properties of soil and the relationship between these properties	Identify the annual rainfall, relative humidity, precipitation data of the property	Identify the fruits and flowering seasons of the resepective plant species
3	Identify the soil properties and its effects on the water and plant relations	Identify the flooding potential of the property	The water and fertility requirement for the normal growth and survival of the plants
4	Identify the relationship between the soil organic matter and basic soil properties	Identify the past and the furure scenarios of flood occurances of the property	Identify contribution of the plant community towards microclimate of the property
5		Identify existing pollution level or future probability of pollution of water	

9.2.1.3. Land Pyramid/Cycle

Intent:-

To identify the components that will contribute to Land Pyramid / Cycle.

Table 3:- Recommended guidelines for Land Pyramid/Cycle

SN	**Land Pyramid / Cycle**		
	Soils	**Waters**	**Plants**
1	Identify the potential of soil to support the growth of fruits and vegetable plants and trees	Identify the water recharging pottential of the soil on the property and their probable locations	Identify the plants capable of serving as a food source (as a part of Land pyramid)
2	Create a possibility of natural decay and decomposition of the dead plant organic matter	Identify strategies and methods for rain water harvesting	Identify the human population to whom the food will cater to
3	Create a strategy to compost the post occupancy organic waste generated on the property for landscape use	Identify the quantam of water that can be recycled and reused on the property	Broadly identify the upper levels of the pyramid which will depend on these plants (existing as well as proposed) for their food

9.2.1.4. Ecological Conscious

Intent:-

To demonstrate the extent to which the development is conscious about the local ecology of the property.

Table 4:- Recommended guidelines for Ecological Conscious

SN	Ecological Conscious		
	Soils	**Waters**	**Plants**
1	Identify the probablity of soil erosion on the property during and post construction stages	Broadly identify the ecological aspects (such as biotic and abiotic componets, organisma, hydrology and so on) of the natural water course (if any) on the property	Identify the ecological importance (in terms of the soil stability, air quality, water purification and so on) of existing plant communities
2	Identify the probablity of soil erosion during normal and heavy rainfall periods	Identify the water holding capacity of the soil	Identify various species of fauna that are dependent on the plant communities and vice versa
3	Identify strategies to enhance the fertility and quality of soil in natural and organic manner	Identify the water requirement of the existing and proposed plant community	Identify the parameters of microclimate that are enchaned by the existing and proposed plant communities(such as heat island effect, wind movement, humdidity, solar radiation etc.)
4	Take special care to prevent contamination of soil during and post construtction stages	Identify ecosystem services benefits on the property and the surrounding area	Identify ecosystem services benefits on the property and the surrounding area
5	As far as possible use biological methods (such as vegetation, swales, contors etc.) for the prevention and contamination of soil and its erosion		
6	Identify the ecosystem services benefits on the property and the surrounding area		

9.2.1.5. Land **Use**

Intent:-

To demonstrate how the land use plan shows concern for the Land Ethic members - soils, waters and plants / animals - within the development parameters of the property. To demonstrate the exploitation of these members to enhance the quality of life through efficient land use plan.

Table 5:- Recommended guidelines for Land Use

SN	Land Use		
	Soils	**Waters**	**Plants**
1	Develop the land use plan in a way to avoid and/ lessen the disturbance on the untouched soil zones	Develop the land use plan considering risks due to flood and climate change	Consider retaining as much existing trees as possible during land use planning
2	Retain the natural topography of the soil as much possible	Plan mitigation measures to combat effects of floods in land use plan	plan the plantation / green belts in way to reduce the heat island effect and enhance the microclimate of the property
3	Take precaution to avoid contaminatio of soil due to land use during and post construction phases	Avoid disturbing the existing natural water bodies or water cource prevailing on the property	Create a network of green belts whereever possible to create a link in the biodiversity
4	Plan land use in a way to prevent soil erosion	Create as much softscape areas as possible (for surface permeability)	Plan for localized zones for production of food
5		Consider recharging the rainwater to replenish the under ground water table	Minimize the built-up areas and plan for as much green areas as possible
6		Plan land use so as to avoid pollution of sub-soil water during and post construction stages	

9.2.1.6. Conservation / Preservation

Intent:-

To formulate strategies to conserve/preserve the vital Land Ethic members within the development parameters of the property.

Table 6:- Recommended guidelines for Conservation / Preservation

SN	Conservation / Preservation		
	Soils	**Waters**	**Plants**
1	Adapt bio-techniques such as swales, contours, vegetation to prevent soil erosion	conserve the natural water bodies and natural water cources present on the property	Retain as much existing trees, shrubs, hedges as possible on the property
2	preserve the natural soil present on the property with due measures and precaution to avoid its	plan to conserve the rain water for reuse for secondary purposes such as flushing, gardening etc.	make use of native plant species as much possible

	contamination		
3	avoid the use of chemical fertilizers to enhnace the soil fertility and prefer the use of organic methods for the same	plan to conserve the rainwater through ground water recharge techniques such as recharge pits, trenches, swales etc.	
4	Retain the topography of the property to maximum possible extent	reduce water demad during planing phase and make use of water efficient fixtures	
5		use native and draught tolerant specices as much possible	
6		plan for irrigation systmes for the landscaped areas	
		Avoid wastage of water through evaporation or leakages	

9.2.1.7. Education/Awareness/Social Interaction

Intent:-

To spread the knowledge and importance of ecology to humans. To encourage actions to conserve and preserve the local ecology. To educate and spread awareness about the idea of ecosystem services. To enhance social interaction for the transfer of knowledge as well as for the strong societal.

Table 7:- Recommended guidelines for Education / Awareness / Social Interaction

SN	**Education / Awareness / Social Interaction**		
	Soils	**Waters**	**Plants**
1	Spread awareness about the importance of natural soil and causes of its depletion	Spread awareness about the importance of water and education on water pollution and its causes and effects	Spread the knowledge about the role played by plants in the rgulation of air, climate and water for the benefit and survival of mankind
2	Spread awareness about the effects of deforestation on the local soil	Spread awareness about the depleting fresh water sourcse due to mis use and over-use	Encourage green spaces in such a way so as to encourge social interaction between mankind communities
3	Educate people about the ecological importnace of soil and its role in the Land pyramid	Higlight the importance of water in terms of ecosystem services rendered to mankind	Higlight the importance of water in terms of ecosystem services rendered to mankind
4	Highlight the value of		

	soil in terms of ecosystem services rendered to mankind		

9.2.2. Theme 2:- Ecosystem Services:-

A gist of ecosystem services directly and indirectly associated with the Land Ethic Members – Soils, Waters and Plants/Animals – are tabulated as under:-

9.2.2.1. Ecosystem Services from Soils

Table 8:- List of ecosystem services associated with Soils:-

SN.	Direct	Indirect
1	Waste treatment	Food
2	Disease regulation	Fiber
3	Water regulation	Fuel
4	Water purification	Genetic resources
5	Cultural diversity	Biochemical
6	Spiritual diversity	Natural medicines
7	Religious systems	Pharmaceuticals
8	Knowledge systems	Ornamental resources
9	Educational systems	Air quality regulation
10	Inspiration	Climate regulation
11	Sense of place	Pest regulation
12	Cultural heritage values	Pollination
13		Natural hazard regulation
14		Aesthetic values
15		Recreation
16		Soil formation
17		Photosynthesis
18		Primary Production
19		Nutrient cycling
20		Water cycling
21		Erosion regulation

9.2.2.2. Ecosystem Services from Waters

Table 9:- List of ecosystem services associated with Waters:-

SN.	Direct	Indirect
1	Disease regulation	Food
2	Cultural diversity	Fiber
3	Spiritual diversity	Fuel
4	Religious systems	Genetic resources
5	Knowledge systems	Biochemical
6	Educational systems	Natural medicines
7	Inspiration	Pharmaceuticals

8	Sense of place	Ornamental resources
9	Cultural heritage values	Air quality regulation
10	Recreation	Climate regulation
11	Ecotourism	Pest regulation
12	Nutrient cycling	Pollination
13	Water cycling	Natural hazard regulation
14		Aesthetic values
15		Recreation
16		Soil formation
17		Photosynthesis
18		Primary Production
19		Erosion regulation

9.2.2.3. Ecosystem Services from Plants/Animals:-

Table 10:- List of ecosystem services associated with Plants/Animals:-

SN.	Direct	Indirect
1	Food	Fresh Water
2	Fuel	Nutrient cycling
3	Natural medicines	Water cycling
4	Ornamental resources	
5	Air quality regulation	
6	Climate regulation	
7	Water regulation	
8	Erosion regulation	
9	Water Purification	
10	Natural hazard regulation	
11	Inspiration	
12	Aesthetic values	
13	Social relations	
14	Recreation	
15	Soil formation	
16	Photosynthesis	
17	Primary production	

9.3. Illustration:-

Following are two illustrations to support the recommended guidelines:-

9.3.1. Land Health Inventory/Matrix Diagram

Diagram for illustrating an inventory or matrix for Land Health [Refer Diagram 1-(9) Land Health Inventory/Matrix Diagram]

This diagram enables the understanding of interrelated and interdependent existence of the Land Ethic members. This understanding is useful in the formulation of

mitigation and conservation measures and decision making on crucial and vital issues.

9.3.2. Concept of community development at city level

Applying the concept of community development at a city level as follows:-

a) Development Plan of Nagpur Improvement Trust is used for the purpose of this demonstration [Plan 1-(9)].
b) An area is identified to be called as a community [Plan 2-(9)].
c) Guidelines are recommended on the basis of Land Ethic keywords – Soils, Waters and Plants (as described below).
d) Designating the overall plan into several such communities.

9.3.2.1. Community Development Guidelines [Refer Plan 3-(9)]:-

Guidelines recommended on basis of Land Ethic keywords are:-

i) Water: - Collecting the roof top water and/ grey water (from households) to be diverted to a central reed bed system located in the traffic island. The treated water to be used for:-
    a) The plantation along the road side
    b) As water body an evaporative cooling to reduce heat island effect.
ii) Soils: - Considering the treatment of waste and production of food in the following ways:-
    a) Allocating a common garbage collection area along with a simple composting system or mechanism within the same place.
    b) Allocating a common area for food production to serve the designated community.
iii) Plants:- Creating intermediate community green belts within each community on the basis of the following calculations:-
    a) Out of the 10% mandatory recreational open space, allocate at least 2% to 4% of the area for the purpose of green belts within each plot. The remainder open space may be proposed as per architectural design (the percentage allocation may depend upon the size of the plot).
    b) Create such green belts comprising of at least 5 mts. of effective width.

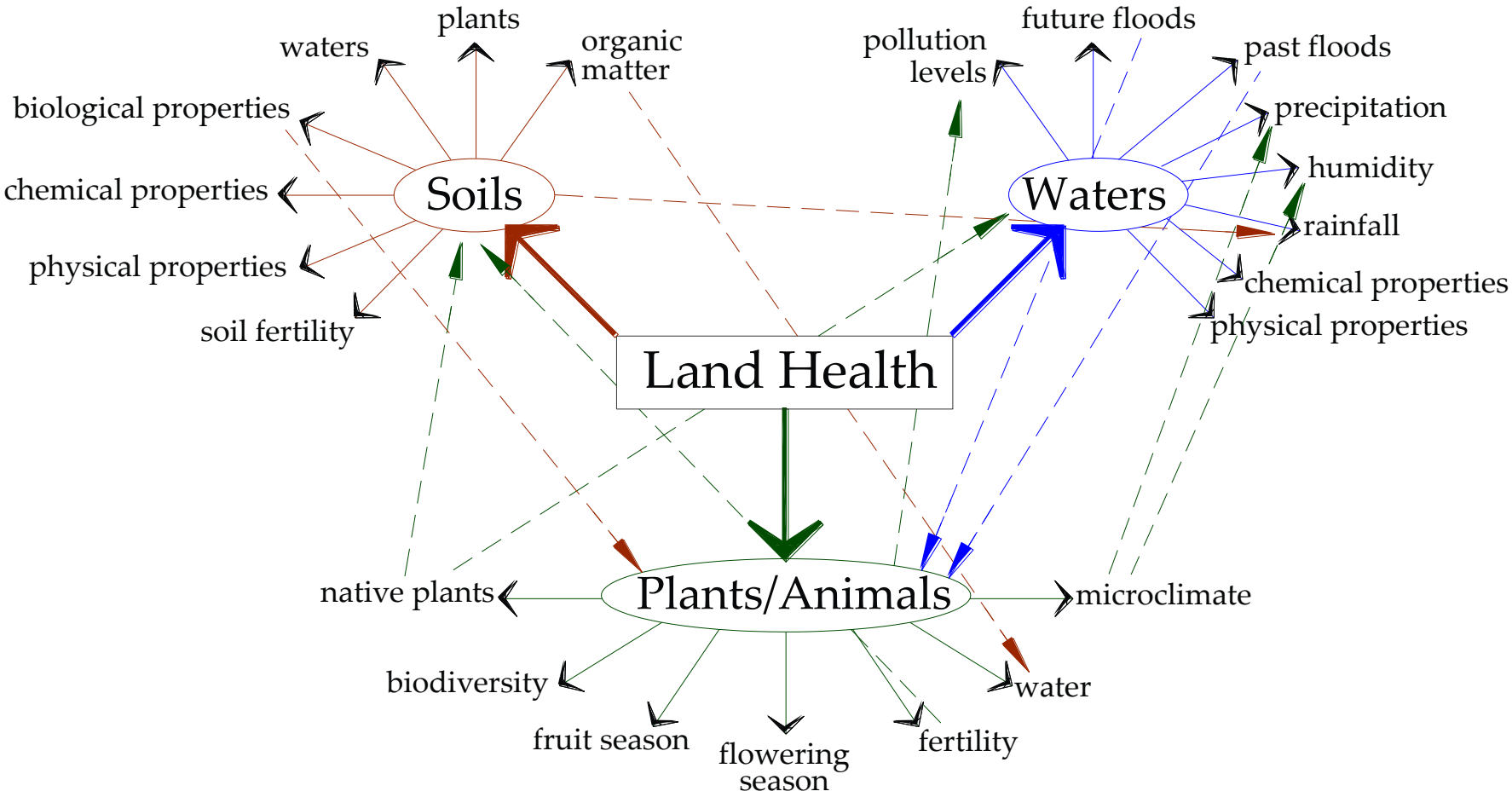
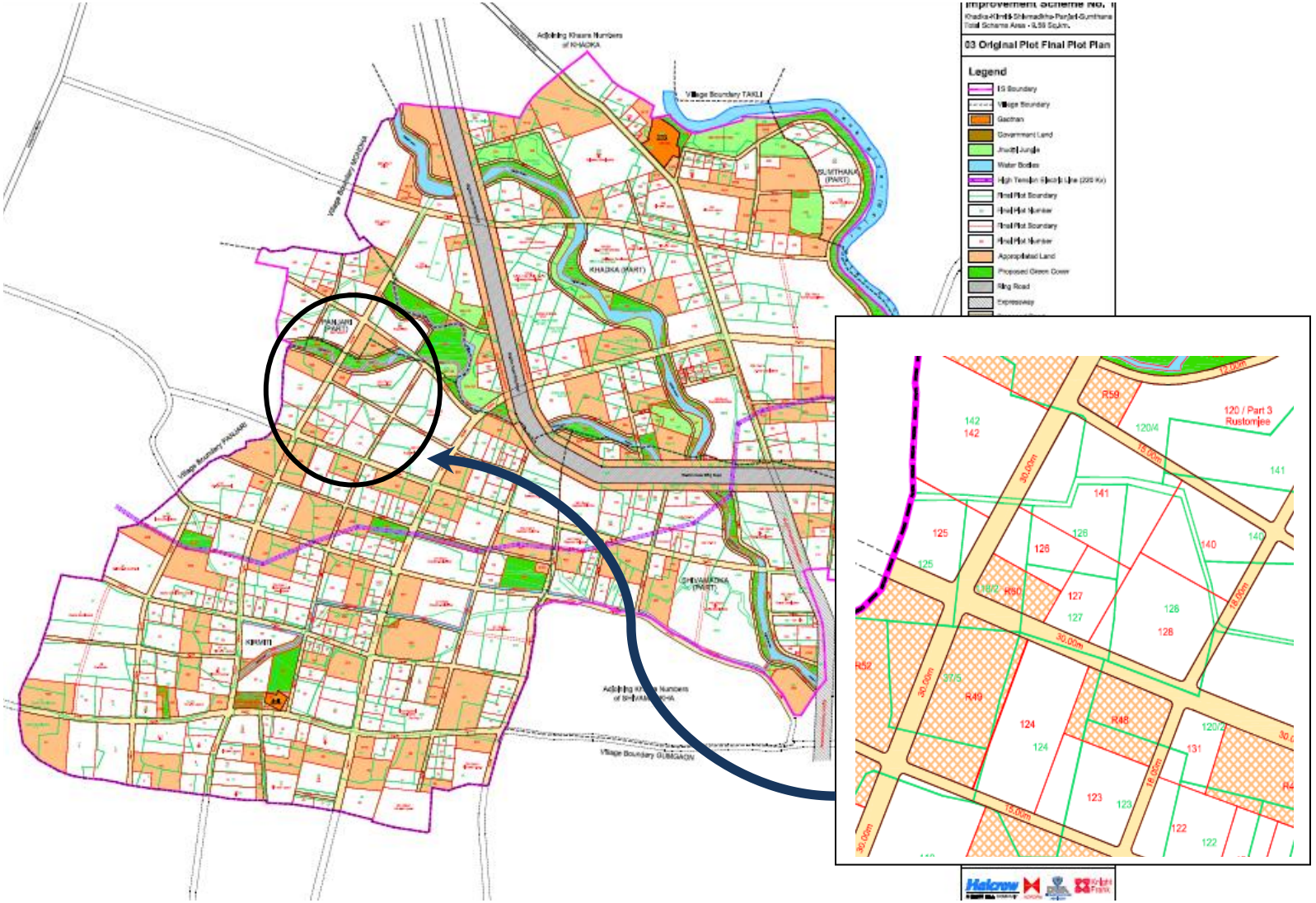


Diagram 1-(9):- Land Health Inventory/Matrix Diagram

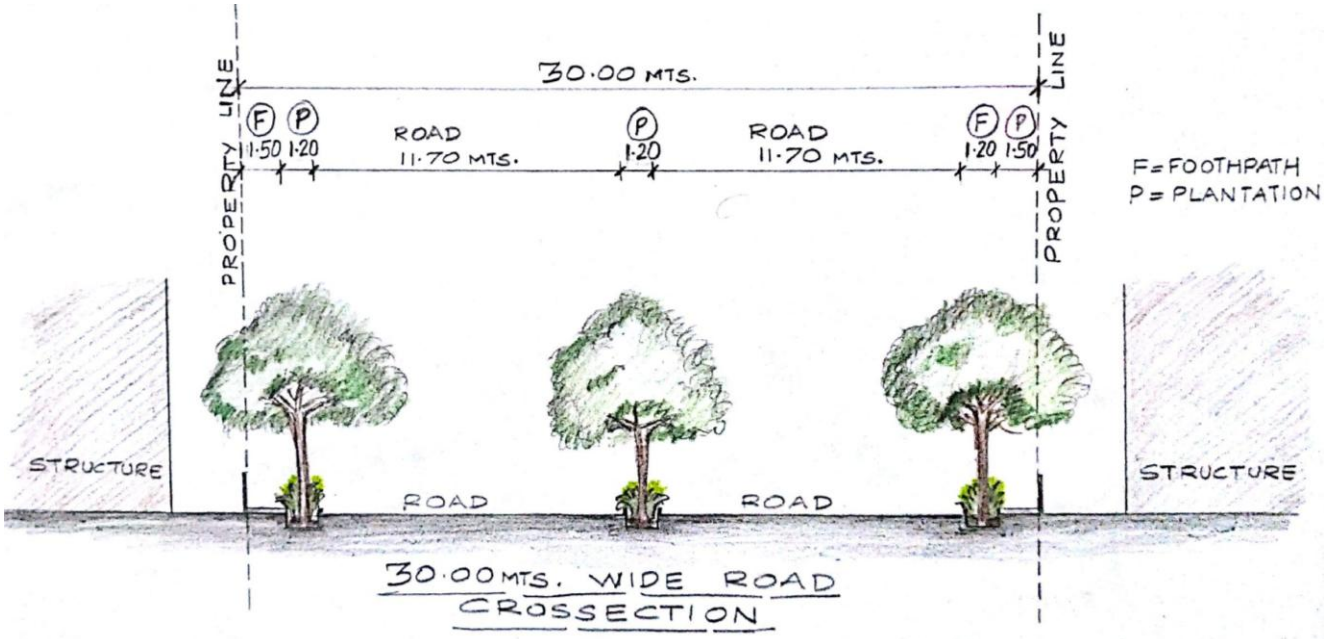


Plan 1-(9):- Original Plot Final Plot Plan of Nagpur Improvement Trust (Dated 11-09-2012)

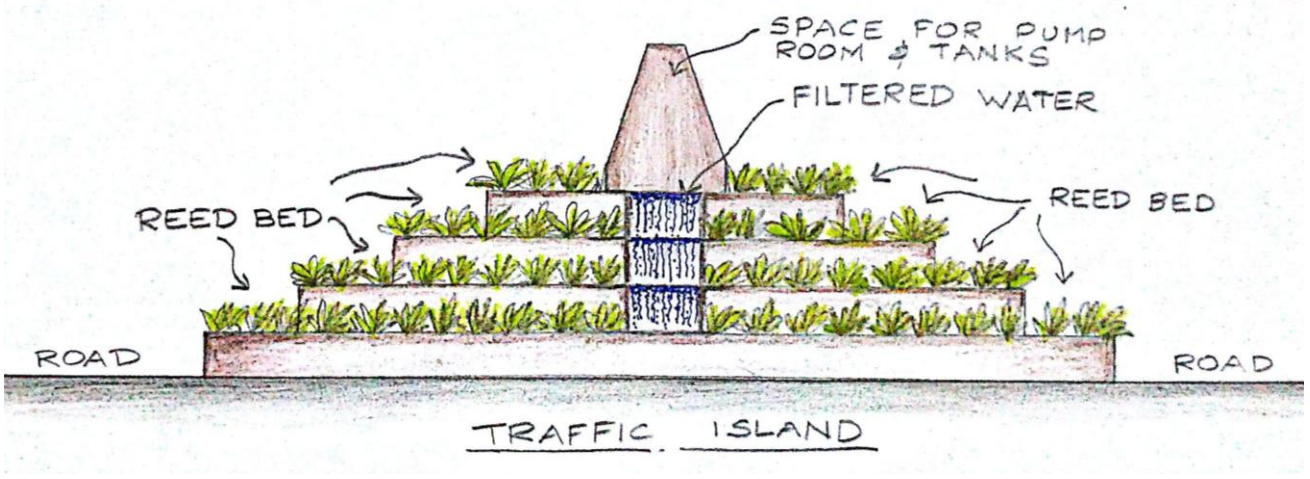
Plan 2-(9):- Area identified as a community

Plan 3-(9):- Proposal illustrating recommended guidelines

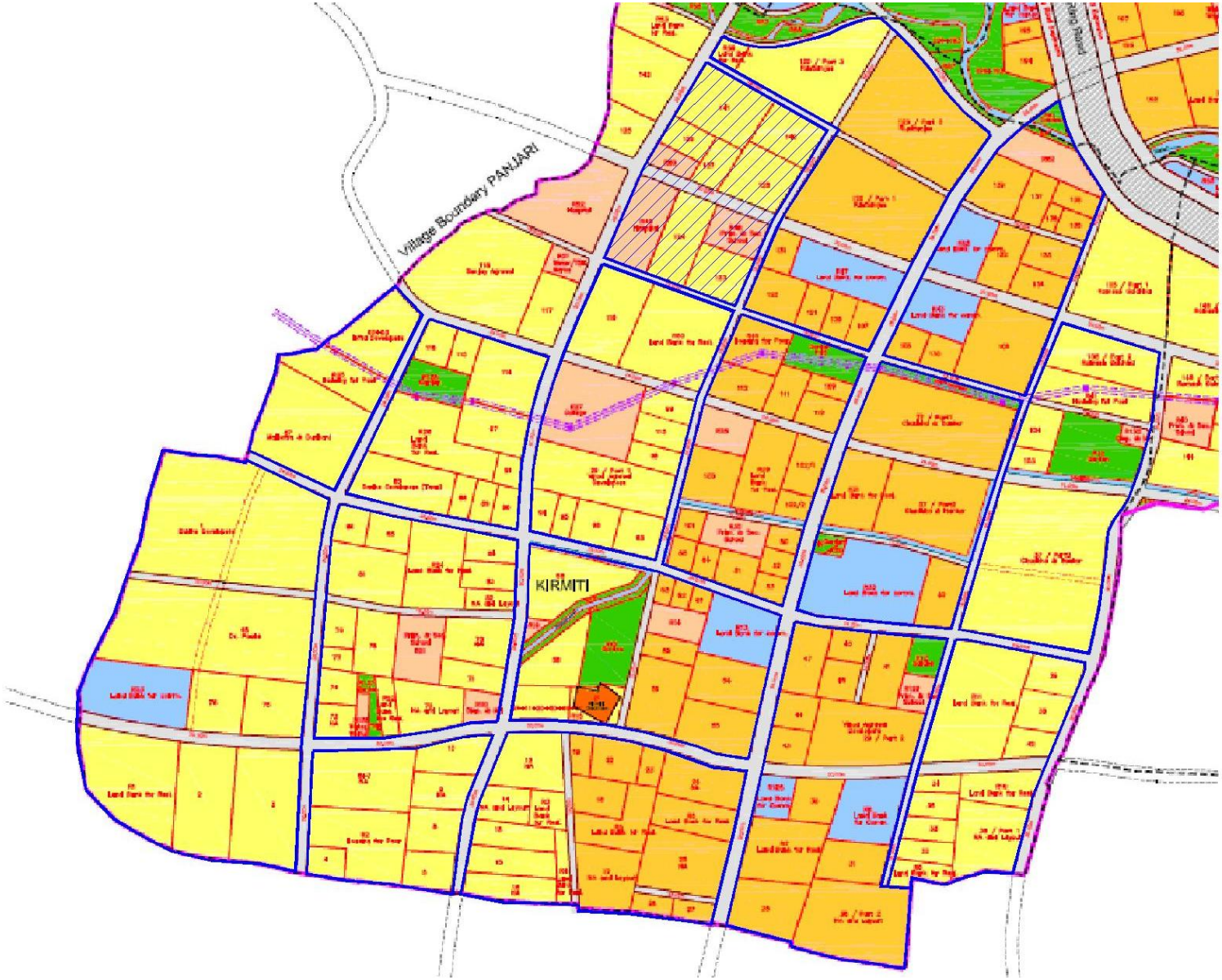
Plan 3-(9):- Plantation along road side & Traffic island



Section 1-(9):- Road Cross Section



Section 2-(9):- Traffic Island - Elevation



Plan 5-(9):- Designation of several Communities on the overall plan

ANNEXURE 1

Millennium Development Goals

Goal 1	Eradicate Extreme Poverty and Hunger	Target 1A: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day
		Target 1B: Achieve full and productive employment and decent work for all, including women and young people
		Target 1C: Halve, between 1990 and 2015, the proportion of people who suffer from hunger
Goal 2	Achieve Universal Primary Education	Target 2A: Ensure that by 2015, children everywhere, boys and girls alike will be able to complete a full course of primary schooling
Goal 3	Promote Gender Equality and Empower Women	Target 3A: Eliminate gender disparity in primary and secondary education, preferably by 2005 and in all levels of education no later than 2015
Goal 4	Reduce Child Mortality	Target 4A: Reduce by two thirds, between 1990 and 2015, the under-five mortality rate
Goal 5	Improve Maternal Health	Target 5A: Reduce by three quarters the maternal mortality ratio
		Target 5.B: Achieve universal access to reproductive health
Goal 6	Combat HIV/AIDS, Malaria and TB	Target 6A: Have halted by 2015 and begun reverse the spread of HIV/AIDS
		Target 6B: Achieve, by 2010, universal access to treatment for HIV/AIDS for all those who need it
		Target 6C: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases
Goal 7	Ensure Environmental Sustainability	Target 7A: Integrate the principles of sustainable development into country policies and programmers and reverse the loss of environmental resources
		Target 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss
		Target 7C: Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation
		Target 7D: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers
Goal 8	Develop a Global Partnership for Development	Target 8A: Develop further an open, rule based, predictable, non-discriminatory trading and financial system
		Target 8B: Address the special needs of the least developed countries
		Target 8C: Address the special needs of landlocked developing countries and small island developing States
		Target 8D: Deal comprehensively with the debt problems of developing countries
		Target 8E: In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries

		Target 8F: In cooperation with the private sector, make available the benefits of new technologies, especially information and communication

ANNEXURE 2

The Aichi Biodiversity Targets

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

- **Target 1**: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.
- **Target 2**: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.
- **Target 3**: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.
- **Target 4**: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use

- Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.
- **Target 6**: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.
- **Target 7**: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.
- Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.
- **Target 9**: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.
- **Target 10**: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic Goal C: Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

- Target 11: By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes.
- **Target 12**: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.
- **Target 13**: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services.

- **Target 14**: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.
- Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.
- **Target 16**: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building.

- **Target 17**: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.
- Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.
- **Target 19**: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.
- **Target 20**: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan 2011- 2020 from all sources and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should

increase substantially from the current levels. This target will be subject to changes contingent to resources needs assessments to be developed and reported by Parties.

Source: Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets "Living in Harmony with Nature, http://www.cbd.int/sp/targets/

ANNEXURE 3

Observed impact of Human use on ecosystem services

SN	Service	Notes
	Provisioning Services	
1	Food - Crops	Food provision has grown faster than overall population growth. Primary source of growth from increase in production per unit area but also significant expansion in cropland.
2	Food - Livestock	Significant increase in area devoted to livestock in some regions, but major source of growth has been more intensive, confined production of chicken, pigs, and cattle.
3	Food – Capture fisheries	Marine fish harvest increased until the late 1980s and has been declining since then. Currently, one quarter of marine fish stocks are overexploited or significantly depleted. Freshwater capture fisheries have also declined. Human use of capture fisheries as declined because of the reduced supply, not because of reduced demand.
4	Food - Aquaculture	Aquaculture has become a globally significant source of food in the last 50 years and, in 2000, contributed 27% of total fish production. Use of fish feed for carnivorous aquaculture species places an additional burden on capture fisheries.
5	Food – Wild plant and animal product	Provision of these food sources is generally declining as natural habitats worldwide are under increasing pressure and as wild populations are exploited for food, particularly by the poor, at unsustainable levels.
6	Fiber - Timber	Global timber production has increased by 60% in the last four decades. Plantations provide an increasing volume of harvested round wood, amounting to 35% of the global harvest in 2000. Roughly 40% of forest area has been lost during the industrial era, and forests continue to be lost in many regions (thus the service is degraded in those regions), although forest is now recovering in some temperate countries and thus this service has been enhanced (from this lower baseline) in these regions in recent decades.
7	Fiber – Cotton, Hemp, Silk	Cotton and silk production have doubled and tripled respectively in the last four decades. Production of other agricultural fibers has declined.
8	Fiber – Wood fuel	Global consumption of fuel wood appears to have peaked in the 1990s and is now believed to be slowly declining but remains the dominant source of domestic fuel in some regions.
9	Genetic resources	Traditional crop breeding has relied on a relatively narrow range of germplasm for the major crop species, although molecular

		genetics and biotechnology provide new tools to quantify and expand genetic diversity in these crops. Use of genetic resources also is growing in connection with new industries based on biotechnology. Genetic resources have been lost through the loss of traditional cultivars of crop species (due in part to the adoption of modern farming practices and varieties) and through species extinctions.
10	Biochemicals, natural medicines and pharmaceuticals	Demand for biochemicals and new pharmaceuticals is growing, but new synthetic technologies compete with natural products to, and meet the demand. For many other natural products (cosmetics, personal care, bioremediation, biomonitoring, ecological restoration), use is growing. Species extinction and overharvesting of medicinal plants is diminishing the availability of these resources.
11	Ornamental resources	Not assessed within the MA
12	Fresh Water	Human modification of ecosystems (e.g., reservoir creation) has stabilized a substantial fraction of continental river flow, making more fresh water available to people but in dry regions reducing river flows through open water evaporation and support to irrigation that also loses substantial quantities of water. Watershed management and vegetation changes have also had an impact on seasonal river flows. From 5% to possibly 25% of global freshwater use exceeds long-term accessible supplies and requires supplies either through engineered water transfers or overdraft of groundwater supplies. Between 15% and 35% of irrigation withdrawals exceed supply rates. Fresh water flowing in rivers also provides a service in the form of energy that is exploited through hydropower. The construction of dams has not changed the amount of energy, but it has made the energy more available to people. The installed hydroelectric capacity doubled between 1960 and 2000. Pollution and biodiversity loss are defining features of modern inland water systems in many populated parts of the world.
Regulating Services		
13	Air quality regulation	The ability of the atmosphere to cleanse itself of pollutants has declined slightly since preindustrial times but likely not by more than 10%. The net contribution of ecosystems to this change is not known. Ecosystems are also a sink for tropospheric ozone, ammonia, NOX, SO2, particulates, and CH4, but changes in these sinks were not assessed.
14	Climate regulation - Global	Terrestrial ecosystems were on average a net source of CO2 during the nineteenth and early twentieth century and became a net sink sometime around the middle of the last century. The biophysical effect of historical land cover changes (1750 to present) is net cooling on a global scale due to increased albedo, partially offsetting the warming effect of associated carbon

		emissions from land cover change over much of that period.
15	Climate regulation – Regional & local	Changes in land cover have affected regional and local climates both positively and negatively, but there is a preponderance of negative impacts. For example, tropical deforestation and desertification have tended to reduce local rainfall.
16	Water regulation	The effect of ecosystem change on the timing and magnitude of runoff, flooding, and aquifer recharge depends on the ecosystem involved and on the specific modifications made to the ecosystem.
17	Erosion regulation	Land use and crop/soil management practices have exacerbated soil degradation and erosion, although appropriate soil conservation practices that reduce erosion, such as minimum tillage, are increasingly being adopted by farmers in North America and Latin America.
18	Water purification and waste treatment	Globally, water quality is declining, although in most industrial countries pathogen and organic pollution of surface waters has decreased over the last 20 years. Nitrate concentration has grown rapidly in the last 30 years. The capacity of ecosystems to purify such wastes is limited, as evidenced by widespread reports of inland waterway pollution. Loss of wetlands has further decreased the ability of ecosystems to filter and decompose wastes.
19	Disease regulation	Ecosystem modifications associated with development have often increased the local incidence of infectious diseases, although major changes in habitats can both increase or decrease the risk of particular infectious diseases.
20	Pest regulation	In many agricultural areas, pest control provided by natural enemies has been replaced by the use of pesticides. Such pesticide use has itself degraded the capacity of agro ecosystems to provide pest control. In other systems, pest control provided by natural enemies is being used and enhanced through integrated pest management. Crops containing pest-resistant genes can also reduce the need for application of toxic synthetic pesticides.
21	Pollination	There is established but incomplete evidence of a global decline in the abundance of pollinators. Pollinator declines have been reported in at least one region or country on every continent except Antarctica, which has no pollinators. Declines in abundance of pollinators have rarely resulted in complete failure to produce seed or fruit, but more frequently resulted in fewer seeds or in fruit of reduced viability or quantity. Losses in populations of specialized pollinators have directly affected the reproductive ability of some rare plants.
22	Natural Hazard regulation	People are increasingly occupying regions and localities that are exposed to extreme events, thereby exacerbating human vulnerability to natural hazards. This trend, along with the decline in the capacity of ecosystems to buffer from extreme

		events, has led to continuing high loss of life globally and rapidly rising economic losses from natural disasters.
Cultural Services		
23	Cultural diversity	Not assessed within the MA
24	Spiritual and religious values	There has been a decline in the numbers of sacred groves and other such protected areas. The loss of particular ecosystem attributes (sacred species or sacred forests), combined with social and economic changes, can sometimes weaken the spiritual benefits people obtain from ecosystems. On the other hand, under some circumstances (e.g., where ecosystem attributes are causing significant threats to people), the loss of some attributes may enhance spiritual appreciation for what remains.
25	Knowledge systems	Not assessed within the MA
26	Educational values	Not assessed within the MA
27	Inspiration	Not assessed within the MA
28	Aesthetic values	The demand for aesthetically pleasing natural landscapes has increased in accordance with increased urbanization. There has been a decline in quantity and quality of areas to meet this demand. A reduction in the availability of and access to natural areas for urban residents may have important detrimental effects on public health and economies.
29	Social relations	Not assessed within the MA
30	Sense of place	Not assessed within the MA
31	Cultural heritage values	Not assessed within the MA
32	Recreation and ecotourism	The demand for recreational use of landscapes is increasing, and areas are increasingly being managed to cater for this use, to reflect changing cultural values and perceptions. However, many naturally occurring features of the landscape (e.g., coral reefs) have been degraded as resources for recreation.
Supporting services		
33	Soil formation	Not assessed within the MA
34	Photosynthesis	Not assessed within the MA
35	Primary production	Several global MA systems, including dryland, forest, and cultivated systems, show a trend of Net Primary Production increase for the period 1981 to 2000. However, high seasonal and inter-annual variations associated with climate variability occur within this trend on the global scale
36	Nutrient cycling	There have been large-scale changes in nutrient cycles in recent decades, mainly due to additional inputs from fertilizers, livestock waste, human wastes, and biomass burning. Inland water and coastal systems have been increasingly affected by eutrophication due to transfer of nutrients from terrestrial to aquatic systems as biological buffers that limit these transfers have been significantly impaired.

37	Water cycling	Humans have made major changes to water cycles through Structural changes to rivers, extraction of water from rivers, and, more recently, climate change.

Source: Joseph Alcamo; Elena M. Bennett, *Ecosystems and Human Well-being, A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment*, Island Press, Washington DC, 2005

ANNEXURE 4

Indicative list of Green Building rating systems followed in respective countries

Rating Systems	Countries following it
Asia System	
Green Olympic Building Assessment System (GOBAS)	China
GRIHA	India
LEED India	India
Green Mark	Singapore
Hong Kong Building Environmental Assessment Method (HK-BEAM)	Hong Kong
Ecology, Energy saving, Waste reduction and Health (EEWH)	Taiwan
Comprehensive Assessment System for Building Environmental Efficiency (CASBEE).	Japan
Europe	
BREEAM	UK
Protocollo ITACA	Italy
ESCALE	France
Eco Quantum	Netherlands
Papoose	Finland
Eco Effect	Sweden
Eko Profiles	Norway
Eco Building Total Quality Assessment	Austria
North America	
LEED	USA, Thailand, UAE, Brazil, Sri Lanka, Chile, Isrel, South Korea, Mexico, New Zeland, Republic of Panama, Pureto Rico, China
LEED Canada	Canada
Australia	
Green Star	Australia
NABERS/ABGR	Australia

Source: Shweta Kakkar, Charu Chadha,Tanaji Chakrabarti & Anshuman Bhusari, India Green Buildings Anthology, Jones Lang LaSalle Meghraj Property Consultants Pvt. Ltd.

ANNEXURE 5

Format for Constructional Environmental Management Plan (CEMP)

Table of Contents		
Section 1	Project or Industry Title Page	
Section 2	Distribution List	
Section 3	Introduction	3.1 List of Abbreviations 3.2 Definition of Terms 3.3 List of Figures 3.4 List of Tables
Section 4	Project Description	4.1 Location 4.2 Scope 4.3 Overall Project and Planned Construction Activities 4.3.1 Environmental Baseline, Current Conditions, and Sensitive Receptors 4.3.2 Construction Project Description 4.3.3 Environmental Permits 4.4 Project Schedule and Milestones
Section 5	Environmental Management	5.1 Policy Statement 5.2 Environmental Management Systems 5.3 Roles and Responsibilities 5.4 Regulations and Requirements 5.5 Environmental Awareness and Training 5.6 Document Review and Updates 5.7 Environmental Commitments 5.8 Coordination with External Entities and Addressing Complaints
Section 6	Environmental Impacts	6.1 Air Emissions Impacts 6.1.1 Dust 6.1.2 Gaseous Pollutants and Particulate Matter Impacts 6.1.3 Odour 6.2 Surface Water Impacts 6.3 Soil and Groundwater Impacts 6.4 Terrestrial Ecology Impacts 6.4.1 Discharges to Land 6.4.2 Wildlife (Fauna) 6.4.3 Vegetation (Flora) 6.5 Marine Ecology Impacts 6.5.1 Discharges to Marine Waters 6.5.2 Wildlife (Fauna) 6.5.3 Vegetation (Flora) 6.6 Noise and Vibration Impacts 6.7 Traffic Impacts 6.8 Waste Management Impacts 6.8.1 Solid Waste 6.8.2 Liquid Waste (Effluent) 6.8.3 Hazardous Waste

		6.9 Other Environmental Condition(s) or System(s) Impacts
Section 7	Environmental Mitigation Measures	7.1 Air Quality Control Plan 7.1.1 Dust Management 7.1.2 Gaseous Pollutants Management 7.1.3 Odor Management 7.2 Erosion and Sediment Control Plan 7.3 Soil and Groundwater Contamination Control Plan 7.4 Terrestrial Ecology Control Plan 7.4.1 Terrestrial Ecological Management 7.5 Water Quality and Marine Ecology Control Plan 7.5.1 Wastewater Management 7.5.2 Marine Ecological Management 7.6 Noise and Vibration Control Plan 7.7 Traffic Control Plan 7.8 Waste Management Control Plan 7.8.1 Minimization, Reuse, and Recycling 7.8.2 Solid Waste Management 7.8.3 Liquid Waste (Effluent) Management 7.8.4 Hazardous Waste Management 7.8.5 PCBs, Asbestos, and ODS Management 7.8.6 Use of Environmental Service Providers for Waste Management 7.9 Chemical and Hazardous Materials Management 7.10 Contingency Plan 7.11 Emergency Management Plan 7.11.1 List of Emergency Coordinators 7.11.2 Emergency Procedures 7.12 Security Plan 7.13 Infrastructure Plan
Section 8	Monitoring and Auditing	8.1 Environmental Performance Monitoring 8.2 Reporting Requirements 8.2.1 Incident Reports 8.2.2 Periodic or Quarterly Performance Reports 8.2.3 Monitoring Compliance and Audit Reports 8.2.4 Environmental Checklists 8.2.5 Procedures to Review Inspections and Steps to Address Non-Compliance
Section 9	Documentation	
Section 10	Annexes	

Source: Technical Guidance Document for Construction Environmental Management Plan (CEMP), April , 2010, Environment Agency, Abhu Dhabi, https://www.ead.ae/_data/global.pdf

Definitions

Agronomy: Agronomy is the science and technology of producing and using plants for food, fuel, fiber, and reclamation. Agronomy encompasses work in the areas of plant genetics, plant physiology, meteorology, and soil science.
Source: http://en.wikipedia.org/wiki/Agronomy#Soil_conservation

Air Quality: The term "air quality" means the state of the air around us. Good air quality refers to clean, clear, unpolluted air. Clean air is essential to maintaining the delicate balance of life on this planet — not just for humans, but wildlife, vegetation, water and soil.
Source: http://www.bcairquality.ca/101/what-is-air-quality

Bioplilia Hypothesis: The biophilia hypothesis suggests that there is an instinctive bond between human beings and other living systems. Edward O. Wilson introduced and popularized the hypothesis in his book, Biophilia (1984). He defines biophilia as "the urge to affiliate with other forms of life". The term "biophilia" literally means "love of life or living systems." It was first used by Erich Fromm to describe a psychological orientation of being attracted to all that is alive and vital.
Source: http://en.wikipedia.org/wiki/Biophilia_hypothesis

Business:-

- An organization or enterprising entity engaged in commercial, industrial or professional activities. A business can be a for-profit entity, such as a publicly-traded corporation, or a non-profit organization engaged in business activities, such as an agricultural cooperative.
- Any commercial, industrial or professional activity undertaken by an individual or a group.
  A reference to a specific area or type of economic activity.
- The word "business" can be used to refer to a specific industry or activity, such as the "real estate business" or the "advertising business".

Source: http://www.investopedia.com/terms/b/business

Civilization: Civilization comes from the Latin word *civis*, meaning someone who lives in a town. When people are called civilized they have organized into large well-organized groups like towns, not in small tribes or family groups. Such a large well organized group is called a civilization, and people in the same civilization not only work together in government, warfare and education, but also often share traditions such as language, arts, architecture.
http://simple.wikipedia.org/wiki/Civilization

Community:

- A group of people living in the same locality and under the same government.
- The district or locality in which such a group lives.
- A group of people having common interests: the scientific community; the international business community.
- A group viewed as forming a distinct segment of society: the gay community; the community of color.
- Similarity or identity: a community of interests.
- Sharing, participation, and fellowship.
- Society as a whole; the public.

- A group of plants and animals living and interacting with one another in a specific region under relatively similar environmental conditions (Ecology).
- A group of organisms or populations living and interacting with one another in a particular environment. The organisms in a community affect each other's abundance, distribution, and evolutionary adaptation. Depending on how broadly one views the interaction between organisms, a community can be small and local, as in a pond or tree, or regional or global, as in a biome (Ecology).
- The region occupied by a group of interacting organisms (Ecology).

Source: http://www.thefreedictionary.com/community

Conservation:

- the act of conserving; prevention of injury, decay, waste, or loss; preservation: conservation of wildlife; conservation of human rights.
- official supervision of rivers, forests, and other natural resources in order to preserve and protect them through prudent management.
- a district, river, forest, etc., under such supervision.
- the careful utilization of a natural resource in order to prevent depletion.
- the restoration and preservation of works of art.

Source: http://dictionary.reference.com/browse/conservation

Cultural services: The nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experience, including, for example, knowledge systems, social relations, and aesthetic values.

Source: Joseph Alcamo; Elena M. Bennett, *Ecosystems and Human Well-being, A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment*, Island Press, Washington DC, 2005

Derivation:

- The act of receiving anything from a source; the act of procuring an effect from a cause, means, or condition, as profits from capital, conclusions or opinions from evidence.
- That which is derived; a derivative; a deduction.

Source: http://en.wiktionary.org/wiki/derivation

Ecology: The scientific study of the interactions that determine the distribution and abundance of organisms.

Source: Kurain Josheph, P. Nagendra, *Essentials of Environmental Studies*, New Delhi, Pearson Education (Sngapore) Pte. Ltd. (Indian Branch), 2004

Economic Growth: Economic Growth the process by which a nation's wealth increases over time. Although the term is often used in discussions of short-term economic performance, in the context of economic theory it generally refers to an increase in wealth over an extended period. Growth can best be described as a process of transformation.

Source: http://www.britannica.com/EBchecked/topic/178400/economic-growth

Ecosystem: A dynamic complex of plant, animal, and microorganism communities and their nonliving environment interacting as a functional unit.

Source: Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*, Island Press, Washington, DC.

Ecosystem services: The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural

services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth. The concept "ecosystem goods and services" is synonymous with ecosystem services.
Source: Joseph Alcamo; Elena M. Bennett, *Ecosystems and Human Well-being, A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment*, Island Press, Washington DC, 2005

Ecological succession: Ecological succession is the observed process of change in the species structure of an ecological community over time. The community begins with relatively few pioneering plants and animals and develops through increasing complexity until it becomes stable or self-perpetuating as a climax community. It is a phenomenon or process by which an ecological community undergoes more or less orderly and predictable changes following disturbance or initial colonization of new habitat.
Source: http://en.wikipedia.org/wiki/Ecological succession

Environment All of the biotic and abiotic factors that act on an organism, population or ecological community and influence its survival and development. Biotic factors include the organisms themselves, their food, and their interactions. Abiotic factors include such items as sunlight, soil, air, water, climate, and pollution. Organisms respond to changes in their environment by evolutionary adaptations in form and behavior.
Source: The American Heritage Science Dictionary by Houghton Mifflin Company. Published by Houghton Mifflin Company

Health: As defined by World Health Organization (WHO), it is a "State of complete physical, mental, and social well being, and not merely the absence of disease or infirmity." Health is a dynamic condition resulting from a body's constant adjustment and adaptation in response to stresses and changes in the environment for maintaining an inner equilibrium called homeostasis.
Source: http://www.businessdictionary.com/definition/health

Landscape: The composite of natural and human features that characterize the surface of the land at the base of the Atmosphere; includes spatial, textural, compositional and dynamic aspects of the land.
Source: William M. Marsh, *Landscape Planning Environmental Applications*, USA, John Wiley & Sons, Inc., 1998

Millennium Development Goals (MDGs): They are eight goals to be achieved by 2015 that respond to the world's main development challenges, the focus being the human dimension. The MDGs are drawn from the actions and targets contained in the Millennium Declaration that was adopted by 189 nations-and signed by 147 heads of state and governments during the UN Millennium Summit in September 2000.
Source: www.undp.org/mdg/basics

Microclimate: The climate of a small, specific place within a larger area. An area as small as a yard or park can have several different microclimates depending on how much sunlight, shade, or exposure to the wind there is at a particular spot.
Source: http://www.thefreedictionary.com/microclimate

Primary production: It is the production of organic compounds from atmospheric or aquatic carbon dioxide. It may occur through the process of photosynthesis, using light as a source of energy, or chemosynthesis, using the oxidation or reduction of chemical compounds as a source of energy. Almost all life on earth is directly or indirectly reliant on primary production.
http://en.wikipedia.org/wiki/Primary_production

Properties of soil:

a) Physical properties: - Soil is comprised of minerals, soil organic matter (SOM), water, and air. The composition and proportion of these components greatly influence soil physical properties, including texture, structure, and porosity, the fraction of pore space in a soil. In turn, these properties affect air and water movement in the soil, and thus the soil's ability to function.

b) Chemical properties:
   - Soil pH: Soil pH refers to a soil's acidity or alkalinity and is the measure of hydrogen ions (H+) in the soil.
   - Salt-affected soils: The presence and concentration of salts in soil can have adverse effects on soil function and management.
   - Calcareous Soils: Soils dominated by calcium and magnesium carbonates

c) Biological Properties
   - Soil Biota: The soil environment is teeming with biological life and is one of the most abundant and diverse ecosystems on earth. Soil biota, including flora (plants), fauna (animals) and microorganisms, perform functions that contribute to the soil's development, structure and productivity.

Source:- Ann McCauley, Clain Jones, Jeff Jacobsen, *BASIC SOIL PROPERTIES*, Montana, Montana State University Publications, January 2005

Provisioning services: The products obtained from ecosystems, including, for example, genetic resources, food and fiber, and fresh water.

Source: Joseph Alcamo; Elena M. Bennett, *Ecosystems and Human Well-being, A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment*, Island Press, Washington DC, 2005

Regulating services: The benefits obtained from the regulation of ecosystem processes, including, for example, the regulation of climate, water, and some human diseases.

Source: Joseph Alcamo; Elena M. Bennett, *Ecosystems and Human Well-being, A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment*, Island Press, Washington DC, 2005

Security: Access to resources, safety, and the ability to live in a predictable and controllable environment.

Source: Joseph Alcamo; Elena M. Bennett, *Ecosystems and Human Well-being, A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment*, Island Press, Washington DC, 2005

Soft Law: The term "soft law" refers to quasi-legal instruments which do not have any legally binding force, or whose binding force is somewhat "weaker" than the binding force of traditional law, often contrasted with soft law by being referred to as "hard law". Traditionally, the term "soft law" is associated with international law, although more recently it has been transferred to other branches of domestic law as well. The term soft law covers elements of action plans such as Agenda 21.

Source: http://en.wikipedia.org/wiki/Soft_law

Supporting services: Ecosystem services are those that are necessary for the production of all other ecosystem services. Some examples include biomass production, production of atmospheric oxygen, soil formation and retention, nutrient cycling, water cycling, and provisioning of habitat.

Source: Joseph Alcamo; Elena M. Bennett, *Ecosystems and Human Well-being, A Report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment*, Island Press, Washington DC, 2005

Sustainable Development: Sustainable Development can be defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs"

Sustainable development is the effective use of resources for economic development while preserving the environment and ecosystem so that not only the needs of presents are fulfilled but also for the future generations. Sustainable development also interlinks the development and carrying capacity of environment and ecosystem.
Source: http://www.environmentabout.com/759/what-is-sustainable-development

Sustainability: - Sustainability in a general sense is the capacity to support, maintain or endure. Since the 1980s human sustainability has been related to the integration of environmental, economic, and social dimensions towards global stewardship and responsible management of resources. In ecology, sustainability describes how biological systems remain diverse, robust, and productive over time, a necessary precondition for the well-being of humans and other organisms. Long-lived and healthy wetlands and forests are examples of sustainable biological systems.
Source: http://en.wikipedia.org/wiki/Sustainability

Urban Heat Island (UHI) effect: Urbanization negatively impacts the environment mainly by the production of pollution, the modification of the physical and chemical properties of the atmosphere, and the covering of the soil surface. Considered to be a cumulative effect of all these impacts is the UHI, defined as the rise in temperature of any man-made area, resulting in a well-defined, distinct "warm island" among the "cool sea" represented by the lower temperature of the area's nearby natural landscape (figure 1). Though heat islands may form on any rural or urban area, and at any spatial scale, cities are favoured, since their surfaces are prone to release large quantities of heat. Nonetheless, the UHI negatively impacts not only residents of urban-related environs, but also humans and their associated ecosystems located far away from cities. In fact, UHIs have been indirectly related to climate change due to their contribution to the greenhouse effect, and therefore, to global warming.
Source: http://www.urbanheatislands.com

Urbanization: It is an index of transformation from traditional rural economies to modern industrial one. It is progressive concentration of population in urban unit. Quantification of urbanization is very difficult. It is a long term process (Kinsley Davis, 1965).
Source: Pranati Datta, *Urbanization in India*, Population Studies Unit Indian Statistical Institute Kolkata, June 2006

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