CHAPTER THREE

BIODIVERSITY AND BIODIVERSITY CONSERVATION: CONTEXT

INTRODUCTION

The 1996 National Biodiversity Policy (NBP)[1] in its rationale statement states that Malaysia's biological diversity has an important economic, technological and social implication to the nation particularly in six key areas that is:

i. Economic benefits;

ii. Security;

iii. Environmental stability;

iv. National Biological Heritage;

v. Scientific, educational and Recreational Values; and

vi. Biosafety.

The Policy then goes on to state that biological diversity is considered at three levels, i.e. genetic diversity, species diversity and ecosystem diversity[2]. The Malaysian Constitution is silent on what is meant by biodiversity, which in turn creates a *lacuna* in the distribution of legislative matters between Federal and State Government. This thesis rests on a set of assumptions, one being that if the terms 'biological diversity' and 'conservation' are not properly contextualised, then the regulation of the same by law would be imperfect.

[1] Malaysia, National Policy on Biological Diversity 1996, page 5.

[2] *Ibid.*

[3] United Nations Convention on Biological Diversity opened for signature 5 June 1992, 92 UNTS 7807 (entered into force 23 Dec. 1993). See Article 2, Use of Terms. Given its number of Parties (191 countries as of 5 June 2008) it serves as the main legal

This Chapter is divided into two main parts, the first looks at the use of terms, highlighting the different 'interpretations' and meanings assigned to biodiversity, conservation and biodiversity conservation that makes up its context. The scientific context for biodiversity, conservation and biodiversity conservation is looked at in great detail to provide a backdrop as to what constitutes biodiversity conservation, the scope and aspects that should be addressed when determining whether or not the present statutory regime has addressed it and what should be looked at if a statute were to be enacted.

The purpose of outlining the context science has given to biodiversity and biodiversity conservation, is to identify options whereby science 'speak' can be 'translated' to 'legal speak', in addition to understanding the scale of the subject matter, including peripheral factors that have bearing on it. This will help ensure that when statutory provisions are proposed, the mechanics of the language would allow for it to be 'properly caught' and addressed.

3.1 BIODIVERSITY IN CONTEXT

As a start the most accepted definition for the term biological diversity comes from the United Nations Convention on Biological Diversity 1992 (CBD)[3] which defines it as the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. This definition has been adopted in the NBP, but the actual fleshing out of what is meant by biodiversity has not been given. This section will review the literature pertaining to

[3] United Nations Convention on Biological Diversity opened for signature 5 June 1992, 92 UNTS 7807 (entered into force 23 Dec. 1993). See Article 2, Use of Terms. Given its number of Parties (191 countries as of 5 June 2008) it serves as the main legal definition.

'biodiversity' and 'conservation', to help categorise the different aspects related to both terms and construct a simple framework that consolidates the different aspects and characteristics that will be used to look at coverage of the existing statutory regime in Chapter Six as well as help flesh out options for consideration.

3.1.1 Biodiversity: Use of Terms and Context

Following from the CBD definition, the term 'biodiversity' literally blankets the biological kingdom and its ecological processes, which covers the wide variety of plant, animals and microorganisms as well as ecosystems. It is a multi-dimensional term that also includes the complexity and interdependency of living organisms and humans, forming the foundation of ecosystems services to which human beings are intimately linked with; a layer of living organisms through the collective metabolic activities of its innumerable plants, animals and microbes physically and chemically unites the atmosphere, geosphere and hydrosphere into one environmental system, which is the manifestation of the workings of life[4].

A complete taxonomic base is not just a compilation of species; it will have to take into account the magnitude of biodiversity and the tangle of evolutionary processes[5]. This means that every biota is characterised by its taxanomic, ecological and genetic diversity[6]. It is also influenced by the determination of spatial patterns, which at present is difficult to illustrate as the understanding related to taxanomic, functional, trophic, genetic and the various dimension of biodiversity has been relatively poorly

[4] Millennium Ecosystems Assessment, 2005. *Ecosystems and Human Well-Being: Biodiversity Synthesis*. World Resources Institute, Washington, D.C. see page 18. This Report synthesizes and consolidates findings from a Millennium Ecosystem Assessment that was carried out between 2000 to 2005, and it was designed to meet the needs of the Convention on Biological diversity 1992 (see Foreword of said document on page ii).

[5] Wilson, E.O., 2003. The Encyclopaedia of Life. TRENDS in Ecology and Evolution Vol.18 No.2 February 2003. See page 79.

[6] *Ibid footnote 4.*

quantified[7]. Noted also is the fact that knowledge on taxanomic diversity has been deemed incomplete and strongly biased toward the species level, megafauna, temperate systems and components used by people[8].

It is not only knowing what constitutes 'biodiversity' that is important, it is the value, benefits and processes, specifically the ecological processes that must also be determined to ensure that conservation efforts are geared effectively, balancing human interests and ecosystems integrity. There already exist different tools and techniques to determine and measure the state, value and antecedent benefits, but they are hampered by the absence of detailed analysis of full costs, risks and benefits that take into account factors such as consumption and willingness to pay[9].

This can perhaps be remedied through improved valuation techniques and information on ecosystems services[10]. This indicates that science pertaining to biodiversity is evolving, and present understanding of biodiversity is open to reinterpretation and determination, which affects not only conservation approaches, methods, technology, techniques, processes and procedures, but poses a challenge for legislators, mindful that there is a need to err on the side of caution. The preamble of the CBD echoes this, stating:

> Noting also that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat[11].

[7] *Id* at 19.
[8] *Ibid*.
[9] *Ibid* at 1-16.
[10] *Ibid* at 6
[11] Convention on Biological Diversity, ninth statement in the Preamble.

Bearing this in mind, legislators will have to frame measures that will make provision for actions which can be taken even in the absence of absolute science, making room for precaution so as not to impact on environmental integrity. It is therefore important to at least put the term biodiversity into context, so as to better guide the ensuing exercise of determining linkages between law and biodiversity in Malaysia as well as framing options and legislative directions.

3.1.1.1. Species

This section looks at how scientists and the international community contextualises 'species'. The first part briefly details samples of categorisation provided by the scientific community, whilst the second part looks at how the international community through multilateral environmental agreements closely related to biodiversity, interprets or describes species.

Species from the perspective of the scientific community.

There is a host of literature[12] that describes or makes reference to species, but not many actually breaks it down to a point that it can be actually called a definitive context of what is actually meant by species. Charles Darwin[13] in his book the Origin of Species, stated that in the case of species, no one definition has satisfied all naturalists; yet every naturalist knows vaguely what he means when he speaks of a species.

[12] See list of references.
[13] Charles Darwin 1979 (Reprint). The origin of species by means of natural selection. Reprint of a 1968 issue published by Penguin Books, by Gramercy Books; online version of the book sourced at http://www.readprint.com/work-439/The-Origin-of-Species-Charles-Darwin.

In 1988, Wilson, E.O. wrote, "in modern biology species are regarded conceptually as population or series of population within which free gene flow occurs under natural condition" and he further sounds caution that this is less ideal in light of factors such as hybridisation and geographic speciation[14]. The CBD provides a glossary for Parties[15] wherein species are "a group of organisms capable of interbreeding freely with each other but not with members of other species", taking on the concept noted by Wilson, E.O. above, but not considering hybridisation. However, Wilson, E.O. 1988, cautions, though the biological concepts of species is the best ever devised, it remains less than ideal, as it works for well for animals and plants, but for some plants and animals in which intermediate amounts of hybridisation occur or where ordinary sexual reproduction has been replaced by self-fertilisation or parthenogenesis, a relook at the current divisions is necessary. This complicates the present legal definition offered by the CBD. The hierarchy of species are often assigned based on their taxonomic groupings, which begins with domain, followed by kingdom, phylum or division, class, order, family, genus then species. The United Nations Environment Programme (UNEP) in its Global Environment Outlook 3[16] lists six types of kingdoms, i.e. bacteria, protoctists, animals (vertebrates), animals (invertebrates), fungi and plants. Wilson, E.O.[17], makes provision for eight kingdoms, in which species can be divided. This is important, as it will allow for the determination of the subject matter for which the law will have to address. A summary of species of living organisms sourced from Wilson, E.O.[18] is shown in Table 3.1 below.

[14] Wilson, E.O., The current state of biological diversity. In *Biodiversity*, E.O Wilson and F.M. Peter (eds), 3-18. Washington, D.C.: National Academy Press, 1988. See pages 5-7.

[15] This glossary can be accessed at the CBD website. 5 June 2008. http://www.cbd.int/cepa/toolkit/html/resources/FD/FDF8CE88-237B-46EE-BB5F-2304D735C23/Biodiversity%20Glossary.pdf.

[16] UNEP, 2002. *Global Environment Outlook 3*. EARTHSCAN

[17] See footnote 11.

[18] *id.*, at pages 4 and 5.

Table 3.1. Species of living organisms

Kingdom	Major sub-division	Common names
Virus	Virus	Viruses
Monera	Bacteria	Bacteria
	Myxoplasma	Bacteria
	Cyanophycota	Blue-green algae
Fungi	Zygomycota	Zygomycete fungi
	Asomycota (including 18,00 lichen fungi)	Cup fungi
	Basidiomycota	Basidiomycete fungi
	Oomycota	Water molds
	Chytridiomycota	Chytrids
	Acrasiomycota	Cellular slime molds
	Myxomycota	Plasmodial slime molds
Algae	Chlorophyta	Green algae
	Phacophyta	Brown algae
	Rhodophyta	Red algae
	Chrysophyta	Chrysophyte algae
	Pyrrophyta	Dinoflagellates
	Euglenophyta	Euglenoids
Plantae	Bryophyta	Mosses, Liverworts, Hornworts
	Psilophyta	Psilopsids
	Lycopodiophyta	Lycophytes
	Equisetophyta	Horsetails
	Filicophyta	FernGymnospermas
	Gymnosperma	Dicots
	Dicotolydonae	Monocots
Protozoa	Protozoa	Protozoans, Sarcomastigophorans, Ciliates and smaller groups

Table 3.1. continued.

Kingdom	Major sub-division		Common names
Animalia	Porifera		Sponges
	Cnidaria, Ctenophora		Jellyfish, Corals, Comb jellies
	Platyhelminthes		Flatworms
	Nematoda		Nematodes (roundworms)
	annelida		Annelids (earthworms andrelatives)
	Mollusca		Mollusks
	Echinodermata		Echinoderns (starfish and relatives)
	Arthropoda		Arthropods
		Insecta	Insects
		Other arthropods	
	Minor invertebrate	Phyla	
Chordata	Tunicata		Tunicates
	Cephalochordata		Acorn worms
	Vertabrata		Vertebrates
		Agnatha	Lampreys and other jawless fish
		Chrondrichthyes	Sharks and other cartilaginous fish
		Osteichthyes	Bony fishes
		Amphibia	Amphibians
		Reptilia	Reptiles
		Aves	Birds
		Mammalia	Mammals

Source: Wilson, E.O., 1988 (as modified).

Table 3.1 above indicates the breadth of species that should be taken into consideration when determining and framing conservation actions. He also noted that the actual list of identified species is still not complete, as new species are being identified, and it is expected that more will be discovered in the future[19]. This then raises the question whether a statutory provision should address species specifically or make provisions to

[19] See *fn* 14.

allow for species to be addressed through the structuring of mandate to an authority to determine the necessary course of action when the need arises.

The International Union for Conservation of Nature and Natural Resources (IUCN) has added it's own context in as far as determining what constitutes species, as shown in its 2009 Summary of Statistics of Numbers of Threatened Species by Major Groups of Organisms[20]. The document classified species into four major groups as summarised in Table 3. 2 below. This then raises the question as to which grouping should prevail. It could be argued that in order to be as comprehensive as possible, the context and categorisation proffered in Table 3.1. should be preferred. The options at hand would be to recognise the categories, and assign mandates to address the categories and species within such categories, but not make regulatory provisions that address the species specifically.

Table 3.2. Threatened species by major groups of organisms.

Group	Type
Vertebrates	Mammals, Birds, Reptiles, Amphibians, Fishes
Invertebrates	Insects, Molluscs, Crustaceans, Corals, arachnids, Velvet Worms, Horseshoes crabs, Others
Plants	Mosses, Ferns and Allies, Gymnosperms, Flowering Plants, Green Algae, Red Algae
Fungi and Protists	Lichen, Mushrooms, Brown algae,

Source: IUCN, 2009, as modified

[20] http://www.iucnredlist.org/documents/summarystatistics/2009RL_Stats_Table_1.pdf accessed November 2009.

Species as contextualised in multilateral environmental agreements

As far as international conventions related to biodiversity are concerned, species are defined or contextualised to suit different convention needs. Six conventions or international treaties are looked here, as Malaysia is party to all of them, and bound by the obligations set out in each agreement. This would mean, context for what is meant by biodiversity in particular species would have great bearing as to how it is contextualised in Malaysia.

As a primary multilateral environmental agreement specific on biodiversity, the CBD[21] does not provide a definition for species, but in a glossary for Parties[22] species are described as "a group of organisms capable of interbreeding freely with each other but not with members of other species". The terms 'Biodiversity' and 'Biological resources' are defined in Article 2.

The term 'biodiversity' has a two-pronged meaning, one that addresses the variability among living organisms from all sources and the ecological complexes of which they are part of. The use of the term biodiversity in the CBD, goes beyond mere objects, and extends towards interactions within ecological complexes. Biological resources, in the same Article 2, is interpreted to include genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity.

[21] Malaysia is a party to the CBD since 9 November 1992.
[22] This glossary can be accessed at http://www.cbd.int/cepa/toolkit/html/resources/FD/FDF8CE88-237B-46EE-BB5F-2304D735C23/Biodiversity%20Glossary.pdf. Document was last accessed on 5 June 2008.

The same Article 2 interprets genetic material as any material of plant, animal, microbial or other origin containing functional units of heredity, whilst genetic resources mean genetic material of actual or potential value.[23] From the description above, broad as it is, that it goes beyond objects and includes ecological interaction, it does not however, particularly for species, take into consideration the issue of hybrids as raised by E.O. Wilson. This is a factor for consideration.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973 (CITES)[24] defines species in Article 1 as any species, subspecies or geographical population thereof. Annex 5 of Resolution Conf. 9.24 (Rev. CoP15) of the 15th Conference of Parties (COP) in 2010[25], reiterates that the terms 'species and subspecies will refer to the biological concept of a species and do not require any further definition'[26]. It goes on to add that the terms now cover varieties, and the term geographically separate population has been added, which refers to parts of a species or subspecies within a particular geographical boundaries, which can be used to refer to stocks as understood in fisheries management. Perhaps at this instance, in lieu of case law, that the biological concept of species can extend to hybridisation as proposed for inclusion by E.O. Wilson (1998).

The Convention on Conservation of Migratory Species 1979 focuses on "Migratory species" which means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of

[23] These six conventions are conventions that are closely linked to the CBD and its implementation, as can be seen at the CBD website. 5 June 2008 http://www.cbd.int/blg/.

[24] Signed at Washington, D.C., on 3 March 1973, and Amended at Bonn, on 22 June 1979. Article 1. Malaysia is party to CITES.

[25] See http://www.cites.org/eng/resources/terms/glossary.php and http://www.cites.org/eng/res/all/09/E09-24R15.pdf both sites last accessed 1 January 2012. The revised resolution was adopted to provide technical assistance to Parties, particularly in relation to amending Appendices I and II, when considering listing of species, focusing on scientific validity in determining the criteria, definition, notes and guidelines and their applicability to different groups of organisms.

[26] Annex 5 of Resolution Conf. 9.24 (Rev. CoP15), at page 7.

whose members cyclically and predictably cross one or more national jurisdictional boundaries. Here the use of terms is confined to species in the animal kingdom, but it is wide enough to infer inclusion of hybridised species.

The International Treaty on Plant Genetic Resources for Food and Agriculture 2004 focuses on plant genetic resources for food and agriculture, which have been defined as any genetic material of plant origin of actual or potential value for food and agriculture. "Genetic material" here means any material of plant origin, including reproductive and vegetative propagating material, containing functional units of heredity. This definition extends to include genetic material, which would fulfil the context put forward by the CBD, with the inclusion of genetic resources.

The Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971[27] and the glossary[28] does not provide specific meaning for species or related terms, save and except waterfowl which have been defined as birds ecologically dependent on wetlands. The World Heritage Convention 1972[29] does not provide specific definition or use of terms, but provides for "natural heritage" that includes references to species as being animal or plant. It includes species and habitats in its definition for geological and physiographical formations and precisely delineated areas, through the inclusion of areas that constitute "habitats of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation". Biological formations or groups are included in the definition for natural features. Again, it does not spell out the what is identified and categorised as

[27] Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 as amended by the Protocol of 3.12.1982 and the Amendments of 28.5.1987. See

[28] *Ibid*. See Glossary 5 June 2008. http://www.ramsar.org/about/about_glossary.htm#glossary.

[29] Convention Concerning the Protection of the World Cultural and Natural Heritage. Adopted by the General Conference at its seventeenth session Paris, 16 November 1972. See Article 2.

species in the Convention text. The term conservation, can be found in its definition of natural sites, but more as a point of view rather than a strict categorisation of what constitutes conservation[30].

It would seem that the world accepted definition, by way of convention, would the one offered by the CBD in its glossary, as the term biodiversity used by the CBD is the one adopted by many countries. For the purposes of this section of the Chapter, species will mean population or series of population as proposed by E.O. Wilson, with a slight modification to include hybridisation.

3.1.1.2. Genetic Diversity, Material and Resource

The term genetic resource, as defined by the CBD means genetic material of actual or potential value. "Genetic material" in the CBD means any material of plant, animal, microbial or other origin containing functional units of heredity. The need to contextualise genetic material and resource lies with the problem often cited as the loss of genetic diversity, i.e. the amount of genetic variation, which goes to the genetic makeup[31] of a particular species.

Genetic diversity would then be the sum of variation or information contained in the individual genes of a species that provides the characteristic[32], which are often essential to the survivability or resiliency of that species. This leads to the question of genetic diversity, which are usually divided into three groups, in terms of measurement, i.e. phenotypic traits (where individuals share the same characteristics);

[30] Ibid. Article 2: natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty

[31] Chiras, D.D. & Reganold J.P., 2005. Natural Resources Conservation: management for a sustainable future (9th Edition). Pearson Prentice Hall. 647pgs. Pgs 405.

[32] Pearce, D and Moran, Dominic, 1994. The Economic Value of Biodiversity. Earthscan. 172pgs. Pg 2-3.

allelic frequencies (variance in genes which need not be representative of the genome as a whole);and sequence variation (this is where a portion of the DNA is sequenced)[33]. Wilson, E.O.[34] notes that each species is a repository of an immense amount of genetic information, and no two species are genetically identical.

The United Nations[35] in its glossary adds another dimension; purpose and target beneficiaries it its inclusion of genetic resources, i.e. genetic resources are genetic material of plants, animals or micro-organisms of value as a resource for future generations of humanity. This stretches the context from it being functional units of hereditary to resources that serves humanity.

Allem, C[36] argues that the term genetic resources is hinged on the aspect of value, and not just the functional units in the genetic material within an animal, plant or microorganisms, should encompass the genetic makeup of plants, animals and microorganisms of value to the material, medical, scientific, aesthetic, recreational, psychological, and cultural needs of the humankind. This could lead to a summation that genetics resources are genetic materials that make up the genetic diversity of a species that has value or potential value to humanity, now and in the future.

We are now pressed to consider non-animal or plant genetic resources and its relationship with humanity, whether it should include humankind and nature or remain exclusive to humankind only. Again, there are a host of literature present that argues

[33] Ibid pages 7-8

[34] See footnote13. Ibid at page 7.

[35] United Nations, 1997. Glossary of Environment Statistics. Studies in Methods, Series F, No. 67, United Nations, New York, 1997.

[36] Allem, A.C., 2000. *The terms genetic resource, biological resource, and biodiversity examined*. The Environmentalist, 20, 335-341, 2000.

the many facets to the definition, context and purpose related to genetic resources, materials, diversity and variation, but the essence to be captured here is that genetic resources are elements of biodiversity, which given the realms of scientific advancement will be subjected to reinterpretation, depending on the genetic source of the species concerned.

3.1.1.3. Habitats and ecosystems

Callicott, 1986[37] notes that ecosystems are the functional aspects of biodiversity. The CBD offers a definition in Article 2 of the convention text, in which "Ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit, and "Habitat" means the place or type of site where an organism or population naturally occurs.

Habitats denote a geographical boundary where organisms are found, but the catch it has to be naturally occurring, which could exclude zoos. Ecosystems basically means the link between organisms and their physical environment, i.e. they have two interactive components, living (biotic) and non-living (abiotic), and it is global, in the sense that all ecosystems are part of a global ecosystem, i.e. biosphere, extends from the bottom of the oceans to the tops of tallest mountains where biospheres are concerned[38].

In the real world, organisms move from one ecosystem to another[39], thus indicating that ecosystems are often delineated artificially when the actual boundary of one

[37] Callicott, J. B., 1986, "On the intrinsic value of nonhuman species", in *The preservation of species: the value of biological diversity*, B. G Norton (ed), Princeton, NJ: Princeton University Press.

[38] See footnote 30, Chiras, 2006 ibid at page 49.

[39] Ibid page 49.

ecosystem to another is often not clear. There have been numerous efforts to contextualise what constitutes ecosystems and how best to 'approach' it, but as noted in Bonn during the Ninth Conference of Parties to the CBD in 2008, a one-size-fits-all solutions for the ecosystem approach are neither feasible nor desirable, the application of the ecosystem approach should be regarded as a process where learning by doing is the priority need at present[40].

In fact global assessments suggest that the approach is not being applied systematically to reduce the rate of biodiversity loss, but there are many examples of successful application at the regional, national and local scales, which can be widely promoted and communicated[41]. The ecosystems approach stems from various concepts and initiatives, as noted in the report, including 'Mountains to the Sea concept', originally proposed by the Ramsar Convention and partners, as currently being promoted by the Worldwide Fund for Nature (WWF), and the "Five Steps to Implementation" developed by the International Union for the Conservation of Nature Commission on Ecosystem Management (IUCN-CEM), the "Large Marine Ecosystem projects" supported by the Global Environment Facility and the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization and other partners[42]. The CBD 'pigeonholes' ecosystems into seven thematic areas i its programmes of work, i.e. agricultural; dry and sub-humid lands; forests; inland waters; islands; marine and coastal; and mountains[43].

[40] Report can be sources at http://www.cbd.int/doc/meetings/cop/cop-09/official/cop-09-29-en.pdf. see pages 88-89

[41] Ibid page 88-89

[42] Ibid at page 88-89

[43] See information provided at

The MEA proposes that ecosystems here should also include managed ecosystems (e.g. plantations, farmland, aquaculture sites, rangeland, and urban ecosystems) as well as the unmanaged ecosystems (e.g. wild land, nature preserves, and national parks)[44]. It is also important to note, that when referring to ecosystems, we are referring to the components of an ecosystems, the functions they provide and the services that can be gained from ecosystems. Wallace, 2007[45] suggests that in managing ecosystems services, there is a need to understand the structure and composition of ecosystems and their processes, which are complex interactions between the biotic and abotic elements to an ecosystems that lead to a definite result, as summarised below in Table 3.3.

Table 3.3. Description of the relationship between ecosystems elements and processes.

Structure and composition of ecosystems	**Ecosystems processes**

Natural elements, including:
• Natural biodiversity
• Land including:
  • Surface soils and regolith
  • Geopmorphology
  • Minerals
• Water
• Air
• Energy
Socio-cultural elements, including
• Cultural biodiversity including domestic stock and humans
• Roads, buildings etc
• Energy
	• Water cycle
	• Nutrient cycle
	• Carbon cycle
	• Energy cycle
	• Regulation of disease and pests organisms
	• Photosynthesis
	• Air regulation
	• Flood regulation
	• Social processes
	• Economic processes

Source: Wallace, 2007[46] as modified.

[44] See footnote 4. Ibid Page 18.

[45] Wallace, K. J., 2007. Classifications of ecosystems services: Problems and solutions. Biological Conservation 139 (2007) 235-246. At page 236-238.

[46] Ibid page 237

Ecosystems function here can be read to mean ecosystems processes, and have been used interchangeably, Wallace, 2007[47] suggests that if ecosystems services, processes, structures and compositions are adequately defined, then ecosystems processes can be read synonymously. Ecosystems services, as defined by the MEA are the benefits people obtain from ecosystems[48], though here it would seem the emphasis is on the natural elements of the ecosystems rather than the socio-cultural elements of the ecosystems.

The MEA establishes the link between ecosystems services to five basic components of human well-being, that is, security, basic material for good life, heath, freedom of choice and action and good social relations. A modified table depicting the link between ecosystems services and constituents of well being based on that given by the MEA[49] is shown in Table 3.4. Added emphasis is made on the contributory linkages that fuel conservation priority setting that can be sourced from the need to conserve resources and ecosystems per se and from the benefits identified from ensuring human well being that drives conservation.

The CBD website[50] offers a summarised explanation as to what constitutes good and services provided by the ecosystems, that is:

a) Provision of food, fuel and fibre;

b) Provision of shelter and building materials;

c) Purification of air and water;

d) Detoxification and decomposition of wastes;

[47] Ibid page 237

[48] See footnote 38 at page 18-19.

[49] Ibid at page 29.

[50] Please refer to http://www.cbd.int/2010/about/. Last accessed for verification 24 January 2010.

e) Stabilisation and moderation of the Earth's climate;

f) Moderation of floods, drought, temperature extremes and forces of wind

g) Generation and renewal of soil fertility, including nutrient cycling

h) Pollination of plants, including many crops

i) Control of pests and diseases;

j) Maintenance of genetic resources as key inputs to crop varieties and livestock breeds, medicines and other products

k) Cultural and aesthetic benefits

l) Ability to adapt to change

In addition, it is often quoted in literature that ecosystems approaches should shift towards landscapes approaches, Odum, 1992[51], advocates that the approach to biodiversity should include genetic and landscape diversity, not just species diversity, and that in preserving biodiversity, action should be at the landscape level, because the variety of species in any region depends on the size, variety, and dynamics of patches (ecosystems) and corridors.

Here it is important to note that where ecosystems are concerned, there is a need to take into account both the ecosystems components, services/functions and services, when putting into context aspects of conservation. This would mean all aspects related to human activities would also have to be considered. Important also is the factor of how best to determine ecosystems boundaries, as at present there is no clear means to establish boundaries, but more of a set of ecological relationships rather than a distinct place[52], the emphasis here is on an approach that links spatial patterns to ecological

[51] Odum, E.P., 1992. Great Ideas in Ecology for the 1990s. *BioScience*, Vol. 42, No. 7, Crop Productivity for Earth and Space (Jul. - Aug., 1992), pp. 542-545

[52] Freyfogle, E.T. 2006. Why conservation is failing and how it can regain ground. Yale University Press. 302 pgs. Pg 180.

processes[53]. This approach has gained much mileage and is included in various work programmes of the CBD to complement ecosystems approaches, as it forms a link between nature and communities[54].

Table 3.4. Linkages between ecosystems services and human well being

<table>
<tr><td colspan="2">Ecosystems Services</td><td colspan="2">Constituents of Human Well being</td></tr>
<tr><td rowspan="4">Supporting
• Nutrient cycling
• Soil formation
• Primary production</td><td>Provisioning
• Food
• Fresh Water
• Wood and fibre
• Fuel</td><td>Security
• Personal safety
• Secure Resource Access
• Security from Disaster</td><td rowspan="4">Freedom of choice and action
Opportunity to achieve what the individual values doing and being</td></tr>
<tr><td>Regulating
• Climate regulation
• Flood regulation
• Disease regulation
• Water purification</td><td>Basic Material for Good Life
• Adequate livelihood
• Sufficient nutritious food
• Shelter
• Access to goods
Health
• Strength
• Feeling Well
• Access to clean air and water</td></tr>
<tr><td>Cultural
• Aesthetic
• Spiritual
• Educational
• Recreational</td><td>Good social relations
• Social cohesion
• Mutual respect
• Ability to help others</td></tr>
<tr><td>Input</td><td>Output</td></tr>
<tr><td colspan="2">Life on Earth – Biodiversity</td><td colspan="2">Conservation priority setting</td></tr>
</table>

Source: MEA 2005 as modified.

[53] Wu, J. 2006. Cross-disciplinarity, landscape ecology, and sustainability science. Landscape Ecology 21:1-4.
[54] Brown, Jessica, Mitchell, Nora and Beresford, Michael (Eds.) (2004). *The Protected Landscape Approach: Linking Nature, Culture and Community.*IUCN, Gland, Switzerland and Cambridge, UK. xv + 270pp.

3.2. CONTEXTUALISING CONSERVATION FOR BIODIVERSITY

The term conservation means many things depending on the use and application to a particular purpose; the approach and practice of forest conservation would differ in meaning and context to wildlife conservation. Gilbert Pinchot in 1910[55] spelt out the principles of conservation which include; it stands for development, not just husbanding resources for future generations as it demands the welfare of the present generation first, the following generation; secondly it stands for the prevention of waste and the destruction of natural resources; thirdly it stands for the development and preservation of natural resources.

In its simplicity, he notes that conservation means the greatest good over the greatest number for the longest time. He further states that conservation advocates the use of foresight, prudence, thrift and intelligence, which includes the application of common sense to common problems for the common good, and the outgrowth of conservation would be national efficiency geared towards prosperity. President Roosevelt's Conservation Doctrine reflects the same stand, whereby it was stated that science offers the tools with which we fulfil public duty to manage multiple natural resources for optimum values to humans[56]. There tomes of literature dedicated to terms "conservation", "biodiversity conservation", "aspects of conservation", "approaches to conservation" and "methods of conservation", including purpose, goals and prerequisites for conservation.

[55] Pinchot, G., 1967. The Fight for Conservation. Seattle: University of Washington Press (originally published in 1910). See pages 40-52.

[56] As cited in Knight, R.L. and Bates, S.F., 1995. A New Century for Natural Resources Management. Island Press. 399 pages. At page 81.

Conservation can mean different things depending on the circumstances and subject matter. Chiras, 2006 for example states that conservation refers to two basic notions; using only the resources we need (frugality principle); and using resources efficiently (efficiency principle). Jordan, 1995 suggests that conservation is a philosophy of managing the environment in a way that does not despoil, exhaust or extinguish, arguing that conservation is not an applied science, but is a means that incorporates aspects of applied science[57].

The 'history' of conservation dates back 3000B.C.[58], and the common factor serves a thread, is that there has to be an entity with authority to direct acts of conservation, providing the purpose and agenda for which objectives can be framed. Conservation was initially pegged on a human centred approach then with scientific advancement shifted to a nature centred approach, and now various multilateral environmental agreements forged at the United Nations are gearing towards an ecologically sustainable approach.

The World Conservation Strategy 1980 defines conservation as the management of human use of biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspiration of future generations, conservation is positive, embracing preservation, maintenance, sustainable utilisation, restoration and enhancement of natural environment[59]. Conservation is a process that is applied cross-sectorally[60] or can be tailored specifically to sectors, such a agriculture, forestry wildlife management, fisheries

[57] Jordan, C. F., 1995. Conservation: Replacing quantity with quality as a goal for global management. John Wiley & Sons, Inc. 340 pgs. See page 3.
[58] Ibid at page 9-10. And as noted in Stone, C. D., 1996. Should Trees Have Standing? And Other Essays on Law, Morals and the Environment. Oceania Publications, 181 pgs.
[59] IUCN-UNEP-WWF, 1980. World Conservation Strategy: Living Resource Conservation for sustainable Development. 77pps. See page 18, paragraph 4.
[60] Ibid, page 18 paragraph 6.

management, recreation and wilderness, beginning at first with the usefulness of components to be conserved, often imperilled species, and with greater advancement in ecology, focused on a system of complex processes, pushing towards balancing use and preservation, taking into account the ecological health of an area[61]. Aldo Leopold states that conservation is a state of harmony between people and land, taking into account that the outstanding discovery of the twentieth century was the complexity of the land organism [62]. It could be said that conservation includes both human and non-human concerns, and has to be hinged on economic growth, necessitating a broader view to acts of conservation.

Based on a literature review undertaken[63] conservation approaches can be divided into four categories, that is, species approach (from the imperilled to almost extinct), habitat approach (where conservation is undertaken in defined and delineated habitats, based on naturally occurring organisms within, which takes on a closed area approach), ecosystems approach (that looks at the ecological processes that will have to be 'protected' in order to ensure organisms and the ecological system is conserved) and landscape approach (which takes into account size, variety, and dynamics of patches (ecosystems) and corridors).

Odum, 1992[64], puts this into context, in that conservation is pegged on purpose and process, noting that there are factors that drive conservation, which he states as his 20 great (concepts) ideas for ecology that has been summarised and modified in Table 3.5. These ideas are key to setting out the purposes later on for legislative and regulatory framing.

[61] *fn* 52. Jordan 1995. Pages 7-35.
[62] Leopold, A., 1993: Round River (reprint).Oxford University Press, New York, 1993, pp. 145-146.
[63] See list of references.
[64] See *fn* 46.

Table 3.5. Twenty great ideas for ecology, as modified from Odum 1992.

Concept	Idea	Factors for consideration
Concept 1	An ecosystem is a thermodynamically open, far from equilibrium, system. Input and output environments are an essential part of this concept.	• Ecosystems • Input and outputs e.g. extraction, abstraction, recharge and addition
Concept 2	The source-sink concept: one area or population (the source) exports to another area or population (the sink).	• Ecosystems linkages • Species 'recruitment' to spur reproduction
Concept 3	In hierarchical organization of ecosystems, species interactions that tend to be unstable, non-equilibrium, or even chaotic are constrained by the slower interactions that characterize large systems. Short-term interactions, such as inter-specific competition; the evolutionary arms race between a parasite and its host, herbivore-plant interactions, and predator-prey activities—tend to be oscillatory or cyclic.	• Ecosystems interaction and dynamics • Landscapes/ecosystem landscapes based management • Control of invasive and parasitic species • Control of atmospheric gaseous balance
Concept 4	The first signs of environmental stress usually occur at the population level, affecting especially sensitive species.	• Indicators of environmental stress
Concept 5	Feedback in an ecosystem is internal and has no fixed goal. There are no set-point controls in the biosphere.	• Ecosystems cybernetics
Concept 6	Natural selection may occur at more than one level.	• Co-evolution and group selections
Concept 7	Two kinds of natural selection, or two aspects of the struggle for existence: organism versus organism that leads to competition, and organism versus environment, thereafter to mutualism.	• Ecosystems and organisms adaptation
Concept 8	Competition may lead to diversity rather than to extinction.	• Adaptation and diversity

Table 3.5. Continued

Concept	Idea	Factors for consideration
Concept 9	Evolution of mutualism increases when resources become scarce. Cooperation between species for mutual benefit has special survival value.	• Species mutualism
Concept 10	Indirect effects may be as important as direct interactions in a food web and may contribute to network mutualism.	• 'Mutualistic' relationship in food web networks
Concept 11	Since the beginning of life on Earth, organisms have not only adapted to physical conditions but have modified the environment in ways that have proven to be beneficial to life in general (e.g., increase O2 and reduce CO2).	• Adaptation and modification
Concept 12	Heterotrophs may control energy flow in food webs.	• Species functions and ecosystem regulation
Concept 13	An expanded approach to biodiversity should include genetic and landscape diversity, not just species diversity.	• Landscape approach
Concept 14	Ecosystem development or autogenic ecological succession is a two-phase process.	• Ecosystems 'organisation'
Concept 15	Carrying capacity is a two-dimensional concept involving number of users and intensity of per capita use.	• Ecosystem carrying capacity
Concept 16	Input management is the only way to deal with nonpoint pollution.	• Non-point source pollution control
Concept 17	An expenditure of energy is always required to produce or maintain energy flow or a material cycle (i.e. larger and more complex units require more of the available energy for maintenance.	• Energy flows and net-energy concept
Concept 18	Bridge the gaps between human-made and natural life-support goods and services.	• Ecosystem support and capacity
Concept 19	Transition costs are always associated with major changes in nature and in human affairs.	• Payment for ecosystems services
Concept 20	A parasite-host model for man and the biosphere is a basis for turning from 'dominionship' to stewardship	• Ecosystems integrity and sustainability

Source: Odum, 1992. As modified.

Table 3.5 above shows that there is a 'conservation chain' that ties resources and ecosystems to the goods and services and thereafter causes and effects (impacts). What Odum, 1992 perhaps is suggesting is that, the range of action that should be taken, should begin with the fundamental 'what do we have', 'what do we manage', 'what scale do we conserve it at' and 'how do we conserve it'.

The processes involved in conservation, be it biodiversity as a whole, its components, its relationships or interactions varies depending on the purpose of the act of conservation, and to an extent on the available scientific information that guides the process and application of conservation methods. Purposes can be driven by various factors, such as ecological thresholds[65], 'biodiversity crisis (i.e. the need to address species decline or habitat or ecosystem degradation or decline in ecosystems health)[66] or conserving to protect livelihoods[67] or preserving biodiversity for future needs[68] or even ensuring sustainable use and resource development[69]. Conservation can take on a spatial dimension, whereby there are numerous promoted approaches that include

[65] See references such as Hugget, A.J., 2005. The concept and utility of 'ecological thresholds' in biodiversity conservation. *Biological Conservation 124 (2003) 301-310*. Science Direct;

[66] Harrison, S, 2005. Biodiversity and Wilderness: The need for systematic protection of biological diversity. *25 J. Land Resources & Envtl L. 53, 21- 31*; Hector A. & Bagchi R., 2007. Biodiversity and ecosystem Multifunctionality. *NATURE Vol 448 2007 188-191*; Freyfogle E. T., 2006. Why conservation is failing and how it can regain ground. Yale University Press. 302 pgs, see pages 179- 218.

[67] See references such as Salafsky, N. & Wollenberg, E. 2000. Linking Livelihoods and Conservation: A conceptual framework and scale for assessing the integration of human needs and biodiversity. *World Development Vol. 28 No. 8 1421-1438*.

[68] See references such as Boudreaux P., 2007. Biodiversity and the new best base for applying environmental statues extraterritorially. *Environmental Law 37.4 (Fall 2007) 1107*; Salafsky, N. & Wollenberg, E. 2000. Linking Livelihoods and Conservation: A conceptual framework and scale for assessing the integration of human needs and biodiversity. *World Development Vol. 28 No. 8 1421-1438*.

[69] Poore, D., 2003. Changing Landscapes. Earthscan. 290 pp. See Chapter 18; Abel, N., Langston, A., Ive, J., Tatnell, B., Howden, M. & Stoi, J. 2002. Institutional Change for sustainable land use: a participatory approach in Australia (Chpater 13) pgs 286- 313. In Complexity and Ecosystem Management: the thory and practice of multi agent systems. Jansen M, ed. Edward Elgar 2002. 344 pps; Knight, R.L. and Bates, S.F., 1995. A New Century for Natural Resources Management. Island Press. 399 pages;

conservation based on the biogeographical region[70] or habitat[71] or ecosystems[72] or even land use approaches[73].

It is also recommended that conservation is approached from a 'scale' perspective, i.e. applying scale in interpreting ecological patterns[74]. Listing of species or the taxonomic approach also can form part of a conservation process[75]. Community based approaches to have often been cited as a means to effect better biodiversity conservation[76]. Noted also were approaches that were pegged to changing consumption patterns and reviewing the 'economics' both is assessment and valuation of biodiversity[77]. What is

[70] See references such as Whitaker R.J., Araujo M. B., ladle J. E. M. and Willis K. J., 2005. Conservation Biogeography: assessment and prospect. *Diversity and Distribution (2005) 11, 3-23.* Blackwell;

[71] See references such as Colburn J. E.., 2007. Bioregional conservation may mean taking habitat. Environmental Law 37.2 (Spring 2007) 249- 301.

[72] See references such as Stoms D. M., Corner P. J., Crist P. J., and Grossman D.H., 2005. Choosing surrogates for biodiversity conservation in complex planning environments. *Journal of Conservation Planning Vol 1 (2005) 26-39;* Molenaar E .J., 2007. Managing biodiversity in areas beyond national jurisdiction. The International Journal of Marine and Coastal Law Vol. 22 No. 1 89- 124; McDonald, J, 2002. Rethinking the Endangered Species Act: Moving beyond Conflicts and Promoting Positive efforts for conservation. *26 Environs Envtl. L & Policy J. 147*; Salafsky, N. & Wollenberg, E. 2000. Linking Livelihoods and Conservation: A conceptual framework and scale for assessing the integration of human needs and biodiversity. *World Development Vol. 28 No. 8 1421-1438*.

[73] See references such as Freyfogle E. T., 2006. Why conservation is failing and how it can regain ground. Yale University Press. 302 pgs; Abel, N., Langston, A., Ive, J., Tatnell, B., Howden, M. & Stoi, J. 2002. Institutional Change for sustainable land use: a participatory approach in Australia (Chapter 13) pgs 286- 313. In Complexity and Ecosystem Management: the theory and practice of multi agent systems. Jansen M, ed. Edward Elgar 2002. 344 pps.

[74] See references such as Beever E.A., Swihart R.K. and Bestelmeyer B.T., 2006. Linking the concept of scale to studies of biological diversity: evolving approaches and tools. *Diversity and Distribution (2006) 12, 229-235*. Blackwell; Salafsky, N. & Wollenberg, E. 2000. Linking Livelihoods and Conservation: A conceptual framework and scale for assessing the integration of human needs and biodiversity. *World Development Vol. 28 No. 8 1421-1438*.

[75] See references such as Stelle, Jr W.W., 1994. Major issues in reauthorizing the Endangered Species Act. *24 Envtl. L. 321, 7- 14*; Solow A R & Broadus J M, 1995. The meaning of Biodiversity: Issues in Measurement of Biological Diversity. *28 Vand. J. Transnat'l. L. 695, 1-6*; Wilson, E.O., 2003. The Encyclopaedia of Life. TRENDS in Ecology and Evolution Vol.18 No.2 February 2003. See page 79

[76] See references such as Chan, K.M.A., Pringle R.M., Ranganathan J., Boggs C.L., Chan Y.L., Ehrlich P.R., Haff P.K., Heller N.E., AlKhafji K. & Macmynowski D.P, 2007. When Agendas collide: Human welfare and Biological Conservation. *Conservation Biology Vol 21 No. 1 56-68*; Salafsky, N. & Wollenberg, E. 2000. Linking Livelihoods and Conservation: A conceptual framework and scale for assessing the integration of human needs and biodiversity. *World Development Vol. 28 No. 8 1421-1438*; Abel, N., Langston, A., Ive, J., Tatnell, B., Howden, M. & Stoi, J. 2002. Institutional Change for sustainable land use: a participatory approach in Australia (Chpater 13) pgs 286- 313. In Complexity and Ecosystem Management: the theory and practice of multi agent systems. Jansen M, ed. Edward Elgar 2002. 344 pps.

[77] Chiras, D.D. & Reganold J.P., 2005. Natural Resources Conservation: management for a sustainable future (9th Edition). Pearson Prentice Hall. 647pgs.

clear is that there is a need to first determine the goal for conservation[78], which will be based on purposes that will drive the process to put into effect the means to achieve that goal. It is also essential to establish the mandate and the right[79] to conserve, and most importantly the boundary of the area for conservation, which will bring about aspects related to jurisdiction and scale[80].

Central to the act of conservation is the approach to be taken, and this is again is dependent on the goal and purpose as well as subject matter at hand, as the entity with the obligation to conserve will do so based on the prescribed mandate, and fundamentally *locus standi*. Issues such as the tussle between public and privately owned lands whereby critical resources are located often stand out as a common concern in most of the literature discussed.

The need to establish the right to conserve is one that will have to be addressed, and the rights of persons affected by conservation will also have to be taken into account. What is clear from the literature is that there is a need to conserve, and depending on the nature or state of biodiversity, the obligation to conserve is often placed in the

[78] Freyfogle E. T., 2006. Why conservation is failing and how it can regain ground. Yale University Press. 302 pgs. See pages 179 and 251.

[79] See Stone, C D, 1996. Should Trees have Standing? And other essays on law, morals and the environment. Oceana Publications 1996; and Cullinan C., 2003. Wild law: A manifesto for Earth Justice. Greenbooks UK. 224 pps; Stelle, Jr W.W., 1994. Major issues in reauthorizing the Endangered Species Act. *24 Envtl. L. 321, 7- 14*.

[80] See references such as Beever E.A., Swihart R.K. and Bestelmeyer B.T., 2006. Linking the concept of scale to studies of biological diversity: evolving approaches and tools. *Diversity and Distribution (2006) 12, 229-235*. Blackwell; Salafsky, N. & Wollenberg, E. 2000. Linking Livelihoods and Conservation: A conceptual framework and scale for assessing the integration of human needs and biodiversity. *World Development Vol. 28 No. 8 1421-1438*; Freyfogle E. T., 2006. Why conservation is failing and how it can regain ground. Yale University Press. 302 pgs; Abel, N., Langston, A., Ive, J., Tatnell, B., Howden, M. & Stoi, J. 2002. Institutional Change for sustainable land use: a participatory approach in Australia (Chapter 13) pgs 286- 313. In Complexity and Ecosystem Management: the theory and practice of multi agent systems. Jansen M, ed. Edward Elgar 2002. 344 pps; Stelle, Jr W.W., 1994. Major issues in reauthorizing the Endangered Species Act. *24 Envtl. L. 321, 7- 14*; Boudreaux P., 2007. Biodiversity and the new best base for applying environmental statues extraterritorially. *Environmental Law 37.4 (Fall 2007) 1107*; Salafsky, N. & Wollenberg, E. 2000. Linking Livelihoods and Conservation: A conceptual framework and scale for assessing the integration of human needs and biodiversity. *World Development Vol. 28 No. 8 1421-1438*.

hands of the government, though now there are shifts towards community based initiatives, which again is dependent on the benefits to be derived from conservation.

3.3. "BUILDING BLOCKS OF BIODIVERSITY CONSERVATION" FOR INTERPRETING AND FRAMING STATUTES

In summary, in determining what we have and what we need to frame future action, the prerequisites of what constitutes biodiversity conservation must be laid out. The different components or elements that make up biodiversity, the processes within conservation should be mapped, in order to help assess later the state of statutory regime in Malaysia in relation to biodiversity and conservation, and shall constitute the elements that will aid statutory interpretation, i.e. it will frame the purposive approach. Here the take would be coverage and gaps.

Diagram 3.1 consolidates the key points raised herein illustrating the various factors that make up the prerequisites for biodiversity conservation based on the literature reviewed. The aforementioned diagram also indicates that there is a need to profile, as far as the statutory regime is in Malaysia, the extent of coverage of the regime over all aspects specific and related to biodiversity, including all factors that contribute to the integrity of biodiversity, as well as the impacts both negative and positive. Based on the above also, the proposed integrative statutory framework that links all aspects related to biodiversity and conservation will have to fit in the means for which to address aspects related to the conservation processes of the resource per se, based on the principles identified that shall serve as a rationale, regulate activities related to the utilisation and conservation biodiversity, as well as the means to effect conservation through a structured system of authority. This Diagram will help set the stage for the statutory regime profile in Chapter Six.