NATURAL ENVIRONMENT FRAMEWORK
DEFINITIONS PAPER

The purpose of this document is to define and explain the terminology that the Natural Environment Framework (NEF) will be using in the next phase of its development.

THE PHYSICAL AND BIOLOGICAL ENVIRONMENT

1. Environment

The environment is all of the biological and physical factors that act on an organism, population, or ecological community and influence its survival and development. Biological factors include the organisms themselves, their food, and their interactions. Physical factors include such items as sunlight, soil, air, water, geology, geomorphology, climate, and pollution. Organisms respond to changes in their environment by evolutionary adaptations in form and behaviour (adapted from the American Heritage Science Dictionary 2005).

The summation of the biological and physical environment is referred to as the biophysical environment and can be divided in many ways; the natural environment, the built environment, the terrestrial environment, the marine environment etc. In reality there is much overlap between these different subdivisions.

2. Geodiversity

Geodiversity is commonly defined as 'the natural range (diversity) of geological (e.g. rocks, minerals, fossils), geomorphological (e.g. landforms and processes) and soil features (Gray, 2004).

A Geosystem can be defined as a 'dynamic association of rocks, minerals, soils and landforms, and the range of physical processes (e.g. weathering, erosion, sediment transport and deposition) operating on them'. A geosystem can refer to a unit at any scale, from country-wide to a single point on the land surface, and will also encompass the entire range of physical environments from seabed and littoral, upland and lowland, fluvial and dune field, to the subsurface. At any one point on the Earth's surface a geosystem can be viewed as an assemblage of one or more 'layers', for example bedrock, superficial deposits, fluvial landforms and processes in the case of a river system.

3. Biodiversity

Biodiversity is "the variability among living organisms from all sources, inter alia, terrestrial, marine and other aquatic ecosystems and ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems" (CBD (1992) Article 2).

Biodiversity is 'the variety of life' on Earth. It includes all plants, animals and micro-organisms (species diversity), the places where they live (habitat diversity), including those created or influenced by man, and the genetic differences between individuals that drives adaptability and evolution (genetic diversity). Biodiversity is key to human survival on earth. It provides us with all our food and medicines and ensures that we have clean air, clean water and fertile soils.

The biodiversity of a given geographical area refers to those species which have a natural range coinciding with this area. A species which occurs outside the range it occupies naturally, or could not occupy without direct or indirect introduction or care by humans, is described by the CBD as an alien species (CBD CoP 6 2002).

4. Habitat

A habitat is a biological and/or physical area that is inhabited by a particular population of species of animal, plant or other type of organism.

Habitat-types are groups of plant communities which have similar habitat relationships, for example, a woodland, grassland or heathland.

Habitats are the building blocks of ecosystems and each ecosystem may contain one or more habitat-types. Habitat-level is typically the scale at which most ecosystem work is undertaken as the different habitat components of an ecosystem will require different action to deliver services.

5. Ecosystem

An ecosystem is a dynamic complex of organisms (plants, animals and micro-organisms) and their physical environment interacting as a functional unit. (adapted from CBD (1992) Article 2 and MA).

Ecosystems are described in terms of structure and function. Structure summarises the physical and biological components, such as the chemicals, bedrock, soil and species (plants, animals and micro-organisms). Function describes the processes which maintain the ecosystem including biological processes such as primary productivity, decomposition and interaction between trophic levels (e.g. herbivores, predators etc.) as well as physical processes such as erosion, sediment transfer and hydrology.

An Ecosystem can refer to any functioning unit at any scale.

5.1 Ecosystem Health

There are a range of approaches and definitions for ecosystem health, ranging from ecological condition and biodiversity constructs to ones based on socio-economic resource management and societal choices.

According to Lackey (2003) Ecosystem Health is typically depicted as a broad societal aspiration rather than a precise policy goal or management target. "Lacking precise definition, it is difficult to consider the concept as a practical public policy goal."

Within the literature, ecosystem health is closely aligned to sustainable development. Burkhard et al. 2008 describes it as "a concept that integrates environmental conditions with the impacts of anthropogenic activities in order to give information for the sustainable use and management of natural resources".

In line with the CBD principles for the Ecosystem Approach, its practical application through NEF will require some measure of ecosystem condition (ecosystem structure, function and resilience) to place the delivery of multiple ecosystem delivery and societal choice in context.

The NEF Programme Board agreed the following definition at its 28th March 2011 meeting:

“A healthy ecosystem is one where the structure and function are sustained. A healthy ecosystem will be dynamic and functionally diverse."

5.2 Ecosystems Resilience

Resilience is defined as an ecosystem’s ability to recover and retain its structure and function following disturbance e.g. recovery after fire.

5.3 Ecosystem Adaptation

Adaptation refers to the adjustments which may occur within an ecosystem to maintain function under long-term chronic disturbance e.g. river erosion.

6. Landscape

Landscape is “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (European Landscape Convention 2004).

The European Landscape Convention (ELC) is the first international treaty on landscape and was signed and ratified by the UK Government in 2006 and came into force on 1 March 2007.

The ELC’s core aim is to achieve sustainable development based on a balanced and harmonious relationship between social needs, economic activity and the environment. It encourages signatories to set up a framework for the pro-active management of their landscapes by identifying what is special about them, the pressures they face and how local people would like to see them develop in the future. The scope of the ELC extends to marine as well as terrestrial landscapes and takes an 'all landscapes matter' approach.

7. Seascape

A seascape is "an area of sea, coastline and land, as perceived by people, whose character results from the actions and interactions of land and sea, by natural and/or human factors" (Briggs, J. and White, S. 2009).

POLICY APPROACHES

1. Sustainable Development

Sustainable development (SD) is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts. SD requires meeting the basic needs of all and extending to all the opportunity to fulfil their aspirations for a better life **(**The Report of the Brundtland Commission, *Our Common Future*, 1987).

The European Union, in its own strategy for SD, recognises that to achieve this, "economic growth, social cohesion and environmental protection must go hand in hand". The EU considers that SD requires that: "economic growth supports social progress and respects the environment, that social policy underpins economic performance, and that environmental policy is cost-effective".

In Wales sustainable development is about improving the long-term economic, social and environmental wellbeing of people and communities in Wales. To be truly sustainable, this needs to be done in ways which promote social justice and equality of opportunity, and which enhance the natural and cultural environment and respect its limits (WAG 'One Wales; One Planet', May 2009).

2. The Ecosystem Approach

"A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way" (CBD1993).

The Ecosystem Approach seeks to secure sustainable long-term benefits and so the outcome may not be immediately measurable. Biodiversity considerations and action are central to delivery of the Ecosystem Approach.

The Ecosystem Approach Principles

The following 12 principles are complementary and interlinked.

Principle 1: The objectives of management of land, water and living resources are a matter of societal choices.

Different sectors of society view ecosystems in terms of their own economic, cultural and society needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

Principle 2: Management should be decentralized to the lowest appropriate level.

Decentralized systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge.

Principle 3: Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.

Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises.

Principle 4: Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:

a. Reduce those market distortions that adversely affect biological diversity;

b. Align incentives to promote biodiversity conservation and sustainable use;

c. Internalize costs and benefits in the given ecosystem to the extent feasible.

The greatest threat to biological diversity lies in its replacement by alternative systems of land use. This often arises through market distortions, which undervalue natural systems and populations and provide perverse incentives and subsidies to favor the conversion of land to less diverse systems. Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs (e.g. pollution) escape responsibility. Alignment of incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay.

Principle 5: Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.

Ecosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these

interactions and processes is of greater significance for the long-term maintenance of biological diversity than simply protection of species.

Principle 6: Ecosystem must be managed within the limits of their functioning.

In considering the likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different degrees by temporary, unpredictable of artificially maintained conditions and, accordingly, management should be appropriately cautious.

Principle 7: The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.

The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterized by the interaction and integration of genes, species and ecosystems.

Principle 8: Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.

Ecosystem processes are characterized by varying temporal scales and lag-effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones.

Principle 9: Management must recognize the change is inevitable.

Ecosystems change, including species composition and population abundance. Hence, management should adapt to the changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential "surprises" in the human, biological and environmental realms. Traditional disturbance regimes may be important for ecosystem structure and functioning, and may need to be maintained or restored. The ecosystem approach must utilize adaptive management in order to anticipate and cater for such changes and events and should be cautious in making any decision that may foreclose options, but, at the same time, consider mitigating actions to cope with long-term changes such as climate change.

Principle 10: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.

Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems.

Principle 11: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use is desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, inter alia, any decision to be taken under Article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against available knowledge and views of stakeholders.

Principle 12: The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.

http://www.cbd.int/ecosystem/principles.shtml

The 12 Principles were adopted by the 5th meeting Conference of the Parties on Biological Diversity in 2000. Ref Fifth Meeting, Nairobi, 15 – 26 May Decision V/6, Annex 1. CBD COP-5 Decision 6 UNEP/CBD/COP/5/23

3. Ecosystem Services

Ecosystem services are “the benefits provided by ecosystems that contribute to making human life both possible and worth living” (MA 2005).

They are the aspects of ecosystems that are utilised (either actively or passively) to produce human wellbeing (physical and mental health). Ecosystem services are divided into four groups; supporting services, regulating services, cultural services and provisioning services. The concept of ecosystem services is integral to, but distinct from the broader ecosystem approach.

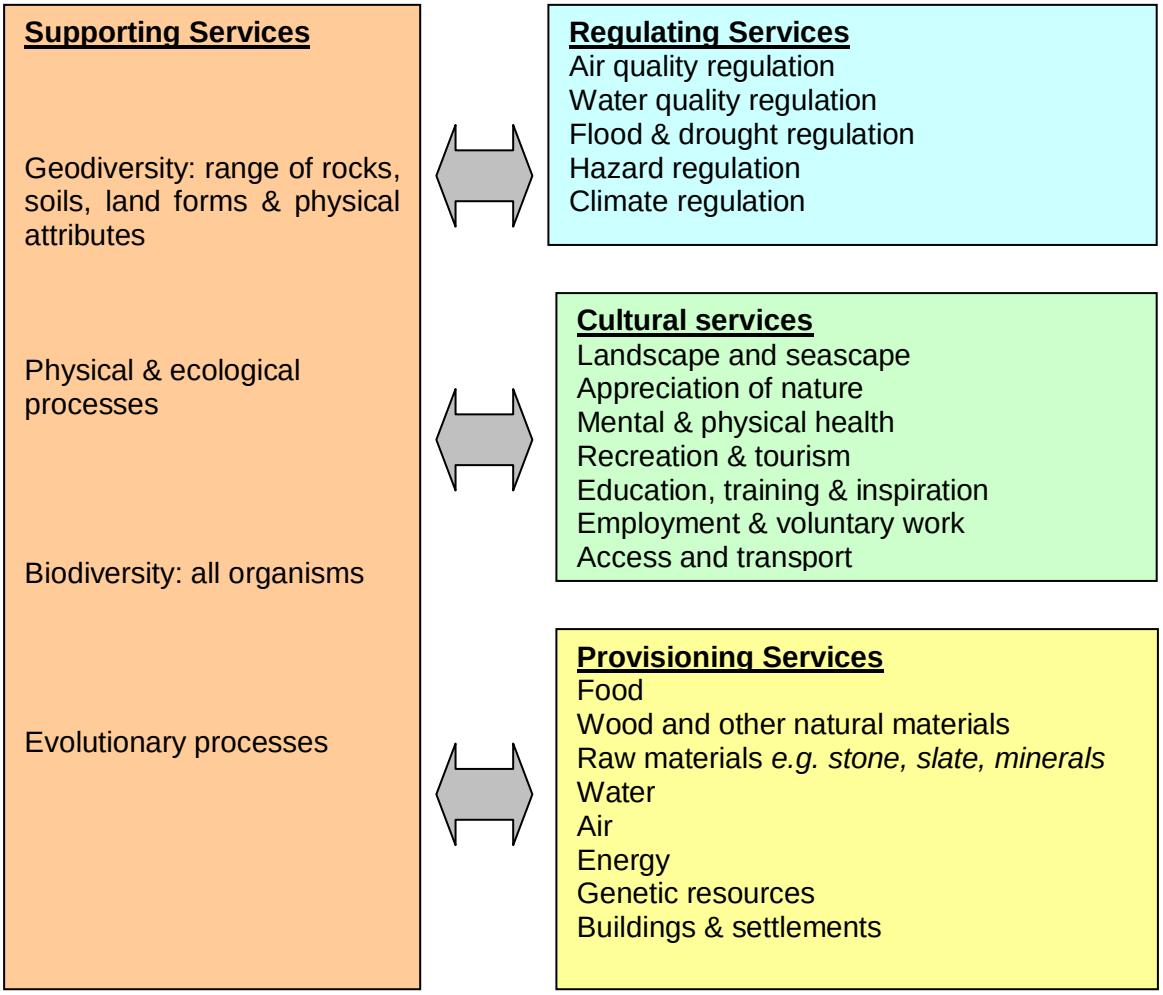
Supporting services provide the basic infrastructure of life, including the capture of energy from the sun, the formation and maintenance of soils for plant growth, and the cycling of water and nutrients, (NEA, 2011). We need to recognise that our "life-support system" is a global one, not just a Welsh one. Supporting services are those that are required for the production of all other ecosystem services that is the regulating, cultural and provisioning services, (NEA, 2011).

Regulating services are the benefits obtained from the regulation of water quality, flooding and drought, biological and geological hazards and climate, by our natural environment.

Cultural services are the non-material benefits people obtain from their natural environment through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience.

Provisioning services are the primary and secondary products obtained from the natural environment such as water and food.

There are a variety of definitions and classifications of ecosystem services based around the categories set out in the Millennium Ecosystem Assessment. The diagram below builds on this work, synthesising work done under the National Ecosystem Assessment (NEA) and RUBICODE projects.



4. Green Infrastructure

Green infrastructure is 'a strategically planned and delivered network of high quality green spaces and other environmental features. It should be designed and managed as a multifunctional resource capable of delivering a wide range of environmental and quality of life benefits for local communities. Green Infrastructure includes parks, open spaces, playing fields, woodlands, allotments and private gardens' (Natural England 2009).

Benedict and McMahon (2002) define the Green Infrastructure as “an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations.”

5. Natural Resources

Two main types of natural resource can be distinguished, non-renewable natural and renewable natural resources

Non-renewable natural resources are those of fixed supply such as oil, coal, gold or iron – that is, their continued use will inevitably result in exhaustion. Renewable natural resources are those that have the capacity to regenerate themselves, and are therefore potentially inexhaustible when used appropriately, e.g. fish, forests, solar energy, water, and the atmosphere (CBD. 2007).

6. Natural Capital

Natural Capital is defined as the natural assets, which provide natural resource inputs and environmental services for economic production. It generally comprises natural resource stocks, land and ecosystems. Natural Capital is considered vital to the long-term sustainability of development.

It is the extension of the economic notion of capital (manufactured means of production) to environmental goods and services. A functional definition of capital in general is: "a stock that yields a flow of valuable goods or services into the future". Natural capital is thus the stock of natural ecosystems that yields a flow of valuable ecosystem goods or services into the future, where value includes both economic and non-economic values to society (adapted from Costanza R. 2008).

Natural capital is the basis of all production in the human economy and the provider of services without which human society could not sustain itself (Porritt, J. 2007).

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ANNEX 1 FURTHER INFORMATION

The Convention on Biological Diversity (CBD)

Agreed in 1992 this is a legally binding convention with over 190 signatories, including the UK. The CBD recognises the Ecosystem Approach as a key tool for delivering against the 3 objectives of the convention

1. Conservation of biological resources
2. Sustainable use of biological resources
3. Equitable sharing of the benefits.

http://www.cbd.int/

Millennium Ecosystem Assessment

'The Millennium Ecosystem Assessment (MA) was called for by the United Nations Secretary-General Kofi Annan in 2000. Initiated in 2001, the objective of the MA was to assess the consequences of ecosystem change for human well-being and the scientific basis for action needed to enhance the conservation and sustainable use of those systems and their contribution to human well-being'. (Ref Millennium Ecosystem Assessment 2005 http://www.millenniumassessment.org/en/About.aspx#)

The Ecosystem Assessment provides a conceptual framework and supports the delivery of the Ecosystem Approach**.** It resulted in the production of a number of reports including a 'Ecosystems, Human Health and Well Being – Biodiversity Synthesis' which states that *'biological diversity plays a crucial role in underpinning ecosystem services'* http://www.millenniumassessment.org/en/index.aspx

Based on ideas developed in the MA, TEEB will promote a better understanding of the true economic value of ecosystem services and provide economic tools to take proper account of their value in decision making. **http://www.teebweb.org/**

National Ecosystem Assessment

The National Ecosystem Assessment (UK NEA), lead by Defra is the first analysis of the UK's natural environment in terms of the benefits it provides to society and continuing economic prosperity. Part of the Living With Environmental Change (LWEC) initiative the UK NEA, which commenced in mid-2009, will be reporting in early 2011. Defra is working with the devolved administrations and in Wales the Environmental Research hub is leading on the Wales Synthesis" which includes a contribution on status and trends in biodiversity in Wales.
http://uknea.unep-wcmc.org/

Using the Ecosystem Approach

The decision at CBD Convention of the Parties 9 stressed that the EA should not be regarded as a single solution but rather, its application provides the basis for bringing together social, economic, cultural and environmental values. It needs to be applied at all levels and embedded across policy. For instance, it has an important role to play in attainment of the Millennium Development Goals. Ref….

Several attempts have been made to order the Principles by importance or theme and practical assistance in applying the EA in the field has been lacking. IUCN's Commission on Ecosystem Management has provided guidance by clustering the 12 Principles into a sequence of five steps A to E. This encourages discussion and planning, making it possible to focus on one set of challenges at a time.

Step A	Determine the stakeholders and define the ecosystem area (P1,7,11,12)
Step B	Ecosystem structure, function and management (P2,5,6,10)
Step C	Economic issues (P4)
Step D	Adaptive management over space (P3,7)
Step E	Adaptive management over time (P7,8,9)

Using the Ecosystem Approach to Implement the Convention on Biological Diversity
Basic steps identified by Smith and Maltby
R.D. Smith and E. Maltby

Mainstreaming the approach: on-the-ground actions

• perform an assessment of on-going projects, programmes and other field level activities to identify compliance with the Ecosystem Approach
• identify priority locations and issues for action by undertaking baseline biodiversity surveys that include measures of ecosystem integrity, diversity and an evaluation of goods and services
• knowledge bases should be constructed that integrate and synthesise the scientific and indigenous knowledge that is relevant to the conservation, use and assessment of biodiversity
• develop and implement awareness-building measures tailored for field practitioners and local communities
• identify existing local-level institutions, stakeholders and management systems that are suitable for applying the Ecosystem Approach
• identify institutional and socio-economic obstacles to meeting the CBD objectives
• encourage NGOs and other appropriate bodies to promote and facilitate implementation of the Ecosystem Approach at the local level
• integrate the Ecosystem Approach into project and programme design

Using the Ecosystem Approach typically brings both socio-economic and ecological benefits

http://www.iucn.org/about/union/commissions/cem/cem_resources/?373/The-Ecosystem-Approach-Five-Steps-to-Implementation

Guidance is also available from the Convention on Biodiversity Sources Book http://www.cbd.int/ecosystem/sourcebook/

Green Infrastructure Development in Europe

In a workshop held in Brussels in March 2009 “Towards Green Infrastructure for Europe” Workshop Proceedings, a specific definition was achieved for this concept, but the confirmation that the concept was widely applied for different territory elements came through. Several definitions where proposed:

- Planning/strategic approaches that maintain ecological functions at the landscape
- scale in combination with multi-functional land uses.
- Existing natural and “man made” structures that can deliver sustainable land use and services for society.
- The part of a territory devoid of permanent man-made structures, that is providing
- directly or indirectly, partly or totally through the vegetation it supports, a series of
- services to the population living on it or more or less near to it.
- System/network of open space, consisting of natural and man-made structures that
- provide directly or indirectly multiple benefits to society and support and improve
- ecological functions.
- Strategic or/and management approach to improve and sustain the multifunctional system of natural and man-made green structures, that provides benefits to society and maintain ecological functions.

In the workshop most participants agreed that whatever it is the definition of Green Infrastructure, it is clear that the Green Infrastructure is much more than a network of natural protected areas (or ecological network), that it provides much more services than biodiversity and nature conservation and that it is a multifunctional tool to ensure ecosystems services.

In this context, green infrastructure consists of natural and man-made elements (such as reforestation zones, green bridges, green urban areas, high nature value farmland or forest areas). It ensures efficient and sustainable use of land by integrating interacting functions or activities on the same piece of land. An essential condition for healthy ecosystems is the maintenance of ecological coherence. That is vital to ensure that the functional elements of ecosystems can continue to interact, both between themselves and with their physical environment (**Towards a European Green Infrastructure** “Natura 2000 preparatory actions, Lot 3: Developing new concepts for integration of Natura 2000 network into a broader countryside”).