Towards a sustainable environment
UK natural capital and ecosystem economic accounting

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Abstract

'*We will put natural capital at the heart of Government accounting. We will work with the Office for National Statistics to fully include natural capital in the UK Environmental Accounts, with early changes by 2013. In 2012 we will publish a roadmap for further improvements up to 2020.*'

Natural Environment White Paper (NEWP), June 2011

The aim of this article is to outline the approach to delivering the 'early changes by 2013' and to share plans for developing the roadmap, including the opportunities to engage with this process. The work outlined will be delivered as part of the Measuring National Well-being programme, working closely with the Department for Environment, Food and Rural Affairs.

Introduction

In 2011, the Office for National Statistics (ONS) initiated the National Accounts Extensions project as part of the Measuring National Well-being (MNW) programme to investigate the recommendations of the 2009 Report by the Commission on the Measurement of Economic Performance and Social Progress (CMEPSP, 2009) regarding classical GDP issues and sustainability and the environment. Commissioned by French President Nicholas Sarkozy and chaired by Nobel economist, Joseph Stiglitz, the Commission concluded, amongst other things:

'*What we measure affects what we do; and if our measurements are flawed, decisions may be distorted. Choices between promoting GDP and protecting environment may be false choices once environmental degradation is appropriately included in our measurement of economic performance. So too, we often draw inferences about what are good policies by looking at what policies have promoted economic growth; but if our metrics of performance are flawed, so too may be the inferences that we draw.*'

CMEPSP, 2009

The CMEPSP (2009) argues that applying a broader definition of wealth, to include natural capital and human capital could provide a better understanding of economic well-being and in

the UK, the Social Impacts Task Force developed a 'capitals approach' to understanding the impact of policies on well-being. Both require an understanding of the stocks of natural capital.

Following consultation with the National Statistician, and recognising the synergy between the objectives of the Measuring National Well-being programme and commitments in the Natural Environment White Paper (NEWP) the following commitment has been encompassed by the project.

'*We will put natural capital at the heart of Government accounting. We will work with the Office for National Statistics to fully include natural capital in the UK Environmental Accounts, with early changes by 2013. In 2012 we will publish a roadmap for further improvements up to 2020.*'

Natural Environment White Paper (NEWP), 2011

The aim of this article is to outline the approach to delivering the 'early changes by 2013' and to share plans for developing the roadmap, including the opportunities to engage with this process. The article sets the UK and international context for this work, outlines the central role of the UK Environmental Accounts and presents planned next steps.

UK and international policy drivers

The Natural Environment White Paper (NEWP) states the UK government's commitments to valuing nature in its policy-making.

'The White Paper – the first on the natural environment for over 20 years - places the value of nature at the centre of the choices that the UK as a nation must make to enhance its environment, economic growth and personal well-being.'

Secretary of State for Environment, Food and Rural Affairs (DEFRA), 2011

NEWP encompasses the UK coalition government's partnership programme announced in 2010.

'*The Government believes that we need to protect the environment for future generations, make our economy more environmentally sustainable, and improve our quality of life and well-being.*'

2010 Coalition government programme by David Cameron and Nick Clegg
The Coalition: Our programme for government

In 2010, the UK contributed in the *Conference of the Parties to the convention on Biological Diversity*, held in Nagoya, Japan. The conference emphasised the value of the natural capital to human welfare and livelihoods, and stressed the links between action of biodiversity, climate change and development.

A number of conventions like United Nations Convention to Combat Desertification, the Ramsar Convention on Wetlands, the Convention on Migratory Species, and the UN Framework on Climate Change have central policy questions relating to the maintenance or improvement of natural capital, ecosystems and the services they provide to present and future generations.

Measurement of natural capital

'*The natural world, its biodiversity and its ecosystems are critically important to our well-being and economic prosperity, but are consistently undervalued in conventional economic analyses and decision making*'.

UK National Ecosystem Assessment (NEA), 2011

Our wealth as a nation and our individual well-being depend critically upon the environment. It provides us with food, water and air that are essential for life and contributes to economic activity and human life by providing the minerals and raw materials - such as fossil fuels, timber and fish - for our industry and consumption. It also provides other critical ecosystem services such as recreation and comfort, improved local air quality and green spaces, and mitigation of some of the risks posed by climate change in the form of carbon sequestration.

Though our well-being is dependent upon the environmental assets and the continued flow of the ecosystem services that they provide, they are predominantly public goods with no markets and no prices, so are rarely detected by our current economic compass. There are growing concerns[1] that the current patterns and practices of economic activity are depleting and degrading the available environmental assets more quickly than they can regenerate themselves. It is argued that to address these concerns, it is essential that the contribution of the natural environment to society's overall well-being is considered alongside its contribution to economic growth.

Over the last 50 years macro-economic policy has largely been based on information flowing from the System of National Accounts (SNA) framework. The SNA was introduced in 1953 as an international standard for measuring economic activity, and not surprisingly, it focused exclusively upon measuring economic growth and in particular production in markets for which prices are available[2]. When the SNA was introduced, there was no need for better treatment of natural resources and the environment, as resources were considered abundant and environment as an inexhaustible sink. Since then, however, the world population and the world economy have grown tremendously, which has put a stress on the natural environment. As a result, there is a danger that we are running down our natural capital stock without fully understanding the value of what we are losing.

System of Environmental-Economic Accounts

The conceptual model adopted by the UK and the international statistical community for environmental accounts is the United Nations' System of Economic and Environmental Accounts (SEEA), a satellite system of the SNA, meaning that accounts produced under this standard bring environmental and economic information together within a common framework. This allows for consistent analysis of the contribution of the environment to the economy, the impact of the economy on the environment, and the efficiency of the use of environmental resources within the economy.

A multi-year process of revision to the SEEA was initiated by the United Nations Statistical Commission (UNSC). The revised SEEA is to consist of three parts:

[1] A number of studies such as National Ecosystem Assessment (NEA), Millennium Ecosystem Assessment (MEA) and The Economics of Ecosystem and Biodiversity (TEEB) have related concerns about the consumption of natural assets, stressing the need for sustainability.

[2] One exception is government output – the SNA measures government output for which market prices are not available

- The **Central Framework** of agreed concepts, definitions, classifications, accounting rules and tables which, following a period of global consultation, is to be presented to the UNSC for adoption as the international statistical standard for environmental-economic accounts to sit alongside the SNA in 2012;

- **Experimental accounts for ecosystems**, which it is currently planned will be presented to the UN Statistical Commission for endorsement in 2013[3];

- **Extensions and Applications**, which will outline applications of environmental economic accounting.

SEEA Central Framework[4]

The **SEEA Central Framework** covers physical flow accounts, monetary accounts and asset accounts. It is the asset accounts which are of most interest from the perspective of measuring natural capital.

The SEEA provides a framework for the development of full physical environmental asset accounts as well as monetary valuation for those assets which have a direct value to the economy. The draft SEEA Central Framework defines the scope of environmental assets as:

'..individual assets that comprise the environment. The scope comprises those types of individual components that may provide resources for use on economic activity. Generally the resources may be harvested, extracted or otherwise moved for direct use in economic production, consumption or accumulation. The scope includes land and other areas of a country that provide space for undertaking economic activity.'

UN SEEA, Draft Chapter 5: Asset Accounts

The environmental assets are classified into: timber resources, mineral and energy resources, land, soil resources, aquatic resources, water resources, and other biological resources.

The SEEA Central Framework proposes to exclude oceans and the atmosphere because these environmental assets are considered too vast to be meaningful for analytical purposes. The CMEPSP (2009) suggested that it may be possible to measure the value of the atmosphere through emissions but it remains open to debate if such measurement could yield information of value.

'*In physical terms conceptual scope for each individual component is broad extending to include all of the resources that currently provide or could provide benefits to humanity. However, in monetary terms the conceptual scope is limited to those individual components that have an economic value based on the valuation principles of the SNA*'

UN SEEA, Draft Chapter 5: Asset Accounts

The example used to illustrate this concept is that of land where for the SEEA all land within a country is in scope for analysing changes in land use and land cover, but in line with SNA and treatment in the National Accounts, only land with an economic value to the market is within scope.

[3] SEEA Experimental Ecosystem Accounts: A proposed outline and roadmap (June 2011)
[4] A brief description of environmental assets accounts within the SEEA Central Framework is given in Appendix A

The value of ecosystems in terms of the ecosystem services they provide is not in scope of the Central Framework.

The aim of asset accounting in the SEEA is to measure the quantity, quality and value of environmental assets and to record and explain the changes in those assets over time. There are two versions to the stock approach to sustainability (CMEPSP, 2009):

- Physical asset accounts – '*assesses whether the stock is increasing or decreasing, and how the quality has been changing, with a view particularly to doing whatever is necessary to keep each above some critical threshold*.' The SEEA suggests that physical asset accounts are usually compiled for specific types of assets rather than for combination of different assets because each asset will usually be recorded in different units and hence aggregation across assets in physical terms is not possible. The table below provides a complete listing[5] of possible flows for each asset account within the Central Framework:

Conceptual form of the physical asset account [6](physical units)

	Mineral & energy resources	**Land (incl. forest land)**	**Soil resources**	**Timber resources**		**Fish resources**		**Water resources**
				Cultivated	**Natural**	**Cultivated**	**Natural**	
Opening stock of resources	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Addition to stock of resources								
Growth in stock	NA	Land reclamation	Soil formation Soil deposition	Natural growth	Natural growth	Growth	Growth	Precipitation Returns Inflows
Discoveries of new stock	Yes	NA	NA	NA	Na	Yes*	Yes*	Yes*
Upward reappraisals	Yes	NA	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*
Reclassifications	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total additions to stock								
Reduction in stock of resources								
Extraction	Extraction	NA	Soil extraction	Removals	Removals	Harvest	Gross catch / Landings	Abstraction
Normal reductions in stock	NA	NA	Erosion	Natural losses	Natural losses	Natural losses	Natural losses	Evaporation Outflows
Catastrophic losses	Yes*	Yes*	Yes*	Yes	Yes	Yes	Yes	Yes*
Downwards reappraisals	Yes	NA	Yes*	Yes*	Yes*	Yes*	Yes*	Yes*
Reclassifications	NA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total reductions in stock								
Closing stock of resources	Yes	Yes	Yes		Yes		Yes	Yes

Source: UN SEEA, Draft Chapter 5: Asset Accounts

*An asterisk indicates that this flow is not usually a significant flow for the resource or it is typically not separately identified in the source data. In practice, not all cells that show the possibility of an entry in the table above should be shown separately in the published accounts for each type of asset

[5] Definition of the terms used in the table can be found in Appendix B

[6] SEEA Central Framework does not currently provide any guidelines on other biological resources.

- Monetary accounts – '*converts all environmental assets into a monetary equivalent, thereby implicitly assuming substitutability between different types of capital when monetary accounts are added together. However, care is needed as such an approach has several potential limitations due to the absence of markets on which valuations of assets could be based. Even when there are market values, there is no guarantee that they adequately reflect how the different assets matter for future well-being. The monetary approach requires imputations and modelling which raise informational difficulties'*, hence the Central Framework starts with a modest approach, focusing the monetary aggregation on items for which reasonable valuation techniques exist, such as certain natural resources that are traded in the market. The general form of the monetary asset account within the Central Framework is presented below:

Conceptual form of the monetary asset account (monetary units)

Opening stock of resources		
Addition to stock of resources		
	Growth in stock	
	Discoveries of new stock	
	Upward reappraisals	
	Reclassification	
	Total addition of resources	
Reduction in stock of resources		
	Extraction	
	Normal loss of stock	
	Catastrophic losses	
	Downwards reappraisals	
	Reclassifications	
	Total reduction in stocks	
Revaluation of the stocks of resources		
Closing stock of resources		

Source: UN SEEA, Draft Chapter 5: Asset Accounts

Experimental ecosystem accounts

Experimental ecosystem accounts are at an earlier stage of development than the Central Framework. The experimental label reflects the ecosystem accounting within the context of national accounting is relatively new.

ONS and Defra are jointly hosting an expert meeting on ecosystem accounts in collaboration with the UNSC, World Bank and European Environment Agency on 5-7 December. The purpose of the meeting is to bring together international experts from the statistical, scientific and economic communities to explore agreement on the key issues that have been identified for developing the SEEA Experimental Ecosystem Accounts.

The SEEA Experimental Ecosystem Accounts will aim to go beyond the scope of the Central Framework to classify ecosystem services, set out definitions and measurement for ecosystem

accounting units and establish methods for recording and valuing stocks and flows relating to ecosystems and ecosystem services.

The Millennium Ecosystem Assessment[7] defines an ecosystem as ‘

four categories of ecosystem services that contribute to human well-being:

- **Provisioning services** – products such as: food (crop, meat and dairy products, fish and honey); water ; fibre (timber and wool); and fuel
- **Regulatory services** – benefits such as: water purification; climate regulation; noise and air pollution reduction and flood hazard reduction
- **Cultural services** - non-material benefits, for example: through cultural heritage, recreation (visit to national park) or aesthetic experience. Accessible green spaces provide recreation, and enhance health and social cohesion
- **Supporting services -** production of all other ecosystem services, for example: soil formation; pollination and nutrient cycling

The NEWP definition of natural capital encompasses these ecosystem services. NEWP defines natural capital as ‘*the stock of our physical natural assets (such as soil, forests water and bio-diversity) which provide a flow of services that benefit people (such as pollinating crops, climate regulation or the mental benefits of a walk in the park).*’

UK and international initiatives measuring ecosystems and ecosystem services

There are a range of UK and international initiatives which can inform the measurement of natural capital in the UK Environmental Accounts and the development of Ecosystem Accounts.

In the UK, domestic initiatives include the UK *National Ecosystem Assessment* which provides a complete assessment of the benefits that nature provides, how these benefits have changed over the past, the prospect of their future and their value to the society. This comprehensive study not only demonstrated the importance of ecosystem services to human well-being, but also showed that many key services are being degraded and lost.

The European Environment Agency (EEA) has embarked on an ambitious program titled “*Fast track implementation of simplified ecosystem capital accounts for Europe*” which should have concrete results by 2012. The World Bank has a long running program on wealth measurement that is broadening towards the *valuation of natural resources and ecosystem* (WAVES). The UK is also supporting this programme, which will enable between eight and ten developing countries to build the value of natural resources into their own national accounts.

UK experience of environmental asset accounting

ONS has published a limited number of environmental asset accounts as part of the UK Environmental Accounts, a “satellite account” to the main National Accounts. Satellite

[7] The Millennium Ecosystem Assessment (MEA) was called for by the United Nations Secretary-General Kofi Annan in 2000. Initiated in 2001, the objective of the MEA 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.

accounts are extensions to the National Accounts that facilitate analysis of the wider impact of economic change. The key environmental asset accounts that ONS has been producing are:

- Oil and gas reserves - providing information in physical and monetary terms
- Forestry – reporting on woodland area, coverage and timber consumption
- Land cover - reporting on the amount and condition of habitats and landscapes in Great Britain
- Fish – a pilot fish stocks was compiled for 2001. A discontinuation of sources meant that this account was never followed up

The scope of the above accounts was limited due to lack of resources and data availability. In 2010, ONS held an open consultation on the strategy for the UK Environmental Accounts and published a paper (Livesey) highlighting the limited scope of the existing Environmental Accounts and setting out the priorities and plans for the next three years for improving these accounts.
As a first step towards implementing these plans ONS published a paper in June 2011(Foxton) that describes the methodology and sources of data used to estimate the monetary value of oil and gas reserves existing within the UK Continental Shelf (UKCS).

The remainder of this article will outline how, with the advent of the National Well-being agenda and the Natural Environment White Paper commitment, this early work will be built upon.

Development of the roadmap to fully include natural capital in the UK Environmental Accounts

'*We will put natural capital at the heart of Government accounting. We will work with the Office for National Statistics to fully include natural capital in the UK Environmental Accounts, with early changes by 2013.* ***In 2012 we will publish a roadmap for further improvements up to 2020.***'

Natural Environment White Paper (NEWP), June 2011

Based on the definition of natural capital in the NEWP, the inclusion of natural capital takes us beyond implementation of the SEEA central framework to consider the measurement of ecosystems and ecosystem services. Clearly, the international programme to develop the SEEA Ecosystem Accounts will be critical to these developments, as is building on the excellent work already carried out in the UK, including the National Ecosystem Assessment.

The timetable of 2020 recognises the challenges which lie ahead, and the development of a roadmap to outline the approach and timetable will be an important early step forward.

In developing the roadmap for publication in 2012, ONS, working closely with DEFRA, will:

- Engage fully in the international developments on experimental ecosystem accounts. The hosting of the international expert group meeting in December 2011 is evidence of the UK commitment to this programme

- Work closely with users and experts in the UK to inform the development of the roadmap. It will be critical to fully understand the potential applications of the accounts, user priorities and the methodological issues to be overcome. To this end, ONS has established a forum to engage with experts and users from a range of disciplines

- Issue a draft roadmap for open consultation during 2012, prior to the final document being published. The open consultation will be pre-announced in line with the Code of Practice for Official Statistics

Assessment of priorities for early changes by 2013

In addition to developing the roadmap, ONS is committed to making early changes to the UK Environmental Accounts by 2013. To this end, an early broad assessment[8] of each environmental asset was carried out against the following criteria:

- Contribution to the UK economy and environment
- Data availability
- Policy priority
- International experience

A brief summary of the assessment is given below but please note that to facilitate making early progress, the review was not meant to be comprehensive and we expect to learn more by working with experts and users on early pilot studies and the development of the roadmap.

Contribution to the UK economy and environment

Forestry, land and aquatic resources contribute both to the economy and environment by providing several ecosystem services; whereas, mineral and energy resources do not provide any other ecosystem service except billions of pounds worth of provisioning services. Water and soil resources contribute positively to the environment; however, due to lack of economic valuation of the services they provide, it is not possible to comment on its contribution to the economy. Generally water has often been made available for a flat charge, which might not be the true value to the economy.

Data availability

A large amount of data is available for timber, and mineral and energy resources to construct both physical and monetary asset accounts within the scope of the Central Framework; however, there are some gaps in the data that need to be addressed. The Forestry Commission's Eftec study and National Ecosystem Assessment could be relevant in assessing the value of the non-provisioning services of forestry. There are some data sources available for constructing land use and cover account for forest and wooded land; however, data for agricultural and other land use and cover is currently limited. Data on fish, soil, and water resources are also currently limited, requiring more work to explore other data sources.

Policy priorities

As already touched upon, the UK government has already set out its priorities for forestry, land management, soil resources and aquatic resources in the NEWP. The EU has established Regulation on Environmental-Economic Accounts based on European policy priorities. Whilst the initial focus has been on air emissions accounts, material use accounts and environmental taxes, modules for proposed future development include water asset accounts,

[8] An assessment was carried out using literature and data from the UK National Ecosystem Assessment, Oil & Gas UK 2009 Report, UK Agriculture, Food and Agricultural Organisation of the United Nations , World Wide Fund for Nature, and other related studies.

forestry accounts and ecosystem services accounts.[9] Internationally, water has been identified by the United Nations Statistics Division as a priority area for implementation of the SEEA; however, a discussion paper[10] put forward in June 2011 at the sixth meeting of the UN committee of Experts on Environmental Economic Accounting has recognised that asset accounts are not equally relevant for all countries and therefore countries should be given certain flexibility in the implementation of the SEEA depending on their relevance importance.

International experience

A comprehensive assessment of country practices in the development of environmental accounting within the EU compiled by Pasquier et al. (2007) shows that in the EU asset accounts for forest (timber) are compiled on regular basis followed by subsoil asset and forest land. However, outside the EU there seems to be a greater interest in asset accounting. Global Assessment (UNSD 2008) suggests that around sixteen countries [11] [12] outside EU are known to have (had) environmental accounting programmes. An earlier assessment by Global Assessment (UNSD 2007) shows that in developed countries asset account for forestry come on top, followed by water resources, mineral resources, fisheries, and land and ecosystem; whereas, for the developing countries water accounts come on top, followed by mineral asset accounts, forest accounts, land and ecosystem accounts, and fisheries accounts. The difference in compilation practices could be understood from the need for resource management of a country's endowments of natural resources and specific issues related to water and energy. A number of countries have not only constructed the basic asset accounts for their important natural resources, but have also extended these accounts at regional and industry level in line with latest international standards.

Conclusions and the way forward

Based on the above assessment criteria, and bearing in mind the international context for the development of the SEEA, the ONS plans to take the following approach to delivering early changes to the UK Environmental Accounts:

- ONS aims to run a pilot study in 2012 to produce forestry accounts. Delivery of the SEEA Central Framework for a physical and monetary account will be prioritised but the aim of the pilot will be to explore the production of a full ecosystem account. Lessons learnt can then be applied more broadly. We will work with our expert engagement group in the development of these accounts

- The next priority is expected to be land use and cover accounts, for inclusion in the UK Environmental Accounts by 2013. However, work on the roadmap and lessons from the pilot study will influence this. A further checkpoint review will therefore be carried out in autumn 2012 to assess progress and confirm priorities

- ONS will in parallel, and with the help of experts including DEFRA, be carrying out feasibility studies to inform the development of the roadmap

[9] This is just a proposal and by no mean an indicative of agreed EU priorities
[10] "Initiating a SEEA Implementation program – A First Investigation of Possibilities" was put forward by Statistics Netherlands in response to the UN Statistical Commission request after consulting with the member states and the regional commissions.
[11] Australia, Botswana, Brazil, Canada, Columbia, India, Indonesia, Japan, Jordon, Mexico, Namibia, New Zealand, Philippines, Korea, South Africa and the USA
[12] This list excludes Norway and Switzerland, which are part of the EEA but not the EU

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Appendix A

SEEA Central Framework[13]

The SEEA central framework classifies the following environmental assets into its framework:

Timber / Forestry resources

The SEEA defines timber resources as *the volume of trees, living or dead, and include all trees regardless of diameter, tops of stems, large branches and dead trees lying on the ground that can still be used for timber or fuel*. Timber is one of the many services provided by forests; however, the scope of the SEEA central framework does not extend beyond provisioning services. This paper extends the scope of central framework by encompassing experimental ecosystem accounts to include other services provided by forests such as regulatory, supporting and cultural services.

Mineral and energy resources

Mineral and energy resources are defined as known deposits of oil resources, natural gas resources, coal and peat resources, non-metallic minerals and metallic minerals. Mineral and energy resources represent a unique type of environmental asset in that they can be extracted and used through economic activity but cannot be renewed on any human time scale[14]. Since they cannot be renewed there is a particular interest in understanding the rate at which these assets are being extracted and depleted, the overall availability of these assets and the sustainability of the industries that exploit them.

Land

Land is a unique environmental asset that delineates the space in which the economic activities and the environmental processes take place and within which environmental assets and economic assets are located. Land area includes surface enclosed by all inland borders including all inland waters. From the perspective of economic and environmental accounting there are two additional views that are of primary importance – land use and land cover. Land use reflects the human use(s) made of a certain land area. Land cover refers to physical material on the surface of the earth, and includes natural vegetation and non-living surfaces. At its most basic level it is comprised of all the individual features, known as basic objects - such as shrub, tree, and mineral etc – that cover areas within a country

Soil resources

Soil resources are a fundamental part of the environment. They provide the physical base to support the production and cycling of biological resources, are the source of nutrients and water for agricultural and forestry systems, provide a habitat for diverse organisms, and fulfil a complex buffering role against environmental variability. Soil properties reflect the physical, chemical and biological characteristics of the soil such as texture, pH level etc. The SEEA central framework distinguishes soil resources from land and associated water areas in physical terms since land is defined through its description of space.

[13] Source: UN SEEA, Draft Chapter 5: Asset Accounts
http://unstats.un.org/unsd/envaccounting/seearev/chapterList.asp?volID=1
[14] There are some arguments that peat is renewable within a human lifetime

Aquatic resources

Aquatic resources are an important biological resource. The key features of aquatic resources distinct from other environmental assets are the capacity for the population to regenerate over time and free movement of the resources – wild aquatic stocks - across national boundaries. *The aquatic resources for a given country comprise those resources that are considered to live within the Exclusive Economic Zone*[15] *of a country throughout their lifecycles, both coastal and inland fisheries, and also those fish stocks, such as migrating and straddling and stocks that complete their life cycle in international waters (high seas), over which exploitation control has been established and to which the access rights of a country are defined in international agreements.*

Water resources

Unlike other environmental assets, such as timber resources or mineral resources that are subject to slow natural changes, water is in continuous movement through the processes of evaporation, precipitation and other flows. *Water resources consist of fresh and brackish water in inland water bodies – surface water*[16]*, groundwater*[17] *and soil water*[18]. Freshwater is naturally occurring water having a low concentration of salt, whereas brackish water has salt concentrations between that of fresh and marine water. However, the definition of brackish and freshwater is not clear cut as the salinity levels used in the definitions vary between countries.

Other biological resources

Other biological resources are largely represented by animals and plants including livestock, annual crops such as wheat and rice, perennial crops such as rubber plantation, orchards and wild animals. Like many environmental assets they provide physical inputs to economic activity; for example, together these biological resources form the basis of food production in all countries.

[15] Exclusive Economic Zone is a sea zone over which a country has special rights over the exploration and use of marine resources.

[16] Surface water includes artificial reservoirs, lakes, rivers and streams, and glaciers, snow and ice

Appendix B

Definitions[19] of the terms used in the physical asset account table

The four types of additions are:

1. Growth in stock – reflects increases in the amount of the stock of resources over an accounting period due to natural growth, for example, timer resources

2. Discovery of new stock – concerns the appearance of new resources to a stock and commonly arise through exploration and evaluation, for example, mineral and energy resources

3. Upwards reappraisals – reflects changes due to the use of updated information that permits a reassessment of the size of the stock

4. Reclassification – generally results from the situations in which an environmental asset is used for a different purpose, for example, increases in forest land due to afforestation are recorded here. Overall, reclassifications have no impact on the total physical quantity of an individual asset type

The five types of reductions are:

1. Extraction – reflects reduction in stock due to physical removal and harvest of an environment asset through a process of production. It includes both those quantities that continue to flow though the economy as products and those quantities of stock that are immediately dispersed to the environment after extraction because they are unwanted – for example by-catch in fishing.

2. Normal reduction in stock – reflects expected losses to stock during accounting period, perhaps due to natural deaths of biological resources or losses due to accidental cause that are not significant enough to be considered catastrophic, for example natural losses in timber resources.

3. Catastrophic losses – reflects losses due to catastrophic and exceptional events that may destroy a significantly large number of assets. They include major earthquakes, volcanic eruptions, tidal waves, exceptionally severe hurricanes, drought and other natural disasters, acts of war, riots, and accidents such as major toxic spills.

4. Downward reappraisals – reflects changes due to the use of updated information that permits a reassessment of the size of the stock.

5. Reclassifications – same as additions to stock but in the context of reduction of stock

[19] Source: UN SEEA, Draft Chapter 5: Asset Accounts