



26.02.02

SEEA 2000 draft manual.

Report from Friends of the Chair to the Statistical Commission.

The Friends of the Chair (FoC) were asked by the Statistical Commission at the previous meeting in March 2001 to review the draft of the SEEA-2000 manual and provide guidance with regards to its completion and publication. The following 8 countries were appointed as FoC: Brazil, Canada, Ethiopia, Indonesia, Korea, the Netherlands, Norway (chair), and USA.

The work of the FoC has focused on identifying potential remaining problems in the manual, providing guidance for resolving these differences and recommending a process for the final required editing and publication of the manual. All active members of the FoC recommend that the SEEA-2000 manual should be published, subject to the recommended changes that are explained below.

As leader of the Friends of the Chair, Mr. Svein Longva, and Statistics Norway led the review process of the draft manual. The FoC members were each given several chapters to review. The chapters were assigned in such a way that countries that had made major earlier contributions to a chapter were not given those chapters to review. The review of the chapters, through several rounds of general and detailed comments from the members of the FoC, eventually gave agreement on the recommendation to accept the draft manual for publication, subject to the following recommended changes.

The recommendations below are based on the SEEA draft chapters as received by the end of January 2002, including the draft of chapter 2 that was distributed somewhat later. Annexes 1 and 2 refer to the earlier SEEA draft called the Post Voorburg version and the new draft of chapter 2. These drafts will be made available to all members and observers of the Statistical Commission on demand.

The FoC wants to compliment the London Group and especially its editor Anne Harrison with the hard work and excellent draft of the SEEA manual. The FoC recommendations do not propose guidelines for further work by the London Group, since this was felt to be outside of the current mandate given to the FoC.

The Friends of the Chair recommend that:

1. The institutions that will be publishing the manual set up a small editorial board to implement the changes as outlined in this Friends of the Chair's report to the Statistical Commission.
2. The Statistical Commission gives the editorial board of the issuing institutions the necessary powers to implement the changes enumerated in Annex 1 and Annex 2 to this report. Editorial changes to language such as phrasing, grammar, typographical errors and punctuation that are also required in the final stages of preparing the manuscript are also authorized, as well as the powers to finalize components such as list of references, glossary, abbreviation list, table of content, index, table of figures, table of tables, etc. and other non-

substantive changes to the text required to ensure consistency and coherence throughout the handbook.

3. The Statistical Commission directs the issuing institutions to make the necessary practical arrangements needed to facilitate the final editing of the manuscript. To this end, all files and drafts of the manual become the property of the issuing institutions.

In addition to the enclosed Annex 1, "Major recommended changes to each chapter that need to be implemented by the editorial board," there exists an Annex 2 containing minor recommended changes that need to be implemented. Annex 2 will be submitted direct to the final board of editors. It will be made available to all members and observers of the Statistical Commission on demand.

The FoC is aware that there exists a later version of the SEEA draft than the one that was reviewed. The FoC suggests that this latest version is forwarded to the final board of editors as supporting material to be used in the preparation of the SEEA publication, subject to the guidelines indicated in recommendation 2 above.

ANNEX 1

Major recommended changes to each chapter that need to be implemented by the editorial board:

Recommendations on Chapter 1

1(1) The discussion of sustainability and how these environment and economic systems of accounts can provide information that can be used to describe and analyze the environment-economic facet of sustainability needs to be expanded although in a relatively limited fashion and included primarily in the introductory chapter.

The text provided at the end of Annex 1 should be inserted as Section 2 in the Post Voorburg version. §1.5 and 1.6 should be kept in chapter 1 and the editorial board needs to find an appropriate place for these two paragraphs. Subsequently, the text of § 1.6 shows the consequences of the strong sustainability condition for four types of assets correctly, which may then be explained in more detail if the editorial board finds this appropriate. (In relation to the last available draft it is section B that needs to be replaced, §1.9-§1.27, finding an appropriate location for §1.12 and §1.13).

Section A5 Monetary sustainability §1.13-1.17 needs to be deleted.

1(2) The manual lacks explanations and guidelines that would help to make the manual easier to understand by non-experts and that would help to provide a sensible way into this relatively complex subject.

Some general guidelines, along the lines of, if a country's economy is based heavily on natural resources then establishing the physical statistics for these resources and the associated valuation of these resources would be important to develop or if pollution (residuals) is a major problem, then the physical data related to the specific types of residuals integrated with the economic accounts would be important to develop. Also the modular focus of the SEEA structure needs to be highlighted.

A short paragraph concerning the notion of integration (or integrated accounting) should be included. This paragraph should present both positions in an equal and unbiased fashion, explaining that some may regard "integrated accounts" as being denominated in one single accounting unit (for example, monetary) while others consider a uniform and consistent set of accounting concepts, classifications, definitions, etc. as a sufficient precondition for considering a system of environmental and economic information to be integrated.

In addition, the flow or logic of the manual needs to be explained more clearly. This discussion could use the following as a guide to developing this text:

First, the manual recognizes both the difficulty of compiling such estimates and the various options available for doing so. Thus, the manual illustrates physical accounts as the most readily available option and the logical first step. The importance of physical accounts should be, and is, clearly illustrated, and the manual correctly goes on to recognize their limitation: the absence of relative weights. In response to this limitation, the natural next step for the manual is to examine economic accounts and their own limitation: the exclusion of corresponding information about environmental impacts. Hybrid accounts address this by allowing the superimposition of physical impact measures on top of monetary measures of production and consumption. The manual should then note that hybrid accounts also suffer from a limitation since they do not show environmental losses in monetary terms. Finally, as the manual

proceeds in integrating these measures in stepwise extensions of the accounting framework, it should be stressed that each step introduces additional uncertainties but allows various applications as well

1(3) A description of the relationship between the accounting system being presented and the environmental, energy and resource statistics is also needed. The larger accounting system will require certain types of information and structure in the statistical systems. There is a symbiotic relationship between the accounting and the statistics and the accounting system that can serve as a guiding framework for the development of the statistical systems. The relevance of environmental accounting compared to environmental statistics needs further explanation (e.g. the relevance of national accounting concepts and definitions, the analytical usefulness of consistent and comparable data and indicators).

1(4) Include a precautionary footnote to the paragraph that discusses hybrid accounts (relevant in the Post Voorburg version to §1.11) regarding the primary disadvantages of these types of accounts, i.e. that these accounts may lead to the mistaken impression that a resource's -- or pollutant's -- relative importance in or impact on the environment is implied by its economic importance in a production process. This may be done by making reference to the new text that is recommended in Chapter 3 (See our recommendation 3(1) for §3.26) on the (dis)advantages of various ways of weighing (and aggregation).

Also related to the discussion on "hybrid accounts," the phrase used in this section (and the heading in Section A.4, before §1.11) should be "hybrid physical and value flow accounts" rather than "hybrid environmental accounts."

1(5) §1.48 as currently written describes an interpretation that can be given to the values added objectively registered in the national accounts. This registration is the purpose of the accounts as currently understood, not the production of a welfare measure. The interpretation in welfare terms should be done very carefully. Indeed it can be maintained that under a certain condition national income is an (approximate) indicator for the welfare increase brought about by the consumption of the goods which the national income stands for. The condition is (the assumption must be true) that the observed economy maximizes welfare. It is intended currently to be (a measure of economic activity only, and the problem which this paragraph should address is that efforts to measure the impact of degradation are, unfortunately, unable to maintain that same standard of objectivity and must instead enter the more subjective realm of welfare) by making an assumption on preferences and including consumer surplus.

Recommended Resolution:

1.48. "Within the national accounts, the prices used reflect the prices actually paid in the market place. The assumption is that the economic value is reflected precisely by the market price. This economic value should not be equated with welfare or well-being, which is an extended concept that would require the inclusion of the total satisfaction derived by all purchasers above that reflected in the price - that is, the consumer surplus, as well as the contribution of environmental functions, social security, etc., to welfare. These steps require additional assumptions about the preferences for these assets. The omission of both steps is an important element in the measurement of objective economic activity rather than welfare; however, the measurement of the impact of degradation may require the use of methods that would include this surplus. These estimates would therefore not be strictly consistent with the prices used in the SNA and will present accounting problems in trying to assimilate them within an SNA-based framework, as explored in chapter 10."

1(6) The chapter titles need to be adjusted in the chapter-by-chapter description according to the chapter title changes recommended. these include:

- Change the title of chapter 4 to: "Hybrid physical and value flow accounts".

- Change the title of chapter 5 to: "Accounting for economic activities and products related to the environment"
- Change the title of chapter 6 to: "Accounting for other environmentally related transactions"

Recommendations on Chapter 2

- 2(1) Delete the second sentence in §2.1. and the word 'nevertheless' in the next sentence.
- 2(2) Redraft paragraphs 2.4-2.6 to eliminate the implied criticisms of environmental statistics. Specifically:
- 2(2a). Replace the text in ¶2.4 beginning from “Sets of environmental data...” through to the end of the paragraph with “Environmental statistics are often compiled with specific regulatory or monitoring functions in mind and, therefore, employ a variety of concepts, methods, classifications and units of measure according to the specific need they serve. For this reason, disparate sets of environmental statistics are generally not integrated with one another, nor with sets of statistics relating to the economy or society.”
- 2(2b). Delete the text at the end of the first bullet in §2.5 following the comma, as it is opinion rather than fact.
- 2(2c). Delete the second bullet in §2.5 altogether. The concepts of stocks and flows are not new to environmental statistics.
- 2(2d). Delete the third and fourth bullets in §2.5 altogether. They are not organizing principles, but objectives.
- 2(2e). Delete the first sentence in §2.6. The meaning of the sentence is unclear and there is an implied and false criticism of environmental statistics that they cannot be reported using common units unless integrated into accounts.
- 2(3) Delete §2.7 on sustainability, as the FoC has already agreed that sustainability will be treated substantively only in Chapter 1.
- 2(4) Replace the second sentence of §2.13 with “The full system consists of three main sections, the first dealing primarily with accounts in physical terms, the second two dealing with accounts in monetary terms.” In its current form, this sentence implies that integration does not occur until the third portion of the handbook.
- 2(5) Replace the sentence in §2.14 beginning with “However, the power...” with “Physical accounts can also be integrated with economic accounts to compare and contrast this environmental importance...” In its current form, this sentence implies a lower degree of importance for physical accounts.
- 2(6) Delete the last sentence of §2.15, as it is untrue. The broadened asset definition of the SEEA is certainly a “fundamental change” from the current SNA.
- 2(7) Replace the first and second sentences in §2.16 with “The third part of the system shows how the interaction between the economy and the environment can be described in monetary terms by expanding upon the economic flow accounts as they currently appear in the SNA.” In their current forms, these sentences suggest that chapters 9 and 10 present exact monetary analogues of the physical accounts, which is not strictly true.
- 2(8). Setting the boundaries of activities and assets should be explicitly mentioned as an additional important benefit of accounting as summed up in §2.17. Add the following as the final item in the list in

§2.17: "determining the boundaries of assets and activities such as consumption and production that belong to the economy of a particular country."

2(9) The title of Section F would be more appropriate as "Stocks of Assets in the SEEA."

2(10) The word "economic" should be deleted from the third sentence of §2.123, as accumulation of environmental assets occurs through both natural and economic processes.

2(11) §2.126 should be deleted. It contains a number of erroneous statements and adds no essential information to the chapter.

2(12) The phrase "at the head waters of river systems" should be deleted from §2.128. Human-induced flooding is caused by much more than just changes to headwaters.

2(13). Change the first sentence of §2.135 to "Often the value of an asset declines in use".

2(14). As acknowledged in the text, Table 2.13 is not a complete integration of asset accounts in a national accounting matrix. It would be informative to refer in this respect to Table 20.7 in chapter XX of the 1993 SNA as an example (at least conceptually) of a complete integrated set of current accounts and balance sheets in one matrix format. Include the following at the end of § 2.146: "Table 20.7 in chapter XX of the 1993 SNA shows how a complete integrated set of current accounts and balance sheets are reconciled in one national accounting matrix."

2(15) Rewrite both §2.138 and §2.139 as follows:

2.138 The SNA supports this valuation and the calculation of the decline in the value of the natural resource, but leaves the value of the decline in the other changes in assets account under the category of "economic disappearance." The treatment in the SEEA is different. Here the decline in the value of natural resources due to economic transactions is termed depletion and is treated in a manner analogous to the treatment of fixed capital in the SNA. That is, depletion of natural resources is shown in the production account of the SEEA as a charge against income and is deducted from gross operating surplus to arrive at an estimate of depletion-adjusted net operating surplus.

2.139 Just as natural assets are depleted through extraction, there may also be additions to stocks. For biological resources, this happens through natural growth. For sub-soil reserves of mineral and energy resources, additions are the result of mineral exploration and reappraisals. The techniques used to value the stock of a resource and its decline can also be used to put a value on stock additions. As with declines in stock value, the SNA includes increases in stock values in the other changes in assets accounts. The SEEA includes the SNA treatment of additions to stocks as one option, but offers other options that see additions to stocks introduced as sources of income in the production accounts. The various options for the treatment of extractions and additions to stocks of natural resources are explained in detail in Chapter 10."

2(16). We suggest that in table 2.9, it should be made clearer which of the columns and rows that contain physical data as opposed to monetary data.

2(17). In §2.147, the use of "may not wish" subtly discourages the integration of environmental and economic accounts. Change "may not wish to implement this part of the SEEA or at least not yet." to "may not be able to implement this part of the SEEA, at least not yet."

- 2(18) Delete the first and second sentences of §2.147, which are incorrect, and replace them with the following: “The third and last main section of the SEEA presents accounts that attempt to measure, exclusively in monetary terms, the impact of economic activity on the environment in terms of depletion and degradation.”
- 2(19). Clarify §2.149 by changing "Thus these issues are those of measuring depletion." to "Thus these issues are those of measuring depletion as well as additions."
- 2(20) The first sentence of §2.153 should be changed to read “The economic rent generated by the extraction of non-renewable resources can be divided into ...” to avoid over generalizing the concept of rent. Rent from sustainably managed biological resources cannot be so apportioned.
- 2(21) Delete the reference to sustainability in §2.157 by replacing the first sentence as follows: “The opposite view is also taken by some commentators.”
- 2(22). In §2.162, the use of the term "radical" could be seen as biased. Suggestion: Change "A more radical response..." to "Another response...".
- 2(23). Add the following text to §2.162: "This treatment does not require depletion or increases to be incorporated (and indistinguishable) from consumption of fixed capital. The discoveries can be separated from the exploration and shown separately, as illustrated in the Integrated Economic and Environmental Satellite Accounts released by the USA's Bureau of Economic Affairs in 1994."
- 2(24) In §2.166, the phrase “the air that... permits combustion” should be replaced with “the oxygen that permits combustion.” The same change should be made to §2.26.
- 2(25) It is difficult to see the distinction between the first two degradation valuation methods outlined in §2.177-2.179 (i.e., the italicised text). Moreover, the descriptions are inconsistent with the related text in Chapter 10. The italicised text in §2.177 should be replaced with the following: “What would value of net domestic product have been for the same level of activity if hypothetically all the costs associated with environmental degradation had been incurred and internalised within market prices.”
- 2(26) The italicised text in §2.179 should be replaced with the following: “What level of GDP could be achieved if producers and consumers faced a different set of relative prices in the economy due to the existence of actual prices for environmental functions.”
- 2(27) In §2.183, delete the sentence “The biggest impact though is on human health.”

Recommendations on Chapter 3

- 3(1) §3.26 be expanded into a full section (1-2 pages) giving a much fuller treatment to the issue of aggregating disparate material flows. This treatment should recognise more fully the limitations of aggregate measures; should discuss the applications for which such measures are appropriate and those for which they are not; should discuss how material flow accounts can be prepared for specific materials so that the need to aggregate is avoided. Discuss the pros and cons of weighing and aggregated measures more generally (e.g. mass oriented, theme oriented, valuation with specific reference to chapters 9 and 10). Mention that the possibilities for aggregating materials using weighting factors are somewhat limited. There are a number of national based weighting factors that have been developed but there is limited standardization for these weighting factors.

Some of the material that is recommended for this new section is found currently elsewhere in the

chapter (e.g., §3.131), so preparing the section will be partly a question of reiterating or moving material already present.

3(2) Recommended resolution for more balanced presentation: Change §3.4 and insert a new paragraph (§3.5) so that §3.4 and §3.5 read as follows:

- 3.4 “Not only is information on physical flows directly useful, one attraction of working in physical terms is that in most cases, the required knowledge of economic accounting may be less extensive for either the compilers or the analysts so this sort of data may be more accessible to those with an approach to sustainability which is more scientific than economic in orientation. That is, it is usually possible to compile data in physical terms without the corresponding economic values, while compiling value accounts is facilitated by a foundation of physical accounts.
- 3.5 (new) “On the other hand, there are limitations to compiling data in purely physical terms. First, the scientific uncertainty surrounding estimates of physical volumes of natural resources or pollutants -- and their impact of sustainability -- can sometimes be as large as the uncertainty surrounding economic measures. Second, in some cases, estimates of physical volumes require the same economic information required for estimates of economic values. For instance, the quantity of oil classified as reserves depends on the future path of costs, oil prices, and technology required to estimate the value of oil reserves. The usefulness of economic measures is discussed in greater detail in chapter 4.”

3(3) §3.51 and §3.52 need to be revised to clarify "gross" and "net" recording. The discussion also needs to include the issue of "re-use" as inputs into household and industry activities. Re-use has a different meaning than recycling and this needs to be included in the discussion.

The following confusion about ‘gross’ and ‘net’ recording, needs to be clarified. The current text remains largely unexplained that the type of flow that is re-absorbed (waste incinerated or stored) may differ from the type of flow that is later released as a result of this absorption (e.g. methane). In fact, you could only refer to ‘gross’ or ‘net’ emissions with reference to one single type of residual. As an example, methane gross emissions will usually equal net emissions. This should be discussed in the text to reach a better understanding. We would not recommend a total abandoning of the notions ‘gross’ versus ‘net’ since for certain residuals this difference is useful, specifically to explain the environmental importance of specific economic activities such as recycling, waste treatment etc.

3(4) The tables and figures missing in the draft need to be filled in using the SEEAland data set.

Recommendations on Chapter 4

4(1) The practical applications presented in Chapter 4 should be prefaced with a clear statement that they are for illustrative purposes and are not meant to suggest that the scope of hybrid flow accounts be restricted to energy and emissions accounts.

4(2) We suggest a new paragraph to follow §4.1:

"This chapter should be viewed together with chapter 3. Much of the general discussion there is also relevant for the present chapter. Many general accounting rules and definitions introduced in chapter 3 that are also relevant here are not repeated."

4(3) We suggest to add the following sentence to §4.21:

"The last sentence is replaced with the following; "It is import to note and to remember at various points in the following expositions, that the prices derived from hybrid accounts are simply prices per

physical quantity. They are thus not necessarily the same as the prices used in economic accounting when adjustments to prices to allow for changing qualities of products are incorporated. Where it is important to draw attention to this fact, the term "SEEA price" is used for the unadjusted price. Similarly, the term "volume" is used only in the context of quality adjusted volumes and the term quantity used when the physical measure is not adjusted for quality differences."

Recommendations on Chapter 5

No substantive changes

Recommendations on Chapter 6

6(1) Table 6.8 needs to include the term "NAMEA" in the title in parentheses and make a reference to the original design of the NAMEA in the paragraph in which this table is introduced (§6.113).

6(2) Decommissioning costs. After defining the problem of decommissioning costs, Section C.3 (Minimising residual generation when fixed capital is disposed of) should continue with an introductory paragraph on the limitations of the SNA 1993 in this respect and the provisional status of accounting suggestions made in the SEEA 2000.

The following text should be inserted before §6.76:

"The 1993 SNA does not discuss specifically how to treat decommissioning costs or the treatment of managing landfill sites. What follows are recommendations based on an interpretation of the SNA. The recommendations are consistent with the capital services approach to measuring capital stock which various experts have pronounced to be consistent with the SNA and which is incorporated in recent manuals published by the OECD on the measurement of capital stock and productivity. Nevertheless, it should be clearly stated that this is not the practice in common use for estimating consumption of fixed capital in the SNA context at present. The matter has not been widely discussed in national accounting circles. If and when such a discussion leads to a formal clarification of the SNA position on terminal costs, then this section of the SEEA should be reviewed. In the meantime, the following summary of the conceptually correct way of handling these issues is put forward."

6(3) The recording of residual outputs of unidentified activities in the goods and services accounts (tables 6.5 and 6.7) does not make sense. Recording emissions from households and capital stocks in the row for Goods and services is inconsistent and meaningless.

A new row needs to be included in tables 6.5 and 6.7 between the current row 1 and 2. The entries in the current row 1, columns 9 and 10 (residuals from consumption and capital formation) need to be moved down into the new row 2.

In addition, the entries in the lower left corner of tables 6.5 and 6.7 for "environmental inputs to production" are incorrectly placed in the column labelled "goods and services." Instead, they should be in the column labelled "production."

6(4) We suggest to delete § 6.48 about fishing rights (as done in the latest version of ch 6).

6(5) We suggest to delete § 6.72.

6(6) We suggest to delete § 6.81 and 6.82.

6(7) Include in §6.89, 2nd sentence: 'capital formation for environmental protection'.

6(8) Include the newest version of the SEEAland table 6.8 in the draft, so that reference to NDP at factor cost is no longer needed. The final board of editors are instructed to change the references in the text accordingly.

Recommendations on Chapter 7

7(1) Table 7.4 should be redone to represent an SNA asset account. It is recommendable to restrict table 7.4 and concomitant discussion entirely to SNA tangible non-produced assets (AN.21) together with the SNA asset accounting structure.

7(2) Change the entries of tables 7.5 and 7.6 "environmental appearance" to "additions to environmental assets" and "environmental disappearances" to "decreases to environmental assets". Include "Other volume changes n.e.c." in the table 7.5; and in 7.113 "classification and structure changes" (idem).

7(3) We think that including "the costs of managing the fishery" could be interpreted as suggesting to include part of general government activity that are normally included in government consumption. This is not suggested for subsoil assets, and we think the point should need a more general discussion. Resource rents should be defined consistently for the various types of assets. We therefore suggest that the § 7.280 should be deleted.

7(4) In § 7.42 we suggest the following new text for the last sentence: "Indirect use benefits do not change the physical characteristics of the environment and are sometimes described as being 'non-consumptive'. The amenity benefit of landscape is one example."

7(5) §7.95 suggests that the SEEA includes environmental assets without any value. This is incorrect. Suggestion: change the 2nd sentence of §7.95 from:

"It makes little sense in the SNA context to say that an entity is an asset with zero value but this is a quite legitimate point of view in the SEEA sense where we wish to keep track of measures of physical quantity as well as values."

To the following:

"It makes little sense in the SNA context to say that an entity with zero observed value can be an asset, but this is a legitimate point of view in the SEEA. Here our focus is not exclusively on assets with observable values, but on any asset that yields a flow of benefits to its owner (either an individual or a collectivity), regardless of whether the benefits are paid for or not."

7(6) We suggest to add the following explanation to the end of §7.101:

"(this is a SNA convention which is carried over to the SEEA for the sake of consistency between the two systems)".

7(7) We suggest that a number of tables are added to chapter 7 to show examples of the calculation of resource rents and associated asset accounts, using the SEEAland dataset. The following text is suggested (paragraphs and tables to be renumbered).

3. Example of asset accounts for oil and gas

7.338 Compiling the asset account in physical terms is fairly straightforward. Table 7.12 shows the account based on the SEEAland data set. The inputs of oil and gas are consistent with those shown in all the hybrid accounting matrices.

Table 7.12 Physical asset account for oil and gas

	Million tonnes			
	Gas		Oil	
	Previous year	Current year	Previous year	Current year
Opening stock	1 215	1 200	570	550
Additions and discoveries	10	7	10	22
Extraction	-25	-27	-30	- 38
Closing stock	1 200	1 180	550	534

Source: SEEAland data set

7.339 The starting place to compile the asset account in monetary terms is to estimate values for the resource rent for oil and gas. This is shown in Table 7.13 using both approaches described in section D. Both start from a figure of gross operating surplus. The first deducts first the value of consumption of fixed capital and then the return to fixed capital. The other simply deducts the value of the capital services rendered by fixed capital to give the value of the resource rent.

Table 7.13 Calculation of resource rent for oil and gas

Billion currency units	
Gross operating surplus	104.1
Consumption of fixed capital	
-mineral exploration	4.1
-other fixed capital	20.8
Net operating surplus	79.2
Return to fixed capital	
-mineral exploration	3.3
-other fixed capital	7.6
Resource rent	58.3
Gross operating surplus	104.1
Capital services	
-mineral exploration	7.4
-other fixed capital	38.4
Resource rent	58,3

Source: SEEAland data set

7.340 Based on this information, net present value techniques are used to determine the value of the stock levels. The life length of the deposits are assumed to be 44 years for gas and 14 years for oil. These are made without allowing for the impact of new discoveries on the life length. A discount rate of 4 per cent and a rate of return of 8 per cent have been used. As well as calculating the value of the

opening and closing stocks, this information has been used to calculate the decomposition of the change between the two stock levels. This is shown in Table 7.14.

Table 7.14 Monetary asset account for oil and gas

	Billion currency units	
	Gas	Oil
Opening stock (= closing stock of previous year)	175.6	523.2
Changes due to:		
Extraction (resource rent)	-9.3	-49.0
Return to natural capital (Revaluation due to time passing)	7.7	21.2
Discoveries and reappraisals	0.4	16.2
Changes in extraction path	9.3	34.7
Change in the unit resource rents (Nominal holding gains/losses)	6.5	-27.5
Closing stocks	190.2	518.8

Source: SEEAland data set

4. Example of asset accounts for the timber resources of forests

7.341 In these examples, both cultivated and non-cultivated forests are assumed to be managed sustainably with no depletion taking place. Table 7.15 shows the physical asset account for noncultivated forests

Table 7.15 Physical asset account for timber in non-cultivated forests

	Million tonnes
Gross increase in timber	45060
Residuals from felling	580
Other natural disappearance	1480
Increase in standing timber	43000
Timber felled	9000
Net increase in standing timber	34000

Source: SEEAland data set

7.342 It is assumed some forestry activity is performed by self-employed workers so the national accounts first produce a figure for mixed income rather than gross operating surplus. From this an estimate of the compensation of labour must be made to derive a figure equivalent to gross operating surplus. Thereafter the calculation is similar to that described earlier. The calculation is shown in Table 7.16.

Table 7.16 Calculation of resource rent for timber in non-cultivated forests

Million currency units	
Mixed income	649
Compensation of labour	100
Gross operating surplus	549
Consumption of fixed capital	174
Net operating surplus	375
Returns to fixed capital	133
Resource rent	242
Gross operating surplus	549
Capital services of fixed capital	307
Resource rent	2421

Source: SEEAland data set

7.343 The monetary asset accounts for forestry in Table 7.17 show an account for cultivated forest, one for non-cultivated forests as well as one for the fixed capital used in both forms of forestry. In this case the discount rate is assumed to be 3 per cent and the return to capital 4 per cent.

Table 7.17 Monetary asset accounts for forestry

	Millions of currency units		
	Cultivated forests	Uncultivated forests	Fixed Capital
Opening stocks	9000	8068	7245
Gross fixed capital formation			269
Consumption of fixed capital			378
Change in inventories, work in progress	-120		
Change in inventories, other			0
Harvest of natural biological resources (timber)		242	
Natural growth of non-produced biological assets		242	
Other changes in assets			
Reclassification			
Price changes			
Catastrophic losses			
Closing Stocks	8880	8068	7136

Source: SEEAland data set

5. Example of asset accounts for fish

7.344 In these tables, three hypotheses about the levels of wild fish stocks are examined. In all of them it is assumed the catch in each year is 2 000 million tonnes. Associated with this usable catch there is an amount of 500 million tonnes wasted. In addition, 1 000 million tonnes a year are attributable to natural death.

7.345 Three separate assumption are made about the level of stocks. In case 1, it is assumed that the level of stock is unknown but increasing so that the level of catch is sustainable without depletion. In case 2 the initial stock is 14 000 million tonnes and grows at 10 per cent per year. Because depletion is consistently higher than natural growth, the stock is exhausted within ten years. In the third case, the stock level is unknown but a figure for net growth is known.

7.346 Table 7.18 shows the calculation of resource rent on the two alternative bases as shown for oil and gas. As with fishing, it is assumed that there is some artisanal activity in the forest industry as so again there needs to be a deduction from mixed income to derive a figure for gross operating surplus as the starting point to determine the resource rent. In the case of capture fishery, it is assumed some of this is performed by artisanal fishermen so the national accounts first produce a figure for mixed income rather than gross operating surplus. From this an estimate of the compensation of labour must be made to derive a figure equivalent to gross operating surplus. Thereafter the calculation is similar to that described earlier.

Table 7.18 Calculation of resource rent for capture fisheries

Millions of currency units	
Mixed income	2318
Compensation of labour	750
Gross operating surplus	1568
Consumption of fixed capital	970
Net operating surplus	598
Return to fixed capital	516
Resource rent	82
Gross operating surplus	1568
Capital service - fixed capital	1486
Resource rent	82

Source: SEEAland data set

7.347 Table 7.19 shows an asset account for fisheries. It gives information on the farmed fish in aquaculture as well as the fixed capital; use in that industry. It also shows the fixed capital used in capture fisheries as well as the estimates of fish stocks, and change in them, under the three cases described above. Even though the physical size of the stock is unknown in case 1, it is possible to place a monetary value on the stock on the basis of the resource rent derived each year and the assumption that the stock is non-declining. In all cases, the discount rate and rate of return are based assumed to be 4 per cent.

Table 7.19 Monetary asset accounts for fisheries

	Millions of currency units					
	Aquaculture		Capture fishery			
	Fixed capital	Farmed fish	Fixed capital	Wild fish Case 1	Wild fish case 2	Wild fish case 3
Opening stocks	3 200	650	12900	2050	610	Unknown
Gross fixed capital formation	304		1087			
Consumption of fixed capital	240		970			
Change in inventories, work in progress (farmed fish)		311				
Change in inventories, other						
Harvest of non-cultivated biological resources (catch)				82	82	82
Returns to natural resources					24	
Natural growth of non-cultivated biological assets				82		21
Other changes in assets						
Reclassification						
Price changes						
Catastrophic losses						
Closing stocks, biological assets	3 264	961	13017	2050	552	Unknown

Source: SEEAland data set

Recommendations on Chapter 8, Section A – Introduction

8A(1) The objective of the chapter as stated in §8.4 should be restated to indicate that it has multiple objectives depending upon the resource in question. For some resources (e.g., minerals) the objective is to provide additional, detailed treatment on specific questions that have not been dealt with elsewhere in the handbook. For other resources (e.g., land and water), the objective is to give a more or less complete exposition of the accounting for these resources because they are not dealt with directly elsewhere in the handbook.

Suggestion: We suggest the following new text to §8.4

"This chapter has multiple objectives depending upon the resource in question. For some resources (e.g., minerals) the objective is to provide additional, detailed treatment on specific questions that have not been dealt with elsewhere in the handbook. For other resources (e.g., land and water), the objective is to give a more or less complete exposition of the accounting for these resources because they are not dealt with directly elsewhere in the handbook. It is also intended to show the flexibility offered by the SEEA to provide an interface between environmental accounting and environmental statistics more generally. The examples presented should be regarded as illustrative; though some accounts fit a given sort of resource more readily than others, there is no intention to tie one particular form of analyses rigidly to only one type of resource."

8A(2) The final subsection (7) titled "Forthcoming work" is likely to be long out of date by the time the handbook is finally published. It is questionable whether such discussions should be included in a handbook that is intended to have a shelf life of five years or more.

Suggestion: Delete subsection 7 "Forthcoming work."

8A(3) The discussion of sustainability in Chapter 8 (§8.2) requires reformulation. The notion of strong and weak sustainability, which are the terms commonly used in the literature, should replace the terms physical and economic sustainability. This reformulation needs to be made in co-ordination with the proposed new text in chapter 1 about sustainability. Referring to the chapter 1 discussion of sustainability should be made.

Recommendations on Chapter 8, Section B – Mineral and sub-soil resources

No substantive changes

Recommendations on Chapter 8, Section C – Water Accounts

8C(1) Add the following paragraph after the existing §8.69 (just before the heading "The hydrological system"):

"The water accounts presented in this section include both physical flow accounts and asset accounts. The physical flow accounts are constructed in accordance with the accounting rules outlined in Chapter 3. They are restricted to measurement of the water flows between the economy and the environment that lie within the scope of physical accounting presented in Figure 3.2. Specifically, they exclude flows of water that occur exclusively within the environment. The asset accounts for water are compiled in accordance with the accounting rules outlined in Chapter 7. They are restricted to measurement of the opening and closing stocks of water within the national environment and of the flows associated with the natural and economic processes that account for the difference between the opening and closing stocks."

8C(2) Change the treatment of "waste water supplied to sewerage" from the category "Products" to the category "Residuals" in tables 8.3 and 8.4 (with the respective changes in the numbers in table 8.4).

Recommendations on Chapter 8, Section D

Only brief corrections to text - see Annex 2.

Recommendations on Chapter 8, Section E

No substantive changes

Recommendations on Chapter 8, Section F

No substantive changes

Recommendations on Chapter 9

9(1) Edit the following paragraphs to read as follows:

- 9.76 “The revealed preference for environmental services can be used as a proxy for the economic, or market, value of the view...”
- 9.81 “Market valuation of economic losses reflects on the economic effects of environmental damage but it does not include impacts on well-being. Estimates of these impacts would require supplementary information...”
- 9.83...”The price effect of the environmental factors can then be taken as a proxy for the market price of the environmental service that they represent.”
- 9.91 “....This can be a strength when the desired measure is well-being or welfare.”
- 9.100 Delete the last sentence of the paragraph.

Recommendations on Chapter 10

10(1) New §10.22b to follow existing 10.22) “Economic accountants have long been aware of the problem inherent in this approach: the resulting accounts do not reflect the parallelism between depreciation of fixed capital and depletion of natural resources and similarly, between investment in fixed capital and additions to natural resources. An alternative approach is to treat depletion of natural resources symmetrically with depreciation and to treat increases in the quantity of the resources -- rather than just the expenditures on technology, exploration, and other activities that add to the value of resources -- as investment. All of these options are described below.”

Add a sentence at the end of §10.52: “Options B2 and B3 allow additions to natural resources to be treated symmetrically with investment in fixed capital.”

10(2) Widen the cited reference underlying this section from the work of Andre Vanoli to also include Hotelling and other standard references from the literature on environmental and natural resource economics. The following text should be inserted either as a footnote to §10.24 or at the end of that paragraph:

There is extensive economic literature on this topic. A few examples, among many, include: (1) Hotelling, Harold. "The Economics of Exhaustible Resources." *Journal of Political Economy* 39, no. 2 (1931): 137-175. (2) El Serafy, Salah. "The Proper Calculation of Income From Depletable Natural Resources." In *Environmental Accounting for Sustainable Development*, edited by Yusuf J. Ahmad, Salah El Serafy, and Ernst Lutz, 10-18. Washington, DC: The World Bank, 1989. (3) Hartwick, John R. "Natural Resources, National Accounting and Economic Depreciation." *Journal of Public Economics* 43, no. 3 (December, 1990): 291-304.

10(3) §10.20, the term “hopefully” near the end of the paragraph suggests a measure of support in contradiction with the chapter introduction’s promise that “This handbook deliberately makes no value

judgement on the issue.” Additionally, there is no real need to set this off as a separate section - the paragraph fits well as the end of the previous section—and the heading is unnecessarily negative. If any heading were needed, “Other issues” would suffice.

Replace “Those not constrained to avoid hypothetical accounting, including hopefully some readers from outside statistical offices” with “Readers interested in hypothetical accounting should be able to find...” Also, delete the section heading 3, “Reservations about the chapter.”

10(4) Change the title of section 3 (before §10.32) to "Accounting for Changes in Environmental Assets". Change subtitles and text accordingly.

10(5) Change §10.195 to read: "Hueting (1974) postulated a *partial* measure of welfare which was derived from the conventional measure of income from economic activity by recognising the dis-benefit caused by *man-made losses* of environmental functions. It refers to the *maximum attainable national income given a set of assumed preferences expected to lead to the restoration and conservation of more environmental functions than the present economy would. This indicator is called a greened economy net national income (geNNI) using the terminology of O'Connor (2000). The concepts and the policy relevance of this type of indicator has been explored in the context of the GREENSTAMP project (Brouwer and O'Connor 1997). The practical calculation of a geNNI involves choosing environmental standards conform the assumed preferences for the approximate use of the environment under these preferences (Hueting and De Boer, 2001). These standards are applied as constraints on the national economy when completing the welfare optimisation in maximising national income using either comparative static or dynamic scenario modelling. Comparisons of these aggregates with the values actually measured in the economy as currently operating leads to measures of opportunity costs in the sense of consumption or investment options that would be necessary to pursue the chosen environmental standards. These standards may correspond to a measure of full sustainability or to a less stringent set of circumstances."*

Recommendations on Chapter 11

11(1) There are some proposed changes in the factual information for Australia. The changes are listed in detail at the end of Annex 1. [Such changes are relevant for paragraphs 11.85, 11.86, 11.87, 11.89, 11.136, table 11.7 and figure 11.8.]

11(2) There are some proposed changes in the information presented for Norway. The detailed list of changes are listed at the end of Annex 1. [Such changes are relevant for paragraphs 11.103, 11.105, 11.109]

11(3) Some reformulations should be made to soften the tone of the chapter. We suggest that:

a: The last sentence of §11.100 ("Fees should be set high enough ...") is deleted

b: The last sentence of §11.99: Change ".. resource management that is efficient, sustainable and equitable requires that ..." to "..resource management that is efficient, sustainable and equitable suggests that ...".

c: In §11.134 change from "As a result, the recreational services and the unique ecosystems on which they depend, are undervalued" to "Even if the costs are covered, a valuation of the recreational services and the unique ecosystems on which they depend, based on entrance fees will undervalue the environmental services of the park."

11(4) Resource management in General Government. Fish (8E) is the only resource for which management costs of General Government are suggested to be deducted from the resource rent. This

activity should be classified as General Government consumption, not as an implicit subsidy to the producing units of the industry as implied in §11.104.

11(5) In §11.7, change the 'economic' to 'physical' in the sentence:
"measures of ecological and physical sustainability can be derived from economic asset accounts"

11(6) Analysing Government income from resource rent, not only taxes on resource rent but also property income should be included.

We suggest that the first sentence of §11.104 is changed from
"In assessing the contribution of the resource to the economy, it is also useful to calculate the share of taxes on resource rent in total government revenues and the share of resource management costs incurred by the government that are recovered through taxes on rent." to "In assessing the contribution of the resource to the economy, it is also useful to compare the share of resource rent in total government revenues and the share of resource management costs incurred by government.

Changes across several chapters that need to be implemented by the editorial board

1. Monetary vs. economic accounts

While the draft sometimes uses 'economic accounts', mostly the term 'monetary accounts' is used to refer to accounts in monetary units, as opposed to accounts in physical units. We tend to agree that the term used should indicate that we expect much more from the accounts than that they contain currency units. We think however that these structural elements also should have implications for accounting entries in physical units. We suggest therefore to use the compromise 'value accounts' to replace the term 'monetary accounts' referring to accounts in currency units rather than physical units.

1a. We suggest that a new paragraph explaining introducing the term 'value accounts' should be inserted in the draft after §1.20.

Suggested new text (insert after §1.20):

Often, the term 'monetary accounts' is used to refer to accounts in monetary units, as opposed to accounts in physical units. However, some prefer the term 'economic accounts', implying that whatever is economically meaningful, according to the theory and principles of economics, will be fully considered by the accounts, and accounting entries will be objectively valued using the various techniques provided by economic theory. However, it should not be suggested that physical accounting is non-economic in this sense. As a somewhat more neutral compromise, we use the term "value accounts," a term that conveys the notion that these accounts incorporate relative weights based on a social valuation.

1b. The final board of editors should replace 'monetary accounts' with 'value accounts' wherever appropriate. To this end they shall be given the list of occurrences of 'monetary accounts' produced by the USA in their first round comments which can be found in Annex 2.

2. Chapter titles

We think that the connection of chapters 5 and 6 to the SNA is sufficiently clear in chapter 2. Considering also the new paragraph explaining the different opinions on the use of the word 'integrated' we think that these considerations no longer need to be entered directly into the chapter titles.

We propose some changes to the chapter titles that we think give a better description of the contents:

2.a Change the title of chapter 4 to: "Hybrid physical and value flow accounts".

2.b Change the title of chapter 5 to: "Accounting for economic activities and products related to the environment"

2.c Change the title of chapter 6 to: "Accounting for other environmentally related transactions"

3. Hierarchical section numbering

Hierarchical section numbering should be considered. The following change could be made throughout (the identifier on the left being what is used currently and that on the right being what is suggested):

A	➔	A
1	➔	A.1
blank	➔	A.1a

4. Eliminating all references to sustainability except in chapter 1 and 11

It is proposed that the discussions in chapters 1 and 11 will be sufficient to describe the usefulness of the SEEA for measuring sustainable development. The editorial board should therefore eliminate references to sustainability from the other chapters, for example in §8.2, and check that the terms weak and strong sustainability are used and not physical, environmental and economic sustainability where the terms sustainability/sustainable development are used.

5. Terminology "appearance and disappearance"

The terms "appearance" and "disappearance", for the SEEA accounts, are to be replaced by "increase" and "decrease" (or additions / reductions) whenever appropriate. This does not apply to where the text is specifically discussing the SNA treatment. Specific changes of this type have been given in Annex 1 for §2.138 and 2.139, titles, subtitles and text in the section including §10.32 and the entries in tables 7.5 and 7.6. The manual text should be examined to be sure that the use of these terms is consistent and changed accordingly.

Changes referred to in Annex 1 for chapter 1

Sustainable development and the SEEA

Many of the concerns related to resource depletion and environmental degradation are reflected in the concept of sustainable development. In its most widely accepted formulation, that of the Brundtland Commission, it is stated that:

Humanity has the ability to make development sustainable -- to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.
(World Commission on Environment and Development, 1987, p. 8)

The Brundtland Commission left its definition intentionally vague so that the concept of sustainable development would not be confined to any particular category of needs. While this is helpful in terms of the simplicity and wide appeal of the message, the Brundtland definition offers little in the way of a measurable objective for sustainable development. Not surprisingly, in the time since the Brundtland report, researchers from many disciplines have attempted to operationalize the concept. Their goal has been to understand its implications for the current and future path of development. The result has been

the emergence of a number of diverging views of sustainable development. Broadly speaking, three currents of thought are evident within the range of views, which can be referred to for convenience as the three-pillar approach, the ecological approach and the capital approach. The basic tenets of each of these approaches are presented below and the applicability of the SEEA to their measurement is discussed.

The three-pillar approach to sustainable development

A widely held view of sustainable development is that the concept refers at once to economic, social and environmental needs. According to this view there must be no single focus (or object) of sustainability, but instead all of the economic, social and environmental systems must be sustainable in and of themselves. Satisfying any one of these three sustainability “pillars” without also satisfying the others is deemed insufficient. First, each of the three pillars is independently crucial. Second, each of the three pillars is urgent and little time is available for debating which one should be addressed first; they must therefore be addressed simultaneously. Finally, the three pillars are interconnected. There is, therefore, a risk of unwittingly causing (or worsening) problems in one system while attempting to correct problems in another. The only sure way to avoid this is to integrate explicitly decisions such that effects in all three systems are considered before action is taken (Robinson and Tinker, 1998).

The three-pillar approach to sustainable development is wide-ranging and complex. No one framework could hope to respond to all the data needs implied by the approach. For its part, the SEEA has a great deal to offer with regard to certain elements of the approach and little of offer for others. Clearly, the SEEA provides for the compilation of much information relevant to environmental systems, but it offers relatively little for understanding economic and social systems (particularly with respect to the latter). As for the interactions between the three pillars, the SEEA has clearly a great deal to say about the integration of environmental and economic systems (indeed, it is about little else), but again offers little with respect to economic/social interaction or social/environmental interaction.

The ecological approach to sustainable development¹

Central to the ecological view of sustainable development is the notion that economic and social systems are sub-systems of the global environment. It follows that sustainability in the economic and social spheres is subordinate to sustainability of the environment. Development, from the ecological viewpoint, is seen to refer to the “the capacity of [an ecosystem] to respond positively to change and opportunity” or the “maintenance of [ecosystems’] dynamic capacity to respond adaptively” (Golley, 1990). The key property to be sustained then is the capacity of ecosystems to respond with resilience to external perturbations and changes.

A strong current within the ecological viewpoint is the notion that the “health” of ecosystems must be protected and enhanced if they are to exhibit the resilience that is necessary for sustainability. Ecosystem health is a metaphor derived from the human health sciences that is difficult to define precisely. In simple terms, it can be thought of as a “resource” that enables ecosystems to adapt and evolve in the face of changing circumstances.

The ecosystem health approach to sustainable development implies measurement within two broadly defined categories. The first includes measures of the “pressures” placed on ecosystems by human activities (material and energy extraction, physical restructuring, pollutant emissions, human appropriation of space and ecosystem productivity, etc.). These pressures are often the cause of reduced eco-

¹ This section draws heavily upon Rapport, 1995.

system health as manifested in degraded service flows and/or reduced management options. The second category includes measures of the responses of ecosystems to these human pressures. The response measures can be of four types: measures that describe the state of the ecosystem; measures that describe the causes of changes in the state of the ecosystems; measures that describe the likely changes in ecosystems in the face of known pressures; and measures of the capability of ecosystems to deal with imposed pressures.

Despite the utility of the SEEA for addressing the data needs of the ecological approach to sustainable development, the system's full power (which lies in the integration of environmental and economic data) is not fully exploited by an approach focussed exclusively on ecosystems. This power is best exploited by the last of the three broad approaches to sustainable development noted above, the capital approach.

The capital approach to sustainable development

The capital approach to sustainable development is most closely associated with the thinking of economists on the subject, although the approach goes well beyond what is typically the domain of economics. It borrows the concept of capital from economics, but broadens it in a variety of ways to incorporate more of the elements that are relevant to the sustainability of human development. In doing so, it takes concepts from the physical sciences (especially ecology and geography) and from the non-economic social sciences and integrates them within a framework based on capital.

Although one finds a predictable amount of disagreement among economists regarding sustainable development, substantial agreement exists on one point: sustainable development is closely related to the long-standing economic concept of income. Most economists refer back to Hicks' (1946) definition of income in this regard:

income is the maximum amount an individual can consume during a period and remain as well off at the end of the period as at the beginning.

The Hicksian concept of income is easily explained with a simple example. Imagine an individual whose only source of income is a stock portfolio valued at \$1 million at the beginning of a year. This is a very well managed portfolio, paying its owner a net return of 10% annually. The investor's annual income in this case is \$100 thousand, as this is the maximum amount that she can consume in a year without depleting her capital investment (that is, her stock portfolio).

Although there are obvious and important differences between the economic affairs of an individual and those of an entire nation, the above definition of income applies equally well to both. The income of a nation can thus be defined as the amount that it can collectively spend during a period without depleting the capital base (or wealth) upon which it relies to generate this income.

The advent of sustainable development has altered the way in which many economists think about national income and its relationship to national wealth. In the past, economists tended to focus on produced capital as the underpinning of wealth and, therefore, of income. To the extent that natural resources were considered at all, they were seen to be free gifts of nature in effectively limitless supply. In recent years, with the emphasis of sustainable development on the preservation of the productive capacity of the environment, many economists have argued that the contribution of a nation's natural capital cannot be ignored in discussions of the sustainability of national income and wealth. Others have added that human capital and social capital must also be considered. This has led to the following interpretation of sustainable development from a capital standpoint:

Sustainable development is development that ensures non-declining *per capita* national wealth by replacing or conserving the sources of that wealth; that is, stocks of produced, human, social and natural capital.

Although human and social capital are important topics that are currently the subject of considerable debate and research, they clearly do not fall within the rubric of integrated environmental and economic accounting. For this reason, they are considered no further here. Likewise, produced capital is not treated at great length in the SEEA and readers interested in learning more about it are referred to other sources, in particular the SNA93.² Where the SEEA does offer a great deal is with respect to the measurement of natural capital. The remainder of this section is therefore devoted to a discussion of natural capital and its relationship to sustainable development, and to what the SEEA offers by way of a measurement framework for natural capital.

Natural capital and sustainable development

Natural capital is generally considered to comprise three principal categories: natural resource stocks, land and ecosystems. All are considered essential to the long-term sustainability of development. Natural resource stocks are the source of raw materials used in the production of both market and non-market goods. Land is essential for the provision of space in which human activities take place. Ecosystems are essential for many services that benefit humans and non-human species alike (a list of these services was noted above in reference to the ecological approach to sustainable development).

According to the capital approach, the long-term sustainability of development is seen to depend upon the maintenance of natural capital (in addition to the other forms of capital). If stocks of natural resources decline to the point where they are no longer able to provide sufficient raw material inputs to support the production of goods, it is obvious that production of that level and type is no longer sustainable.³

Likewise, if the natural functioning of ecosystems is disrupted by human activities to such a point that the quality of the services they provide declines, then the prevailing pattern of development may no longer be sustainable. Of course, this is not to say that *some other* pattern of development is no longer possible, only that changes will have to be made to either 1) eliminate the need for a particular natural capital service or 2) find a means of replacing the natural capital service with a service of produced capital.⁴

The need to “maintain” stocks of land is slightly more complicated, as land is (for all practical purposes) neither created nor destroyed. However, land of a particular type (e.g., good quality agricultural land) can be exchanged for land of another type (e.g., urban land). To the extent that the economy relies on the availability of adequate areas of specific land types, it is possible that long-term economic sustainability may be threatened by changes in land use patterns.

² Produced capital is treated in two elements of the SEEA framework. The first is the asset accounts, where cultivated natural resources are treated as produced capital and the second is the environmental protection and resource management accounts, where produced capital employed for environmental purposes is measured.

³ To the extent that current recycling rates for natural resources are below those that are maximally attainable, increased recycling offers a means of offsetting the demand for virgin natural resources. Once maximum rates have been achieved however, further growth in material consumption can only be furnished through increased rates of virgin resources.

⁴ Sewage treatment plants are a good example of the latter. Because sewage production far exceeds that which rivers could accept without suffering a dramatic decrease in functioning, society has been forced to divert financial and human resources away from other purposes into the production and operation of sewage treatment plants. These plants do nothing more than replace the waste assimilation service that the natural capital (the river) cannot provide at that level of sewage production.

Even if many researchers accept the basic idea that sustainable development requires maintenance of natural capital, the relationship between natural capital and other types of capital remains a matter of debate. In particular, the extent to which produced and human capital can act as substitutes for natural capital remains controversial. Many economists argue that produced and human capital are very often, if not always, substitutes for natural capital. Society has, they note by way of example, employed produced and human capital to devise chemical fertilizers that substitute for the natural fertility of soil. Even soil itself can be replaced in a limited way through the use of hydroponics. History is full of similar examples where technological advancement has allowed substitution of scarce resources with those that are more abundant. Many would claim there is every reason to believe that such advancement will continue, even at increased rates, in the future.

Others argue that the possibilities for substitution are more limited, even completely absent in some cases. Many forms of capital, they argue, are of value only when combined with another form. For example, a fishing fleet (produced capital) is essentially worthless unless combined with healthy fish stocks (natural capital) to exploit. In this case, the fishing fleet and the fish stocks are said to be complementary. But this is just a limited example of complementarity, where a subset of one type of capital is complementary with a subset of another type of capital. There is another possibility as well. This is that a certain form of capital provides a service that is essential to the functioning of the entire planetary system and for which there exists no known substitute. Although examples of this type of capital are few (and there may be no absolute example), global atmospheric systems that provide the services of protection from solar radiation and climate regulation come close.

The controversy over the degree of substitutability of produced and human capital for natural capital has translated into a continuum of capital-based approaches to sustainable development. At the opposing ends of this spectrum are found the concepts of *weak* and *strong* sustainability (see Text Box). Regardless of which of these concepts one accepts, the same basic tenet is apparent: use of the environment must be compatible with long-term maintenance of capital stocks. Although this principle is inherent in both the strong and weak definitions of sustainability, its implications differ depending upon which interpretation one accepts.

Under a regime of weak sustainability, natural resource stocks may be depleted, and environmental systems degraded, but only if this depletion/degradation is offset by equivalent or greater increases in the stocks of other forms of capital. That is, so long as there is no reduction in total capital *per capita*, development is assumed to be sustainable. Since it is the total capital stock that is to be maintained, all forms of capital must be measured using the same yardstick. Practically speaking, this implies measurement of capital in monetary terms.

Strong sustainability sets more strict rules for the use of the environment. Renewable natural resources (such as forests) may be used, but only at the rate at which they naturally regenerate. That is, depletion of renewable resource stocks is not allowed. Non-renewable resources may also be used, but only at the rate at which renewable substitutes can be produced. Non-renewable resources for which no substitutes exist are to be used minimally (if at all), and maximum recycling of these resources is required. Environmental systems are, in general, not to be degraded. In the limited instances where substitutes are available for these systems, degradation is allowed, but only to the extent that increased service flows from other forms of capital offset the lost natural capital services. Environmental systems that provide irreplaceable services (such as the ozone layer) are not to be degraded at all.

Strong sustainability requires that all capital stocks be maintained intact independent of one another. There is, therefore, no reason why all forms of capital must be measured using the same unit of measure. This allows for measurement of natural capital stocks in physical, rather than monetary, units. This is often straightforward. Stocks of many natural resources can be measured using simple physical units and readily available stock data (subsoil and timber assets are generally of this nature). Measuring the natural capital represented by environmental systems—the waste assimilation capacity of a river system for example—is much more difficult. The SEEA includes accounts designed to measure such ecosystem services, but it must be noted that current knowledge and experience in this field is limited. The ecosystem accounts presented in the SEEA should then be viewed as works in progress. They will evolve along with our understanding of ecosystems and the services they provide.

The SEEA as a framework for measuring sustainable development

It is clear from the foregoing that the SEEA can serve as at least a partial framework for measuring sustainable development from a number of perspectives. It has not been designed to serve any particular perspective and, indeed, should be of considerable value regardless of the user's particular point of view on the concept. This said, it is clear that the SEEA's focus on macro-level accounts integrating environmental and economic data makes it particularly useful from the perspective of the capital approach. The SEEA has the capacity to respond to data needs across the full range of views within the capital approach.

Text Box: Sustainable development continuum

In order to operationalize the concept of sustainable development, many economists interpret it as the need to maintain stocks of various forms of capital (Daly and Cobb; 1989; Pearce *et al.*, 1989; Pearce and Turner, 1990; Victor, 1991; El Serafy, 1996). Although there is agreement that all forms of capital are important when considering sustainability, there is a divergence of opinion as to whether the various forms are complements or substitutes (especially as to whether natural capital can be replaced by other forms). This divergence has led to the development of two opposing interpretations of sustainability.

- *Weak sustainability* seeks to maintain from year-to-year the *per capita* income generated from the **total** capital stock available to a nation. No regard is given to the composition of this stock, as it is assumed that all forms of capital are substitutes for one another. Thus, only the total value of capital need remain intact for income to be non-declining. Weak sustainability clearly allows for the depletion or degradation of natural resources, so long as such depletion is offset by increases in the stocks of forms of capital (for example, by investing royalties from depleting mineral reserves in factories).
- *Strong sustainability* requires that all forms of capital be maintained intact independent of one another. The assumption implicit in this interpretation of sustainability is that different forms of capital are mainly complementary; that is, all are generally necessary for any to be of value. Produced capital used in harvesting and processing timber, for example, is of no value in the absence of stocks of timber to harvest. Only by maintaining both natural and produced capital stocks intact, the proponents of strong sustainability argue, can non-declining income be assured.

Regardless which of the two interpretations one accepts, the effect of an increasing population is the same. Not only must capital stocks be non-diminishing, but (other things being equal) they must in fact grow at the same rate as the population if per capita income is to remain constant. Of course, the effects of technological change may mean that the population can grow faster than capital stocks with no reduction in income earning potential.

Three major strands to the SEEA accounting system

(Please note: the above section title is suggested if the introductory paragraph §1.28 is used from the latest draft version and a title for the next section is needed.)

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Changes referred to in Annex 1 for chapter 11

1.1 Required changes relating to information for Australia

11.85 The second to last sentence "Produced assets consisted of just under 60 percent of the total with land accounting for the remaining fraction of approximately one third." should be changed to "Produced assets made up about two thirds of the total with land accounting for the just under one third."

Figure 11.8 change title from "Growth rates of different classes of assets, Australia 1992 to 2000" to: "Index of real growth of different classes of assets, Australia 1992 to 2000".

11.86: Change 3rd sentence from "Over the period, non-produced assets increase by almost fifty per cent due to new discoveries of subsoil resources." to: "Over the period, non-produced assets other than land increased by one third, driven by the increase in soil resources. Stocks of native timber declined slightly in real terms."

11.86: Change sentences five and six from " The value of land also increased slightly. This reflects the change noted above of some land being reclassified from agricultural to urban use with a consequent increase in economic value." to: "Land increased by 16 per cent due to the reclassification (rezoning) of some land from rural to urban status with a consequent increase in value."

11.86: Delete last sentence " In the case of Australia, therefore, it seems from these figures that national wealth is more than sustainable but it must be remembered that no allowance has been made for any deterioration in other environmental media."

11.87: Change first sentence from "The composition of wealth is important ... " to "The composition of total assets is important ...". Same change in the third sentence.

11.89: Change the first sentence from "...trends in total wealth" to "...trends in total assets and wealth".

Table 11.7: Change the data entries in the row for 'other produced assets' from 4.6 to 4.0 for 'per cent of total non-financial assets' and from 11.6 to 5.0 for 'per cent of asset class owned by general government'.

11.136: Change the second sentence from "...when looking at the composition of the components of wealth..." to " when looking at the components of wealth". Change the fourth sentence from "...discoveries was about one half of one per cent higher than NDP." to "...discoveries was up to one half of one percent higher than NDP."

1.2 Required changes relating to information for Norway

11.98: Change sentence 2 from "Figure 11.9 to Figure 11.11 show the rent generated by each of these resources and, in line with the recommendations of Chapter VI, the distribution of that rent between government and private sector." to " Figure 11.9 to Figure 11.11 show the rent generated by each of these resources and the share appropriated by government." Remove the last sentence "Taxes net of subsidies represent government's share as the owner of the rent; the remainder accrues to the private sector."

11.100: Change the first sentence from "Uncultivated forests in Norway are also managed in a way that generates substantial value added and resource rent, but, rather than contributing this rent to government, the rent accrues to the private sector which receives large subsidies from government." to "Uncultivated forests in Norway generate substantial value added and resource rent, but since they are

privately owned, the rent accrues to the private sector. Government not only does not appropriate part of this rent, it pays some subsidies to the industry."

11.104: Change the third sentence from "The taxes paid by the petroleum industry cover the costs of" to "The share of the resource rent paid by the petroleum industry to government is sufficient to cover the costs of...". Delete the last sentence "These two industries remain heavily subsidized, not only through direct subsidies, but through the additional unrecovered costs incurred by government of managing the industry".

11.111: Replace the last sentence "While it is unlikely that any industry is perfectly efficient, the fisheries industry in Norway represents an extreme case of economic inefficiency where the economic value of its fish stocks is zero." by "Another option is to maximize not income but sustainable yield. Usually this solution will lead to larger stock than the income maximizing solution."

Occurrence of “Monetary” in the SEEA draft: List of Paragraphs

Chapter 1:

1.11, 1.12, 1.13, 1.23, 1.25, 1.33, 1.37, 1.40, 1.41, 1.42, 1.44, 1.49, 1.53, 1.54, 1.69, and Table 1.1

Chapter 2: 2.21, 2.25 (this chapter needs to be more thoroughly checked)

Chapter 3:

3.4, 3.34, 3.35, 3.48, 3.52, 3.57, 3.75, 3.85, 3.86, 3.87, 3.88, 3.135, 3.168, 3.187, and 3.192

Chapter 4:

4.1, 4.3, 4.4, 4.6, 4.16, 4.21, 4.27, 4.29, 4.30, 4.31, 4.32, 4.33, 4.34, Table 4.1., 4.37, Table 4.3, 4.39, 4.40, Table 4.4, Figure 4.1, 4.50, 4.53, 4.54, 4.59, 4.61, 4.64, 4.65, 4.67, 4.69, 4.73, 4.76, Figure 4.3, 4.86, 4.188, 4.123, and 4.124

Chapter 5:

5.41, 5.46, 5.161, 5.187, and 5.195

Chapter 6:

Box, 6.1, 6.3, 6.13, 6.108, and 6.112

Chapter 7:

7.1, 7.10, 7.12, 7.13, 7.18, 7.19, 7.26, 7.28, 7.36, 7.40, 7.46, 7.47, 7.53, 7.94, 7.95, 7.96, 7.112, 7.141, 7.143, 7.144, Box 7.2, 7.208, 7.215, 7.219, 7.261, 7.268, 7.290, and 7.295

Chapter 8:

8.2, 8.3, 8.5, 8.8, 8.11, 8.24, 8.32, 8.41, 8.67, 8.68, 8.69, 8.85, 8.126, 8.127, 8.128, 8.143, 8.145, 8.146, 8.147, 8.187, Part 4 title, 8.192, 8.205., 8.206, 8.210, 8.224, 8.225, 8.244, 8.248, 3.5, Part 6 title, 3.10, 8.301, 8.334, and 8.362

Chapter 9:

9.1, 9.2, 9.5, 9.6, 9.7, 9.21, 9.35, 9.67, 9.86, 9.87, 9.103, 9.104, 9.105, 9.116, 9.117, 9.127, 9.130, and 9.132

Chapter 10:

10.1, 10.4, 10.17, 10.46, 10.122, 10.123, 10.138, Figure 10.1, Box 10.11, 10.237, and 10.243

Chapter 11:

11.7, Title before 11.82, 11.83, 11.86, 11.132, 11.143, 11.148, 11.150, and 11.155