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OPTIONS FOR ALLOCATING ENVIRONMENTAL FLOWS TO TOURISM THROUGH INTEGRATION OF DATA FROM TOURISM AND ENVIRONMENTAL-ECONOMIC ACCOUNTS

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1. Introduction

One main part of the UN World Tourism Organization (UNWTO) and UN Statistics Division (UNSD) project on Measuring Sustainable Tourism (MST) is the development of a methodological document describing a statistical framework for MST. A draft outline of a methodological document was discussed at the 1st meeting of the Working Group of Experts on Measuring Sustainable Tourism, held in Madrid in October 2016.

The international statistical recommendations and standards that are in place for the measurement of tourism and for the development of environmental-economic accounts are considered to be of utmost importance for setting up the statistical framework for MST. These various recommendations are to be taken into consideration in an integrated way and include the International Recommendations for Tourism Statistics 2008 (IRTS 2008), the Tourism Satellite Account: Recommended Methodological Framework 2008 (TSA: RMF 2008), the System of Environmental-Economic Accounting - Central Framework (SEEA-CF) and the SEEA Experimental Ecosystem Accounting (SEEA-EEA)¹. They are all to be suitably combined to develop a statistical framework for MST. The guidance they provide will help to measure tourism from a sustainability perspective by taking into account economic and environmental aspects at the same time.

Social and cultural aspects will need to be taken into account as well within an even more comprehensive perspective, but for the time being a systems based approach is not available for organizing statistical information in the social and cultural areas. Thus, the development of the statistical framework for describing the role played by tourism in sustainable development will be initially focused on the integration of environmental and economic aspects.

¹ The international statistical standard for integrated environmental and economic accounting is SEEA-CF. Both environmental-economic accounts and tourism satellite accounts are "satellite" to the core system of national accounts.

The present paper considers the use of resources, such as water and energy, and the generation of residuals, such as greenhouse gas (GHG) emissions, wastewater and solid waste. Each of these represent areas of measurement that are considered key domains in the envisaged statistical framework for MST².

Data concerning these phenomena, collectively referred to as environmental flows, are commonly compiled using SEEA-CF physical flow accounts. By means of so-called combined presentations, the most important physical aggregates measuring these flows (e.g. final water use, total GHG emissions) can also be related to monetary aggregates concerning economic activities to which they are linked (e.g. measures of output and value added). Thus the SEEA-CF facilitates highlighting the interrelationships between environmental and economic aspects.

For the purposes of the present paper, environmental flows such as those mentioned above are assumed to be regularly measured based on guidelines provided by SEEA-CF. The estimates, made for the whole economy, are allocated to industries as well as to households where relevant.

The available statistical information on environmental flows does not make reference to tourism, though environmental flows related to tourism activity are embedded in the estimates. For example, data on air emissions generated by production processes that produce output purchased by visitors (e.g. accommodation or transport services) is not available with specific reference to the tourism share. At least, such information is not produced on a regular basis within official statistics. It is envisaged, therefore, to build on aggregates in physical units already available for the different types of environmental flows, as recorded in SEEA-CF physical flow accounts or combined presentations, and from there derive estimates of tourism-related environmental flows.

The methodological document describing the statistical framework for MST has to provide clear guidelines in terms of concepts, definitions, classifications, measurement boundaries and data structures and sources. Measurement challenges are one specific point of interest. To the extent that tourism-related environmental flows are measured through tourism shares of aggregate environmental flows from SEEA-CF accounts, the methodological issue is to determine proper methods to apportion environmental flows to tourism. This paper discusses the relevant issues and options and the associated assumptions.

2. Assigning environmental flows to tourism from a satellite accounting perspective

Like other human activities, tourism's activity normally takes place at the cost of causing some impacts on the natural environment either via extraction of materials and resources (natural inputs) or the release of residuals, i.e. through material flows from the natural system to the economic system and vice-versa. For example, surface water or groundwater may be abstracted as an essential resource for use as an input for cooking or sanitation purposes in tourism resorts. Timber resources is another example of natural input, with various possible uses of wood materials for tourism purposes, including for cooking or heating. Also - as for examples of release of residuals - flows of wastewater may be returned to the environment from hotels, instead of being sent to treatment facilities, while flows of air emissions may be released as a side-effect of heating in hotels. In the case of tourism, these environmental flows are caused by economic activities serving visitors' demand and by visitors themselves³.

Concerning the use of natural inputs (e.g. water, energy) by production processes, since products may be purchased with different purposes including for tourism, part of this type of environmental flows can be considered as having to do with tourism's demand. The same can also be said for flows of residuals that are

² These are crucial phenomena in the interaction between economy and environment, and energy use in tourism's activity is also one specific topic on which the UNWTO has drawn attention within international discussion on targets and indicators in relation to Sustainable Development Goals. Ecosystem services, as discussed in SEEA EEA, are also of interest for the purposes of MST; the focus of the present discussion paper, however, is on aggregates that are commonly calculated for environmental flows like those mentioned above, the purpose being to start discussion on how to apportion shares of available estimates of those aggregates to tourism.

³ In principle, the extension of tourism statistics' scope from monetary flows like those in TSA: RMF 2008 to cover the interaction between tourism and the natural environment would have to go beyond environmental flows that are taken into account by SEEA-CF, to cover ecosystem services. These may contribute as well to satisfaction of visitors' needs; one example is benefits from tourism activity in protected areas such as national parks. All this is to be taken into consideration in the developmental work on MST, but in the current stage of development and given the experimental character of ecosystem accounting there are some limitations to developing this area for the time being.

generated by production processes (e.g. GHG emissions, solid waste). Concerning flows of residuals that consumers directly cause when they use certain products (e.g. vehicle fuel), visitors are a subset of the users of those products (e.g. when driving their own cars during trips).

The above considerations apply equally to the output of both tourism and other industries. In practice, tourism expenditure represents a significant share of tourism industries' supply⁴, while the main part of other industries' output happens to be purchased for purposes other than tourism⁵. Thus, the size of tourism share of the acquisition of products may vary significantly, between tourism characteristic activities and other industries. For example the tourism share for accommodation services will be significantly higher than the tourism share for sales of fruit and vegetables.

Starting from aggregates included in SEEA-CF physical flow accounts, there is a need to measure suitable shares of those aggregates for allocating them between tourism and non-tourism output. For the purposes of MST, estimates of environmental flows thus assigned to tourism can be linked to monetary aggregates about tourism activity from a tourism satellite account (TSA), e.g. tourism gross value added or production as well as tourism expenditures. This supports integrated consideration of economic and environmental aspects of tourism.

Only direct flows are accounted for in SEEA-CF physical flow accounts, while indirect flows are left aside for modeling exercises. This focus on direct flows corresponds to a similar focus established for monetary flows in the core system of national accounts, as well as in satellite accounts, including TSAs. For example, in the case of flows of natural resource inputs, material flows originating from the natural environment and directly reaching economic units that produce energy (e.g. electricity generators) are accounted for. Then, the use of energy is registered in terms of flows from these energy producers to other economic units. Also, concerning for instance the release of residuals of a given industry, the physical flows directly generated by production processes belonging to the industry are accounted for; the flows of emissions indirectly caused e.g. as side-effects of production of goods that are used in the industry as intermediate consumption are not registered. Nevertheless, the latter emissions may be assessed through modeling, based on information from SEEA-CF physical flow accounts and other sources.

Apart from technical aspects that may be at the origin of this approach, it is worth noting that the national accounts are supposed to serve different potential users. By recording only direct flows, it is possible to develop any type of complex analysis. As a matter of fact, this is possible because direct flows just describe straightforward facts. The recording of indirect flows requires making additional assumptions and the resulting estimates are likely to be suitable only for specific potential uses.

3. From SEEA-CF physical flow accounts to extended tourism satellite accounts

According to SEEA-CF, natural inputs are physical flows that enter the economic system from the natural environment and are directly used by enterprises through production processes; these flows include natural resource inputs like e.g. mineral and energy or biological resources, as well as other natural inputs like e.g. inputs from soil. Residuals are physical flows that are caused by both enterprises and households and they take place as a result of production, accumulation or consumption processes; important examples in this respect are, as already mentioned, physical flows of GHG emissions, wastewater and solid waste. Flows of both natural inputs and residuals, as defined in SEEA-CF, can take place in relation to tourism activity. They are to be taken into account as appropriate in the statistical framework for MST, through approaches that allocate them to tourism's activity⁶.

⁴ IRTS 2008, paras. 5.10-5.11 and 5.18.

⁵ Anyway international comparability of tourism is recommended with limitation to tourism characteristic products and related activities (IRTS 2008, para. 5.9). This might be considered also when discussing issues related to tourism shares of environmental flows.

⁶ If analysis were extended beyond SEEA-CF's scope by considering the whole set of human activities that generate tourism-related environmental flows, tourism could not be investigated just according to a supply-use scheme. Rather, a functional perspective would be useful, focused on consideration of a full range of visitors' activities and on different ways in which visitors needs are satisfied, including e.g. walking in the wilderness. Indeed, benefits accruing to visitors from (non-produced) ecosystem services are also of interest for consideration in the statistical framework for MST. However, this is out of scope in the present paper.

From an economic perspective, tourism's activity encompasses production and consumption activities. Tourism, in fact, takes place when visitors satisfy their needs through the acquisition of goods and services, which in turn are supplied by different industries producing them, including both tourism characteristic activities and other industries. From the supply side, any output - of all industries - may be involved in tourism's activity to the extent that the same output is consumed by visitors. Tourism shares of output may be large or small depending on the industry, large shares being typical of tourism industries.

In relation to tourism shares of output, there is a need to measure corresponding environmental flows. To that end, the ideal would be direct collection of environmental data related to tourism activities, following SEEA-CF accounts' structures, perhaps with enhanced detail as appropriate. However, it seems to be not realistic to envisage such an exercise at this stage, at least on a regular basis within official statistics.

Since tourism is in principle a subset - in terms of output purchased - of the same industries to which natural inputs and residuals are allocated within environmental-economic accounts, it is considered that, starting from estimates of environmental flows obtained from SEEA-CF accounts and by applying suitable ratios to such estimates, proper shares of the environmental flow estimates could be derived for apportioning specifically to tourism.

The ratios could be in terms of relevant monetary aggregates, e.g. production values as well as consumers' expenditures on certain products; the variables actually entered in the ratios would depend also on availability of data. Ideally, for the derivation of tourism shares, monetary aggregates on the supply side would be broken down - following TSA: RMF 2008 - by both industry and product item. For each industry, the ratio would be derived by dividing the measure of output matching tourism's demand by total industry output. In the case of consumer's expenditures, the numerators and denominators would refer to expenditures for tourism purposes on a given product and to total product expenditure respectively.

Conceptually, these procedures are possible because both the flows of natural inputs and residuals as estimated within SEEA-CF physical flow accounts and the flows of tourism output and expenditure following the TSA: RMF 2008 are compiled by industry or product item, and the underlying classifications used for industries and for products are the same. Indeed, both accounting frameworks are linked to the classifications used for the supply-use tables in core national accounts (SUTs). Thanks to this, links between environmental flows and TSA: RMF 2008 monetary aggregates that measure e.g. tourism expenditure or production matching tourism's demand can be established.

The typical measurement challenge would be then as follows. With reference to a given industry, one would have to measure, for each of the environmental flows commonly associated to that industry's production, the part that can meaningfully be assigned to the output directly purchased for tourism purposes (as far as both use of natural inputs and generation of residuals are concerned⁷). In the case of certain products, flows of residuals are generated also at the stage of their use by visitors⁸; these residuals are embedded in environmental flows attributed to households in SEEA-CF physical flow accounts, where they are associated to households' expenditures for the acquisition of those products. In relation to these residuals, which add to those that can be attributed to the industry providing the product, one would have to measure, starting from estimates available from SEEA-CF physical flow accounts, the part that can be assigned to visitors and meaningfully associated to specific visitors' expenditures.

The rationale for this articulation of tourism's environmental flows reflects the fact, already highlighted in general, that natural inputs are used and residuals are generated by production processes and additional residuals are generated by consumers when using certain products.

In practice, the determination of ratios for calculating shares for tourism according to the rationale described above may be complicated by a number of issues, mainly depending on available data.

⁷ It's worth noting that e.g. waste arising from visitors staying in hotels would be associated to the accommodation industry.

⁸ One example, recalled before, is air emissions caused by visitors through the use of vehicle fuel for their trips.

4. Aligning the level of industry and product detail in TSA: RMF 2008 and SEEA-CF accounts

Generally speaking, beyond what has been considered in the previous paragraph on conceptual grounds, it should be noted that in practice there might be differences in the level of industry and product detail between TSA: RMF 2008 and SEEA-CF accounts actually in place. Due to this, some work would likely be required in order to align break-down of data in these accounts in a way that facilitates the derivation of proper tourism shares of environmental flows starting from estimates obtained from SEEA-CF accounts.

As far as the implementation of the TSA: RMF 2008 is concerned, it is noted that when statistical offices start developing TSAs as part of their national accounting work - as normally seems to be the case - it may be the case that no new collection of basic data is launched for that specific purpose. Therefore, certain components of the TSA: RMF 2008 will need to be estimated mainly by using data available from national accounting databases, and incorporating information derived from business surveys, travel surveys, and administrative data sources.

However, the break-down by industry of output data in the core national SUTs may not be sufficient for the purposes of compiling production accounts of tourism industries according to TSA: RMF 2008. On the other hand, perhaps information on full-time equivalent jobs might be available with a detail by economic activity more suitable than the SUT production values⁹. Considering that this variable is a measure of labour input, then one possible option for filling gaps concerning output values that are missing for certain tourism activities could be to use ratios of full-time equivalent jobs. Such an approach was experimented, for example, in a pioneering work developed in Italy in 2012¹⁰. This procedure, and related approaches using labour input measures, imply the assumption that labour productivity does not vary from one activity to another within a given industry¹¹. Where labour productivity does vary significantly these procedures will be less appropriate.

Also, TSAs may be incomplete to the extent that while estimates of tourism demand for the various products are available at a detailed level, tourism shares of the various industries' supply of each product have not been calculated. In these cases, in order to allocate tourism expenditure on a given product to the different industries, one option could be to distribute it to industries in proportion to each industry's supply of the same product. In other words, for each particular product, the ratio of tourism expenditure to its total supply (the tourism commodity ratio) would be applied to the same-product component of industries' output. Commodity ratios have been applied e.g. by Statistics Canada¹². The implicit assumption is that for a given product purchased for tourism purposes but supplied by different industries, the distribution of expenditures among those made for tourism purposes and non-tourism purposes does not vary by industry.

Also the way SEEA-CF accounts are implemented and the stage of actual development of the same accounts at a given point in time have an impact on their industry and product level of detail and on the alignment of the latter with TSA: RMF 2008 accounts' own level of detail. While this is an issue beyond the scope of the present paper, the point here is that having a similar break-down for SEEA-CF environmental flow data and TSA: RMF 2008 data would be a prerequisite for being able to derive proper tourism shares of environmental flows through apportioning procedures.

5. Main dimensions to be considered and possible ways to allocate shares of environmental flows to tourism

Ideally, with TSAs and SUTs in place, available data on output of both tourism characteristic activities and other industries would be cross-classified by product and industry.

⁹ This national accounting aggregate is defined in terms of total hours actually worked by all employed persons divided by the average number of hours actually worked in full-time jobs (SNA para. 19.43).

¹⁰ Massimo Anzalone: "La valutazione della sostenibilità del turismo: proposta di realizzazione di una contabilità integrata di tipo ibrido turismo-ambiente", PHD dissertation, 2012, Studiorum Universitas Messinae, Italy.

¹¹ It is also worth noting that the number of full-time equivalent jobs - which is an accurate way of quantifying labour force - may be the best option available among potential proxies of production. Furthermore, calculations assuming constant labour productivity would probably be made only for a limited number of tourism industries.

¹² See Demi Kotsovos: "Towards sustainable tourism indicators: Linking the Canadian Tourism Satellite Account 2012 with the Canadian System of Environmental-Economic Accounts", paper presented at the 14th Global Forum on Tourism Statistics, Venice, Italy, 2016.

The industry / product dimension is the first element to consider when reflecting on ways for allocating SEEA-CF estimates of environmental flows to tourism. The focus on industries leads to specifically consider output / intermediate consumption / value added as dimensions of interest in the discussion of possible allocation procedures. Since these aggregates are measured in monetary units, prices and quantities are other dimensions to be considered. It is noted that the focus on industries and products points to the importance of production processes in the assessment of allocation methods, because of specificities and differences that are linked to technological and other practical aspects of supply.

Using output to allocate environmental flows

On conceptual grounds, there is a good argument for linking environmental flows to production processes and thereby for allocating these flows to different industries in proportion to output. The argument is twofold: 1) industries' output is obtained as a result of production processes at the same time that use of natural resources and generation of residuals take place as direct inputs or side-effects; 2) the link between production and natural inputs or side-effects on the natural environment is relevant, for the purposes of allocating environmental flows to tourism, first of all because of the physical reality of this connection.

In the light of the above, it is proposed that the estimate of environmental flows for tourism be derived as the ratio of the tourism share (in value) to the total output (in value) of a given industry, known as the tourism output ratio, multiplied by estimates of total environmental flows as recorded for the same industry in SEEA-CF accounts.

Though the breakdown by industry ideally would be the same for estimates of both SEEA-CF environmental flows and TSA: RMF 2008 output values, most probably this is not exactly the case at the initial stages of development of TSA: RMF 2008 and SEEA-CF accounts. Also, as noted in the previous section concerning tourism industries, their breakdown may or may not coincide with industry breakdown in available SUTs; in certain cases a given tourism characteristic activity may be made up of several activities in terms of the industrial classification adopted in the supply-use table of a given country, while another tourism industry may be a subset of a certain industry. It will be necessary to establish appropriate alignment across the different accounts in terms of industry detail.

Table 1 provides an example of the approach based on output ratios. Elements of a hypothetical TSA and SEEA-CF air emissions accounts are combined in a unique picture, with a common break-down by industry assumed to be available for TSA and SEEA-CF data. The figures are intended to be quite realistic. For sake of simplicity, only three tourism industries and one pollutant are shown. The section "Other industries" is shown for completeness. The table is self-explaining; in particular, columns 3 and 5 show the way calculations are made. The figures shown in this and in other tables from now on are consistent across the different methods.

In Table 1, with reference for example to industry "i1_3", starting from an estimate of total CO₂ emissions equal to 1272700, available from the SEEA-CF Air emissions account, a tourism share of CO₂ emissions amounting to 297764 is obtained by multiplying 1272700 by the output ratio 0.23 derived from the TSA Table 6. This tourism share of CO₂ emissions (297764) is attributed to the tourism characteristic activity "Accommodation for visitors", which includes also two other industries, namely "i1_1" and "i1_2".

Table 1. How to allocate environmental flows to tourism - an example of application of output ratios

TSA - Table 6 - industries' output					SEEA-CF - Air emissions account -	Tourism share of CO ₂ emissions
Industries		Total output (at basic prices)	Tourism share (in value)	Output ratio	Total CO ₂ emissions released to the environment by industries	Tourism share of CO ₂ emissions released to the environment by industries (in tonnes)
headings	ISIC items	(1)	(2)	(3) = (2)/(1)	(4)	(5) = (4)*(3)
- Tourism industries -						
1. Accommodation for visitors	i1_1	44000	43200	0.98	910200	893651
	i1_2	23900	21600	0.90	492100	444743
	i1_3	79500	18600	0.23	1272700	297764
...
5. Water passenger transport	i5	13600	3800	0.28	22003800	6148121
...
10. Sports and recreational industry	i10_1	400	300	0.75	736900	552675
	i10_2	6300	6100	0.97	51800	50156
	i10_3	14300	12100	0.85	326800	276523
- Other industries -						
...

As previously anticipated, since figures used for numerators and denominators in output ratios are monetary aggregates, also a prices / quantities dimension appears to be relevant in this discussion. When considering the use of output ratios, indeed, one should also be aware about price levels that might differentiate purchases made for satisfying visitors' needs as compared to corresponding non-tourism expenditure, provided that significant differences actually occur with respect to this¹³.

Since these ratios are derived in terms of output, an assumption implicit in these ratios is that the amount of environmental flows per unit of output is the same for production processes from which generate output for tourism demand and for all other outputs.

At least for tourism characteristic industries, a significant share of supply is represented by products that are purchased for satisfying visitors' needs and, correspondingly, the great majority of production processes are linked to tourism's demand¹⁴. Empirical findings suggest that output ratios for characteristic industries are likely to be greater than 70%. In the Italian work mentioned in a previous footnote, for example, these ratios turned out to be greater than 80% for five tourism industries, while similar indications arise from the work recently developed at Statistics Canada. Because of this, the above implicit assumption probably would not affect remarkably the quality of estimates for tourism characteristic activities¹⁵.

¹³ The existence of differences may depend very much on countries' specificities. In certain countries, for instance, the cultural activities or the food and beverage-serving industry may be examples where prices may differ between visitors and locals. Quantifying these differences for statistical purposes may be a very complex task.

¹⁴ It's worth recalling that a given economic activity is identified as a tourism characteristic activity in as much as it typically produces tourism characteristic products (TSA: RMF 2008, para. 3.8). Furthermore, a given product is identified as a tourism characteristic product if it satisfies one or both of two criteria, one of which is known as the share-of-supply condition: tourism expenditure on the product should represent a significant share of the supply of the product in the economy (IRTS 2008, para. 5.10). On conceptual grounds, this is behind the statement made in the text.

¹⁵ Implicit assumptions may be there also in calculations of environmental flows themselves, within environmental-economic accounting. Such an issue is not discussed in the present paper. Concerning calculations in focus here, also further developments in environmental statistics/ accounts could be crucial for the possibility of reducing the number of assumptions, thus refining estimates.

Further implicit assumptions could exist depending on the way TSAs have been compiled. For instance - just to recall an example made before - there might be some production estimates that have been derived by applying full-time equivalent job ratios to an output aggregate, implicitly assuming constant labour productivity across different activities within a given industry. If this was assumed, the implications for the corresponding estimates of tourism environmental flows would be that the latter would be linked to production not directly but via full-time equivalent jobs, thus being even less accurate because differences in labour productivity across the industry would be ignored.

The above considerations on possible implicit assumptions would be in principle particularly relevant as concerns industries other than tourism characteristic activities, because for these non-tourism industries products matching tourism's demand represent a minor part of total supply and the same holds for corresponding production processes. When output ratios are applied to environmental flows for non-tourism industries, then, the implicit assumption of an equal amount of environmental flows per unit of output - i.e. the same for both the tourism share and the rest of the output - might have an impact on the quality of estimates. Nevertheless, if the tourism output ratio is relatively small, then the effect of this assumption on the overall estimate of the tourism-related environmental flow - i.e. concerning tourism and non-tourism industries as a whole - is likely to be small.

Using gross value added to allocate environmental flows

Where output ratios are not available because TSAs are incomplete and, in particular, if tourism expenditure data is not available by industry while tourism shares of gross value added are, one can try to apply gross value added ratios to available environmental flow estimates in order to apportion the latter to tourism. The use of such ratios has been tested by Statistics Canada for tourism industries¹⁶.

In principle, while it makes sense to distinguish a share of total output for a given industry in terms of products matching tourism's demand, a similar separation cannot be thought for gross value added. This is because, while gross value added represents economic performance of the production process as a whole, no specific reference exists to individual products. Actually, in the core national accounts, gross value added is never calculated with reference to particular products within the output of a given industry.

Nevertheless it is possible to attribute shares of gross value added to tourism by industry and with a view to allocating environmental flows, but one must assume that "the share of industry value added directly attributable to tourism equals the share of industry gross output due directly to tourism", as it is argued for the Canadian work referred to above.

Indeed, as has already been recalled, for most tourism characteristic activities the majority of supply corresponds to products matching tourism's demand, which implies quite high output ratios; this, in turn, means that gross value added ratios may turn to be suitable substitutes for output ratios.

The approach based on gross value added ratios is shown in Table 2.

¹⁶ See the paper mentioned in a previous footnote.

Table 2. How to allocate environmental flows to tourism - an example of application of gross value added ratios

TSA - Table 6 - industries' gross value added					SEEA-CF - Air emissions account -	Tourism share of CO ₂ emissions released to the environment by industries (in tonnes)
Industries		Total gross value added (at basic prices)	Tourism share (in value)	Gross value added ratio	Total CO ₂ emissions released to the environment by industries	Tourism share of CO ₂ emissions released to the environment by industries (in tonnes)
headings	ISIC items	(1)	(2)	(3) = (2)/(1)	(4)	(5) = (4)*(3)
- Tourism industries -						
1. Accommodation for visitors	i1_1	24864	24593	0.99	910200	900305
	i1_2	9541	8623	0.90	492100	444749
	i1_3	69571	16277	0.23	1272700	297764
...
5. Water passenger transport	i5	4238	1882	0.44	22003800	9770808
...
10. Sports and recreational industry	i10_1	190	121	0.64	736900	469583
	i10_2	1540	1492	0.97	51800	50189
	i10_3	6802	5873	0.85	326800	282179
- Other industries -						
...

One peculiar case is that of the tourism characteristic activity “Water passenger transport”. It is a subset of the industry referred to as “i5” in the example, whose total output includes other products in addition to water passenger transport services, among which freight transport services. The gross value added ratio is quite low (0.44) and is also quite different from the corresponding output ratio calculated for the same industry (0.28), shown in Table 1. This peculiarity is consistent with one point highlighted before, when it has been argued that gross value added ratios similar to corresponding output ratios most probably can be observed when output ratios are high.

As concerns the prices / quantities dimension of allocation mentioned above with reference to output aggregates, a similar issue cannot be raised with value added aggregates because of the very nature of value added. As a matter of fact, while it is obvious that subsets of total output can be distinguished (including, potentially, corresponding prices and quantities) depending on who is the consumer, i.e. whether a visitor or not, the same is not possible for value added.

Concerning industries other than tourism characteristic activities, the risk is high that gross value added ratios would not be suitable substitutes for output ratios. It seems to be clear, therefore, that it is output ratios that should be used for apportioning environmental flows to tourism.

To complete what has been argued so far, it is also to be noted that one more assumption would be implicit in calculations for allocating environmental flows to tourism if, as discussed before, tourism commodity ratios had been applied to specific-product components of the output of “Other industries” for determining their tourism shares. In these cases, it would be implicitly assumed that the tourism share of each product’s supply is the same across different industries. This would, in turn, have the effect that the estimates of tourism-related environmental flows might be further biased because in the reality the tourism share of a given product supplied by several industries may vary significantly among those industries.

Using intermediate consumption to allocate environmental flows

One way of improving the relevance in the use of tourism ratios is to consider using different approaches for the allocation of different types of environmental flows to tourism. First of all, a distinction could be made between use of natural inputs and generation of residuals. Then, as concerns industries' environmental flows, ratios in terms of intermediate consumption could be applied in calculations concerning the use of natural inputs, e.g. flows of energy from natural inputs or flows of abstracted water. This would be based on the consideration that these are inputs to production processes and their market value contributes to determining the value of intermediate consumption itself¹⁷. Of course, it makes sense to think about using such a method to the extent that output and intermediate consumption ratios would actually be different, which would depend on how they would have been calculated¹⁸.

Table 3 provides an example of intermediate consumption ratios applied to inputs of energy from renewable resources for obtaining tourism shares of energy use¹⁹. With reference to a given industry, for example, the use of energy from natural inputs (measured in physical terms) could be allocated to tourism by applying ratios between tourism shares of intermediate consumption (in value) and the total value of intermediate consumption - derived from TSA: RMF 2008 accounts - to estimates available from SEEA-CF physical flow accounts for energy.

Table 3. How to allocate environmental flows to tourism - an example of application of intermediate consumption ratios

TSA - Table 6 - industries' intermediate consumption					SEEA-CF - Physical supply table for energy - Flows from the environment - Inputs of energy from renewable sources	SEEA-CF - Physical use table for energy - Inputs of energy from renewable sources - intermediate consumption			Tourism share of use of inputs of energy from renewable sources (in joules)
Industries		Total intermediate consumption (at purchasers' prices)	Tourism share (in value)	Intermediate consumption ratio		...	Electric power generation, transmission and distribution	...	
headings	ISIC items	(1)	(2)	(3) = (2)/(1)		(4)	(5)	(6) = (5)*(3)	
- Tourism industries -					$403229 * 10^{12}$	- Tourism industries -			
1. Accommodation for visitors	i1_1	19136	18607	0.97		...	$20831 * 10^{12}$	...	$20255 * 10^{12}$
	i1_2	14359	12977	0.90		...	$4406 * 10^{12}$	...	$3982 * 10^{12}$
	i1_3	9929	2323	0.23		...	$655 * 10^{12}$	...	$153 * 10^{12}$
...
5. Water passenger transport	i5	9362	1918	0.20		...	$78 * 10^{12}$	...	$16 * 10^{12}$
...
10. Sports and recreational industry	i10_1	210	179	0.85		...	$175 * 10^{12}$	...	$149 * 10^{12}$
	i10_2	4760	4608	0.97		...	$2046 * 10^{12}$	...	$1981 * 10^{12}$
	i10_3	7498	6227	0.85		...	$1144 * 10^{12}$	...	$950 * 10^{12}$
- Other industries -						...	...	...	...
...

Flows of energy from renewable sources are shown in Table 3 as supplied by the natural environment (column 4) and used by the industry "Electric power generation, transmission and distribution". It is, in fact, through this industry that physical flows of energy are made available for use, in turn, as intermediate consumption of other industries, as shown in column 5. Starting from the figures reported in the latter column, the tourism shares of energy use are derived by applying the intermediate consumption ratios (column 3).

¹⁷ It's worth noting that taking into account intermediate consumption can be seen as being in line with understanding tourism supply as the direct provision to visitors of the goods and services that make up tourism expenditure (paras. 6.2 and 5.2 of IRTS 2008), as the intermediate consumption considered here contributes to determine the value of the output of productive activities serving visitors and in direct contact with them.

¹⁸ TSA: RMF 2008 does not provide strong recommendations about how to calculate tourism shares of intermediate consumption (para. 4.56).

¹⁹ In the case of intermediate consumption of inputs of energy from renewable resources, in addition to what is argued in the preceding footnotes concerning intermediate consumption in general, it is noted that the national accounting principle of registering direct flows would be followed by describing the full articulation of the relevant (direct) flows, i.e. from the natural environment to the industry that extracts the natural inputs and from this industry to productive activities serving visitors and in direct contact with them.

In this case, the implicit assumption would be that, for a given industry, the amount of energy per unit of intermediate consumption would be the same for products matching tourism's demand and for other products. Again, as discussed before, the impact of such an assumption on the quality of estimates might be different for tourism and for other industries, depending on the mix of production processes used in different industries.

Allocating environmental flows for visitors

As anticipated above, in addition to environmental flows to be assigned to tourism industries and other industries directly serving visitors' needs, there are others embedded in environmental flows attributed to households in SEEA-CF physical flow accounts that should be assigned to tourism in order to complete the picture, namely the air emissions directly generated by visitors during their trips through the use of vehicle fuel that they purchase. These emissions, in fact, are environmental flows other than those generated in the production process of which the same vehicle fuel is the output.

Beyond the use of vehicle fuel, it is noted that the use of other products may generate flows of solid waste possibly to be taken into account. For these, a distinction would have to be made between flows that visitors generate e.g. when staying in a hotel and when visiting a wild area. It is considered that in the first case no further amount would have to be registered in addition to what is already accounted for as a side-effect of the production process in the accommodation industry; in the second case, instead, the flows generated by visitors would have to be registered, but further development of ecosystem accounting would be needed for that²⁰.

In general, for identifying tourism shares of environmental flows attributed to households in SEEA-CF physical flow accounts, i.e. residual flows due to visitor activity that are not attributed to industries, the relevant products would need to be carefully identified like in the case of vehicle fuel mentioned above. In principle, the products at issue could be identified among tourism connected products and non-tourism related consumption products.

Once the relevant products are identified, for allocating environmental flows to visitors, one possible option would be to focus on expenditures carried out by households and by visitors for the acquisition of those products and to establish expenditure ratios for apportioning corresponding environmental flows specifically to tourism. In the expenditure ratios visitors' expenditures and households' expenditures would be the numerators and denominators respectively. Visitors are in fact a subset of final consumers within the household institutional sector.

On conceptual grounds, it makes sense to use consumption expenditure ratios for calculating the flows of residuals directly caused by visitors, because what matters is the connection between residuals and the amounts of products from which they originate as a result of the use of those products. These amounts would be measured in monetary terms and, as mentioned before, prices levels might be an issue if non trivial differences can be observed between prices paid by visitors and by locals. A fine tuning of the allocation of residuals to visitors could probably be obtained by complementing information coming from TSAs with other more detailed tourism statistics.

Additional considerations

The discussion above suggests, and the example of energy use emphasizes that, in general, different types of environmental flows would require different treatments. Methods for apportioning SEEA-CF estimates to tourism as discussed above perhaps could be better tailored in some way, for example according to whether the use of energy or the generation of solid waste residuals is to be allocated to tourism.

A way forward would be to consider, for each type of environmental flow, first whether they would be better allocated to tourism in proportion to the output or to the intermediate consumption of the various industries, provided that output ratios are actually not identical to intermediate consumption ratios. Then, going on with a more in depth analysis according to the articulation of environmental flow categories, methods for assigning each

²⁰ As highlighted before, interactions between visitors and the natural environment such as those linked to enjoying amenities of a beach or a natural park, from which benefits arise to visitors from ecosystem services, are also to be taken into consideration in the developmental work on MST. As already mentioned, these aspects are not discussed at this stage also because of the experimental character of ecosystem accounting.

category to tourism would be developed case by case, based on the whole set of information available. In this way, assumptions on how tourism consumption affects each industry would be as accurate as possible and, overall, making the measurement of tourism shares of environmental flows more precise.

As has also emerged from the discussion above, one step forward towards a proper articulation of methods for allocating environmental flows to tourism would be, wherever possible and depending on available information, to go beyond the consideration of tourism consumption expenditure as a whole. Type of product may be a relevant dimension to be taken into account, then, to assign environmental flows to tourism. Of course, specific information that can be traced to individual items of tourism consumption would then be needed.

The articulation of tourism in different forms as highlighted in TSA: RMF 2008²¹ is another critical point as far as environmental flows are concerned. A specific focus on this aspect would suggest that the international / domestic dimension should be taken into account carefully in methods for assigning environmental flows to tourism. In particular, a focus on outbound tourism's activities and outbound tourism consumption might suggest issues deserving further reflection.

A further relevant dimension is the national / destination level, which is one aspect of specific interest in the measurement of tourism in a sustainable development perspective. While ideas like those put forward above do fit with a national focus, further reflection is needed to consider how TSA: RMF 2008 and SEEA-CF guidelines might be adapted in a way that measurement methods following those principles can be suitably applied at the destination level.

A more general issue concerns environmental flows indirectly caused by tourism demand, which also are of interest in the framework of MST, beyond those taken into account as direct effects of tourism' activity. However, it is clear that by combining data from satellite accounts such as TSA: RMF 2008 and SEEA-CF accounts it would be possible also to arrive at some measure of the indirect effects at issue only if some modeling is developed based and that information.

6. Concluding remarks

The discussion developed in the previous sections is centered on information that can be derived by combining TSA: RMF 2008 and SEEA-CF accounts. It is assumed, in general, that these statistical standards are both implemented and, at least, the main aggregates of tourism and environmental satellite accounts are already available. However, while the role played by TSA: RMF 2008 for the purposes of MST is in the first instance relevant on conceptual grounds, it cannot be assumed that TSAs are already in place when statistical offices start setting up statistical systems for measuring tourism from a sustainable development perspective. The same can also be said for SEEA-CF physical flow accounts²².

Going further along these lines, it is noted that work would need to be undertaken to determine also how estimation can take place in the absence of important elements of TSA: RMF 2008 and SEEA-CF accounts or even when such accounts are not in place at all.

In particular, as far as methods for apportioning environmental flows to tourism are concerned, it is stressed that there could be situations, within work for the compilation of TSAs, in which it might be necessary to partition certain national accounting data for determining, for example, the size of tourism industries in terms of total output or the size of product-components within other industries. In these cases, the methods used would have an impact on apportioning procedures used for environmental flows, including on assumptions that may be implicit in those procedures, all considered.

The scope of the measurement task as discussed so far with reference to environmental flows caused by industries includes both tourism characteristic activities and other industries, because in principle tourism's activity is part, from the supply side, of all industries. Since, however, tourism shares of output are very much

²¹ See Figure 2.1 in TSA: RMF 2008.

²² The issue of aligning the level of industry and product detail in TSA: RMF 2008 and SEEA-CF accounts has been touched in particular in section 4, taking also into account some difficulty in the implementation of TSA: RMF 2008. Furthermore, the importance of the way TSA: RMF 2008 is implemented has been highlighted when discussing ratios to be used for apportioning environmental flows specifically to tourism.

larger in tourism industries than in other industries, it could be recognized that focusing on environmental flows caused by tourism characteristic activities would be an acceptable objective for the time being.

One merit of using methods like those discussed in the present paper is the fact that a systems based approach is followed. Furthermore, these methods have the advantage of being relatively straightforward to implement. Possible estimation methods as alternatives to satellite accounting exercises are likely to be much less cost-effective, while, as highlighted before, direct collection of environmental data related to tourism activity most probably would not be an option.

It is recognized, nevertheless, that statistical information more detailed than that available from standard TSA: RMF 2008 and SEEA-CF accounts may be needed in order to refine apportioning procedures based on the use of satellite accounts data.

Within the methods for apportioning environmental flows as discussed above, the soundness of using ratios such as output ratios and intermediate consumption ratios is quite high in principle, while the use of each type of ratio should be decided depending on the type of environmental flow to be apportioned. In general, it seems that the use of these ratios is to be recommended.