

Annex 1: Implications of the approaches on the management of forest resources

The present IPCC default, *stock-change*, *production*, and *atmospheric-flow* approaches all give similar results for national CO₂ emissions inventories when wood is produced and consumed domestically, although the IPCC default approach does not reflect the long-term storage of carbon in wood products.

If wood is traded, this picture changes. In the *atmospheric flow* approach, gross emissions from imported wood appear in the accounts of the importing country. The *stock-change* and *production* approaches differ in that the storage of C in the long-lived wood products traded appears in the consuming country under the *stock-change* approach, but in the producing country under the *production* approach.

The amount of roundwood traded globally is a small fraction - less than 5% - of the total global production. But a substantial proportion of products are imported and exported; these include; sawn goods (about 30%), plywood and veneer sheets (about 35%), particle board (about 22%), fiberboard (about 25%) paper and paperboard (about 25%). Global production of roundwood totals 3.4 billion m³, of which a 120 million m³ of roundwood is traded. This factor may be more important for some specific countries or for the Parties to specific projects which involve trading of wood products.

The disadvantage of the present IPCC default approach is that it fails to capture the possibility that the carbon storage in wood products may change with time, although it does report changes in carbon storage in above-ground biomass and soils in the forest. The IPCC default approach also acknowledges the benefits of using imported wood to displace use of fossil fuels. The *atmospheric-flow* approach does not provide this incentive for the displacement of fossil fuels, it only provides an incentive if wood is harvested sustainably, and if this wood is used domestically to displace fossil fuels .

A simple way to differentiate among the four approaches for the allocation of CO₂ emissions is to examine the consequences on the emissions accounts of two hypothetical countries. In Table A1-1, we use 12 simple scenarios to illustrate how emissions are reported when wood products are produced and traded between these two countries. There are four scenarios each to represent situations when forest is sustainably managed, harvested without replacement, or harvested even as forests expand. Note, that for every scenario the *atmospheric flow*, *stock-change*, and *production* approaches report the same total of net emissions to the atmosphere; but that these emissions are allocated differently between countries A and B. Whenever long-lived wood products are produced, the IPCC default approach reports larger net emissions than do the three approaches that acknowledge carbon-stock changes in wood products. The *stock-change* and *production* approaches give identical results for all scenarios involving short-lived products and biofuels and differ only when long-lived wood products are traded. The *production* approach counts the accumulation of long-lived products in the country where the wood was grown, the *stock-change* approach in the country where the wood products are in use. Several examples are given below and in Table A1-1 on the implications of approaches on the management of forests:

Sustainable forest management

Case 1: Country A manages its forest with no net carbon stock changes and exports 1 unit of harvested wood to country B where it is: (case 1.1) burned to produce energy or used as a short-lived product with immediate oxidation, or (case 1.2) put into long-term storage, so that wood product stocks increase by 0.5 unit (there is an assumed oxidation rate from these stocks of 0.5 units). Country B has no forest.

Case 2: Country A manages its forest with no net carbon stock changes and uses 1 unit of harvested wood itself either: (case 2.1) to produce energy or short-lived products with assumed immediate oxidation, or (case 2.2) to produce long-lived products, so that wood product stocks increase by 0.5 unit.

Deforestation

Case 3: Country A harvests its forest without regrowing it (deforestation) and exports 1 unit of harvested wood to country B where it is: (case 3.1) burned to produce energy or used as a short-lived product with immediate oxidation, or (case 3.2) put into long-term storage so that wood product stocks increase by 0.5 unit.

Case 4: Country A harvests its forest without regrowing it (deforestation) and uses 1 unit of harvested wood itself either: (case 4.1) to produce energy or short-lived products with assumed immediate oxidation, or (case 4.2) to produce long-lived products, so that wood product stocks increase by 0.5 unit.

Afforestation

Case 5: Country A manages and expands its forest with an increase of 1 unit in carbon stock (afforestation) and exports 1 unit of harvested wood to country B where it is: (case 5.1) burned to produce energy or used as a short-lived product with immediate oxidation, or (case 5.2) put into long-term storage, so that wood product stocks increase by 0.5 unit.

Case 6: Country A manages and expands its forest with an increase of 1 unit in carbon stock (afforestation) and uses 1 unit itself either: (case 6.1) to produce energy or short-lived products with assumed immediate oxidation or, (case 6.2), to produce long-lived products, so that the wood product stocks increase by 0.5 unit.

The above case studies show how approaches can influence incentives for improved carbon management. Such incentives can be an important criterion when selecting an approach for GHG accounting. The implications of the approaches on the management of forest resources are shown in Table A1-2. The examples in this table are illustrative and may not be comprehensive. They compare the present IPCC, *stock-change*, *production*, and *atmospheric-flow* approaches with respect to the incentives they may provide for:

- preservation of forest carbon stocks;
- impact on deforestation;
- long-term storage of carbon in wood products;
- substitution of fossil fuels with biofuels;
- importation and exportation of sustainably grown wood.

Table A1-1. Country case studies: credits and debits for CO₂ emissions with different accounting approaches

Case	IPCC default approach			Stock-change approach			Production approach			Atmospheric-flow approach		
	Country A	Country B	A+B	Country A	Country B	A+B	Country A	Country B	A+B	Country A	Country B	A+B
1.1	0	0	0	0	0	0	0	0	0	+1	-1	0
1.2	0	0	0	0	+0.5	+0.5	+0.5	+0	+0.5	+1	-0.5	+0.5
2.1	0	----	0	0	----	0	0	----	0	0	----	0
2.2	0	----	0	+0.5	----	+0.5	+0.5	----	+0.5	+0.5	----	+0.5
3.1	-1	0	-1	-1	0	-1	-1	0	-1	0	-1	-1
3.2	-1	0	-1	-1	+0.5	-0.5	-0.5	0	-0.5	0	-0.5	-0.5
4.1	-1	----	-1	-1	----	-1	-1	----	-1	-1	----	-1
4.2	-1	----	-1	-0.5	----	-0.5	-0.5	----	-0.5	-0.5	----	-0.5
5.1	+1	0	+1	+1	0	+1	+1	0	+1	+2	-1	+1
5.2	+1	0	+1	+1	+0.5	+1.5	+1	0	+1.5	+2	-0.5	+1.5
6.1	+1	----	+1	+1	----	+1	+1	----	+1	+1	----	+1
6.2	+1	----	+1	+1.5	----	+1.5	+1.5	----	+1.5	+1.5	----	+1.5

Negative numbers represent a CO₂ source (net emission to the atmosphere)

Positive numbers represent a CO₂ sink (net uptake from the atmosphere)

Table A1-2 (a). Implications of approaches for estimating the fate of carbon from forest harvesting and wood products on the management of forest resources

Possible implications	Default IPCC approach	Stock-change approach	Production approach	Atmospheric-flow approach
Does it promote conservation of forest carbon stocks ?	Yes. Decreased carbon stocks will result in net emissions in the inventory and vice versa.	Yes. Decreased carbon stocks will result in net emissions in the inventory and vice versa.	Yes. Decreased carbon stocks will result in net emissions in the inventory and vice versa.	In general yes, but does not give debits for depleted carbon stocks to the extent that losses in carbon stocks are exported.
What is the implication for deforestation?	Net carbon source is accounted for in the country where deforestation occurs.	Net carbon source is accounted for in the country where deforestation occurs.	Net carbon source is accounted for in the country where deforestation occurs.	Could promote deforestation. If wood from deforestation is exported, a carbon source is accounted for in the importing but not the exporting country.
Does it provide an incentive for the long-term storage of biomass into wood products?	No. Stock change is <u>not</u> captured.	Yes.	Yes, for domestic wood. No, for imported wood.	Yes.
Does it provide an incentive to switch from fossil-fuels to imported biofuels?	Yes. If biofuels are imported, emissions are accounted for in the producing country and not the consuming country.	Yes. If biofuels are imported, emissions are accounted for in the producing country and not the consuming country.	Yes. If biofuels are imported, emissions are accounted for in the producing country and not the consuming country.	No. Emissions are accounted for in the consuming country. (Therefore the importation of biofuels would not be encouraged.)
Trace gases- This depends on whether trace gas emissions from biofuels are greater or less than those emissions from fossil fuels. For all these approaches, trace gas emissions are accounted for in the <u>consuming</u> country.				
Does it provide an incentive to switch from fossil-fuels to domestically-produced biofuels?	Yes, harvest can be balanced by regrowth. All three approaches are equivalent for domestically-grown wood. For the flow approach, an exporting country would benefit by a decrease in national emissions.			

Table A1-2 (b): Implications of approaches for estimating the fate of carbon from forest harvesting and wood products on the management of forest resources (Cont.)

Possible implications	Default IPCC approach	Stock-change approach	Production approach	Atmospheric-flow approach
<p>Does it provide an incentive for the import and export of sustainably-grown wood?</p>	<p>Import/export not captured.</p>	<p>Imported wood is treated in the same way as wood produced within the importing country. Exported wood is treated in the same way as if it were used within the exporting country.</p>	<p>Carbon stocks in imported wood are not counted in the importing country, but in the exporting country. Thus, there is less incentive to import and more incentive to export long-lived wood products than in the IPCC and <i>stock-change</i> approaches. For short-lived products and biofuels, this factor does not apply.</p>	<p>Provides no incentive for imports of sustainably-grown wood. The importing country is allocated the carbon emissions embodied in imported products. Provides incentive to export sustainably-grown wood. The exporting country is assigned a carbon sink equivalent to the carbon embodied in exported products.</p>
<p>Does it provide an incentive to trade biofuels between accounting entities (e.g. countries): are woody and non-woody biomass treated differently?</p>	<p>No.</p>	<p>No.</p>	<p>No.</p>	<p>Yes. Importing accounting entity reports emissions when woody biofuels are burned, but not when other biofuels (e.g., straw) are used.</p>