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Southland Regional Carbon Footprint 2018

Harvest Wood Products & Economic Breakdown

On behalf of Great South

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Executive Summary

Great South is Southland's regional development agency that aims to leverage opportunities for Southland in the areas of economic development, business development, tourism and events, and regional wellbeing. Great South commissioned AECOM New Zealand Limited (AECOM) to assist in the development of the Southland Regional Carbon Footprint for the 2018 calendar year that includes harvesting emissions and emissions by economic sector.

thinkstep-anz (thinkstep) was commissioned by Great South to recalculate the emissions from harvested wood products and the regional split of Southlands emissions into economic sectors.

The methodology to calculate the harvesting emissions is based on PAS2050:2011 (British Standards Institution, 2011). The standard describes two methods. AECOM already calculated the harvesting emissions based on the first method described in PAS2050:2011, chapter 6.4.9.3.1, which treats emissions as single-release, occurring at the start of the 100-year assessment period. This report focusses on the second method, described in PAS2050:2011, chapter 6.4.9.3.2, which delays the release of emissions in line with the lifetime of the products made of the harvested wood. This approach allows a better reflection of the actual emissions from harvested wood products in Southland.

Applying the delayed emissions method results in 1,229,292 tCO₂e of harvesting emissions which is approximately 16% lower than the result based on the single-release method (1,462,133 tCO₂e).

Please note that PAS2050 states that if an organisation wishes to identify the emissions based on the delayed emission method, both outcomes (single-release and delayed emission) shall be recorded together in parallel.

The split of Southland regional emissions into economic sectors has been adjusted to apply a more southland specific split. The emissions used are based on reviewed emissions data from the City Inventory Reporting and Information System (CIRIS), the system AECOM used to collate the greenhouse gas inventory, as outlined in thinkstep's report 'Southland Regional Carbon Footprint 2018 Review' (thinkstep I, 2019). Where no Southland region specific breakdown data was available the national split was used. All applied sources as well as the split into economic sectors and subsectors were confirmed by Great South.

Abbreviations

Term	Definition
AECOM	AECOM New Zealand Limited
AFOLU	Agriculture, Forestry and Other Land Use
CIRIS	City Inventory Reporting and Information System
GPC	Global Protocol for Community Scale Greenhouse Gas Emissions Inventory
HWP	Harvested Wood Products
IPPU	Industrial Processes and Product Use
MfE	New Zealand's Ministry for the Environment
Stats NZ	Statistics New Zealand
WRI	World Resource Institute
CO₂e	Carbon Dioxide-equivalent

Harvest Wood Products (HWP)

Harvested wood products (HWP) include all wood material that leaves harvest sites and constitutes a carbon reservoir. The time carbon is held in products will vary depending on the product and its uses. Fuel wood, for example, may be burned in the year of harvest, and many types of paper are likely to have a use life less than five years, including recycling. Wood used for panels in buildings, however, may be held for decades to over 100 years.

Carbon stored in wood products

In AECOMs summary report for 'Southland Regional Carbon Footprint 2018' (AECOM, 2019) the emission arising from harvested wood product have been presented using the single-release method. thinkstep was commissioned to calculate the delayed emissions arising from harvested wood products (HWP) for a New Zealand specific context in addition to the direct, single-release of harvesting emissions. Both methods are described below.

- a) **Single-release (main) method:** Emissions and removals arising over the life of a product during the 100-year assessment period are included as single-release, as if occurring at the start of the 100-year assessment period. PAS2050:2011, 6.4.9.3.1 (British Standards Institution, 2011).

Harvesting emissions for Southland using the single-release method: 1,462,133 tCO₂e.

- b) **Delayed-release (additional) method:** Emissions and removals arising over the life of a product during the 100-year assessment period are delayed and calculated to represent the weighted average time the emissions are in the atmosphere during the 100-year assessment period. PAS2050:2011, 6.4.9.3.2 (British Standards Institution, 2011). Please note that the delayed-release method can only be used in addition to the single-release method. Both outcomes (single and delayed release) need to be recorded in parallel. Details for the delayed-release method are defined in the following sub-chapters.

Harvesting emission for Southland using the delayed-release method: 1,229,292 tCO₂e.

Delayed/weighted average emissions arising from wood products

PAS2050:2011, Annex E (British Standards Institution, 2011) defines that if an organisation wishes to identify the effect of emissions released over the life of products derived from harvested wood this can be reported in addition to the single-release assessment specified in PAS2050:2011, 6.4.9.3.1 (British Standards Institution, 2011).

Products from wood harvested in New Zealand

To reflect the emissions from wood products harvested in Southland/New Zealand, data from a paper published in the New Zealand Journal of Forestry (Manley, 2017), have been applied. The

paper quantifies the carbon stored in products made from New Zealand wood; used within and exported from New Zealand. The paper analyses the main markets for logs harvested in New Zealand (New Zealand 47%, China 36%, South Korea 9%, India 6% and Rest 2%). For each market the main products (primary and secondary), related volumes (in %), end-use pathways and life span are presented in a material flow diagram. An example is shown in Figure 1 below.

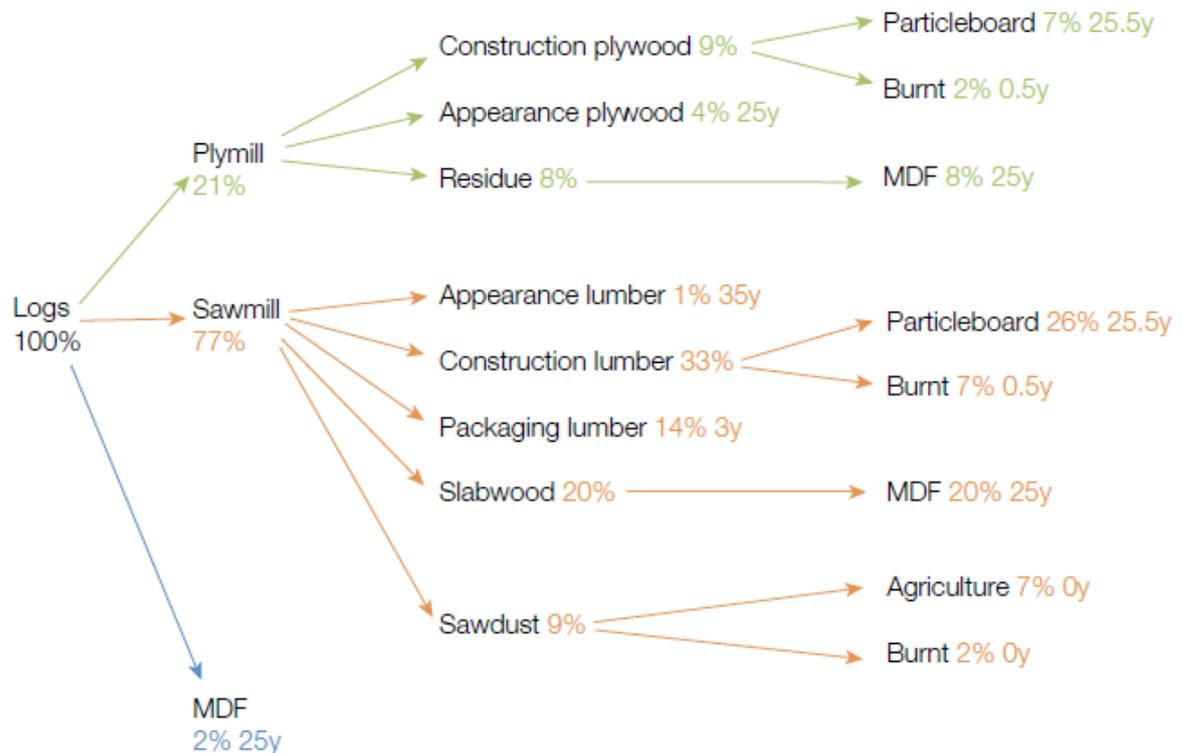


Figure 1: Example outline of material flow for logs exported from New Zealand to South Korea

PS2050:2011 Methodology

The methodology to calculate the delayed emissions arising from wood products is based on PAS2050 Annex E (British Standards Institution, 2011). It defines that where the impact of delayed emission is to be assessed, the emissions arising over the lifetime of the product over a period of more than one year, shall be taken into account using the following formula:

$$FW = \frac{\sum_{i=1}^{100} x * (100 - i)}{100}$$

i = each year in which emissions occur

x = the proportion of total emissions occurring in any year i.

Delayed emissions method applied to harvested wood in Southland

Based on the material flow diagrams provided for each market, weighted average carbon emissions have been calculated. The results have been calculated using a more detailed approach, which releases the emissions separately for each step in the material flow diagram, and a simplified approach, which releases all emissions after the weighted average lifetime has been

reached. The difference in the results between both approaches is less than 0.5%. Therefore, the simplified approach is deemed to be suitable to be used in future years.

Simplified approach:

- Average lifetime (i): 15.92 years (thinkstep II, 2019)
- Carbon sequestered (potential emission stored) in the wood: 1,462,133 tCO₂e

This leads to the following harvesting emissions:

$$[(1,462,133 \text{ tCO}_2\text{e} * (100 - 15.92))/100] = 1,229,292 \text{ tCO}_2\text{e}$$

It can be seen that the delayed-release method, which includes the weighted average time the emissions are present in the atmosphere during the 100-year period, shows lower emissions (16%) than the single-release method, which releases all emissions at the beginning of the 100-year period.

Please note, GHG emissions including the effect of delayed emissions shall be a) separately reported from the single-release assessment and b) only recorded in parallel with the emission based on the single-release assessment. PAS2050:2011, 6.4.9.3.2 (British Standards Institution, 2011).

Emissions by Economic Sectors

Table 1 below shows gross emissions for the economic sectors and subsectors identified as relevant for the Southland region by Great South, derived from the national split for the calendar year 2017 used by Statistics New Zealand (Stats NZ) (Stats NZ, 2019). Detailed calculations can be found in thinkstep's recalculations file (thinkstep III, 2019).

Table 1: Southland Economic Sectors and Subsectors

Economic Sector	Economic Subsector	t CO ₂ e	%
1. Agriculture & Forestry	1.1 Dairy	2,900,319	32.5%
	1.2 Beef cattle	486,869	5.5%
	1.3 Sheep	2,312,310	25.9%
	1.4 Horses, goats & pigs	3,686	0.0%
	1.5 Deer	211,939	2.4%
	1.6 Fertiliser (Urea, DAP, Ammonium, other Fertiliser, Limestone, Dolomite)	178,855	2.0%
	1.7 Crops	2	0.0%
	1.8 Organic soils	33,092	0.4%
	1.9 Off-road transportation	57,943	0.6%
2. Mining	2.1 Mining	115,499	1.3%
3. Good Producing Industries	3.1 Dairy	406,730	4.6%
	3.2 Meat	101,411	1.1%
	3.3 Wood & paper products manufacturing	4,555	0.0%
	3.4 Metal product manufacturing	1,415,348	15.9%
	3.5 Construction	40,918	0.5%
4. Waste & wastewater	4.1 Waste & wastewater	38,284	0.4%
5. Service Industries	5.1 Transport, postal and warehousing	90,730	1.0%
	5.2 Institutional & other services	75,498	0.8%
6. Tourism	6.1 Tourism	91,384	1.0%
7. Households	7.1 Household	44,561	0.5%
	7.2 Domestic on-road transportation	307,429	3.4%
Total gross emission for Southland region		8,917,265	

The reviewed gross emissions data (excluding biogenic CO₂ emissions) listed in the CIRIS tool was used as a basis to allocate the emissions from the Southland Regional Carbon Footprint 2018 to the seven relevant economic sectors. Emissions in CIRIS are divided into sectors according to the

Global Protocol for Community Scale Greenhouse Gas Emissions Inventory (GPC) (WRI, C40, ICLEI, 2014), which deviates slightly from the economic split used by Statistics New Zealand (Stats NZ) (Stats NZ, 2019).

Where available Southland region specific data was used for the economic breakdown. Where no Southland region specific breakdown data was available, the national split for New Zealand was applied. In the following the allocation of CIRIS emissions to the relevant economic sectors and subsectors for Southland are described, including sources and methods used.

All emissions for the economic sector '1. Agriculture & Forestry' have been adopted without any changes from CIRIS GPC sectors 'Agriculture, Forestry and Other Land Use (AFOLU)' (for economic subsector 1.1-1.8 Table 1) and 'Transportation' (for economic subsector 1.9). See Table 1 above for details.

The economic sector '2. Mining' contains fugitive emissions from coal mining listed in CIRIS GPC sector 'Stationary Energy'. No other emissions are assigned to the mining sector.

Product use emissions from the CIRIS GPC sector 'Industrial Processes and Product Use (IPPU)' have been split into the economic sectors '3. Good Producing Industries', '5. Service Industries' and '7. Households' using the national percentage split of refrigeration and air conditioning emissions from 'New Zealand's Interactive Emissions Tracker' for the calendar year 2017 (MfE, 2019) and estimations from Great South.

The economic sector '3. Good Producing Industries' is split into five economic subsectors. The subsector '3.4 Metal product manufacturing' includes all emissions from the aluminium smelter on Tiwai Peninsula that are included in CIRIS GPC sectors 'Stationary Energy' and 'IPPU'.

All emissions from foam blowing agents listed in CIRIS GPC sector 'IPPU' have been assigned to the economic subsector '3.5 Construction'. This sector also includes 'Manufacturing Industries and Construction' emissions listed in the CIRIS GPC sector 'Stationary Energy'. To allocate 'Manufacturing Industries and Construction' emissions to '3.5 Construction' a national percentage share from Stats NZ (Stats NZ, 2019) was applied (7.7%). The national share was calculated by comparing the emissions from the national subsector 'Construction' to all Southland relevant emissions within the national sector 'Good Producing Industries'.

For the economic subsectors 3.1, 3.2 and 3.3 an internal database regularly updated by Great South was used to calculate the percentage of coal use for the three industries: dairy (81%), meat (18%) and wood (1%). Those percentages were applied to emissions from remaining energy sources within the CIRIS GPC sector 'Stationary Energy - Manufacturing Industries and Construction'. Around 92% of the emissions from CIRIS GPC sector 'IPPU' were assigned to the economic subsectors '3.1 Dairy' and '3.2 Meat' (the rest of the 'IPPU' emission is assigned to the subsector '3.5 Construction; and '7. Household').

The economic sector '4. Waste & wastewater' contains all emissions from CIRIS GPC sector 'Waste' except emissions from septic tanks, which are allocated to the economic sector '7. Households'.

The economic sector '5. Service Industries' is split into '5.1 Transport, postal and warehousing' and '5.2 Institutional & other services'. The subsector '5.2 Institutional & other services' includes all emissions from CIRIS GPC sector 'Stationary Energy - Commercial and institutional buildings' as

well as a share of emissions from CIRIS GPC sector 'IPPU'. Emissions assigned to the economic subsector 5.1 are explained in the last paragraph below.

According to Statistic New Zealand (Stats NZ, 2019) 15.6% of total household on-road transport emissions (CIRIS GPC sector 'Transport') is attributed to domestic tourism and is therefore allocated to the economic sector '6. Tourism'. In addition to domestic tourism Stats NZ (Stats NZ, 2019) allocates of 7.8% of the national on-road transport to international tourism. The economic sector '6. Tourism' only includes on-road transport emissions since no data was available for other forms of transport or other areas such as accommodation or services industries. The 'Environmental-economic accounts 2019' report from Statistic New Zealand (Stats NZ, 2019) estimates that "emissions by tourism related to other transport forms are likely to be significant". It also states that "emissions from accommodation and food services; transport, postal, and warehousing; and recreation services could, with development, be allocated to tourism". If this information becomes available, it is recommended to adjust the calculations for the economic sector '6. Tourism'.

The economic sector '7. Households' is divided into emissions from '7.1 Household' and '7.2 Domestic on-road transport'. Emissions from septic tanks included in CIRIS GPC sector 'Waste' and emissions from 'Residential Buildings' included in CIRIS GPC sector 'Stationary Energy' are allocated to economic subsector '7.1 Household'. In addition, emissions from the CIRIS GPC sector 'IPPU' have been allocated to this sector based on the proportion of domestic refrigerants listed in New Zealand's Interactive Emissions Tracker for the calendar year 2017 (MfE, 2019).

On-road emissions from CIRIS GPC sector 'Transportation' have been allocated to the economic subsector '7.2 Domestic household on-road transportation' by applying a national split of domestic transportation emissions (Stats NZ, 2019).

All transportation emissions from CIRIS GPC sector 'Transportation' which were not allocated to other economic subsectors are included in the economic subsector '5.1 Transport, postal and warehousing'. These are emissions from aviation as well as on-road and waterborne transport.

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