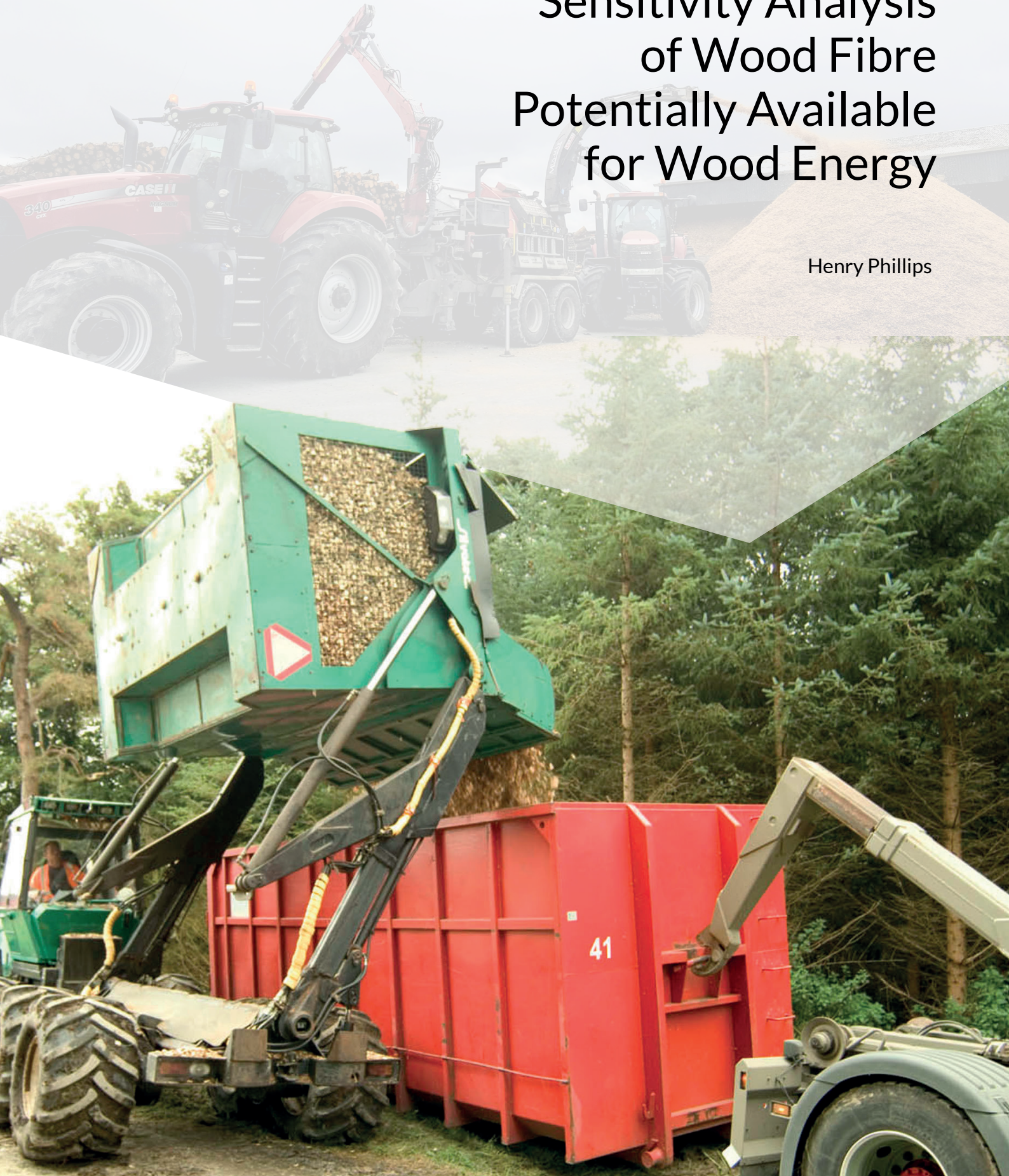




Sensitivity Analysis of Wood Fibre Potentially Available for Wood Energy

Henry Phillips



*Sensitivity Analysis of Wood Fibre
Potentially Available for
Wood Energy*

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Background

The All Ireland Roundwood Production Forecast 2021-2040 provides a separate annual forecast of wood fibre potentially available for wood energy in the Republic of Ireland up to 2040. This forecast is based upon a number of assumptions the most significant of which are:

- a) The wood based panels (WBP) demand increases by 1% per annum. The WBP demand is met from a combination of Coillte small roundwood, private sector small roundwood and processing residues from the sawmilling sector. This supply is ring fenced and is assumed not to be available for other uses. In compiling the forecast this WBP demand is met first and then the remaining balance of material is potentially available for energy. This assumption is an artificial construct and while in practice and in accordance with the cascade principle almost all of the Coillte small roundwood will be directed to WBP, the private sector volumes and processing residues not being used for WBP will go to the highest paying end user unless there are supply contracts in place.
- b) The balance of the processing residues after the WBP demand has been met is potentially available for wood energy. In practice however sawmills will retain part of this material for their own use, mainly for process heat and in a small number of cases for combined heat and power generation (cogeneration). Based on more recent evidence, a sawmill conversion rate of 52% was used as opposed to 49% in the All Ireland forecast.
- c) Harvesting residues of an estimated 80 green tonnes per net ha will potentially be available from clearfell of sites of yield class 18 or higher with a minimum area of 4 ha. This material was subject to a distance constraint from an existing end user.

Table 1. Forecast of Wood Fibre and Potential for Energy ROI¹ ('000 m³)² as estimated using the methodology in the 2021-2040 roundwood production forecast

Year	Roundwood 7 - 13cm	Downgrade + Wood Residues	Harvesting Residues	Total
2021	184	589	113	886
2022	258	708	93	1,059
2023	348	1,005	112	1,465
2024	325	1,002	86	1,413
2025	357	1,013	95	1,464
2026	394	982	145	1,522
2027	396	1,052	164	1,612
2028	363	1,037	153	1,553
2029	405	1,129	145	1,679
2030	467	1,280	146	1,893
2031	505	1,416	91	2,011
2032	591	1,538	98	2,226
2033	496	1,492	86	2,074
2034	593	1,432	96	2,121
2035	528	1,683	96	2,307
2036	394	1,550	55	1,999
2037	371	1,540	47	1,958
2038	327	1,512	32	1,871
2039	310	1,497	35	1,842
2040	301	1,472	45	1,819
Totals	7,914	24,928	1,933	34,775

¹ COFORD 2021. All Ireland Roundwood Production Forecast 2021-2040. COFORD, Kildare St., Dublin 2.

² Harvesting Residues are expressed in '000 green tonnes

The remit of the Climate Change group of the COFORD council included the development of a statement on the potential contribution of modern bioenergy³ to the achievement of national climate change, energy and forest policies. A key element of the statement will be the level of current and future sustainable forest-based biomass supply. While the estimates provided are well founded, they are based on a set of assumptions around the level of thinning, methods of thinning and the recovery of forest biomass at final felling.

It was decided to revisit the assumptions behind Table 1 and determine the potential effects on sustainable forest biomass supply of:

1. Levels of first thinning
2. Recovery rates of biomass at thinning – including the level of use of systems that harvest most of the above ground biomass (excluding foliage)
3. Recovery rates following specified biomass harvesting at final felling (this refers to planned harvesting of separately piled tops and branches on clear-felling sites in accordance with good practice (Gavigan and Hendrick 2023)).

This forest-based biomass forecast is not intended to replace the All Ireland forecast, but is viewed as supplementary information that can be used to make an informed assessment of the current and future production based on policy and market demand.

³ Modern bioenergy refers to efficient and clean combustion of sustainably sourced forest-based biomass, and other forms of bioenergy.

Methodology and Approach

Wood Fibre Elements

Tip to 7 cm Assortment: This is the stem roundwood volume overbark from 7 cm diameter to the tip of the tree arising from the harvesting of thinnings and clearfells. The volumes per hectare are relatively small but represent a largely untapped source of biomass. The harvesting of this material is not always possible or indeed always desirable due to site conditions and / or site limitations.

7 cm to 13 cm Assortment: This is the assortment that is typically referred to as *pulpwood*. The end uses for this category are stake, pulpwood, and forest-based biomass for energy, (including woodchip and firewood). The proportion of a crop that forms this assortment varies with site productivity (yield class) and thinning treatment and the timing of clearfells (rotation length). Typically, a significant proportion of this assortment comes from first and second thinnings. While most harvest contractors harvest pulpwood down to a minimum of 7 cm top diameter overbark, some harvest material down to 5 cm top diameter in order to increase the volume per hectare harvested.

Roundwood Downgrade: Pulpwood is typically harvested as 3 m lengths and small sawlog as 3.4 m or 3.7 m lengths. The quality (straightness) requirements for small sawlog together with the small end diameter (SED) requirement of 14 cm means that a proportion of the 14-19 cm category will be harvested and marketed as pulpwood or fuelwood. As with the pulpwood, while the majority of harvest contractors operate to a minimum SED of 14 cm some will harvest material down to 12 cm depending on the mill and future end use.

Harvesting Residues: This is the material comprising the tips of trees and branches remaining on site following clearfell. There are currently no regulations in Ireland regarding the minimum site requirement for harvesting.

This process is now referred to as **specified biomass harvesting (SBH)** and is defined as: planned and specified biomass harvesting (SBH), comprising tops and branches removed during roundwood harvest and piled in situ on the forest floor adjacent to extraction racks (Figure 1), and left for a sufficient time to allow needle and leaf fall before collection. It excludes the material used to make brush mats, or their removal off the site⁴. SBH also specifies the productivity range for sites suitable for residue collection, of deadwood to be retained on the site following biomass harvesting, and good practice in laying out brush mats. The All Ireland forecast required a minimum harvest area of 4 ha and a yield class of 18 or greater. Only spruce crops were considered. The recommendations in SBH can be extended to a wider range of sites and species.

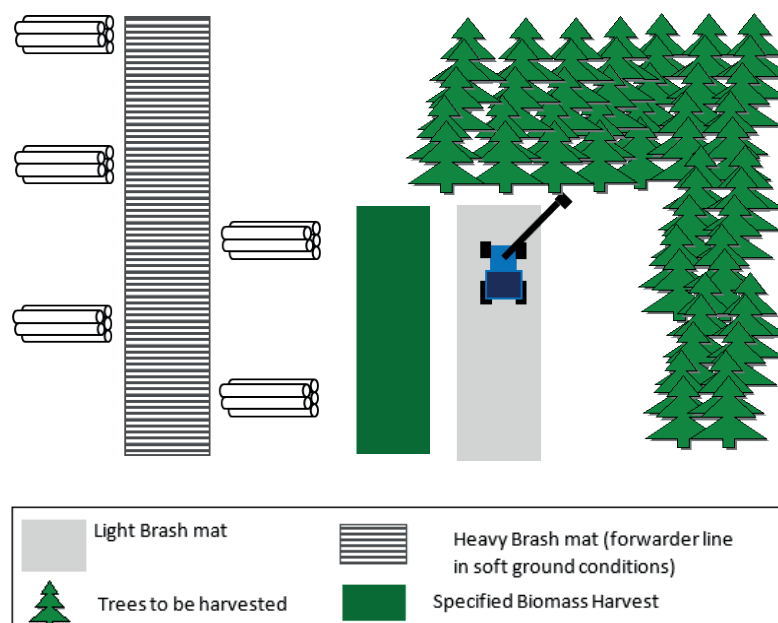


Figure 1. SBH on Clearfell Site (Gavigan & Hendrick (2023))

⁴ Gavigan N, Hendrick E. 2023. Specified Biomass Harvesting: Good practice guidance for energy assortment harvesting at clearfell. Irish Bioenergy Association, Dublin.

Approach

The starting point was the All-Ireland Roundwood Production Forecast 2021-2040 (the Forecast). The spreadsheet tables behind the Forecast were rearranged and reformatted to allow for their detailed analysis. Wherever possible, tables were maintained at county level to facilitate any future more detailed query at a regional or county level similar for example to that undertaken on behalf of IrBEA for the midlands development region (MDR)⁵.

Additional material from the Forecast data set was extracted to allow for analysis of the impact of varying the levels of thinning and whole tree harvesting of first thinnings. Coillte and Silvalytics, which compiled the Forecast, provided an additional forecast for harvesting residues from clearfell sites. Coillte provided an estimate of the potential availability of Coillte small roundwood (volume 7-13 cm plus the downgrade of material from the 14-19 assortment) for the wood energy / biomass market over the period 2022 to 2040.

Assessment of Woody Biomass from Private Sector

In order to allow for the ready comparison of the impact of varying thinning areas, types of thinning and levels of SBH recovery on overall woody biomass supply the current situation as of 2023 was evaluated and is provided in Table 2. Unlike the previous forecast, this does not assume any private sector volume or wood residues going to meet the WBP demand.

- a) The harvestable element of the tip-7 cm assortment is estimated to be 10% of the assortment volume.
- b) The downgrade from 14-19 cm to small roundwood due to quality and length consideration is estimated at 20% of net realisable volume in this assortment.
- c) The wood residues exclude the residues retained by sawmills for their own use and assumes an average conversion rate of 52%. The Forecast assumed 49%.
- d) The SBH values are those in the Forecast.

The total volume is 35.76 million m³ with processing residues being the main contributor (53.4%) followed by 7-13 cm assortment (26.7%), downgrade (18.6%), SBH (1%) and tip-7 cm (0.5%). The volumes include circa 9% broadleaves. The dataset for the private sector Forecast relies on a Forest Inventory and Planning System (FIPS)⁶ classification for crops planted before the mid-1980s for circa 68,000 ha. There are broad forest crop classes e.g. young other broadleaves (BYO) and each of the fifteen FIPS classes was assigned a species, age, yield class and management regime in the Forecast. The greater proportion of the FIPS area comprises mature broadleaves and mature mixed forests. The BYO element is responsible for the spike in supply in 2034 while the mixed young forest (MYF) is largely responsible for the spike in 2032. The broadleaf volumes should be treated with caution.

Table 2. Current Assessment of Woody Biomass Supply from the Private Sector ('000 m³) Excluding private sector WBP demand (SBH data are '000 Green Tonnes)

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Totals
Tip to 7cm	9	8	9	10	11	10	10	11	12	13	12	13	12	9	9	8	8	8	185
7 - 13cm	420	387	433	498	502	455	514	603	665	788	653	791	698	491	464	409	393	381	9,548
Downgrade 14-19cm	210	225	216	230	254	276	292	304	339	343	364	376	437	466	478	564	574	619	6,568
Residues Processing	684	707	709	780	841	865	924	1,006	1,074	1,131	1,153	1,119	1,314	1,230	1,272	1,386	1,420	1,489	19,104
SBH	44	18	27	17	36	25	17	18	16	23	11	21	21	25	17	2	5	15	358
Total	1,367	1,346	1,394	1,535	1,644	1,630	1,757	1,943	2,107	2,298	2,193	2,320	2,483	2,222	2,241	2,370	2,400	2,513	35,762
Broadleaves	346	187	53	67	39	46	106	83	148	552	127	599	203	202	109	117	52	69	3,107

⁵ Potential bioenergy supply in the Midlands Development Region 2022-2040. A report prepared for the Irish Bioenergy Association Hendrick, E., Phillips, H. Hickey, T. November 2022.

⁶ Fogarty G., Coggins K. and Gallagher G. 2000. Forest Inventory and Planning System (FIPS) ITGA Forestry Year Book 2000.

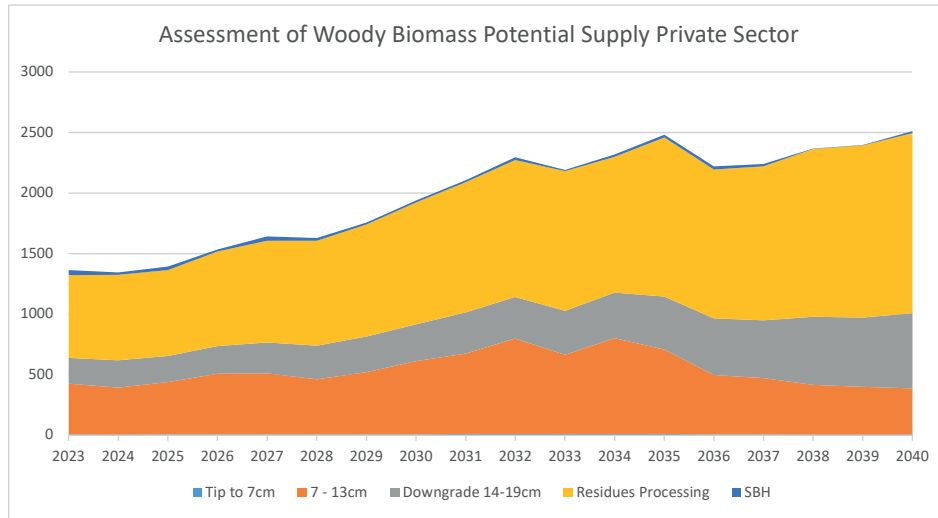


Figure 2. Private Sector Potential Woody Biomass ('000 Green Tonnes)

Results

Updated Estimate of Wood Fibre Market Availability

The Forecast estimates were updated to take account of the following:

- a) Increased sawlog conversion factor of 52%
- b) Static WBP demand based on the demand estimate for 2021 and
- c) An estimate of the demand for stakewood was subtracted from the 7-14 cm assortment.

The results are shown in Table 3. The total volume decreases marginally from over 34.77 million m³ to 34.48 million m³. The decrease in the 7-13 cm assortment of 3 million m³ is due to the removal of stake material from this category. This decrease is more or less counter-balanced by an increase in wood residues due to the static WBP demand over the forecast period despite the improvement in sawlog conversion which would reduce the residue slightly. The harvesting residues (SBH) remain unchanged.

Table 3. Updated Estimate of Wood Fibre Market Potential Availability for Energy and other uses ('000 m³)⁷

Year	Roundwood 7 - 13cm	Downgrade + Wood Residues	Harvesting Residues	Total
2021	34	557	113	704
2022	108	693	93	894
2023	198	1,003	112	1,313
2024	175	1,018	86	1,279
2025	207	1,047	95	1,349
2026	244	1,035	145	1,424
2027	246	1,122	164	1,532
2028	213	1,125	153	1,491
2029	255	1,235	145	1,635
2030	317	1,404	146	1,867
2031	355	1,555	91	2,001
2032	441	1,695	98	2,234
2033	346	1,669	86	2,102
2034	443	1,631	96	2,170
2035	378	1,897	96	2,371
2036	244	1,785	55	2,084
2037	221	1,796	47	2,064
2038	177	1,788	32	1,997
2039	160	1,794	35	1,990
2040	151	1,790	45	1,987
Totals	4,914	27,639	1,933	34,485

⁷ SBH values are expressed in '000 green tonnes

Based on SEAI biomass data the material in Table 3 was converted to green tonnes and then allocated in varying proportions across the following sectors (Table 4):

- a) **Power only generation** – 35% up to 2030 with a moisture content of 45%. No supply post 2030 as Edenderry is set to cease operating.
- b) **Industry** – 49% up to 2030 with a moisture content of 50%. From 2031 onwards 75% of material with a moisture content of 45% (to include applications such as high temperature heating and cogeneration).
- c) **Residential** – 16% up to 2030 with a moisture content of 30%. From 2031 onwards 25% with a moisture content of 30% (to include applications such as commercial and district heating).

Table 4. Forest-based Biomass Estimated Energy Content and End User

Year	Green Tonnes ('000)				Energy ('000 GJ)		
	Roundwood 7 - 13cm	Downgrade + Wood Residues	SBH	Total	Power Generation	Industry	Residential
2023	198	1,003	112	1,313	2,925	3,989	1,411
2024	175	1,018	86	1,279	2,850	3,887	1,375
2025	207	1,047	95	1,349	3,005	4,098	1,450
2026	244	1,035	145	1,424	3,172	4,326	1,530
2027	246	1,122	164	1,532	3,413	4,654	1,646
2028	213	1,125	153	1,491	3,322	4,531	1,603
2029	255	1,235	145	1,635	3,642	4,968	1,757
2030	317	1,404	146	1,867	4,159	5,672	2,006
2031	355	1,555	91	2,001	0	9,551	3,360
2032	441	1,695	98	2,234	0	10,664	3,751
2033	346	1,669	86	2,102	0	10,033	3,529
2034	443	1,631	96	2,170	0	10,359	3,644
2035	378	1,897	96	2,371	0	11,320	3,982
2036	244	1,785	55	2,084	0	9,948	3,499
2037	221	1,796	47	2,064	0	9,855	3,466
2038	177	1,788	32	1,997	0	9,533	3,353
2039	160	1,794	35	1,990	0	9,498	3,341
2040	151	1,790	45	1,987	0	9,487	3,337
Totals	4,772	26,389	1,727	32,888	26,488	136,375	48,041

The analysis in Table 4 represents the best estimate of current use and the baseline for the sensitivity analysis undertaken. It does not include the residues from the import of round logs by some sawmills nor does it take account of the export of round logs to Northern Ireland or the export of pulpwood to the UK. It also excludes imports from EU and other non EU countries.

Based on COFORD Woodflow reports⁸ and on statistics from DAFM⁹, there are likely to be net exports within the range -250,000 m³ to -130,000 m³. It is unclear whether round sawlogs will continue to be imported against a backdrop of increasing supply from the private sector. The export of pulpwood has in the past been sporadic and dependant on price. Whether the price advantage of pulp export will continue in the medium term is uncertain. There is also the added difficulty of sourcing certified pulp supplies from the private sector which would act to curtail any expansion of exports in the short term.

⁸ COFORD 2019. Woodflow and forest-based biomass energy use on the island of Ireland (2018). COFORD Connects Processing/Products no. 51

⁹ DAFM 2024. Forest Statistics Ireland 2024. DAFM, Johnstown Castle Estate Co. Wexford

Sensitivity Analysis

Thinning

The Forecast for the private sector has a set of rules to determine whether crops will be thinned or remain unthinned. These include rules around minimum harvestable area, minimum yield class (productivity), wind speed, soil type and distance from a county road. The rules are based on a combination of a survey of forest companies and forestry consultants¹⁰. The area designated as no thin by the Forecast was obtained for each county together with the area in each county receiving a first thin for each year of the Forecast (Table 5). The percentage thinned area averaged 56% across all counties and varies from 75% in Laois to 25% in Dublin.

Table 5. Forecast Thin and No Thin Areas

	Forecast Area (ha)	Forecast No Thin Area (ha)	Forecast Thin Area (ha)	% No Thin	% Thin
Carlow	2,886	1,174	1,712	41%	59%
Cavan	12,101	4,776	7,325	39%	61%
Clare	30,825	15,537	15,288	50%	50%
Cork	43,497	20,553	22,944	47%	53%
Donegal	21,776	12,181	9,595	56%	44%
Dublin	1,896	1,414	482	75%	25%
Galway	22,792	10,739	12,053	47%	53%
Kerry	37,391	19,540	17,851	52%	48%
Kildare	5,940	2,826	3,114	48%	52%
Kilkenny	11,993	3,398	8,595	28%	72%
Laois	9,698	2,419	7,279	25%	75%
Leitrim	15,017	4,624	10,393	31%	69%
Limerick	15,947	6,882	9,065	43%	57%
Longford	7,724	2,995	4,729	39%	61%
Louth	2,049	1,239	810	60%	40%
Mayo	24,614	12,188	12,426	50%	50%
Meath	7,096	3,232	3,864	46%	54%
Monaghan	3,691	1,929	1,762	52%	48%
Offaly	12,311	4,771	7,540	39%	61%
Roscommon	15,840	5,344	10,496	34%	66%
Sligo	10,950	4,470	6,480	41%	59%
Tipperary	23,612	8,456	15,156	36%	64%
Waterford	11,175	4,558	6,617	41%	59%
Westmeath	10,883	3,754	7,129	34%	66%
Wexford	8,295	3,646	4,649	44%	56%
Wicklow	13,845	6,246	7,599	45%	55%
Totals	383,844	168,890	214,954	44%	56%

To rerun the Forecast with a new set of thinning rules was considered but the preferred approach was to increase the area of first thin by a given percentage as this avoided interaction between the various parameters in the thinning rules which could confuse the overall result. If the area of first thinning is increased then the area of second thinning is also increased and the allocation of volume across the four size assortments (tip-7 cm, 7 cm - 13 cm, 14 cm -19 cm and >+20 cm top diameter) is impacted with a greater proportion of the total crop volume ending up in the >=14 cm assortment categories. The additional volume (7-13 cm) plus

¹⁰ DAFM are currently undertaking an assessment of thinning operations in plantation forests, which will provide accurate information on the characteristics of thinnings that are currently taking place. The results from this ongoing work may necessitate a change in approach to the thinning assumptions adopted in future roundwood forecasts, in terms of the timing of thinning operations and level of volume being removed during thinning interventions.

the downgrade from 14-19 cm for first and subsequent thinning was assessed to be 45 m³ per ha. Increases of 10%, 20% and 30% in first thinning area were analysed and the results are shown in Table 6. While it should be possible to have some increase in the overall thinning area, increases of the order of 20% and 30% would require some form of relaxation of the regulatory requirements, a timber price incentive and/or a growing forest-based biomass demand, and a positive promotional campaign to encourage thinning.

Table 6. Additional volume of small roundwood (‘000 Green Tonnes) from increased thinning

Increase	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Totals
10%	22.9	24.4	24.3	25.6	21.3	17.6	15.8	13.7	14.1	13.7	11.4	11.9	12.2	13.1	14.3	12.2	13.7	16.3	298.5
20%	45.8	48.9	48.6	51.1	42.6	35.2	31.6	27.3	28.2	27.5	22.9	23.8	24.3	26.1	28.5	24.5	27.5	32.6	597.0
30%	68.7	73.3	72.9	76.7	63.9	52.8	47.4	41.0	42.2	41.2	34.3	35.7	36.5	39.2	42.8	36.7	41.2	48.9	895.4

For every 10% increase in first thinning there is an additional 0.298 million green tonnes of small roundwood made available over the period 2023 to 2040 (Table 6). However, this additional volume should be assessed against the estimated total of 12.65 million m³ small roundwood for the same period (Table 2). A 30% increase in thinning area would account for only a 7.1% increase in small roundwood supply.

The increase in small roundwood volume is temporary in nature and would need to be offset against the reduced small roundwood recovery from thinned as opposed to unthinned crops at the time of clearfell. As a general rule, thinned crops will produce more large sawlog (>=20 cm) and less small sawlog (14-19 cm) per hectare than unthinned crops. A further point to note is that unthinned crops of Sitka spruce will on average produce slightly greater volume per hectare than thinned crops based on current rotation ages. Overall, there is likely to be a small reduction in the total woody biomass (small roundwood plus processing residues) from thinned crops of the order of circa 30 m³ per ha over a rotation.

Whole Tree Thinning

Whole tree thinning is where the whole stem and branches are harvested and extracted to the roadside typically during first thinning. When the needles have dried and fallen off, the trees are then chipped. Although not a widespread practice in Ireland, it is undertaken in a number of countries e.g. Denmark. The additional biomass yield from first thinnings is of the order of 30-60%¹¹.

Three scenarios were considered where the percentage of whole tree harvesting in first thinning was 10%, 20% and 30%. Whole tree harvesting was assessed to yield an additional 35m³ per ha of biomass. The results are shown in Table 7.

Table 7. Additional biomass from increased whole tree thinning (‘000 Green Tonnes)

Increase	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Totals
10%	20.0	21.4	21.3	22.4	18.6	15.4	13.8	12.0	12.3	12.0	10.0	10.4	10.6	11.4	12.5	10.7	12.0	14.3	261.2
20%	40.1	42.8	42.5	44.7	37.2	30.8	27.7	23.9	24.6	24.0	20.0	20.9	21.3	22.9	24.9	21.4	24.0	28.5	522.3
30%	60.1	64.2	63.8	67.1	55.9	46.2	41.5	35.9	37.0	36.0	30.0	31.3	31.9	34.3	37.4	32.1	36.1	42.8	783.5

For each 10% increase in whole tree harvesting there is a corresponding additional 0.261 million green tonnes of woody biomass potentially available over the period 2023 to 2040. This additional biomass should be assessed against the estimated total of 12.65 million green tonnes small roundwood (Table 2) for the same period. A 30% increase in whole tree thinning would account for only a 6.2% increase in volume.

¹¹ Kofman, P.D. (2010) A synthesis and comparison of forest energy harvesting methods in conifer plantations. COFORD Connects Harvesting/Transportation No. 26. COFORD

Specified Biomass Harvesting (SBH)

Two additional forecasts, one for the private sector and one for Coillte, were run where the distance and market constraints for SBH were removed. The additional biomass potentially available is 4.065 million tonnes of which 2.5 million comes from the private sector (Table 8).

Table 8. Additional Biomass SBH 80t/ha ('000 Green Tonnes)

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Totals
Private	128	129	144	143	120	154	129	90	144	133	127	158	120	248	253	81	96	104	2,500
Coillte	73	76	61	70	93	69	75	79	104	102	93	103	116	87	94	86	105	79	1,564
Totals	202	205	205	212	212	222	205	169	248	234	220	262	236	335	347	167	200	183	4,065

If the harvest recovery is reduced to 60 t per ha and the distance and market constraints remain removed then the additional biomass is reduced to 3.05 million tonnes (Table 9).

Table 9. Additional Biomass SBH 60t / ha ('000 Green Tonnes)

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Totals
Private	96	97	108	107	90	115	97	67	108	99	95	119	90	186	190	61	72	78	1,875
Coillte	55	57	46	52	69	51	56	59	78	76	70	77	87	65	70	64	79	60	1,173
Totals	151	154	154	159	159	167	153	126	186	176	165	196	177	251	260	125	150	137	3,048

Tip to 7 cm

The Tip to 7 cm category contributes relatively little to the overall volume of potentially available woody biomass (Table 2). To increase the percentage available would in effect constitute a form of double counting as this material is already encompassed in increased levels of whole tree thinning and in the relaxing of rules around SBH on clearfell residues.

Most Likely Scenario

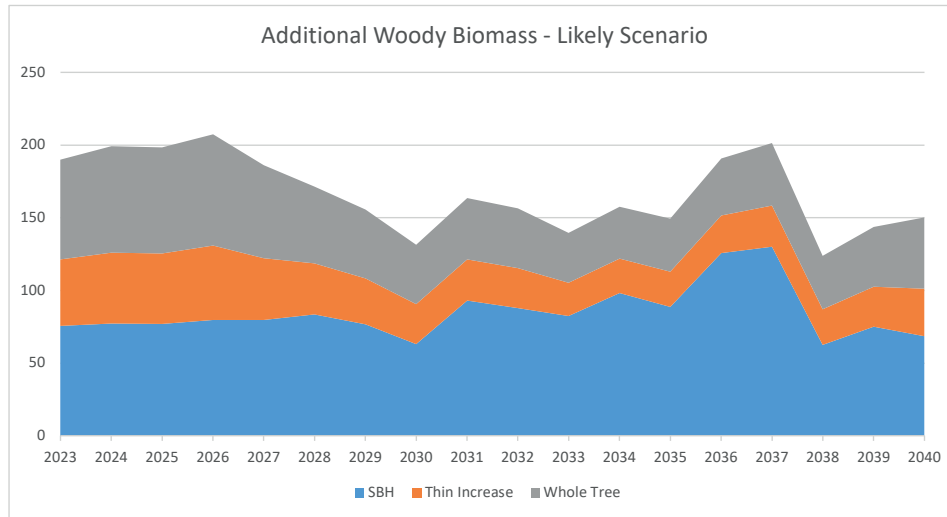
The most likely scenario based on the analysis above and assuming there will be some relaxation of the regulations on thinning, an increasing demand for wood energy and increased wood paying capability is:-

- a) No harvesting of the tip-7 cm assortment
- b) 20% increase in thinning area in the private sector
- c) 20% whole tree harvesting of first thinnings in the private sector
- d) 50% of the SBH at a yield of 60 t per net ha.

This would yield an additional 2.778 million m³ (Table 10) with SBH being the main contributor at 55% followed by increased first this (24%) and whole tree harvesting (21%).

Table 10. Increase in Woody Biomass - Likely Scenario ('000 Green Tonnes)

	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Totals
Harvest 50% SBH (60t/ha)	75.6	77.1	76.9	79.7	79.6	83.4	76.7	63.2	93.1	87.8	82.4	98.1	88.6	125.6	130.0	62.6	75.1	68.6	1,524
20% Thinning Increase	45.8	48.9	48.6	51.1	42.6	35.2	31.6	27.3	28.2	27.5	22.9	23.8	24.3	26.1	28.5	24.5	27.5	32.6	597
20% Whole Tree Thinning	68.7	73.3	72.9	76.7	63.9	52.8	47.4	41.0	42.2	41.2	34.3	35.7	36.5	39.2	42.8	36.7	41.2	48.9	895
Totals	190.1	199.3	198.3	207.5	186.0	171.4	155.8	131.6	163.5	156.4	139.6	157.7	149.4	190.9	201.3	123.9	143.8	150.2	3,017

**Figure 3. Additional Woody Biomass ('000 Green Tonnes)**

Using the same assumptions as for Table 4, the additional biomass was allocated across the three main end use sectors and the results are shown in Table 11.

Table 11. Additional Woody Biomass Allocation and Energy Potential

Year	Green Tonnes ('000)				Energy ('000 GJ)		
	Harvest 50% SBH (60t/ha)	20% Thinning Increase	20% Whole Tree Thinning	Total	Power Generation	Industry	Residential
2023	76	51	77	204	454	619	219
2024	77	55	82	214	477	650	230
2025	77	54	82	213	474	647	229
2026	80	57	86	223	496	677	239
2027	80	48	72	199	443	604	214
2028	83	39	59	182	405	553	196
2029	77	35	53	165	368	502	178
2030	63	31	46	140	311	425	150
2031	93	32	47	172	0	821	289
2032	88	31	46	165	0	786	277
2033	82	26	38	146	0	699	246
2034	98	27	40	165	0	787	277
2035	89	27	41	157	0	748	263
2036	126	29	44	199	0	949	334
2037	130	32	48	210	0	1,002	352
2038	63	27	41	131	0	626	220
2039	75	31	46	152	0	726	255
2040	69	37	55	160	0	764	269
Totals	1,524	669	1,003	3,196	3,429	12,585	4,436

Conclusion

Reassessing the assumptions and the underlying parameters behind the Forecast of Wood Fibre has the potential to yield significant sustainable increases in woody biomass over the period from 2023 to 2040 (Figure 4 and Table 12).

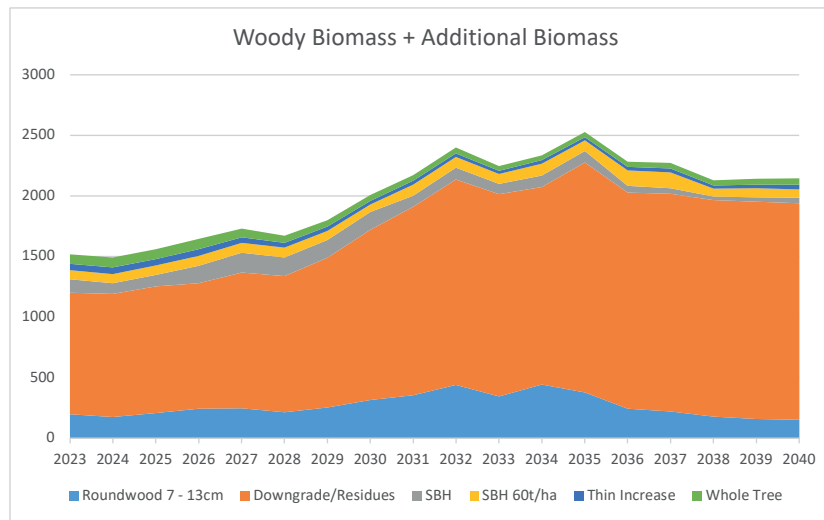


Figure 4. Woody Biomass Including Additional ('000 Green Tonnes)

The identified potential increases will only happen if there is a growing market for wood energy with a paying capacity that will lever supplies from the private sector. A growing demand and paying capability is not sufficient in the absence of some relaxation of the regulatory framework around road construction and harvesting. There is evidence that currently the level of thinning in the private sector has decreased and this will need to be reversed if the potential woody biomass is to be realised.

Table 12. Summary of Biomass and Energy Potential

Year	Green Tonnes ('000)						Total	Energy (PJ) Table 4 + Table 11
	Roundwood 7 - 13cm	Downgrade + Wood Residues	SBH	Harvest 50% SBH (60t/ha)	20% Thinning Increase	20% Whole Tree Thinning		
2023	198	1,003	112	76	51	77	1,517	9.6
2024	175	1,018	86	77	55	82	1,493	9.5
2025	207	1,047	95	77	54	82	1,562	9.9
2026	244	1,035	145	80	57	86	1,647	10.4
2027	246	1,122	164	80	48	72	1,731	11.0
2028	213	1,125	153	83	39	59	1,673	10.6
2029	255	1,235	145	77	35	53	1,800	11.4
2030	317	1,404	146	63	31	46	2,007	12.7
2031	355	1,555	91	93	32	47	2,173	14.0
2032	441	1,695	98	88	31	46	2,399	15.5
2033	346	1,669	86	82	26	38	2,248	14.5
2034	443	1,631	96	98	27	40	2,335	15.1
2035	378	1,897	96	89	27	41	2,528	16.3
2036	244	1,785	55	126	29	44	2,283	14.7
2037	221	1,796	47	130	32	48	2,274	14.7
2038	177	1,788	32	63	27	41	2,128	13.7
2039	160	1,794	35	75	31	46	2,142	13.8
2040	151	1,790	45	69	37	55	2,147	13.9
Totals	4,772	26,389	1,727	1,524	669	1,003	36,084	231.4

Appendix 1 Increased Thinning Area – County Analysis

	Increase 1st Thin area 10% >=7 cm ('000 m ³)			10% 40 m ³ /ha																Totals
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040		
Carlow	0.11	0.13	0.25	0.17	0.10	0.16	0.20	0.10	0.12	0.05	0.13	0.12	0.16	0.19	0.10	0.16	0.09	0.07	2.4	
Cavan	0.93	0.96	0.72	0.73	0.87	0.76	0.96	0.61	1.01	0.81	0.44	0.55	0.45	0.84	0.75	0.68	0.82	0.67	13.6	
Clare	1.78	1.60	1.66	2.01	1.40	1.30	1.67	0.87	0.82	0.87	0.58	0.62	1.01	0.57	0.96	0.75	0.81	1.30	20.6	
Cork	2.55	3.32	3.02	3.62	2.76	2.64	2.14	2.04	2.34	2.33	1.60	1.73	1.99	2.10	1.78	1.71	1.64	1.96	41.3	
Donegal	0.97	1.00	1.77	1.66	1.21	0.78	0.30	0.37	0.46	0.48	0.33	0.20	0.15	0.28	0.19	0.06	0.17	0.25	10.6	
Dublin	0.03	0.03	0.04	0.02	0.01	0.02	0.00	0.02	0.00	0.04	0.01	0.00	0.01	0.00	0.01	0.02	0.05	0.00	0.3	
Galway	1.40	1.16	1.04	1.18	1.04	0.77	0.80	0.56	0.77	0.76	0.66	0.74	0.86	0.59	0.55	0.77	0.70	1.03	15.4	
Kerry	2.30	2.81	3.13	2.74	2.91	1.56	1.53	1.25	0.94	1.09	0.86	1.04	0.92	0.89	1.29	0.92	1.07	1.10	28.3	
Kildare	0.33	0.66	0.48	0.53	0.28	0.16	0.31	0.12	0.42	0.42	0.11	0.16	0.18	0.13	0.28	0.17	0.15	0.19	5.1	
Kilkenny	0.86	0.74	0.93	0.93	0.70	0.65	0.82	0.62	0.87	0.66	0.33	0.40	0.52	0.71	0.82	0.50	0.54	0.90	12.5	
Laois	1.21	1.04	0.89	0.82	0.80	0.67	0.42	0.34	0.45	0.31	0.33	0.25	0.29	0.58	0.37	0.55	0.51	0.65	10.5	
Leitrim	1.15	1.77	1.17	1.07	1.09	1.23	0.68	0.55	0.66	0.67	0.53	0.71	0.66	0.67	0.90	0.95	1.50	1.83	17.8	
Limerick	1.38	1.77	1.42	2.18	1.49	1.15	0.91	0.94	0.94	0.93	0.90	0.84	0.57	0.52	0.65	0.47	0.39	0.81	18.3	
Longford	0.55	0.54	0.77	0.46	0.40	0.75	0.66	0.47	0.35	0.36	0.53	0.32	0.41	0.59	0.44	0.41	0.35	0.44	8.8	
Louth	0.05	0.01	0.03	0.16	0.02	0.14	0.03	0.13	0.04	0.12	0.09	0.10	0.12	0.11	0.19	0.05	0.05	0.03	1.4	
Mayo	1.39	1.07	1.34	1.42	1.17	1.27	0.93	0.81	0.66	0.41	0.53	0.59	0.65	0.78	0.72	0.93	1.03	0.61	16.3	
Meath	0.60	0.56	0.43	0.65	0.62	0.23	0.36	0.31	0.44	0.46	0.40	0.22	0.35	0.35	0.40	0.26	0.35	0.35	7.3	
Monaghan	0.21	0.08	0.15	0.13	0.11	0.14	0.09	0.07	0.14	0.17	0.26	0.20	0.21	0.16	0.25	0.24	0.19	0.26	3.0	
Offaly	0.76	0.88	1.28	1.25	1.15	0.77	0.94	0.97	0.60	0.42	0.40	0.46	0.45	0.49	0.55	0.63	0.59	0.66	13.2	
Roscommon	1.21	1.71	1.39	1.39	1.21	1.04	0.85	0.62	0.71	0.87	0.94	0.94	0.86	0.92	0.66	0.62	1.21	1.10	18.3	
Sligo	1.04	0.73	0.76	1.00	0.79	0.43	0.34	0.46	0.24	0.27	0.26	0.34	0.34	0.47	0.74	0.56	0.53	0.52	9.8	
Tipperary	1.97	1.99	1.87	2.02	1.32	1.37	0.97	1.34	1.09	0.95	0.98	1.07	0.97	1.00	1.33	0.55	0.70	0.95	22.5	
Waterford	0.60	0.64	0.64	0.60	0.63	0.32	0.50	0.58	0.50	0.53	0.25	0.37	0.25	0.42	0.60	0.51	0.49	0.68	9.1	
Westmeath	1.33	0.92	0.94	0.69	0.74	0.48	0.84	0.47	0.48	0.65	0.47	0.38	0.43	0.37	0.72	0.70	0.56	0.85	12.0	
Wexford	0.43	0.56	0.59	0.71	0.48	0.41	0.23	0.40	0.53	0.62	0.53	0.46	0.32	0.44	0.45	0.25	0.41	0.65	8.5	
Wicklow	0.51	0.69	0.50	0.49	0.56	0.50	0.25	0.31	0.17	0.15	0.35	0.54	0.49	0.45	0.28	0.29	0.50	0.42	7.4	
Totals	26	27	27	29	24	20	18	15	16	15	13	13	14	15	16	14	15	18	334.3	

Increase 1st Thin area 20% >=7 cm ('000 m ³)	20% 40 m ³ /ha																		Totals
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Carlow	0.22	0.27	0.50	0.34	0.20	0.31	0.40	0.19	0.25	0.09	0.25	0.24	0.33	0.38	0.19	0.31	0.17	0.14	4.8
Cavan	1.85	1.93	1.43	1.47	1.75	1.52	1.93	1.22	2.02	1.62	0.88	1.10	0.90	1.69	1.49	1.36	1.64	1.35	27.1
Clare	3.56	3.20	3.32	4.03	2.80	2.60	3.34	1.74	1.63	1.75	1.17	1.25	2.03	1.14	1.93	1.50	1.62	2.60	41.2
Cork	5.10	6.63	6.05	7.24	5.53	5.28	4.27	4.07	4.67	4.67	3.20	3.45	3.99	4.20	3.56	3.43	3.29	3.93	82.6
Donegal	1.95	2.00	3.54	3.32	2.41	1.57	0.59	0.74	0.93	0.96	0.65	0.41	0.30	0.55	0.38	0.12	0.34	0.51	21.3
Dublin	0.05	0.05	0.08	0.04	0.01	0.03	0.01	0.03	0.00	0.07	0.03	0.00	0.02	0.00	0.02	0.04	0.11	0.01	0.6
Galway	2.79	2.33	2.08	2.37	2.07	1.54	1.60	1.12	1.55	1.52	1.31	1.47	1.72	1.19	1.09	1.53	1.39	2.06	30.7
Kerry	4.60	5.62	6.26	5.49	5.81	3.12	3.07	2.50	1.88	2.18	1.73	2.08	1.84	1.78	2.57	1.84	2.14	2.20	56.7
Kildare	0.66	1.32	0.97	1.06	0.56	0.32	0.61	0.25	0.85	0.83	0.22	0.32	0.35	0.26	0.56	0.34	0.30	0.37	10.2
Kilkenny	1.71	1.47	1.86	1.86	1.40	1.30	1.63	1.24	1.74	1.33	0.66	0.81	1.05	1.41	1.64	1.00	1.08	1.80	25.0
Laois	2.43	2.08	1.77	1.63	1.60	1.35	0.83	0.68	0.90	0.61	0.66	0.49	0.58	1.16	0.73	1.10	1.02	1.29	20.9
Leitrim	2.30	3.54	2.34	2.14	2.18	2.47	1.37	1.11	1.33	1.34	1.06	1.43	1.31	1.33	1.79	1.91	2.99	3.65	35.6
Limerick	2.77	3.54	2.85	4.35	2.98	2.31	1.82	1.87	1.88	1.86	1.81	1.68	1.14	1.04	1.29	0.94	0.77	1.61	36.5
Longford	1.09	1.09	1.53	0.92	0.79	1.51	1.32	0.93	0.70	0.72	1.05	0.64	0.82	1.17	0.88	0.82	0.69	0.87	17.6
Louth	0.10	0.01	0.06	0.31	0.05	0.28	0.06	0.26	0.08	0.23	0.18	0.20	0.25	0.21	0.37	0.09	0.11	0.06	2.9
Mayo	2.77	2.14	2.68	2.84	2.33	2.55	1.85	1.61	1.32	0.82	1.06	1.18	1.30	1.56	1.44	1.87	2.05	1.22	32.6
Meath	1.20	1.12	0.85	1.30	1.23	0.46	0.72	0.61	0.88	0.91	0.81	0.44	0.69	0.70	0.80	0.51	0.71	0.69	14.6
Monaghan	0.42	0.17	0.30	0.25	0.23	0.28	0.17	0.14	0.29	0.33	0.52	0.39	0.41	0.32	0.50	0.48	0.38	0.52	6.1
Offaly	1.52	1.75	2.56	2.50	2.29	1.54	1.89	1.93	1.21	0.84	0.80	0.92	0.89	0.98	1.10	1.26	1.18	1.32	26.5
Roscommon	2.42	3.43	2.77	2.77	2.43	2.07	1.69	1.25	1.42	1.74	1.89	1.88	1.72	1.84	1.32	1.25	2.41	2.20	36.5
Sligo	2.08	1.47	1.52	2.01	1.58	0.86	0.68	0.92	0.48	0.54	0.52	0.68	0.68	0.95	1.48	1.12	1.07	1.04	19.7
Tipperary	3.94	3.99	3.74	4.03	2.64	2.75	1.94	2.69	2.18	1.90	1.97	2.13	1.93	2.00	2.67	1.11	1.39	1.90	44.9
Waterford	1.20	1.27	1.29	1.20	1.26	0.64	1.00	1.15	1.00	1.05	0.50	0.74	0.50	0.84	1.21	1.02	0.97	1.35	18.2
Westmeath	2.65	1.84	1.89	1.38	1.47	0.97	1.69	0.95	0.97	1.30	0.94	0.76	0.85	0.75	1.44	1.40	1.11	1.70	24.1
Wexford	0.86	1.12	1.18	1.41	0.95	0.81	0.46	0.81	1.06	1.24	1.05	0.92	0.64	0.89	0.90	0.49	0.83	1.29	16.9
Wicklow	1.03	1.37	1.00	0.98	1.11	1.00	0.50	0.61	0.34	0.30	0.69	1.08	0.98	0.90	0.56	0.59	1.01	0.84	14.9
Totals	51	55	54	57	48	39	35	31	32	31	26	27	27	29	32	27	31	37	668.6

	Increase 1st Thin area 30% >=7 cm ('000 m ³)			30% 40 m ³ /ha																Totals
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040		
Carlow	0.34	0.40	0.74	0.50	0.30	0.47	0.59	0.29	0.37	0.14	0.38	0.36	0.49	0.58	0.29	0.47	0.26	0.21	7.2	
Cavan	2.78	2.89	2.15	2.20	2.62	2.27	2.89	1.84	3.03	2.43	1.32	1.65	1.35	2.53	2.24	2.05	2.46	2.02	40.7	
Clare	5.34	4.79	4.97	6.04	4.20	3.89	5.01	2.61	2.45	2.62	1.75	1.87	3.04	1.71	2.89	2.25	2.43	3.91	61.8	
Cork	7.65	9.95	9.07	10.86	8.29	7.93	6.41	6.11	7.01	7.00	4.79	5.18	5.98	6.31	5.34	5.14	4.93	5.89	123.8	
Donegal	2.92	3.00	5.32	4.98	3.62	2.35	0.89	1.10	1.39	1.43	0.98	0.61	0.45	0.83	0.58	0.18	0.51	0.76	31.9	
Dublin	0.08	0.08	0.12	0.05	0.02	0.05	0.01	0.05	0.00	0.11	0.04	0.00	0.03	0.00	0.03	0.06	0.16	0.01	0.9	
Galway	4.19	3.49	3.12	3.55	3.11	2.30	2.40	1.68	2.32	2.28	1.97	2.21	2.59	1.78	1.64	2.30	2.09	3.09	46.1	
Kerry	6.90	8.42	9.39	8.23	8.72	4.69	4.60	3.75	2.82	3.28	2.59	3.12	2.76	2.68	3.86	2.75	3.20	3.30	85.0	
Kildare	0.99	1.99	1.45	1.59	0.84	0.48	0.92	0.37	1.27	1.25	0.33	0.49	0.53	0.39	0.84	0.51	0.45	0.56	15.2	
Kilkenny	2.57	2.21	2.80	2.79	2.09	1.95	2.45	1.85	2.62	1.99	1.00	1.21	1.57	2.12	2.46	1.49	1.63	2.70	37.5	
Laois	3.64	3.12	2.66	2.45	2.40	2.02	1.25	1.01	1.35	0.92	0.99	0.74	0.87	1.74	1.10	1.65	1.53	1.94	31.4	
Leitrim	3.46	5.30	3.52	3.21	3.28	3.70	2.05	1.66	1.99	2.01	1.59	2.14	1.97	2.00	2.69	2.86	4.49	5.48	53.4	
Limerick	4.15	5.31	4.27	6.53	4.47	3.46	2.74	2.81	2.82	2.78	2.71	2.52	1.72	1.56	1.94	1.41	1.16	2.42	54.8	
Longford	1.64	1.63	2.30	1.39	1.19	2.26	1.99	1.40	1.05	1.08	1.58	0.97	1.23	1.76	1.32	1.23	1.04	1.31	26.3	
Louth	0.14	0.02	0.08	0.47	0.07	0.42	0.09	0.39	0.12	0.35	0.26	0.30	0.37	0.32	0.56	0.14	0.16	0.08	4.3	
Mayo	4.16	3.21	4.02	4.26	3.50	3.82	2.78	2.42	1.98	1.23	1.60	1.77	1.95	2.35	2.15	2.80	3.08	1.83	48.9	
Meath	1.80	1.69	1.28	1.96	1.85	0.69	1.08	0.92	1.33	1.37	1.21	0.65	1.04	1.05	1.19	0.77	1.06	1.04	22.0	
Monaghan	0.63	0.25	0.45	0.38	0.34	0.42	0.26	0.21	0.43	0.50	0.78	0.59	0.62	0.47	0.75	0.72	0.56	0.78	9.1	
Offaly	2.28	2.63	3.85	3.74	3.44	2.31	2.83	2.90	1.81	1.25	1.20	1.39	1.34	1.47	1.65	1.89	1.77	1.98	39.7	
Roscommon	3.63	5.14	4.16	4.16	3.64	3.11	2.54	1.87	2.13	2.61	2.83	2.82	2.58	2.76	1.99	1.87	3.62	3.30	54.8	
Sligo	3.13	2.20	2.27	3.01	2.37	1.29	1.01	1.38	0.72	0.81	0.78	1.02	1.01	1.42	2.22	1.68	1.60	1.55	29.5	
Tipperary	5.91	5.98	5.61	6.05	3.96	4.12	2.92	4.03	3.26	2.84	2.95	3.20	2.90	3.01	4.00	1.66	2.09	2.85	67.4	
Waterford	1.80	1.91	1.93	1.81	1.88	0.96	1.49	1.73	1.49	1.58	0.74	1.11	0.75	1.26	1.81	1.53	1.46	2.03	27.3	
Westmeath	3.98	2.77	2.83	2.07	2.21	1.45	2.53	1.42	1.45	1.95	1.41	1.13	1.28	1.12	2.17	2.10	1.67	2.56	36.1	
Wexford	1.29	1.68	1.76	2.12	1.43	1.22	0.68	1.21	1.59	1.86	1.58	1.37	0.96	1.33	1.35	0.74	1.24	1.94	25.4	
Wicklow	1.54	2.06	1.50	1.47	1.67	1.49	0.75	0.92	0.51	0.45	1.04	1.62	1.47	1.35	0.84	0.88	1.51	1.26	22.3	
Totals	77	82	82	86	72	59	53	46	47	46	38	40	41	44	48	41	46	55	1,002.9	

Appendix 2 Increased Whole Tree Thinning – County Analysis

Increase the % Whole Tree Harvest ('000 m ³)	10% 35 m ³ /ha																			Totals
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040		
Carlow	0.10	0.12	0.22	0.15	0.09	0.14	0.17	0.09	0.11	0.04	0.11	0.11	0.14	0.17	0.09	0.14	0.08	0.06	2.1	
Cavan	0.81	0.84	0.63	0.64	0.76	0.66	0.84	0.54	0.88	0.71	0.39	0.48	0.39	0.74	0.65	0.60	0.72	0.59	11.9	
Clare	1.56	1.40	1.45	1.76	1.22	1.14	1.46	0.76	0.71	0.76	0.51	0.55	0.89	0.50	0.84	0.66	0.71	1.14	18.0	
Cork	2.23	2.90	2.65	3.17	2.42	2.31	1.87	1.78	2.04	2.04	1.40	1.51	1.74	1.84	1.56	1.50	1.44	1.72	36.1	
Donegal	0.85	0.88	1.55	1.45	1.06	0.69	0.26	0.32	0.41	0.42	0.28	0.18	0.13	0.24	0.17	0.05	0.15	0.22	9.3	
Dublin	0.02	0.02	0.03	0.02	0.01	0.01	0.00	0.01	0.00	0.03	0.01	0.00	0.01	0.00	0.01	0.02	0.05	0.00	0.3	
Galway	1.22	1.02	0.91	1.04	0.91	0.67	0.70	0.49	0.68	0.67	0.57	0.65	0.75	0.52	0.48	0.67	0.61	0.90	13.5	
Kerry	2.01	2.46	2.74	2.40	2.54	1.37	1.34	1.09	0.82	0.96	0.76	0.91	0.80	0.78	1.13	0.80	0.93	0.96	24.8	
Kildare	0.29	0.58	0.42	0.46	0.24	0.14	0.27	0.11	0.37	0.37	0.09	0.14	0.15	0.11	0.25	0.15	0.13	0.16	4.4	
Kilkenny	0.75	0.64	0.82	0.81	0.61	0.57	0.71	0.54	0.76	0.58	0.29	0.35	0.46	0.62	0.72	0.44	0.47	0.79	10.9	
Laois	1.06	0.91	0.77	0.71	0.70	0.59	0.36	0.30	0.39	0.27	0.29	0.22	0.25	0.51	0.32	0.48	0.45	0.57	9.2	
Leitrim	1.01	1.55	1.03	0.94	0.96	1.08	0.60	0.48	0.58	0.59	0.46	0.62	0.57	0.58	0.78	0.83	1.31	1.60	15.6	
Limerick	1.21	1.55	1.25	1.90	1.30	1.01	0.80	0.82	0.82	0.81	0.79	0.73	0.50	0.46	0.56	0.41	0.34	0.70	16.0	
Longford	0.48	0.48	0.67	0.40	0.35	0.66	0.58	0.41	0.31	0.32	0.46	0.28	0.36	0.51	0.38	0.36	0.30	0.38	7.7	
Louth	0.04	0.01	0.02	0.14	0.02	0.12	0.03	0.11	0.03	0.10	0.08	0.09	0.11	0.09	0.16	0.04	0.05	0.02	1.3	
Mayo	1.21	0.94	1.17	1.24	1.02	1.11	0.81	0.71	0.58	0.36	0.47	0.52	0.57	0.68	0.63	0.82	0.90	0.53	14.3	
Meath	0.52	0.49	0.37	0.57	0.54	0.20	0.32	0.27	0.39	0.40	0.35	0.19	0.30	0.31	0.35	0.22	0.31	0.30	6.4	
Monaghan	0.18	0.07	0.13	0.11	0.10	0.12	0.08	0.06	0.13	0.15	0.23	0.17	0.18	0.14	0.22	0.21	0.16	0.23	2.7	
Offaly	0.66	0.77	1.12	1.09	1.00	0.67	0.83	0.85	0.53	0.37	0.35	0.40	0.39	0.43	0.48	0.55	0.52	0.58	11.6	
Roscommon	1.06	1.50	1.21	1.21	1.06	0.91	0.74	0.55	0.62	0.76	0.83	0.82	0.75	0.80	0.58	0.55	1.05	0.96	16.0	
Sligo	0.91	0.64	0.66	0.88	0.69	0.38	0.30	0.40	0.21	0.24	0.23	0.30	0.30	0.42	0.65	0.49	0.47	0.45	8.6	
Tipperary	1.72	1.74	1.64	1.77	1.16	1.20	0.85	1.18	0.95	0.83	0.86	0.93	0.85	0.88	1.17	0.49	0.61	0.83	19.6	
Waterford	0.52	0.56	0.56	0.53	0.55	0.28	0.44	0.50	0.44	0.46	0.22	0.32	0.22	0.37	0.53	0.45	0.43	0.59	8.0	
Westmeath	1.16	0.81	0.83	0.60	0.65	0.42	0.74	0.41	0.42	0.57	0.41	0.33	0.37	0.33	0.63	0.61	0.49	0.75	10.5	
Wexford	0.38	0.49	0.51	0.62	0.42	0.36	0.20	0.35	0.46	0.54	0.46	0.40	0.28	0.39	0.39	0.22	0.36	0.57	7.4	
Wicklow	0.45	0.60	0.44	0.43	0.49	0.44	0.22	0.27	0.15	0.13	0.30	0.47	0.43	0.39	0.25	0.26	0.44	0.37	6.5	
Totals	22	24	24	25	21	17	15	13	14	13	11	12	12	13	14	12	13	16	292.5	

Increase the % Whole Tree Harvest ('000 m ³)	20% 35 m ³ /ha																		Totals
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Carlow	0.20	0.23	0.43	0.29	0.17	0.27	0.35	0.17	0.22	0.08	0.22	0.21	0.28	0.34	0.17	0.27	0.15	0.12	4.2
Cavan	1.62	1.69	1.25	1.28	1.53	1.33	1.69	1.07	1.77	1.42	0.77	0.96	0.79	1.48	1.31	1.19	1.44	1.18	23.8
Clare	3.11	2.80	2.90	3.52	2.45	2.27	2.92	1.52	1.43	1.53	1.02	1.09	1.77	1.00	1.69	1.31	1.42	2.28	36.0
Cork	4.46	5.81	5.29	6.33	4.84	4.62	3.74	3.56	4.09	4.08	2.80	3.02	3.49	3.68	3.11	3.00	2.88	3.44	72.2
Donegal	1.70	1.75	3.10	2.91	2.11	1.37	0.52	0.64	0.81	0.84	0.57	0.35	0.26	0.49	0.34	0.10	0.30	0.45	18.6
Dublin	0.05	0.05	0.07	0.03	0.01	0.03	0.01	0.03	0.00	0.06	0.03	0.00	0.02	0.00	0.02	0.03	0.10	0.01	0.5
Galway	2.44	2.04	1.82	2.07	1.82	1.34	1.40	0.98	1.35	1.33	1.15	1.29	1.51	1.04	0.96	1.34	1.22	1.80	26.9
Kerry	4.03	4.91	5.48	4.80	5.09	2.73	2.68	2.19	1.64	1.91	1.51	1.82	1.61	1.56	2.25	1.61	1.87	1.92	49.6
Kildare	0.58	1.16	0.85	0.93	0.49	0.28	0.54	0.21	0.74	0.73	0.19	0.28	0.31	0.23	0.49	0.30	0.26	0.33	8.9
Kilkenny	1.50	1.29	1.63	1.63	1.22	1.14	1.43	1.08	1.53	1.16	0.58	0.71	0.92	1.24	1.43	0.87	0.95	1.57	21.9
Laois	2.12	1.82	1.55	1.43	1.40	1.18	0.73	0.59	0.79	0.54	0.58	0.43	0.51	1.01	0.64	0.96	0.89	1.13	18.3
Leitrim	2.02	3.09	2.05	1.87	1.91	2.16	1.19	0.97	1.16	1.17	0.93	1.25	1.15	1.17	1.57	1.67	2.62	3.20	31.1
Limerick	2.42	3.10	2.49	3.81	2.61	2.02	1.60	1.64	1.64	1.62	1.58	1.47	1.00	0.91	1.13	0.82	0.68	1.41	31.9
Longford	0.95	0.95	1.34	0.81	0.70	1.32	1.16	0.82	0.61	0.63	0.92	0.56	0.71	1.03	0.77	0.72	0.61	0.76	15.4
Louth	0.08	0.01	0.05	0.27	0.04	0.25	0.05	0.23	0.07	0.20	0.15	0.17	0.22	0.18	0.33	0.08	0.09	0.05	2.5
Mayo	2.43	1.87	2.35	2.48	2.04	2.23	1.62	1.41	1.16	0.72	0.93	1.03	1.14	1.37	1.26	1.63	1.79	1.07	28.5
Meath	1.05	0.98	0.75	1.14	1.08	0.41	0.63	0.53	0.77	0.80	0.71	0.38	0.61	0.61	0.70	0.45	0.62	0.61	12.8
Monaghan	0.36	0.15	0.26	0.22	0.20	0.25	0.15	0.12	0.25	0.29	0.46	0.34	0.36	0.28	0.44	0.42	0.33	0.46	5.3
Offaly	1.33	1.53	2.24	2.18	2.00	1.35	1.65	1.69	1.06	0.73	0.70	0.81	0.78	0.86	0.96	1.11	1.03	1.15	23.2
Roscommon	2.12	3.00	2.43	2.42	2.13	1.81	1.48	1.09	1.24	1.52	1.65	1.65	1.50	1.61	1.16	1.09	2.11	1.93	31.9
Sligo	1.82	1.29	1.33	1.75	1.38	0.75	0.59	0.81	0.42	0.48	0.46	0.60	0.59	0.83	1.29	0.98	0.93	0.91	17.2
Tipperary	3.45	3.49	3.27	3.53	2.31	2.40	1.70	2.35	1.90	1.66	1.72	1.87	1.69	1.75	2.33	0.97	1.22	1.66	39.3
Waterford	1.05	1.11	1.13	1.05	1.10	0.56	0.87	1.01	0.87	0.92	0.43	0.65	0.44	0.74	1.06	0.89	0.85	1.18	15.9
Westmeath	2.32	1.61	1.65	1.21	1.29	0.85	1.48	0.83	0.85	1.14	0.82	0.66	0.75	0.66	1.26	1.23	0.97	1.49	21.1
Wexford	0.75	0.98	1.03	1.24	0.83	0.71	0.40	0.71	0.93	1.08	0.92	0.80	0.56	0.78	0.79	0.43	0.73	1.13	14.8
Wicklow	0.90	1.20	0.87	0.86	0.97	0.87	0.43	0.54	0.30	0.26	0.61	0.94	0.86	0.79	0.49	0.51	0.88	0.73	13.0
Totals	45	48	48	50	42	34	31	27	28	27	22	23	24	26	28	24	27	32	585.0

Increase the % Whole Tree Harvest ('000 m ³)	30% 35 m ³ /ha																			Totals
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040		
Carlow	0.29	0.35	0.65	0.44	0.26	0.41	0.52	0.26	0.33	0.12	0.33	0.32	0.43	0.50	0.26	0.41	0.23	0.18	6.3	
Cavan	2.43	2.53	1.88	1.93	2.29	1.99	2.53	1.61	2.65	2.12	1.16	1.44	1.18	2.22	1.96	1.79	2.15	1.77	35.6	
Clare	4.67	4.20	4.35	5.28	3.67	3.41	4.38	2.28	2.14	2.29	1.53	1.64	2.66	1.50	2.53	1.97	2.12	3.42	54.1	
Cork	6.69	8.71	7.94	9.50	7.26	6.93	5.61	5.34	6.13	6.12	4.19	4.53	5.23	5.52	4.67	4.50	4.32	5.16	108.4	
Donegal	2.55	2.63	4.65	4.36	3.17	2.06	0.78	0.97	1.22	1.26	0.85	0.53	0.39	0.73	0.51	0.16	0.45	0.67	27.9	
Dublin	0.07	0.07	0.10	0.05	0.02	0.04	0.01	0.04	0.00	0.10	0.04	0.00	0.03	0.00	0.03	0.05	0.14	0.01	0.8	
Galway	3.67	3.06	2.73	3.11	2.72	2.02	2.10	1.47	2.03	2.00	1.72	1.94	2.26	1.56	1.43	2.01	1.83	2.70	40.4	
Kerry	6.04	7.37	8.22	7.20	7.63	4.10	4.02	3.28	2.46	2.87	2.27	2.73	2.41	2.34	3.38	2.41	2.80	2.89	74.4	
Kildare	0.86	1.74	1.27	1.39	0.73	0.42	0.81	0.32	1.11	1.10	0.28	0.42	0.46	0.34	0.74	0.45	0.39	0.49	13.3	
Kilkenny	2.25	1.93	2.45	2.44	1.83	1.71	2.14	1.62	2.29	1.74	0.87	1.06	1.37	1.86	2.15	1.31	1.42	2.36	32.8	
Laois	3.19	2.73	2.32	2.14	2.10	1.77	1.09	0.89	1.18	0.81	0.86	0.65	0.76	1.52	0.96	1.44	1.34	1.70	27.5	
Leitrim	3.02	4.64	3.08	2.81	2.87	3.24	1.79	1.45	1.74	1.76	1.39	1.87	1.72	1.75	2.35	2.50	3.93	4.80	46.7	
Limerick	3.63	4.64	3.74	5.71	3.91	3.03	2.39	2.46	2.47	2.44	2.38	2.20	1.50	1.37	1.69	1.23	1.01	2.11	47.9	
Longford	1.43	1.43	2.01	1.21	1.04	1.98	1.74	1.23	0.92	0.95	1.38	0.85	1.07	1.54	1.15	1.08	0.91	1.15	23.1	
Louth	0.13	0.02	0.07	0.41	0.07	0.37	0.08	0.34	0.10	0.31	0.23	0.26	0.33	0.28	0.49	0.12	0.14	0.07	3.8	
Mayo	3.64	2.81	3.52	3.73	3.06	3.34	2.43	2.12	1.73	1.08	1.40	1.55	1.71	2.05	1.88	2.45	2.69	1.60	42.8	
Meath	1.57	1.47	1.12	1.71	1.62	0.61	0.95	0.80	1.16	1.19	1.06	0.57	0.91	0.92	1.04	0.67	0.93	0.91	19.2	
Monaghan	0.55	0.22	0.39	0.33	0.30	0.37	0.23	0.19	0.38	0.44	0.68	0.51	0.54	0.41	0.66	0.63	0.49	0.68	8.0	
Offaly	1.99	2.30	3.37	3.28	3.01	2.02	2.48	2.54	1.58	1.10	1.05	1.21	1.17	1.29	1.44	1.66	1.55	1.73	34.7	
Roscommon	3.18	4.50	3.64	3.64	3.19	2.72	2.22	1.64	1.86	2.29	2.48	2.47	2.25	2.41	1.74	1.64	3.16	2.89	47.9	
Sligo	2.73	1.93	1.99	2.63	2.07	1.13	0.89	1.21	0.63	0.71	0.69	0.89	0.89	1.25	1.94	1.47	1.40	1.36	25.8	
Tipperary	5.17	5.23	4.91	5.30	3.47	3.61	2.55	3.53	2.86	2.49	2.58	2.80	2.54	2.63	3.50	1.46	1.83	2.49	58.9	
Waterford	1.57	1.67	1.69	1.58	1.65	0.84	1.31	1.51	1.31	1.38	0.65	0.97	0.65	1.10	1.59	1.34	1.28	1.78	23.9	
Westmeath	3.48	2.42	2.48	1.81	1.94	1.27	2.22	1.24	1.27	1.71	1.23	0.99	1.12	0.98	1.90	1.84	1.46	2.24	31.6	
Wexford	1.13	1.47	1.54	1.85	1.25	1.07	0.60	1.06	1.39	1.63	1.38	1.20	0.84	1.17	1.18	0.65	1.09	1.70	22.2	
Wicklow	1.35	1.80	1.31	1.29	1.46	1.31	0.65	0.81	0.45	0.39	0.91	1.42	1.28	1.18	0.74	0.77	1.32	1.10	19.5	
Totals	67	72	71	75	63	52	46	40	41	40	34	35	36	38	42	36	40	48	877.5	

Appendix 3 SBH – County Analysis

Private Specified Biomass Harvesting ('000 tonnes)	80 t/ha																			Totals
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040		
Carlow	1.55	1.77	2.97	1.72	1.67	0.80	0.00	0.24	1.95	0.21	0.31	1.79	0.25	1.64	1.45	0.48	1.64	1.14	21.6	
Cavan	5.95	5.93	8.44	4.39	4.16	4.88	5.08	2.39	10.12	7.91	7.71	6.75	5.13	14.12	16.62	3.53	2.62	6.43	122.2	
Clare	19.11	16.18	13.39	14.95	14.20	12.12	12.14	14.02	9.13	15.40	10.18	13.47	11.84	15.76	20.44	16.02	6.27	6.10	240.7	
Cork	10.50	13.94	18.95	15.93	15.63	34.04	19.03	7.54	21.03	22.92	16.95	23.14	22.18	37.91	33.11	5.90	8.57	4.00	331.3	
Donegal	4.92	2.56	4.52	2.54	3.87	12.31	6.87	6.41	4.03	5.46	3.35	3.52	2.11	6.64	3.91	4.54	1.35	1.79	80.7	
Dublin	0.00	0.27	0.00	0.00	0.17	0.00	0.88	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.05		2.7	
Galway	5.12	4.38	4.37	3.84	4.26	3.91	3.50	1.39	3.19	4.17	7.37	5.21	5.18	8.53	7.83	1.62	1.97	5.21	81.0	
Kerry	13.13	8.76	15.08	13.03	11.38	16.08	13.73	7.06	17.94	12.04	15.88	27.24	11.31	18.98	13.69	4.76	2.37	1.83	224.3	
Kildare	1.16	3.69	0.25	1.14	0.13	0.37	0.04	0.28	0.03	0.00	1.11	0.04	0.10	1.00	0.64	0.00	0.67	0.26	10.9	
Kilkenny	6.44	9.59	9.13	17.93	9.65	7.64	11.10	3.19	4.14	4.60	2.65	8.58	5.26	20.13	11.22	1.21	3.93	4.23	140.6	
Laois	9.92	5.97	6.69	12.02	7.81	2.47	8.00	6.98	8.85	5.89	2.27	4.62	2.74	5.58	5.90	0.46	2.07	2.22	100.5	
Leitrim	15.66	9.86	13.42	10.18	10.63	20.96	5.82	4.70	8.34	9.71	9.20	13.29	9.29	13.05	25.57	22.51	23.70	19.32	245.2	
Limerick	5.48	5.64	7.67	5.03	8.69	7.94	9.57	10.58	18.69	22.73	13.90	12.21	11.53	26.14	28.29	2.10	1.40	1.69	199.3	
Longford	1.15	1.50	1.21	2.43	0.86	0.69	0.20	0.67	2.34	2.12	2.28	3.69	2.25	3.98	2.70	0.19	6.65	2.43	37.3	
Louth	0.00	0.00	0.00	0.00	0.00	0.00	1.53	0.00	0.00	0.24	0.00	0.00	0.06	1.85	0.96	0.00	0.37	0.06	5.1	
Mayo	5.21	7.81	7.82	7.66	6.87	7.97	9.91	8.79	7.66	9.99	6.38	4.84	6.38	10.29	12.36	5.45	5.47	9.03	139.9	
Meath	1.11	0.45	1.45	0.42	1.71	1.26	7.67	1.89	2.24	3.50	0.76	1.25	0.74	8.58	3.18	0.36	0.96	0.94	38.4	
Monaghan	0.46	0.87	0.79	0.36	0.80	0.11	1.02	0.83	0.99	1.09	1.23	1.01	2.64	2.55	3.00	0.84	0.77	0.76	20.1	
Offaly	3.83	1.38	0.00	0.84	2.13	0.64	1.58	3.19	2.52	0.00	1.90	5.40	1.47	2.83	2.40	0.10	0.86	7.56	38.6	
Roscommon	5.62	9.12	6.04	8.24	6.80	3.83	3.30	3.83	5.15	2.39	8.29	8.55	10.40	11.57	10.02	2.28	5.06	7.88	118.4	
Sligo	11.58	6.02	4.81	5.94	4.05	5.87	5.70	2.19	6.22	3.04	3.85	5.79	3.00	5.75	9.34	4.48	1.99	5.90	95.5	
Tipperary	22.01	9.00	23.49	12.30	22.84	15.15	12.52	13.08	13.57	10.58	11.04	13.18	10.33	27.67	26.39	2.13	9.68	12.76	267.7	
Waterford	5.77	5.49	7.04	8.78	3.70	8.81	2.76	0.96	5.39	3.59	4.89	5.41	7.81	10.75	11.63	1.81	5.34	6.68	106.6	
Westmeath	2.24	5.91	0.59	1.70	3.77	0.46	1.39	1.36	0.13	3.99	1.99	0.95	2.04	5.18	1.95	0.79	1.99	1.78	38.2	
Wexford	6.38	7.60	7.31	4.21	6.19	3.80	0.82	2.93	3.03	3.37	3.22	6.27	5.97	7.16	12.92	0.77	3.00	5.11	90.1	
Wicklow	7.48	3.40	4.94	4.32	3.75	6.39	2.04	2.05	3.76	0.41	1.23	3.17	1.38	5.84	4.52	1.12	1.41	3.88	61.1	
Totals	172	147	170	160	156	179	146	108	160	155	138	179	141	273	270	83	100	119	2,858.1	

Private Specified Biomass Harvesting ('000 tonnes)	60 t/ha																		
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Totals
Carlow	1.16	1.33	2.23	1.29	1.25	0.60	0.00	0.18	1.46	0.16	0.24	1.34	0.19	1.23	1.09	0.36	1.23	0.86	16.2
Cavan	4.46	4.45	6.33	3.29	3.12	3.66	3.81	1.79	7.59	5.93	5.78	5.06	3.85	10.59	12.47	2.65	1.97	4.82	91.6
Clare	14.33	12.13	10.04	11.21	10.65	9.09	9.11	10.52	6.85	11.55	7.63	10.11	8.88	11.82	15.33	12.02	4.70	4.57	180.5
Cork	7.87	10.45	14.21	11.95	11.72	25.53	14.27	5.65	15.77	17.19	12.71	17.36	16.64	28.44	24.83	4.42	6.43	3.00	248.5
Donegal	3.69	1.92	3.39	1.91	2.90	9.23	5.15	4.81	3.02	4.09	2.51	2.64	1.59	4.98	2.93	3.40	1.02	1.35	60.5
Dublin	0.00	0.20	0.00	0.00	0.13	0.00	0.66	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.04	2.0
Galway	3.84	3.29	3.28	2.88	3.20	2.93	2.62	1.04	2.40	3.13	5.52	3.91	3.88	6.39	5.88	1.21	1.48	3.90	60.8
Kerry	9.85	6.57	11.31	9.78	8.54	12.06	10.30	5.30	13.46	9.03	11.91	20.43	8.48	14.24	10.27	3.57	1.78	1.37	168.2
Kildare	0.87	2.77	0.19	0.85	0.10	0.27	0.03	0.21	0.02	0.00	0.83	0.03	0.08	0.75	0.48	0.00	0.51	0.20	8.2
Kilkenny	4.83	7.19	6.85	13.45	7.24	5.73	8.33	2.40	3.11	3.45	1.99	6.44	3.94	15.09	8.42	0.91	2.94	3.17	105.5
Laois	7.44	4.48	5.02	9.02	5.86	1.85	6.00	5.23	6.64	4.41	1.70	3.46	2.05	4.18	4.42	0.35	1.56	1.67	75.3
Leitrim	11.75	7.39	10.06	7.64	7.97	15.72	4.36	3.53	6.26	7.28	6.90	9.97	6.97	9.79	19.18	16.88	17.77	14.49	183.9
Limerick	4.11	4.23	5.75	3.77	6.51	5.96	7.18	7.94	14.02	17.05	10.42	9.15	8.65	19.60	21.22	1.57	1.05	1.27	149.4
Longford	0.86	1.13	0.91	1.82	0.64	0.52	0.15	0.50	1.75	1.59	1.71	2.77	1.69	2.99	2.02	0.14	4.99	1.82	28.0
Louth	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	0.00	0.18	0.00	0.00	0.05	1.39	0.72	0.00	0.27	0.04	3.8
Mayo	3.90	5.85	5.87	5.75	5.15	5.98	7.43	6.59	5.74	7.49	4.79	3.63	4.78	7.71	9.27	4.09	4.10	6.77	104.9
Meath	0.83	0.34	1.09	0.31	1.28	0.94	5.76	1.42	1.68	2.63	0.57	0.93	0.56	6.43	2.39	0.27	0.72	0.71	28.8
Monaghan	0.34	0.65	0.59	0.27	0.60	0.08	0.77	0.62	0.74	0.81	0.92	0.76	1.98	1.91	2.25	0.63	0.58	0.57	15.1
Offaly	2.87	1.03	0.00	0.63	1.60	0.48	1.19	2.39	1.89	0.00	1.43	4.05	1.10	2.12	1.80	0.07	0.64	5.67	29.0
Roscommon	4.21	6.84	4.53	6.18	5.10	2.87	2.48	2.87	3.86	1.79	6.21	6.41	7.80	8.68	7.52	1.71	3.80	5.91	88.8
Sligo	8.69	4.52	3.61	4.45	3.03	4.40	4.28	1.64	4.66	2.28	2.89	4.34	2.25	4.31	7.00	3.36	1.49	4.43	71.6
Tipperary	16.51	6.75	17.62	9.23	17.13	11.37	9.39	9.81	10.18	7.93	8.28	9.89	7.74	20.75	19.79	1.60	7.26	9.57	200.8
Waterford	4.33	4.12	5.28	6.58	2.78	6.61	2.07	0.72	4.04	2.70	3.67	4.06	5.86	8.06	8.72	1.36	4.01	5.01	80.0
Westmeath	1.68	4.43	0.44	1.28	2.82	0.34	1.05	1.02	0.10	2.99	1.49	0.71	1.53	3.89	1.46	0.59	1.49	1.34	28.7
Wexford	4.79	5.70	5.48	3.15	4.65	2.85	0.62	2.20	2.27	2.53	2.42	4.70	4.48	5.37	9.69	0.57	2.25	3.83	67.5
Wicklow	5.61	2.55	3.71	3.24	2.81	4.80	1.53	1.53	2.82	0.31	0.92	2.38	1.04	4.38	3.39	0.84	1.06	2.91	45.8
Totals	129	110	128	120	117	134	110	81	120	117	103	135	106	205	203	63	75	89	2,143.5



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