

Wales Domestic Firewood Survey 2012



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Pobly Fforest **ELWY WORKING WOODS CO-OP**



Executive summary

A Wales-wide survey of the use of firewood for domestic heating was undertaken in May-June 2012. A mix of door-to-door and street interviews in eight locations resulted in 535 responses to a short questionnaire. Urban areas were relatively under-sampled but there are sufficient data to represent general patterns of usage from South, Mid and North Wales.

Results were stratified according to the Wales Rural Observatory (WRO) classification of rurality and this revealed strong differentiation of firewood use. In urban areas around 5% currently use firewood and 6% express an interest in burning wood. Around 25% of rural populations use firewood with 5-15% expressing an interest in doing so while in deep rural areas up to 70% of the households use firewood. There is a clear inverse relationship between population density and use of firewood and it appears that demand for firewood may be relatively uniform across the country. The Forestry Commission Public Opinion Survey results for 2011 support the findings of this study and indicate that firewood is used for domestic heating by 14% of the households in Wales.

Based on the frequency of use and reported firewood consumption, households were classified into three use profiles:

- high volume users who burn firewood all day during the winter and consume around 12 m³ a year,
- moderate volume users who burn firewood in the evenings during the winter and require around 6 m³ a year,
- low volumes users who burn firewood occasionally and use around 2.5 m³ a year.

The frequency of use profiles in WRO classes and the average volumes per year yields an estimated national consumption of 914,000 m³ of stacked firewood which is equal to 576,000 m³ of solid wood. A rough conversion of this to heat energy (2,880 GWh_{heat}yr⁻¹ of potential heat) suggests that domestic firewood is a significant contribution to use of renewable energy in Wales. The displacement of heating oil and gas by local firewood may also constitute a reduction in the carbon footprint of domestic heating especially in rural areas.

There is a strong preference for hardwood and especially ash and oak for use as firewood but softwoods (conifers) are also regularly used. Households obtain their firewood from a variety of sources with 37% using wood taken from trees on their own property, 46% purchasing wood, 13% obtaining wood as in kind payment, 32% collecting it free from neighbours' land, 19% taking it free and 22% using waste wood (e.g. pallets). A lot of this wood arises as a by-product of general land management activities such as hedge trimming, arboriculture (often on trees in urban areas), wayleave clearance etc.. Wood which is collected is often fallen dead wood, trees blown down in a storm or branches left after timber harvesting.

The firewood supply chain is usually short but has many variants with transactions between supplier and consumer being either; cash, in kind; social or familial in nature with wood often obtained free. There is a need to more fully understand firewood supply perhaps using value chain analysis which can be used to describe non-monetary transactions. This will be especially important for assessing the use of firewood by households experiencing or at risk of fuel poverty.

Less than half of firewood used is purchased. Sales are in a variety of units ranging from packs of kindling from the garage forecourt to pick-up truck loads which makes it difficult to determine the volume of commercial firewood or to compare prices. Prices reported suggest an average of £70 per cubic metre and £50 per tonne. Most people who process their own firewood reported costs of between £100 and £200 per year to cover transport and fuel costs.

Firewood is most often burnt in a log stove (75%) and these are fitted into all types of dwelling except flats. Most of these stoves are older than 10 years but there is steady interest in stove installation with around a 9% increase in the number of stoves installed per year over the past five years. A comparison with a 2003 survey in the Dyfi Valley suggests that a large proportion of open fires have apparently been replaced with stoves. Around a third of households using firewood use it as the main source of heat, but most households combine firewood with other heating systems, most often oil or LPG central heating. Only 2% of households using firewood burnt it in a boiler and only one of these was a pellet boiler.

Growing demand for firewood suggests the emergence of new markets for hardwoods which could provide an income diversification opportunity and an incentive for introduction of management in under-managed woodland. However, firewood procurement is complex, often very local in nature and tends to rely on word of mouth rather than direct marketing. This, together with local variation in prices and relative insecurity of supply suggests that new firewood enterprises need to be carefully researched to be successful.

The people interviewed had a reasonable level of awareness of what constitutes good quality firewood and most were able to store wood for a year with those sourcing green wood drying it for 1-3 years. A quarter of respondents had heard of quality assurance for firewood and a quarter said they would be willing to pay a small premium (median of 5% of current prices) to ensure wood they purchased was good quality.

Some of the interviewees were concerned about the sustainability of firewood supplies. However, comparison of the volumes being used to the standing resource of hardwood and consideration of the mixed sources for firewood suggests there is no reason to think that firewood use is a threat to woodland except perhaps within a farm or close to particular localities. Nevertheless, maintenance of a constant flow of good quality firewood will require management planning and ideally dedicated silviculture and species to ensure the optimal production of good quality firewood. Advice, support and research will be required to encourage the adoption of firewood management. This could perhaps be considered when the Glastir Woodland Management scheme is next reviewed.

Respondents who said they would like to use firewood gave their reasons as; it is better for the environment, aesthetics (fires are nice to look at/smell etc.) and cost (cheaper than present fuel). Of those who had given it some real thought, 75% wanted a wood-stove and two were considering wood-fired boilers and heat recovery systems. The main barriers to installation of a wood burning stove were the lack of a suitable chimney/flue, restrictions on alternations imposed by the landlord and concerns about supply and storage of wood.

This study was undertaken by Llais y Goedwig member groups with the support of the Forestry Commission Wales and Woodfuel Wales and a work placement provided by GOWales. It is an example of co-produced research by WG and the third sector on a previously under-recognised policy issue identified by Llais y Goedwig.

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Abbreviations

DUKES	Digest of UK energy statistics
FC	Forestry Commission (GB)
FCW	Forestry Commission Wales
LlyG	Llais y Goedwig
NRW	Natural Resources Wales
POS	Public Opinion Survey
RDP	Rural development plan
RWAS	Royal Welsh Agricultural Show
WG	Welsh Government
WRO	Wales Rural Observatory

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Carolyn Griffiths of FCW entered these data. Special thanks also to the 560+ people who generously gave us ten minutes of their time to answer questions on firewood.

Thanks also to Barbara Anglezarke and the FCW 'Woodlands for People' team for hosting a meeting to discuss the draft report at Y Plas in Machynlleth and to the 19 people who contributed to the lively and useful discussions on the day. Many of the recommendations in this report arise from these discussions.

Nevertheless, responsibility for the contents of this report remains with the authors.

Photographs in the text were provided by James Walmsley.

1 Introduction

The impetus for this study originated with Llais y Goedwig (LlyG) in response to a realisation that increasing numbers of member groups were providing firewood or considering firewood sales as a means of generating revenue. In order to guide these decisions, data on the size, nature and value of local firewood markets in Wales are required but are lacking because there has been no concerted market research directed at domestic firewood use. LlyG has no independent financial resources so sought partners with an interest in domestic firewood who may be able to assist with funding. This project was therefore established using co-production principles using: staff provided by a Go Wales graduate work experience placement (Kirsten Hails); match funding from Forestry Commission Wales (FCW); volunteer time from LlyG Board, LlyG member groups (Elwy Working Woods Co-op, Pobl y Fforest, Moelyci, Blaen Bran Community Woodland and Coetir Mynydd), Woodfuel Wales and Bangor University. The study was therefore a co-operative venture and ended up serving many objectives for a number of partners.

The aims for the domestic firewood project for LlyG were to:

- provide members with market information on current demand for domestic firewood;
- provide a third sector work placement, and
- guide preparation of an Advisory Note on Firewood market research for LlyG members.

The data to be collected by the survey (of primary interest to FCW and Woodfuel Wales) were to:

- estimate the proportion of households in survey areas which use firewood;
- describe the wood burning technologies used;
- estimate household consumption of firewood;
- characterise the domestic firewood supply chain including, species, units of sale, prices, storage etc.;
- enquire about users' appreciation of firewood quality, and
- develop usage profiles to characterise a range of firewood users.

This report presents the results of the survey which was undertaken in June-July 2012.

2 Methodology

During the period May – July 2012, a questionnaire survey of households from across Wales was undertaken to further understanding of domestic firewood supply and consumption.

The questionnaire used in the survey is shown in Appendix 1. This was drafted by Kirsten Hails and was reviewed by Woodfuel Wales and James Walmsley (Bangor University). Woodfuel Wales also provided leaflets for distribution to any respondents who wanted further information.

Our initial idea was to sample in urban, peri-urban and rural and to ensure that the survey was spatially distributed to cover South, Mid and North Wales. Surveys were undertaken by Kirsten Hails together with LlyG members and volunteers provided by Woodfuel Wales.

Five sampling strategies were employed in the survey.

- **Door-to-door surveys** were used in Cwmbran in Torfaen, Abergele in Denbighshire and Tregarth & Mynydd Llandygai (adjoining villages) in Gwynedd. In these surveys streets were selected at random and all households within those streets were approached by the interviewer moving from door-to-door. Data arising from these three areas will have limited bias and it should therefore be possible to extrapolate results from the sample as the total number of households in the community is known. The door-to-door surveys all included social housing.
- **Street surveys** were used in Welshpool and two nearby villages (Meifod and Llanfair Caereinion). The survey in Welshpool was done on market day when there are a lot of people on the streets. In the two villages there were few people on the roads so very few interviews were conducted. Although there is a random element in the selection of interviewees there is perhaps more likelihood of people with an interest in firewood stopping to answer questions which may increase the risk of bias. It is also difficult to extrapolate from this type of data as the number of people who might be in town on market day and how this relates to the total population of the catchment area of the market are not known.
- Customers at a **village shop and local sawmill** were asked to complete questionnaires while on the premises. The shop survey was systematic with people asked to complete questionnaire to represent the known catchment area of the shop. The sawmill sample was small in number.
- People attending two **national shows**, the Smallholders & Garden Festival and the Royal Welsh Agricultural Show (RWAS) in Builth Wells were approached by the interviewers with questionnaires. This maybe a relatively unbiased sample of the people at the shows but the population attending is composed of people with an interest in the countryside and may therefore be more inclined to burn firewood. It is possible to extrapolate from the sample to the total number of people attending the show as this is known but it is not possible to extrapolate further to the whole population as the representativeness of show attendants of the total population of Wales is unknown.
- Llais y Goedwig members were also given the opportunity to complete the questionnaire **online**. This was extremely biased and only people who used firewood responded.

A total of 577 questionnaires were returned from these surveys and used in the analysis. Of these, seven were records of people who did not wish to complete the questionnaire and 26 were from households located in England which were excluded from the analysis. After these exclusions 535 questionnaires as shown in Table 1 were entered into the analysis. Because of the differences in sampling design it was not possible to treat all the data in the same way and so a meta-analysis led by the questions being asked was undertaken. This meant careful consideration of which sub-sets of data could be used in each analysis. For example, if we want to know the relationship between the type of property and firewood appliance fitted we can include all records which have responses to both questions regardless of whether they came from a door-to-door or the RWAS; but if we wish to estimate total firewood demand we should only use data derived from objective samples. In

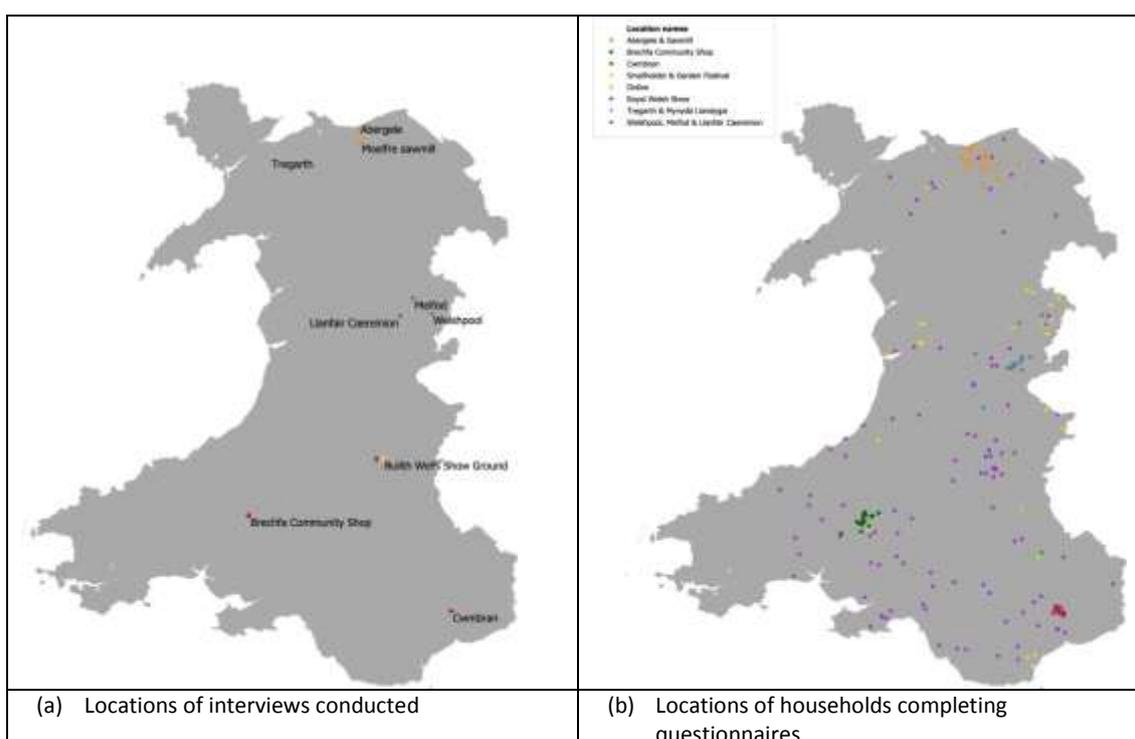
this way the number of records in each analysis varies so care is needed in extrapolating from the data tables.

Figure 1 (a) shows the locations at which people were interviewed while Figure 1 (b) shows the distribution of completed questionnaires across Wales. This shows that there is at least some coverage of most of the country with the main omissions being Anglesey and Pembrokeshire.

Table 1: Distribution of questionnaires

Location / sub-sample	County	Location in Wales	N	Notes on sampling technique
Abergele	Denbighshire	North	36	Door-to-door survey
Other	Denbighshire	North	14	Visitors to sawmill
Tregarth&MynyddL landygai	Gwynedd	North	111	Door-to-door survey
Welshpool	Powys	Mid	33	People approached on street on market day
Meifod&Llanfair Caereinion	Powys	Mid	11	People approached out and about in the villages
Cwmbran	Torfaen	South	113	Door-to-door survey
Brechfa	Carmarthenshire	South	49	Customers in community shop asked to complete questionnaires to represent a 1-in-4 sample of households spread over the (previously identified) geographical catchment area of the shop. Four personal visits made to fill in known gaps.
Smallholder & Garden Festival	All	All	24	Visitors to Show in Builth Wells 19-20 th May 2012
Royal Welsh Agricultural Show	All	All	137	Visitors to Show in Builth Wells 23-26 th July 2012
Online	All	All	7	Llais y Goedwig members
Total			535	

Figure 1: Sample locations



The survey distinguished between rural and urban in a rather loose sense but in order to more formally describe firewood usage a more objective means of assigning questionnaires to these classes based on postcodes was required. The Wales Rural Observatory (WRO) uses two criteria to classify communities (White&Tippireddy 2009). One subjectively classifies at county level into 'Rural', 'Urban', 'Valleys' and 'Other'. The other assigns constituencies according to population density into three classes; 'sparse' – less than 150 persons per km², 'medium' – 150 to 1,500 persons per km² and 'dense' – >1,500 persons per km². The allocation of local authority and constituency areas to these classes is given in Appendix 2 and Table 2 shows the distribution of questionnaires included in the analyses (in red) against these WRO classes. It is obvious that there are gaps in coverage, most notably in the Valleys and Urban areas.

Table 2: Grouping results according to the WRO classification of rurality in Wales

Rural/Urban ¹	Counties	Population density calculated at constituency level (persons per km ²)		
		Sparse < 150	Medium 150-1500	Dense > 1500
Rural Nine counties dominated by agriculture	Carmarthenshire, Ceredigion, Conwy, Denbighshire, Gwynedd, Monmouthshire, Pembrokeshire, Powys, Ynys Mon	393,440 373	77,024 11	-
Other Four counties with a mix of urban/rural areas	Flintshire, Torfaen, Vale of Glamorgan, Wrexham	32,639 3	174,452 117	12,809 0
Valleys Six counties with industrial towns in close proximity to moorland and forest	Blaenau Gwent, Bridgend, Caerphilly, Merthyr Tydfil, Neath Port Talbot, Rhondda Cynon Taff	-	368,390 16	-
Urban Three counties which contain substantial conurbations	Cardiff, Newport, Swansea	-	99,030 4	217,056 10

Figures in black are the number of households from the postcode database provided by FCW October 2012. Figures in red are the numbers of completed questionnaires from each WRO category.

3 Use of firewood

As shown in Table 1, five sampling strategies were employed in the survey and careful consideration is required to pool these data for analysis to minimise bias and provide a robust basis for extrapolating results to Wales. Table 3 gives the numbers of people who use, would like to use, and have no interest in firewood for all datasets grouped by sampling strategy. These figures show a great deal of variation and it is difficult to separate possible bias from real differences between communities.

Figure 2 shows the proportions of households using firewood for six locations for which there are more than ten questionnaires in Table 3 ranked from lowest to highest population density. As expected there is a relationship between the proportion of the households using firewood and population density. So, 70% of households use firewood in Brechfa with an average of 46 persons per km² while only 5% of households use firewood in Cwmbran which has an average of 690 persons per km². This is likely to be a direct reflection of the

¹Wales Rural Observatory, undated:35, <http://www.walesruralobservatory.org.uk/reports/english/statistical%20report1.pdf> accessed 18.10.12

availability of wood and alternative sources of fuel there being more trees and fewer alternatives e.g. mains gas supply in more remote, rural locations with low population densities. However, small percentages of large populations still represents significant firewood demand – 5% of people in Cwmbran represents the same number of firewood users per km² as 70% of people in Brechfa.

Table 3: Use of firewood by sub-sample

Sampling strategy	Location	Number of households			
		Use firewood	Would like to use firewood	No interest in firewood	Total
Door-to-door	Abergele	10	2	24	36
	Tregarth	27	4	80	111
	Cwmbran	6	7	100	113
	Sub-total	43	13	204	260
On street	Welshpool(market day)	5	13	15	33
	Meifod	2	2	3	7
	Llanfair Caereinion	3	-	1	4
	Sub-total	10	15	19	44
Shop visitors	Moelfre sawmill	9	3	2	14
	Brechfa community shop	35	2	12	49
	Sub-total	44	5	14	63
Builth Wells	Smallholder Show	11	8	5	24
	Royal Welsh Show	70	21	46	137
	Sub-total	81	29	55	161
Self-selected	Online	7	0	0	7
	Total	186	61	288	535

These observations are intriguing and worth further investigation as it may provide the basis for modelling firewood demand. However, for this study it was decided to restrict headline results to those derived from the most objective i.e. the door-to-door surveys in Tregarth, Abergele and Cwmbran, and the shop survey in Brechfa.

Generalising from our data it appears that we can expect around 25% of households in rural communities (with social housing) to use firewood with a latent demand for firewood use in a further 5% of households (see Chapter 4). In ‘deep rural’² locations typified by scattered communities more than 70% of the households use firewood.

We expected few households in urban areas to have wood burning appliances and to be actively using them. However, we discovered that there is significant interest in firewood with 5% of households in Cwmbran using firewood and a further 6% who said they would like to be able to use firewood.

² ‘Deep rural’ is a WRO category which is used to describe the most isolated communities – it is assigned subjectively so it was not possible to use this as a stratum in this study.

Figure 2: Firewood usage across sample locations in Wales

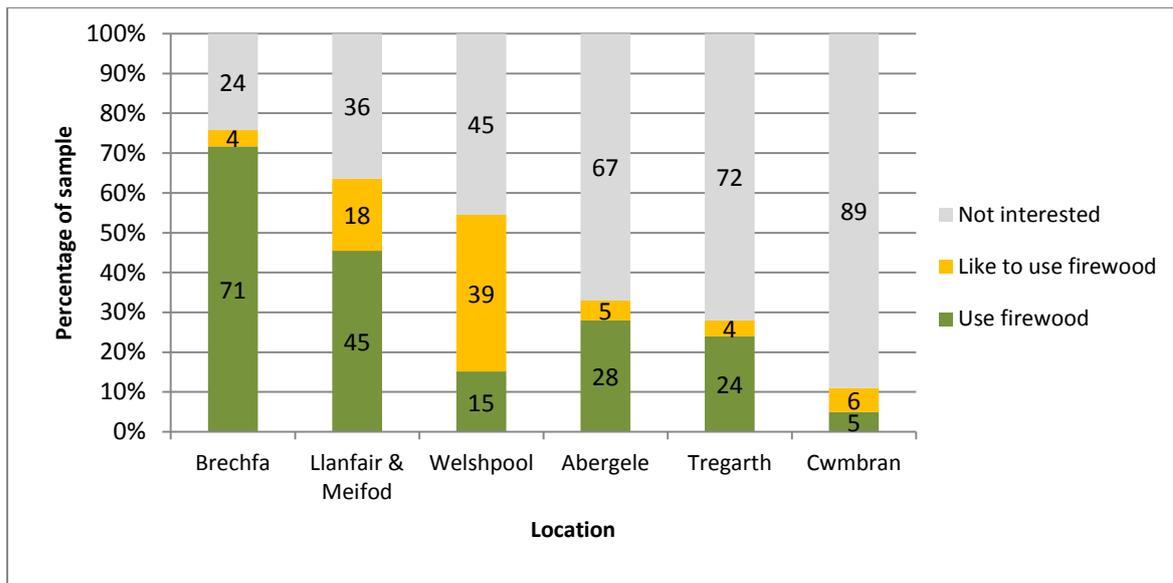
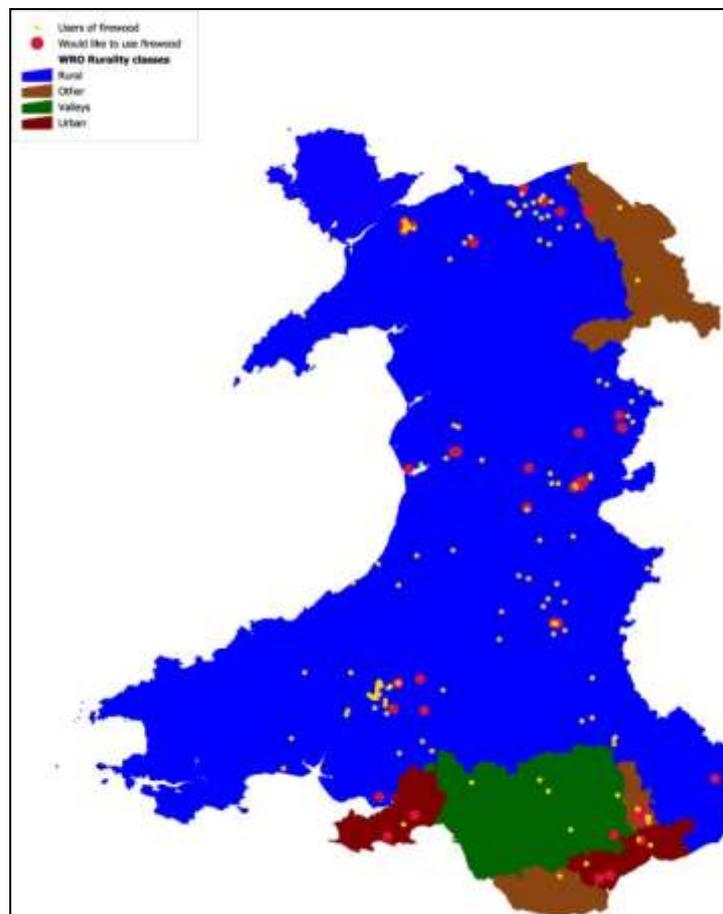


Figure 3 shows the location of all households which use or would like to use firewood (using the whole dataset) against the WRO rurality classes. There are no apparent spatial patterns and we conclude that there are households in every part of Wales who use or have an interest in using firewood. However, it is clear that there are very few samples from several areas.

Figure 3: Location of households using and wishing to use firewood



3.1 Frequency of firewood use

We wished to understand something of how often and for how long households had their fires lit as this is a useful indicator of the amount of wood they may consume. The responses to this question are summarised in Table 4.

Reported summer usage was much lower with the majority of respondents reporting that they never use (45%) or only occasionally use (40%) firewood in the summer. Not a single respondent reported *not* using firewood in the winter.

Over 41% of respondents reported using firewood all day throughout the winter whilst a further 44% used firewood every evening throughout the winter (Table 4). Many fewer respondents reported using firewood just at weekends or occasionally through the winter.

Table 4: Time period and seasonality of firewood usage

Time period	Percentage of 186 respondents who reported using firewood	
	Winter	Summer
Every day - all day	43%	5%
Every day - evenings	43%	5%
Weekends	5%	2%
Occasionally	7%	39%
Use firewood	100%	52%
Never use firewood	0	44%

Further analysis was undertaken using these data to estimate the amount of time that households burned firewood for during the year. This resulted in a total of 14 different demand classes, ranging from those using firewood all day every day all year to occasionally in the winter. However, most classes containing too few responses to undertake further analysis and develop realistic usage profiles.

Summer usage is infrequent; 5% of firewood users reporting using it all day, 5% in the evenings and 41% lighting an occasional fire. The small amounts of firewood required for summer use are therefore relatively insignificant so we adopted winter use as a proxy for annual demand. Using these data we identified the following three broad demand classes which we term 'use profiles':

1. All day –fire lit all day, every day, all winter
2. Evenings –fire lit in evenings, every day, all winter
3. Occasional –fire lit infrequently most often in the winter

Table 5 gives the number of households in each use profile for the four communities which had sample sizes greater than 30.

Table 5: Use profiles for sampled communities

		Cwmbran	Tregarth	Abergele	Brechfa
WRO population density class		Medium	Sparse	Sparse	Sparse
Sample size		113	111	36	49
Percentage of respondents in each use class	All day	0.9%	11.1%	4.5%	36.7%
	Evenings	2.6%	13.9%	14.4%	32.6%
	Occasional	1.8%	2.8%	5.4%	2.0%
Percentage of households using firewood		5.3%	27.8%	24.3%	71.3%

3.2 Dwelling type where firewood is used

All the data for households which burn firewood were pooled for this analysis giving a total of 186 responses. As shown in Table 6 the proportion of dwelling types surveyed in this study is comparable to those for Wales as a whole (ONS 2008) and can be viewed as representative.

From Table 6 it appears that more firewood is burnt in detached houses than any other dwelling type and, perhaps not surprisingly, no firewood is burnt in flats. However, although relatively few farmhouses were surveyed, a very high proportion burn firewood.

Table 6: Properties which use firewood

Property	Percentage of households which use firewood	Households in sample		Wales ³
		Number	Percentage of sample	
Detached house	55.8%	154	29%	27%
Farmhouse	86.8%	38	7%	
Semi-detached house	31.7%	145	27%	30%
Terraced house	8.2%	134	25%	32%
Flat	0.0%	24	4%	10%
Other (bungalow, caravan etc.)	25.0%	40	7%	Not specified
Total	34.8%	535	100%	

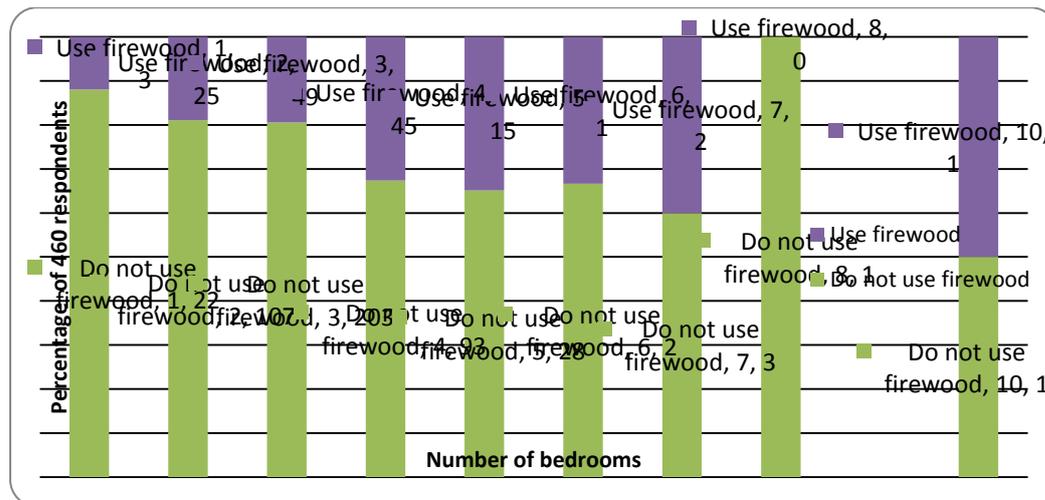
Regardless of the type of dwelling, Figure 4 reveals a correlation between the proportion of households using firewood and the size of the dwelling as indicated by the number of bedrooms.

The median number of bedrooms in the sample was three with very few households with more than five bedrooms.

Social housing was represented in the datasets from Tregarth, Abergele and Cwmbran. The responses to the questionnaire suggest that was very low firewood usage in social housing because the tenants are often not in control of the form of heating used in the dwelling and are not permitted to make substantive changes to the dwelling.

³ Data on dwelling stock for Wales taken from Office for National Statistics (2008)

Figure 4: Number of bedrooms and firewood usage



3.2.1 Heating appliances

Wood burning stoves were found to be by far the most widespread technology used to burn firewood (Table 7) and were reported as installed and used in three quarters of firewood-using households.

Table 7: Type of firewood appliance used

Frequency of use	Percentage of 185 respondents who reported the type of firewood burning appliance used			
	Wood burning stove	Biomass boiler (log & pellet)	Open fire	Range
All day	31.4%	2.2%	5.4%	4.8%
Evenings	35.2%	0	5.9%	1.6%
Occasional	7.6%	0	5.9%	0
Total	74.2%	2.2%	17.2%	6.4%



Cast iron stove used as main source of heat in traditional stone terrace house

The sample size for wood-fired kitchen ranges was small (n=12) but 75% of those with kitchen ranges reported having back boilers attached to them. By contrast only 20% of log wood stoves and 16% of open fires were reported to have back boilers. Overall 21% of firewood users reported having a back boiler attached to their firewood system.

There are also substantial properties which use firewood in a range of appliances, and one respondent commented: “Logs are used in Rayburn in house, open fire in house, there are log fires in holiday let (all have back boilers). Guests also use fire pit in garden.”

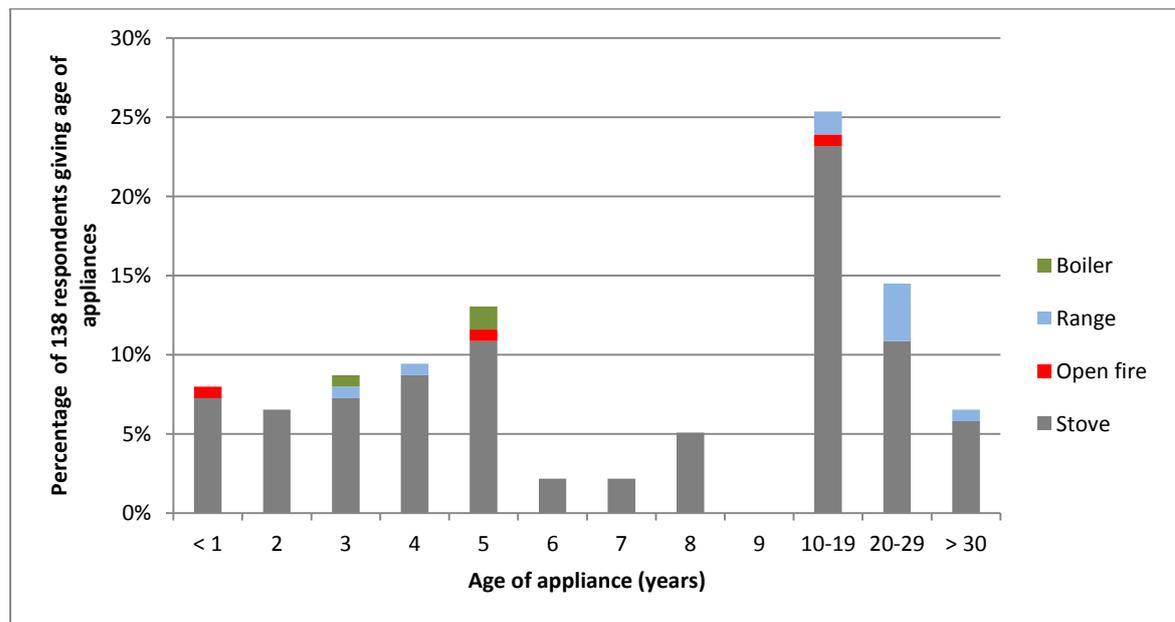
3.2.2 Age of appliance

The age of firewood burning appliances is given in Figure 5. The majority of appliances in use are more than ten years old which probably represents older properties where chimneys have been retained and converted some time ago to wood-burning stoves. However, there is clear evidence of an increase in installation of new wood burning appliances in the past

five years indicating that these respondents were either new firewood users or had recently replaced older systems e.g. open fires (the survey results did not enable us to distinguish between these alternatives).

Our data are mostly for rural areas but there is also a discernible trend of increasing firewood use in urban areas exemplified by articles such as that titled ‘Hearth of the matter’⁴ which notes “wood-burning stoves have become incredibly popular over the past five years” but oddly then goes on to suggest that “the simplest and most cost-effective option is an open fire”. However, as shown in Table 7 and Figure 5 open fires are not present in many properties or not much in use.

Figure 5: Age of wood burning appliance



3.3 Heating strategies

Our results indicate that a notable number of respondents use firewood both as the main source of heating and to heat the whole house (Table 8) although it is clear that firewood plays a variety of roles in household heating strategies.

Households which burn firewood all day in the winter are more likely to use firewood as their main form of heating for the whole house. However, even in this class, firewood may not be the only form of heating and maybe combined with other types of fuel (Table 9). The most common alternative source of fuel is oil which reflects the mainly rural location of firewood users. For some users, firewood is secondary to other forms of heating (most often oil-fired central heating) whilst for others it is the main source of heat with central heating used as a backup. The traditional combination of coal and firewood are burnt together and a proportion of users have multi-fuel stoves or burn both on an open fire.

⁴ Friday Style, i 27 October 2012.

Table 8: Role of firewood in heating by use profile

Percentage of 191 respondents to both these questions	Main form of heating		Secondary form of heating	
	Percentage of all firewood using households	Whole house heated (% of households using firewood)	Percentage of all firewood using households	Percentage of where whole house is heated with firewood
All day	26.2%	76.0%	15.2%	20.7%
Evenings	11.5%	68.2%	34.0%	3.1%
Occasional	0.5%	0.0%	12.6%	12.5%

Table 9: Other sources of heat used alongside firewood

Heat sources	Percentage of 144 respondents		
	All day	Evenings	Occasional
LPG	2.8%	1.4%	2.1%
Coal	4.2%	2.8%	2.8%
Air source heat pump	0.7%	-	-
Oil	16.7%	24.3%	7.6%
Electricity	4.2%	4.2%	0.7%
Solar	0.7%	-	-
Gas	2.8%	15.3%	4.2%
Central heating (fuel not mentioned)	-	2.8%	-

3.4 Nature of wood used for domestic heating

Several questions related to the type of wood which people used as firewood. The responses to these can be used to generate a profile of the preferences of firewood users and also their opinions of the characteristics of good quality firewood.

3.4.1 Species preference

The respondents were asked to report their preferences for hardwood, softwood and briquettes with the results given in Table 10. There is a strong preference for hardwoods and some antipathy for briquettes with no-one using it as a first choice. Softwood appears to be gaining in popularity perhaps because there is more experience of burning it along with greater amounts being made available as firewood (especially larch) in recent years and possibly increasing shortfalls in the availability of fuel from hardwoods. Looking deeper into species preferences as shown in

Table 11, oak and ash are by far the most desired tree species for firewood.

Table 10: Stated preference for firewood

Types of woodfuel	Percentage of 184 respondents to this question		
	First choice	Second choice	Would never use
Hardwood logs	70.1%	2.7%	0
Softwood logs	4.3%	53.2%	1.6%
Briquettes	0	2.2%	13.0%

Table 11: Firewood species preferences

Tree species / type	Percentage of 107 responses
Oak	30%
Ash	41%
Other (hardwood) ¹	17%
Softwood ²	3%
Miscellaneous ³	6%

¹ – aggregation of preferences for species, such as hazel, elm, cherry, sycamore, alder, willow, beech, apple.

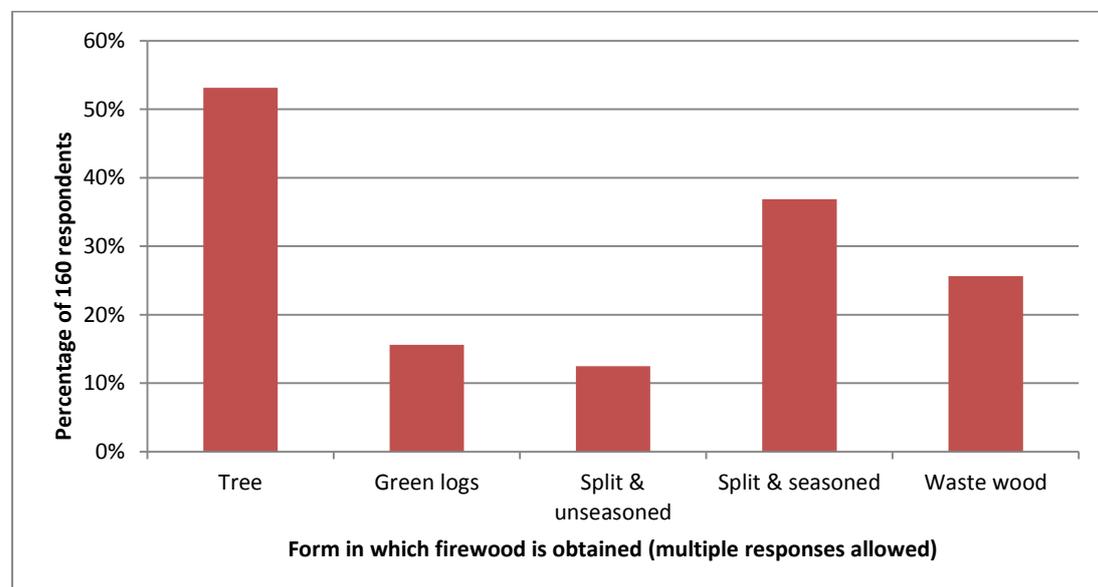
² – softwood species (spruce, pine and Scots pine mentioned).

³ – serendipity refers to responses such as ‘whatever will burn’, ‘whatever falls’.

3.4.2 Form in which firewood is obtained

Respondents obtain firewood in a number of different forms (Figure 6), with whole trees reported as the most common (53%) presumably a reflection of the prevalence of personal felling and collection of trees (see Table 12). Around 82% of the respondents reported obtaining firewood ‘green’, indicating that firewood users typically invest significant time and effort into processing the raw material into usable firewood. Around 40% of respondents receive firewood in a ‘ready to use’ form (i.e. split and seasoned or waste wood).

Figure 6: Form in which firewood is obtained



Note: the total exceeds 100% as some respondents obtain fuelwood in more than one of the forms listed.



3.4.3 Firewood quality

Over half of respondents (54%) who reported using firewood were aware that firewood needed to be dry. 18 people (9%) of firewood users check the moisture content of their firewood using a moisture meter with a further six people (3%) assessing firewood quality by eye, weight or experience.

3.5 Sources of firewood

Respondents reported a wide range of sources for their firewood (Figure 7). Just under half (45%) of respondents said they bought wood, usually from a local firewood merchant but also occasionally from a local sawmill or farmer. Many people who bought firewood also obtained it from other sources and only 32 respondents (17%) purchased all their firewood. A small number (9%) obtained wood as offcuts from work and a few (4%) obtained it in lieu of payment for work (in kind).

Social networks (family, friends and neighbours) are also important in sourcing firewood. In several communities this has segued into community woodland management for firewood as in the case of Llangattock Community Woodland⁵.

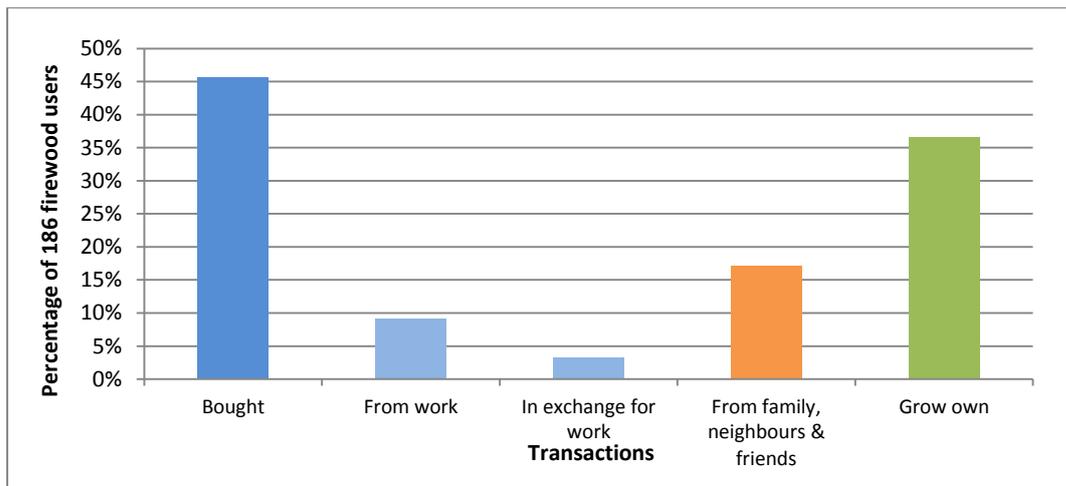
Just under half of firewood users obtain wood to burn free. This takes the form of collecting wood arising from other activities e.g. hedgerow trimmings or waste wood with the owner's permission (the family, neighbours and friends in Figure 7) as indicated by one respondent who said, *"I get some of my wood from a local farmer when he is doing his hedging. I pick out what I want from the hedgerow trees and he brings them to me on his trailer."*

As shown in Figure 8 many respondents (36%) grow their own firewood with the trees coming from their own land, although very few said the trees had been specifically planted or managed to provide firewood. This 'own land' is most often farmland but also private woodlands, gardens and hedgerows. A few mentioned that they had been using wood from their own land but this was no longer available⁶, so they would need to look for other sources of wood.

⁵ For more information see Case study of this initiative <http://llaisgoedwig.org.uk/wp-content/uploads/2011/02/CS3-Llangattock.pdf>

⁶ Note this may also not indicate that harvesting of fuelwood was unsustainable.

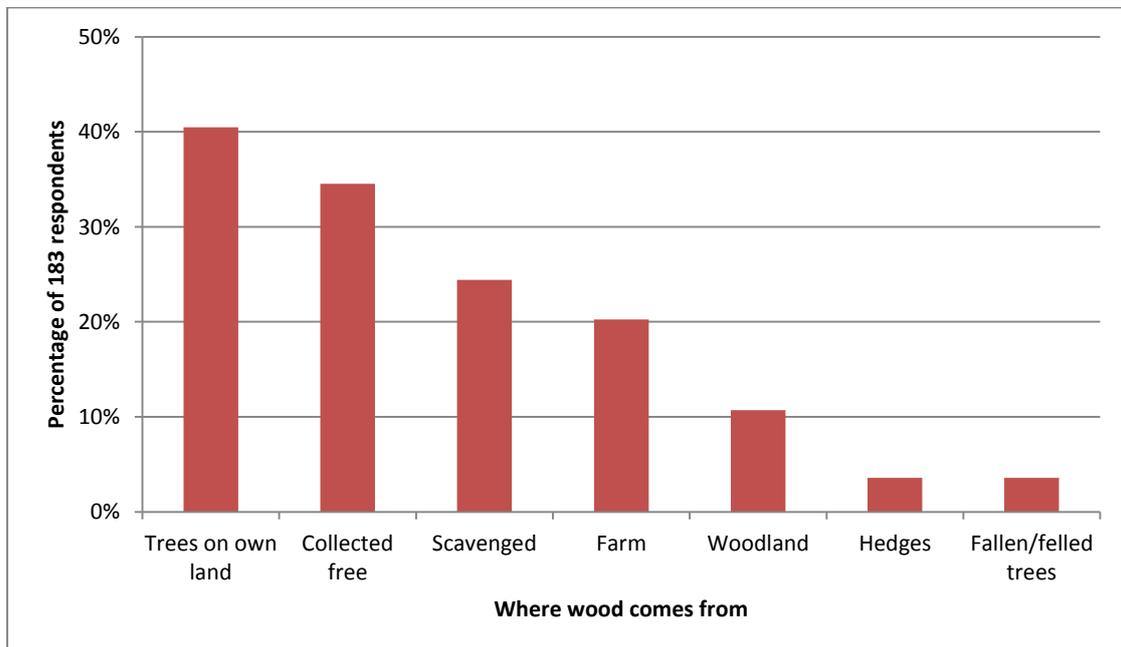
Figure 7: People from whom firewood is sourced



Key: Dark blue – cash transaction; light blue – in kind transaction; orange – social exchange (free), green – self-provisioning (free)

Although the perceived distinction between ‘collect’ and ‘scavenge’ was not pursued with respondents, the context of their responses suggest that ‘collect’ is more likely to represent picking up wood with permission and ‘scavenge’ picking up fallen branch wood or wind-fall trees and brash without express permission. Only seven firewood users obtained all their firewood from scavenging and this activity is mostly opportunistic collection of waste and dead wood to supplement other sources of firewood or to use as kindling.

Figure 8: Where wood comes from



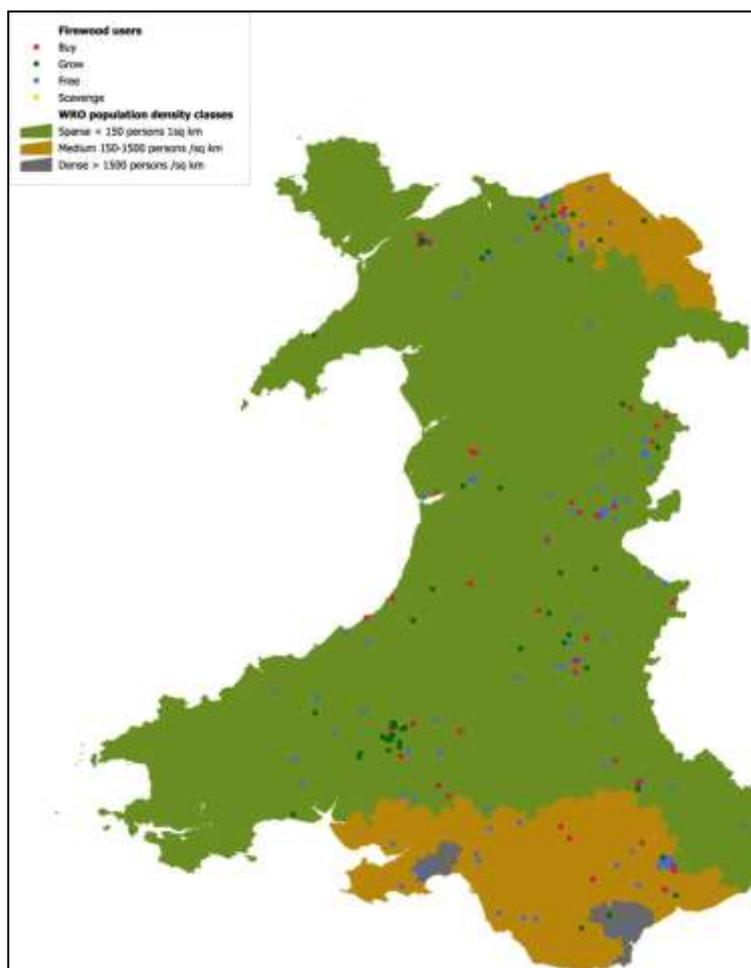
In order to begin to ascertain the significance of the different sources Table 12 was drawn up to see if there is any relationship between the amount of wood being burnt and how it is being obtained. There is a discernible pattern in Table 12 (chi square $p=0.415$) with slightly more than expected households who burn firewood all day or in the evenings sourcing fuel from their own trees instead of buying it.

Table 12: Sourcing of firewood by use profiles

Use profile	Percentage of 183 respondents who reported the source of their firewood						
	Grow	Buy	From work	In kind	Collect free	Scavenge	Waste wood
All day	19.1%	16.9%	2.2%	2.2%	14.2%	4.9%	9.3%
Evenings	14.8%	23.5%	5.5%	2.7%	14.8%	10.9%	10.9%
Occasional	3.3%	6.0%	1.6%	-	2.7%	3.3%	2.2%
Total	37.2%	46.4%	9.3%	3.8%	31.7%	19.1%	22.4%

As would be expected the use of home-grown firewood is an easier option for households in rural locations (Figure 9) and especially for farmers or private woodland owners. Box 1 gives a more complete profile of households able to grow their own firewood.

Figure 9: Firewood procurement strategies across Wales



Box 1: Growing your own firewood

Wood obtained from cutting from land belonging to the households which is:

Source	Unspecified	Woodland	Farm	Garden	Hedge	Orchard
Number of households	32	9	9	3	2	1

Trees grown on their own property is the only source of firewood) for 43 (23%) of households using firewood. Of these households, half used firewood all day, 40% used firewood in the evenings and 10% burnt wood only occasionally.

Of the properties which grew all their firewood, all but six used firewood as the main source of heat for the whole house and had it running all day. The appliances used were mainly log-stoves but there were also three properties with kitchen ranges, two with log boilers and two using open fires. Both the log boilers used fuel from woodlands connected to the property and the owners would presumably therefore be eligible for the Renewable Heat Incentive as these properties have no other form of heating.

The occasional users burn small amounts of wood in open fires and wood stoves to supplement other forms of heating.

Quotes:

"Limited amount from cutting our own trees"

"Have been using wood off our land but this is nearly all gone"

"We felled a large tree last year"

"From our own hedgerow trees"

"We have planted trees for amenity and heating over the last 40 years"

"I own 150 acres of woodland"

"We have four acres of woodland and hedgerow trees"

"We have 17 acres of ancient semi-natural coppice"

"I get my fuel wood from wherever I can. Some of it comes from my small bit of woodland which I manage for firewood, and will be coming from the adjoining bit of field which I have planted to increase my supply in the future."

"Some of my fuel wood comes from trees in my hedges. I still have to buy in wood, but have planted some of my field and hope that that will help my fuel wood supply in the future."

"Anything big enough from my hedges gets cut into lengths and I use it is fuel wood."

3.6 Volumes of firewood used

Firewood users were asked to estimate the volume of firewood they obtain per year. For many people this is a difficult question to answer so we asked people to report the volumes of firewood in whichever unit they were most familiar.

Firewood was found to be traded in a wide variety of units (Figure 10) with cubic metres (23% of responses), small pickups (17%) and tonnes (30%) being most often reported. This plethora of units is frustrating for buyers and one respondent commented *"I get mixed up with measurements- cubic metres, tonnes, wagon load, car boot full etc.. I would like comparison tables/guides with recommended retail prices (averages for Wales)"*. In addition there were a number of esoteric units reported such as 'small rush baskets' which highlights the small scale nature of some firewood sourcing activities which includes gleaning for kindling which further complicates estimating firewood consumption. Table 13 gives the minimum, average and maximum number per year of each of the units reported.

Figure 10: Units in which firewood is traded

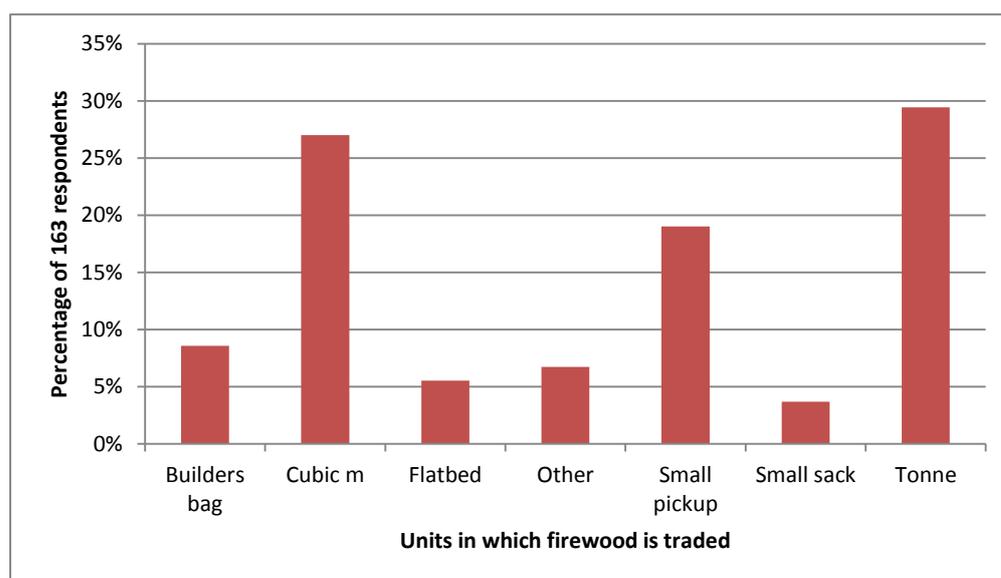


Table 13: Volumes of firewood consumed by use profile

Units	All day			Evenings			Occasional		
	Min	Average	Max	Min	Average	Max	Min	Average	Max
Builders bag	1	5.13	10	1	4.60	20	1	4.33	10
Cubic metre	3	11.42	35	1	5.75	15	1	3.00	5
Flatbed	6	6.00	6	1	1.43	2	-	-	-
Small pickup	1	5.19	16	1	5.56	36	1	1.00	1
Small sack	-	-	-	10	20.00	30	5	7.50	10
Tonne	0.5	7.37	24	1	3.92	10	0.5	2.58	4.5
Other	0.5	1.75	3	1	1.50	2	6	6.00	6

n=168

We needed to be able to standardise these units in order to estimate average annual consumption of firewood. There are a range of conversion factors for firewood (see Box 2). However, these do not help for many of the units reported nor does it help with half of the users who report firewood in 'trees'. Finding some means of accurately recording firewood volumes used in domestic appliances is a significant challenge which may require agreement at UK level and certainly some accurate monitoring of firewood consumption at household level.

Box 2: Firewood volume conversion factors

- Solid cubic metre (m³) is a volume entirely occupied by wood and this is the measure usually used for timber
- Stacked cubic metre (stacked m³) is the unit of measurement most appropriate for neat stacks of firewood (as right)
- Loose (or bulk) cubic metre (loose m³) is the unit of measurement most appropriate for loose piles of split firewood – i.e. as piled into the back of a pickup. This is also the most appropriate unit for deliveries in a net or builders' bag.

1 m³ solid wood = 1.4 m³ stacked logs
 = 1.2 m³ stacked split firewood

= 2.0 m³ loose split firewood

The conversion from volume to tonnes is problematic as the density of wood varies by species and the moisture content of the wood. Dry firewood should be 25% moisture content or less (<http://www.woodfuelwales.org.uk/en/firewood.php>).

At 20% moisture content

Species	Conversion factors to tonnes	
	Solid m ³	Stacked m ³
Beech	0.730	0.453
Oak	0.724	0.450
Spruce	0.488	0.315
Pine	0.541	0.349

For green hardwoods (~40% moisture content) a solid m³ ~ 1 tonne.

Source: Wood Fuels Handbook (Francescato *et al* 2008)



Starting from the average annual units in Table 13: if we assume that a flatbed and pickup would be capable of carrying around 2.5 m³ loose firewood then the average number of loads (6) gives an annual consumption of 12 m³ stacked firewood. This is close to the self-reported average of 11.42 m³(if we presume this is based on stacked volume) and roughly equivalent to the self-reported average of 7 tonnes. Woodfuel Wales also estimate that 12 m³ of seasoned stacked logs are required to heat the whole of a 3-4 bedroom semi-detached house⁷. The same reasoning applied to evening and occasional use gives the following estimates of household consumption of stacked split firewood for each user profile:

- | | |
|---|-------------------------------------|
| 1. All day - Winter use, every day/all day | 12 m ³ yr ⁻¹ |
| 2. Evenings - Winter use, every day/evenings only | 6 m ³ yr ⁻¹ |
| 3. Occasional - Weekends and occasional use | 2.5 m ³ yr ⁻¹ |

3.7 Storage

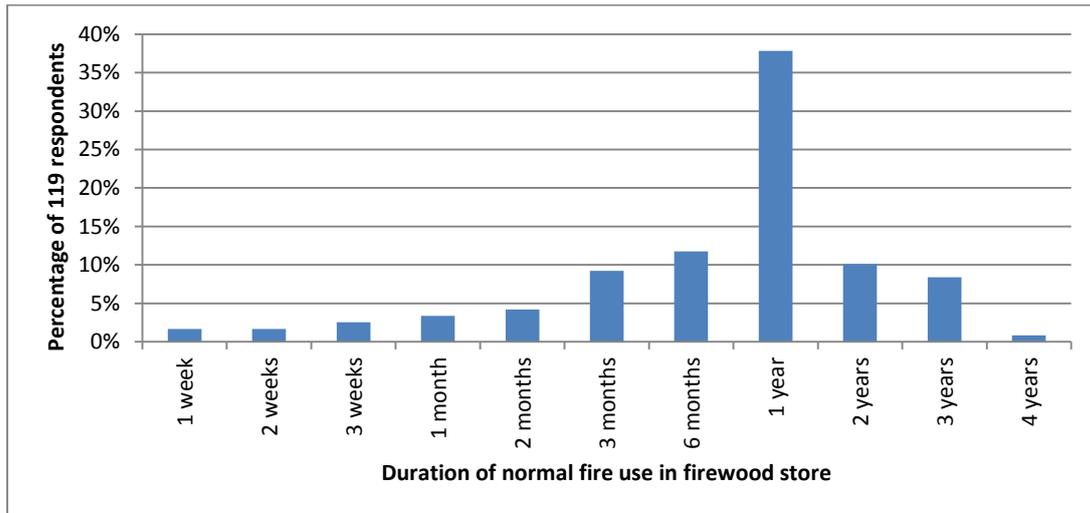
Firewood is bulky and storage can be a problem in properties with little outside space. Of the 186 firewood users, 119 responded to questions on storage. Only 9% of households which burn a large volume of firewood (all day) said that they had problems with storing firewood, though this increased slightly to 15% of evening users and 16% of occasional users which suggests lack of storage space may limit the extent to which they can use firewood. The lack of space was expected to be a problem for people with smaller properties but only 13% of respondents claimed that lack of storage space was limiting their use of firewood.

These results are perhaps not surprising as existing firewood users are expected to have suitable firewood storage facilities. Most of these facilities are covered outdoor stacks. However, relatively few are bespoke log stores (20%) with barns, taibach, old pigsties, greenhouses, sheds, farm buildings, sheep sheds and garages are all pressed into service. Outdoor stacks are covered with tarpaulins, canvas, corrugated iron or left uncovered.

⁷<http://www.woodfuelwales.org.uk/en/firewood.php>. They also give annual consumption of 8 m³ for a cottage and 16 m³ for a detached farmhouse.

In order to get some idea of the size of a log store the respondents were asked to estimate the length of time the log store could keep their fire running with the responses shown in Figure 11. There are a surprising number of very small log stores which could only be used to store wood for immediate use. This would seem like a sensible option for households which buy in wood for occasional use but there were households who burn firewood all day who only stored sufficient wood for a week or month. Nevertheless, the median size of store was able to hold a years' supply of wood which facilitates for bulk purchasing and seasoning of green wood.

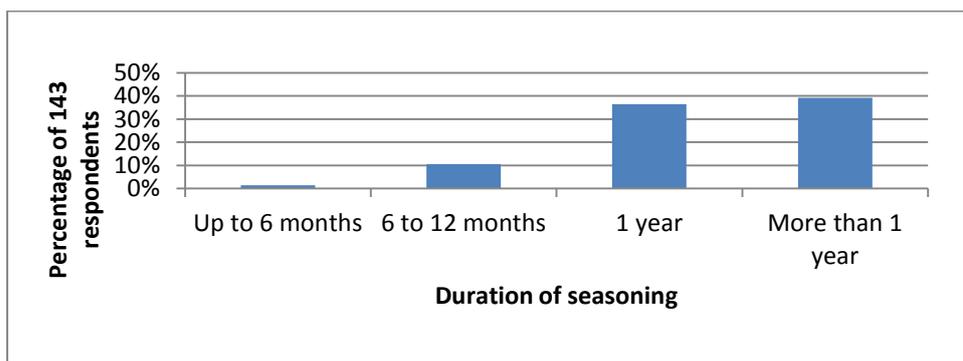
Figure 11: Length of time logs are stored



3.7.1 Seasoning

Seasoning is the drying of green wood so it will burn efficiently. It is possible to burn wood green but the yield of heat is greatest when moisture content is below 20%. Most firewood is air dried and with the length of time required being dependant on species. Given the preponderance of households who source their wood green it is not surprising that 77% of firewood users said they seasoned wood. Most of these respondents indicated how long they seasoned wood before use (Figure 12). It seems that most firewood users are well aware of the need to season wood and that it varies by species. Most season wood for a minimum of one year and some are prepared to dry wood for up to three years.

Figure 12: Duration of wood seasoning in household firewood store



3.8 Purchased firewood

Around 27% of respondents buy all their firewood and a further 18% buy at least some of their firewood. Sixty respondents mentioned from whom they most often bought firewood (Figure 13). As shown in Figure 14, social networks in the form of local contacts, knowledge and loyalty are the means by which people choose their suppliers. Only one respondent mentioned using the internet while two said they found it difficult to source wood.

Local for some is very close as revealed by some of the comments:

“Whilst the quality of wood I purchase is good it does travel about 10 miles to get to me.”

“We have found a reliable supplier but I wish he was nearer”

“would like to buy locally produced pellets - good quality, dry for use in Okofen stove”

The difficulty of finding a reliable supplier who can be trusted to provide good quality firewood is also something which people commented on:

“When you buy wood you can never be sure what it will be like, is the quality and quantity as stated?”

“Supply of logs is just so haphazard, quality can’t be guaranteed and availability also patchy. So more recently have switched to briquettes as better for my stove, and easier to store and handle”

Figure 13: Sources of purchased firewood

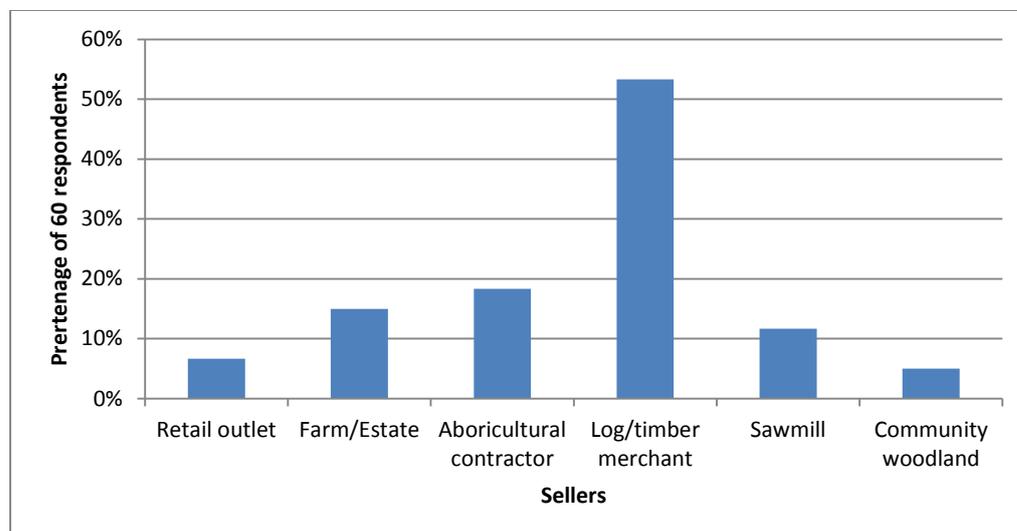


Figure 14: Locating suppliers of good quality firewood



3.8.1 Price per unit

The price per unit of delivered firewood varied widely (Table 14).

Table 14: Reported prices (£) for different units of firewood

Unit	Frequency	Price £ / unit		
		Min	Max	Median
Builders bag	17	35	80	45
Cubic metre	46	40	90	70
Flatbed truck	9	90	200	140
Small pickup	35	40	100	60
Small sack	6	4.5	10	-
Tonne	61	20	200	50
Other	11	25	40	-

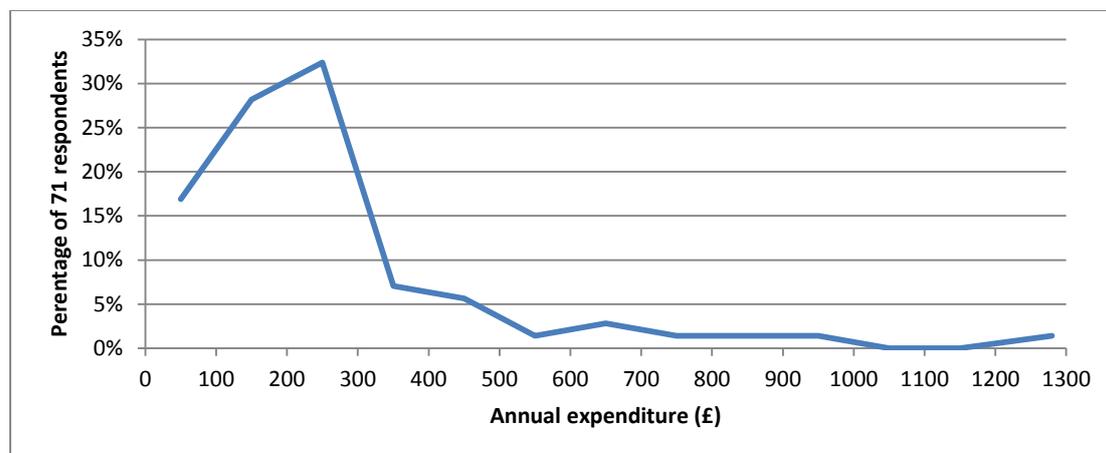
3.8.2 Total annual expenditure

Respondents were asked to give their total annual expenditure on firewood which was intended to serve as a check on the units and prices requested in earlier questions. The total expenditure on firewood is given in Figure 15.

However, 18 of the 120 respondents to this question said that expenditure was their own labour, transport costs and chainsaw fuel and oil. These costs were typically very low and ranged from £10 to £200 which included an element for hired labour. Therefore expenditure below £200 is probably for small amounts of firewood or for costs associated with personal collection and processing of firewood.

There is a marked peak at £200 which would be sufficient to purchase between 2-4 cubic metres of firewood at the prices indicated in Table 14. This is sufficient for occasional use and is further confirmation of the importance of free sources of firewood. If all firewood is purchased then the 12 m³ needed to support all day use would cost around £800 and the 6 m³ for evening use would cost around £420. In all 11 respondents (15%) reported annual expenditure commensurate with purchasing all firewood which corresponds well with the estimated 17% of users who only purchased firewood.

Figure 15: Annual expenditure on firewood



Cost is an issue for many firewood users and firewood is used by people who would otherwise be in fuel poverty to meet their heating needs. Comments made on this point were:

“We can't afford to buy firewood so we collect all our wood locally and process it ourselves”.

“I would burn much more wood if I could get hold of it cheaply or source it free. I would do this in preference to coal which I know is polluting. But wood is more expensive than coal to buy. I burn wood that I source for free”

3.8.3 Awareness of quality assurance for firewood

Awareness of formal quality assurance for firewood is relatively low, with 25% of the 196 people who responded to this question saying they knew there are schemes of this type. This is perhaps not surprising as a large proportion of firewood users self-source and for them firewood quality assurance is irrelevant. One respondent was antagonistic to quality assurance and asked for it to be *“got rid of”*.

Respondents were asked if they would be willing to pay a premium to be sure they were buying good quality firewood. Of the 193 people who responded, 26% said they would be willing to pay a premium with the amounts given as an extra £5-10, with a few willing to pay more with the highest premium suggested at 50% of current prices. Of course these responses only apply to those who buy firewood and relates to the prices they currently pay which as shown in Table 14 is very variable.

3.9 Concerns and comments

The questionnaire closed with open-ended opportunities for respondents to voice any concerns and to make comments.

75% of the 115 respondents did not have any concerns about the use of firewood with the majority of those who expressed concerns mentioning that purchased firewood was of poor quality, either improperly seasoned or rotten. One respondent was worried about pests being transferred from the firewood to a timber dwelling and two respondents said they

were concerned about sustainability. Comments also revealed some anxiety that the rapid increase in wood-stoves might result in unsustainable sourcing of wood:

"The demand is increasing and I have noticed more wood piles appearing, where is all this extra wood going to come from."

"Sustainability is a concern! With an increasing number of people turning to wood as a fuel I wonder how much is being done to maintain the woods and forests it is taken from. "

"I am concerned about the amount being consumed at the present time as wood stoves are very popular at the moment."

"For it to be sustainable have to grow more as we cut/use."

"I am concerned that there is a shortage of firewood locally, however I don't want to see random tree cutting in woodlands."

"There is a need to keep our forests, to plant more with quick growing hardwoods, coppicing too."

The increase in demand is also seen as potentially driving up prices and many consider present prices too high and unaffordable:

"With the increasing popularity of wood stoves the price is likely to increase."

"I think it will get more expensive and harder to source"

"We can't afford to buy firewood so we collect all our wood locally and process it ourselves."

Nevertheless, the cost of other forms of heat is prompting some to make the switch and consider managing woodland for firewood:

"We are planning to increase our use of wood by getting rid of our storage heaters & water immersion & installing another wood stove with back boiler (+ solar water). We also plan to manage our own woodland to provide at least some of the wood we need."

"Concerned with cost of coal, but concerned with the inconvenience of wood as I am getting old"

While some see selling wood as an opportunity:

"I will be looking for people to buy wood from my woodland"

4 Latent firewood users

There were 349 respondents who do not currently use firewood (Table 2). Further questioning of these respondents revealed that 61 (17%) of these people would like to be able to burn firewood. Numerous reasons given were given of the perceived attraction of firewood by 46 respondents and these were placed into six broad categories to facilitate

interpretation (Table 15). Aesthetics – ‘lovely smell’, ‘love fires’, ‘like real fires’, ‘visual appeal’ is obviously important to people as is the positive association with sustainability and environmental benefits. The environmental benefits are most often expressed as rather vague statements such as ‘naturally sustainable’, ‘better for the environment’. However, there were more specific comments such as ‘sustainable woodland management’ and ‘lower CO₂ emissions’. This suggests that the environmental feel-good for firewood use is getting across but not the specific messages. Cost and the ability to diversify heat sources in the home are also significant attractions and a few people expressed a desire to make use of known sources of waste wood or wood that could be made available from a family farm.

Table 15: Attraction of firewood use

Category of reason	Percentage of 46 respondents
Environmental / sustainability	30.4%
Aesthetics / cultural	30.4%
Cheaper than what is used at present	28.3%
Increase choice of heating systems	10.9%
Wood availability (from family farm or waste wood)	8.7%
Recommendation (by friend or family)	2.2%

Of the 61 people who said they would like to use firewood, 34 (53%) had apparently given this some thought and provided details of the type of appliance they were considering purchasing (Figure 10). Log stoves were the most popular choice (74%) with three considering biomass boilers and two preferring an open fire. The high proportion of people interested in firewood appliances may be a consequence of the questionnaires at the RWAS being administered from the Woodfuel Wales stand but the preferences for different appliances largely mirrors that of established firewood users so is probably not excessively biased.

Table 16: Preference for new wood burning appliance

Type of appliance	Percentage of 39 respondents expressing a preference a new wood burning appliance
Wood burning stove	64%
Clearview (wood) stove	10%
Multi-fuel stove	8%
Log/wood boiler	8%
Open fire	5%

When asked 50 respondents gave reasons why they did not burn wood (Table 17). Most of these people had expressed an interest in using firewood so these reasons can be viewed as barriers to the uptake of wood fired heating. Although the most common reason given was the lack of a chimney and suitable appliance only two recognised the cost of installing a stove and one respondent said that his neighbour had just spent £3,000 installing wood burning system in their dwelling. The lack of information on costs is also off-putting as one

respondent commented there is “no reliable information on the cost of heating with firewood”.

Table 17: Reasons why respondents are unable / unprepared to use firewood

Reason	Percentage of 50 respondents
Lack of suitable appliance (stove / fireplace)	24%
No chimney / major work required	22%
Possible but not doing it	14%
Lack of skill	4%
Hard work	3%
Not allowed (by landlord)	2%
Impractical	2%
Concerned about reliability of supply	>1.5%
Lack of storage space for firewood	>1.5%
Installation costs	1%

5 Discussion

Although the questionnaire only covered two A4 sheets and was timed to be completed in not more than ten minutes the analysis has touched on a wide range of topics and raised a lot of issues for further consideration. This chapter explores the findings of this study in relation to the initial objectives and identifies issues for further work.

5.1 Implementation and limitations of the study

As explained in the Introduction this study involved many partners, some of whom provided cash backing while others contributed staff and volunteer time in kind. The project partnerships worked well as an example of co-production.

Although less than ideal from a statistical perspective it was possible to allow the partners to find a means of completing questionnaires in a manner which suited them. Careful meta-analysis involving the separation of sub-samples and pooling data in the most appropriate ways to analyse different questions was used to maximise the utility of the dataset. Each sampling strategy had its own strengths and weaknesses though it was only those which employed objective sampling strategies within a pre-determined sampling frame which could be used to estimate total firewood demand. If local market surveys are required then we recommend the use of randomised street surveys within discrete geographical area e.g. a ward for which the total number of households is known.

A weakness of the study is that the dataset does not cover the whole of Wales (See Table 1 and Figure 1) and sample sizes are small for some sample strata especially the urban/dense WRO classes. The results presented in this report should therefore be considered indicative rather than definitive. In particular, further research is necessary to more accurately estimate household firewood consumption as well as refine the ‘user profiles’ identified in this study. There is a suggestion that the proportion of households using firewood is correlated to population density and this may provide the basis for a more sophisticated model to predict firewood demand, perhaps in conjunction with the size of a dwelling which is also correlated with firewood demand.

We encountered a number of different measures of firewood volume, several of which are rather esoteric and are likely to confound simple volumetric conversion into standard units. A more direct measure of firewood consumption use such as monitoring of flue temperatures may be a better way to proceed than attempts to equate trailer loads of hardwood branches to neatly stacked softwood logs. Some stove manufacturers give an estimate of wood consumption per stove e.g. according to their catalogue a 7 kW MCZ stove uses 1.9 kg of wood per hour at maximum heat output⁸ and a Morso Squirrel will use 0.02 m³ of beech and 0.04 m³ of sycamore per day - when heating all day and evening⁹.

The results have also not been fully analysed in the wider Wales or UK context – as shown by the small number of papers and reports referenced in the study.

5.2 Estimating national consumption of domestic firewood

The sample size for this domestic firewood survey is relatively small and even as a low intensity sample it does not give a complete geographic coverage of Wales. Nevertheless, since there are few other data, we have attempted to guesstimate the annual domestic firewood demand for Wales from our results to give a first indication of the volumes of sustainably produced firewood that is needed to meet demand for domestic heat.

‘Bulking up’ or extrapolating from survey results to national estimates from several sub-samples of varying degrees of objectivity requires careful consideration. The first decision is the selection of a framework that can be used as a basis for extrapolation of the study results. Since it is apparent from our analyses that firewood usage is negatively correlated with population density the population density classes defined by the Wales Rural Observatory can serve as this framework. Using the data from Table 5, the estimates of annual firewood consumption in Chapter 3.6 and the total number of households from the postcode dataset we can make a guesstimates of the total firewood consumption in Wales to estimate per household firewood consumption as shown in Table 18.

Table 18: Calculations to determine annual average household firewood consumption for ‘objective’ samples

Community	WRO population density class	Number in sample	Proportion of sample (%)			Estimated per household consumption (m ³)
			All day 12 m ³	Evenings 6 m ³	Occasional 2.5 m ³	
Cwmbran	Medium	113	0.88%	2.65%	1.77%	0.310
Tregarth	Sparse	111	4.50%	14.41%	5.41%	1.541
Brechfa	Sparse	48	33.33%	33.33%	2.08%	6.052
Abergele	Sparse	36	11.11%	13.89%	2.78%	2.236

There is considerable variation in the average firewood volumes for the three rural communities in the Sparse population density class so these were used to bracket our guesstimates by generating a ‘low’ and ‘high’ guess as shown in Table 19. We only have one sample point for Medium density population areas so there is only one estimate used for this. The survey data includes only 14 and 16 questionnaires for households in the Urban and Valleys WRO classes respectively completed by visitors to the RWAS and are therefore not an objective sample. Nevertheless, these data do indicate that people in dense, urban situations also use firewood with four users (three all day and one occasional) of the Urban

⁸<http://www.mcz.it/en/p219-nogal.html>

⁹ James Walmsleyerscomm from measurements of log dimensions.

responses using firewood and five users (two all day, one evenings and two occasional) in the Valleys. Although these data are biased (it is highly unlikely that 31% of valley populations use firewood) it does serve as an indication that there is firewood use in these areas. The area of Cwmbran sampled is urban in character but close to the countryside so households could possibly be expected to have greater interest in firewood than more densely populated urban centres. So as a first approximation we have taken urban demand for Wales to be half of that found in Cwmbran based on the observation that firewood use is correlated to population density. However, Cwmbran is a new town with a large proportion of social housing. Urban Cardiff and Swansea with a higher proportion of older, private housing may have more opportunities for firewood use so guesses with the assumption that these areas will have at least the same proportion of firewood users as Cwmbran are also included in Table 19.

Table 19: Estimate of per household firewood consumption by WRO population density class

WRO density class	Basis of figures	Per household firewood stacked volume (m ³)
Urban (low)	Half of Cwmbran	0.154
Urban (high)	Same as Cwmbran	0.309
Medium	Based on Cwmbran	0.309
Sparse (low)	Based on Tregarth	1.541
Sparse (high)	Average of Tregarth, Abergele & Brechfa = all available rural communities	3.276

The figures in Table 19 were used to generate estimates of total firewood consumption as shown in Table 20. These calculations reveal that domestic use of firewood in Wales may currently consume between 0.5 and 1 million m³ of solid wood per year. Given the uncertainties with these data it is best to be conservative with the headline results so the best guesstimate for firewood consumption in Wales for 2012 is 576,000 m³ of solid wood.

Table 20: Guesstimate of national firewood consumption

		WRO population density class			National firewood consumption	
		Sparse	Medium	Dense	Stacked firewood (m ³)	Solid = 0.63 stacked (m ³)
Number of households		426,000	718,900	229,900		
Basis for guesstimate (m ³ per household)	Low sparse + low urban	1.541	0.309	0.154	914,000	576,000
	Low sparse + high urban	1.541	0.309	0.309	949,000	598,000
	High sparse + low urban	3.276	0.309	0.154	1,653,000	1,041,000
	High sparse + high urban	3.276	0.309	0.309	1,689,000	1,064,000

These results have profound implications on current understanding of timber flows in Wales as shown in (Table 21). Of course the firewood consumption cannot be simply added to or directly compared to the official cut as it arises from a variety of sources, Using the figures in Table 12 and the average demand for each use profile we estimate that 24% of firewood is home-grown, 26% bought, 18% waste wood, 22% collected and 10% scavenged. These calculations include an element of double counting (e.g. as wood gleaned from clear fells

and sawmill offcuts will already be counted) and should be treated with extreme caution. Nevertheless, we can safely assume that grown, collected and scavenged wood which together account for just over half of domestic firewood will not be captured in official wood production figures.

Table 21: Wood Production: Wales (2011)¹⁰ and results of this study

Type of wood	Source	Green tonnes yr ⁻¹
Softwood	Forestry Commission Wales	689,000
	Non FC	501,000
	Total	1,190,000
Hardwood	Forestry Commission Wales	6,000
	Non FC	21,000
	Total	27,000
Total (official annual production)	FC and non-FC	1,217,000
Total firewood consumption (mixed mainly hardwood)	This study (non-FC) 576,000 solid m ³ / 1.11 conversion to green tonnes overbark hardwood (FC 2012b)	518,000

Perhaps the main reason why firewood supply has been under-represented in official statistics is because most of this activity will not require a felling license as it will be below 5 m³ ha⁻¹ per quarter¹¹. Much of the wood is also effectively a by-product of arboricultural or agricultural activities or naturally occurring fallen and dead wood. All the below are potentially sources of firewood:

- Arboricultural arisings;
- roadside and powerline clearance;
- poor quality hardwood from softwood harvesting operations e.g. birch, oak, willow – this is typically not reported but can still enter the firewood supply chain;
- fallen deadwood, fallen branches and limbs;
- fallen trees;
- branch wood and leavings from timber felling;
- hedge trimmings and hedgerow tree lopping;
- private gardens; and
- management of urban trees.

There are relatively few instances of woodland management explicitly for firewood and even fewer records of silvicultural systems for firewood i.e. managed coppice.

Wales has a large proportion of ash (21%) (NFI 2012) and this is the preferred firewood species which might suggest a resource well suited to demand. Unfortunately, the arrival of *Chalarafraxinea* places much if not all of this resource at risk. Infected trees can be used as

¹⁰Data from Forestry Commission (2012) Wood production 1976-2011, available from [http://www.forestry.gov.uk/pdf/ch2-woodland_fs2012.xls/\\$FILE/ch2-woodland_fs2012.xls](http://www.forestry.gov.uk/pdf/ch2-woodland_fs2012.xls/$FILE/ch2-woodland_fs2012.xls) accessed 1.11.12

¹¹See <http://www.forestry.gov.uk/forestry/infid-5z8qeh> for details of requirements for felling licenses.

firewood which may lead to a glut on the market while the need to secure future firewood supplies suggests replacement of these trees should be using species and silvicultural systems appropriate to sustainable production of high quality firewood.

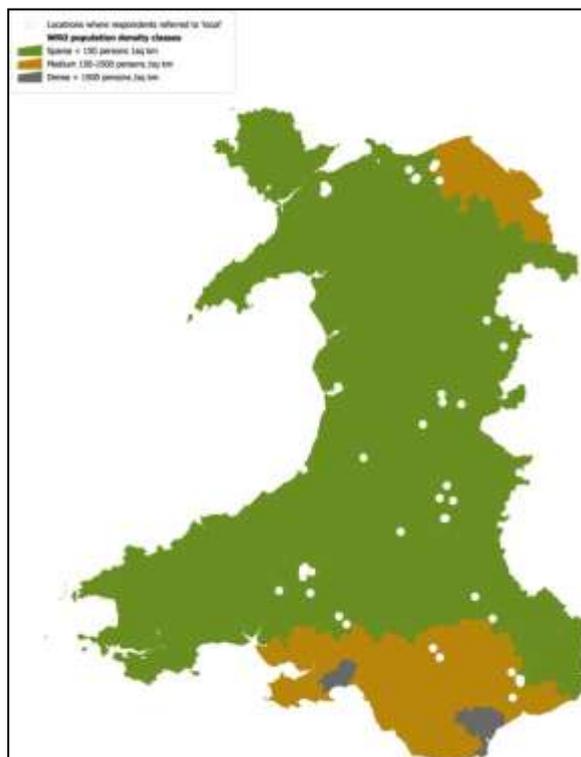
5.3 Present domestic firewood supply chains

Firewood supply chains are challenging to characterise not least because firewood is traded and exchanged in a number of different units and forms.

Firewood users typically obtain wood from a number of sources with conventional cash-based markets playing a relatively small role. Social and familial networks are as, if not more, important as cash transactions and increasing numbers of users are sourcing firewood from trees on their own property. In kind transactions are common and difficult to quantify. Recommendations via word of mouth and trust arising from customer loyalty are also important in the choice of firewood merchant. Interestingly it is traditional social networks which are most prevalent and the internet as a source of information was only mentioned once.

Sourcing wood 'locally' was specifically mentioned by a third of firewood users and was highly valued. As shown in Figure 16 although loyalty to local suppliers is strong in rural locations it is also evident in urban areas. Local is often taken as within ten miles though people will use a reputable merchant from further afield. Interestingly a recent survey of firewood merchants showed that 42% of 336 firewood suppliers obtained their wood from within ten miles with only 17% of suppliers going more than 40 miles (Kinash 2012). This suggests that the carbon miles in firewood supply chains may be relatively low.

Figure 16: Location of respondents who mentioned 'local' in connection with sourcing firewood



No attempt was made to estimate the employment generated in the firewood supply chain but this is also likely to be difficult to determine since much of the labour involved is not paid for.

The scale and nature of additional benefits flowing from the supply of firewood such as community cohesion around group firewood schemes, health benefits from outdoor activity and personal satisfaction of burning wood in the home (many people *like* real fires).

The firewood supply chains in their current forms are robust and enable rural communities to retain a measure of self-sufficiency in terms of their heating requirements. This is particularly the case in low-income areas in deep rural locations where dependency on firewood can be high.

A recent firewood procurement survey by Woodfuel Wales (2012) of members showed that wood is obtained from a wide variety of sources. The 45 log suppliers in the survey expected their businesses to grow by around 54%. Which is comparable to the growth in stove installation. Nevertheless, several Llais y Goedwig members who have considered firewood supply enterprises report that the current firewood market presents a challenging market for new businesses, given the great range in prices offered by competitors, competition from self-supply and casual suppliers, insecurity of supply, lack of a formal marketplace and relatively high capital costs to establish a supply of larger volumes of dry firewood.

5.4 Sustainability of the resource

The officially reported annual production of hardwood from private sources is 21,000 green tonnes (FC 2011). Our results indicate that the real figure could be many times more than this (Table 21). However, the National Forest Inventory (NFI 2012) figures for the standing broadleaf resource in Wales is 23,953,000 m³ from 126,200 ha - set against this even if all the firewood is coming from broadleaved woodland (which is not the case) it would only represent 2% of current standing stock and would be well within even the lowest estimate of increment rates any projected sustainable annual cut.

The general perception among foresters in Wales is that the broadleaf resource and particularly on farms are unmanaged and there is no significant cutting of trees from this resource. Indeed, the response of the NFI to the preliminary results of our survey was *“NFI have figures on what woodland is managed and by our definition that means any activity (broken down into each activity). It is a while since I checked this data, but from memory the majority of predominantly broadleaved woodland is unmanaged in terms of any activity. Even if the odd tree being removed slips under our radar, the stocking in the woods is pretty high and would not reflect high levels of removals.”* This is perhaps not surprising as the activities which are providing much of the firewood in rural areas arises from gardens, hedge-cutting, clearing fallen trees and felling of small numbers of trees as cutting on farms is to supply at most a few households rather than an enterprise. Nevertheless there is perhaps a need to reconcile where firewood is being sourced, how many farms use their tree resource for firewood and whether this constitutes management as defined by NFI. One source of information on this would be the Glastir Advanced woodlands which will be visited by a woodland advisor. This visit could be used to explore the proportion of farm woodlands used as a source of firewood as well as assessing the impact of this on the health of the woods and whether any support is needed to ensure the woodlands are being exploited in a sustainable manner.

Nevertheless, even though overall production might be within sustainable limits this may not be the case in every locality. Indeed, the comments listed in Section 3.9 suggest that sustainability is an existing concern for several users and may be an issue for some. Certainly

sourcing from wind throw and branch fall in third party woodlands cannot be considered sustainable in the long term, not least because there is no assurance that in the longer term the old trees will be replaced. These removals may also disrupt management which has the accumulation of deadwood as an objective and does in fact constitute theft (see Box 8) even if small removals do little actual harm. Likewise although use of hedge trimmings and cutting the occasional tree from a farm does little harm it is also does not constitute pro-active management of the resource.

An interesting question is what sustainable management for annual output of half a million m³ of hardwood firewood from Wales would look like. Would there be sufficient thinnings and arisings from conventional timber-orientated silviculture to maintain the supply of firewood? Might there be a need for dedicated firewood silviculture i.e. coppice, not just of hazel but also oak, ash etc.? Might community woodlots be a way to establish a secure supply for those without access to land¹²? Could these be on the public forest estate?

5.5 Energy and carbon

Increasing the use of renewable energy is an ambition of the Welsh and UK Governments as a contribution to the achievement of reductions in carbon emissions and energy policy. The apparent scale of local use of wood as domestic firewood in modern log-burning stoves in Wales suggests that this is likely to be a significant contribution to WG renewable energy targets. However, as shown in Box 3 there are very poor statistics on domestic wood consumption despite it being the largest component of renewable heat generation. The official figures from DUKES are for the UK so there are no specific figures for Wales but a pro rata allocation based on population gives an official estimate of 20.4 thousand tonnes of oil equivalent¹³. Taking our estimate of 576,000 solid m³ and the UNECE (2013) conversion rate of 0.3215 tonnes oil equivalent then we estimate Welsh heat energy generation from domestic firewood to be 185 thousand tonnes of oil equivalent. This is significantly more than official estimates which as shown in Box 3 are also guesstimates. In order to properly represent Wales' and indeed UK renewable heat energy consumption there is a need to develop better methods of recording and monitoring firewood use.

Box 3: Digest of UK energy statistics (DUKES) for domestic wood combustion 2102

Domestic wood accounted for 4.9% of all renewable fuel use in 2011 and is the main contributor to renewables used for heat – comprising around 35% of the renewable heat total. These figures are derived as described in Chapter 6 of the notes:

Chapter 6 - Domestic wood combustion

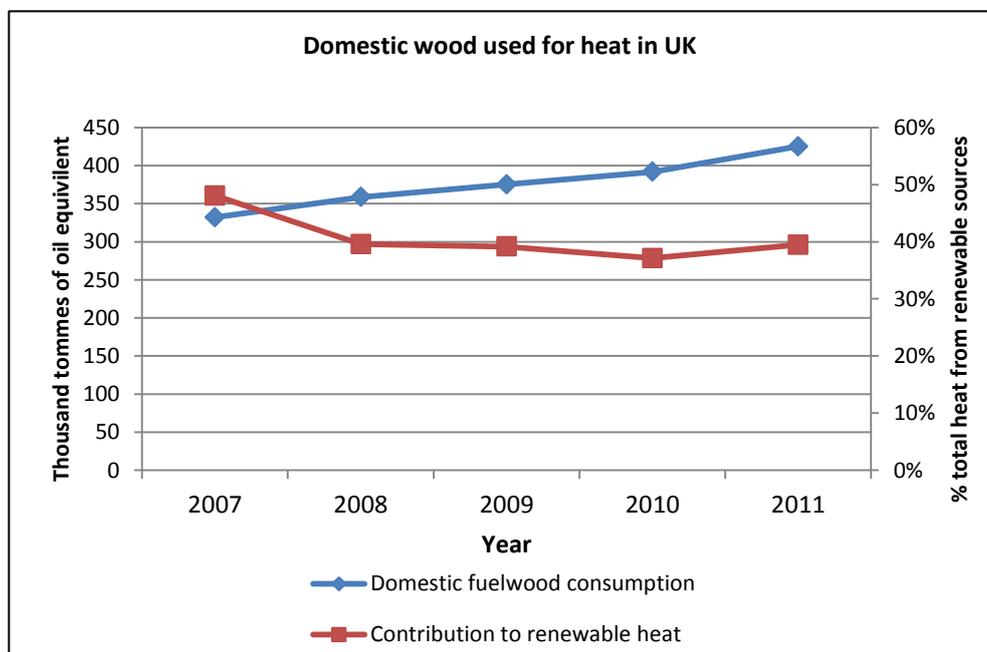
“6.67 Domestic wood use includes the use of logs in open fires, “AGA”-type cooker boilers and other wood burning stoves. Up to 2002 the figure given for each year is an approximate estimate based on a survey carried out in 1989.

6.68 A review of the approach to calculate domestic wood use carried out a few years ago suggested a 50 per cent growth rate over a 2 to 3 year period based on anecdotal information and subsequently supported from other sources (HETAS, the National Association of Chimney Sweeps and discussions with a risk assessor acting on behalf of

¹²See Llais y Goedwig Case study 3 Sustainable local firewood: Llangattock Community Woodlands for an example of such a scheme. <http://llaisygoedwig.org.uk/wp-content/uploads/2011/02/CS3-Llangattock.pdf>

¹³ UK estimate 425 thousand tonnes of oil equivalent, population of Wales is 4.8% of UK population.

insurance companies); additional discussions in 2011 to glean further anecdotal information have confirmed that this growth rate still persists. The Forestry Commission is continuing to review wood fuel data availability and gaps to identify further work that could be taken forward within the available resources that includes domestic wood use. Any new data that might arise from this work will be used to refine the UK estimates for this resource.”



Source: <http://www.decc.gov.uk/assets/decc/11/stats/publications/dukes/5956-dukes-2012-chapter-6-renewable.pdf> (downloaded 10 Dec 2012)

Interestingly, the figures for domestic wood use in DUKES (DECC 2012) apparently bear little resemblance to the figures published by Eurostat (2012) which indicate that only 12% of a total UK production of 10 million m³ roundwood was used as fuelwood. Our results indicate that there is probably this much domestic firewood produced in Wales alone.

An approximation of the amount of heat energy contributed by domestic firewood can be made using a few assumptions;

- Our 2012 survey suggests that in Wales, domestic firewood usage is (at least) 576,000 m³ yr⁻¹
- Assume that 1 m³ firewood = 5 MWh
- 576,000 m³ yr⁻¹ x 5 MWh = 2,880,000 MWh_{heat}

From these figures domestic renewable energy generation from firewood is estimated at 2,880GWh_{heat}yr⁻¹. This is *potential* energy and would be reduced by efficiency losses, for a well-run stoves efficiency can be high (>70%) but much lower in open fires. The official (DECC) figure for total energy produced from renewables in 2011 (DECC 2013) is 2,000GWh_{elec} with the Rhyl flats 90 MW offshore windfarm generating ~225 Gwh_{elec} yr⁻¹. Although heat and electricity are not directly comparable, it does appear as if domestic firewood is making a significant contribution to achievement of government targets on renewables.

Use of local renewables is also thought to contribute to reduction of carbon emissions by substituting the burning of fossil fuels. As shown in Table 9, the fuel which is most often

replaced with firewood is heating oil and LPG. The kind of carbon savings which arise from this can again be illustrated with figures from Francecatoet *al* (2008). Burning logs in a 10 kW appliance has a CO₂equivalent in kg/MWh of 19.27 while heating oil in a 10kW boiler releases 318.91 kg/MWh of CO₂. This suggests a significant saving from use of firewood but there are many confounding factors such as transport distances, species, quality etc.. Further investigation of the carbon footprint of domestic wood burning appliances in Wales would be necessary to determine the full carbon benefit (if any) of the increasing use of firewood.

5.6 Trends

The DUKES estimates are based on an assumption of steady year-on-year growth (~50% over 2-3 years) increase in demand for domestic firewood based on extrapolations on the expert opinion the trade organisations representing stove retailers and chimney sweeps. Our data on the age of stoves (Figure 5) suggest an installation rate of between 8 and 14% per year which is much the same as the official estimate. However, comparison with a firewood survey in 2003 in the Dyfi valley (Box 4) suggests that the wood-burning stoves are not new installations but replacements for open fires (use of wood-burning stoves increased from 36% to 75% of firewood using households (Table 7). This shift has likely greatly increased the efficiency of wood burning and has been instrumental in the increase in reliance on firewood as the sole form of heating for the whole house. The installation of a wood stove represents a commitment to use of firewood and also a significant financial investment by households. Purchase and fitting of a wood stove and flue is likely to cost between £1000-£3000 and as shown in Figure 5 there has been a relatively steady investment in stoves over the past five years. The net result has likely been a significant increase in the use of renewable heat based on small private investments without any intervention, support or recognition from the government.

Box 4: Domestic firewood use in mid-Wales 2003

In the Dyfi Valley (rural, sparse population density) – 35% of households used some woodfuel for heating and hot water and 4% used wood as the sole source of heating. Of the firewood users, 57% burnt it in an open fire, 36% in wood-burning stoves and 7% in both open fires and stoves.

Logs were sourced from:

- the householders own land
- bagged from garage forecourts, fuel suppliers etc.,
- by the load from farmers, tree surgeons and other suppliers and
- from forestry waste (licenses for wood left after felling on Forestry Commission land).

Across Powys around 40% of for firewood users do not pay for firewood. In addition, it was found that 80% of suppliers sold firewood ‘informally’ to supplement income from their main business (often farming or forestry) and typically supplied small quantities of between 20-40 tonnes per year to local customers. Logs were sold by the load, which varied in weight, volume, moisture content and species and customers were obliged to store and season the wood themselves.

Source: Data from CAT (2003) and Rural Resources (2003) as quoted in MacDermot(2005)

The patterns and motives of actors in the firewood supply chain have also apparently changed little over the past ten years. The only significant change being the recent withdrawal of the granting of licenses to individuals to ‘glean’ or scavenge wood left by

contractors on clear fell sites¹⁴. Only one of our respondents reported obtaining wood from Forestry Commission clear fell but it was not clear whether this was a present or past activity and under what arrangements it is being done. Although FCW contend that scavenging on clear fell was never a widespread practice in Wales, the loss of this opportunity is keenly felt by some of our respondents:

"FCW should re-introduce 'scavenging rights' for local communities."

"Fundamentally FCW shouldn't have repealed the Magna Carta in Wales. They have franchised one of our rights under the guise of health and safety"

"FCW should offer firewood licences to individuals"

"Annoyed at removal of scavenging rights by FCW, so much wood is wasted by them"

What our respondents appear to be referencing is the ancient right of 'estovers' and in particular 'firebote' which is "the right of a tenant to take firewood from the landlord's estate" (Oxford English Dictionary). Whether this actually applied to the FCW managed estate is moot as local people are not tenants and most common rights were expunged by the Forestry Bylaws (1982)¹⁵. Nevertheless Firewood Scavenging Permits for individuals and families are issued in North West England by FCE¹⁶ so there are precedents for the retention of personal collection of firewood from the public forest estate.

5.7 Comparison with FC Public opinion survey

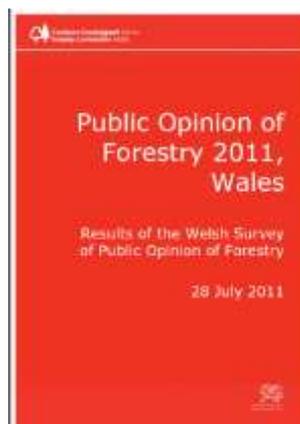
Since 1995 the Forestry Commission has undertaken biennial Omnibus surveys of public attitudes to forestry and forestry-related issues. These are based on questionnaire surveys of a representative sample of 1000 individuals aged over 16 and in this respect results should be comparable to those in our survey. The results of the survey for 2011 (FC 2011) are reproduced in Box 5.

Box 5: FC Public Opinion Survey of Forestry

Wood as a fuel

11% of respondents to the 2011 survey reported using wood as a fuel in their home, either on its own, or with other fuels. Of these, 53% classified themselves as a regular user, while 19% said they used it as the main fuel for heating. Almost one half (46%) of respondents who did not use wood as a fuel stated that it was 'not practical for this property' and a further 37% said they were 'happy with the existing system'.

Respondents were asked whether they ever use wood as a fuel in their home, either on its own or with other fuels. Around one in ten respondents (11%) in 2011 reported using wood as a fuel.

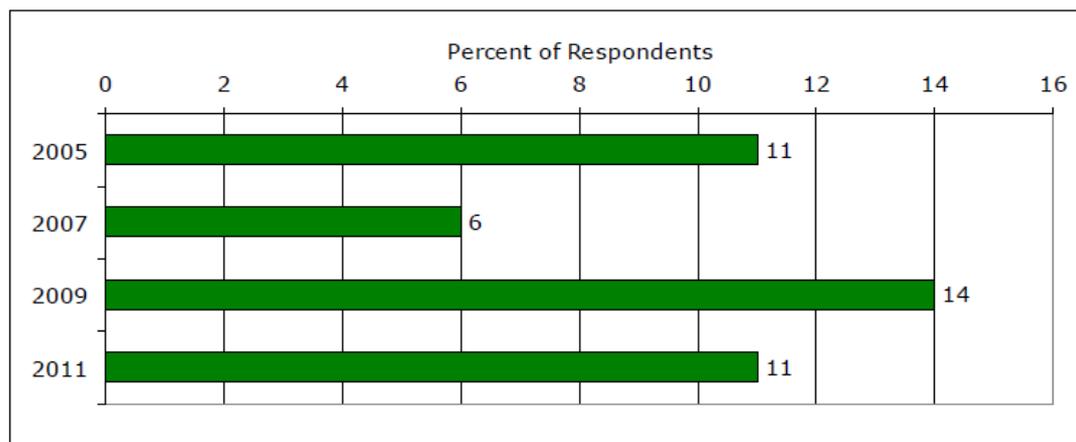


¹⁴ <http://www.forestry.gov.uk/forestry/INFD-7KTLDR>

¹⁵ [http://www.forestry.gov.uk/pdf/fce-fc-byelaws.pdf/\\$FILE/fce-fc-byelaws.pdf](http://www.forestry.gov.uk/pdf/fce-fc-byelaws.pdf/$FILE/fce-fc-byelaws.pdf)

¹⁶ <http://www.forestry.gov.uk/forestry/INFD-7ZPJVV>

Figure 3: Use of wood as a fuel in the home



Weighted base: All respondents – 2005 (1,001), 2007 (953), 2009 (1,002), 2011 (1,002).

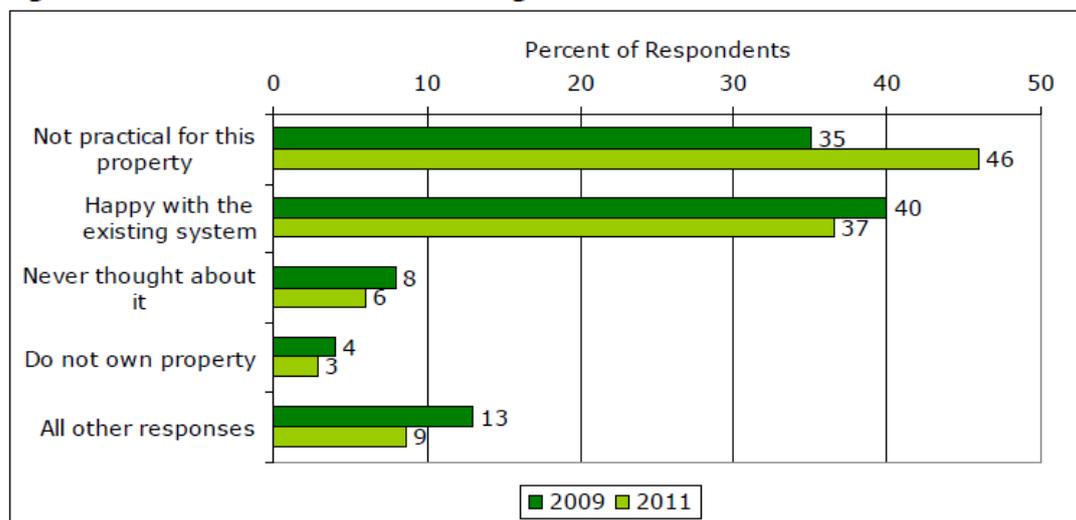
Of those using wood as a fuel:

- Around one third (35%) of respondents in 2011 obtained their wood a few bags at a time, 32% gathered their wood fuel themselves and 26% received it by the truck/van load;
- Over half of the respondents who used wood as a fuel would class themselves as a regular user (53%) while the rest said they used it occasionally;
- Around one fifth (19%) said they used it as the main fuel for heating their home, while the rest mainly use something else.

Reasons for not using wood as a fuel

Respondents who said they did not use wood as a fuel were asked to give the main reasons why not. In the 2011 survey, almost one half of these respondents (46%) said that woodfuel was ‘not practical for this property’ and a further 37% stated that they were ‘happy with the existing system’.

Figure 4: Main reasons for not using wood as a fuel



Weighted base: Respondents who don't use wood as a fuel – 2009 (867), 2011 (892)

The Public Opinion Survey (POS) results are broadly congruent with those of our study. The 11% of the population which use firewood is not too different from the 14% of the pooled data for Tregarth and Cwmbran. Other figures e.g. proportion sourcing their own firewood are probably statistically similar though the results of the POS tend to be lower than our study which could be due to a dilution with samples from dense, urban areas we did not sample.

The POS figures can also be used to guesstimate national consumption of firewood as shown in Table 22, in combination with the use profiles generated by this study. The high end estimates in Table 22 are within the range given in Table 20 which further supports the veracity of the guesstimates.

Table 22: Estimate of annual consumption of domestic firewood from Public Opinion Survey figures

Households in Wales	1,374,800			
Guesstimates	Low end		High end	
% population using firewood	6% (POS, 2007)		14% (POS, 2009)	
% regular users (50%)	3%		7%	
Use profile	Use regularly	Heat whole house	Use regularly	Heat whole house
% of users	80%	20%	80%	20%
Annual consumption / household (stacked m ³ yr ⁻¹)	2.5	6	6	12
Annual consumption Wales Stacked (m ³ yr ⁻¹)	82,488	49,493	461,933	230,966
Annual consumption Wales Stacked (m ³ yr ⁻¹)	131,981		692,899	
Annual consumption Wales Solid = 0.63 stacked (m ³ yr ⁻¹)	83,148		436,526	

5.8 Wood as a fuel

It is clear that there is strong and sustained interest from the public in the use of local firewood to replace oil, gas and electric heating to save money, environmental and wellbeing benefits. That this is a wider than our sample which is rural in nature is supported by articles in national newspapers aimed at urban populations which suggest that the attractions of wood burning stoves has changed little over the past four years (Box 6).

Box 6: What the papers say	
The Telegraph 2008	The Guardian 2012
<p>Credit crunch sparks a rise in wood burning stove sales</p> <p>Consumers are warding off the chill wind of the economic downturn by going back to the traditional and cheap method of heating homes with wood.</p> <p>Sales of wood-burning stoves have risen every year since 2005 to 140,000 last year, according to manufacturers, as electricity bills have increased along with the cost of oil.</p> <p>With the credit crisis, sales this year are expected to rise by a further 36 per cent to 190,000 stoves.</p> <p>Richard Hiblen, of trade body www.stovesandchimneys.co.uk said people were installing wood-burning stoves in order to save money on fuel bills in the longer term because wood is cheap and freely available.</p> <p>He said: "We have never experienced anything like this</p>	<p>Hot topic - wood burning stoves can bring fuel bills down</p> <p>As energy prices go up and up, consumers are finding new ways to save</p> <p>As energy prices go up and up, consumers are finding new ways to save</p> <p>With energy prices on an ever upward trajectory, Britons are increasingly turning to wood-burning and other solid fuel stoves to heat their homes – in some cases running them on home-grown or recycled wood.</p> <p>Last year more than 180,000 UK homes had a stove installed, and sellers say this week's domestic gas and electricity price increases will only add more interest to the sector.</p> <p>"Every time the big energy companies put up their prices we head off to the pub to celebrate," says John Nightingale, who has run his family business (Stovesonline.co.uk) for the past 30 years from his base, now in Devon. He says customers install</p>

<p>before. Stove manufacturers are forecasting an extra 50,000 stoves will be sold in the UK alone this year.</p> <p>"In addition to this manufacturers of chimney flues are reporting a 55 per cent increase in sales this year. We would say that this sales increase is partly due to the rising cost of more traditional heating fuels and consumers searching for cheaper options, but also to growing concerns about the environment. Consumers have embraced the fact that wood burning stoves are carbon neutral."</p> <p>Nick Rau, energy campaigner with Friends of the Earth, said wood was a carbon neutral product when it was replanted and in plentiful supply from sustainably managed woodland and as by-product from the construction industry.</p> <p>He said: "If it is wood from sustainably managed woodland or waste product from the construction industry, which is currently going to landfill, then this is something we would welcome.</p> <p>"It can also help fuel poverty, especially in rural areas where there is a cheap supply of wood."</p> <p>Source: The Telegraph online 1 Oct 2008 http://www.telegraph.co.uk/finance/financialcrisis/3184448/Credit-crunch-sparks-a-rise-in-wood-burning-stove-sales.html (accessed 5/11/12)</p>	<p>stoves to reduce carbon emissions, but principally to bring down their heating bills.</p> <p>While gas and heating oil prices have risen substantially in recent years, he says that the price of wood has remained steady. He estimates households can reduce their annual bills by a third by installing a stove.</p> <p>In the past, most buyers were those replacing an open fire with a much more fuel-efficient wood burner. Open fires lose large amounts of a home's warmth up the chimney whether in use or not.</p> <p>The Stove Industry Alliance, set up to promote their use, says wood is one of the most environmentally friendly fuels. It is a renewable energy and virtually carbon neutral. It claims the most efficient models achieve 80% efficiency – compared to an open fire at 32%, and a room open gas effect fire at 20% to 55% efficiency.</p> <p>Prices for a wood/solid fuel stoves start at around £350 but are typically closer to £500. Installation materials typically cost £200-£300, says Nightingale, and installation will take a two-man team a day – at local rates.</p> <p>How much it will cost to run will entirely depend on how much – if anything – you pay for locally sourced wood. The prices paid around the country varies enormously but is around £100 per 1.2m squared.</p> <p>Many people – this writer included – use recycled off-cuts taken for free from local joineries who are happy, indeed delighted, to get rid of it as they don't have to pay for disposal.</p> <p>Source: The Guardian online 19 Oct 2012 http://www.guardian.co.uk/money/2012/oct/19/wood-burning-stoves-bring-fuel-bills-down (accessed 5/11/12)</p>
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The continuing economic difficulties and relentlessly rising fuel prices mean that this interest is likely to continue. Our results suggest that there is latent demand for at least a 50% increase in firewood use and there is likely to be an increase in firewood use without any interventions. Awareness raising programmes in conjunction with development of local community-based supply chains associated with community wood stores could help encourage those in fuel poverty to take up the opportunity to diversify fuel sources and reduce costs, especially perhaps in the peri-urban communities of south Wales.

Unfortunately, there is also a downside to this interest and there are increasing reports of firewood thefts (Box 7) and there maybe a need to address this in some way.

Box 7: Firewood theft



The large-scale theft of timber from National Trust woodland in Gloucestershire may be due to high fuel prices, say countryside rangers.

Staff at the Haresfield Beacon estate near Stroud say people are driving away vehicles laden with logs.

An increase in the use of wood-burning stoves because of high gas prices has been blamed for the thefts.

The trust says dead wood left on the ground is an important part of the woodland habitat.

National Trust countryside ranger Tim Jenkins said at least 20% of trees cut down in managed woodland were left on the ground deliberately. The remaining trees are sold on.

'Chain saws'

Mr Jenkins said he had now started spraying the name of the company that has bought the timber on individual logs using fluorescent orange

He said logs had been taken from all parts of the 200-acres of woodland managed by the National Trust in the area, including Stock End Wood, Standish Wood and Randwick Woods.

"It's a huge problem. In one area of woodland near Whiteshill there is nothing left.

"The scale is moving on towards people taking van loads of timber away.

"I've seen people going in with chain saws [to cut up tree trunks] and ferrying it off in wheelbarrows to parked cars.

"Everything within 400m of the road has disappeared. I can only put it down to an increase in gas prices."

Experts say decaying wood is important because it provides an ideal habitat for plants and animals and supports several endangered species.

Mr Jenkins said he had reported the problem to Gloucestershire Police and he would keep a record of incidents from now on.

Source: BBC online <http://www.bbc.co.uk/news/uk-england-gloucestershire-17546497> (accessed 5 Nov 2012)

6 Recommendations

The findings presented in this report show that there is significant use of locally sourced firewood for domestic heating in Wales. This has previously been under-represented in both the woodland and renewable energy policies and there is a need to re-examine both to see where and how domestic firewood fits into them.

The response to our findings will need to be developed with relevant stakeholders which will take time. As a first step FCW convened a workshop on the 28th February 2013 in Y Plas, Machynlleth for the organisations and people who were involved in the survey to consider the next steps (see Appendix 3 for the list of people who attended this meeting). The key recommendations of this workshop are presented in this section with a few observations from the report's authors.

6.1 Sustainability and management of Welsh woodlands

Farmers and the owners of trees and woodlands are using their trees as a source of firewood. It appears that much of this is being done in an ad hoc fashion without formal management planning. The impact of this on the trees and woodlands is not known but the consensus of the workshop was that there is a need to improve general awareness of woodland management and of sustainable firewood production. There is also a need to promote greater public understanding of woodland management and to show that felling trees and generating useful products and is not a threat to woodlands as perceived by a large proportion of the public.

The production of a constant supply of firewood from a farm or woodland should ideally be regulated by a management plan. However, there is a lack of experience in Wales of management and silviculture for firewood production and particularly of hardwood coppice. NRW should look at coppice and short rotation forestry and the balance between conservation, firewood and timber production from such systems.

The potential scale of firewood fellings raises questions about the integrity of woodlands. Perhaps the NFI could use aerial photography and random sampling of private woodland

plots to get a clear national picture of the impact of firewood on small woodlands. Are woodlands being re-stocked or depleted of firewood?

Firewood scavenging is a concern – studies will be needed to generate more information on the scale and impacts of this activity.

6.2 How can woodland owners and communities make the most of emerging the firewood market opportunities?

Before woodland owners can take advantage of expanding markets for firewood they first need to know about it; so there is a need to publicise the opportunities presented by firewood markets. However, this must be realistic, firewood supply chains are complex, prices are very variable and customers may be price sensitive – so careful market research in the target markets will be needed to support business planning for any new firewood venture and especially one which has firewood as its main offer.

Training will be essential for new or expanding firewood enterprises. This costs money which may be difficult to find – e.g. £800 / person + chainsaw and personal protection equipment.

If a community wish to source firewood it is not always easy to get access to suitable woodland. One problem is that it can be hard to establish the ownership of private woodland and another is that owner's perceptions of 'conservation' and 'tree cutting' between incompatible can be a barrier. However, there are examples where a community group have made agreements with private woodland owners to manage woodland in exchange for the wood which is then sold as firewood.

Communities and woodland social enterprises need to work together and co-operate - pool equipment and sharing access to woodland. Networking between local groups can be very effective and there may be scope for group marketing opportunities which could be supported through supply chain development.

Another way to draw attention to opportunities might be to identify geographic locations with potential for development of firewood supply or enterprises. Such a GIS based analysis could identify areas where there is scope for an increase in the proportion of households using firewood and accessible local woodland resources.

There may be scope for social landlords to be both a source of wood (management of trees in landscaping schemes) and a market for firewood though this may mean relaxing prohibitions on installation of wood-burning stoves.

Firewood is already used for heating for people who would otherwise be in fuel poverty. There is potential to expand the use of firewood to address fuel poverty and create jobs.

Access to WG forests through NRW timber sales and Woodlands and You should be developed in a way which complements and responds to the natural development of the sector.

6.3 Advice and support for firewood producers and users

Advice and support systems and services are needed to promote sustainable woodland management – especially on farms. This advice should include:

- silvicultural advice for coppicing and hedgerow tree management;

- guidance on optimal silvicultural systems for managing broadleaf stands for firewood production;
- when a felling license is needed and when it is not.

The content of this advice should draw from existing knowledge in the academic community, from woodland manager and farmers. Research is also needed on e.g. coppice growth rates.

Advice could perhaps be channelled through existing bodies, groups, networks and contacts (e.g. Llais y Goedwig, Woodfuel Wales, Coed Cymru etc.) to promote this advice, and provide management support. Involve the Farmer's Union Wales and Farmers Weekly in the promotion of firewood management.

Look to develop an RDP funded advisory service, including joint marketing; equipment sharing etc.

6.4 Evidence gaps

The first observation is that the present study does not include data from all rurality classes or geographical areas of Wales. The most notable gaps are the WRO Urban area (Cardiff and Swansea), Anglesey and Pembrokeshire. There is a need to supplement the data from the present study with samples from these areas and also to increase the sample size i.e. number of communities sampled in all WRO classes to ensure results represent the whole of Wales. Data arising from new samples should be added to the dataset and ideally use objective sampling strategies. The questionnaire developed by the study seems robust and could be used in future surveys but it may be worth elaborating a little more on the type of firewood most often used (softwood, hardwood, waste wood) and the nature of the resource from which people are self-sourcing or collecting firewood.

It appears that a proportion of firewood arises from arboricultural operations on urban trees many of which are owned and managed by local authorities – e.g. there is over 1000ha of council owned woodland in Cwmbran. Some of this ends up in informal firewood supply chains and some is not burnt. Can all of this be brought into the firewood supply chain?

Wood arising from trees which are cut as part of routine maintenance activities such as wayleave clearance is often left at the disposal of the contractor. Some of this enters the firewood supply chain but it is difficult to estimate the volumes produced. Some of this wood is distributed gratis through informal social networks or for the asking – if this wood was diverted into more formal markets who might be disadvantaged by the loss of free firewood?

Firewood pricing is very variable across Wales. Some of this volatility is a result of many suppliers having access to cheap or free sources of wood and offering firewood for sale as supplementary income for an arboricultural enterprise or farm. The experience of three firewood merchants who took part in the survey suggests that sale of firewood is not viable as a stand-alone enterprise. Firewood supply chains are generally short but very complex and include social exchanges, customer sensitivity to prices which can result in both fuel and source switching and insecurity of supply. There is a need to understand in more detail the nature of firewood value chains across Wales. In particular there is a need to understand the role of firewood in fuel poverty and the impact of increases in firewood prices which would result from a regularisation of firewood markets might have on poorer households.

The results of this survey have shown the benefits of adopting a user-centric approach to firewood markets. This raises a number of questions and suggests there is a need for more information from customers' perspectives such as:

- pressure on supply chain – do users know enough to plan ahead for winter/cold spells?
- why are people foraging?
- why are they installing stoves?
- How do changing prices affect the use of gas/oil and firewood?

We have seen that farms are a source of firewood but we do not know how many farm woodlands are being used for firewood, but branded as 'unmanaged'? The findings of the National Forestry Inventory suggest there is very little tree cutting in farm woodlands and this needs to be reconciled with the findings of this study. This might be difficult to answer as landowners may be reluctant to share what they know. Might it be possible to use the Glastir Advanced woodland visits to get a better idea of how many farm woodlands and trees are used for firewood and the impact of this on the woodland and farm?

6.5 Units of measurement/terminology – how to promote consistency?

Most merchants sell firewood loose so it will be easiest to measure in loose m³. Conversion factors for the standard builder's bags should be made available so people can compare prices and volumes.

HEATAS terminology is the best to ensure consistency.

It is difficult to assess firewood volumes being used by households who source from their own woods and measure volumes in trees. Cutting of trees for firewood could perhaps come from the NFI. Estimates of total firewood consumption could also come from estimates of stove consumption and the length of time it is lit or, if suitable technology can be found, from flue temperature loggers.

6.6 Policy mapping

Our results will have a bearing on several Welsh Government policies and the findings of this report should be brought to the attention of the relevant WG departments for them to consider further.

NRW and WG need to take this work forward and their role in promoting and supporting firewood production needs to be clarified. The present study has been co-produced by a partnership of the FCW policy team and third sector organisations and partnership working in this area should be continued.

The findings of the study are relevant to the Sustainable Development and Environment Bills and represent a good example of the delivery of ecosystem services.

The use of domestic firewood is potentially a significant contribution to WG renewable energy targets which is likely of the same order or magnitude as all currently reported renewable electricity generation combined. Very little of this is currently represented in official energy statistics which are woefully out of date and subjective. There is also potentially a significant carbon saving in the substitution of fossil fuels with locally sourced firewood. Further studies into both of these aspects are required.

Firewood has the potential to contribute to alleviation of fuel poverty, create jobs and training and development of new enterprises.

What are the implications of the existence of a significant market for domestic firewood in Wales on the way the WG forest estate is managed, who has access to the wood and who it is managed by?

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APPENDIX 1: Firewood Survey questionnaire

Firewood survey



Please take 10 minutes of your time to complete this short anonymous survey. Llais y Goedwig is an organisation representing community woodland groups and other interested parties throughout Wales. Through this survey we are hoping to identify the current and potential future market for local firewood production by looking at domestic firewood consumption and trends.

POSTCODE _____

PROPERTY TYPE:

Semi-detached House		Flat	
Terraced house		Farmhouse	
Detached house		Other	
Number of bedrooms			

1. Do you use woodfuel (or woody biomass) for heating?	YES	NO
If yes, go to 2, if no complete question 1 only.		
Would you like to use wood as a fuel?	YES	NO
Why are you considering using wood? Are there any problems you foresee with this?		
Are you considering a specific appliance? If so what?		
If yes, would you like further information about wood fuel? (see Information)		

2. What sort of appliance(s) are you currently using?	
Wood stove (log or pellet) Does this appliance have a back boiler?	
Kitchen Range With back boiler?	
Open fire	

Boiler (pellet, log or chip)			
How old is your stove? (approx age)			
Does the appliance heat your whole house?	YES	NO	
3. Is burning firewood your main form of heating?	YES	NO	
What other form of heating do you use?			

4. How often do you burn wood?	Winter	Summer
Every day (all day)		
Every day (evenings only)		
Weekends		
Occasionally (please specify)		
Never		

5. Where do you source your wood? Please specify			
Buy it		from	
Grow my own			
Get it free		from	
Scavenge it		from	
Other source		Where?	

6. In what form do you get your wood fuel (please estimate proportions and specify units where possible)	
Buy or acquire it in situ as a standing or fallen tree	
Buy green logs/discs for cutting and splitting at home	
Buy it cut and split: Seasoned:	
Unseasoned:	
Grow it	
Collect it myself	
Waste wood (does this contain paint or varnish etc?)	

Please describe	
Do you know about moisture content, if so do you measure it yourself?	

7. Do you have any preferences between the following?			
	First choice	Second choice	Would not use it
Hardwood			
Softwood			
Composite briquettes			
No preference – all wood burns			
Do you have a species preference?			

8. What quantities do you use in a year?	Bought		Free wood
	Number	Price	Estimated number
Cubic meter (m ³)			
Tonne			
Trailer load (Pickup e.g. Toyota (1.2 M ³) Transit) (2.2 M ³) please specify			
Builders bag			
Small sack (e.g.-from garage forecourt)			
Other quantity e.g.: Cord			

9. Estimated annual expenditure on firewood (£)	
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10. Wood store				
How much wood do you store?	Week(s)	Month(s)	Year	Several years
Is lack of storage space limiting your use of firewood?				

Tell us about how you store wood	
Do you season wood yourself? How long do you think it takes to dry/season green (freshly cut) wood?	

11 Quality Assurance?		
How do you go about sourcing good quality firewood?		
What is good quality firewood?		
Have you heard of Quality Assured Wood fuel QAF-	YES	NO
Would you pay a premium for quality assured wood?	YES	NO
If yes, how much more would you be willing to pay?		
Do you have concerns about the quality of the wood you buy?		

Do you have any further comment or concerns with firewood availability, quality, price etc.?

APPENDIX 2: Classification of areas of Wales by rurality and population density

Classification follows White S & Tippireddy H (2009) *Statistical report on Rural Wales: Volume 1*. Wales Rural Observatory.

Rurality applied to unitary authority level. Population density groups defined at electoral division level as defined on Postcode database released Oct 2012 using household numbers per postcode area assuming 2.24 people per household after Household estimates 2010 (National Statistics 2011). Classes are: sparse < 150 persons per sq km, medium 150-1500 persons per sq km, dense > 1500 persons per sq km.

ONS code	Unitary authority	Rurality	Constituency	Population density	Number of households		
					Total	Sample	In sample using firewood
W06000001	Ynys Mon	Rural	Ynys Mon Co Const	Sparse	33,923		
W06000002	Gwynedd	Rural	Arfon Co Const	Sparse	25,453	114	29
W06000002	Gwynedd	Rural	Dwyfor Meirionnydd Co Const	Sparse	33,411	5	4
W06000003	Conwy	Rural	Aberconwy Co Const	Sparse	27,442	5	3
W06000003	Conwy	Rural	Clwyd West Co Const	Sparse	27,250	40	15
W06000004	Denbighshire	Rural	Clwyd South Co Const	Sparse	3,664	1	0
W06000004	Denbighshire	Rural	Clwyd West Co Const	Sparse	6,838	1	1
W06000004	Denbighshire	Rural	Vale of Clwyd Co Const	Medium	32,667	9	5
W06000005	Flintshire	Other	Alyn and Deeside Co Const	Medium	35,296		
W06000005	Flintshire	Other	Delyn Co Const	Medium	30,595	3	2
W06000006	Wrexham	Other	Clwyd South Co Const	Sparse	28,055	1	1
W06000006	Wrexham	Other	Wrexham Co Const	Medium	30,682		
W06000008	Ceredigion	Rural	Ceredigion Co Const	Sparse	33,752	7	5
W06000009	Pembrokeshire	Rural	Carmarthen West and South Pembrokeshire Co Const	Sparse	22,395		
W06000009	Pembrokeshire	Rural	Preseli Pembrokeshire Co Const	Sparse	37,039	1	0
W06000010	Camarthenshire	Rural	Carmarthen East and Dinefwr Co Const	Sparse	32,683	58	39
W06000010	Camarthenshire	Rural	Carmarthen West and South Pembrokeshire Co Const	Sparse	14,095	4	2
W06000010	Camarthenshire	Rural	Llanelli Co Const	Medium	36,939	1	0
W06000011	Swansea	Urban	Gower Co Const	Medium	35,883	1	0
W06000011	Swansea	Urban	Swansea East BoroConst	Dense	36,685		
W06000011	Swansea	Urban	Swansea West BoroConst	Dense	36,517	4	1

ONS code	Unitary authority	Rurality	Constituency	Population density	Number of households		
					Total	Sample	In sample using firewood
W06000012	Neath Port Talbot	Valleys	Aberavon Co Const	Medium	30,400		
W06000012	Neath Port Talbot	Valleys	Neath Co Const	Medium	33,853	4	1
W06000013	Bridgend	Valleys	Bridgend Co Const	Medium	34,886	3	0
W06000013	Bridgend	Valleys	Ogmore Co Const	Medium	26,295		
W06000014	Vale of Glamorgan	Other	Cardiff South and Penarth BoroConst	Dense	12,809		
W06000014	Vale of Glamorgan	Other	Vale of Glamorgan Co Const	Medium	41,948	1	1
W06000015	Cardiff	Urban	Cardiff Central BoroConst	Dense	32,266	1	0
W06000015	Cardiff	Urban	Cardiff North BoroConst	Dense	36,877		
W06000015	Cardiff	Urban	Cardiff South and Penarth BoroConst	Dense	35,710		
W06000015	Cardiff	Urban	Cardiff West BoroConst	Dense	39,001	3	1
W06000016	Rhondda Cynon Taf	Valleys	Cynon Valley Co Const	Medium	32,071	2	2
W06000016	Rhondda Cynon Taf	Valleys	Ogmore Co Const	Medium	6,838		
W06000016	Rhondda Cynon Taf	Valleys	Pontypridd Co Const	Medium	34,502	1	1
W06000016	Rhondda Cynon Taf	Valleys	Rhondda Co Const	Medium	32,854		
W06000018	Caerphilly	Valleys	Caerphilly Co Const	Medium	37,420	2	0
W06000018	Caerphilly	Valleys	Islwyn Co Const	Medium	32,908	1	0
W06000018	Caerphilly	Valleys	Merthyr Tydfil and Rhymney Co Const	Medium	7,488		
W06000019	Blaenau Gwent	Valleys	Blaenau Gwent Co Const	Medium	32,306	1	1
W06000020	Torfaen	Other	Monmouth Co Const	Sparse	4,584	2	2
W06000020	Torfaen	Other	Torfaen Co Const	Medium	35,931	112	4
W06000021	Monmouthshire	Rural	Monmouth Co Const	Sparse	32,635	2	0
W06000021	Monmouthshire	Rural	Newport East Co Const	Medium	7,418		
W06000022	Newport	Urban	Newport East Co Const	Medium	25,761		
W06000022	Newport	Urban	Newport West Co Const	Medium	37,386	3	2
W06000023	Powys	Rural	Brecon and Radnorshire Co Const	Sparse	33,558	47	25
W06000023	Powys	Rural	Montgomeryshire Co Const	Sparse	29,302	53	16
W06000024	Merthyr Tydfil	Valleys	Merthyr Tydfil and Rhymney Co Const	Medium	26,569		

APPENDIX 3: Attendance at project workshop at Y Plas, Machynlleth 28 February 2013

	Name	Organisation
1	Robert Luxton	WoodFuel Wales
2	Roger Cooper (Chair of meeting)	WSAP
3	James Walmsley	Bangor University
4	Jenny Wong	Llais y Goedwig Board / CoetirMynydd
5	Kirsten Hails	Go Wales work placement
6	Fay Sharpley	Llais y Goedwig Board / Pobl y Fforest
7	Roger Davies	Llais y Goedwig Board / GolygfaGwydyr
8	Dave Higginson	Blaen Bran Community Woodland
9	Ralph Miller	Blaen Bran Community Woodland
10	Frankie Owen	Wales Forest Business Partnership
11	Patience Eastwood	FCW
12	Helen John	FCW
13	Chris Edwards	FCW
14	Roz Owen	FCW
15	Richard Davies	FCW
16	Aaron Fortt	FCW
17	Bill MacDonald	FCW
18	Barbara Anglezarke	FCW
19	Ian Sachs	FCW
	Apologies	
	Kyle Williams	FCW
	Mike Pitcher	FCW
	Nic Snell	Certainly Wood
	Gareth Ellis	Llais y Goedwig Board / The Green Valleys
	Sharon Sweeny	CoetirMynydd
	Adrian Farey	Elwy Working Woods
	Hugh Jones	FCW