

6 Findings regarding Fire wood Collection Behaviour

6.1 Introduction

The firewood collection behaviour studied was specifically the collection of 'dry wood only' as opposed to cutting wet wood, i.e. felling trees in order to provide domestic fuel. The only deviation from this behavioural concept was the inclusion of single tree harvesting, i.e. pruning. Although not dry wood, pruning was also deemed an appropriate method of collecting wood that would not damage the existing tree population (Table 4). The 'focused' extension intervention carried out between **January to September 2001** therefore focused on the promotion of dry wood harvesting and pruning. The following presentation and discussion identifies the impact of the 'focused' extension intervention on the firewood collection behaviour and future collection intentions of rural Dagbani speaking women in the Northern Region of Ghana.

An initial 'first' structured survey carried out in 1998 regarding barriers to 'dry' firewood collection identified the following:

- The overriding perception that there would not be a problem with future access to firewood
- Perceived social pressure to continue current practices
- Low self-perception amongst women regarding their tree harvesting (pruning) capabilities
- The rejection of many of the traditional taboos and beliefs regarding the effect of certain types of wood on their health.

It was felt that extension messages aimed at encouraging sustainable firewood collection behaviour should:

- Raise awareness regarding the possible destruction of the fuel wood source.
- Build a positive self-perception regarding tree harvesting (pruning) ability via 'demonstrating' and reinforcing good practice.
- Reinforce some of the traditional taboos that have an actual physical basis for their existence, e.g. the effects of some types of wood smoke on the health of the household.

The first survey identified the most influential social referents and their perceived normative influence on the women respondents. From these findings it was recommended that future extension should:

- Be carried out through groups representing natural friendship networks rather than an emphasis on individuals
- Involve the most important social referents and gain their endorsement of the proposed practices, particularly the chief
- Be promoted by the local extension agents.

During the workshop held in January 2000, it transpired that firewood collection had not been a focus of the attending extension agencies' respective interventions. This was immediately recognised as an important behavioural area and the different participating agencies demonstrated a real desire to include this topic within their respective extension programmes. During the workshop different extension messages and strategies were developed and a commitment expressed to under take the diffusion of these in a 'focused' extension initiative.

Unlike the other two behaviours, 'improved stove use' and 'wood lot planting', the inclusion of 'sustainable firewood collection' was new and both tools and methods of integrating the 'collection' messages within existing programmes had to be developed. The follow-up workshop in December 2000 reinforced the earlier workshop's outcomes and promoted the development of various extension tools, e.g. dramas and flip charts to assist this process. Support was also provided between January and September 2001 to ensure the application of the 'focused' extension process amongst rural Dagbani speaking communities. It is for this reason that the 'focused' extension intervention regarding firewood collection is considered to have only been undertaken over the six month period prior to the 'second' impact survey. Although this study observes the impact on the women, the main collectors and users of firewood, the extension initiative was gender inclusive.

Table 4: Comparison of Changes in Improved Stove Use Behaviour due to Extension Interventions applying the Mann-Whitney U Test

Firewood Collection Behaviour	First and Second Survey Comparison			Involvement in Extension Programme			Attendance of Extension Demos		
	First N = 62 Mean	Second N = 230 Mean	MW Sig.	Without Extension N = 28 Mean	With Extension N = 201 Mean	MW Sig.	Not Attended N = 46 Mean	Attended N = 184 Mean	MW Sig.
Buying wood	-0.32	0.08	0.005	0.07	0.08		0.00	0.10	
<u>Selling Wood</u> ^a	0.26	0.07		0.00	0.12		-0.30	0.17	0.004
Only dead wood	-0.19	-0.06		-0.14	-0.07		0.04	-0.09	
Pruning	-0.29	0.12	0.004	0.50	0.07	0.033	-0.13	0.18	
<u>Ring barking (no taboo)</u>	0.74	0.20	0.000	0.14	0.22		0.74	0.07	0.000
<u>Ring bark (with taboo)</u>	0.94	0.90		0.86	0.92		0.83	0.92	
Roots and grasses	-0.48	-0.39		-0.43	-0.37		-0.65	-0.33	0.032
<u>Acquired new access</u>	0.58	-0.17	0.000	-0.14	-0.21		-0.04	-0.20	
Reduced head-loads per week	0.00	0.00		0.00	0.02		-0.09	0.02	
<u>Theft of wood</u>	0.81	0.86		0.71	0.87		1.00	0.83	0.039
Fire wood collection behaviour index Range (-10 to +10)	2.03	1.62		1.57	1.66		1.39	1.68	

^a Activities underlined have their signs changed to gain an overall behaviour reading 'toward collecting dry wood only', i.e. 'pro' conservation behaviour.

Table 5: Dry firewood collection only: Attitude change comparisons (Mann Whitney U Test)

Firewood Collection Attitudes (Dry wood only)	First survey N = 62 mean	Second survey N = 230 Mean	MW Sig.	Without Ext N = 28 mean	With Ext N = 201 mean	MW Sig.	Demos No N = 46 mean	Demos Yes N = 184 mean	MW Sig.
<u>Dangerous for women FCAT1</u>	-0.71	-1.28		-0.14	-1.44	0.004	-1.24	-1.29	
<u>Collecting less wood FCAT2</u>	-1.44	-0.84		-0.79	-0.85		0.11	-1.08	0.001
<u>Duration of head-load FCAT3</u>	-1.27	-0.90		-0.39	-0.98		-0.41	-1.03	
<u>Punished or cutting wet wood FCAT4</u>	0.73	0.77		0.43	0.82		0.89	0.74	
<u>Loss of fertility FCAT5</u>	-0.47	-0.80		-0.68	-0.81		-0.52	-0.86	
<u>Only men FCAT6</u>	1.27	1.24		0.79	1.31		2.33	0.97	0.000
<u>No punishment for ring barking FCAT7</u>	1.00	0.79		0.57	0.82		0.96	0.75	
<u>Punishment for disregard of tradition FCAT8</u>	1.32	0.83		1.25	0.78		0.28	0.97	
<u>Leaders restricting future access FCAT9</u>	0.71	0.93		1.07	0.92		1.61	0.77	0.005
<u>Some fruit trees cannot be pruned FCAT10</u>	-0.26	0.04	0.039	-0.03	0.04		0.18	0.00	
<u>Regular pruning of trees possible FCAT11</u>	1.06	1.14		1.11	1.14		1.37	1.08	
<u>Stealing wood will bring evil FCAT12</u>	-0.27	-0.96		-1.32	-0.91		-1.72	-0.77	0.008
<u>Women destroy trees FCAT13</u>	-0.23	0.48		0.43	0.49		1.00	0.35	0.024
<u>Need to buy wood in future FCAT14</u>	-0.47	-0.68		-0.32	-0.73		-0.41	-0.75	
<u>Always be able to buy wood FCAT15</u>	1.29	1.27		1.29	1.27		1.72	1.16	0.030
<u>God will not permit destruction of trees FCAT16</u>	1.87	2.03		1.57	2.09		2.80	1.84	0.001
<u>Landlords will restrict future access FCAT17</u>	1.10	1.09		0.61	1.16	0.038	1.98	0.87	0.000
<u>Use of some woods will cause illness FCAT18</u>	-1.13	-1.17		-0.50	-1.27		-1.67	-1.05	
<u>No harm if ignorant of traditions FCAT19</u>	1.39	1.52		1.04	1.59		2.15	1.36	0.011
<u>No future problem of access to wood FCAT20</u>	0.47	1.07		1.43	1.02		1.98	0.85	0.000
Dry wood only (sum) of attitude $\sum b_i * e_i$	5.97	6.59		7.40	6.48		13.37	4.89	0.000
Range (-80 to +80)									

^a The outcome beliefs that are considered to be anti conservation (dry wood only) are underlined.

6.2 Changes in the main TORA variables (Impact of the focused extension)

The Principal variables are, the overall measure of attitude (product sum), the subjective norm statement (not the product sum) and the product sum measure of the subjective norm, intention and overall behaviour (index of sub-practices). It should be noted that in the analysis (e.g. Figures 8 to 13) the subjective norm statement has been used rather than the product sum reading.)

As in the case of the adoption of improved stoves and wood lot planting, the same questionnaire was applied in the second survey as in the first. When the reliability of the different scales applied to the collection of firewood were tested, all apart from the behaviour scale they were found to have acceptable reliability coefficients⁹, i.e. α of >0.6. The behaviour scale in both the first and second surveys registered a similar low reliability coefficient. This is mainly due to the inclusion of both negative and positive behaviours.

With regard to the principal TORA variables regarding firewood collection there have not been significant changes between the first and second survey samples and between those targeted, or not, by the 'focused' extension initiative. However, there have been significant changes in the attitudes and

⁹ The Cronbach Coefficient Alfa was applied to test reliability of the different scales used in the questionnaires. The reliability coefficient demonstrates whether a certain collection of items will yield interpretable statements about individual differences (Cronbach 1951). Scales demonstrating coefficients of >0.6 are normally deemed reliable.

Figure 8: Collecting Dry Firewood Only 'First Survey Sample': n=62

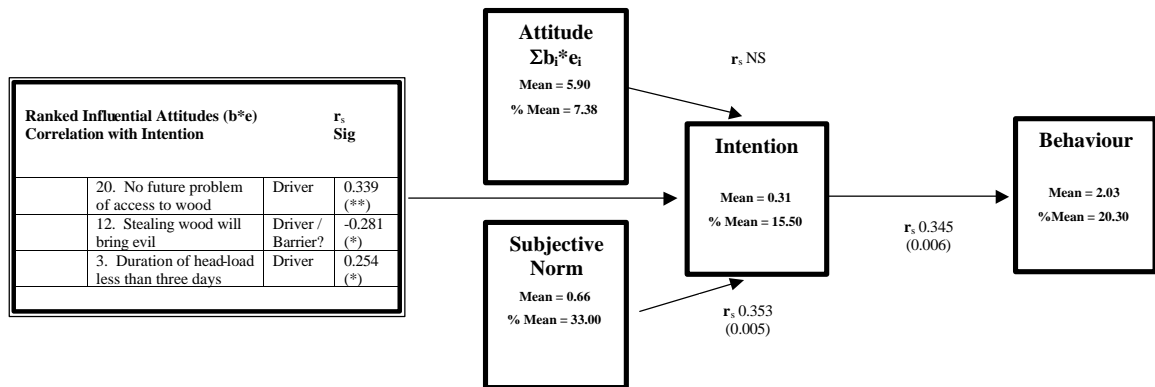
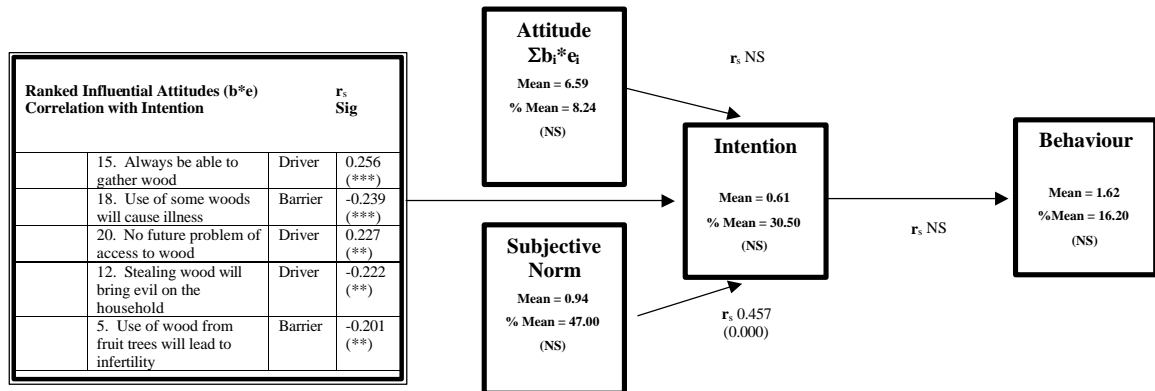


Figure 9: Collecting Dry Firewood Only 'Second' Survey Sample: n=230



r_s Spearman Rank Order Correlation.
 Degree of significance (*p < 0.05; **p < 0.01, ***p < 0.001)

Figure 10: Collecting Dry Firewood Only: ‘Without Extension’: n=28

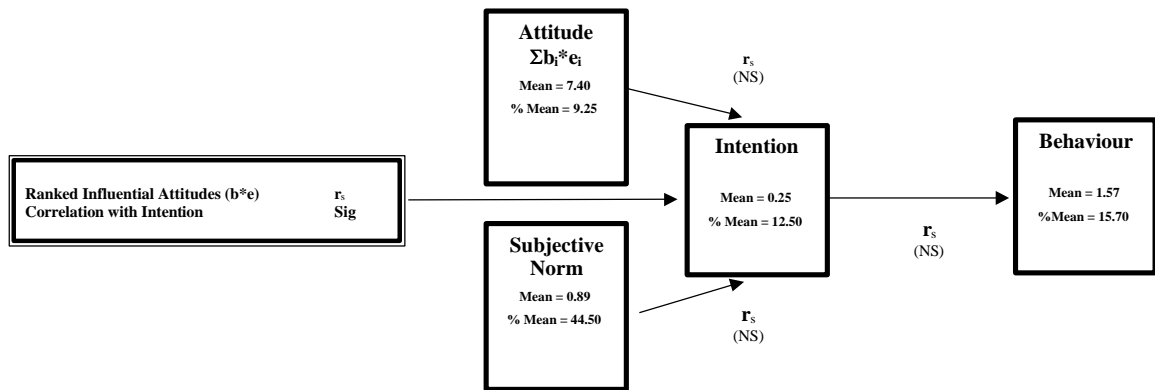
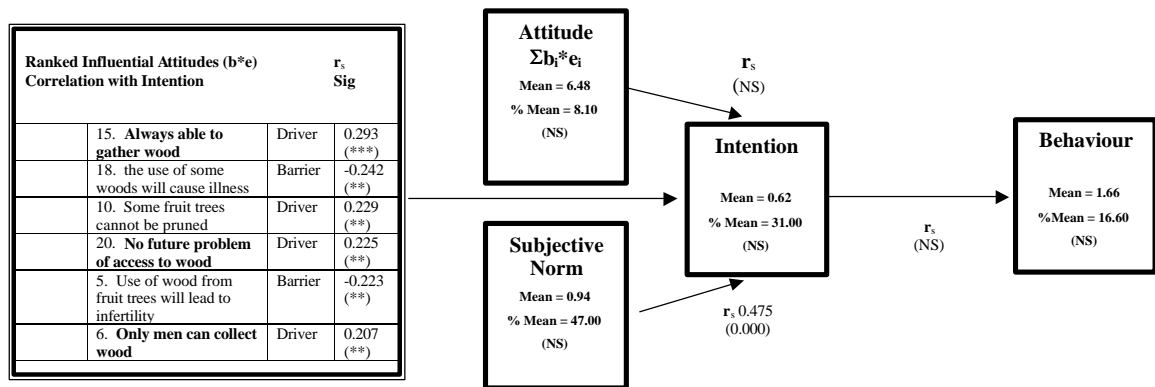


Figure 11: Collecting Dry Firewood Only: ‘With Extension’ Sample’: n=202



r_s Spearman Rank Order Correlation.
 Degree of significance (*p < 0.05; **p < 0.01, ***p < 0.001)

Figure 12: Collecting Dry Firewood Only: 'Not Attended' Any Demonstrations: N=46

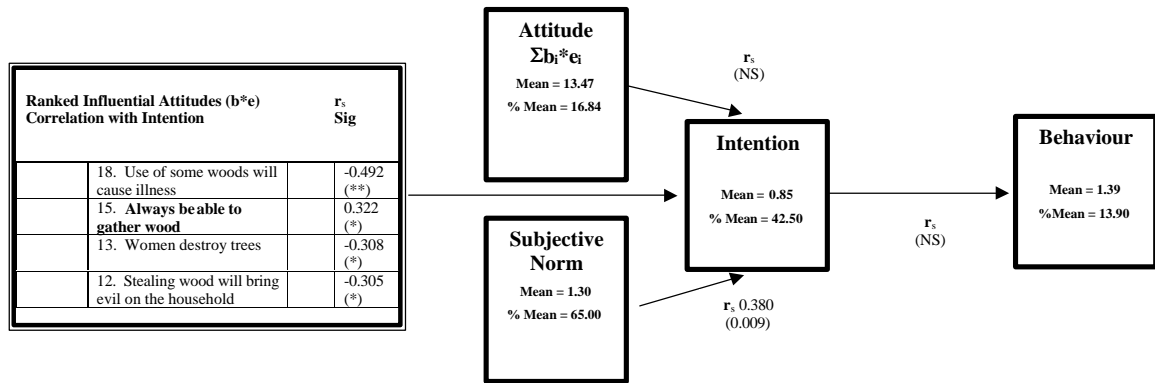
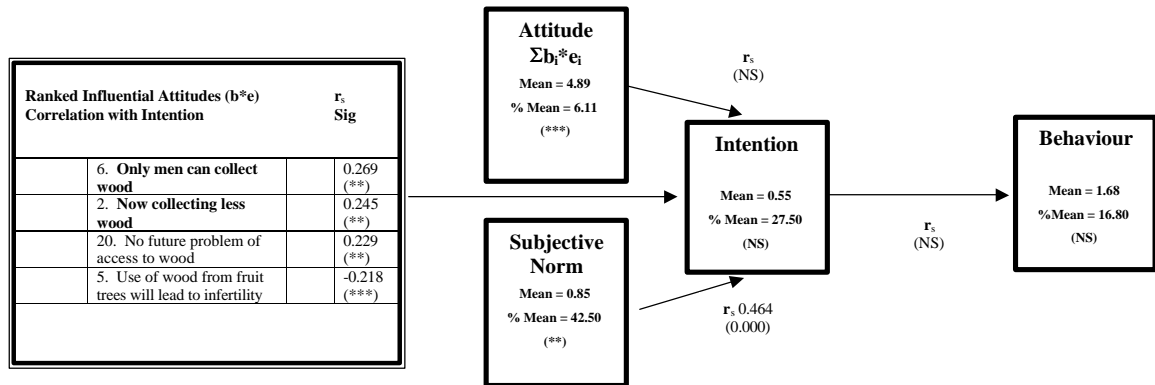


Figure 13: Collecting Dry Firewood Only 'Attended' Demonstrations: n=183



r_s Spearman Rank Order Correlation.
Degree of significance (*p < 0.05; **p < 0.01, ***p < 0.001)

subjective norms of those who had attended a demonstration as opposed to those who had not. In the instance of those who had attended demonstrations, the registered overall attitude and subjective norm had weakened significantly, which appears counter-intuitive. I.e. a strengthening of the attitude and subjective norm would have been expected after exposure to demonstrations. The following paragraphs discuss this anomaly. The figures 9, 11 and 13 demonstrate if there has been a significant change with regard to overall attitudes, subjective norm, intentions or behaviour. Changes in behaviour, attitudes and subjective norms can also be observed in Tables 4, 5 and 6 respectively.

When the scores of those who had attended demonstrations and those who had not within the 'first' survey sample were compared, no significant differences were noted regarding any of the main TORA variables or between the separate outcome attitudes (b*e) or referent subjective norms (m*b). This indicates that the changes that have occurred between those attending demonstrations or not within the 'second' survey sample are due to interventions after the 'first' survey.

Significant changes are noted between those who have or have not attended demonstrations within the second sample regarding both the attitude component and subjective norm statement, Both have weakened significantly (Figures 12 and 13). However, in the case of firewood collection the issue of demonstration attendance applies to the attendance of any form of development demonstration. Therefore demonstration attendance may not have any relationship to natural resource management, e.g. firewood collection behaviour or decisions regarding future collection practice.

The significant weakening in attitude and perceived social pressure to collect only dry wood cannot therefore be directly related to demonstration attendance but expresses the influence of other factors that relate to demonstration attendance. When the characteristics of those who attend and those who do not attend demonstrations were analysed, the significant difference in age of the attendees stood out. Within the second survey sample those below 30 years of age are significantly less likely have attended demonstrations than those aged between 30 and 50 years ($p = 0.031$) or those over 50 years ($p = 0.026$). I.e. the older the respondent the more likely they are to have attended demonstrations. Regarding firewood collection, age is found to be influential, although it was not found to be regarding improve stove adoption.

The question of why age is influential in the case of firewood collection appears to be related to membership of multi-wife households, those under 30 are significantly less likely to be part of a multi-wife household than those over 50 ($p = 0.004$). The multi-wife household may be able to dedicate more labour to collection. However, there are no significant differences regarding access to, time taken in collection and duration of firewood or the size of household and number of meals cooked per day between the different age groups. There is a significant difference between the under 30s and the middle age group (30 to 50) regarding land and livestock ownership, although not between the under 30s and of over 50s.

The under 30s demonstrated a significantly stronger intention to collect only dry wood (0.88) than those aged between 30 to 50 (0.43). A similar significant difference in the attitude statement¹⁰ was also noted between the under 30s (1.56) and over 50s (1.22). The subjective norm statement of the younger group was also significantly stronger (1.24) than that of the middle-aged respondents (0.82). It is therefore found that the under 30s appear to have a greater predisposition to adopt more sustainable fuel wood collection practices.

6.3 The adoption of more sustainable gathering practice

Table 4 demonstrates the changes in the practices associated with firewood collection. The overall collection of firewood in a sustainable fashion appears to have diminished over the period spanning the first and second surveys. For instance if the first survey sample behaviour score (2.03) is compared with the second survey of sample of those who have not been exposed to any form of extension demonstration (1.39) the greatest disparity can be observed (Table 4). This suggests that the natural tendency within the target area over the past 3 years has been for firewood collection to become more unsustainable. This may be an indicator of the degradation of the fuel wood resource in the targeted area over this relatively short period of time. A comparison of the first and second survey samples

¹⁰ The general attitude statement is the response to the general question of whether the subject felt it was good or bad to collect only dry wood. The response was measured on a bi-polar scale ranging from very good to very bad, the mid-point indicating a neutral attitude.

indicate that although access to land for collect appears to have improved over the last 3 years, the time taken to collect a head-load increased while the duration of the load decreased¹¹. This suggests that the quality of wood collected is also diminishing. This natural negative trend needs to be borne in mind when considering the impact of the extension intervention.

The sustainable nature of collection had improved as a result of exposure to extension demonstrations (1.57 to 1.66 respectively) (Table 4). Although, a significant change as yet has not been achieved, the 'focused' intervention over a relatively short period of time appears to have reversed the natural negative trend regarding sustainable collection behaviour. It is suggested that given a more prolonged exposure to the extension initiative a significant positive change could be achieved, particularly involving demonstrations.

When the individual collection sub practices are compared, it is noted that there has been a significant increase in the purchase of wood between the 'first' and 'second' surveys. This suggests a growing lack of access to collectable wood as opposed to increasing wealth. However, when a comparison of various wealth and access indicators was made between the first and second samples, the second sample registered significantly higher incidence regarding land ownership, access to land, livestock, radios and bicycles per household. Although there is a significant ($p = <0.05$) positive correlation between both land and livestock ownership and collection behaviour, the correlation coefficients are <0.20 ¹² and therefore are not deemed to be particularly influential.

Pruning was the only sub-practice to register a significant difference between those who were exposed to the 'focused' extension initiative as opposed to those who were not. Interestingly those who were covered by the extension programme were less likely to have pruned live trees as a means of collecting wood (Table 4). In this instance pruning as a form of sustainable resource management had been encouraged and is therefore treated as a 'pro-conservation' behaviour, although it is not a form of 'dry wood' collection.

The instance of reported ring barking of trees without taboos has increased significantly over the past three years. Those exposed to the 'focused' extension programme do not mirror this negative trend regarding ring barking, i.e. (-0.14 to -0.22). Although this positive change is not significant, it should be noted that the self-reported incidence of negative behaviour could indicate a stronger underlying trend. I.e. those who have become more aware of the negative implications associated with ring-barking through exposure to the extension programme may be less likely to report the practice.

Overall, the intervention of the 'focused' extension programme has reversed the marked deterioration in sustainable firewood collection behaviour. However, given the short period of expose to this extension initiative a statistically significant, positive behavioural change had not been achieved at the time of the second survey (Figure 10).

6.4 Changes in the expressed intention to collect only dry wood in future

As indicated, there was no statistically significant change noted in the expressed intention to collect only dry wood (Figures 8 to 13). However, those who had been exposed to the 'focused' extension programme expressed a stronger intention (0.62) than those that were not (0.25) (Figure 10 and 11). The similarity of the expressed intention of the first survey sample (0.31) and those not exposed to the extension programme (0.25) suggests that the extension programme has been the main reason for the more positive intention of those exposed (0.62).

When the relationship between expressed intent and actual behaviour is observed, the only group demonstrating a significant correlation between these two variables was the sample from the 'first' survey (Figure 8). In this instance the 'first' sample reported the strongest incidence of sustainable collection behaviour and a weaker intention than the 'second' sample (Figure 9). Amongst those

¹¹Between the first and second survey samples regarding the perceived difficulty of collection, access to land, time taken to collect a head-load and the duration of a head-load, a significant change was only noted with respect to access. 65% of the first survey sample had access as opposed to 90% of the second survey sample. Other firewood collection and use variables also reflected growing difficulty regarding firewood management. I.e. 73% of both first and second survey samples reported it was very difficult to find wood. 27% of the first survey sample were taking more than 6 hours to collect a head-load as opposed to 38% of the second survey sample. 56% of the first survey sample reported that a head-load lasted less than 3 days as opposed to 62% of the second sample.

¹² Correlation coefficients of <0.2 are not assumed to be influential.

exposed to the extension programme the expressed intention is stronger than current behaviour. This suggests that there is a probability within the targeted communities for a continued strengthening of sustainable collection practices if the current barriers to adoption are addressed through a projected extension programme.

6.5 Attitude

One of the most interesting findings is that the overall attitude (the sum of the statement products $\Sigma b_i * e_i$) has tended to decrease toward the collection of 'dry wood' after exposure to the 'focused' extension. In the case of the respondents that have attended 'any' demonstrations, the negative change is significant (Table 5 and Figures 11 and 13). The expressed 'general' attitude measure¹³ also demonstrates a similar and significant negative change. However, it is also noted that the under thirties in the second sample demonstrated a significantly stronger positive 'general' attitude than the over 50s (1.56 and 1.22 respectively), again suggesting a linkage between demonstration attendance and age.

None of the sampled groups registered a significant correlation between overall attitude and intention (Figures 8 to 13). In all these cases the subjective norm appears to greater influence on the decisions regarding firewood collection behaviour.

6.6 The subjective norm

The decision regarding firewood collection behaviour appears to be most influenced by the opinions of the social referents most important to the respondents with regard to both those who have been exposed the 'focused' extension programme and / or demonstrations.

In response to the open question regarding whom is / was their most important social referent regarding firewood collection, those 'not' exposed to extension mentioned: Husband (29%), Landlord (25%), Chief (18%) and Extension agent (7%). However, those exposed to 'focused' extension mentioned the Chief (44%), Husband (17%), Extension agent (11%) and Family (10%). Only 4% of those exposed now mentioned the landlord. With those exposed to extension the influence of the Chief and Extension agent has become more important while the influence of the landlord has reduced. Radio was mentioned by 2% of those exposed to the 'focused' extension programme. It is felt that the mention of radio may have been triggered due to its inclusion in the questionnaire prior to the open question¹⁴.

In the case of those who have been exposed to the 'focused' extension programme, the subjective norm has strengthened, although not significantly (Figures 10 and 11). This strengthening is based on significant changes in the subjective norms regarding the chief, the extension agent and radio that have occurred after exposure to the 'focused' extension programme (Table 6). With regard to the chief and extension agent, the change is based on a significant positive change in both motivation to comply and the belief that these two referents would wish them to gather only dry wood. This positive trend is reflected in the strengthened intent to gather only dry wood of those exposed to the extension programme as opposed to those who were not.

However, it appears that none of six tested referents were influential prior to exposure to the 'focused' extension programme, i.e. none produced a significant correlation between the referent subjective norm and the intention to collect only dry wood. In contrast after exposure to extension three referents demonstrate correlations significant at $p < 0.000$. These were the family (r_s 0.324), radio (r_s 0.276) and friends (r_s 0.274).

The TORA suggests that the referents whose subjective norms correlate most strongly with intention are those that have most influence on the subjects' decision regarding firewood collection behaviour. Therefore, although the recognised social pressure of the chief and extension agent have increased

¹³ The general attitude statement was the response to the question of how good or bad they felt only collecting dry wood was. The strength of the response was measured on a 5 point bi-polar scale. The general attitude statement is normally more positive than the measure taking the sum of the outcome statement products ($\Sigma b_i * e_i$).

¹⁴ Radio was one of the six social referents mentioned in the questionnaire prior to the open question regarding the most important referent.

positively regarding dry wood collection in the case of those exposed to the 'focused' extension, according to the TORA, it appears that family and friends are still the most influential. The radio issue is treated with some caution, as it was found in a follow-up survey of the extension agents¹⁵ involved in the programme that the women had little access to the radio, it being dominated by the men. However, one cannot ignore the fact that the normative reading regarding radio demonstrated the greatest positive change after exposure to the extension programme (Table 6). It is suggested that the radio programme and the use of tapes did have an influence on those extension programme participants who were exposed.

These findings demonstrate the importance of an integrated approach to the extension strategy, which involved the key social referents. In this case the local chief and the role of the extension agent in the process as well as family and friends. As mentioned above, the decision regarding firewood collection strategies appear to be controlled by perceived social pressure (subjective norm) rather than the subjects' own experience (attitude). Therefore it was important to include the most important referents in the extension process and to influence their attitudes toward firewood collection and tree management. The combination of the three different behaviours¹⁶ within the 'focused' extension programme and the involvement of both genders and different social strata helped achieved the integration of both natural resource management strategies and influence positively the different important social referents strengthening the perceived social support of more sustainable collection.

6.7 Changes in the outcome beliefs, values and attitudes regarding firewood collection

The focused extension programme targeted specific outcome attitudes, which were considered to be barriers to the practice of sustainable collection. The barriers related to three key issues, the prevailing concept that there would not be a problem of fuel wood access in future, the self perception of their inability to harvest trees (pruning) and the weakening influence of traditional beliefs that tended to protect trees. A comparison of the attitude changes can be observed in Table 5 between the pre and post extension intervention states.

Those who have been exposed to extension registered a more positive overall attitude ($\Sigma b_i * e_i$) in comparison to the control group who were not exposed, although not significantly different (Table 5). The same more negative trend, also not significant, is also noted in the open attitude statement. When the attitude constructs of those exposed as opposed to those not exposed to the 'focused' extension programme are compared, significant differences are only registered on two of the outcome attitudes ($b * e$) (Table 5). These two outcome attitudes are 'that it is dangerous for women to collect' and that 'landlords will restrict future access'. In both these cases the strength of the attitude has increased significantly. Those exposed to extension tend to believe more strongly that it is dangerous and feel more negative about this issue, i.e. forming an attitude that may act against more sustainable collection practice. They also expressed a significantly stronger belief that landlords will reduce their future access and feel more positive about this possible outcome, i.e. expressing an attitude that supports the future protection of wood resources.

When the attitude constructs of the first and second survey samples are compared, the trend over time appears to have become more positive, i.e. the comparison of overall attitude ($\Sigma b_i * e_i$) of the first sample compared with those not exposed to the focused extension programme (Table 5). Between the first and second samples significant change has occurred in two of the outcome attitudes. A significant increase in the belief that 'trees can be pruned' strengthens the overall attitude toward sustainable collection, as does a significant strengthening of the belief that 'the trees can be pruned regularly'. However, the attitude product regarding 'future access to wood has weakened', i.e. fewer people believe there will be a problem with access than before¹⁷.

¹⁵ A separate survey was conducted of the different extension agents involved in the 'focused' extension programme during November 2001 to determine the content, method and intensity of the programme within the different targeted communities.

¹⁶ Improved stove use, firewood collection and tree planting.

¹⁷ It should be noted that the second sample had significantly greater access to land and wood than the first sample ($p < 0.001$). However, the reduced belief in future access also noted by those exposed as opposed to those not exposed to extension appears to offset this influence.

Between the first and second survey samples several significant changes are also observed regarding outcome beliefs, but which do not result in significant changes in the corresponding outcome attitudes. The beliefs in the taboos and associated outcomes have significantly weakened overtime. For instance regarding the 'loss of fertility' and 'illness if certain woods are used'. The belief in the ability to 'always gather wood in future' has also weakened significantly, which is also reflected in significantly stronger belief that they will 'have to buy wood in future'. However, they now tend to believe the 'leaders will not restrict their future access'¹⁸. In relation to the positive attitude expressed toward tree harvesting (pruning) they now do not believe that 'women destroy trees'. These changes are seen to support sustainable collection. Apart from the issue of regular pruning and illness resulting from the use of some woods, these pro sustainable collection changes in the outcome beliefs are also reflected in those exposed to extension. In other words, there has been a positive change in the targeted pro-sustainable collection beliefs when compared with both those not exposed to the 'focused' extension programme and the 'first' survey sample.

Through an analysis of the ranking of the different outcome attitudes within the respective comparative groups it appears that changes in the attributed importance of the salient outcomes have occurred due to exposure to the 'focused' extension initiative. These are with regard to the perceived danger of collecting wood, punishment and/or impact of disregarding traditions, restriction of access to wood in future and the impact of theft.

When the seven most highly ranked¹⁹ outcome attitudes are compared, the belief that 'God will not permit the destruction of all the trees' is the most strongly held and does not change in its primary ranking across the different comparison groups (Table 5). With those exposed to the extension programme, the outcome that 'no harm will come to the person who is ignorant of the traditions (taboos)' and the 'danger of collecting wood' were ranked second and third. The danger of collecting is not ranked highly with any of the prior state groups²⁰. In contrast, with those not exposed to the extension programme, the issue of 'the future problem with access to wood' was the second most strongly expressed followed by their attitude regarding the outcome of 'stealing on the thief's household' (Table 5). I.e. they believed that there would be a problem of access and that evil would come upon the house of a thief. The issue of theft is not highly ranked by those exposed to extension or demonstrations (<10th). The other notable difference in the ranking between the before and after status relates to the issue of the 'chief and leaders punishing the people for not respecting the traditions regarding wood use.' This issue is highly ranked (4th and 5th) by the first sample and those not exposed to the extension programme, but is not highly ranked (<10th) by the post extension group and second sample. Similarly the issue of 'leaders restricting future access' was ranked 7th by those not exposed to extension but not ranked (<10th) by those who had been exposed.

6.8 Attitudinal Barriers and Drivers of sustainable firewood collection

When the different outcome attitudes are correlated with intent the influence of the respective attitudes can be identified on the subjects' current decision making regarding the adoption of more sustainable wood collection practice. Within this section a comparison is made between those exposed to extension as opposed to those who have not been so as to determine changes in the influence of the different outcomes on the subjects' decision or intention to adopt more sustainable collection practices. These comparisons are presented in Figures 10 and 11. Comparisons are also presented between the first and second survey samples (Figures 8 and 9) and between those who have attended demonstrations or not (Figures 12 and 13).

As can be observed there is a notable difference between the identified barriers and drivers between those who have or have not been exposed to the 'focused' extension programme (Figures 10 and 11). None of the outcome attitudes correlate with the stated intent to collect only dry wood of those not

¹⁸ There is a difference between 'freedom of access' and perceived 'ability to gather wood'. One may have the freedom of access to areas that are now or will shortly be denuded of trees thus not presenting the opportunity to gather wood.

¹⁹ The attitudes were ranked in accordance their strength, i.e. the highest rank (first) = the highest score whether positive or negative.

²⁰ The issue is not ranked within the top seven most strongly expressed attitude statements of the 'first' sample, those not exposed to extension and those who have not attended demonstrations.

exposed to extension. In contrast those who have been exposed demonstrate significant correlations between various outcome attitudes and stated collection intention (Figure 11). When the relationships between the overall attitude measure and individual outcome attitudes are observed a similar pattern appears. Those exposed to the 'focused' extension programme registered significant correlations ($p < 0.05$) between all the outcome attitudes and the overall measure of attitude. However, those not exposed only registered a similar significant relationship between 11 of the 20 possible outcome attitudes. This suggests that those exposed to the extension intervention express a more 'reasoned' attitude toward the firewood collection.

Six outcome attitudes appear to now influence the intentions of those exposed to the 'focused' extension programme to gather only dry wood. (Figure 11). None of the six are the same as those that were influential with the first survey sample (Figure 8). Of the six influential attitudes two represent possible barriers to the collection of dry wood, the belief that 'some woods will cause illness' and that the use of some woods for cooking will lead to the 'loss of the woman's fertility'. The other four influential beliefs appear to support a more sustainable approach to firewood collection. These relate to the beliefs that they 'will not always be able to gather wood', the fact 'some woods can be pruned', that 'there will be a future problem of access to wood' and the belief that women (rather than men only) can still collect wood'.

The only outcome attitude that was commonly influential on the decisions of both the first survey sample and those exposed to the extension programme relates to the possible future problem of access to wood (Figures 8 and 11). The attitude expressed is now more strongly pro conservation matching the increased strength of intent of those covered by the extension programme (Table 5).

The extension programme has led to an increased awareness of future fuel-wood scarcity influencing the participants behavioural decisions. However, concern regarding the possible damaging effects of using certain woods to their health and fertility may limit the use of many of the dry wood types available, thus reducing their ability to depend on dry wood collection alone. The ability to prune or harvest wood from living trees has grown in influence as a result of the extension programme.

6.9 Summary for firewood collection

There has been a general deterioration in sustainable collection behaviour over the past 3 years, however, the 'focused' extension programme does appear to have halted this negative trend and has led to more sustainable behaviour being reported by those who were covered by the programme.

Those exposed to the extension programme also demonstrate a stronger propensity to practice more sustainable collection in future. This is supported by a more positive expressed intention and a stronger correlation between the intention and the subjective norm of those exposed to the extension programme. I.e. those exposed to the extension programme perceive that those social referents most important to them support their adoption of more sustainable collection behaviour.

Although, the overall attitude of those exposed to the extension programme still appears to have little influence on the subjects' intentions regarding future collection behaviour, those exposed demonstrated a more 'reasoned' attitude. I.e. their attitude construct was more integrated, all the individual outcome attitudes correlated significantly with the overall attitude and several of these with the expressed behavioural intention. This was not the case with those not covered by the extension programme.

The previously identified outcome attitudes that were considered barriers to sustainable collection practice and addressed by the 'focused' extension programme have changed within the targeted population. The awareness of the possible future scarcity of fuel-wood as an outcome of poor management, the belief that it is possible to prune trees and women are capable, have become key influences on the decision to adopt more sustainable collection practices. However, the influence of beliefs regarding the negative impact of certain woods on health has grown and now may act as possible barriers to the adoption of more sustainable practice, particularly the collection of the dry wood of these tree species, thus increasing the pressure on the other tree species.

6.10 Conclusion for firewood collection

The 'focused' extension programme has had a positive impact on both current collection behaviour and the participants' future intentions regarding sustainable firewood collection. This is mainly due to a change in the perceived social pressure of their most important social referents to collect only dry wood. Although, the extension programme appears to have successfully influenced the targeted barriers

regarding previously influential expected outcomes and their associated values, the subjective normative element still remains the most important influence on the target groups' decisions regarding firewood collection.

The 'focused' extension intervention has managed to reverse a general deterioration in sustainable collection practice within an increasingly difficult context. The positive change has taken place within a more dangerous and deteriorating fuel-wood collection environment, i.e. the poorer quality of wood collected and its increased cost, reflected in the longer collection time need per unit of firewood and the shorter duration of that unit. This was observed within a context where household size and number of meals cooked have not significantly changed over the period of intervention.

In the case of the rural Dagomba women, the main finding is the importance of targeting / involving the subjects' important social referents and changing the referent's perceived attitudes toward the natural resource in question, in this instance firewood and its source, trees. The Theory of Reasoned Action identifies the salient attitudinal and normative cognitive barriers toward a recommended behaviour and the influences of these two independent variables' on the subjects' decision-making process. The theory therefore provides the ability to 'focus' the attention given to the particular barriers, whether outcome attitudes or specific important referents, in the development or adjustment of extension strategies. The findings suggest that the future extension strategy regarding sustainable firewood collection promotion amongst the rural Dagomba women should place more emphasis on involving the women's peer or friendship groups and that radio messages, if they are continued, should specifically target the under thirties. The women under thirty appear to be more open to the adoption of sustainable collection practice than the thirty to fifty age-group, however, the under-thirties are less likely to attend extension activities. Sensitivity to age needs be more apparent within future extension strategies addressing the natural resource management behaviour of Dagomba women.

There may be a need for the extension programme to be prolonged to consolidate the positive behavioural and cognitive changes already achieved.

Table 6: Comparison of differences between Normative variable mean scores regarding ‘dry firewood collection only’ (Mann-Whitney U Test)

Firewood Collection (Dry Wood Only) Subjective Norms	First and Second Survey Comparison			Involvement in Extension Programme			Attendance of Demonstrations		
	First N = 62 Mean	Second N = 230 Mean	MW Sig.	Without Extension N = 28 Mean	With Extension N = 201 Mean	MW Sig.	Not Attended N = 46 Mean	Attended N = 184 Mean	MW Sig.
Motivation to comply with Chief	1.38	1.34		1.11	1.38	0.026	1.59	1.28	0.014
Motivation to comply with extension agents	0.79	1.07		0.71	1.12	0.006	1.30	1.02	0.016
Motivation to comply with friends	0.65	0.82		0.54	0.86		1.04	0.76	
Motivation to comply with family	0.94	1.22		1.25	1.21		1.43	1.16	0.007
Motivation to comply with Landlords	0.94	1.12		1.21	1.10		1.37	1.05	0.009
Motivation to comply with Radio	0.37	0.67		0.47	0.70		1.04	0.58	0.002
Chief's agreement	1.48	1.46		1.25	1.49	0.041	1.61	1.42	
Extension agents' agreement	1.00	1.23		1.32	1.22		1.33	1.21	
Friends' agreement	0.76	0.78		0.86	0.77		1.00	0.72	
Family's agreement	1.02	1.14		1.36	1.11	0.010	1.41	1.07	0.003
Landlord's agreement	1.06	1.11		1.18	1.10		1.41	1.03	0.001
Radio/media agreement	0.45	0.70		0.64	0.71		1.07	0.61	0.003
Chief's agreement (SN 1)	2.38	2.27		1.64	2.35	0.018	2.74	2.15	
Extension agents' agreement (SN 2)	1.27	1.53	0.029	1.07	1.59	0.041	1.93	1.42	
Friends' agreement (SN 3)	0.82	1.17	0.019	0.82	1.22		1.63	1.05	0.009
Family's agreement (SN 4)	1.19	1.55		1.82	1.51		2.22	1.39	0.001
Landlord's agreement (SN 5)	1.21	1.57		1.50	1.57		2.13	1.42	0.002
Radio/media agreement (SN 6)	1.34	1.18		0.58	1.26	0.003	1.70	1.05	0.002
Firewood subjective norm (sum) $\sum m_j * b_j$	8.25	9.26		7.44	9.51		12.35	8.48	0.001
Range (-24 to +24)									