

# **LIFE CONNECT CARPATHIANS**



**Enhancing landscape connectivity for brown bear and  
wolf through a regional network of NATURA 2000 sites in  
Romania**

## **Action A5**

**A report on the level of conflict and the  
effectiveness of existing damage prevention  
methods**

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**EU LIFE+ project, Maintaining and Enhancing Connectivity for Bear  
and Wolf through a Network of NATURA 2000 Sites in Romania**



**Gareth Goldthorpe: October, 2015**



# Introduction

## *Background*

The EU LIFE+ NATURE project, Maintaining and enhancing connectivity for bear and wolf through a network of NATURA 2000 sites in Romania, addresses threats to connectivity within a landscape corridor that is critically important for the conservation of priority species, the European bear and wolf. Passing through a network of twenty Natura 2000 sites, the Zarand landscape corridor is increasingly fragmented and there remains only one key route through which bears, wolves and other wildlife can move between the Western and Southern Carpathians.

The Romanian Carpathian Mountains are an important biodiversity reservoir providing habitat for bears, wolves and Eurasian lynx and supports their dispersal across Central and Western Europe. However, the region is undergoing rapid economic transition; land-use change towards more intensive agricultural and forestry practices and infrastructure developments are fragmenting the landscape, reducing ecosystem connectivity and biodiversity values. There is only one narrow habitat corridor suitable for ensuring connectivity; the Zarand Landscape Corridor and efforts need to focus on: ensuring the functionality of the corridor and effectiveness of the Natura 2000 network; habitats critical to the maintenance of connectivity needs to be secured; human-wildlife conflicts and negative attitudes towards large carnivores and Natura 2000 sites need to be addressed, and; the planning and management of forestry, hunting and other land / resource uses need to be guided to be sympathetic to the conservation management of priority species. Ensuring this process is the main goal of the project and is being addressed in several key ways, including the securing and restoration of critical habitat and landscape features, addressing direct threats such as human-wildlife conflict and poaching, the development of species action plans and building the awareness and advocacy of the local population and other stakeholders for the conservation of the bear and wolf and Natura 2000 sites in the corridor.

The work undertaken in this report focus on one specific area, human-wildlife conflict and contributes directly to the key project action: Developing and implementing practical strategies to reduce human-wildlife-conflict and to ensure a rapid and effective response should conflicts occur, thus building tolerance for the presence of carnivores. Specifically, this report addresses the projects need to “assess the level of human-wildlife conflict in the project area.

The work detailed here-in has been based on similar approaches taken, by FFI, in the South Caucasus countries of Georgia and Armenia.

## *Objectives*

The key objectives of the study were to:

- gain an overall understanding of human-carnivore conflict (HCC) in the project area
- gather baseline data from which project/mitigation impact can be measured
- begin forming positive relations with farmers

This was achieved through the implementation of a semi-structured interview survey of relevant interest groups in the area, including: Livestock owners/managers, shepherds/herders, crop farmers, bee-keepers and orchard owners. As significant overlap between these groups was predicted, a single data sheet incorporating all forms of agriculture was prepared (see appendices).

Through this survey, we sought to answer the following questions:

- What is the nature of the livestock farming industry in the project area? (Type of livestock/crop; size of flock/herd/cultivated land; number of shepherds/herders/farmhands, etc.)

- What is the extent and intensity of the conflict with wild animals? (Proportion of households affected by HWC; how many sheep/cattle/crops are lost each year to predators; are any of the sites within the project area more intensely affected by HWC; are losses stable or have they been increasing or decreasing)
- What is the actual impact of the conflict and is it bearable? (social and economic costs of HWC to the affected households)
- What livestock management/animal husbandry techniques are currently used by the shepherds to mitigate conflict? (How do shepherds currently protect their flocks from predators, disease and other threats; are these approaches useful)

## Methodology

### *Study Sites*

Through discussions with the project team, three survey areas were identified as follows (with rationales):

Site 1: Rusca Montană-Țarcu-Retezat Corridor, a Core area with; an Important corridor between north and south populations, high densities of large carnivores, intact local knowledge, seasonal movement of livestock with conflict likely to be high in summer pastures, beehives at higher altitudes and orchards in the lowlands.

Site 2: Drocea-Codru Moma Corridor, where; an important and clearly defined corridor connects a re-colonisation area, there are high densities of livestock, abandoned orchards and some crops and beehives

Site 3: Apuseni-Bihor where; relatively high densities of large carnivores are present and local knowledge is still intact; there is seasonal movement of livestock with conflict likely to occur in both winter and summer pastures; bee hives & orchards also present.

### *Sampling protocol*

Exploratory visits were made to each area where commune leaders (mayors) and/or local agricultural associations were asked to provide details of individuals with agricultural interests (pastures, crops, orchards or beehives) within, or no more than 3km from the relevant Natura site. As a minimum, details included contacts names and addresses and telephone numbers where available. The subsequent contact lists were used for each of the three sites to randomly select individuals for inclusion in the survey. This was supplemented with snow-ball sampling.

### *Survey protocol and guidelines for interviews*

#### The datasheets

The survey was administered during visits to folds/farms, by a team of surveyors consisting of one interviewer and one assistant. The role of the assistant was to record data onto the relevant datasheets (see appendices). In the case of livestock, data for each fold/farm were entered on separate datasheets, assuming each fold had one flock or herd. Where two or more **independent** flocks operated from the same fold, separate datasheets were used for each flock.

The bulk of the interview (covering details of the fold/farm, pastures/fields, livestock numbers/crop details, products, losses to wild animals, details of attacks and preventive measures) was recorded onto an “HCC baseline” datasheet (Appendix 1). At the end of the interview, the interviewee was asked to give details of the most recent conflict event and this was recorded on the separate “attack” datasheets (Appendix 2). Once recorded, the interviewee was then asked to give the details of the conflict event before that and so on, until the interviewee cannot recall anymore; a different

“attack” sheet was used for each attack event. Each interview was given a unique identifier, marked on the relevant datasheets, and consisting of a unique number and the date of the interview.

Best practices, to reduce observer bias, were followed; in particular, the interviewers avoided sharing his/her own experiences and views or voicing their opinions.

### Definitions of terms

Terms were used consistently to avoid potential confusion and misinterpretation. The following glossary of key terms was used to ensure clarity and consistency of usage.

- **Crop farmer:** A person growing crops – but not livestock.
- **Fold:** Buildings (pens, barn, house) used by shepherds/herders/owners to contain their flocks/herds at or near the summer pastures.
- **Farmer:** A person who owns or manages, either wholly or in part, a farm.
- **Farmhand:** A worker in a livestock farm.
- **Flock:** A number of sheep/goats kept and grazed together.
- **Herd:** A number of cattle/horses kept and grazed together.
- **Herder:** A worker who tends cattle/horses on a daily basis but is not the owner of a significant proportion (>10%) of the herd.
- **Livestock:** For the purposes of this survey, livestock is considered to include sheep, goats, cattle, horses and pigs.
- **Livestock owner:** The owner of at least 20 head of livestock, who may or may not attend it daily.
- **Shepherd:** A worker who tends sheep/goats on a daily basis but is not the owner of a significant proportion (>10%) of the flock.
- **Shepherd/sheep dog:** A large breed of dog used to guard livestock, living close to the flock.

### **Data analysis**

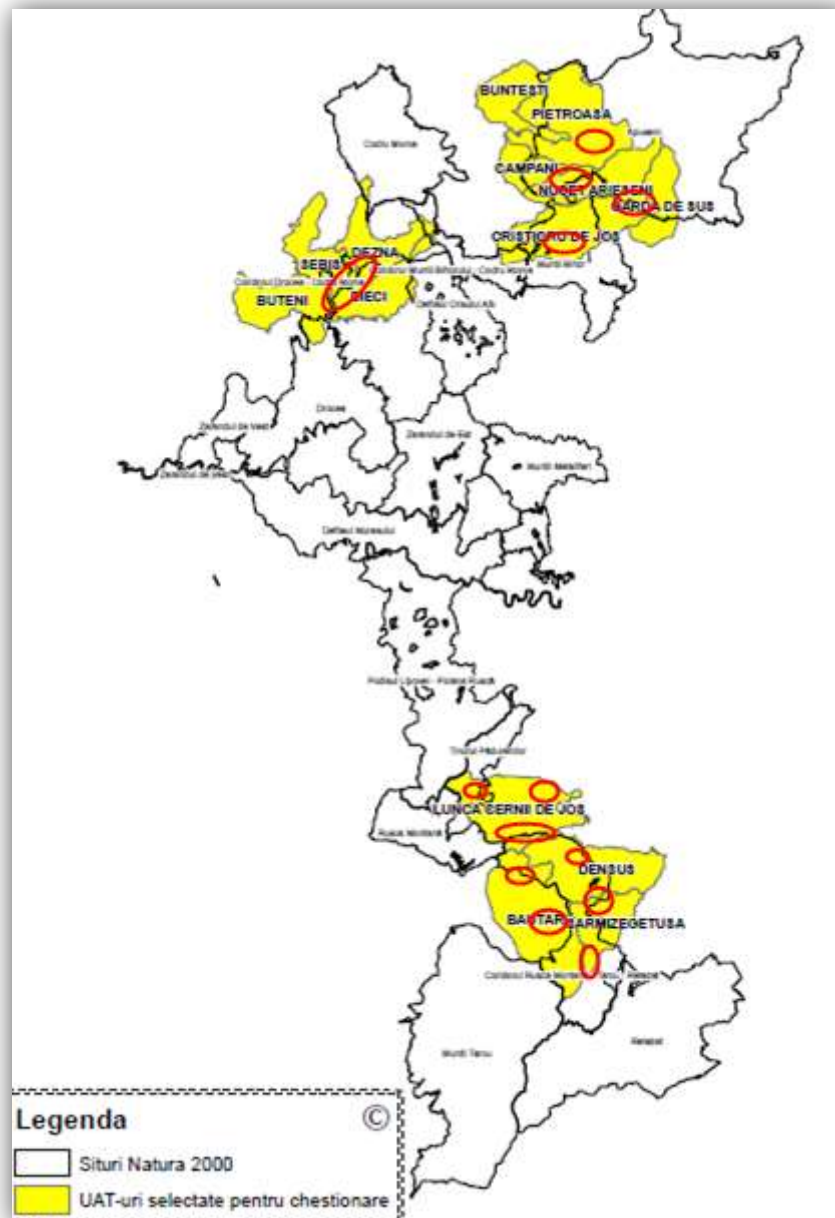
Much of the data relies on descriptive and summary stats to map the nature of farming and livestock/crop protection approaches.

To identify factors associated with higher levels of predation, reported losses (expressed as absolute numbers and percentage of fold stock) were tested (linear regression etc.) against 13 potential predictor variables (taken either from the survey or from GIS): fold location by survey zone; distance to tree cover; distance to nearest ravine; extent of shrub cover in pastures; if fold is owner-occupied or leased; number of years using the fold; number of herders; number of livestock; number of dogs; type of dog; owners' ratings of dogs; rating of loss of income due to predation; rating of problems with disease.

## Results & Discussion

### *Demographics*

The survey took place in three main study areas comprising a total of 44 villages in 20 communes. There were a total of 85 respondents from the three sites surveyed, distributed as follows: 30 from Coridorul Rusca Montană-Țarcu-Retezat (Site 1), 13 from Coridorul Drocea-Codru Moma (Site 2) and 42 from Apuseni Bihor (Site 3) (Map ).



Map 1: Distribution of Study Sites across Project Area.

The 30 respondents from Site 1 were distributed amongst 17 villages from four communes; the 13 respondents from Site 2 came from six villages in four communes, and the 42 from Site 3 were from 19 villages in 10 communes.

The majority (94%) of respondents were male and the average age was 49 (Range = 23-78): none were less than 20, 30% were aged between 20 and 39, 47% were between 40 & 59 and 23% were older than 60.

Agriculture was the primary source of income for the majority (95%) of respondents, whilst Pension and Salary were popular Secondary sources (23% & 18% respectively).

### ***Dominant forms of agriculture, farm descriptions and land details***

#### **Forms of agriculture**

Across all three sites, the tendency is for people to utilise multiple forms of agriculture. The vast majority (98%) own livestock whilst most (87%) also grow crops and/or have orchards (56%).

Of the livestock owners, 71 (84%) consider it to be the primary form of agriculture; other primary forms are livestock manager (10%) and crop farmer (7%) (Figure 1). Of the 21 livestock managers, the average number of herds they manage is five (Range = 1-15).

Crop farming is the main secondary form of agriculture for 48 people (56%), followed by livestock farming (14%) and fruit orchards (11%) (Figure 1). This pattern holds true within each study site.

NB: Only one person from the entire sample kept bees and so this form of agriculture has been excluded from any further investigation.

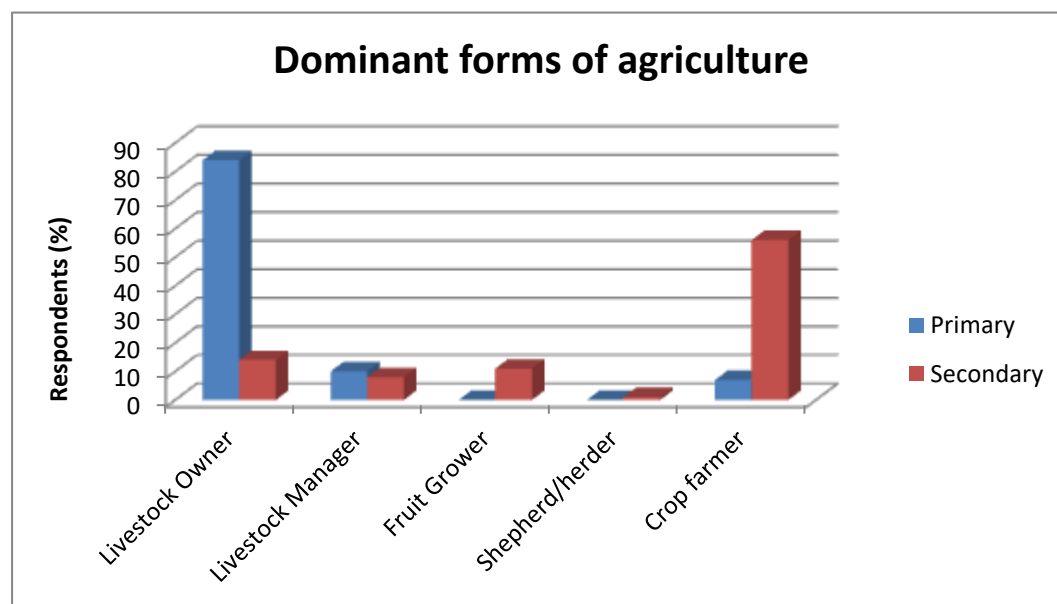


Figure 1. Forms of agriculture practised within the project area

#### **Farm descriptions**

Of those that described their winter farm (N=78), all have a permanent house (most likely their main family home). Most (88%) also have a stable (generally used for housing large stock, such as cattle) and a large barn (83%; this is used for general storage of farm equipment and animal fodder), whilst only 17% also have a smaller barn.

In contrast, of those that described their summer farm, or sheep fold (n=67), only 13% include a permanent structure for living in. Most have a fold (87%) and corral (78%) or a fenced yard (51%), whilst only some have a shelter for young animals (18%) and/or a barn or shed (22%).

Across all three sites, 70 respondents (82%) commented on the number of people working at their farm/fold. An average livestock farm has two livestock owners (Range = 1–9); an average sheep farm

has two shepherds (Range = 1–4) whilst an average cattle farm has one herder (Range = 1–2). Farms with crops had an average of two farm hands (Range = 1–2).

The average number of years spent at the same farm/fold was 25 (Range = 1–80): some farms had been passed through generations.

The majority of respondents (90%) take their livestock to their home-village for the winter. In both Sites 1 & 3, this represents all the livestock owners whilst, in Site 2, more than half (54%) stay at the summer pastures for the winter (though this is questionable as three of these also give arrival and departure dates for the summer pastures). Of those that only spend summer at the site where they were interviewed (n=75), most (56%) arrived in May and will leave in either September (26%), October (29%) or November (20%).

### Land size, tenure and state

For livestock, pastures are, on average, around 55ha (Range = .3–400ha) whilst the average area of land used for crops is three hectares (Range = 0.1ha–22ha) and the average number of fruit trees is 132 (Range = 10–600). With land tenure, the division between those that fully own their land and those that fully lease it is around equal (37% and 35%, respectively) whilst 28% use a mix of self-owned and leased land.

Across all sites, of those that commented on the state of their pastures (n=81), most consider them to be either completely free of woody plants (7%) or only slightly overgrown (44%). No-one reported pastures to be more than 50% overgrown. With regard to the distance of pastures from water, 71 respondents were able to estimate this, describing an average distance of 465 metres (Range = 10m–10km). Even with the presence of an obvious outlier (after the records for 10,000m, the next highest figure was 2,500m), this clearly shows that all farms have good access to water. In the drier environment of Vashlovani in Georgia, where similar surveys have been carried out, we found access to water to be a major issue for sheep farmers.

## ***Livestock & crops***

### Livestock

Sheep were the most abundant livestock kept across all sites; 65 farms (77%) kept 18,153 with an average of 279 per farm (Range = 18–1,000) (Table 1). In addition, 26 people (31%) own goats for a total of 1,242 and an average of 48 (Range = 1–260). In Site 1, the average number of goats is higher (78) as the range is wide (1–260); compared to Sites 2 & 3 where the average is 22 (Range = 7–50 & 2–80, respectively). Most of those that own goats also own sheep (76%) and, as the trend seems to be for owners of large sheep flocks to own a relatively few goats, these have been combined for future analysis.

**Table 1.** Numbers of livestock across all sites

	n farms	Per Farm		Total
		Mean	Range	
<b>Sheep</b>	65	279	18–1,000	18,153
<b>Goats</b>	26	48	1–260	1,242
<b>Cattle</b>	57	10	1–100	593
<b>Horses</b>	28	3	1–30	76
<b>Donkeys</b>	8	2	1–3	12
<b>Pigs</b>	46	8	2–40	345

Across all sites, 57 respondents (68%) owned cattle; a total of 593 cows and an average of 10 per farm (Range = 1–100) whilst 46 farms (55%) held pigs; a total of 345 and an average of eight per



farm (Range = 2–40). Horses (33%) and donkeys 10%) were the least common animal with total numbers at 76 & 12, respectively (Table 1). When looking at the three sites independently, there were no clear deviations from these norms.

Only 18 respondents (22%) with livestock had only one species and these were either sheep (50%) or cattle (50%) (NB: the first category includes one farmer with only goats). In these cases, the average numbers were 422 (Range = 50-900) and 18 (Range = 3-70), respectively.

If we exclude horses and donkeys, which are more likely to be kept as beasts-of-burden than as livestock (the one exception being a sheep farmer from Site 1, Vasiloni Romulus, who kept 30 horses; he may either be a horse breeder or taking care of other farmers' horses), only 24 respondents (29%) had two species with the most common combination being either sheep & cattle (37%) or sheep & pigs (33%). The most common number of livestock species was three with 26 respondents (33%) having mostly a mixture of sheep, cattle & pigs (20 respondents; 77%).

### Crops

Of those with crops (n=80), nearly all (97%) grow hay, 73 (92%) potatoes and 51 (65%) grow corn. Other crops are cereals (47%) and alfalfa (30%) (Table 2).

**Table 2.** Hectares of crops at farms across all sites

	n farms	Per Farm (hectares)		Total
		Mean	Range	
<b>Corn</b>	51	2	0.01-16	93
<b>Potatoes</b>	73	0.33	0.01-2	24
<b>Hay</b>	77	6	0.1-41	443
<b>Alfalfa</b>	24	2	0.2-5	37
<b>Cereal</b>	37	1	0.02-6	36

No farms had only one crop species whilst 14 (17.5%) had two; the most common combination being potatoes with hay (86%). Most crop farmers (42%) had three crop types with the most common combinations being corn, potatoes and hay (50%) and potatoes, alfalfa and hay (35%). Nineteen respondents (24% of crop growers) had four crops, the most common combination (58%) having corn, potatoes, hay and cereals.

### Fruit trees

Of those with fruit trees (n=43), nearly all (95%) had plum trees and/or apples (86%) whilst 59% had walnuts. Only four farms (9%) had only one type of fruit tree; all plums. Of the rest, most (35%) had two tree types and most of these (87%) had plum and apples. Of those that had three tree types (27%) all were a combination of plum, apple and walnuts.

**Table 3.** Number of fruit trees across all survey sites

	n farms	Per Farm (trees)		Total
		Mean	Range	
<b>Plum</b>	42	103	5-565	4,346
<b>Apples</b>	38	29	3-150	1,104
<b>Walnuts</b>	26	14	Mar-40	375
<b>Cherry</b>	16	17	6-60	116
<b>Other</b>	7	18	5-40	125

## Products

Of the farms that reported on the types and quantities of produce from sheep and goats (combined) (n=70), 93% produced cheese at an annual average of 870kg (Range = 15–5,000kg); 91% produced meat, average was 2,741kg (Range = 20–40,000) and 84% produced wool, with an average of 410kg of fleece (Range = 2–2,000). Production of milk was very low and, when looking at the three sites individually, only Site 1 produced any sheep/goat milk at all. The distribution of all other sheep products was similar between all three sites, though Site 1 had higher percentages of livestock owners reporting on all (Figure 2).

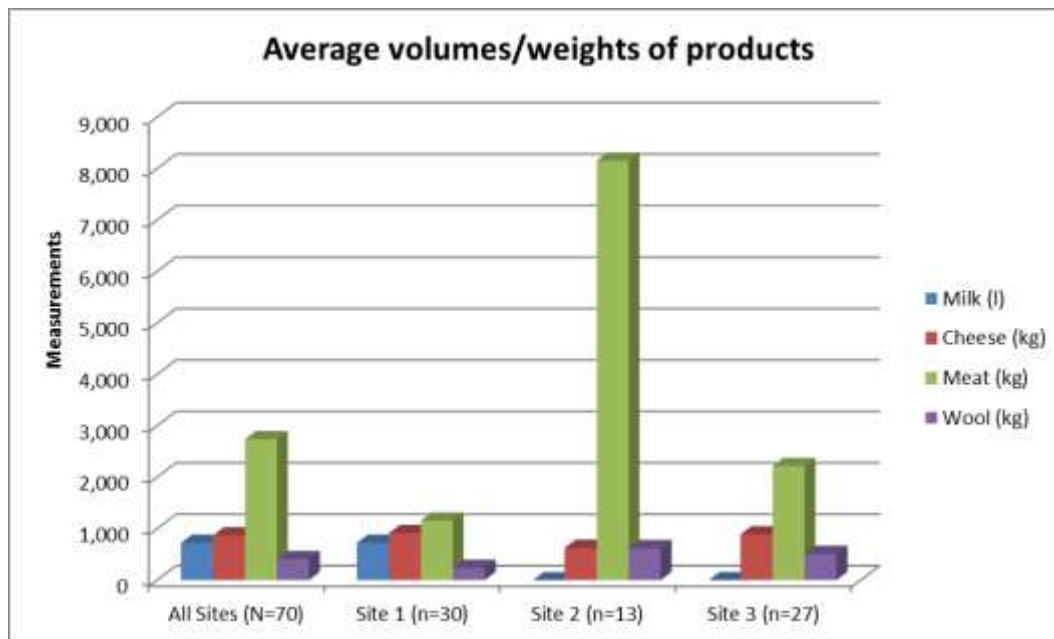


Figure 2. Annual averages of sheep products from all three sites

The main products being produced by cattle farmers (n=37) were milk (62%), cheese (49%) and meat (84%). The average annual quantities were 2,303 litres, 239 kg and 473 kg, respectively (Figure 3). Site 1 was the biggest producer of milk with 83% of cattle farms producing an average of 2,303 litres per year (compared to 50% and 41% producing 200lt and 1,014lt per year for sites 2 & 3 respectively). However, the records for cheese are less clear; whilst Site 1 produces an average of 126kg, Site 3 cattle farmers are the biggest producers of cow cheese with 71% of farmers producing 148kg in a year. No cheese is produced in Site 2. Across all sites, the production of the three main fruits is fairly well distributed with 76%, 79% & 69% producing plums, apples and walnuts, respectively.

Amongst those with crops, 63 gave details on the amount of produce they harvest in a year. Across all sites, the main crops produced were potatoes (92% of farmers) and hay (86%). Producers of Alfalfa and wheat were relatively low across the board (27% & 19% respectively). In terms of production, hay was produced in the largest quantities with an annual average of 24,417kg (range = 400–80,000kg). Despite being the most populous produce, actual weights of potatoes were quite low with an annual average of only 2,499kg across all sites. This may reflect the nature of the crop however, as potatoes are mostly grown for subsistence and, therefore, represent a small plot (as demonstrated by the relatively small plots dedicated to potatoes; Figure 3), whilst hay is fed to livestock and maybe sold to other farms.

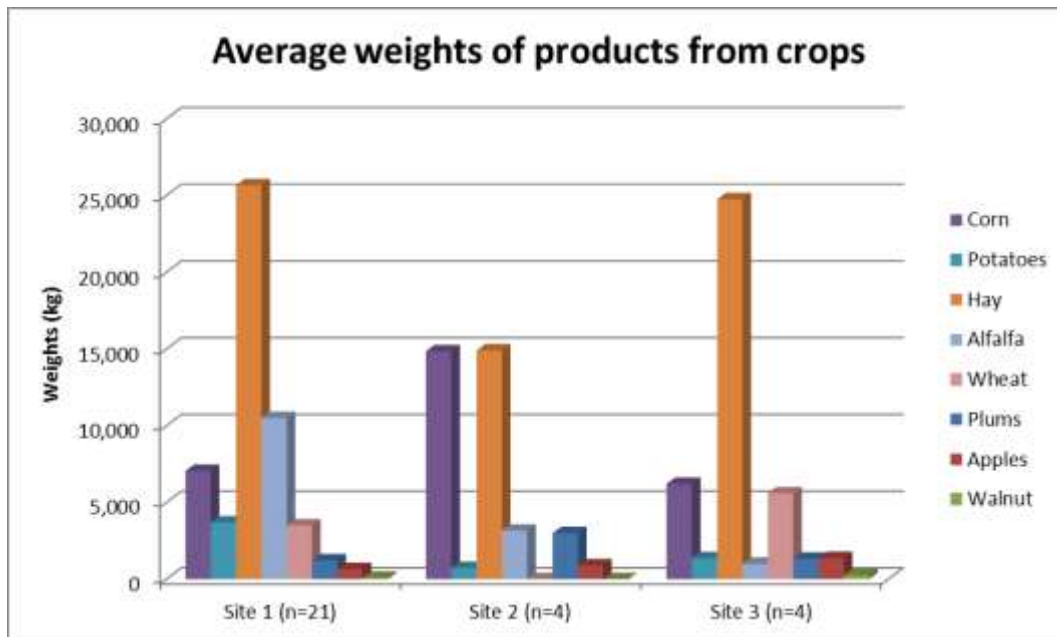


Figure 3. Annual averages for key crop yields in each site

### Access to Markets

Eighty respondents gave details on how they sell their products (Figure 4). Across all sites, almost half (48%) sell their products from home (presumably, to members of their community) whilst 30% take their products to a local market. These trends are similar in sites 1 & 3 but, within the villages of Site 2, the tendency is to sell in the market (50%) with only 7% selling from home. Overall, 16% of respondents do not sell any of their produce.

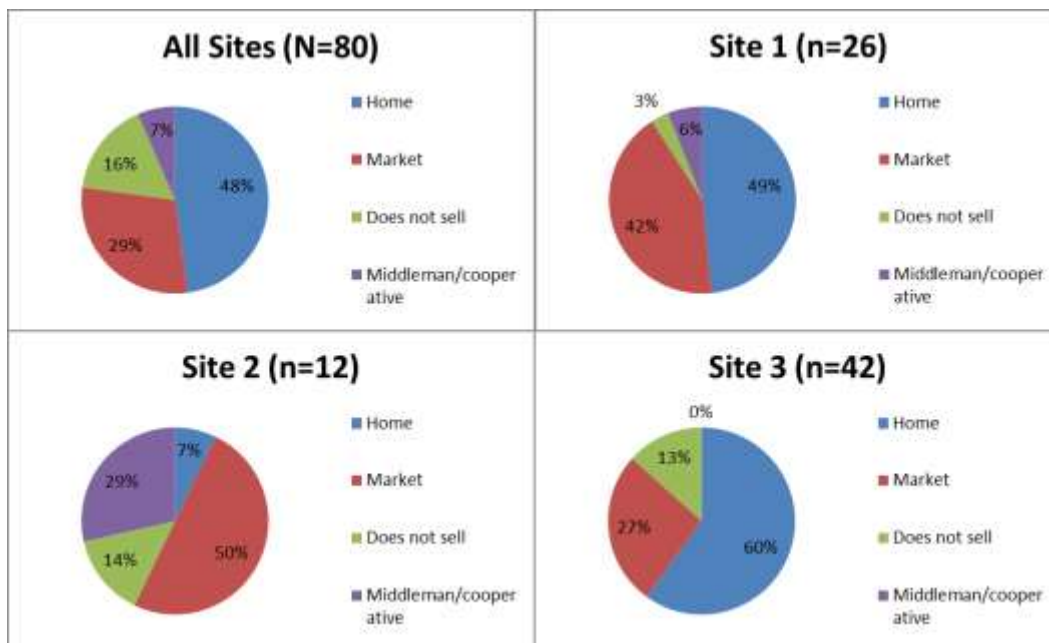


Figure 4. Different methods of selling farm produce across all sites and at each individual site

When asked what difficulties they face when trying to sell their produce, 62 people responded. A majority of these (37%) identified Low Prices as a major issue, followed by a Lack of Demand (31%). This pattern was repeated within each site (Figure 5) with the exception of Site 3, which identified a Long Distance to Market as the second biggest issue (33%) after Low Prices (37%).

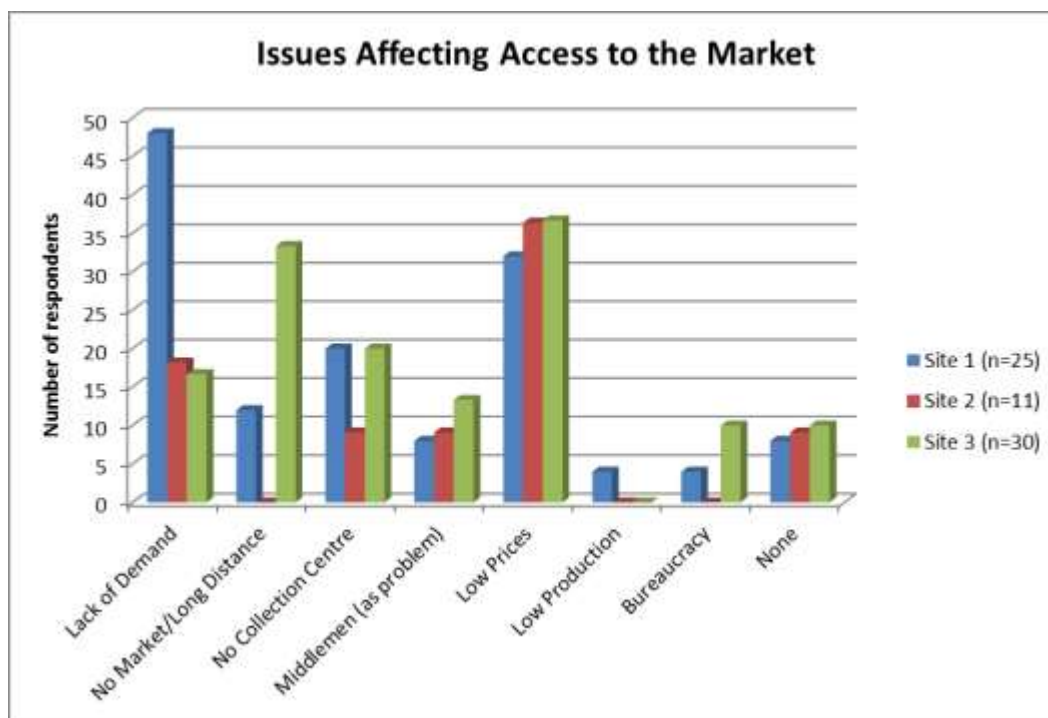


Figure 5. Various problems faced when trying to sell produce within each site

### Losses to Wild Animals

When asked to rank the importance of a selection of problems commonly faced by agriculturists in Romania, the majority of respondents (58%) across all sites (n=84) ranked Wild Animals as the primary concern, followed by Disease (21%) and Weather (15%). Wild Animals also featured as the second most important problem (20%), though the gap between it and Disease was narrower with 18% choosing it as the second biggest problem (Table 4).

**Table 4.** Respondents identify which sources of loss are most important

Cause of Loss	Sum of respondents scores ranking sources of loss from most (1) to least problematic			Not mentioned/Not a problem
	1	2	3	
Pests/Disease	18	15	1	50
Wild Animals	49	17	2	16
Theft	1	1	1	79
Weather	15	8	3	57
Access to Water	3	0	0	78

Looking at each site individually, Wild Animals were seen as the primary problem by most; in Site 2, however, the perception was almost unanimous (92%; n=13). In all three, the difference between the number of people seeing Wild Animals as primary and those seeing Disease as primary was around double.

When asked where the problem was worst, in the summer, winter or when moving between pastures, 71% across all sites (n=68) identified the summer pastures whilst only 4% named the migration route as most problematic. Comparing results between the three sites, however, 33% of respondents from Site 2 (n=12) named the winter site as the most problematic 50% stating no difference between winter and summer.

Respondents were asked to identify which wild animal they saw as being the most problematic them (Figure 6). Across all sites (n=69) both the wild boar and the wolf were seen as equally problematic

(48% & 49% respectively). Bears were seen as the primary problem animal by only two respondents but as the second most problematic by 13 people (19%). The jackal, deer and dog were not seen as important problems by anyone. When comparing between the sites, the wolf is given the mantle of most problematic animal by the majority of respondents in Sites 1 & 2 but is second to the wild boar in Site 3 (69% & 24%, respectively).

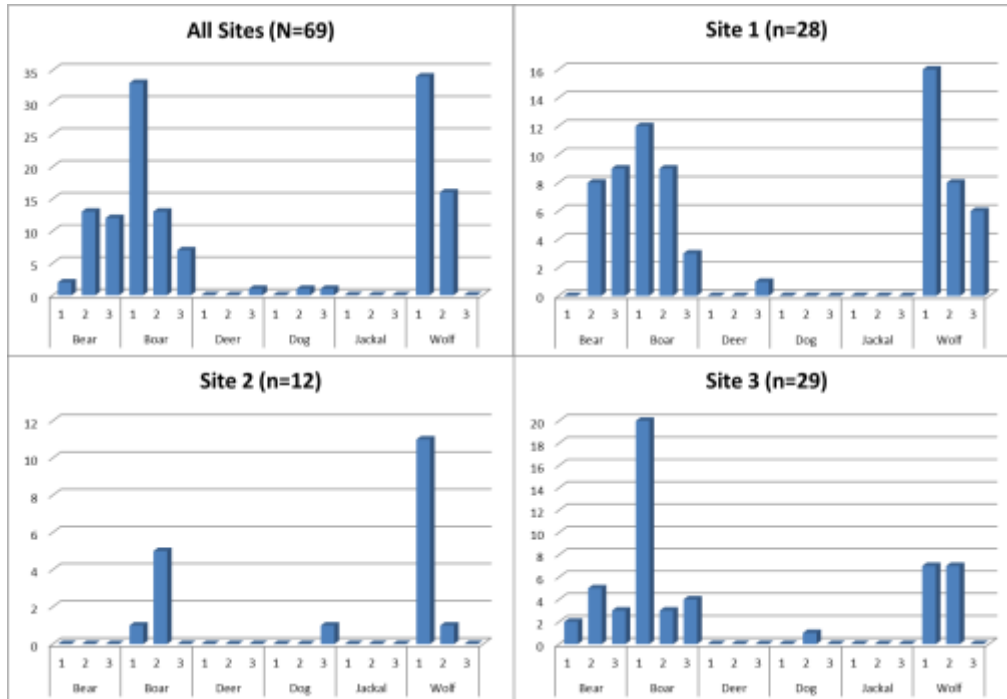


Figure 6. Respondents perceptions on which animals present the biggest problem to their livestock and/or crops

Unfortunately, as nearly all those interviewed engage in multiple forms of agriculture, there is no way, from the data, to determine which species is most problematic for each particular type of agriculture. However, it is probably safe to assume that wolves are the main predator of sheep whilst boars and, possibly, bears will be important threats to crops and orchards.

When asked, in which month(s) problems with animals were worst, the answers of most respondents fall within the summer months (May through to September). If we use the reports of peoples arrival and departure from the summer pastures (see Farm Description, above) as a proxy for the number of active farms we can compare these two results. As is shown in Figure 7, there is an association between these two variables with the general form of the curve closely aligned with the busiest months. This finding needs to be treated with some caution, however, as the accounts of HWC here include attacks on crops by boars which may occur in the lowland villages. Indeed, this probably accounts for the second rise in attacks around January. According to respondents, the majority of losses occur in September. Looking at individual sites the pattern is much the same, although in Site 2 the peak is delayed until January.

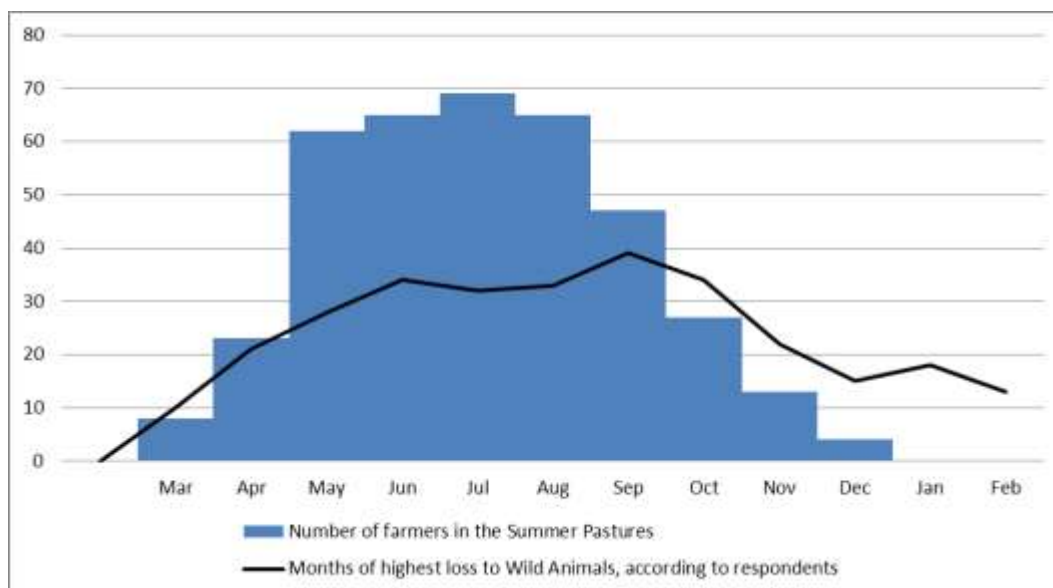


Figure 7. Estimated numbers of active farms in the summer pastures compared to respondents reports of high HWC events

When asked to comment on any trends in the occurrence of attacks on stock and/or crops by wild animals over the past five years, the majority of respondents (64%) across all sites claimed that problems with wild animals had been getting more common. This outcome stands when looking at each site individually.

### Details of Attacks

Respondents were asked to comment on specific HWC events that had occurred in the previous year (2014). Again, across all sites (n=69), more respondents had, in that year, experienced problems with wild animals at the summer pastures (68%) than at the winter sites (38%); of these, 13% reported problems in both sites. This trend was similar in sites 1 & 2 whilst at site 3 (n=29), there was an equal division between the winter and summer pastures with 52% of respondents saying they experienced problems with wild animals in either the summer or winter pastures (this included three people who reported problems at both sites, hence the total of 104%).

When asked how many attacks by wild animals they experienced in 2014, 60 people responded, for a total of 924 attacks (Table 5). This averaged out at around 15 attacks per farm (Range = 1-100). When looking at the average number of attacks received within each site, the numbers for Sites 1 & 3 are similar (13 and 15 attacks per farm, respectively). However, Site 2 seems to have received disproportionately more attacks, with an average of 24 attacks per farm. This is most likely down to one particular farm which reported 100 attacks in 2014 (the maximum number of attacks in Sites 1 & 3 were 60 and 35 respectively).

**Table 5.** Number of attacks by wild animals in 2014 for all sites and each site

	n farms	Per Farm		Total
		Mean	Range	
<b>All Sites</b>	<b>60</b>	<b>15</b>	<b>1-100</b>	<b>924</b>
<b>Site 1</b>	25	13	1-60	1104
<b>Site 2</b>	11	24	2-100	116
<b>Site 3</b>	24	15	1-35	125

Of the 62 that reported details of HWC events in 2014, seven (11%) of them reported only on attacks on livestock, 28 (45%) on attacks only on crops (including fruit and nuts) and 27 (44%) on both. We will take a closer look at the groups below.

### Attacks on livestock

Amongst livestock, the most common stock to be attacked was sheep; 34 respondents reported attacks on sheep in 2014 compared with no reported attacks on cattle and only six reports of attacks on dogs. Of those that reported attacks on their sheep, a total of 349 sheep, across all sites, were attacked (mean = 10). Of these, most (86%) were killed. This pattern is seen within all sites.

When looking at the rates of attacks, on sheep, between summer and winter pastures (Figure 8), we can see, again, that most (72%) were killed in the summer pastures further reinforcing the finding that HWC, in the form of depredation on livestock, is most serious in the summer pastures. As this type of conflict primarily involves wolves (as illustrated in the previous section) this finding follows ecological norms whereby wolves tend to avoid built-up areas (in this case, the villages where winter pastures tend to be located). The pattern is repeated at the level of the individual sites with the exception of Site 2, where the difference between summer and winter losses is less pronounced (57% killed in the summer pastures). However, this may be explained by the observation that more than half (54%) of farmers from Site 2 remain at their summer pastures throughout the year. It should also be noted, however, that the overall sample size for Site 2 (n=13) was also comparatively low with in the study.

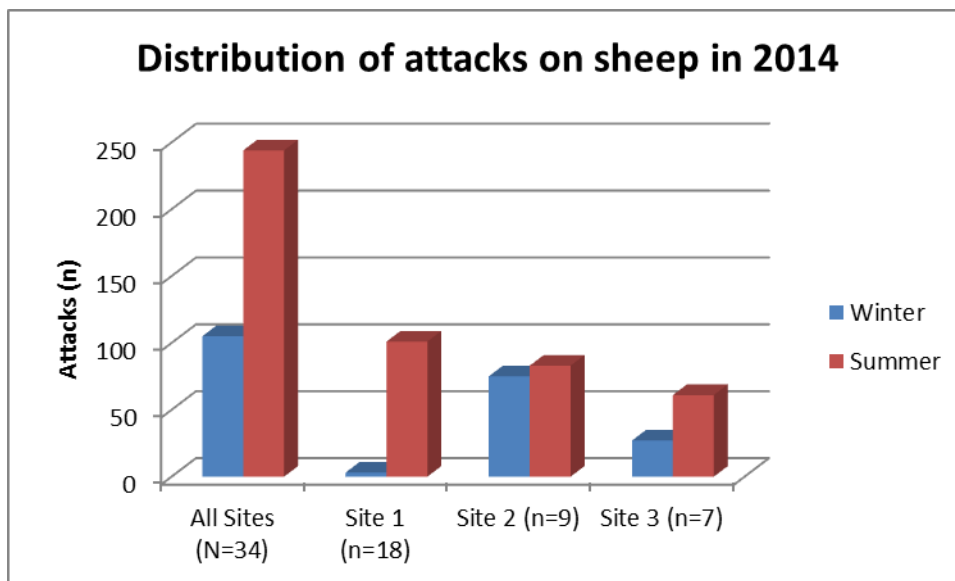


Figure 8. Distribution of attacks on sheep, resulting in the death or injury of livestock, in 2014

Interestingly, when we look at the attacks on dogs, whilst overall numbers are low (just six reports of dogs being attacked across all sites) we see that, of the 13 dogs attacked, most resulted in injured, rather than killed dogs (seven and six, respectively). Looking at each site individually, the pattern is repeated except in Site 2, where all dogs (n=4) were killed.

The number of sheep killed at farms seem fairly low; of the 60 farms that gave details of sheep killed in 2014, 33% reported five or less animals killed that year (Figure 9). With an average of 279 sheep at each farm, this equates to a loss of around 1.8% of livestock lost each year.



Figure 9. Total numbers of sheep killed (grouped) in 2014 as reported at 60 farms

Returning to the small group of respondents who only suffered from attacks on their livestock; all also grew crops and most (57%) thought the winter & summer sites were equally problematic. All named wild animals as their primary problem, and six named the wolf as the most important of these (the seventh named the bear). In 2014, they suffered from a total (reported) of 194 attacks (mean = 28) and lost a total of 106 sheep (71 from the summer pastures), or an average of 12 sheep per farm. Collectively, the seven sheep farmers had (in 2015) 2,590 sheep (mean = 370) so that their 2014 losses amounts to 3.2% of the average stock. Four of the seven farmers considered this to be a “Big” economic loss.

Six of these farmers had dogs and slept with the flock at night as a means of protection. Four of these also avoided risky areas when grazing and used standard fencing. Half of the sheep farmers thought their protection methods were good whilst the other half felt they were only partly so. All the dog owners raised their pups with the flock and all but one thought they were good dogs (the errant dog apparently scared the goats).

#### Attacks on crops (including orchards)

When reporting about damage to crops, 62% of all respondents claimed to have suffered attacks by wild animals. Amongst these, the most frequently damaged crops were hay meadows (77%) followed by corn (55%) and potatoes (43%).

Looking at the severity of attacks (i.e. the level of damage done, as measured by an estimate of the number of hectares damaged), whilst hay and corn still represent the first and second most damaged, the third place is now taken by cereals (there were no reports of Alfalfa crops being damaged by wild animals in 2014). This may be a reflection on the nature of the crop; whilst corn, hay and cereal crops tend to cover around two hectares of land, potatoes are a very specific subsistence crop and, therefore, cover smaller areas (typically only 0.33ha). Using hectares lost as a measure of severity, then, would tend to underestimate the tendency of such small-scale crops. It maybe that for future assessments, an alternative measure for HWC severity in crops should be devised; estimating loss in terms of financial revenue lost is often favoured but, as much of the production here seems to be for subsistence, this also may not be appropriate.

Overall, there were relatively few reports of fruit trees being damaged by wild animals in 2014 with only 11 respondents giving such details (13% of all respondents), all of which originated from Site 1. Of those that did report damage, all gave details of damage to plum trees while 63% also reported damage to apple trees. Only one respondent also reported damage to his walnut trees.



Unfortunately, it is not possible, from the data, to discern whether fruit trees were more likely to be attacked by bears rather than boars.

In terms of severity, plum trees appeared to have fared worse, with an average of 20 trees per household damaged; this compares to averages seven apple trees and three walnut trees damaged.

Of the 28 that only had crops damaged in 2014; nearly all (27) grew hay, 26 grew potatoes, 19 cereal and 12 had both plum and apple trees. However, 22 (79%) also had livestock (including 19 with sheep and 24 with cattle). When identifying the main challenges, 20 (71%) named wild animals with the remaining eight split equally between disease and weather. Interestingly, nearly all (23) named the summer pastures as the most problematic. Most, 24, named the wild boar as the main problem animal (although four saw the wolf as the biggest threat). Hay was the most frequently damaged crop with an average of 2ha destroyed at each farm. Whilst 10 (36%) saw this as a big impact economically, nine said the impact was only medium (four said it was small and two, insignificant).

The primary source of crop protection was fencing, and this was used by 21 (75%) respondents (21 also have dogs but it is assumed that these are kept with the livestock). Fifteen (54%) felt that the methods are effective (eight thought only partly so). Of the 21 that have dogs, 17 think they are good dogs; all are raised with the flocks.

Finally, a closer look at the 27 that suffered attacks on both animals and crops in 2014, reveals that all had sheep and/or goats, whilst 18 also had cattle. The majority, 74%, also grew hay, potatoes and corn whilst 19 owned plum trees (17 of these also had apple trees). Most, 67%, saw wild animals as the primary problem, followed by seven (26%) that saw disease as such. Most, 70% saw the wolf as the primary problem animal followed by seven (26%) rating the wild boar first.

Amongst this group, a total of 194 sheep were killed in 2014 (mean=7.14) whilst a total of 55 ha (mean=3ha) of hay and 5.6 ha (mean=.33ha) of corn was lost. A total of 222 plum trees (mean=20) and 48 apple trees (mean=7) were damaged. A large number, 48%, saw these losses as having only medium levels of economic impact. All had dogs and slept with their flocks and all protected their crops with fencing. Twenty one (78%) saw these methods as effective. Most, 93% of dog owners raised their pups with the flock.

### Trends in HWC

When asked if the level of damage sustained in 2014 was more, less or the same as usual, 48% (n=61) thought it was more than usual whilst 33% and 21% thought it was about the same or less than usual, respectively (Figure 10a). This pattern is repeated between the sites except for Site 2 where more respondents claimed losses to be the same (46%) than those that claimed them to be more (38%) or less (17%) than usual.

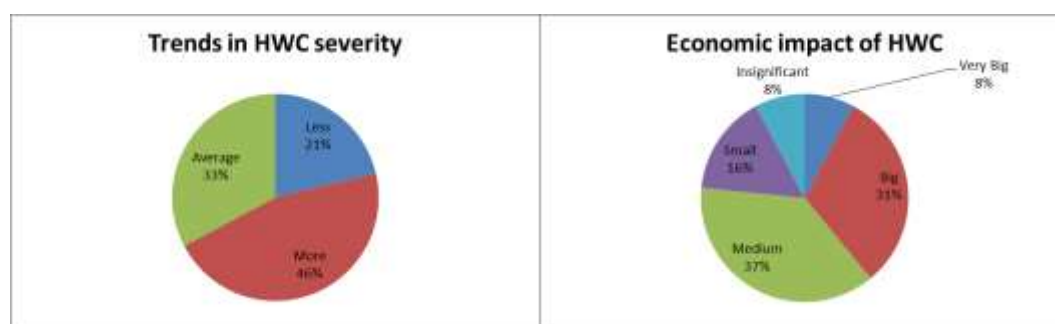


Figure 10 a) Trends in the severity of HWC over the previous five years & b) respondents' perceptions of the levels of economic impact of HWC

Across all sites, 38% of 64 respondents claimed that damage to their livestock or crops in 2014 represented a medium impact on their income. However, 31% said this had a big impact whilst only 16% and 8% said wildlife damage caused a small or insignificant impact, respectively, on their

income (Figure 10b). Interestingly, when looking at the sites individually, 38% of respondents from Site 3 (n=26) claimed a big impact.

Of the 30 respondents who responded to the question of what happened to animals that are killed or injured by wild animals, most (70%) reported that the remains of killed animals were fed to the dogs whilst those that were injured were treated (88%).

### ***Preventative Measures***

Of those that commented (n=83) on efforts to protect their livestock and/or crops from wild animals, the majority (89%) use dogs, followed closely by fencing (88%) and sleeping with the stock (78%) (Figure 11). These findings are repeated at the individual site level. No one admitted to shooting wild animals and only two people reported using electric fencing. Two used scare devices, one of which used an explosive whilst the other simply banged pans with sticks.

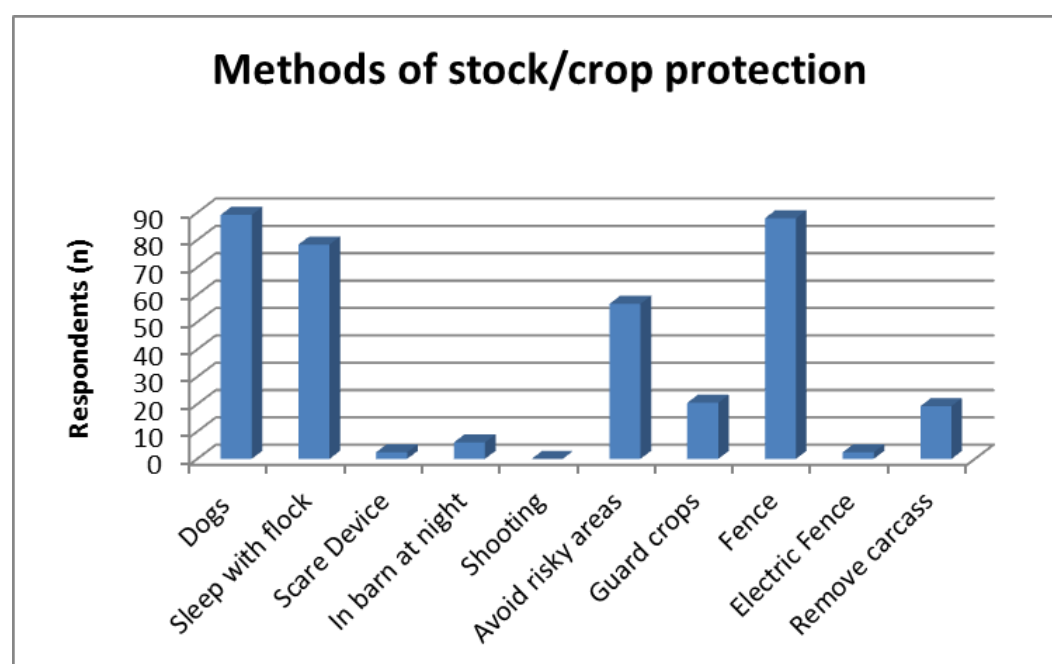


Figure 11. Methods currently used to protect livestock and/or crops from wild animals

Most people (41%) used at least four methods for protecting their stock/crop and, of those, most (85%) combined dogs, sleeping with the flock, avoiding risky areas and using standard fencing. Of the 19 respondents (23%) that used five methods, eight also used this combination with the additional precaution of guarding their crops. The majority of respondents (68%) thought that the methods they applied were effective whilst 29% (n=79) thought they were only partly so. Only two people, both from Site 1, thought the methods they applied were not effective; one of them only used dogs.

Only five people used only one protection method; one used only dogs, two put their animals into the barn at night and two only used a standard fence. Interestingly, of these five, three reported above average levels of attacks in 2014 (i.e. more than 15) and most identified wild boar as the most problematic animal (only one, with sheep, identified wolves and he only puts his stock into a stable at night). It is these kinds of individuals (suffering relatively high levels of damage but with little effort on protection) that can provide good targets for trialling new mitigation methods.

### **Livestock Guarding Dogs**

All those with dogs had adults and around half (53%) also had juveniles. In total, there were 427 dogs (334 adult & 93 juvenile) in the sample, with an average of five adult dogs and two juvenile dogs per farm (range = 1-13 adults & 1-6 juveniles). The pattern was the same between sites.

In terms of breeds, most had mixed-breed dogs (63%), followed by those with Miortic (39%) and Bucovina (33%) breeds (Figure 12). Only six respondents, all in Site 3, had Caucasian dogs whilst 10 (six in Site 1 and four in Site 3) had Carpathian breeds. Also across all sites, 13% had herding dogs (presumably Collies). This pattern was repeated within each site with the exception of Site 3, which had a more even spread of Miortic, Bucovina and mixed-breed dogs.

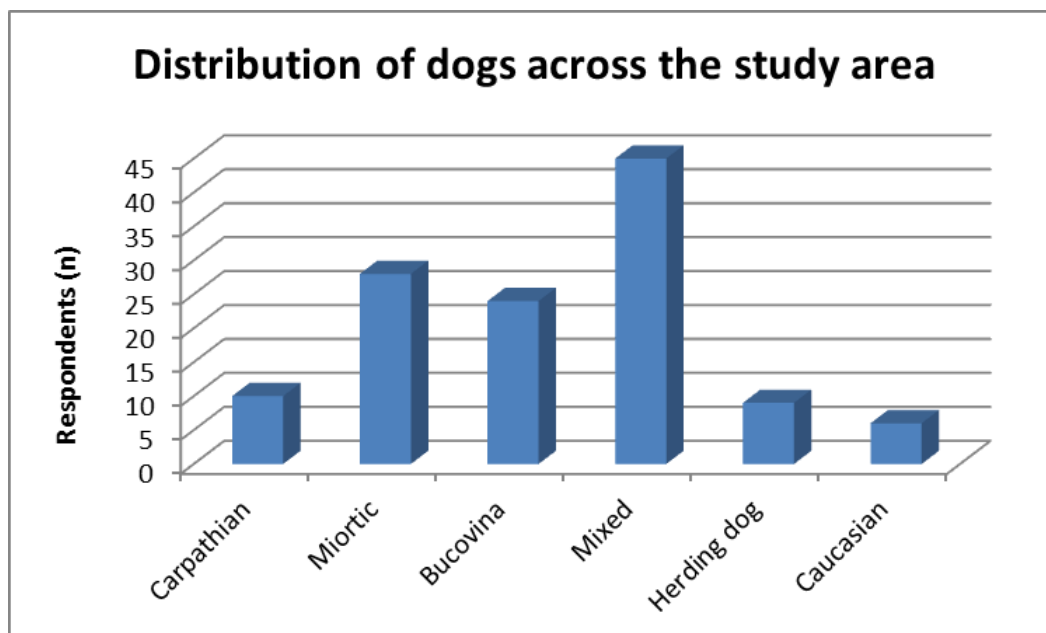


Figure 12. Different breeds of dogs currently used by livestock and crop farmers to protect their livestock and/crops

Most respondents (53%) had only one type of dog and 68% of these were of a mixed breed (six had only Miortic and three had only Bucovina). Of those that had two breeds (26%), 37% had Bucovina & mixed-breed dogs.

When asked if they thought their dogs were good/effective, the majority (88%) answered Yes; only 4% answered No whilst 8% replied Partly. Of those that responded No or Partly, reasons given ranged from *lack of experience* and *incorrect reaction* to the *presence of wild animals* or the fact that *the dogs scared the livestock*.

Amongst those that responded positively (Figure 13), 17 (23%) responded that they had suffered *no/low levels of damage* and therefore their dogs were good, suggesting that they may have misunderstood the question (rather than explaining what makes their dogs good, they were showing why they thought their dogs were good). Fourteen (19%) thought their dogs were *sensitive to their surroundings* and therefore, assumedly, more likely to be aware of approaching predators, whilst only six (8%) referred to their dogs as being *attentive to the flock* (a recognised trait of good livestock guarding dogs).

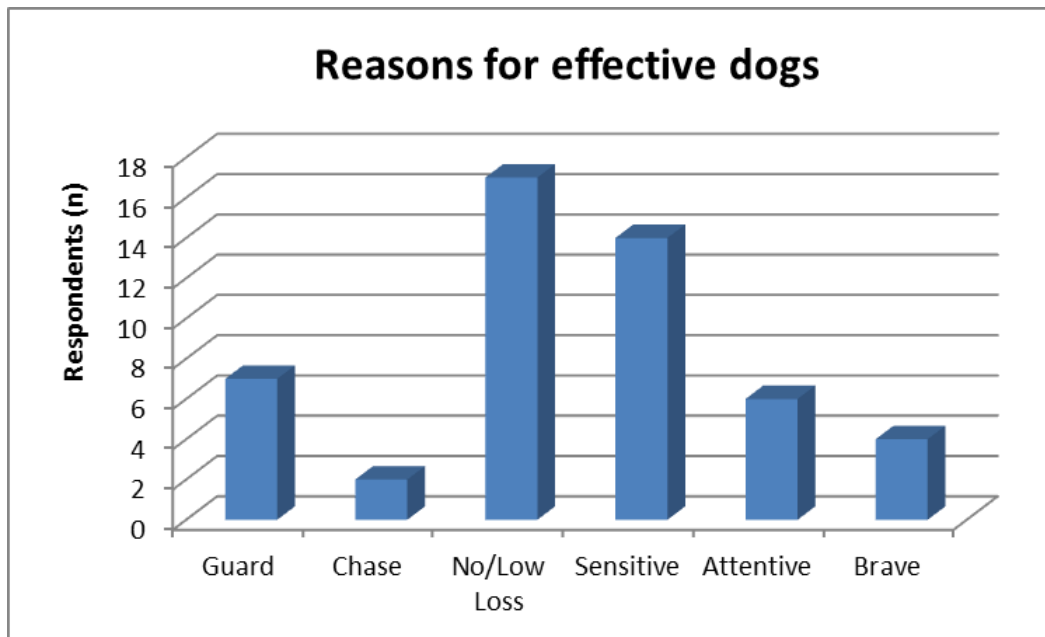


Figure 13. Respondents perceptions on why their dogs are effective at protecting crops and/or livestock

Most respondents with dogs source those dogs either from other shepherds (41%) or breed them themselves (41%). Only around 15% buy them from local markets. Variations in this pattern at individual sites were that, at Site 3, there was a more pronounced tendency to source dogs from other farms (52%) and, in Site 2, the second most common source was other breeders in the village (36%).

Respondents were asked to comment on how their dogs were raised (we avoided the use of the word training as this has certain connotations which aren't always relevant to the raising of good livestock guarding dogs). Across all sites, almost all (94%) emphasised that the dogs were *taken to live with the sheep as puppies*. This is promising as, termed socialising, the recommended method for ensuring effective livestock dogs is to raise the dogs from a very young age with the flock. Around a third of respondents (30%) also spoke of secondary measures, including ensuring the *dogs were well fed* (45%), *taught by adult dogs* (40%) or *trained by a shepherd* (10%). This combined approach to ensuring good dogs was most commonly observed in Site 3 (45%).

Respondents were asked, as an open question, to speculate on why wild animals were attacking their livestock and/or crops. A total of 67 responded, the majority of whom (72%) felt that it was because *there was not enough food available in the wild*; only 19% felt that it was because *there were too many animals* (three of these also cited *not enough food*). A variety of other reasons were given by 12% of the respondents and these included; *that the villages are depopulated*, *that wild animals (particularly boar) prefer domestic crops*, or that *wild animals (specifically the wolf) are acting on instinct*. All respondents (n=72) agreed that they would *suffer more loss* if they didn't try to protect their livestock and crops.

When asked, as an open question, what could be done to resolve HWC and who should be responsible, 68 people responded. Most thought that *wild animals should be culled* (32%) and that it is the responsibility of the Hunting Administration (56%). The second most popular response suggested that *supplementary food should be provided to wild animals* (19%) with the second most popular responsible agency being the Forestry Administration (12%).

## Key Findings & Conclusions

The primary source of income in the study area is agriculture but, there is a tendency for people to utilise multiple forms of agriculture; almost everyone owns livestock and grows crops. Surprisingly,

beekeeping was overwhelmingly underrepresented with only one respondent owning hives. Furthermore, this individual followed no other type of agriculture and can be considered a specialist. This data-point was not included in any analysis. The majority follow a transhumance regime, moving their livestock between winter and summer pastures, the former being their home-village. Summer falls within May and September, though some will stay in the mountains as late as November. Pastures tend to be fairly small, around 55ha, and crops more so; usually around 3ha. There is a fairly equal division between those that own and lease their land.

Sheep (with goats) are the most abundant livestock (a total of 19,395 were reported) though many also keep a small number of cattle and pigs. Only household in Site 1 produces any sheep/goat milk and is also the biggest producer of cow milk; Site 3 is the biggest producers of cow cheese. Nearly everyone also grows hay, potatoes and corn and many had plum or apple trees. Most sell some of their produce and almost half sell their products from home (presumably, to members of their community). Unfortunately, prices are low and there is a lack of demand.

The main problem experienced by more than half of the households surveyed is wild animals (in Site 2, this was almost a unanimous choice). This was followed, distantly, by disease. This problem is worst in the summer pastures and the main culprits are wild boar and wolves; the wolf is the most problematic animal in Sites 1 & 2, with wild boar seen as the main threat in Site 3. Unfortunately, there is no way to determine which species is most problematic for any particular mode of agriculture but we can probably assume that wolves are the main predator of sheep whilst boars threaten crops and orchards.

There seems to be some correlation between the number of active farms in the summer pastures and the number of reported attacks by wild animals. Most households feel that problems with wild animals are getting more common.

In 2014, a total of 924 attacks, or 15 attacks per farm, were reported (to the survey) with Site 2 receiving the highest number of attacks (though this is most likely down to one farm which reported 100 attacks). During that time, of the livestock, only sheep were attacked (though some households also reported attacks on dogs) and most of these were killed in the summer pastures. This could suggest that wolves are actively avoiding the built-up areas around the winter pastures (although, of those that only had attacks on livestock, more than half thought the winter & summer sites were equally problematic). A third reported five or less animals killed; a loss of around 1.8% of average stock.

The most frequently attacked and severely damaged crops were hay and corn. However, using hectares lost as a measure of severity may underestimate small-scale crops, such as potatoes, and future assessments may need an alternative measure, such as financial revenue lost.

Nearly all households have dogs and most use at least four methods for protecting their stock/crop. The most common combination is dogs, guarding the flock at night, avoiding risky areas at pastures and fencing, and the general feeling is that these methods are effective. Only five households use only one preventative method and three of these reported above average levels of attacks, by wild boar, in 2014. These individuals may benefit from intervention by the project.

Households have an average of seven dogs and most of these are mixed breed. Most think their dogs are good and, generally, they are either traded from other shepherds or bred at the farm. There seems to still be a good level of knowledge on the best way to raise livestock guarding dogs with most owners citing the importance of raising the dogs as part of the flock and feeding them well. This combined approach was most commonly observed in Site 3.

Most households feel that they experience problems with wild animals because *there is not enough food available in the wild*. However, many also think that the solution is to cull populations and that this should be done by the Hunting Administration.

## Appendices

### *Datasheet for HWC interviews*

*[Items marked \* may be recorded directly by the interviewer]*

- \*1. Interview #: \_\_\_\_\_ \*2. Date: \_\_\_\_\_
- \*3. Interviewer: \_\_\_\_\_ \*4. \_\_\_\_\_ Survey site: \_\_\_\_\_  
\_\_\_\_\_
- \*5. Exact location (GPS coordinates): \_\_\_\_\_
6. Name of interviewee: \_\_\_\_\_ 7. Age: \_\_\_\_\_
8. Primary income source: Agriculture \_\_\_\_\_ Other \_\_\_\_\_  
(specify) \_\_\_\_\_
9. Agriculture (*circle as appropriate and underline primary form*):
- livestock owner      livestock manager      fruit grower      shepherd/herder
- bee keeper      crop farmer
10. Home village/county \_\_\_\_\_ 11. Contact details: \_\_\_\_\_  
\_\_\_\_\_

### ***Description of fold/farm & pastures/fields***

12. Description of winter farm infrastructure

*Circle all applicable:* house      large barn      smaller barn(s) for lambs

other (specify \_\_\_\_\_)

13. Description of fold/farm infrastructure (*circle all applicable*):

fold (give details) \_\_\_\_\_ night-time corral (give details) \_\_\_\_\_

small shelter for young animal      other (specify \_\_\_\_\_)

14. If beekeeper, number of beehives \_\_\_\_\_

15. If fruit grower, number of trees \_\_\_\_\_ and/or \_\_\_\_\_ ha

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16. If livestock, size of pastures: \_\_\_\_\_ ha

17. If crops, size of fields: \_\_\_\_\_ ha

18. Pastures/fields are: *owned*      *leased*

19. If livestock manager, number of livestock owners:

\_\_\_\_\_

20. Degree to which pastures around fold are overgrown with bushes or trees:

*Circle applicable:*    0%    1–10%    11–25%    26–50%    >50%

21. Location of nearest water (*GPS/map*) \_\_\_\_\_

22. Number of shepherds/herders/farm hands at the fold/farm (specify): \_\_\_\_\_

23. For how many years have you used the same fold/fields? \_\_\_\_\_

24. Where are livestock kept in winter? \_\_\_\_\_

25. If seasonal, when did you arrive here? \_\_\_\_\_ 26. When will you leave?

\_\_\_\_\_

### ***Livestock numbers/crop details***

27. Livestock type & number:

a. Sheep: #: \_\_\_\_\_

b. Goats: #: \_\_\_\_\_

c. Cattle: #: \_\_\_\_\_

d. Horses: #: \_\_\_\_\_

e. Donkeys: #: \_\_\_\_\_

f. Pigs: #: \_\_\_\_\_

28. Crop types and ha

a. corn: \_\_\_\_\_ ha

b. potatoes: \_\_\_\_\_ ha

c. hay \_\_\_\_\_ ha

d. alfalfa \_\_\_\_\_ ha

e. wheat

f. others \_\_\_\_\_ ha

29. Fruit types and number of trees

a. plums \_\_\_\_\_

b. apples \_\_\_\_\_

c. walnut \_\_\_\_\_

d. other \_\_\_\_\_

### ***Products***

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What are the main products produced in the summer and how much is produced each season?

30. Sheep: milk \_\_\_\_\_ l      cheese \_\_\_\_\_ kg      meat \_\_\_\_\_ kg      wool \_\_\_\_\_ kg

31. Cattle: milk \_\_\_\_\_ l      cheese \_\_\_\_\_ kg      meat \_\_\_\_\_ kg

32. Bees: Honey \_\_\_\_\_ kg

33. Fruit: plums \_\_\_\_\_ kg      apples \_\_\_\_\_ kg      walnut \_\_\_\_\_ kg      other \_\_\_\_\_

34. Crops: Corn \_\_\_\_\_ kg Potatoes \_\_\_\_\_ kg hay \_\_\_\_\_ kg alfalfa \_\_\_\_\_ kg wheat \_\_\_\_\_ kg

35. How do you sell your products? \_\_\_\_\_

36. What are the difficulties of selling your products? \_\_\_\_\_

### **Losses to wild animals**

37. Which of these are important problems for you? *Rank by importance:*      disease/pests  
wild animals      theft      weather other (specify \_\_\_\_\_)

38. Are the problems worse in winter pastures, in summer pastures or during the migration?

*Circle applicable:*      winter      summer      migration

39. Which is the most troublesome wild animal? *Rank in order of importance:*

bear      boar      deer      dog      jackal      wolf      other (specify \_\_\_\_\_)

40. In which month(s) do you tend to lose most stock/crops/hives to wild animals (specify)?

\_\_\_\_\_

41. If you consider the last 5 years, have problems with wild animals been:

Less (1)      same (2)      more (3)

### **Details of attacks**

42. Did you have you any problems with wild animals in 2014?

a) in the village:      yes (1) no (0)      b) on summer pasture:      yes (1) no (0)



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(if b, ask them to indicate where the summer pastures were that year)

43. How many attacks did you suffer that year? \_\_\_\_\_

44. How many head of livestock and what type did you lose?

	<i>Winter</i>		<i>Summer</i>	
	<i>killed</i>	<i>injured</i>	<i>killed</i>	<i>injured</i>
<i>Sheep/goats</i>				
<i>Cattle</i>				
<i>other (specify)</i>				

45. How many hectares of crops damaged/lost?

a. corn: \_\_\_\_ha      b. potatoes: \_\_\_\_ ha      c. hay \_\_\_\_ ha

d. alfalfa\_\_\_\_\_ ha      e. wheat      f. others \_\_\_\_\_ ha

46. How many fruit trees were damaged?

a. plums \_\_\_\_\_ b. apples \_\_\_\_\_ c. walnut \_\_\_\_\_ d. other \_\_\_\_\_

47. How many hives were damaged? \_\_\_\_\_

48. Was this: *less than usual* (1)      *about average* (2)      *more than usual* (3)

[illegible]

50. What happens to the killed animals? \_\_\_\_\_

51. What happens to injured animals? \_\_\_\_\_

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### **Preventive measures**

52. What measures do you use to protect your livestock and/or crops from wild animals?

*Circle all those used and rank in order of importance:*

*dogs                      sleeping with flock                      scare devices (specify \_\_\_\_\_ )*

*shooting              avoiding risky places (specify \_\_\_\_\_ )                      guarding crops*

*fencing              electric fence                      removing dead livestock*

*other (specify \_\_\_\_\_ )*

53. Do you think these measures are effective?

*yes (1) no (0) partly (3)              explain \_\_\_\_\_*

54. Guard dogs #: \_\_\_\_ of which adults (>1 yr): \_\_\_\_ juveniles (<1 yr): \_\_\_\_

55. Are they: *Carpathian (1)              Mioritic (2)              Bucovina (3)              mixed breeds (4)*

*other (specify \_\_\_\_\_)*

56. Do you think you have good dogs?

*yes (1) no (0) partly (2)                      explanation: \_\_\_\_\_*

57. Where do you get your dogs from? \_\_\_\_\_

58.                      How                      do                      you                      raise                      them?

\_\_\_\_\_

59.      Why      do      you      think      animals      are      attacking      your      livestock/crops?

\_\_\_\_\_

\_\_\_\_\_

—

60. What would happen if you didn't protect your livestock/crops?

*Nothing (1)              would lose more (2)              doesn't know (3)              other (specify \_\_\_\_\_ )*

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61. How do you think we could resolve these problems and who is responsible? \_\_\_\_\_

\_\_\_\_\_

—

### ***Remarks***

62. Do you have anything else you would like to add about what we have talked about?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Appendices

### Details of recent attacks/conflict events for interview #: \_\_\_\_\_

1. Date of attack: \_\_\_\_\_

2. Time of attack:                      *dawn*   *am*       *pm*       *dusk*   *night-time*

(approx. time if known \_\_\_\_\_ )

3. Animal(s) involved and number if seen:

*bear* (\_\_\_\_)   *boar* (\_\_\_\_)   *deer* (\_\_\_\_)   *dog* (\_\_\_\_)

*jackal* (\_\_\_\_)   *wolf* (\_\_\_\_)   *other (specify* \_\_\_\_\_ *)*

4. Distance of attack site to nearest forest \_\_\_\_\_ m

5. Location coordinates (from *map* or *GPS*): \_\_\_\_\_

6. Weather (*circle applicable*):              *clear*   *cloudy*              *mist/fog*       *rain*       *snow*

*other (specify* \_\_\_\_\_ *)*

7. Activity of flock/herd immediately before the attack: (*circle applicable*):

*grazing on pasture*       *drinking at water source*       *sleeping at fold*

*resting on pasture*       *walking to/from pasture (details* \_\_\_\_\_ *)*

*other (specify* \_\_\_\_\_ *)*

8. # and type of livestock killed or injured:

Sheep;    killed \_\_\_\_\_       injured \_\_\_\_\_

Cattle;    killed \_\_\_\_\_       injured \_\_\_\_\_

Other (specify); \_\_\_\_\_ killed \_\_\_\_\_       injured \_\_\_\_\_

9. Area (hectares) of crops damaged/lost

Corn \_\_\_\_\_ ha              potatoes \_\_\_\_\_ ha       hay \_\_\_\_\_ ha       alfalfa \_\_\_\_\_ ha

10. Number of fruit trees were damaged/lost

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plums \_\_\_\_\_ apples \_\_\_\_\_ apricot \_\_\_\_\_ pears \_\_\_\_\_

11. Number of hives were damaged/lost \_\_\_\_\_

12. Dogs present:                      yes (1) no (0)

13. Dog behaviour toward predator: *Circle applicable:*

no reaction (0) bark (1)              chase (2)              bite/contact (3)              run away (4)

other (specify \_\_\_\_\_)

14. People present                      yes (1)(specify \_\_\_\_\_) no (0)

15. Person's behaviour toward wild animal: *Circle applicable:*

no reaction (0)              shout (1)              chase (2)              shoot (3)

other (specify \_\_\_\_\_ )

16. Was the attack reported?              Yes (1)no (0) (If not, why? \_\_\_\_\_)

17. Did you receive compensation? Yes (1) no (0) still waiting (2)

18. Is there anything else you would like to add about what we have talked about?

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*[Now ask for the next previous attack and repeat data questions, and then for the attack before that, until all attacks have been registered and/or interviewee loses interest. If no more, note here the total number recorded \_\_\_\_\_]*