



## **Overall evaluation and monitoring of the project conservation achievements**

**Action E.2 of the project “Conservation and surveillance of the  
conservation status of the wolf (*Canis lupus*) population in Slovenia  
(2010-2013)- SloWolf”**

Jasna Mulej  
Irena Bertoncelj  
Rok Černe  
Klemen Jerina  
Irena Kavčič  
Aleksandra Majič-Skrbinšek  
Urša Marinko  
Hubert Potočnik  
Matej Vidrih  
Maja Jelenčič  
Tomaž Skrbinšek

December 2013

*Univerza v Ljubljani*





## Contents

Contents .....	2
Abbreviations .....	3
INTRODUCTION .....	4
METHODS .....	5
RESULTS and DISCUSSION by actions .....	6
ACTION A.1: Establishment of methods for the surveillance of wolf population conservation status .....	6
ACTION A.2: Elaboration of wolf population action plan .....	7
ACTION A.3: Assessment of wolf natural prey base in Slovenia, identification of the needs for specific actions and preparation of management improvements .....	8
ACTION A.4: Assessment of damages caused by wolves to agriculture .....	10
ACTION A.5: Analysis of existing farming systems in wolf areas and preparation of best practices recommendations.....	11
Action A.6: Analysis of attitudes of the general public, hunters and sheep farmers toward wolves and preparation of management recommendations .....	12
Follow-up surveys on the public attitudes toward wolves .....	13
Evaluation of the public participation process.....	23
ACTION C.1: Establishment of surveillance of wolf population conservation status ..	36
ACTION C.2: Improvement of management of wild ungulate species .....	53
ACTION C.3: Involvement of hunters and volunteers in the wolf population monitoring activities.....	56
ACTION C.4: Improvement of wolf damage inspections and training of inspectors for recognition and evaluation of large carnivore damages to agriculture .....	60
ACTION C.5: Training of agriculture advisory service in damage prevention measures	62
ACTION C.6: Best practice demonstration of damage prevention measures at selected wolf damage hot-spots.....	63
ACTION D.1: Public awareness and education campaign about wolves on national and local levels.....	65
ACTION D.2: Promotion of coexistence of wolves with agriculture.....	68
ACTION D.3: Education campaign on wolves for hunters in wolf areas.....	69
ACTION D.4: Project website.....	70



ACTION D.5: Layman's report .....	72
ACTION D.6: Networking through organization of a thematic conference .....	72
ACTION E.3: Revision of Wolf Population Action Plan.....	74
REFERENCES .....	75
APPENDIX I .....	77

## Abbreviations

CAFS	Chamber of Agriculture and Forestry of Slovenia
CRO	Representatives from Croatia
E	Expert
FB	Facebook
GO	Government organization
MAE	Ministry of Agriculture and Forestry
SFS	Slovenian Forest Service
SHA	Slovenian Hunters Association
SH	Stakeholder



## INTRODUCTION

Intensive conservation projects such as those supported by the EU's LIFE Programme aim to improve conditions for species conservation, but their effectiveness is rarely systematically tested (Ferraro & Pattanayak, 2006). Evaluation of conservation projects is essential for their transparency and credibility and such evaluation must address social as well as biological variables (Ferraro & Pattanayak, 2006; Kleiman et al., 2000; Stem, Margoluis, Salafsky, & Brown, 2005). This is especially important in conservation of charismatic and controversial large carnivores in human dominated landscapes such as Central Europe and Slovenia within it.

In order to summarize the lessons learned in the LIFE+ project Conservation and surveillance of the wolf conservation status of the wolf (*Canis lupus*) population in Slovenia- SloWolf and propose recommendations of the best practices in large carnivore conservation, an evaluation of the project actions was performed. The main objective of this evaluation is to determine the effectiveness of the project actions. Measuring the effectiveness of a conservation project is reasonable when clear threats for the conservation object are identified and actions are taken to target those threats (Salzer & Salafsky, 2006). There were seven threats to the conservation of the wolf population in Slovenia defined prior the project started and addressed directly by project actions:

1. Inadequate management of the wolf population due to insufficient knowledge about the population conservation status
2. Deterioration of prey base due to deficiencies in prey species management
3. A growing conflict spiral because of the wolves' damages to livestock, louder and louder calls for higher carnivore culling quotas and tensions caused by high costs of damage compensations
4. Negative attitudes of hunters caused by competition with wolves for the prey/hunting species
5. Negative public attitudes toward wolves amplified by sensationalistic media reports
6. Infectious and parasitic diseases transferred between domestic and wild canids (scabies, viral diseases...)
7. Wolf habitat fragmentation caused by traffic infrastructure

The main goal of the project was to facilitate long-term conservation of the wolf population in Slovenia. For that, it is necessary to conserve also wolves' prey base and habitats, as well as improve their coexistence with humans. The existence of wolves in Slovenia depends on a number of factors that had been studied (Actions A.3, A.4, A.5, A.6, C.1) in the project and were planned to be incorporated into wolf management (Actions A.2, A.3, A.4, A.5, E.3, C.1, C.2). One of the goals of the SloWolf project was to raise the acceptance of wolves by Slovene society. Several project actions (Actions C.3, C.5, C.6, D.1, D.2, D.3, D.4, D.5) were designed to improve attitudes and knowledge of the key interest groups (i.e., sheep and goat farmers, hunters, agriculture advisors) about wolves and wolf management.



## METHODS

### Evaluation design

This evaluation covered the period from 2010 to 2013 and was conducted internally with the project staff. Since it was produced already at the end of the project, mostly effects (i.e. results vs objectives) and not the impacts of the project actions have been assessed. Effectiveness of each action was discussed in a manner to what extent were the objectives of the project actions achieved and how they contributed to the overall project goal.

The evaluation of each action was performed by the person responsible for the action. Each action evaluation followed a pattern of:

- Short action description and its goal
- A summary of achieved outputs in comparison to expected outputs (where quantitative output measures were predefined, achieved results were compared to expected and discussed)
- Explain cases in which expected results weren't fully reached
- Report on additional outputs that were not foreseen in the project application
- Comment on the action effectiveness from a subjective perspective (how the results of the action contributed to overall project objectives; where unforeseen difficulties were encountered and what are recommendations for future or similar programmes)

Special attention was given to the evaluation of the effectiveness of the informational and educational campaign (Action D.1) and public involvement actions (Actions A.2, C.2, C.3, C.5, C.6). A quasi-experimental approach was used to measure changes in attitudes and knowledge about wolves and wolf management. A public opinion survey was conducted twice, at the beginning and toward the end of the project. Especially in public participation, the quality of outputs depends strongly on the nature of the process of participation (Innes & Booher, 1999). Therefore, public involvement actions were additionally evaluated with the focus on the quality of the process of participation. Methods used for the qualitative evaluation of public participation are described in detail in the chapter *Evaluation of the public participation process*.

Quantitative and qualitative data for the evaluation were obtained from:

- survey responses
- short evaluation forms
- reports
- interviews with participants



## RESULTS and DISCUSSION by actions

### ACTION A.1: Establishment of methods for the surveillance of wolf population conservation status

EXPECTED RESULTS	QUANTITATIVE INDICATORS
<ul style="list-style-type: none"><li>• Well designed, organized and implemented surveillance of wolf population conservation status in Slovenia.</li><li>• prepared study designs of the surveillance activities</li><li>• evaluated protocols and guides for collaborators in surveillance activities</li><li>• established cooperation network between institutions responsible for wolf monitoring</li><li>• Wolf Monitoring Portal ready for use</li></ul>	1 plan of project measures (Prepared protocols and guides for surveillance of conservation status activities )

**Action evaluation summary:** All the expected results were successfully achieved. We produced the entire set of evaluated and fine-tuned protocols and guides for surveillance of conservation activities. We prepared a final set of optimized methods and protocols that were recommended for implementation into the national wolf surveillance/monitoring system. That was included into a revised national Action plan for the wolf in Annex 1. We also established and formalized (through accepted Action plan) cooperation network between institutions responsible for or involved in wolf monitoring. An open, internet-based interface - Wolf Monitoring Portal for collection and dissemination of knowledge about has been developed and became an interface where all monitoring data are collected, presented and results distributed.

The entire set of protocols and guides for surveillance activities have been prepared through expert meetings and communication and related directly to Action C.1, which was the actual implementation of the monitoring, and, where relevant, to Action C.3. We divided activities into preparatory activities for cyclic (permanent/yearly) surveillance sessions, and into single-time activities required prior to the first surveillance session. Within cyclic activities we prepared and printed thematic maps, sampling grids and forms for snow-tracking and performing howling tests, preparation of sampling material (envelopes, tubes, forensic swabs) including appropriate labelling. Detailed protocols and guides for participant (volunteers, hunters, employees of SFS) in wolf surveillance sessions (genetic sampling, snow tracking, monitoring of reproductions (howling tests)) were prepared (<http://www.volkovi.si/sl/multimedia/publikacije>). On a yearly basis we prepared educational workshops and session meetings with representatives of participating hunting clubs, volunteers and Slovenia Forest Service personnel (see Action C.1 for details), prepared logistic plans



and organized snow-trackings, howling sessions and non-invasive genetic sampling. After partial analysis of results of the previous session and before beginning of the next session we reassessed and fine-tuned of surveillance design and procedures and, if needed improved them for the next session. As a result, after three yearly sessions, we prepared a final set of optimized methods and protocols that were recommended for implementation into the national wolf surveillance/monitoring system. That was included into a revised national Action plan for the wolf in Annex 1.

An important single-time preparatory action for the monitoring was successful development of an open, Internet-based informational infrastructure for collection and dissemination of knowledge about wolves (Wolf Monitoring Portal - see Action C.1, point 5), which practically became an interface where all monitoring data are collected, presented and results distributed.

### **ACTION A.2: Elaboration of wolf population action plan**

#### **EXPECTED RESULTS:**

- Action plan elaborated and presented to the wider public.
- Competent authority accepts the action plan.
- 1000 copies of the action plan printed and distributed to the authorities, managers, stakeholders.

**Action evaluation summary:** *Draft action plan was produced in time and submitted to the competent authority. The government has accepted the action plan with a delay, therefore a revised version developed at the end of the project (Action E3) was printed. Although with certain unexpected challenges this action was completed successfully.*

The Action Plan was prepared by 57 participants from 21 governmental and non-governmental organizations with very different backgrounds and agendas. The Slovenian government officially accepted the action plan in February 2013. In order to draft the plan, we've organized five all-day workshops and invited all interest groups involved in wolf management in Slovenia as well as wolf experts from Croatia. At the first workshop the biggest challenges of wolf management were determined and priorities for each challenge were set. On the second and third workshop, long-term and specific goals for each challenge were defined, while the last two workshops were devoted especially to the topic of wolf damages to livestock, which was recognized as top priority challenge regarding wolf management in Slovenia. Sheep breeders were additionally invited to the last two workshops to ensure all different point of views were considered. The actual text were written by the project team members based on the workshop results and circulated one more time among the workshop participants and published on the project website before being submitted to the authorities. At the end of each of the workshops the participants have filled in an evaluation form to let us know what they liked about the process and what would they like to see being differently



implemented. In that way, we had a real-time feed-back from the participants and could adjust the process of public involvement in decision-making.

### **ACTION A.3: Assessment of wolf natural prey base in Slovenia, identification of the needs for specific actions and preparation of management improvements**

EXPECTED RESULTS	OUTPUT INDICATORS
<ul style="list-style-type: none"> <li>• 5 digital maps: maps of availability of each prey species (red and roe deer, chamois, wild boar), map of cumulative prey base biomass for the wolf</li> <li>• Permanent database and digital maps of relative yearly abundances of ungulate species in the wolf core area (Kočevsko and Snežnik-Pivka) obtained from snow-tracking counts integrated into wolf monitoring portal (Action C.1)</li> <li>• 1 report - evaluation of the dietary needs of the wolves in Slovenia (predation rates, species spectrum and sex/age structure of the prey) + management recommendations</li> <li>• 1 report - analysis of prey species population models (simulated effects of different management scenarios with and without carnivore presence on dynamics and sizes of prey species populations)</li> <li>• Management recommendations - summarized results of research and models with an emphasis on management implications and actions to be taken (guidelines for Action C.2).</li> </ul>	<ul style="list-style-type: none"> <li>• number of roe deer and red deer hunted in wolf areas/ decrease the roe deer and red deer quotas at least by 3%</li> <li>• 1 guideline</li> </ul>

**Action evaluation summary:** All the expected results were successfully achieved, some strongly overreached. We produced management recommendations based on wolf prey base density estimates of much higher accuracy and larger spatial coverage (entire country) than initially planned. Change in methodology required additional funds which were provided from Department of Forestry program research money of the leader of this specific action. A quantitative measure of 3 % decrease of the red deer and roe deer hunted in wolf areas was not reached, since ungulate densities proved to be several times higher than limiting densities that would cause increased livestock predation by wolves.

Red and roe deer are key species for wolves in Slovenia. However, regional densities of wild ungulates are poorly known since they are only estimated through hunting bag data. Sound knowledge of prey populations is necessary to ensure reasonable prey base, decrease conflict among wolves and hunters, as well as among wolves and agriculture. The goal of the action A.3 was to determine density and distribution of main wolf prey species, especially roe and red deer. This action





was a preparatory action for the integration of the needs of carnivores into wild ungulate management (Action C.2) and for the preparation of the Wolf Management Action Plan (Action A.2).

All the expected results were successfully achieved, some strongly overreached. The methodology to obtain prey densities was changed (after the approval of EU commission). We did not use winter linear transect counts method as foreseen in project application, because with the implementation of extended pellet-group count method and new available maps of local (1×1 km grid) density indices for all indigenous ungulates in Slovenia, this was no longer needed. Instead we have extrapolated density estimates (by the use of spatially explicit models calibrated on the pellet group counting data) over the entire country and in this manner prepared very good maps of year-round densities of all wolf prey species for entire Slovenia. We have gained significantly better project results as initially planned, where only winter data for two smaller pilot areas would be obtained, instead of year-round data for the entire Slovenia. By sampling on a year-round basis we were able to estimate spring, summer and winter densities of all ungulates representing main wolf prey species. Seasonal migratory behaviour is typical for ungulates and considering seasonal changes in ungulate distribution makes the method of pellet-group counts better and more accurate. Important side-result of the analysis of the densities of ungulates was accurate spatially explicit model for prediction of densities of each ungulate species based on spatially explicit recorded mortality of ungulate species (killed by a hunter, found dead, traffic accidents). This model can be used for future predictions of local densities of ungulate species over entire Slovenia, and thus for accessing the wolf prey available biomass and thus also fully covers the second foreseen result of this action (Permanent database and digital maps of relative yearly abundances of ungulate species in the wolf core area, Kočevsko and Snežnik-Pivka, obtained from snow-tracking counts integrated into wolf monitoring portal).

Additionally, article Review of faecal pellet-group count methods for estimating deer numbers was published in Research reports Forestry and Wood Science and Technology, and report describing new methodology for recalibration recorded ungulate mortality into population densities based on pellet group density estimates which was not planned in project application and can be useful in the future for preparation of similar actions.

As indicator for assessing the achievement of the project objectives, a quantified measure was set: decrease the roe deer and red deer quotas at least by 3%. Analysis made during the project showed that the ungulate densities in the entire wolf range are several times higher than limit densities that would cause increased livestock predation by wolves. Therefore, decrease in red and roe deer quotas in order to increase their density, does not make sense in terms of reducing livestock damages. For this reason the foreseen indicator- decreased roe and red deer quota at least by 3%, was not considered in the project. Nevertheless, analysis showed that wolves often prey upon hinds and cubs, and less upon adult red deer stags. Therefore, in areas of constant wolf presence, the portion of adult male red deer in culling quota was increased wildlife management plans. As adult male deer is a popular trophy, this change was highly desired among hunters and can in a long-term increase the acceptability of wolves within this interest group.



Overall the action was successful. It facilitates one of the main goals of the project – long term conservation of the wolf in the country. We expect that modified harvest structures of ungulates will on long term promote acceptance of the wolves between the hunters. The originally planned action was altered in several details and improved. During the project application preparation the modifications could not be foreseen and justified, because certain data in information were not available. In order to implement such changes (that improve the project) the approval administrative procedures should not be too rigid - paper work demanding.

#### **ACTION A.4: Assessment of damages caused by wolves to agriculture**

EXPECTED RESULTS	OUTPUT INDICATORS
<ul style="list-style-type: none"><li>• 1 report: how and why the damages happen, and the guidelines for damage prevention for the actions D.2 and C.5</li><li>• 2 digital maps showing areas where conflicts with agriculture are more likely.</li><li>• 1 digital map showing the areas where spatial expansion of the wolf is bound to cause problems with the agriculture.</li><li>• 1 management recommendations – summary report with the guidelines for damage prevention and actions to be taken.</li></ul>	number of damages to livestock caused by wolves/ decrease the number of damages at least by 10%

**Action evaluation summary:** All foreseen results within this action were reached. Some additional analysis were made and included in the report. The action was a preparatory action for Action C.6. Within A.4 we found out that most of the damages happen at a small number of farms and we contacted those farmers in the Action C.6. In comparison with the year 2010 we recorded in 2013 a 72 % decrease in the total number of damage cases, although it is not possible to conclude that this is a direct result of the project Action C.6.

The available and collected parameters of the registered wolf damage cases since 1994 were analyzed by use of GIS, as well as by searching for statistical correlations between the damage prevention measures used and the amount of the damage suffered. This data were analyzed on two levels: (a) identification and evaluation of the parameters for individual pastures; (b) spatial analysis of larger areas with the purpose of predicting the areas with different degrees of risk for the existing pastures, planned pasture developments and/or for areas in which wolf population is expected to recover. The results of the analysis, maps and management recommendations were all included in a report published on the project webpage.

The extent and nature of damages which wolves do to agriculture was assessed and the report finished as planned. We have analyzed all registered wolf damage cases since 1994 until 2009. The report includes six digital maps with the spatial presentation of the damages during the analyzed time period. A habitat model for the potential wolf population expansion was developed, including a



map of areas where conflicts with agriculture are more likely to occur today as well as in case of spatial expansion of the wolf population and spatial expansion of the sheep breeding. So all expected results were reached and additional graphs and analysis are shown within the report.

This action was a preparatory action for the action Action C.6: Best practice demonstration of damage prevention measures at selected wolf damage hot-spots. When analysing the data within A4 we got the necessary knowledge which was needed for the right approach to best practice demonstration. One of the most important results was the conclusion that around ½ of all yearly damages happens at only 10 farms. Result of this conclusion was that in close collaboration with damage inspectors we knew to which farmers we have to approach and work with. Future collaboration was established only with the farmers willing to be actively involved into C.6.

The data collected on the number of damages was used also for the evaluation of the effectiveness of Action C.6, whereby it is important to note, that although in the time of project the foreseen 10 % reduction in the total of damage cases per year has been reached and was even exceeded. In comparison with the year 2010 we recorded in 2013 a 72 % decrease in the total number of damage cases, the effectiveness of the distributed damage prevention measures should only be evaluated for farms that participated in Action C.6. Just few of all farms which contribute the biggest share to the damage causes were controlled during the time of the project and therefore it is not possible to conclude that the damage reduction is only due to the donated protection measures.

#### **ACTION A.5: Analysis of existing farming systems in wolf areas and preparation of best practices recommendations**

EXPECTED RESULTS	QUANTITATIVE INDICATORS
<ul style="list-style-type: none"><li>• 1 Financial analysis of case study farms (costs of damage prevention vs. costs of damage compensation).</li><li>• 2 Management recommendations - summarized results of case study analyses with recommendations for actions to be taken to implement best practices, in a form of a technical report will be presented to the authorities as well as to the interested public.</li></ul>	1 guideline/report

The action outputs covered those specified in the project proposal as expected results. Most farms with sheep or goats use farming as a secondary activity, they are so called hobby farmers, and breed smaller (around 30 animals) to medium ( around 60 animals) sized flocks of livestock. Fewest are the farms with farming as the only activity (so called professional breeders) and those usually have large flocks of livestock. Comparisons between used system of fences and size of the flock showed that most farms have fences with three or four wires, those with larger flocks also five and seven. Nets are used primarily in farms with smaller number of livestock. Mainly, grazing management, and with



this processes connected activities, are oriented toward situations and space where no large carnivores are present and consequently no carnivore predation on grazing sheep and goats is expected. If damage prevention measures exist, they are everywhere similar to the whole sample. Current damage prevention systems are in line with principles of the controlled pasture of livestock and are not including the demands for preventing the wolf attacks to livestock. Field visits to locations on the territory of permanent or occasional presence of large carnivores confirmed inconsistencies even within these principles. Analysis of the purpose of sheep farming showed that it was primarily only for meat. Only on three farms, farming for milk was documented.

As the most valuable animals in this research proved to be milking sheep and goats and also such animals were not put out to the pastures (day or even night) as frequent as those animals bred for meat. The reason lied in the fact that such animals were never compensated good enough in the case of carnivore predation.

Management recommendations for the purpose of lessen the predation impact on pasturing livestock during the project stayed on the level and also in farmers heads that is still not in favour of coexistence between livestock grazing and wolf preservation.

#### **Action A.6: Analysis of attitudes of the general public, hunters and sheep farmers toward wolves and preparation of management recommendations**

EXPECTED RESULTS	OUTPUT INDICATORS
<ul style="list-style-type: none"><li>• Documented attitudes of the general public, hunters, sheep farmers and high school students toward wolves.</li><li>• Surveys carried out.</li><li>• 1 report containing statistically analysed results prepared, published on the project web-page and passed on to the decision-makers.</li></ul>	1 study

**Action evaluation summary:** *The action outputs exceeded those specified in the project proposal. The results of the study were distributed wider than foreseen (not only to decision makers but also to participants in the study and representatives of different interest groups). In the future, more emphasis should be given to sampling methods to obtain a representative sample of hunters.*

Within this action we conducted a quantitative survey of attitudes and knowledge of the residents in the wolf area, hunters and sheep farmers about wolves and their management in order to identify areas of public support and disagreement over different management options. The goal of this action was to document and improve human attitudes toward wolves and management decisions. A knowledge gap analysis served as a basis to prepare a communication strategy (as a starting point of the public awareness campaign in action D.1) and to integrate this strategy to wolf management in Slovenia. The questionnaires for the hunters and the general public were sent by mail and the farmers were interviewed personally. We took the opportunity of personal interviewing of farmers



who participated in the survey also to identify potential candidates who were willing to participate in best practice action (D.6) to receive donated electric fences or livestock guardian dogs.

All expected results for this action were reached. The attitudes of general public and other interest groups were documented; surveys carried out and a report containing statistically analysed results prepared. On the 1<sup>st</sup> July 2011 we published it on the project webpage and passed it on to decision-makers. Preliminary results were presented on the first workshop for National Wolf Action plan on 28th January 2011.

The report was additionally sent to survey participants, from whom we received e-mail contacts, interested hunters, volunteers and nature conservation oriented organizations. Three short reports of the work on this action have been published on the project web page under the web tab Blog and Press Release covering this topic. A popular article discussing the main results of this action was prepared for the hunting magazine Lovec.

The problems experienced in this action were connected to the lower response rates of hunters. Lower hunters' response rate than expected was probably due to the fact that all questionnaires for each hunting club members were sent for distribution to one person, the president of the hunting club. If the president wasn't willing to distribute the questionnaires to other members, than no response from that hunting club was received. Personal data protection law prevented us to gain the personal contacts of each hunter. In order to improve sampling we asked the receiver (the president of the hunting club) to distribute questionnaires using the last birthday selection method. Since the questionnaires were sent close to Christmas holidays we took the opportunity to contact each hunting club to express holiday greetings and remind or thank them for the participation in the study.

This action was successfully completed according to the plan. The results of the action served several above mentioned purposes; the study was a chance for the public opinion to be included in wolf management and importantly contributed to the achievement of one of the main goals of the project – coexistence with humans.

### **Follow-up surveys on the public attitudes toward wolves**

**Summary:** *A follow-up survey revealed that generally, attitudes and knowledge levels about wolves have remained stable over the first half of the project implementation. Changes between years were measured on the level of populations and not within subjects. Socio-demographic characteristics between samples within interest groups varied little, although farmers in 2012 samples tended to be about two years older and more of them lived in the countryside.*

*The quantitative measure of 5% improvement of attitudes toward wolves was not reached in any of the studied groups. However, attitudes of hunters and the general public were mostly positive already*



*at the beginning of the project. Although attitudes toward wolves generally seem to have remained stable, we documented a change over the two years of the project implementation in beliefs about the extent of wolf caused damage and actual and acceptable wolf population size. Comparing a change in perceived wolf numbers to the change of acceptable wolf numbers revealed a depolarization between these two beliefs, as the difference between the belief about the existing wolf number and acceptable wolf number in Slovenia decreased in 2012. Such a change indicates a potential decrease in the conflict within interest groups originating from different wolf acceptance capacities. However, directions of change differed between groups: the median of the acceptable number of wolves within hunters lowered from 2010 to 2012, increased within farmers and remained the same within general public. An indicator of higher awareness about wolf conservation issue was also the increase in the belief that a higher number of wolves in Slovenia are needed for their long term conservation. Another indicator of reduced conflict was that more hunters and farmers in 2012 believed that wolf caused damage is decreasing.*

*Knowledge levels tested with the knowledge index didn't improve during the time of the project. The possible reasons are that hunters, farmers and the general public are not interested enough in the wolf biological facts or that the messages tested with knowledge items were not effectively communicated. There were also more missing answers in 2012 than in 2010, especially in the knowledge item where a negative change was measured within hunters and the general public (i.e., the item about the wolves' main food source), probably due to the increased length of the questionnaire in 2012. For the future, we recommend a more careful construction of knowledge items that would measure specifically the changes in perceived messages communicated within the project.*

*A quantitative measure of at least 10 % of wolf area residents remember hearing about the SloWolf project was highly exceeded. A large part of respondents in the 2012 survey, a half of the general public, almost 40 % of farmers and over 90 % of hunters, reported hearing about the SloWolf project, mainly from the media. These proportions rose significantly from 2010. Whether this accurately represents the population is a question in the case of hunters and general public, because people familiar with the project are more likely to have filled out a questionnaire. In the case of farmers, where interviews were conducted on nearly the whole selected sample, this estimate is probably closer to the population parameter. We did not measure, if the project image was positive or negative, however, a printed media content analysis showed that after the start of the SloWolf project, negative and misleading reporting decreased (Kastelic, 2013).*

The aim of this part of the action E.2 is to objectively evaluate the effectiveness of the public information and awareness campaigns. The same procedure as for the Action A.6 was used.

A follow-up survey on attitudes of hunters, farmers and the general public toward wolves and wolf management was completed in April 2013. Questionnaires for hunters and the general public were sent by mail to a sample of selected respondents (N= 3300). The response rates were 27 % of the sampled general public, 26 % of sampled hunters and 80 % of sampled farmers. Response rates for



farmers and hunters were lower compared to 2010, possibly due to the increased length of the questionnaire. The results were entered in a database that was merged with the database from 2010, analysed and compared.

**Table 1: Quantitative indicators to measure the effectiveness of the public information and awareness campaigns**

Description of indicators	Quantified measure
attitudes toward wolves of the inhabitants of wolf areas	statistically significant improvement of attitudes toward wolves (at least 5 % change)
knowledge about wolves of the inhabitants of wolf areas	statistically significant improvement of knowledge wolves (at least 5 % change)
% of the inhabitants of the wolf areas that have heard about the project	at least 10 % of the inhabitants to remember hearing about the project

**Included in the analysis:**

- Compared socio-demographic characteristics of the samples between years and between wolf presence areas (occasional and permanent wolf presence, Figure 1)
- Changes in general attitudes toward wolves
- Changes in perceived wolf numbers and acceptable wolf numbers
- Changes in knowledge
- Changes in perceived wolf damages
- Changes in attitudes toward complete wolf protection and toward wolf management
- Self-evaluated attitude change





Figure 1: The study area was divided into two areas of permanent (blue) and occasional (orange) wolf presence in Slovenia

### Socio-demographic characteristics:

There were no significant differences in the gender structure per interest group in the two areas of wolf presence in both years (Table 22, Appendix I). The samples of farmers and general public are biased toward men, but the sample of hunters is in accordance to the gender structure in the population, which includes around 1.5 % of females ("Podatki o stanju članstva med leti 2004 in 2009," ). There was a significant difference in mean age in the 2010 samples of farmers and general public and 2012 samples of hunters; however no difference in mean ages between wolf presence areas exceeded four years (Table 23, Appendix I). Age across all samples ranged from 18 to 91 and their means from 49 (SD= 14) to 58 (SD= 15). Farmers were in average the oldest, followed by the general public and hunters. There was a significant difference of 2.5 years between 2010 and 2012 in



mean farmers' age. Most of the residents reside in the countryside (Table 24, Appendix I) and have finished primary or secondary school (Table 25, Appendix I). There were no differences in these characteristics across areas in all interest groups. Between 11.2 % and 14.4 % of farmers also reported to be hunters and this was also the case in between 5.4 % and 7.9 % of the general public (Table 26, Appendix II). There was also a significant difference in the rate of sheep and goat farmers among hunters in the 2012 samples (Table 27, Appendix II), with more farmers among hunters residing in the area of permanent wolf presence. Analyses for differences between years of joined samples of permanent and occasional wolf presence revealed significant differences in mean age of farmers (Table 29, Appendix II), their place of residence (Table 30, Appendix II) and education structure (Table 31, Appendix II). The samples of hunters and general public were comparable in all other socio-demographic characteristics (i.e., gender, age, type of residence and education) (Table 28 to Table 31, Appendix II).

#### Changes in general attitudes toward wolves:

**Table 2: Rates of answers to the question “Which of the following best describes your feelings toward wolves?” separately for the three interest groups. Rates for each group are compared by year with the Pearson's chi square test with df=4 for each test.**

INTEREST GROUP		Completely against (%)	Against (%)	Neither in favour nor against %	Modrately in favour %	Completely in favour %	Pearson's Chi-square	p-value (2-sided)
FARMERS	2010, N=254	27	26	26	15	6	3.217	0.522
	2012, N=267	24	27	23	21	6		
HUNTERS	2010, N=399	5	13	10	41	31	2.196	0.700
	2012, N=322	6	11	10	44	30		
GENERAL PUBLIC	2010, N=570	8	14	15	38	25	2.600	0.627
	2012, N=504	6	16	14	37	27		

Generally, attitudes toward wolves measured with the question “Which of the following best describes your feelings toward wolves” on a 5-point Likert scale didn't change between 2010 and 2012 (Table 2). In both years, hunters were the most favourable with 72 % of sampled hunters in 2010 and 74 % of sampled hunters in 2012 expressing positive attitudes toward wolves. Positive attitudes prevailed also in general public (63 % in 2010 sample and 64 % in 2012 sample). On the other hand, farmers remain the most negatively oriented group with 53 % of sampled farmers in 2010 and 51 % in 2012 expressing negative attitudes.



## Changes in perceived and acceptable wolf numbers

The perceived number of wolves in Slovenia varied between 0 and 10 000 wolves in both years. However, the median of the perceived number of wolves (Table 3) shifted lower in 2012 in all three groups to a number that is closer to the one determined in the project (Action C.1) and communicated to the public (Action D.1). Less respondents in 2012 also believed that the wolf population in Slovenia is increasing (Table 5). This change in perceived wolf numbers indicates that this project result was effectively communicated to the public and interest groups.

**Table 3: The median for the opinion of number of wolves living in Slovenia as seen by the three interest groups and p-values of Mann-Whitney U test of independent samples.**

Interest group	2010		2012		P-value Mann-Whitney U test
	Median	N	Median	N	
Farmers	150	57	100	154	0.047*
Hunters	100	344	60	283	0.000**
General public	100	422	80	409	0.000**

\*significant difference in distribution at  $p < 0,05$

\*\*significant difference in distribution at  $p < 0,001$

On the other hand, the median of the acceptable number of wolves (Table 4) changed in different directions in the three studied groups: the median of the acceptable number of wolves within hunters lowered from 2010 to 2012, increased within farmers and remained the same within general public. However, comparing a change in perceived wolf numbers and the change of acceptable wolf numbers within groups shows a reduction of the divergence in 2012 between these two beliefs. This depolarisation potentially suggests a reduction in the conflict within interest groups originating from different wolf acceptance capacities. An indicator of higher awareness about wolf conservation issue was also the increase in the belief a higher number of wolves in Slovenia are needed for their long term conservation.

**Table 4: The median of acceptable number of wolves in Slovenia for the three interest groups and p-values of Mann-Whitney U test of independent samples.**

Interest group	2010		2012		P-value Mann-Whitney U test
	Median	N	Median	N	
Farmers	40	85	100	147	0.001*
Hunters	100	347	57	280	0.000**
General public	100	383	100	369	0.177

\*significant difference in distribution at  $p < 0,05$

\*\*significant difference in distribution at  $p < 0,001$

**Table 5: The rates of respondents answering the question »In your opinion, is the number of wolves in Slovenia: decreasing, stable or increasing?«. Differences between years are tested with the Pearson's chi squared test (df=2).**

Interest group	Year	Decreasing (%)	Stable (%)	Increasing (%)	Pearson's chi square	P (2-sided)
Farmers	2010, N=212	5.7	25.0	69.3	21.331	0.000**
	2012, N=225	15.1	36.0	48.9		
Hunters	2010, N=408	6.9	29.2	63.9	29.938	0.000**
	2012, N=326	16.2	38.4	45.3		
General public	2010, N=571	25.4	34.2	40.4	14.053	0.001*
	2012, N=512	34.7	34.1	31.2		

\*significant difference in distribution at  $p < 0.05$

\*\*significant difference in distribution at  $p < 0.001$

Another indicator of reduced conflict was that more hunters and farmers in 2012 believed that the wolf caused damage is decreasing (Table 6). The wolf caused damage trend from 1994 to 2013 reached its peak between 2007 and 2011 with between 408 and 575 reported damage cases and 217,338 euro and 346,029 euro of total paid compensation a year ("Strokovno mnenje za odstrel velikih zveri za obdobje 1.10.2012- 30.9.2013," 2013). Donations of electric fences within the SloWolf project on ten hot spots lowered the total damage compensations by about 100,000 euro a year (Action C.6).

**Table 6: The rates of respondents answering the question »Is the damage caused by wolves in Slovenia: increasing, decreasing or stable?«. Differences between years are tested with the Pearson's chi squared test (df=3).**

Interest group	Year	Increasing (%)	Decreasing (%)	Stable (%)	Not sure (%)	Pearson's chi square	P (2-sided)
Farmers	2010, N=253	51.4	9.9	1.2	37.5	9.034	0.029*
	2012, N=267	50.9	18.4	0.7	30.0		
Hunters	2010, N=408	64.7	22.1	3.7	9.6	15.209	0.002*
	2012, N=326	50.9	31.9	6.1	11.0		
General public	2010, N=571	44.3	7.4	21.9	26.4	0.935	0.817
	2012, N=512	41.4	7.8	22.9	27.9		

\*significant difference in distribution at  $p < 0.05$



**Table 7: The rates of respondents answering the question »In your opinion, is the number of wolves in Slovenia for their long term conservation: too small, enough or too many? «. Differences between years are tested with the Pearson's chi squared test (df=3).**

Interest group	Year	Too small (%)	Enoguh (%)	Too many (%)	Not sure (%)	Pearson's chi square	P (2-sided)
Farmers	2010, N=255	5.1	35.7	31.8	27.5	26.808	0.000**
	2012, N=267	10.5	48.7	14.6	26.2		
Hunters	2010, N=406	17.5	55.4	20.2	6.9	11.774	0.008*
	2012, N=326	24.5	57.7	14.1	3.7		
General public	2010, N=578	26.4	39.4	14.5	21.6	10.254	0.017*
	2012, N=515	31.8	38.3	14.0	15.9		

\*significant difference in distribution at  $p < 0.05$

\*\*significant difference in distribution at  $p < 0.001$

### Knowledge about wolves

Knowledge index was calculated as a sum of scores of correctly answered questions about wolf biology and conservation status and ranged between zero and eight scores. There was no difference in knowledge index between years in all three groups. Generally, hunters were more knowledgeable than general public and farmers (Table 8). When inspecting differences in individual knowledge items, most frequently the correct answer in all three groups was that wolves live in packs (Table 9) and in 2012 significantly more respondents from hunters and the general public answered this question correctly. The least frequently correct answer of hunters and the general public was that historical distribution of wolves covered the entire Slovenian territory. The least frequently correctly answered questions within farmers was the question about wolf hunting success, but the percent of correct answers increased in 2012. In 2012 significantly fewer respondents from hunters and general public correctly answered the question about wolves' main food source. However, the response rates for these knowledge items were lower in 2012, probably due to the increased length of the questionnaire and therefore the change in these knowledge items might not accurately reflect the change in the knowledge of the studied populations.

According to these results, the knowledge levels didn't improve during the time of the project as planned. The possible reasons are that the hunters, farmers and the general public are not interested enough about wolf biological fact or that the messages tested with knowledge items were not effectively communicated. We recommend a more careful construction of knowledge items for future surveys and a more carefully planned information campaign to target the tested beliefs.

**Table 8: Knowledge index median in the three interest groups and p-values of Mann-Whitney U test of independent samples**

Interest group	2010	2012	P-value Mann-Whitney U test
Farmers	4.0	4.0	0.102
Hunters	6.0	6.0	0.345
General public	5.0	5.0	0.551

\*significant difference in distribution at  $p < 0.05$

**Table 9: Rates of correctly answered questions about wolves that comprise the knowledge index separately for the three interest groups. Rates for each group are compared by year with the Pearson's chi square test with  $df=1$  for each test.**

Knowledge item	Interest group	Percent of correct answers 2010 (%)	Percent missing answers 2010 (%)	Percent of correct answers 2012 (%)	Percent missing answers 2012 (%)	Pearson's chi square	P-value (2-sided)
<i>Wolf body mass</i> <i>Rec2B3</i>	Farmers	39,9	0,8	47,9	0	3,390	0,066
	Hunters	58,6	1,0	63,4	1,8	1,720	0,190
	General public	48,4	2,7	46,1	4,0	0,567	0,452
<i>Wolf main food source</i> <i>Rec2B4</i>	Farmers	61,3	0,8	59,0	0,4	0,272	0,602
	Hunters	88,9	1,5	82,3	8,5	6,254	0,012**
	General public	73,0	1,5	63,0	8,6	12,147	0,000*
<i>Wolf hunting succes</i> <i>Rec2B5</i>	Farmers	16,9	0,4	30,3	0	12,903	0,000*
	Hunters	58,6	1,5	56,0	0,9	0,507	0,476
	General public	40,7	2,9	41,3	3,4	0,051	0,822
<i>Wolf social organization</i> <i>Rec2B6</i>	Farmers	73,2	0,4	73,3	0,4	0,000	0,984
	Hunters	86,0	1,5	96,0	8,2	19,834	0,000*
	General public	76,6	1,5	85,5	4,0	13,933	0,000*
<i>Arrival of wolves in Slovenia</i> <i>Rec2B7</i>	Farmers	62,7	0	59,9	0	0,437	0,508
	Hunters	84,8	1,0	84,1	4,3	0,072	0,789
	General public	76,8	1,5	77,0	3,2	0,010	0,922
<i>Historical distribution of wolves in Slovenia</i> <i>Rec2B8</i>	Farmers	33,7	0	39,0	0	1,539	0,215
	Hunters	37,6	1,2	38,4	1,5	0,049	0,825
	General public	35,9	1,4	34,4	1,1	0,266	0,606
<i>Reason for wolf decline in the past</i> <i>Rec2B9</i>	Farmers	44,7	0	47,7	0,4	0,484	0,487
	Hunters	81,8	1,2	76,9	6,1	2,572	0,109
	General public	66,6	2,2	61,7	4,8	2,775	0,096
<i>Wolf protection status in Slovenia</i> <i>Rec2B12</i>	Farmers	61,4	0,4	63,3	0	0,196	0,658
	Hunters	78,7	1,0	77,4	4,3	0,172	0,678
	General public	59,4	1,5	62,4	4,0	1,017	0,313

\*significant difference in distribution at  $p < 0,05$

\*\*significant difference in distribution at  $p < 0,001$



### The rate of the inhabitants in the wolf presence areas that have heard about the project

In 2010, 25 % of the sampled farmers, 83 % of hunters and 30 % of the general public reported to have heard about the SloWolf project (Table 10). In 2012, more respondents in all three groups reported their familiarity with the project. The rates were raised to 39 % in farmers, 94 % in hunters and 50 % in the general public sample. These rates are substantially higher than the foreseen 10 % of the inhabitants of the wolf areas, set as the quantitative indicator.

More detailed questions about respondents' familiarity with the project were added in the 2012 questionnaire. The most frequent information source for all three groups in 2012 were the media (Table 11), followed by personal communication.

**Table 10: The rates of respondents that reported hearing about the SloWolf project with the results of the Pearson's chi squared test of differences (df=1) between years.**

Interest group	Year	Heard about the SloWolf project (%)	Pearson's chi square	P (2-sided)
Farmers	2010, N=253	24.9	0.001	0.000**
	2012, N=256	38.9		
Hunters	2010, N=407	83.3	17.402	0.000**
	2012, N=322	93.5		
General public	2010, N=586	30.2	45.988	0.000**
	2012, N=509	50.3		

\*\*significant difference in distribution at  $p < 0.001$

**Table 11: Frequencies and rates of respondents reporting their information sources in 2012 about the SloWolf project.**

Interest group	Media		Personal communication		Participated in the project		Do not remember		Other	
	%	N	%	N	%	N	%	N	%	N
Farmers	26.2	70	6.0	16	2.2	6	2.7	1	3.4	9
Hunters	39.3	129	32.3	106	11.0	36	3.7	12	8.2	27
General public	36.1	190	16.8	66	1.5	8	3.2	17	12.5	66



## Evaluation of the public participation process

**Summary:** *In-depth interviews with participants and document analysis of the main documents, e.g. the wolf population management plan, suggest that focusing on the quality, rather than only on outcomes of the participation process is essential for a good perception of participation and thus improved wolf conservation. We found considerable evidence of learning through participation and increased social capital that positively influences the coexistence between wolves and humans in Slovenia. For a long lasting improvement of wolf conservation in Slovenia, we recommend continuation and institutionalisation of participation.*

To explore the role of public participation for improved wolf conservation, we additionally carried a qualitative evaluation of the public participation process in the SloWolf project. Research on public participation suggests that with carefully implemented public participation, solutions to wildlife related conflicts can be found and willingness to coexist with carnivores can increase (Jackson & Wangchuk, 2004), but if participation is not well planned, conflicts might even expand (Gerner, Heurich, Gunther, & Schraml, 2011; Lange & Hehl-Lange, 2011). Therefore, we were interested in what constitutes an effective public participation in wolf conservation in Slovenia and how can it enhance wolf conservation and management.

Evaluation of public participation can address different questions, such as the success of participation (whether the objectives were met), effectiveness of the process (what worked well and what not) and its impacts (on participants, quality of decisions, etc.) (Warburton, Wilson, & Rainbow, n.d.). Laurian & Shaw (2009) also identified multiple possible goals of participation for evaluation, ranging from process-based goals to outcome-based goals. In public participation, outcomes and process are often blurred (Innes & Booher, 1999). Therefore, this evaluation focuses on the participants satisfaction with the participation process. Focusing on the intermediate level criteria (Kleiman, et al., 2000) (i.e. the quality of the participation process) allows for the evaluation of the progress toward the ultimate project goal, which is to ensure long term conservation of wolves in Slovenia.

According to the theory of attitude change (Fisbein & Ajzen, 1975), active participation is potentially more effective in changing attitudes than passive exposure to information. Therefore, we sought to assess also the impact of public participation on participants' attitudes toward wolves, which should become more positive after being involved in the project.

The purpose of this research was to find out what constitutes a good public participation process for wolf conservation and management in Slovenia, as well as the extent to which the SloWolf project has met these criteria. Ultimately, we were interested in how the public involvement process could enhance the coexistence between wolves and humans in Slovenia and improve wolf conservation and management.



### *SloWolf public involvement actions*

One of the goals of the SloWolf project was to raise the acceptance of wolves by Slovene society. The project actions were designed to improve attitudes of the key interest groups toward wolves and wolf management. A short description of these actions follows.

#### **Development of the action plan for wolf population management (Action A.2)**

The goal of this action was the development of a Management Action Plan for the wolf population in Slovenia, as an operational document for a period of five years. The main objective of the action plan is to establish a system of wolf conservation management in Slovenia, thereby increasing the potential for long-term wolf conservation while minimizing the number of human – wolf conflicts.

The proposal of the action plan was designed through five facilitated workshops with the collaboration of 55 participants from 22 different organisations (Table 12). Invitations were sent to 26 organisations that were identified in a stakeholder analysis performed by the project team. Each workshop started with a series of presentations to provide necessary background for a common discussion. At the first workshop, participants worked within smaller groups to define the main challenges for wolf management in Slovenia. Identified challenges were then grouped into themes that became titles of chapters within the action plan. Each participant made a list of five priority themes which require the most attention. At the end of the first workshop, participants agreed on the content of introductory presentations for the next workshop. At the following two workshops, participants worked in groups to propose specific activities to resolve previously identified challenges. Those were finally presented, discussed and if necessary, adjusted within the whole group. The proposal of the action plan also specifies who is responsible for each activity, time frame for its implementation and the associated costs. During the time period of this study, the document was in the process of adoption by the government.

#### **Improvement of management of wild ungulate species (Action C.2)**

By the time of the interviews, three of five planned workshops for preparation of a proposal for management of wolf prey species were carried out. Improving wild ungulate management was an action designed to link hunting management of wolf prey species with wolf management to ensure a sufficient prey base for the wolf and to raise the acceptance of proposed management by interest groups. Hunters, foresters, biologists and agronomists were recognized as interest groups for this action, in which 48 participants from 8 different organisations participated. To ensure that the views from the whole wolf area were included, workshops were organized at different locations. Participation methods were similar as those described under Action A2.

#### **Involvement of hunters and volunteers in the wolf population monitoring activities (Action C.3)**

Involvement of hunters and volunteers in wolf population monitoring is a form of citizen science, which on one hand aids in large-scale data collection and on the other aims to strengthen interest in





wolf conservation through enhancing citizen trust in scientific information. By the end of 2012, after three years of the program, over 850 people provided their contact details for receiving information about volunteering. A total of 732 attendance signatures were collected at educational seminars. In reality, fewer people attended the seminars, since some attended the seminar more than once. A total of 190 volunteers were counted in wolf howling monitoring, ranging from 60 to 65 participants each year. Again, some of these volunteers were counted more than once if they attended multiple monitoring events. A total of 453 participants were counted in winter snow tracking monitoring, ranging from 37 to 134 per year.

#### **Training of agriculture advisory service in damage prevention measures (Action C.5)**

An educational seminar about damage prevention measures was organized for agriculture advisory service employees with the aim to enable employees to then disseminate this knowledge to the farmers. This is the action with the lowest participation level. Participants were given lectures and taken to the field to experience best practice examples of damage prevention; 12 agriculture advisors attended the seminar. The rest of participants were project staff, experts and interested public.

#### **Best practice demonstration of damage prevention measures at selected wolf damage hot-spots (Action C.6)**

18 sheep breeders and one cattle breeder participated in this action, with 10 receiving a donation of electric fencing and 12 a guarding dog. Farmers signed a contract about appropriate prevention measures and reported their effectiveness to the action coordinator, who frequently monitored the sites. Three of the farmers quit the program during the time of the project, either because they did not use the fence appropriately or because the dogs exhibited unwanted behaviour that was not possible to change.

#### *Data collection and analysis*

Data sources included 19 in semi-structured interviewees with a range of participants that were involved in different public involvement actions (Table 13) and key documents associated with the participation process (e.g. workshop reports, evaluation forms, Wolf Management Action Plan proposal, invitation letters, etc.).

Participants, ranging from experts (i.e., researcher, project coordinator), government representatives, and stakeholders (i.e., farmers, agriculture and farmers' association representatives, forester, hunters, volunteers, animal rights association representative) to representatives from Croatia (see Table 13), were interviewed between August 10 2013 and October 16 2012. The interviewees participated in one or more project actions. Six of them were females and thirteen males. The interviews lasted between 29 and 83 minutes. Interviewees were chosen on the basis of



preliminary discussion with project action coordinators or selected from lists of participants, with the aim to reach a wide range of participants sharing a stake in wolf management and conservation. Croatian representatives were involved in the Slovenian project to share their experience, since they completed a similar wolf conservation project before the SloWolf project and because Slovenia and Croatia share the same wolf population.

**Table 12: The number and types of participants by actions and the number of conducted interviews.**

Action	Involve- ment type	Title of the action	N of partici- pants	Type of participants	N of interviews
A2	FACILITATED WORKSHOPS	Elaboration of wolf population action plan	55	Decision makers	5
				Experts	2
				Animal rights associations	1
				Hunters	/
				Agriculture	3
				Foresters	1
				Croatian representatives	2
C2	FACILITATED WORKSHOPS	Improvement of management of wild ungulate species	48	Decision makers	1
				Experts	2
				Foresters	1
				Hunters	1
C3	CITIZEN SCIENCE	Involvement of hunters and volunteers in the wolf population monitoring activities	190/ 453/ 732*	Experts	1
				Hunters-volunteers	1
				Non-hunters volunteers	1
C5	EDUCATION	Training of agriculture advisory service in damage prevention measures	30	Experts	2
				Chamber of agriculture and forestry in Slovenia	1
				Union of sheep and goat farmers associations	1
				Agriculture advisors	1
C6	DONATION PROGRAM	Best practice demonstration of damage prevention measures at selected wolf damage hot-spots	19	Sheep and cattle breeders	2

\*A total of 732 attendance signatures were collected at educational seminars. In reality, fewer people attended the seminars, since some attended the seminar more than once. A total of 190 volunteers were counted in wolf howling monitoring, ranging from 60 to 65 participants each year. Again, some of these volunteers were counted more than once if they attended multiple monitoring events. A total of 453 participants were counted in winter snow tracking monitoring, ranging from 37 to 134 per year.

**Table 13: The structure of interviews by the actions in which respondents participated, gender and organization or occupation, which they represent (GO=government organization; E=expert; CRO=Representatives from Croatia; SH= stakeholder).**

ID	Organisation	Gender	A2	C2	C3	C5	C6
GO-N1	Slovenian environment agency	F	x				
E-1	Biotechnical faculty, researcher	M	x	x		x	
SH-AR	Animal rights association	F	x				
CRO-GO	State institute for nature protection	F	x				
SH-A1	Chamber of agriculture and forestry in Slovenia	M	x			x	
GO-A	Ministry of agriculture and the environment, agriculture sector	M	x				
GO-N2	Ministry of agriculture and the environment, nature sector	M	x				
CRO-E	Faculty of veterinary medicine, researcher	M	x				
SH-A2	Union of sheep and goat farmers associations	M	x			x	
SH-F	Slovenian forest service	M	x	x	x		
GO-N3	The institute of the Republic of Slovenia for nature conservation	M	x			x	
SH-A3	Sheep breeder	F, FAMILY					x
SH-V	Volunteer	M			x		
SH-HV	Hunter, volunteer	M			x		
SH-A4	Agriculture advisor	M				x	x
GO-N4	Ministry of agriculture and the environment, nature sector	F	x	x		x	
SH-H	Hunter	M		x			
SH-A5	Farmer	M	x				
E-2	Project coordinator	F	x	x	x	x	x

An interview schedule was designed based on Reed's (2008) criteria and the various participation opportunities within the project. Participants were asked about their perception on the importance of each criterion and to what extent those criteria were present in the participation process. At the end of each interview, participants were asked to share their own perspective on good public participation in wolf conservation and management and to address any issues that had been missed by the interview schedule.

Two forms of thematic analysis were used for qualitative analysis: theoretical, to test and evaluate the participation process with criteria developed by Reed (2008) and inductive, to explore participant's own views on this topic. Themes (see Table 14) were derived from Reed's (2008) criteria after initial coding of interviews and documents. This initial round of coding ensured patterns not related to Reed's criteria could also be identified.

**Table 14: Themes and questions derived from Reed's criteria as a guide for semi-structured interviews. The order of questions does not represent the order in which they were asked. Some questions were analysed with more than one criterion, but asked only once.**

Reed's criteria	Themes	Questions
<i>1. Stakeholder participation needs to be underpinned by a philosophy that emphasises empowerment, equity, trust and learning</i>		<ul style="list-style-type: none"> <li>Do you think your input will be/was incorporated into decisions about wolf conservation/ management?</li> <li>What outcomes do you expect by the end of the project?</li> <li>Tell me something about your engagement with the representatives of other interest groups in the project. Do you believe all views were equally accepted?</li> <li>Do you feel that your input wasn't respected despite of strong arguments? Please explain.</li> <li>How important do you think it is, that all views are equally represented?</li> </ul>
<i>2. Where relevant, stakeholder participation should be considered as early as possible and throughout the process</i>	<ul style="list-style-type: none"> <li><b>Early involvement</b></li> <li><b>Stakeholder's input</b></li> <li><b>Flexibility</b></li> </ul>	<ul style="list-style-type: none"> <li>How did your involvement in the SloWolf project start?</li> <li>When did it start- in the implementation or preparation phase of the project?</li> <li>In which actions of the SloWolf project did you participate?</li> <li>What was your overall input?</li> <li>Tell me about your involvement in the SloWolf project. Describe the process.</li> <li>How important do you think is early involvement in the process?</li> </ul>
<i>3. Relevant stakeholders need to be analysed and represented systematically</i>	<ul style="list-style-type: none"> <li><b>Relevant stakeholders</b></li> <li><b>Level of participation</b></li> </ul>	<ul style="list-style-type: none"> <li>Why do you think you were asked to be involved?</li> <li>Who do you think should be included in wolf conservation and management, how and why? Are there specific groups?</li> <li>How important do you think it is to include the general public and interest groups into wolf conservation and management?</li> </ul>
<i>4. Clear objectives for the participatory process need to be agreed among stakeholders at the outset</i>	<ul style="list-style-type: none"> <li><b>Clear goals and objectives</b></li> <li><b>Agreed objectives</b></li> </ul>	<ul style="list-style-type: none"> <li>Were the objectives of your contribution made clear to you?</li> <li>Did you feel that your positions were acknowledged in the process or did you have to negotiate them?</li> <li>Did you have the chance to express your concerns? Were they addressed appropriately?</li> <li>How important do you think it is that participants are familiar with project/action goals?</li> </ul>
<i>5. Methods should be selected and tailored to the decision-making context, considering the objectives, type of participants and appropriate level of engagement</i>	<ul style="list-style-type: none"> <li><b>Methods of involvement</b></li> <li><b>Satisfaction with the process</b></li> <li><b>Proposed changes</b></li> </ul>	<ul style="list-style-type: none"> <li>Were you satisfied with the process of your involvement in the SloWolf project? Please explain.</li> <li>What would you change about the process?</li> <li>What do you think about the organization of the meetings (time, place)?</li> <li>What do you like the most about the process?</li> </ul>

Reed's criteria	Themes	Questions
6. <i>Highly skilled facilitation is essential</i>	<ul style="list-style-type: none"> <li><b>Skilled facilitation</b></li> </ul>	<ul style="list-style-type: none"> <li>Do you remember the facilitator and his job?</li> <li>What were the qualities and weaknesses of the facilitator/ action coordinator?</li> <li>How important do you feel good facilitation is, when different interest groups are involved and why?</li> </ul>
7. <i>Local and scientific knowledge should be integrated</i>	<ul style="list-style-type: none"> <li><b>Learning</b></li> <li><b>Understandable material</b></li> </ul>	<ul style="list-style-type: none"> <li>Did your understanding of the wolf conservation/ management issue change during the process and how? How much did you learn during the process?</li> <li>Did you learn anything else than about wolves and wolf management?</li> <li>Was the material you received during the process understandable for you?</li> <li>How important is learning in the process?</li> </ul>
8. <i>Participation needs to be institutionalized</i>	<ul style="list-style-type: none"> <li><b>Institutionalization</b></li> <li><b>Continuation of participation</b></li> </ul>	<ul style="list-style-type: none"> <li>Do you believe you will continue to participate in issues related to wolf management and conservation? Please explain.</li> <li>What does your future participation depend on?</li> <li>How important do you think is continuation/ institutionalization of the participatory process in wolf conservation/management?</li> </ul>

### Results and discussion

Findings regarding the evaluation of the SloWolf involvement process are presented in Table 15 according to themes derived from Reed's criteria. Participants provided evidence for the presence or absence of each criterion, which is grouped as different concerns or reasons for satisfaction with the process. In cases where a criterion could not be evaluated with a concern or satisfaction due to lack of data or mixed results, comments are listed without a positive (+) or negative (-) sign. For example, for *CR2 timing*, the majority of participants only reported on timing of their involvement, but did not comment whether there are satisfied or dissatisfied with it.

The majority of interviewed participants of action A2 and C2 agreed that views were equally respected in the process, but some expressed the concern with the imbalanced representation of interest groups at workshops. A farmer commented on the inequality from the view of urban dominance in wolf management decision making that he felt through the project.

Empowerment can be measured on several levels, e.g. psychological, social, economic and political (Constantino, et al., 2012). Here, we sought to measure empowerment on an individual, psychological level. In the case of the donation program action, presence of empowerment was confirmed, if the farmer believed that the donated guarding dog is preventing wolf attacks on livestock, whereas in the A2 action plan, empowerment meant that the participant believed that his or her input will be incorporated in the action plan and that the plan will be actualized in practice. Regarding the action plan and the ungulate management proposal, participants mostly believed their input was correctly integrated in the document that is therefore more legitimate. However, there



were concerns related to the fact, that the documents were not enacted or that no feedback was received at the time of interviews.

Mostly, representatives of interest groups were involved at the implementation phase of the project, but did not express any concern related to early or ongoing involvement. Only one participant from the action A2 was not satisfied, because he did not receive any feedback about the progression of the action plan document development.

While some participants, mostly government representatives, believed that all relevant interest groups were involved at facilitated workshops in actions A2 and C2, there were also those, who identified some missing interest groups such as landowners, recreational land users and foreign researchers. Regarding the level of participation, almost all participants would like to be involved more intensively in wolf conservation, management or research. All interviewees, except SH-AR, confirmed that the objectives of participation were made clear to them. I found little evidence that these objectives were agreed upon, but also no concerns pertaining to this criterion.

Participants were mostly satisfied with the participation process, organisation of meetings, field work and the accessibility of advice in the case of livestock protection donations. However, some were not satisfied with the selection of time and place or organisation of the meetings. They provided also ideas for improvement in the process. Participants from the action A2, preparation of the action plan proposal, recommended a separate workshop for farmers only (SH-A1), ensuring more balanced representation of interest groups (GO-N1), including the voice of the general public from public opinion surveys (SH-AR), an uninvolved person as the workshop moderator (SH-AR), collecting individual ideas instead of group ideas (SH-A5) and preparing also an international action plan (CRO-GO, CRO-E). Volunteers from the action C3 proposed continuous wolf monitoring over longer periods (SH-HV) and communicating back research results, based on the data they helped to collect (SH-V). A farmer (SH-A3) involved in the protection measures donation program offered to present his experience to other farmers.

All participants, except SH-AR, were satisfied with either the workshop moderator or action coordinator and did not point out any negative characteristics.

Participants pointed out several types of mutual learning from the process that they see as beneficial. Regarding the information material received before or at the beginning of participation, most reported to be well informed, whereas SH-F wanted to be better informed. Mostly, participants expressed a wish to continue with their participation in the future. However, government representatives (GO-N2, CRO-GO) also expressed a concern that this may not be possible due to financial limitations. Thus, a commitment to institutionalization is uncertain.

**Table 15: Expressed satisfaction (+, green text) and concerns (-, red text) of participants on themes derived from Reed's criteria by each involvement action.**

	A2- action plan	C2- ungulate management	C3- citizen science	C5- education seminar	C6- best protection practice
CR1 equity	+ all views equally respected (GO-N2, SH-A1, GO-N4, CRO-GO, CRO-E, SH-H ) -Numbers of participants from different interest groups not balanced (GO-N1, SH-AR, GO-A, SH-F)	+ all views equally respected (GO-N4)	No evidence	No evidence	-urban dominance in decision making (SH-A3)
CR1 empowerment	+ input integrated into AP (GO-N2, SH-A1, SH-A5, GO-N4, GO-A, SH-F, CRO-GO, CRO-E, SH-H) + believing in legitimacy of the AP (GO-A, SH-F, SH-A5, GO-N4, GO-N3) - AP not enacted (GO-A, SH-A5) - no feed back (SH-AR, SH-A2) -financial limitations to fulfilling the AP (GO-N1, SH-A4, GO-N3)	+ believing in legitimacy of the proposal (GO-N4, SH-F) - the proposal not enacted (SH-F)	+ collected data contributing to research (SH-HV) -no feedback (SH-V)	No evidence	+ satisfied with receiving a guarding dog (SH-A3,SH-A4) - No evidence for effectiveness of the damage prevention method (SH-A3,SH-A4)
CR2 timing	Preparation phase (GO-N2, GO-A, CRO-GO, CRO-E, E-1, E-2 ) Invited at the implementation phase (GO-N1, SH-AR, SH-A5, GO-N3) Not invited (SH-A2) -No feedback (SH-A2)	+ Preparation phase (E-1, E-2) Implementation phase (SH-F, SH-H)	Preparation phase (E-1, E-2) Implementation phase (SH-V, SH-HV)	Preparation phase (E-1, E-2) Invited at implementation phase (SH-A4)	Preparation phase (E-1, E-2) Implementation phase (SH-A3, SH-A4)
CR3 stakeholders representation	+ all interest groups involved (GO-N2, GO-A, E-1, CRO-GO, GO-N3, GO-N4, SH-A2) -not enough landowners (SH-A1) -missing local residents (GO-N1) -missing independent researchers (SH-AR) -missing wildlife protection groups (SH-AR) -too many animal protection groups (SH-A2) -missing experts from agriculture (SH-A2) -missing researchers from Italy (SH-F) -missing recreational users (CRO-E)	+all interest groups involved (GO-N4) -not high enough representation of local hunters (SH-F)	+ accessible to the public (SH-HV) -not enough involvement of the youth (HV-V)	-foreign experience missing (SH-A2)	-not enough involvement of local residents (SH-A3)
CR3 participation level	+enough involvement (GO-A) +expert opinion more weight (SH-F, E-1) -different representatives from the same organisations attending the workshops (GO-N2) -interest groups should not have the right to decide for the whole nation (SH-AR)	-input of local hunters not enough considered (SH-F)	- a wish for higher involvement in field research (SH-V) -hunters not paid for their work (SH-H)	-not high enough response from agriculture advisors (SH-A1) -not enough integration of practical experience (evaluation forms)	-not enough cooperation on the local level (SH-A3)
CR4 clear objectives	+ yes (GO-N2, AP, GO-N1, SH-A5, GO-N4, GO-A, workshop report, SH-F, GO-N3, CRO-GO, CRO-E) -not clear (SH-AR)	+ yes (GO-N4, SH-H)	+yes (SH-HV, SH-V)	+yes (SH-A1, SH-A4, GO-N3)	+yes (SH-A3, SH-A4)



	A2- action plan	C2- ungulate management	C3- citizen science	C5- education seminar	C6- best protection practice
CR4 agreed objective	+ agreed presentation topics for next workshops (workshop report)	No evidence	No evidence	No evidence	+about the frequency of reporting (SH-A3)
CR5 satisfaction With participation methods	+appropriate and well preformed method (GO-N2, SH-A1, GO-N1, SH-A5, GO-N4, GO-A, evaluation forms, SH-F, GO-N3, CRO-GO, CRO-E) +well organized (GO-N2, GO-N1, GO-A, SH-F, GO-N3) -not appropriate method (SH-AR) -time and place not accessible to everyone (SH-AR, SH-A2)	+well organized (SH-H) +appropriate and well preformed method (SH-H, evaluation forms) -not enough time for formulating conclusions (GO-N4) -introductory lectures too long (SH-F)	+ well organized (SH-HV, SH-V) +several dates for preparatory lectures (SH-HV)	+place and time well chosen (GO-N3) +content and method positively evaluated (evaluation forms, GO-N3) -place and time not well chosen (SH-A1, SH-A2) -discussion missing (SH-A1)	+ advice always accessible (SH-A3, SH-A4)
CR6 facilitation	+skilled facilitation (GO-N2, GO-N1, SH-A5, SH-A2, CRO-GO, CRO-E, GO-A, SH-F, GO-N3) -the moderator allowed offensive behavior (SH-AR)	+skilled facilitation (SH-H)	+ reliable, well organized (SH-HV, SH-V)	+focused (GO-N3) + no negative critics (GO-N3)	+ kind, accessible (SH-A3, SH-A4) + no negative critics (SH-A3, SH-A4)
CR7 learning	+about wolf biology (GO-N2) +about the complexity of wolf management (GO-N2, SH-AR, CRO-E, GO-A, SH-F) +about other attitudes toward the wolf (GO-N1, CRO-E, SH-F, GO-N3) +about protection measures (SH-A5, GO-A) +about participation methods (GO-N2, GO-N4) -did not learn about alternatives to wolf culling (SH-AR)	+about wolf biology (SH-H) +about other attitudes toward the wolf (SH-H)	+ about wolf biology and research (SH-HV, SH-V) + about the complexity of wolf management (SH-V)	+ through discussions with participants (SH-A4) +lost fear of wolves through learning (SH-V)	+ about wolf behaviour (SH-A3) + about damage prevention methods (SH-A3, SH-A4)
CR7 understandable material	+ well informed (SH-AR, SH-A5, GO-A) -missing material before workshops (SH-F)	+ well informed (SH-H) -missing material before workshops (SH-F)	+ well informed (SH-HV)	+ Material and lectures positively evaluated (evaluation forms) + appropriate introductory lectures (SH-A1)	No evidence
CR8 continuation	+ wish to continue (GO-N2, SH-AR, SH-A5, CRO-GO, CRO-E, GO-A) -financial limitations (GO-N2, CRO-GO)	No evidence	+ wish to continue (SH-H)	+ wish to continue (SH-HV, SH-V)	+ wish to continue (SH-A3)

As a part of evaluation, participants were asked about their attitude change toward wolves. The majority of participants reported that their attitude toward the wolf remained the same as it was before their involvement of the project. None of them reported a negative attitude change, three



participants reported their attitudes became slightly more positive and two claimed they became strongly more positive toward the wolf. Although most of participants did not change their attitude toward the wolf, those who reported a positive attitude change, where involved in actions with a higher participation level, involved in more than one action or already held positive attitudes toward the wolf. While farmers, who were involved in best practice demonstration, did not change their initially negative attitude, they learned useful information about wolf behaviour and damage prevention measures that are necessary for improving their coexistence of wolves.

Even though we tested the same evaluation criteria on a variety of different involvement processes within the same project, our findings suggest that they are fundamental enough to be applied in different circumstances with slight modifications. All interviewed participants agreed on the importance of the criteria of empowerment, equity, early and inclusive involvement, clear objectives and appropriately selected methods, skilled facilitation, learning and institutionalisation of participation. However, their perception about the degree of the presence of those criteria in the project varied. The following themes occurred in discussions about participant's own views on what constitutes good participation for improved wolf management and conservation: systematic representation, respect, consensus building, and continuation, educating the youth and informing the public.

Learning through participation was found as the most important contribution to improved wolf conservation. As opposing views about wolf management are one of the major challenges for their conservation, social learning enhances the capacity to learn about the complexity of wolf management and enhances the information flow about possible solutions and about others' perspectives. The action that provided the most opportunity for social learning was the common preparation of a wolf management action plan, where the widest spectrum of interests was brought together. Interviewees expressed that they had learned about wolf biology, the complexity of wolf management, about the variety of perceptions about wolves, about damage protection measures and about participation methods. Also, in the quantitative study, learning was found as the most common reason for self-evaluated positive attitude change toward wolves. Although the majority of interviewed participants claimed their attitude toward wolves in the course of involvement in the project did not change, learning about the complexity of wolf management is an important step toward improving their long-term conservation.

Innes & Booher (1999) and Plummer & Armitage (2007) pointed out the importance of intangible outcomes and of public participation being integral to consensus building and adaptive co-management. Tangible outcomes can be easily recognized, for example, the creation of a wolf management action plan. Intangible outcomes are on the other hand less obvious, but no less important. In the case of the participatory production of a wolf management action plan, they refer, for instance, to enhanced legitimization for the enforcement of policies and actions. Even when a consensus building process does not produce agreement, the results of this study suggest that success of a participation process should be measured by learning about the problem, each other's



interests and the possibilities of working together to solve a joint problem. In this way, participants build on available social, intellectual and political capital, with possible consequences measured long after the process. However, outcomes and process are often blurred in participation (Innes & Booher, 1999; Plummer & Armitage, 2007). Even when a good public participation process has positive intangible effects on participants, if outcomes that are delayed or not reported back, this might degrade the perception of the quality of the process and lead to dissatisfaction. In Slovenian context, public participation in wolf conservation and management is a novel approach and it is therefore necessary to lay solid foundations for participation that should continue also after the end of the project. Continuation and institutionalisation of participation would be therefore needed to make a long lasting improvement of wolf conservation in Slovenia.

### ACTION C.1: Establishment of surveillance of wolf population conservation status

	EXPECTED RESULTS	OUTPUT INDICATORS
<p>Point 1</p> <p>Field-collected spatial and demographic parameters for surveillance of the wolf population</p>	<ul style="list-style-type: none"> <li>Established surveillance of reproductive success of wolves in Slovenia using howling surveys.</li> <li>Established surveillance of the number and spatial distribution of wolf packs and individual wolves in Slovenia using data from snow-tracking.</li> <li>Yearly surveillance session reports (3) – estimation of number, distribution and composition of wolf packs in pilot areas and presence of reproduction events.</li> <li>3 articles presenting results from surveillance actions in Slovenian hunting magazine “Lovec”</li> <li>Promotion of the species and the Life+ programme through direct involvement of hunters and public (volunteers) in the wolf surveillance effort and the feedback provided by the project team.</li> <li>Yearly surveillance session reports (3) – evaluation of the dietary needs of the wolves in Slovenia and their effects on prey populations (predation rates, species spectrum and social structure of the prey)</li> </ul>	<p>accuracy of the wolf population size estimate/ maximum error margin of <math>\pm 20\%</math></p>
<p>Point 2</p> <p>Examination and analysis of dead wolves</p>	<ul style="list-style-type: none"> <li>Examination of 36 wolf carcasses (number estimated on basis of average yearly wolf mortality), included in yearly surveillance session reports;</li> <li>Record and analysis of fitness/health status record and analysis of reproductive status and pregnancy rates of female animals,</li> <li>Record of food items found in digestive tracts.</li> </ul>	
<p>Point 3</p> <p>Conservation genetics status of the wolf population using non-invasive genetics</p>	<ul style="list-style-type: none"> <li>Established surveillance of the number and spatial distribution of wolf packs and individual wolves in Slovenia using non-invasive genetics.</li> <li>Approximately 330 non-invasive samples analysed per yearly sampling session.</li> <li>Established surveillance of reproductive success of wolves in Slovenia using non-invasive genetics.</li> <li>Three Yearly surveillance session reports within this project, with following results for each session: <ul style="list-style-type: none"> <li>An estimate of unrecorded wolf mortality in Slovenia,</li> <li>Estimate of population size,</li> <li>Estimate of the number of wolf packs,</li> <li>Estimate of the number of wolf litters,</li> <li>The number of detected individuals,</li> <li>Comparison with previous years, trends, management recommendations.</li> </ul> </li> <li>Established non-invasive genetic surveillance of damages attributed to wolves but caused by domestic dogs, corrections of the damage assessments.</li> <li>Established system for identification and surveillance of “problematic” wolf packs through non-invasive genetic sampling at damage cases and management recommendations.</li> <li>Produced database of individual genotypes of Slovenian wolves, enabling trans-boundary tracking of migrating/dispersing wolves.</li> <li>Promotion of the species and the Life+ programme through direct involvement of hunters and public (volunteers) in the wolf surveillance effort</li> </ul>	



	and the feedback provided by the project team (approximately 1000 hunters actively involved in opportunistic sampling, approximately 100 volunteers involved in intensive sampling through snow-tracking).	
Point 4  Surveillance of individual wolves using GPS-GSM telemetry	<ul style="list-style-type: none"> <li>• Precise movement and spatial use data for 8 wolves of both sexes. Approximately 8,000 – 10,000 GPS locations.</li> <li>• A habitat model for the wolf in Slovenia (digital map of suitable habitat for the wolf in Slovenia – required for Action plan revision – Action E.6).</li> <li>• Created maps showing spatial use and homerange size of wolves in Slovenia to be used as educational and promotional material and as basis for wolf management (Action A.2).</li> <li>• Finding of 100 – 150 prey animals as a direct result of near-real-time GPS surveillance data.</li> <li>• Precise understanding of events at damage cases caused by the monitored animals.</li> <li>• Corrected population size estimates, obtained by non-invasive genetics, with regard to spatial movements of wolves.</li> </ul>	
Point 5  Wolf Monitoring Portal	<ul style="list-style-type: none"> <li>• A database for collection and dissemination of knowledge about wolves and data about their presence, freely available to everyone through a GIS (mapping) web interface (with limitations regarding GPS telemetry data to ensure safety of monitored wolves).</li> <li>• Minimum 50 registered users.; Minimum 100 entries of signs of wolf presence.</li> </ul>	

**Action evaluation summary:** *In general the surveillance of wolf population conservation status, including all methodological approaches, was successfully established and accurate population size estimates with less than +/- 15% error margins were obtained. Three comprehensive yearly surveillance session reports were produced. After first two sessions, yearly surveillance results were presented in the national hunting magazine »Lovec«, however, the manuscript for the third article is currently submitted to the magazine. Generally, a telemetry surveillance of wolves proved to be very successful, since a high quality spatial data about wolves' movements and distribution of packs were obtained. Additionally, during different surveillance activities, large amount of non-invasive samples (scats) were collected that were genetically analysed as well as a large sample of prey remains and scats for nutrition-predation analyses were collected. With the use of standard field methods and complementary use of non-invasive genetic methods, we were able to obtain one of the best insights into wolf population status in Europe.*

We established a national surveillance system for conservation status of the wolf population. It includes governmental institutions concerned with nature protection, wildlife management and agriculture, as well as academic institutions and non-governmental organizations. The goal was to achieve synergy of these organisations and tap into the potential of an interdisciplinary approach.

All surveillance activities were organized into yearly surveillance sessions designed to include one wolf reproductive season. Sessions were set from July 1 of the first year until June 30 of the next year. Three yearly surveillance sessions were planned. (2010-2011, 2011-2012 and 2012-2013).



An effective surveillance of an elusive species like the wolf must include several different methodological approaches to obtain a realistic picture of the population conservation status needed for effective management. We divided the methods for assessment of wolf conservation status into four groups with regard to methodology, with one additional set of activities for organization and presentation of the collected data:

1. The first methodological group consists of methods for collection and analysis of data on spatial distribution, numbers, reproduction events/litters of wolf packs/wolves using wolf tracks (footprints, hair, faeces, urine, prey remains), sightings and howling tests. Particular field methods were gradually implemented and tested into yearly surveillance sessions and fully implemented in the third surveillance session.
2. In the second group we obtained fitness and demographic data from dead animals (shot wolves, traffic mortality, diseases, injuries etc.): morphology, biometrics, sex, age, physical (health) and reproductive status.
3. The third group were non-invasive genetic sampling/analyses methods (genetic data obtained from material left in the environment - faeces, hair, urine, saliva). These methods provided a very robust, unbiased data for surveillance of a wide range of population parameters important for determining its conservation genetics status.
4. The fourth set of methods were the methods within the framework of GPS-GSM telemetry, the modern state-of-the-art technology, exclusively developed for monitoring activity of highly mobile animals like wolves. Using this methodology we can get high quality data on movements and, indirectly, on other activities, e.g. predation patterns, social interactions and conflict events caused by the monitored animals/packs.
5. An open, Internet based informational infrastructure - Wolf Surveillance Portal for collection and dissemination of knowledge about the wolf population was developed to facilitate collection of data and dissemination of results to the wider public.

Point 1 (Field-collected spatial and demographic parameters for surveillance of the wolf population):

In three subsequent yearly sessions that took place at the end of August beginning of September 2010 to 2012 we performed the howling tests sessions. During three to six night sessions 1944 to 3297 series of simulated howling were performed in the project area. We got up to 13 responses of territorial wolves or pups, of which in five to seven packs we were able to confirm the presence of pups yearly (Figure 2).

Winter seminars for snow tracking were organized for volunteers in winters 2010/11, 11/12 and 12/13, and for hunters, 30 seminars were organized every January, where also results of previous years were presented. On 48 of 85 field days wolves were tracked in 224 tracking groups and altogether 78 urine and 96 scat genetic samples were collected, 12 prey remains were found. Overall



in 989 volunteer-days during all winter tracking sessions 229 km of forest roads and tracks was checked, and 171 km of wolf tracks were followed.

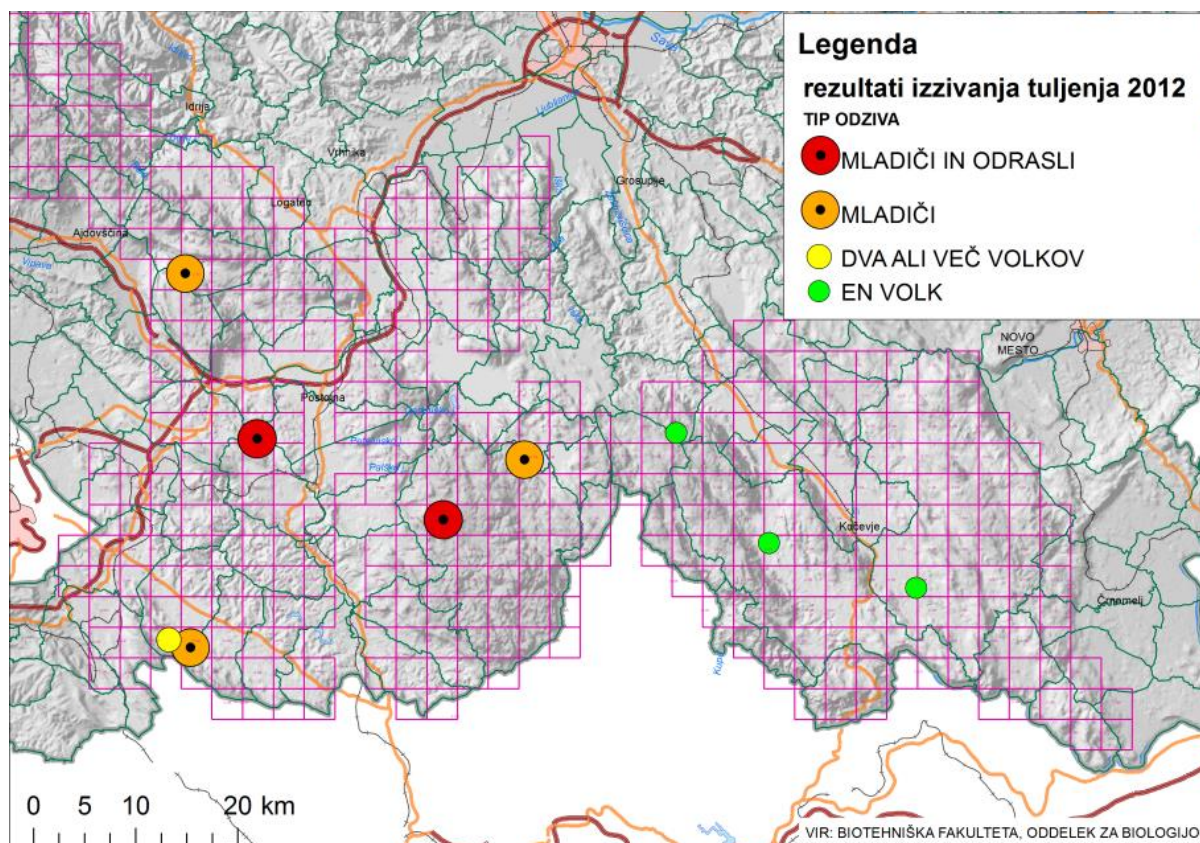


Figure 2: Example of wolf howling surveillance results in 2012. Red circles representing-pups and adult responses, orange circles-pups responses, yellow circles-two or more adult wolf responses, green circle-adult wolf responses.

#### Point 2: Examination and analysis of dead wolves:

It started in March 2010 and was finished as planned in June 2013. The Beneficiary estimates that 100% of the work has been done. Examination and analysis of dead wolves” was evaluation of wolf health status and their physical condition. Wolves are subjected to a number of injuries and various diseases due to their lifestyle. For the assessment of wolf general health status standard diagnostic techniques were applied and when indicated special diagnostic tools were used as well.

From 2010 to 2013 we have examined in total 35 animals (36 estimated) out of which 30 animals were harvested according to legal removals, 3 animals died as a consequence of car collision and 2 animals died due to other causes.

Using the results of our study the medical conditions of wolves can be roughly divided into five groups namely parasitic diseases, diseases of skin, inflammatory diseases, trauma and zoonoses.



Parasitological infestation of various grades was confirmed in all examined animals. In total nine types of pulmonary, intestinal and muscle parasites were recovered. Four animals were suffered severe skin lesions diagnosed as bacterial dermatitis and/or sarcoptic mange. Both conditions were painful and significantly affected animal's immunity subsequently. Three animals died due to massive internal bleeding and severe injuries of internal organs as a consequence of collision with a vehicle. One of these wolves was the GPS collared alpha female that was just few days prior to parturition having seven foetuses in the uterus. In one female wolf the cause of death could not be determined reliably due to incomplete sample. Visible damage on the carcass may result from bites, with additional investigations; we excluded mechanical damage or shot gun injury. The presence of *Trichinella* spp. larvae were confirmed in muscle tissue of four animals. Brain tissue of all wolves was negative for the presence of rabies virus and parvovirus antigen.

Necropsy, as the main method of investigation has revealed some of the characteristics of wolf's life from a medical point of view. These results can be important because they represent the first information about the medical condition of wolf population in this region. Detailed results are available on project website.

### Point 3: Conservation genetics status of the wolf population using non-invasive genetics

***Evaluation summary:*** Genetic study was a critical part of the SloWolf project, and an overwhelming success. While the main goal has been estimating wolf abundance, which was often a critical issue in wolf conservation in Slovenia, the project results go well beyond that goal. What we are showing in this evaluation are only summary of the findings; the study provided pack-level, or in many cases even individual-level understanding of our wolves. The project provided everything needed for continuous genetic monitoring of Slovenian wolves: a robust, objective estimate of the current status and the know-how to continue with this type of monitoring in the future.

### **Study design and study goals**

Genetic monitoring of wolves in Slovenia was designed as a "robust design" mark-recapture study with three annual sampling seasons. Within each sampling season we are assuming demographic closure of the population, which enables robust abundance estimates. Between seasons we assume the population to be demographically open (immigration/fecundity, emmigration/mortality), which enables us to estimate population dynamics.





## **Sample collection**

We have been collecting noninvasive samples of wolves for three yearly sampling sessions, over the entire wolf range in Slovenia. Noninvasive genetic samples are genetic material that is left in the environment by the animal. We collected wolf scats, urine in snow and saliva around bite wounds on killed natural prey or livestock. We use this material to extract DNA, which is then used to produce an individual-specific genotype of the animal, genetically "marking" the animal. We are then able to reliably recognize this animal when we meet its DNA again - when finding another sample, capture for telemetry, or upon mortality.

Several hundred people were involved in the sample collection: project staff, volunteers, Slovenian Forest Service employees, and hunters of the Slovenian Hunting Association. During the second season (January 2012) we organized 10 meetings with representatives of 108 hunting clubs from the wolf area (in partnership with the Slovenian Hunting Association), where we presented the results of the first season and asked for further cooperation. We organized similar meetings during the second season, in February 2013, where we presented population monitoring results with an emphasis on genetic monitoring.

We altogether analysed 1703 noninvasive samples, and obtained 517 useful wolf genotypes. Many samples were discarded because of low DNA quality, wrong species (dog, fox) or mixed samples (especially in saliva and urine samples).

## **DNA extraction and genotyping**

When working with noninvasive genetic samples that have typically very low quality and quantity of DNA, one must observe very strict contamination prevention protocols. All DNA extraction and PCR setup is done in a dedicated laboratory for noninvasive genetics, which is physically separated from the areas where tissue samples and PCR products are being handled. We have established a one-way flow of material between laboratories and strictly limited movement of personnel, ensuring that high-quantity DNA or PCR products never enter the critical parts of the analytical workflow. When laboratory is in use, all working surfaces are daily decontaminated by 10% bleach.

Genotyping of each analyzed sample was repeated at least twice and up to eight times, so that we could ensure 99% genotype accuracy of each sample. We use a panel of 8 microsatellite markers for individual ID and a sex-ID locus, which gives us enough resolution to reliably differentiate different individuals while providing some redundancy for non-amplifying markers and flexibility to include the possibility of a low-level genotyping error in individual identification.

We took the best sample of each identified individual and amplified them on additional 24 loci and another sex-ID locus to verify sex assignment, ending-up with a highly- informative panel of 32 polymorphic microsatellite markers and two sex-ID markers. With this amount of genetic data and

the high number of individual included in the study, we have one of the best, most information-rich databases about a wolf population genetics ever produced.

### Genetic diversity and probability of identical genotypes in different animals

We estimated the main genetic diversity parameters for each marker - observed and expected heterozygosity, allelic diversity and effective number of alleles. We also estimated the information content in each markers for the purposes of individual identification.

Genetic diversity data is provided in Table 16. The population's genetic diversity is relatively high ( $A=7.32$ ;  $H_e=0.70$ ). The marker system we used is more than sufficient for reliable individual identification in our study. Using this marker system (8 reliably genotypeable markers + Sex ID), the probability of two unrelated individuals having an identical genotype is 1:680 000 000, while the same probability for siblings is 1:1164. Whenever in doubt, (e.g. poor amplification on several loci) we expanded the analysis with additional five markers.

**Table 16: Genetic markers, genetic diversity and probability of identity analysis. A - allelic diversity; Ae - effective number of alleles; Ho - observed heterozygosity; He - expected heterozygosity; PI - probability of identity; Plsib - probability of identity for siblings; PI-c - cumulative PI for a multi-marker system; Plsib-c - cumulative Plsib for a multi-marker system.**

Marker	A	Ae	Ho	He	PI	Plsib	PI-c	Plsib-c
C20_253*	7	5,11	0,79	0,80	0,07	0,36	0,0669	0.3648
C09_250*	8	4,80	0,79	0,79	0,07	0,37	0,0050	0.1360
CPH5*	6	3,65	0,70	0,73	0,12	0,42	0,0006	0.0566
Cxx_121*	8	3,45	0,67	0,71	0,12	0,43	0,0001	0.0241
FH2010*	7	3,24	0,68	0,69	0,15	0,44	1,05E-05	0.0107
CPH12*	5	3,06	0,67	0,67	0,17	0,46	1,77E-06	0.0049
CPH9*	7	2,64	0,58	0,62	0,18	0,49	3,26E-07	0.0024
CPH7*	5	2,62	0,58	0,62	0,21	0,49	6,81E-08	0.0012
FH2137	12	8,59	0,88	0,88	0,02	0,31	1,68E-09	0.0004
AHT137	11	5,99	0,83	0,83	0,05	0,35	8,09E-11	0.0001
REN247M23	7	5,96	0,83	0,83	0,05	0,35	4,05E-12	4.39E-05
Cxx_123	8	5,67	0,81	0,82	0,05	0,35	2,18E-13	1.54E-05
CPH2	10	5,28	0,80	0,81	0,06	0,36	1,31E-14	5.55E-06
FH2004	11	4,42	0,62	0,77	0,08	0,38	1,06E-15	2.13E-06
FH2848	6	4,12	0,74	0,76	0,10	0,40	1,05E-16	8.44E-07
REN169D01	9	4,04	0,78	0,75	0,10	0,40	1,06E-17	3.37E-07
AHTk253	8	3,88	0,72	0,74	0,11	0,41	1,15E-18	1.37E-07
AHTh171	7	3,71	0,75	0,73	0,11	0,41	1,32E-19	5.67E-08
VWF	6	3,71	0,71	0,73	0,12	0,41	1,53E-20	2.35E-08
FH2088	8	3,60	0,71	0,72	0,12	0,42	1,85E-21	9.83E-09
INU030	6	3,57	0,71	0,72	0,12	0,42	2,22E-22	4.13E-09
CPH4	6	3,46	0,73	0,71	0,13	0,43	2,89E-23	1.77E-09
INU055	6	3,16	0,66	0,68	0,15	0,44	4,22E-24	7.85E-10
INRA21	6	2,98	0,62	0,66	0,17	0,46	7,32E-25	3.62E-10
CPH22	4	2,89	0,60	0,65	0,18	0,47	1,35E-25	1.70E-10
REN54P11	6	2,72	0,64	0,63	0,17	0,48	2,26E-26	8.09E-11
REN169O18	9	2,72	0,58	0,63	0,17	0,48	3,83E-27	3.85E-11
FH2054	7	2,60	0,65	0,62	0,18	0,49	6,95E-28	1.88E-11



Marker	A	Ae	Ho	He	PI	PIsib	PI-c	PIsib-c
REN162C04	8	2,22	0,54	0,55	0,25	0,54	1,70E-28	1.01E-11
CPH6	9	2,06	0,50	0,52	0,26	0,56	4,51E-29	5.64E-12
FH2096	4	1,70	0,36	0,41	0,40	0,64	1,79E-29	3.63E-12
<b>Average</b>	<b>7,32</b>	<b>3,79</b>	<b>0,68</b>	<b>0,70</b>		<b>Individual ID:</b>	<b>6,81E-08</b>	<b>0,0012</b>

\* Markers used for individual ID

## Population abundance estimates

Even through high-intensity sampling we can't expect to obtain a genotype of every last individual. For this reason we obtained the final wolf abundance estimate using mark-recapture modelling, to enable an estimate of the number of animals that our sampling "missed". We used various methodological approaches - some modern models (Capwire, Huggins, Huggins Heterogeneity), as well as some "classic" (Mh-Chao, Jackknife). We prioritized the models robust to capture heterogeneity, which can be expected considering the characteristics of the species and the study area. All methods provided very similar results, and we used the Capwire model for the final estimates since it is very robust, fits well with our data collection process and provides narrow confidence intervals.

We estimated maximum abundance for each season, but then used other data (mortality, parentage) to estimate the derived within-season estimate (minimum) for population dynamics. The maximum estimate that includes all fecundity and no mortality is provided as "October" estimate, and the minimum estimate before reproduction but after mortality as "March" estimate. Through networking with Croatian colleagues (dr. Josip Kusak, dr. Đuro Huber) we obtained also samples from the area in Croatia covered by transboundary packs, which improved the total estimates considerably.

The "October 2010" estimate for the first season (maximum number - after reproduction, before mortality) for the wolves in Slovenia and the part of Gorski Kotar (Croatia) with transboundary packs is 47 wolves, with 95% confidence interval (CI) 46 to 51. Considering the locations of samples of individual animals and pedigree reconstructions, we estimate that 19 of these wolves resided in the transboundary packs. To obtain an estimate only for Slovenia, which is required for management purposes, we counted 1/2 of these wolves as Slovenian and 1/2 as Croatian.

In this manner we estimate that in October 2010 there were 39 (34-42 95% CI) wolves in Slovenia. Similarly, we estimated for the second season (October 2011) that there were 51 (49-54; 95%CI) animals in the entire study area, and 40 (38-43; 95% CI) animals in Slovenia alone. For the third season (October 2012) we estimate 54 wolves in the entire study area (53-62; 95% CI), and 46 (45-55; 95% CI) only for Slovenia.

During the third season we obtained only a few samples from Croatia, which and the total abundance was probably underestimated. This is also indicated by the data on missing and newly detected animals, Figure 3.



We produced a robust, objective abundance estimate for wolves in Slovenia. The abundance is lower than what has been estimated before project SloWolf. However, the abundance remained nearly identical through all three years of intensive monitoring, indicating numerical stability of this part of the Dinaric wolf population.

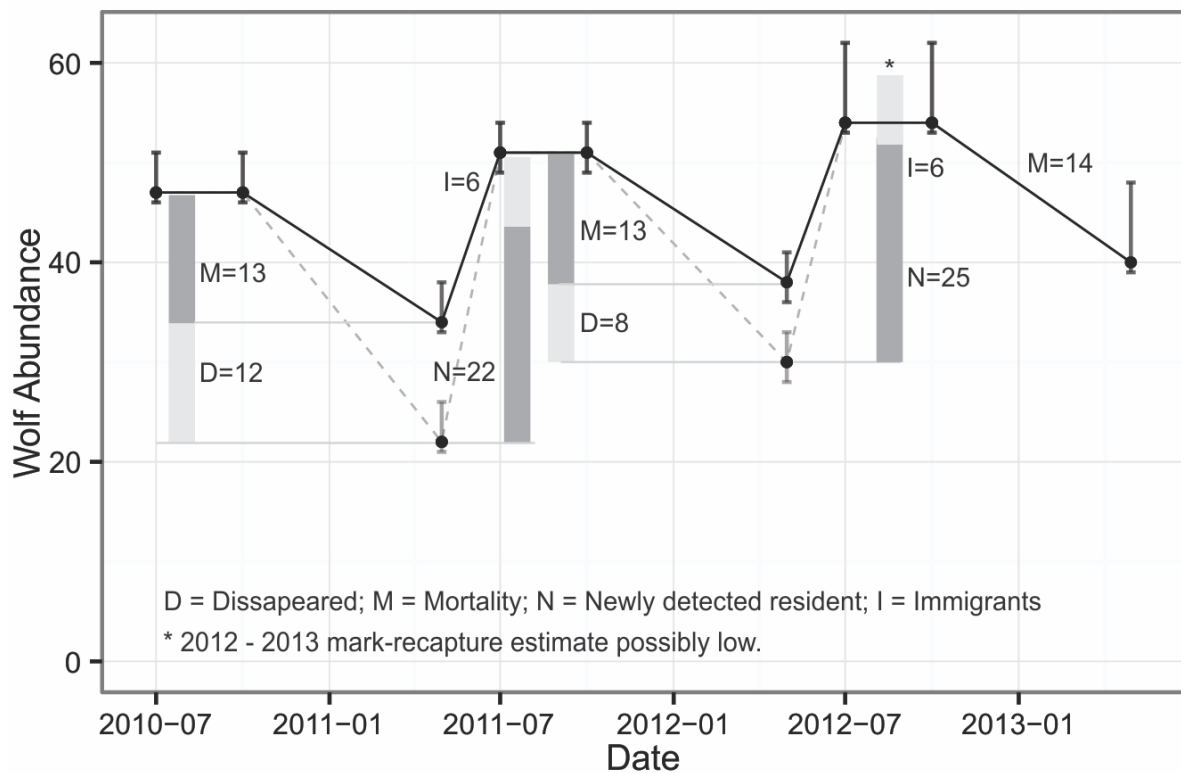
### **Pedigree reconstruction, estimates of population dynamics parameters and connectivity along Dinaric mountain range**

We determined pedigrees using a parentage/sibship analysis with the Bayesian method implemented in program COLONY for simultaneous sibship and parentage reconstruction. The program also allows for genotyping errors.

We used the results to determine social structure and pack dynamics, estimate reproduction and immigration (we can differentiate wolves born in the study area from immigrants), and to estimate undetected mortality/emigration. Due to computing intensity of the task we used a high-power computer of the Faculty for Machine Engineering, University of Ljubljana. The analysis was run in 10 parallel Markov chains, and the results were checked for consistency. Alignment with real-life data when pedigrees were known was also checked.

We were able to also include the genotypes of 245 wolves from Croatia, provided by our Croatian colleagues (dr. Josip Kusak, dr. Đuro Huber), and analysed the results in a GIS to understand connectivity of our wolf population in a spatial sense.

Pedigree reconstructions obtained with different Markov chains with different parameters / starting points provided nearly identical results. The estimated population dynamics is shown in Figure 3.



**Figure 3: Wolf abundance estimates for the entire study area (Slovenia + transboundary packs in Gorski Kotar, Croatia).** Annual fluctuations have been calculated by subtracting detected mortality (solid line) or "missing" wolves, not detected in the following season (dashed line), respectively. Since only one wolf missed in the second season reappeared in the third, we can reasonably assume that the majority of "missing" wolves either died or emigrated from the area. We used pedigree reconstruction to differentiate between resident wolves and their offspring, and wolves that recently immigrated in the area.

About 38% of wolves in Slovenia live in transboundary packs. Every year approximately 56% of new wolves (two-season average) appear in the area: 45% through reproduction in resident packs, and 11% through immigration. Additional to the detected mortality, which was on average 13.3 individuals (~26%) per year for the three-year monitoring period (for the entire area, Slovenia + transboundary pack areas in Croatia), wolves "disappear" from the area through emigration and undetected mortality. On average 10 wolves (~21%) went missing in each of the two seasons when this estimate was possible, which included 3.5 reproductive wolves (~26%). Each year also 1-2 reproductive wolves (~8.5%) died. This makes the annual removal of reproductive wolves (death or emigration caused by death of the wolf's partner) on average ~29%.

The results show that while the abundance fluctuates considerably at the annual scale, it seems very stable from year to year. This is expected according to the species biology, where high (and frequently undetected) mortality follows dispersion of young animals, while survival of reproductive wolves is high. However, the possibility of poaching should not be discounted, since it is certainly present in the area, but very hard to quantify with the current data. Wolves on the other hand have a very high reproductive potential to rapidly compensate for the losses.

More important than total mortality is disappearance of reproductive wolves, which can lead to local extinctions in a certain area. Although it seems that such "holes" are filled rapidly, we were able to witness a local extinction at the area of Menišija (south of Ljubljana) in 2011-2012 season. This shows that extreme caution is warranted in any management intervention since any mortality in the low abundance we have can rapidly cause a temporary local extinction.

### Geneflow along Dinaric mountains

The pedigree analysis provided us with an unprecedented insight into geneflow along the Dinaric Mountains (Figure 4). We can see that spatial fragmentation is not an issue for this species, and that the intensity of geneflow is high.

Sampling intensity in Croatia is much lower than in Slovenia, and spread-out over a long time period (1995 - present). Nevertheless we detected a considerable number of family relations, which indicates a constant movement of animals in both directions. This additionally stresses the need in transboundary collaboration and population-level management as the Dinaric countries actually share a single, well-connected population.

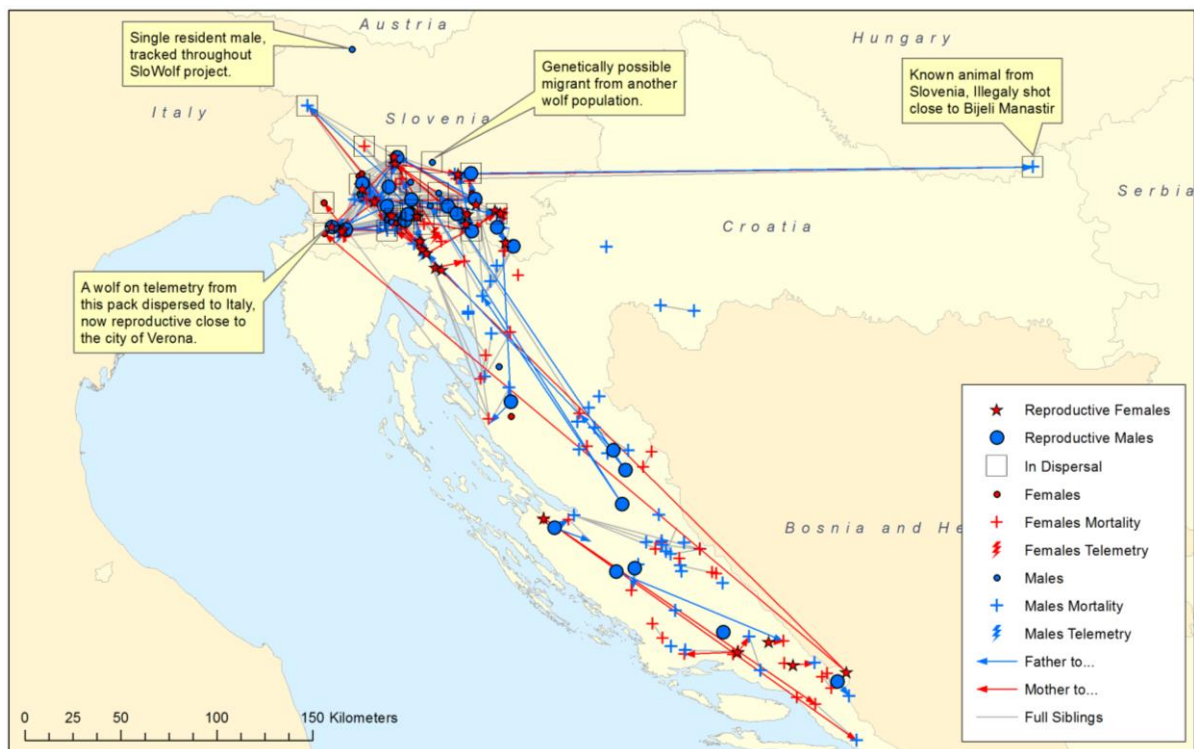


Figure 4: Geneflow between wolves in Dinaric Mountains. We can observe very long dispersals (e.g. the wolf in the SE was actually tracked in its birth pack in Slovenia prior to dispersal) and high connectivity.



### **Detection of wolf-dog hybrids and analysis of wolf-dog hybridization in our landscapes**

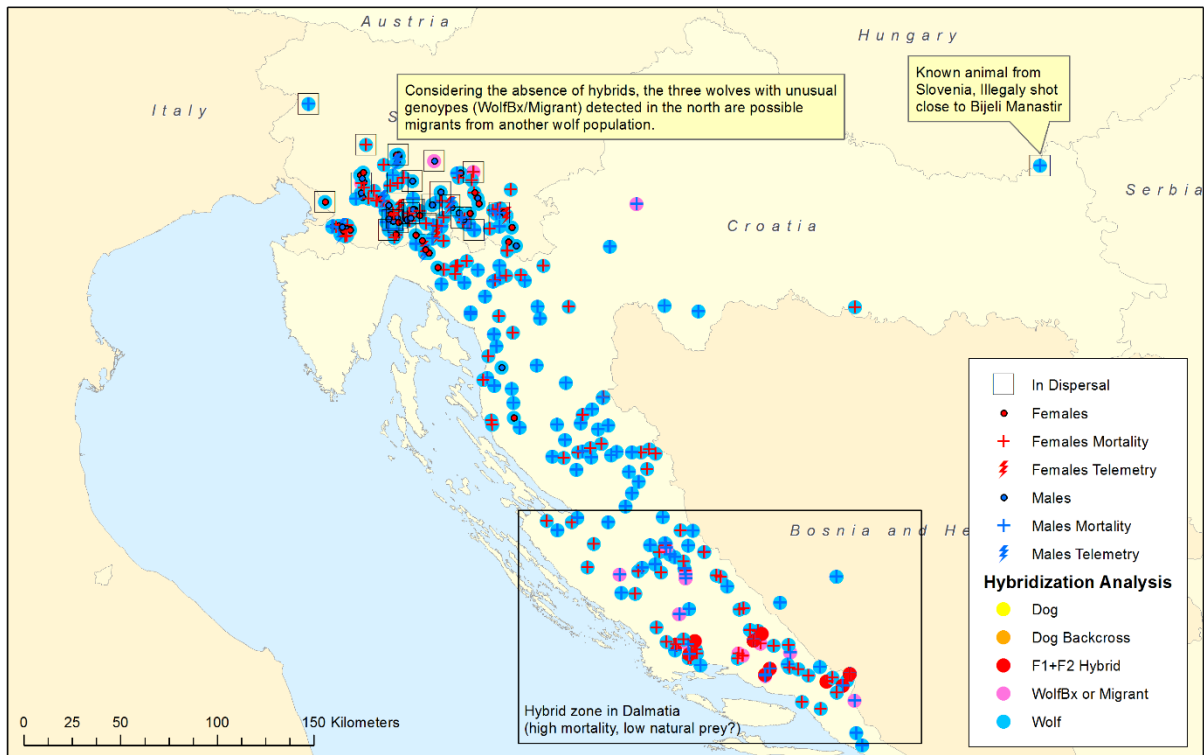
Wolf and dog are a closely related species, with hybridization between them frequently being recognized as a very important threat for wolf conservation. We genotyped 54 reference dogs and 369 wolves, presumed wolves and hybrids. We obtained genotypes of 245 individuals from Croatia through networking with Veterinary faculty of University of Zagreb (dr. Josip Kusak, dr. Đuro Huber).

We estimated hybridization using Bayesian clustering algorithm implemented in program "STRUCTURE". We used program "HybridLab" to simulate hybridization of reference dogs and reference wolves to obtain thresholds for determination of pure wolves, pure dogs, F1+F2 hybrids, and wolf/dog backcrosses. Besides the Dinaric wolves we also included samples of two wolves from Mongolia and one wolf from captivity of unknown origin to get an idea how an immigrant from a different population wolf be classified. We analysed the result in a geographic information system (GIS) to understand the wolf-dog hybridization in a spatial context.

The analysis provided a clear differentiation between wolves and dogs, and also a reliable detection of F1 and F2 hybrids. We didn't detect any dog - hybrid backcrosses, but we observed that wolves from other populations can be detected as pure wolf - hybrid backcrosses. The results are presented in Figure 5.

We didn't detect any wolf-dog hybridization in Slovenia. We did detect 3 animals (2 in Slovenia, 1 south of Zagreb in Croatia) in the northern Dinaric Mountains classified as possible wolf-hybrid backcrosses. The same result was observed for the three individuals originating from other wolf populations we included in the analysis, and considering the complete lack of detected hybrids outside Dalmatia it would seem that immigration from another wolf population (or escape of captive animals) is the most likely explanation. These hypothesis remains to be confirmed through collaboration with other laboratories.

Wolf - dog hybridization is a considerable problem in Dalmatia. Ecological circumstances there are considerably different than in the rest of the area, with very low forest cover and practically zero natural prey. The wolves appeared there during 1990s. They feed mainly on livestock, causing considerable damages and very low tolerance among local people. They are often shot on sight, with poachers frequently hanging the carcass on a visible place (e.g. a traffic sign). This high mortality and high contact with humans create ideal conditions for hybridization, but the exact drivers of the process still remain to be studied.



**Figure 5: Analysis of wolf - dog hybridization in the NW Dinaric Mountains. The absence of F1 and F2 hybrids in the north indicates that the three animals with a different genotype (wolf-hybrid backcross) are likely immigrants from another wolf population or animals escaped from captivity. There is no hybridization in the north, however this problem seems quite urgent in southern Croatia in Dalmatia.**

#### Point 4: Surveillance of individual wolves using GPS-GSM telemetry

During the project we captured 12 wolves. Seven of them were equipped with GPS/GSM collars and monitored with telemetry. The other five wolves were too young and we released them without collaring in order to avoid any problems with the collar during their growth. Among the seven collared wolves there were four males and three females, including two breeding females (Table 17). Although eight wolves were planned to be equipped with GPS collars, the realized seven wolves is a great success for telemetry studies of elusive animals like wolves.



**Table 17: Information about captured and collared wolves within the project. Age and weight measurements refer to the time of capture.**

WOLF	SEX	AGE	WEIGHT	PACK	POSITION IN THE PACK
BRIN	male	3 years	38 kg	Slavnik	subordinate male
VOJKO	male	5 years	40 kg	Vremščica-Nanos	subordinate male
SLAVC	male	2 years	40 kg	Slavnik	subordinate male, later dispersed and became alpha male in a new pack
LUKA	male	1 year	26 kg	Gotenica	subordinate male
TONKA	female	6 years	33 kg	Vremščica-Nanos	breeding alpha female
TIA	female	2 years	30 kg	Rog	subordinate female
JASNA	female	4 years	35 kg	Gotenica	breeding alpha female

#### *Destinies and success of obtaining spatial use data of collared wolves*

Although collars were scheduled to last for 58 weeks (406 days), the average monitoring time was 204 days (Table 18). This shorter monitoring time was due to mortality and/or lost signals of monitored wolves. Two of them were legally shot, for one we lost GPS and VHF signal and was supposed to be dead/killed, two were hit by car, but one probably survived the accident. One wolf dispersed to Italy and there survived until the drop-off mechanism of the collar activated and in 2013 established new reproductive pack with a territory in Lessinia Natural Park, Italy. One alpha female wolf was still being monitored during the time of preparation of this report (25.3.2014).

**Table 18: Fates of collared wolves and time of monitoring.**

WOLF	DATE OF CAPTURE	DESTINY	DURATION OF MONITORING
BRIN	13.4.2010	20.10.2010 legally shot	190 days
VOJKO	6.5.2011	26.9.2011 signal lost, probable poaching	143 days
SLAVC	17.7.2011	emigration to Italy in December 2011; 27.8.2012 successful drop-off activation; survived till 2014	407 days
LUKA	27.8.2011	15.5.2012 signal lost (car collision, probably still alive)	262 days
TONKA	18.5.2012	18.9.2012 collar lost (died in vehicle collision 10.6.2013)	123 days
TIA	5.7.2012	22.9.2012 legally shot	79 days
JASNA	15.8.2013	collar still active (on 25.3.2014)	223 days

The first wolf collared in the project in 2010 was a subordinate male named “Brin”. He was a member of his natal transboundary pack “Slavnik” and he stayed with this pack until being legally shot six months after collaring.



In 2011 three wolves were equipped with collars. Subordinate male named “Vojko” was member of his natal pack “Vremščica-Nanos”. We lost his signal after three and a half months inside his home range. Since GSM and VHF signals were lost simultaneously, although they have separate batteries and according to the informal information we received, we suspect that he was illegally killed and his collar destroyed.

Subordinate male named “Slavc” was in the beginning of his monitoring member of his natal pack “Slavnik”. In December 2011, five months after collaring, he left his natal pack and dispersed. During dispersal he crossed entire Slovenia, large part of Austria and the Italian Alps before settling in the Lessinia Regional Park in Italy, where he, together with a female from Italian population named “Juliette”, established the first wolf pack in that region. Dispersal lasted 100 days during which this wolf overcame several anthropogenic and natural barriers such as highways, railways, urbanized and cultivated areas, river dams, large rivers and mountain ridges (Figure 6). The total consecutive straight line distance between his locations was 1176 km and the straight line distance between natal and new home range approximately 200 km. We monitored Slavc with telemetry until 27<sup>th</sup> August 2012 when drop-off system on his collar activated as scheduled and we were able to retrieve the collar. A manager from Lessinia Natural Park informed us that currently “Slavc” is still alive and in 2013 first litter was born to the newly established pair. Thus this is the first recorded case of reproduction between wolves from Italian peninsula and Dinaric-Balkan populations. Due to great distance travelled and first recorded re-colonization of this part of the Alps by the wolves the monitoring of “Slavc” received considerable attention by the public and media. Monitoring of its dispersal also led to tight collaboration among wolf researchers in Slovenia, Austria and Italy and improved the networking among institutions of these three countries.

**In total we obtained 10009 (8552 successful) GPS locations from collared wolves as planned (cca. 8000-10000 fixes), on 8000-10000 fixes), on average 1221 locations per wolf. The average GPS fix success rate was 85% with a range from 76 to 96% for each collar. The average home range size of wolves in Slovenia estimated with 100% estimated with 100% minimal convex polygons was 403 km<sup>2</sup> with a range 259–560 km<sup>2</sup> (**

Table 19, Figure 7).

It has to be noted that several wolves have been monitored only for a few months, thus the annual home range sizes would likely be larger. Nevertheless, high sampling density and accuracy of the GPS locations gave us a good understanding of home range sizes and movements of wolves in Slovenia, which is comparable with results from other regions with similar environmental conditions.

Large number of GPS telemetry data together with other data on signs of wolves’ presence (non-invasive genetic samples; urine, scats, damage cases on livestock) enabled us to build a habitat suitability model for wolves in Slovenia (part of Revised Action plan; Action E.6, Yearly report).

**Table 19: Telemetry data collected and home range sizes of collared wolves (estimated with 100% convex polygons).**

WOLF	DURATION OF MONITORING	SUCCESSFUL GPS LOCATIONS	GPS FIX ATTEMPTS	GPS FIX SUCCESS RATE	HOME RANGE SIZE
BRIN	190 days	1323	1384	96%	422 km <sup>2</sup>
VOJKO	143 days	922	1063	87%	550 km <sup>2</sup>
SLAVC	407 days	2445	2793	88%	442 km <sup>2</sup>
LUKA	262 days	1375	1674	82%	560 km <sup>2</sup>
TONKA	123 days	701	918	76%	266 km <sup>2</sup>
TIA	79 days	447	545	82%	259 km <sup>2</sup>
JASNA	108 days	647	768	84%	320 km <sup>2</sup>
<b>TOTAL</b>	<b>1427 days</b>	<b>8552</b>	<b>10009</b>		
<b>AVERAGE</b>	<b>204 days</b>	<b>1221</b>	<b>1430</b>	<b>85%</b>	<b>403 km<sup>2</sup></b>

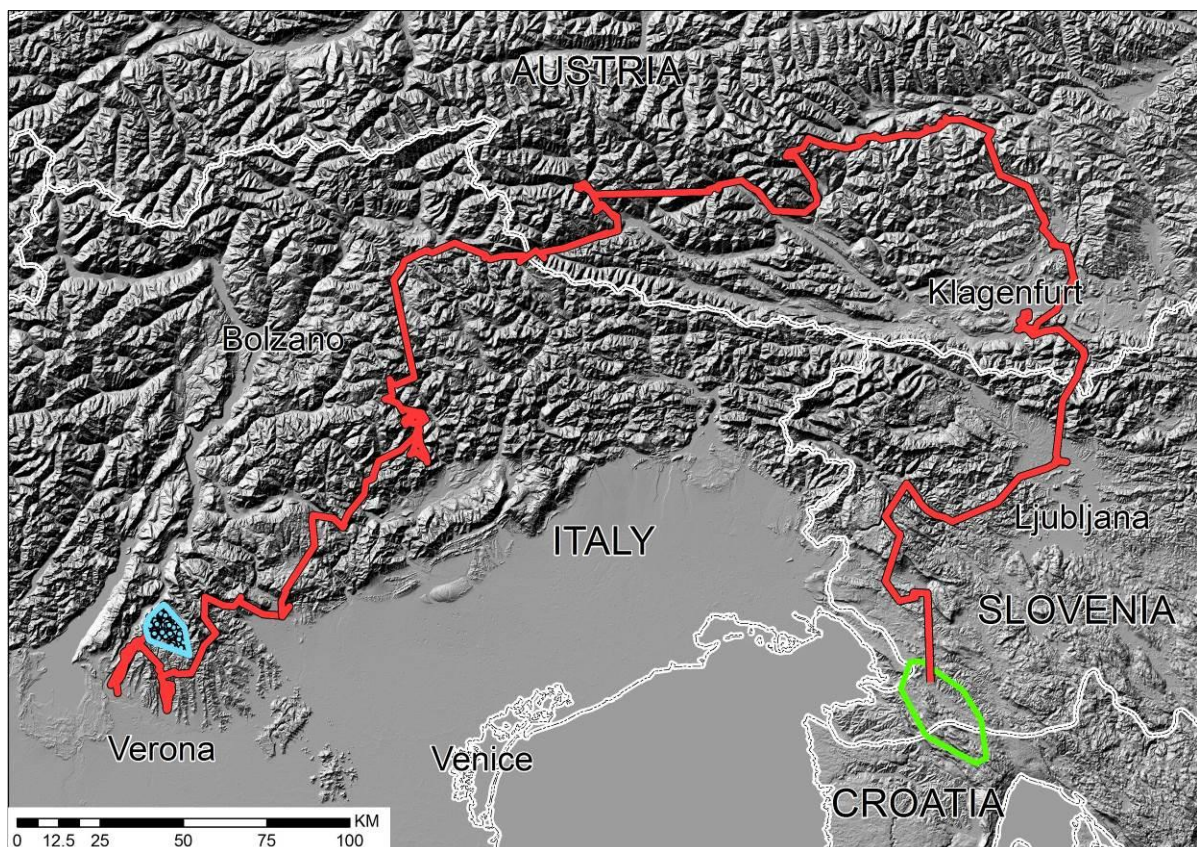




Figure 6: We obtained 2445 successful GPS locations from collar of male “Slavc”. His home range while staying with the natal pack “Slavnik” measured 442 km<sup>2</sup> (green). During his dispersal he walked over 1000 km (red). His home-range size after he settled down in Lessinia was estimated to 117 km<sup>2</sup> (blue).

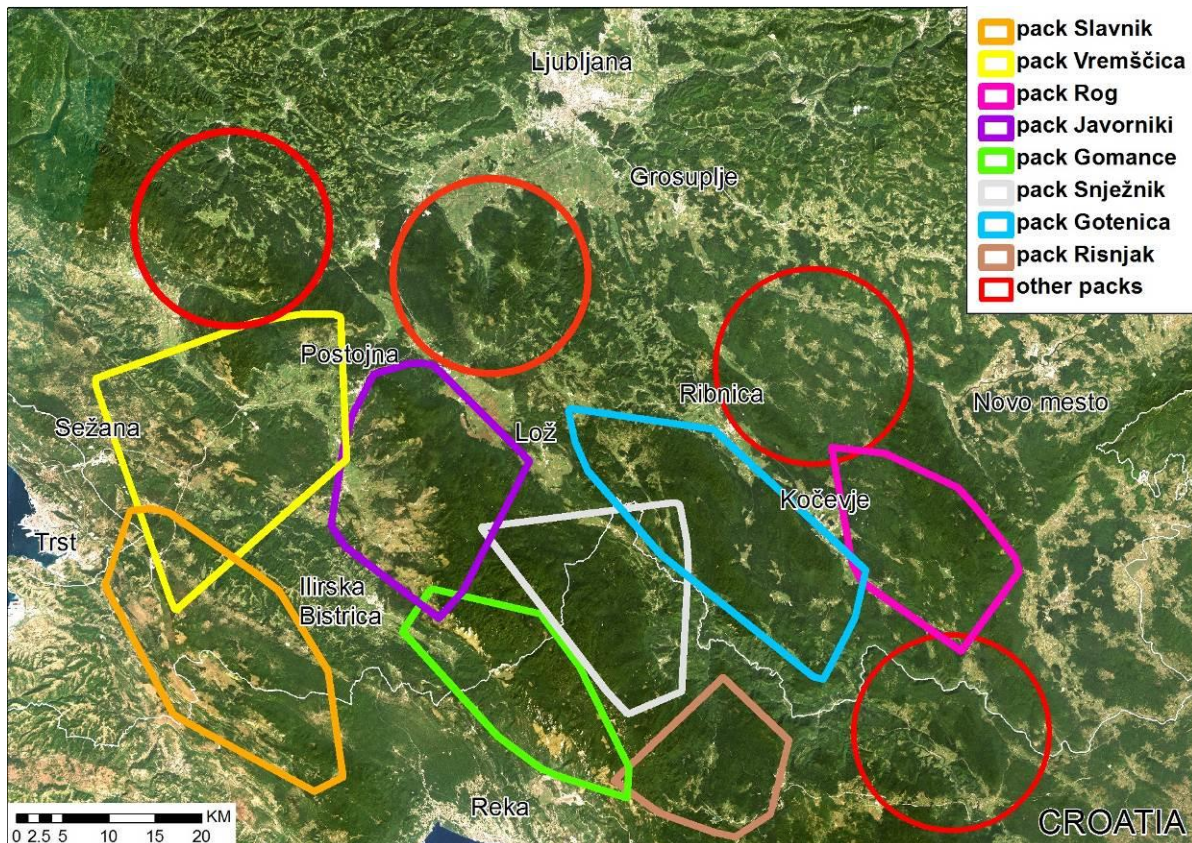


Figure 7: Map of distribution of wolf territories in Slovenia and neighbouring part of Croatia based upon data collected within SloWolf and other projects. Red circles represent approximate territories of packs that were not monitored with telemetry, but detected with other methods (size of circles correspond to average home-range size of packs monitored with telemetry).

#### *Predation by wolves upon wild ungulates*

In total we found 83 wolf prey remains, which is less than predicted goal (100-150). This was the consequence of short duration of monitoring of collared wolves (204days) due to their unexpectedly high mortality rate. Nevertheless, we consider the collected sample adequate for estimating prey use of wolves in Slovenia.

Since probability of detecting potential kill site using telemetry data (GPS location cluster analysis) and finding prey remains in the field depends on the size of the prey, these results probably underestimates the proportions of smaller prey. For this purpose use of scat analysis gave us more reliable results and analysis of found prey remains is most useful for determining the proportion and demographic structure for larger prey. Therefore additionally wolf diet was studied in the project area, occupied by 8 to 10 packs between 2010 and 2012 using indirect method of scat analysis of 475



scats. Pack affiliation was determined for all sampled scats using telemetry data on wolf's territories and/or genetic information on parentage analysis. (Final report on surveillance of wolf population in Slovenia).

Generally, a telemetry surveillance of wolves proved to be very successful, since a high quality spatial data about wolves movements and distribution of packs were obtained. Additionally, during capturing wolves, large proportion (over 60%) of non-invasive samples (scats) were collected that were genetically analysed as well as a large sample of prey remains and scats for nutrition-predation analyses were collected. Together with use of non-invasive genetic methods, we were able to obtain one of the best insights into wolf population status in Europe.

#### Point 5: Wolf monitoring Portal

The Wolf Monitoring Portal has been developed with external assistance and has passed through the thorough test phase in the first two years of the project. Currently is available and used by the project partners and public. The database is being filled with different wolf-related data (genetic samples, damages to livestock, telemetry data, howling survey data, snow tracking data). It has 66 registered users with 3899 entries of signs of wolf presence. The portal is now available at <http://portal.volkovi.si> and is integrated within the project website. Manual for users has been prepared and is available online. Overall this part of the C1 action has been completed successfully.

### **ACTION C.2: Improvement of management of wild ungulate species**

#### **EXPECTED RESULTS:**

- Five workshops carried out.
- Results of the workshops include a detailed plan (1 document) with respect to integration of the large carnivores' requirements in prey species (wild ungulates) management in the wolf areas.

**Action evaluation summary:** *Overall this action was successfully accomplished and all expected results were reached. We managed to involve all interest groups in the preparation of the management recommendations for integrating large carnivore requirements into wild ungulate management. An additional workshop was organized in order to discuss a draft of the management recommendations based on the input from previous workshops. The management recommendations were already incorporated into yearly hunting plans. It is very important to inform the hunters about the benefits of the presence of large carnivores on their hunting grounds from the perspective of hunters' hunting preferences and the flexibility of the realization of the yearly roe and red deer hunting plans.*



Biology research and analysis can define the range of needs for the wolf population. However, a sound management decision regarding hunting management of the wolf prey requires also taking into account the socio-economic aspects of wildlife management. The best way to achieve this is to directly involve participants of different interest groups. This is why within this action five workshops were planned and six carried out. The results of the Action A.3 and Action A.6 were presented to the participants. A professional facilitator was coordinating the first four workshops to define by consensus necessary steps for the integration of the needs of the carnivores into the hunting system. Results of the workshops include a detailed plan (1 document) with respect to integration of the large carnivores' requirements in prey species (wild ungulates) management in the wolf areas.

The first two workshops were joined into a larger two-day workshop and were organized on 29 and 30.11.2011. The topic of this joined workshop was broader relation between wild carnivores, their prey and forest. On this broader workshop mostly forest and wild ungulate managers from SFS were present. On the third and fourth workshop, where mainly hunters were present, we discussed the problems they see especially in roe and red deer management, in the areas where wolf is present. Both workshops were organized in wolf presence areas, one in Kočevska region and the other in Notranjska region. The fifth meeting was organized only among wild ungulate managers from SFS where concrete requirements for prey species management were produced on the basis of the results of all previous workshops.

All workshops were very constructive and raised many important issues which in our opinion had to be negotiated further among all stakeholders. We therefore prepared draft management recommendations which were unified at the additional (sixth) meeting on 29.1.2013 with members of SFS (foresters, wildlife managers), hunters and researchers.

We received positive feedback from participants of the workshops. At the end of the first workshop, participants filled out an evaluation form to rate the workshop and the participation method. 23 participants filled out the form. 19 participants stated that the workshop fulfilled their expectations; one participant stated it exceeded his/her expectations, three were moderately satisfied with the workshop and none were dissatisfied. Nine participants were completely satisfied with the participation method, 11 participants were satisfied, three moderately satisfied with the participation method and none were dissatisfied.

Within writing the final document about integrating the wolf and also the lynx into yearly ungulate plans we managed to involve the most important interest groups (hunters, foresters, wild ungulate managers, researchers). The most important thing was to listen to each other and be prepared to search for compromises and to actively involve people who actually implement the regulations- the hunters. Because of strong input from wild ungulate managers the instructions could be quickly implemented into yearly management plans in the areas where wolves are present. The written instructions concretely affect the structure of culling and culling quotas in accordance with the written reports based on yearly wild ungulate monitoring. They were incorporated in the yearly hunting plans, already in the year 2013.

Possible threat for maintaining hunters' high acceptance of wolves is that the hunters are not aware of the benefits which they get because of their presence. The main benefits are higher flexibility of culling quotas for fawns and yearlings (roe deer and red deer) and lower hunting quotas for red deer females in the areas where wolves or lynx are regularly present. We are trying to reduce this threat



with explaining the benefits within the yearly ungulate management plans which are produced by SFS and on the presentations of these plans to the broader public and hunters.



### **ACTION C.3: Involvement of hunters and volunteers in the wolf population monitoring activities**

#### **EXPECTED RESULTS:**

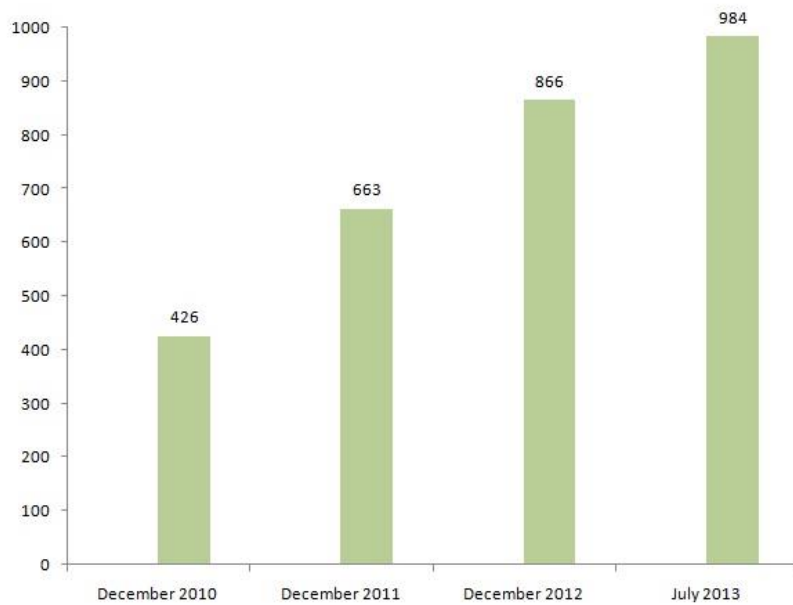
- Organized opportunistic sampling of non-invasive genetic samples of wolves. At least 200 – 250 useable non-invasive genetic samples of wolves collected each year. Approximately 1000 hunters actively involved each year.
- One transect count of signs of wolf presence organized each winter.
- Five intensive snow tracking weekend sessions organized each winter (for three yearly monitoring sessions), at least 40 non-invasive samples found and at least 50 km of wolf tracks recorded.

**Action evaluation summary:** *All expected results were strongly overreached. We managed to engage a considerably higher number of volunteers, although hunters were less interested to participate than expected. Great interest of volunteers in participating in the wolf monitoring enabled cost-effective collection of important data needed for successful conservation management of a protected species. Through media, they attracted much of attention of general public and consequently raised conservation and acceptance issues in society. It proved use of layman collected data in population monitoring very successful and is recommended to implement it to other species in the future.*

During the project volunteers and hunters were included in different activities; they were included in different seminars, wolf howling surveillance activity, snow-trackings and non-invasive sample collection, as described in Action C.1. Instructions for volunteers were prepared, printed, distributed and published on Life+ SloWolf website [www.volkovi.si](http://www.volkovi.si). Material for non-invasive sampling was distributed on field.

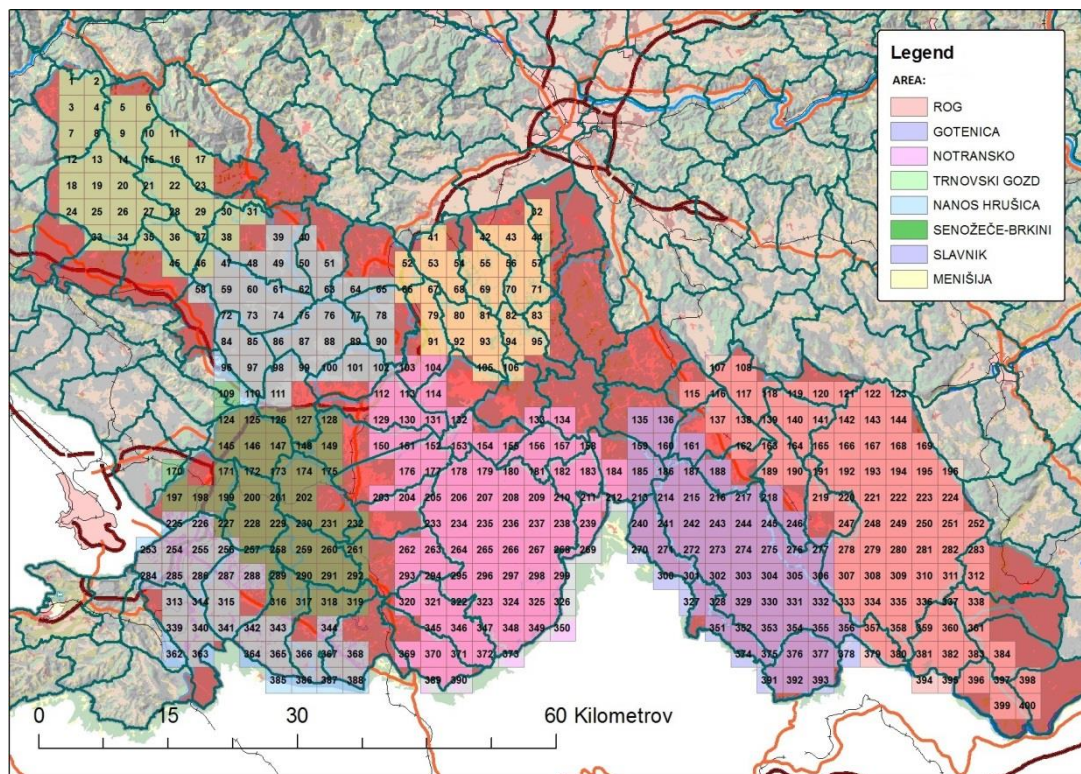
We finished with activities for volunteers of this action at the end of July 2013. Altogether 2429 hunters and volunteers were included in wolf surveillance activities: 984 volunteers interested in wolf research were registered in our database and regularly invited to educational seminars and to participate in field surveys, 891 volunteers and hunters attended educational seminars, 453 took part in winter snow tracking, 245 in summer wolf howling monitoring (Figure 8).





**Figure 8: Number of volunteers and hunters interested in wolf research and included in database from 2010-2013**

In summers five seminars for volunteers for summer wolf howling surveillance were organized and attended by 196 participants. Summer wolf howling surveillance was done in 3 seasons by 245 volunteers. With their inclusion it was possible to monitor an area up to 3384 km<sup>2</sup> in one day (Figure 9).



**Figure 9: Total area of 3384 km<sup>2</sup> for wolf howling surveillance was monitored at once in summer 2012 by 120 volunteers in 65 groups.**

There were 65 winter snow tracking sessions organized, 7 in season 2010/11, 24 in 2011/12, and 4 in 2012/13 what exceeded our expectations. Altogether 453 volunteers and hunters were included and 20 winter seminars were attended by 359 volunteers and 336 hunters. In winter minimum of 2230km of forest roads were checked, 171 km of wolf tracks were followed and 185 genetic samples were found. All involved volunteers received a promotional T-shirt. Drink, food and cost for petrol were refunded only in summer howling activities and on winter snow tracking 19.1.2013, where almost all wolf area was covered in one day (Figure 10).



Figure 10: Area of winter snow tracking 2/3 of it were covered by 74 participants in 31 groups on February 19th 2013 following five different wolf packs

Activities of this action were organised in modified time schedule and more extended work – it was carried out almost throughout the whole year on the same planned budget. Collaboration with interested and trained volunteers was used to improve coverage of study area, although it is often difficult to coordinate such large groups of volunteers at once, especially in winter activities, when large varieties in snow and weather conditions exist. Hunters' response was lower than expected but overall, we were surprised about large interest of volunteers, participating in these actions in previous months and years, about their big involvement and interest, exceeding all our expectations.

Table 20: Summarization of summer activities for hunters and volunteers from 2010-2012 (Vol-volunteers, Hu-hunters, SFS-Slovenian Forest Service personel, SloW-SloWolf project members)

Summer activities:	Period	Nr. of days	Nr. of volunteers	Area (Nr. of quadrants 3X3 km <sup>2</sup> )	Nr. of howlings	Nr. of howling sessions	Litters detected	Territorial howling responses of adult wolves	Participants
<b>Summer wolf howling surveillance 2010-2012</b>		<b>18</b>	<b>245</b>	<b>860</b>	<b>2506</b>	<b>7432</b>			Vol., SFS, SloW
Summer wolf howling surveillance 2010	30.8-7.9.2010	9	65	272	740	2191	6	7	Vol., SFS, SloW
Summer wolf howling surveillance 2011	17.8-25.8.2011	6	60	216	650	1944	7	2	Vol., SFS, SloW
Summer wolf howling surveillance 2012	16.-19.8.2012	3	120	372	1116	3297	5	4	Vol., SFS, SloW
<b>Seminar for volunteers for summer wolf howling surveillance 2010-2012</b>		<b>5</b>	<b>196</b>						Vol
Seminar for volunteers for summer wolf howling surveillance 2010	July 2010	1	20						Vol
Seminar for volunteers for summer wolf howling surveillance 2011	22.7. and 9.8.2011	2	85						Vol
Seminar for volunteers for summer wolf howling surveillance 2012	25.7.2012 and 6.8.2012	2	91						Vol
Unformal volunteers meeting 2011	18.9.2011	1	40						Vol, SloW
Unformal volunteers meeting 2012	24.9.2012	1	30						Vol, SloW
<b>Summer activities:</b>		<b>30</b>	<b>511</b>	<b>860</b>	<b>2506</b>	<b>7432</b>			

**Table 21: Summarization of winter activities for hunters and volunteers from 2010-2013 (Vol-volunteers,Hu-hunters,SFS-Slovenian Forest Service personel, SloW-SloWolf project members)**

Winter activities:	Period	Nr. of days/ winter snow tracking days	Nr. of days when signs of wolves were found	Nr. of Vol	Nr. Of groups	Approximate minimum length of forest roads checked (km)	Approximate length of wolf (Canis lupus) tracks followed (km)	Nr. of scat genetic samples	Nr. of urine genetic samples	Nr. of genetic samples	Participants
<i>Winter snow tracking 2010-2013</i>	<i>5.2.2011-21.3.2013</i>	<i>65</i>	<i>48</i>	<i>453</i>	<i>226</i>	<i>2230</i>	<i>171</i>	<i>81</i>	<i>104</i>	<i>185</i>	<i>Vol,H,SFS,SloW</i>
<i>Winter snow tracking 2010/2011</i>	<i>5.2-30.3.2011</i>	<i>7</i>	<i>7</i>	<i>37</i>	<i>28</i>	<i>375</i>	<i>10</i>	<i>3</i>	<i>8</i>	<i>11</i>	<i>Vol,H,SFS,SloW</i>
Organised group snow trackings 2010/2011	4.3-30.3.2011	3	3	57	24	375	10	3	8	11	Vol,H,SFS,SloW
Individual-local winter snow trackings 2010/2011	5.2-4.3.2011	4	4	10	4	?	?	?	?	?	Vol,H,SFS,SloW
<i>Winter snow tracking 2011/2012</i>	<i>21.12.2011-1.3.2012</i>	<i>24</i>	<i>17</i>	<i>134</i>	<i>63</i>	<i>771</i>	<i>25,5</i>	<i>36</i>	<i>32</i>	<i>68</i>	<i>Vol,H,SFS,SloW</i>
Organised group snow trackings 2011/2012	9.2.2012-29.2.2012	7	5	111	25	?	?	24	17	41	Vol,H,SFS,SloW
Individual-local winter snow trackings 2011/2012	21.12.2011-1.3.2012	16	12	24	19	?	?	12	15	27	Vol,H,SFS,SloW
<i>Winter snow tracking 2012/2013</i>	<i>7.12.2012-21.3.2013</i>	<i>34</i>	<i>24</i>	<i>282</i>	<i>135</i>	<i>1084</i>	<i>135,5</i>	<i>42</i>	<i>64</i>	<i>106</i>	<i>Vol,H,SFS,SloW</i>
Organised group snow trackings 2012/2013	7.12.2012-17.3.2013	11	9	202	83	832	67	23	56	79	Vol,H,SFS,SloW
Individual-local winter snow trackings 2012/2013	14.12.2012-21.3.2013	21	11	59	30	252	19,5	19	8	27	Vol,H,SFS,SloW
Organised snow tracking from SFS 2012/2013	9.2.2013-24.2.2013	4	4	21	21	?	49	?	?	?	SFS
<i>Seminar for Hu for winter snow tracking 2010-2013</i>	<i>2.11.2010-11.1.2012</i>	<i>20</i>		<i>359</i>							<i>Hu</i>
Seminar for Hu for winter snow tracking 2010	2.11-4.11.2010	10		112							Hu
Seminar for Hu for winter snow tracking 2012	9-11.1.2012	10		105							Hu
Seminar for Hu for winter snow tracking 2013	29.1-31.1.2013	10		142							Hu
<i>Seminar for Vol for winter snow tracking 2010-2013</i>	<i>6.1.2011-15.1.2013</i>	<i>5</i>		<i>336</i>							<i>Vol</i>
Seminar for Vol for winter snow tracking 2010/2011	6-12.1.2011	3		258							Vol
Seminar for Vol for winter snow tracking 2011/2012	20.12.2011 and 15.1.2012	2		61							Vol
Seminar for Vol for winter snow tracking 2012/2013	15.1.2013	1		17							Vol
Winter activities summary:		90	48	1148	226	2230	171	81	104	185	

#### ACTION C.4: Improvement of wolf damage inspections and training of inspectors for recognition and evaluation of large carnivore damages to agriculture

##### EXPECTED RESULTS:

- Two seminars for damage inspection prepared and carried-out, 30 inspectors attending.
- Damage inspectors have better technical, forensic and legal understanding of the damage inspection process, and improved communication skills.
- Damage cases are photo documented and georeferenced.
- Handbook for recognition of damages done by large carnivores on livestock and practical damage inspection, printed and distributed among the damage inspectors.

**Action evaluation summary:** This action was successfully implemented and all expected results were reached. The attendance of inspectors at seminars was considerably higher than planned. Additionally, damage inspection procedure was improved through the tool of genetic sampling of livestock carcasses in cases where the predator cannot be safely determined. To ensure continuity in educating damage inspectors, similar seminars are foreseen in the Wolf Management Action Plan.

Damage inspectors are the first and in most cases the only official persons that visit farmers after the damage has happened. Farmers, being directly affected both economically and emotionally by the presence of carnivores, are probably the most sensitive interest group. Since potential negative attitudes toward large carnivores are one of the main challenges in carnivore conservation, it is crucial that the first contact with the authorities responsible for carnivore conservation does not generate additional bad feelings. In addition to this it is important that officials are able to advise



how the damages can in the future be prevented and to have all necessary knowledge and equipment to correctly assess the damage cases.

In November 2010 we successfully carried out the first seminar for damage inspectors at the Veterinary Faculty in Zagreb in Croatia. In the first part of the seminar experts on large carnivore damages gave us lectures how to distinguish damage cases done by different wild animals and which for human dangerous diseases domestic animals can have. The second part of the seminar has taken place in the anatomization room, where gathered knowledge has been tested on carcasses of animals that were killed by the wolves. The seminar was attended by 55 damage inspectors.

The second seminar was organized on in November 2012 in Slovenia and attended by 67 damage inspectors and members of Ministry for agriculture and environment. The main topic was how to prevent damages caused by wolf. We invited 2 foreign experts, Umberto Vesco from Italy and Daniel Mettler from Switzerland, to present how these two countries deal with damage prevention. SloWolf members presented successful implementation of damage prevention measures at selected wolf damage hot - spots (Action C.6). In the afternoon we visited 2 farms included in action C.6.

All damage inspectors are now equipped with GPS devices and cameras so that all damage cases are now photo documented and georeferenced.

A handbook for recognition of damages done by large carnivores on livestock with damage inspection protocols has been finished and distributed among damage inspectors. Within this handbook we described the approach when damage inspectors arrive on a damage case. We also described the basic biology of these species and in details explained how it is possible to recognize damage cases caused by wolf, bear, lynx, fox and jackal. We also explained how to distinguish wolf and dog attacks on domestic animals. This book was distributed to all damage inspectors.

Within this action we provided additional knowledge and equipment for damage inspectors. In addition to this, genetic sampling of predators on dead sheep was firstly implemented (action C1) as part of wolf monitoring and checking the quality of wolf damage inspection. At the end of the project this has been implemented into regular work as a tool which is used for more certain damage inspection in cases where damage inspectors have doubts which animal (e.g., wolf, dog) caused the damage. So within this action and in combination with other actions of the project damage inspection was greatly improved on long term.

In the future similar education campaigns are necessary for further improvement of the knowledge of damage inspectors and for education of new inspectors. Therefore, we integrated the organization of future educational seminars for damage inspectors into the Wolf Management Action Plan.





### **ACTION C.5: Training of agriculture advisory service in damage prevention measures**

#### **EXPECTED RESULTS:**

- “Educators” educated about best practice damage prevention measures.
- Two seminars carried out.

**Action evaluation summary:** Overall, this action was successfully completed and has contributed to coexistence between wolves and agriculture. Two seminars were carried out, agriculture advisors educated and cooperation with the Chamber of Agriculture and Forestry (CAFS) increased. An additional deliverable was the production of an educational leaflet on best practice damage prevention measures prepared together with CAFS. However, the success of the action would be better if CAFS would be more intensively included in the project. For future similar activities additional budget to cover participants travel costs would also be recommended.

Damages to the livestock are one of the most important causes of human-wolf conflict and preventing damages is very important for improving coexistence between wolves and agriculture. However, effective methods to prevent livestock depredations have been forgotten. CAFS advisers work closely with farmers and give advice to farmers about best practice in agriculture. However, advisers sometimes lack the expertise about the effective prevention of large carnivore damages. This action was aimed to educate the advisors about the results of best practice implemented during the project (Action C.6).

Beneficiary estimates that all of the expected results have been reached within this action. Two seminars for CAFS were carried out. First training seminar was prepared on December 6<sup>th</sup> 2011. Eight lectures were prepared within which purpose and objectives of SloWolf project were outlined, information about wolves in Slovenia, their predatory techniques and analysis of damages caused by wolves (Action A.4) were presented. Moreover, CAFS presented their view on damages caused by wolves and representative of MAE presented renovation of regulations regarding appropriate protection of domestic animals. The emphases of the seminar were the lectures about use of guarding dogs and portable electric fences for night enclosures as the most effective methods to protect sheep against wolf depredations. After the seminar, participants visited hot spot farms where best practice damage prevention measures were implemented within action C.6.

The second training seminar was carried out on 12<sup>th</sup> September 2013 in the final year of the project in order to present the results of the best practice for prevention measures of wolf attacks on sheep (Action C.6). Six lectures were presented. Besides lectures on wolf damages (CAFS) and compensation schemes (MAE), analysis of effectiveness of prevention measures and the lessons learnt about the use of guarding dogs and portable electric fences for night enclosures (Action C.6) were presented. Participants were also shown video footage recorded by infrared cameras on the pastures (Action C.6), demonstrating the importance of proper setting and maintenance of high



electric netting. After the lectures, attendees visited a farm participating in action C.6 that demonstrated the good practice example directly on the field. This gave the attendees the opportunity to speak directly to a farmer who has effectively reduced wolf damages.

In our opinion “educators” were effectively educated about best practice damage prevention measures as CAFS was very interested in preparing the second seminar. Moreover, in addition to foreseen activities and in cooperation with CAFS we prepared an informational leaflet of effective sheep protection measures against wolf depredation, which will be distributed by agriculture advisors to sheep breeders in the field.

However, the participation at the two seminars was lower than expected. Therefore, the location for the second seminar was moved from the capital closer to agriculture advisors living in the wolf range area, but the participation still did not increase. The success of the action would be better if CAFS would be more intensively included in the project, which was also expressed from their side. For future similar activities additional budget to cover participants travel costs would also be recommended as this would help to increase the number of participants on the seminar.

### **ACTION C.6: Best practice demonstration of damage prevention measures at selected wolf damage hot-spots**

#### **EXPECTED RESULTS:**

- At least four “hot spot” pastures with most wolf damages to livestock equipped with effective electric fence.
- Video footage – comparison of wolf behaviour and attacks before and after implementation of the protection measures.
- Power-point presentation about “good practice” examples for the Agricultural Advisory Service personnel.
- Report on the monitoring of effectiveness of protection measures.
- Popular article about the “good practice” example in an agricultural magazine.

**Action evaluation summary:** *All expected results were achieved, some strongly overreached. We managed to equip 12 more »hot spot« pastures than originally planned and published several popular articles about the best practice protection measures. A positive result of this action is also the contribution to reduction of damages caused by wolves to agriculture. For the future, we recommend a different selection method of participating sheep breeders.*



Within action C.6, Best practice demonstration of damage prevention measures at selected wolf damage hot-spots, it was planned to equip at least four pastures with frequent wolf attacks on livestock with effective damage prevention measures (usage of high electric nettings as night enclosure). These “hot-spot” pastures were planned to be intensively monitored and used as a demonstration for good practice, as part of education program for Agriculture Advisory Service of Slovenia (Action C.5) and promotion of wolves with agriculture (Action D.2). The aim of the action was to stimulate farmers to start implementing effective protection measures if their livestock on pastures is likely to be endangered and attacked by wolves.

One of the results was a video footage showing comparison of wolf behaviour and attacks before and after implementation of the protection measures. We have recorded a very good educational video footage of brown bears behaviour on the pasture when approaching night enclosure with sheep. Wolves were recorded in close vicinity to the pasture but have never attacked animals inside night enclosures. Regardless of the species recorded, we have obtained very good shots explaining the behaviour of large carnivores near the pasture and indicating the importance of electricity in the electric nettings. The video footage was successfully used for education of Agriculture Advisory Service and sheep-breeders. For this reason beneficiary estimates, that goal of this specific activity have been reached.

We have equipped 16 “hot spot” pastures with livestock protection measures, 12 more than planned in project application. As a protection measure, high electric nettings or/and livestock guarding dogs were used. Overall, 13 electric netting sets were donated to 10 different sheep breeders, which is 9 more than planned. Additional electric nettings donations were enabled because of the additional budget provided by Slovenian Forest Service. Moreover, 13 livestock guarding dog pups were donated, which is 5 more than initially planned. This was possible because we were able to get guarding dog pups for a cheaper price than expected. Additionally, we have produced livestock guarding dog warning signs which was not planned in the application but was very beneficial: use of guarding dogs is a forgotten method of flock protection in Slovenia and is therefore very important to educate about proper behaviour also people passing by. Intensive monitoring of dogs behaviour (through field visits and phone interviews) resulted in more than 200 reports on dogs’ development, which will be very useful material in the future for similar actions.

Besides one planned article, we have published four additional articles about the “good practice” examples in agricultural magazines (Kmečki Glas, Drobница, Lovec, Kmetovalec).

We estimate that the action C.6 was implemented very successfully. After installation and usage of electric nettings by the livestock breeders there were no more damages caused by wolves on “hot-spot” pastures. Because of this there was 100.000 EUR less paid damage compensation in the year 2011, compared to 2010 and before protection measures were in place, and the same amount was earned also in 2012. Some damages were still caused by brown bear, but with the help of infrared cameras we were able to prove that damages happened because of the absence of electricity or improper setting of electric nettings. By demonstrating that sheep can be effectively protected, the





actions has act towards one of the main goals of the project, which is to reduce livestock depredations and improve the coexistence between wolves and agriculture.

In the future we would recommend a different approach for sheep breeder selections. In the current project we have mainly used suggestions from SFS damage inspector's, who had information about affected pastures and farmers motivation. In the future it would be helpful to foresee an application procedure where all farmers in the project area could apply for donation set.

### **ACTION D.1: Public awareness and education campaign about wolves on national and local levels**

#### **EXPECTED RESULTS:\***

- 6000 brochures produced and distributed.
- 1000 posters about the project produced and distributed.
- 500 copies of the produced documentary films + PowerPoint presentation.
- 1000 T-shirts with project logo
- 50 educational kits for high schools produced and distributed to biology teachers
- Seminar for biology teachers prepared and carried out.
- Yearly bulletin of the project – 4 x 700 pieces – produced and distributed.

\*Beside quantitative expected results, also special expected results were defined for this action (i.e., improved public attitudes toward wolves; improved knowledge of school children, general public and hunters about the wolves and ways of human-carnivore coexistence; positive attention to the wolves and the wolf conservation project in the media; informed public which can justly participate in the controversial aspects of wolf management). Those were discussed in the chapter »Follow-up surveys on the public attitudes toward wolves«

**Action evaluation summary:** *The action outputs exceeded those specified in the project proposal. Throughout the project many additional activities have arisen as a result of a close cooperation with a public involved in the project, growing interest in the wolf issue and using diverse communication approaches to the public. For the future public awareness campaigns special attentions should be given to communication with media targeting farmers, especially the ones that avoid publishing news about possible coexistence with large carnivores or tend to publish only negative impacts of wolf presence. Monitoring of the media coverage about wolf, publishing press releases on all important occasions containing key messages, regular informing of the public about the topic and responding in time on false and sensationalistic media is crucial for maintaining acceptable tolerance levels toward wolf among public.*



The aim of this action is to provide ongoing, well planned targeted public awareness and education campaign about wolves based on the data provided by the public attitude and knowledge survey (action A.6) and the experience we already have. Through awareness raising campaigns we provide information to the targeted publics. In this way we influence their attitudes and knowledge levels in order to increase public tolerance toward wolves.

In the start of the project we developed project graphic identity (project logo, letter head, ppt template, ect.) which was used together with Natura 2000 and LIFE logos on all promotional and awareness raising materials. The brochure about wolves, all four issues of project bulletin and posters were prepared, designed and printed as planned. The brochure and bulletin were widely distributed among farmers, hunters, decision-makers, volunteers, and other interested parties. Posters were distributed as a part of the educational tool kit as well. We additionally designed and printed two larger posters carrying general information about the project vision, goals and information about wolf with no additional costs to the project. They were used in on hunters' fair organized by Hunting Association of Slovenia in Gornja Radgona and on other project events. Promotional T-shirts with four different motives were prepared and distributed to the volunteers, hunters, decision-makers, visitors of project events and other interested publics. Educational movie about the project and wolves was postponed twice in order to include as many information collected during the project. That is why it was completed in the last year of the project. The national TV premier of the movie will after the end of the project due to the postponed production and movie technical adaptation for the national TV standards broadcasting. We organized six documentary movie nights for Slovenian catholic Girl Guides and Boy Scouts Association, libraries Grosuplje, Kočevje and Ribnica (within area of wolf presence), House of Experiments in Ljubljana and University Botanic Gardens Ljubljana. It was additionally broadcasted on three lectures for hunters in the end of the year (action E.3). The number of visitors of the movie evenings exceeded project expectations and many movie evenings with presentations are already planned in January and February 2014 (Ecomuseum in Pivka, Natural History Association, library in Stari Trg in Kočevska region, Biotechnical high school). Movie was distributed among all important national and private TV media companies, libraries in the wolf presence area, passed on to decision-makers, project partners, museums, as part of the educational kit for schools and other interested parties.

The seminar for biology teachers was organized at Biotechnical faculty. Due to financial constraints and principal approval a fewer teachers participated in the seminar than expected. The remaining 20 educational kits will be delivered to the teachers who will bring students to the workshops organised at the faculty. Participating teachers expressed high satisfaction with the seminar. The seminar was evaluated with the questionnaire. On the 4-point scale teachers evaluated the seminar with average 3.8 point (i.e. the seminar novelties in educational practice, the participant's active engagement in the seminar, expert lecturers, and the practical use of the materials). In addition, workshops for 400 high school students were conducted where students evaluated prepared education materials. We prepared questionnaires with which students'



knowledge and attitudes toward large carnivores of Slovenia were assessed. Results will be presented in three graduation thesis. In January 2014 teaching materials will also be presented at the educational conference organized by Pedagogical faculty, University of Ljubljana.

Throughout the project we organized and participated in four press conferences on all major project occasions and topics concerning the project. The first independently organized press conference covered all the topics of the main wolf management challenges, where project members presented results of the analysis of the wolf damages on livestock, effective protection measures, number of wolves in Slovenia, etc. The conference was highly visited by media representatives, large carnivore decision-makers and even important interest groups such as farmers. Although the project plan was to prepare 6 press releases we released 22 of them of which one was published in January 2014, additional 10 short statements for two press conferences and even one press release in Italian for Italian media. Media coverage of the project and wolves exceeded our expectations. In the end of the project there were 361 published articles on internet (15 planned), 140 in print (17 planned), 32 on TV (2 planned) and 22 on radio (4 planned) in national, local and specialized media. Press releases were additionally sent to the list of interested organizations (GOs and NGOs) and individuals. Since the members of the project partner Dinaricum were involved in the wolf monitoring activities (action C.3) the press releases were sent to their Google group as well. The agreement was made between the SloWolf project and hunting magazine "Lovec" to monthly publish short articles about the project activities. In four years 21 short news and eight 3-6 pages long articles were published. The project group prepared also articles about effective damage prevention measures and livestock owners' experience with donated materials (action D.6) for the newspapers "Drobnica" targeting sheep and goat farmers and "Kmečki glas" targeting farmers in general. Additionally, the media content analysis of wolves in Slovenia from year 2008 to year 2011 was conducted within the graduation thesis. The results have shown the significant increase in media coverage of wolves already after the first year of the project.

Timely response to false or sensationalistic media was recognized as crucial in effective public awareness raising campaign. Therefore, two démenti to media was published in the national daily newspaper and main newspaper targeting farmers as a reply on the article with false and misleading information about the wolf management. Project group additionally responded on two newspapers articles which were implying to the threat of a possible wolf attack on humans with the request to the editors to publish article with the main facts about wolf nature (biology) and proper use of livestock protection measures against large carnivore attacks. One newspaper published the article, whereas the other rejected the request since the editor considers wolves dangerous to humans as well. Therefore, the letter to the Ministry of agriculture and environment was sent explaining the event. The article was sent again to the newspaper in March 2014 via ministry and was successfully published in above mentioned media.



Project visibility and raising of public interest and knowledge about wolves was achieved by several public presentations of the project and wolves organized for hunters (Action D.3). In addition, an info board about wolves in Slovenia was prepared and installed on frequently visited educational trail in Mašun. It included all the public awareness campaign main messages about the wolves and its presence. To present the project, its activities and to disseminate project promotional and educational materials we participated in the EC promotional event about biodiversity called “Biotska raznovrstnost, v tem smo skupaj”, annual hunting fair “Lov” in Gornja Radgona and two annual events “Week of forests” within workshops for children. For the LIFE’s 20<sup>th</sup> anniversary the project participated in a photo completion, a competition to sum up, in 20 words or less, what LIFE means to the LIFE project members and organization of the project event exhibition of the grey wolf in Slovenia. Project members participated in the preparation of the contents for the exhibition of the grey wolf. The opening of the exhibition was also opportunity to celebrate anniversary of EU program LIFE, Habitat directive and Natura 2000.

Project communication strategy prepared in the second project year on the basis of Action A.6, other planned activities within the project in regular upgrading the campaign from the experience gained throughout the project activities has enabled us to run a successful campaign which was carefully designed for the specific situations, time and places for a specific audience. High number of people involved in the project activities, necessary improvements in legislation concerning wolf management, increasing media interest for wolf conservation issue, many new partnerships with journalists and their compliments in the end of the project is an opportunity to take when running public awareness campaigns on other charismatic species as brown bear and lynx.

## **ACTION D.2: Promotion of coexistence of wolves with agriculture**

### **EXPECTED RESULTS:**

- 5 workshops for farmers in the project area.
- 6000 brochures about damage prevention measures (2x 3000)

**Action evaluation summary:** *The action was carried out successfully. All expected results were reached. For similar actions, we recommend a higher level of cooperation with Chamber of Agriculture and Advisory Service for organisation of workshops and additional budgeting for more promotion of the events in the media to gain more interest from the farmers.*

Within action D.2, Promotion of coexistence of wolves with agriculture, promotional materials about use of electric fences in damage prevention and about use and proper training of livestock guarding dogs were prepared. Prevention of livestock damages is crucial in human-wolf conflict mitigation.



Following the near extinction of wolves in Slovenia, farmers have forgotten about the effective methods to reduce livestock depredations. For this reason it is important to educate farmers about proper flock protection as farmers which are successful in preventing damages will demonstrate less opposition to wolf conservation in Slovenia.

Beneficiary estimates that all of the expected results have been reached within this action. Five workshops for farmers were carried out on September 3rd 2011, December 9th 2011, May 18th 2012, October 6th 2012 and 29<sup>th</sup> of March 2013. During these workshops participants were educated about proper care and training of livestock guarding dogs and correct use of portable electric fences for night enclosures. Main results from hot spot farms where best practice damage prevention measures were implemented within action C.6, were also presented. Educational-promotional printed materials about the use of the electric fences and livestock guarding dogs for damage prevention were prepared in December 2011 (2x3000 pieces) and were distributed to the farmers on the workshops as well as through Agriculture Advisory Service employees.

The action was carried out successfully and has worked toward the improvement of coexistence between wolves and agriculture. At the beginning of the project farmers on the workshops were more reluctant to the idea of effectively protecting their flocks, but later in the project more and more farmers took personal initiative to contact us after the workshop to learn more about the effective measures of livestock protection and possibilities of receiving a donation set (action C.6). Especially in the beginning of the project, there was a poor turnout on the workshops. For this reason we would recommend more intensive cooperation with Chamber of Agriculture and Advisory Service for the organization of similar workshops in the future in order to ensure better attendance of farmers on such events. It would also be recommended to plan additional budget for short advertisements in agriculture newspapers to inform the farmers about lectures, workshops or similar events.

### **ACTION D.3: Education campaign on wolves for hunters in wolf areas**

#### **EXPECTED RESULTS:**

- 7 lectures for hunters and 3 for hunters and general public carried out within the Slovenian wolf range.
- Minimum 400 hunters from the wolf range will hear the lecture.

**Action evaluation summary:** Overall we estimate this action was successfully completed according to the plan. High interest of general public reflected in high numbers of volunteers who participated in project activities (action C3). Better knowledge and understanding of wolf biology among hunters should contribute to better acceptance of wolves by hunters. For future projects, a strategy to gain higher participation of hunters should be developed.



The aim of this action was to provide education for hunters and for the general public in the wolf range through a series of lectures about wolf biology, their role in the ecosystem and conservation. It was also aimed at encouraging hunters to participate in the wolf surveillance activities of the project.

In collaboration with SHA we organised: 11 lectures for hunters in December 2011 (112 hunters attending the lectures), 10 lectures in January 2012 (105 hunters attending) and 10 lectures in January 2013 (142 hunters attending). These lectures included general information on wolf biology and aims and activities of SloWolf project. In 2012 and 2013 we also presented first results of the project population estimates which were of great interest to hunters, since they participated in the collection of data in the field. Hunters were encouraged to participate in the population surveillance activities: winter tracking, collection of non-invasive genetic samples and howling (actions C1 and C3). This project introduced a new methodology also to hunters which is a good basis for future cooperation as we expect higher motivation of hunters in future projects due to results achieved during SloWolf project. These results were recognised by hunters as an important part of efficient conservation management.

In addition, three lectures on final results of SloWolf project were organised in December 2013 in Pivka (3.12.2013; 29 hunters attending); in Kočevje (4.12.2013; 53 hunters attending); in Novo Mesto (5.12.2013; 19 hunters attending). In total 460 hunters were educated on wolf biology and conservation. At these additional lectures the documentary film produced in Action D1 entitled “Za volkovi” was shown.

In order to raise awareness of general public on the issues of wolf conservation a total of 5 lectures were organised in Ig (12 attendants), Ljubljana (17 attendants), Logatec (38 attendants), Postojna (30 attendants) and Novo Mesto (73 attendants), total of 170 participants. These activities were complemented by public projections of the documentary film produced in Action D1 on wolves entitled “Za volkovi” at six locations in November and December 2013 (Action D1). In addition our colleague dr. Miha Krofel was invited by Tedx talks to give a talk on wolves in Slovenia. In the Tedx session in Ljubljana this talk was selected as the best talk and is freely available on youtube (<http://www.youtube.com/watch?v=PH0ppQEjgfl>).

#### **ACTION D.4: Project website**

EXPECTED RESULTS	OUTPUT INDICATORS
<ul style="list-style-type: none"><li>• Website set up and working by the 7th month of the project.</li><li>• Website constantly updated with new information at least once per month.</li></ul>	Average number of visitors 80/ month



**Action evaluation summary:** *Results of this action exceeded the expected results. Over 40.000 visitors visited the webpage during the time of the project, which are significantly more than approximately 3500 expected visitors. The webpage was constantly updated, with an average of over 4 new posts per month. We propose ensuring funds for constant IT specialist support. A creation of a project Facebook account proved to be an effective tool in promoting the project webpage, mobilizing volunteers and communication with the interested public.*

This action was planned to set up and monthly update the project website which will provide information about the project objectives, progress of the project and final results.

Project web site was set up and published as planned on 30<sup>th</sup> June 2010 on the web address: [www.volkovi.si](http://www.volkovi.si). The website includes information about LIFE+ program and links to relevant sites, information on the project objectives, progress of the project and final results of each action. The web site also provides information about the species and project area, contact information and links to all the partners.

Throughout the project we published the progress of the project's activities in news (total of 60 posts) and blog sections (total of 112 posts). We also uploaded 47 project publications and 30 other publications related to wolves in Slovenia. Following the comments of EC on Progress report several of the project colleagues invested considerable effort into translating all the main themes on the project website to English. All main themes except Blog (which is mainly dedicated to Slovene volunteers and interested individuals) are now translated to English.

The website is received wider attention on a national and international level. Throughout the project duration the website was viewed more than 300,000 times with a total of over 80,000 visitors. Approximately a half of those were returning visits, so in terms of unique visitation over 40,000 people saw the website. The majority of visitors were from Slovenia (84%) followed by Italy (6.5%), Spain (1.4%), Croatia (1%) and 99 other countries. Website was equally visited by men and women with most of the visitors between 18-34 years old (61%). On average the duration of visits was just under 3 minutes.

As website is a passive communication medium we also set up a Facebook (FB) project account («SloWolf Projekt») in August 2012. We used FB for communicating new project developments, actions taken and planned events. FB was also used to promote our website - we posted links to news and articles published on the website. It proved as very useful especially for communication with volunteers about planned activities. Sometimes our posts stimulated a debate, in which experts answered the questions, therefore it also served for education.

Furthermore we created an additional website for SloWolf thematic conference Wolf Conservation in Human Dominated Landscapes at [www.conference.slowolf.si](http://www.conference.slowolf.si) which is dedicated entirely to the conference and includes topics: Abstract submission, Registration, Topics and Schedule, Venue and Accommodation and Important information. This website includes online abstract submission and





registration forms and gives information on conference program, conference venue, how to get there, accommodation and social events. After the conference we published 17 presentations of authors who agreed with publication (these are also published on the main project website).

On technical side, we found it challenging to resolve some technical issues which occurred during website maintenance. In order to avoid this, we would suggest to provide funds for a constant IT specialist support.

### **ACTION D.5: Layman's report**

#### **EXPECTED RESULTS:**

- 1000 reports produced and distributed.
- 300 copies of the report in English language produced and distributed.

#### ***Action evaluation summary:***

Layman's report was produced and printed in 500 copies of each language (English and Slovenian). Due to a greater than expected interest of international public for our project, we've decided to increase the number of copies printed in English language. An electronic version of the report is also available at the project web-site. The action has been completed as planned.

### **ACTION D.6: Networking through organization of a thematic conference**

#### **EXPECTED RESULTS:**

- Electronic book of abstracts.
- Short report from a workshop.

***Action evaluation summary:*** All expected action results and more were reached. The interest in the conference and consequently participation was larger than expected. The action contributed also to networking with another LIFE wolf project. For the future, we recommend more emphasis on practical wolf management issues in international meetings for the exchange of best practice among European countries. Although the organization of the conference was the only networking activity foreseen in the project, there were numerable other networking activities (see below) that were carried out regardless and without extra cost to the project.





The goal of our international conference entitled *Wolf Conservation in Human Dominated Landscapes* was to share knowledge and experience in order to increase effectiveness of wolf conservation, improve cooperation, and promote transition from country-based management towards management at the level of populations.

The conference took place between 25 and 27 September in Postojna, Slovenia. The target audience of the conference were wolf researchers, experts and managers, as well as students with interests in wildlife management and conservation. Conference attracted 180 participants from 22 countries. Conference was opened by the Slovene minister of environment and agriculture Mr. Dejan Židan and by the Commissioner for Environment dr. Janez Potočnik (via video-talk).

The main conference topics were: wolf sociobiology and ecology, population monitoring, genetics and molecular ecology, conflict mitigation and resolution, wolves and human attitudes. We received 62 abstracts of which 33 were accepted for oral presentations and further 29 for poster presentations. All abstracts were included in a printed and electronic Book of abstracts which was distributed to conference participants. On the second day two targeted workshops were organised entitled “Using layman-collected data in population monitoring – challenges and opportunities” and “Sustainable hunting of wolves – destructive for an individual, but beneficial for the population? Pros, cons & solutions.” In the conference folder participants also received Life Focus publication “LIFE and human coexistence with large carnivores”. All information about the conference including the Book of abstracts and PowerPoint accompanying oral presentations are available on the conference website <http://www.conference.slowolf.si/>.

This conference contributed greatly to the networking of different wolf projects all across Europe and even beyond. With Italian LIFE project WolfNet, which organised a conference in November 2013, we established a common European wolf forum and there was an exchange of representatives between the two projects. Conference received notable attention from the Slovene press and was mentioned in several daily newspapers.

For future projects we would also suggest dedicating a part of the conference specifically to practical wolf management issues, with the aim to exchange hands on experience on an international level. This would enable networking among wildlife managers and exchange of best practice among European countries.

In order to organise this event the project team was assisted by 10 volunteers who helped with logistics at the conference. We also managed to attract several sponsors and donators. We estimate this action was very successful and surpassed the expectations outlined in the application.

Other main networking activities which were not foreseen in the project but were still carried out were:

- Project presentations at international meetings abroad (Hungary, Italy, Germany, Netherlands, Spain, Portugal, Canada, USA).



- Project presentations outside the project area (Ljubljana, Maribor).
- Cooperation with experts abroad – telemetry of wolf Slavc (Italy, Austria).
- Cooperation on the 20th anniversary of LIFE programme and HD – Technical Museum Bistra (exhibition „Tvigi in Vid iz Bistre“), MAE (exhibition, brochure, participation at the organised event).
- Cooperation with foreign universities – University of Zagreb (exchange of telemetric and genetic data), Memorial University of Newfoundland (MSc student Jasna Mulej), University of Idaho (Maja Jelenčič, genetic lab).
- Visits of foreign experts (Italy, Germany, Croatia, USA).
- Student exchange within ERASMUS.
- Cooperation with ARD - Bayerischer Rundfunk TV station during a filming of documentary on wolves.
- Workshops for children at the Slovenian Forestry Institute
- Research camp for biology students.
- Cinema Dvor – preparation of brochure for film “Entrelobos” promotion and lecture after the premiere.
- Cooperation with MAE in preparation of actions for rural development 2014-2020.
- Cooperation with Slovene Chamber of Agriculture and Forestry in preparation of Brochure on protective measures.

### **ACTION E.3: Revision of Wolf Population Action Plan**

#### **EXPECTED RESULTS:**

- Produced revised Wolf Action Plan for the period of 5 years.

#### ***Action evaluation summary:***

During the last year of the project, we have organized two instead of one planned workshops for revision of the action plan developed at the beginning of the project (Action A2). The purpose of the revision was to integrate the knowledge and experiences gathered during the project, thus ensuring implementation of the activities introduced during the project also after it ends.

Both workshop meetings have been productive and focus was directed towards constructive planning of the future wolf population conservation objectives and measures. Besides the action plan, the revised document now includes a chapter with comprehensive overview of current knowledge regarding wolf conservation and management and a chapter with detailed description of population parameters to be monitored on a regular basis and methods available and suitable for monitoring of those parameters. The revised action plan was printed in 1000 copies and is being distributed to managers and other stakeholders. Thus all expected results and more (additional workshop, additional chapters, printing of the action plan) were achieved.



## REFERENCES

- Constantino, P. d. A. L., Carlos, H. S. A., Ramalho, E. E., Rostant, L., Marinelli, C. E., Teles, D., . . . Valsecchi, J. (2012). Empowering Local People through Community-based Resource Monitoring: a Comparison of Brazil and Namibia. *Ecology and Society*, 17(4). doi: 10.5751/es-05164-170422
- Ferraro, P. J., & Pattanayak, S. K. (2006). Money for Nothing? A Call for Empirical Evaluation of Biodiversity Conservation Investments. *PLoS Biol*, 4(4), e105. doi: 10.1371/journal.pbio.0040105
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behaviour: An introduction to theory and research*. Boston, MA: Addison-Wesley Publishing Company.
- Gerner, J., Heurich, M., Gunther, S., & Schraml, U. (2011). Red deer at a crossroads-An analysis of communication strategies concerning wildlife management in the 'Bayerischer Wald' National Park, Germany. [Article]. *Journal for Nature Conservation*, 19(5), 319-326. doi: 10.1016/j.jnc.2011.06.002
- Innes, J. E., & Booher, D. E. (1999). Consensus building and complex adaptive systems: A framework for evaluating collaborative planning. *American Planning Association. Journal of the American Planning Association*, 65(4), 412-423.
- Jackson, R. M., & Wangchuk, R. (2004). A Community-Based Approach to Mitigating Livestock Depredation by Snow Leopards. *Human Dimensions of Wildlife*, 9(4), 1-16. doi: 10.1080/10871200490505756
- Kastelic, L. (2013). *Analiza medijskih objav o volku od leta 2008 do 2011*. Graduation thesis, University of Ljubljana, Ljubljana.
- Kleiman, D. G., Reading, R. P., Miller, B. J., Clark, T. W., Scott, J. M., Robinson, J., . . . Felleman, F. (2000). Improving the Evaluation of Conservation Programs. *Conservation Biology*, 14(2), 356-365. doi: 10.1046/j.1523-1739.2000.98553.x
- Lange, E., & Hehl-Lange, S. (2011). Citizen participation in the conservation and use of rural landscapes in Britain: the Alport Valley case study. [Article]. *Landscape and Ecological Engineering*, 7(2), 223-230. doi: 10.1007/s11355-010-0115-2
- Laurian, L., & Shaw, M. M. (2009). Evaluation of Public Participation: The Practices of Certified Planners. *Journal of Planning Education and Research*, 28(3), 293-309. doi: 10.1177/0739456x08326532



- Margolouis, R., Stem, C., Salafsky, N., Brown, M. (2009). Design alternatives for evaluating the impact of conservation projects. In M. Birnbaum & P. Mickwitz (Eds.), *Environmental program and policy evaluation. Addressing methodological challenges. New directions for Evaluation*, 122, 85-96
- Plummer, R., & Armitage, D. (2007). A resilience-based framework for evaluating adaptive co-management: Linking ecology, economics and society in a complex world. *Ecological Economics*, 61(1), 62-74. doi: <http://dx.doi.org/10.1016/j.ecolecon.2006.09.025>
- Podatki o stanju članstva med leti 2004 in 2009. In Lovska Zveza Slovenije (Ed.).
- Reed, M. S. (2008). Stakeholder participation for environmental management: A literature review. *Biological Conservation*, 141(10), 2417-2431. doi: <http://dx.doi.org/10.1016/j.biocon.2008.07.014>
- Salzer, D., & Salafsky, N. (2006). Allocating resources between taking action, assessing status, and measuring effectiveness of conservation actions.
- Stem, C., Margoluis, R., Salafsky, N., & Brown, M. (2005). Monitoring and Evaluation in Conservation: a Review of Trends and Approaches. *Conservation Biology*, 19(2), 295-309. doi: 10.1111/j.1523-1739.2005.00594.x
- Warburton, D., Wilson, R., & Rainbow, E. (n.d.). Making a difference: A guide to evaluating public participation in central government. London: Involve.

## APPENDIX I

### Socio-demographic characteristics

Table 22: Gender rates per interest group, wolf presence area and year with the results of the Pearson's chi squared test of differences (df=1) in the gender structure between areas of permanent (PA) and occasional (OA) wolf presence.

Year	Interest group	Wolf presence area	Female (%)	Male (%)	Pearson's chi square	P (2-sided)
2010	Farmers N=259	PA	29.1	70.9	0.114	0.787
		OA	31.1	68.9		
	Hunters N=420	PA	2.3	97.7	0.188	0.765
		OA	3.0	97.0		
	General public N=605	PA	35.3	64.7	0.231	0.672
		OA	37.2	62.8		
2012	Farmers N= 267	PA	27.6	72.4	4.287	0.051
		OA	39.7	60.3		
	Hunters N=329	PA	6.2	93.8	2.960	0.104
		OA	2.4	97.6		
	General public N=529	PA	31.5	68.5	1.613	0.204
		OA	36,8	63,2		

Table 23: Mean age per interest group, wolf area of permanent (PA) and occasional (OA) presence and year with the results of the t-test for independent samples for differences between years.

		Wolf presence area	Mean	SD	t	df	P (2-sided)
2010	Farmers	PA, N=126	55.40	12.44	2.000	252	0.047*
		OA, N=128	52.15	13.78			
	Hunters	PA, N=217	48.78	14.20	-1.143	417	0.245
		OA, N=202	50.38	14.42			
	General public	PA, N=319	53.48	14.16	2.204	605	0.043*
		OA, N=288	51.11	14.70			
2012	Farmers	PA, N=116	57.70	14.85	1.321	265	0.188
		OA, N=151	55.19	15.76			
	Hunters	PA, N= 161	48.86	14.48	-2.050	323	0.041*
		OA, N=164	52.07	13.74			
	General public	PA, N=278	53.61	14.66	-0.388	533	0.698
		OA, N=257	54.12	15.45			

\*the difference is significant at a level of  $p < 0.05$



Table 24: Rates of participants residing in a city versus countryside per interest group, wolf presence area and year with the results of the Pearson's chi squared test of differences (df=1) in the residence type structure between areas of permanent (PA) and occasional (OA) wolf presence.

Year	Interest group	Wolf presence area	City (%)	Countryside (%)	Pearson's chi square	P (2-sided)
2010	Farmers N= 259	PA	10.2	89.9	4.162	0.051
		OA	3.8	96.2		
	Hunters N=406	PA	15.6	84.4	1.754	0.198
		OA	20.6	79.4		
	General public N=598	PA	21.0	79.0	1.692	0.193
		OA	25.4	74.6		
2012	Farmers N= 267	PA	2.6	97.4	3.950	0.081
		OA	0	100		
	Hunters N=322	PA	23.0	77.0	0.000	/
		OA	23.0	77.0		
	General public N=529	PA	23.0	77.0	0.957	0.365
		OA	26.7	73.3		

Table 25: Education structure per interest group, wolf presence area and year and the results of the Pearson's chi squared test of differences (df=3) in the education structure between areas of permanent (PA) and occasional (OA) wolf presence.

Year	Interest group	Wolf presence area	Unfinished primary school	Primary school	Secondary school	Higher education	Pearson's chi square	P (2-sided)
2010	Farmers N= 258	PA	5.6	34.1	50.0	10.3	5.626	0.131
		OA	6.1	21.2	62.1	10.6		
	Hunters N=413	PA	1.4	11.6	69.9	17.1	2.348	0.503
		OA	1.0	9.6	66.5	22.8		
	General public N=606	PA	3.1	16.4	50.9	29.6	6.972	0.073
		OA	0.7	12.5	56.2	30.6		
2012	Farmers N= 267	PA	4.3	42.6	41.7	11.3	0.404	0.939
		OA	4.6	38.8	44.1	12.5		
	Hunters N=328	PA	0.0	11.2	65.2	23.6	4.948	0.176
		OA	1.8	6.6	66.5	25.1		
	General public N=533	PA	1.1	8.3	58.8	31.8	0.518	0.915
		OA	0.8	7.8	57.0	34.4		



Table 26: The rate of hunters between farmers and general public per wolf presence area and year with the results of the Pearson's chi squared test of differences (df=1) between areas of permanent (PA) and occasional (OA) wolf presence.

Year	Interest group	Wolf presence area	Hunter (%)	Pearson's chi square	P (2-sided)
2010	Farmers N= 259	PA	11.8	0.379	0.538
		OA	14.4		
	General public N=606	PA	7.3	0.462	0.497
		OA	5.9		
2012	Farmers N= 268	PA	11.2	0.026	0.872
		OA	11.8		
	General public N=535	PA	7.9	1.294	0.255
		OA	5.4		

Table 27: The rate of sheep and goat farmers between hunters and general public per wolf presence area and year with the results of the Pearson's chi squared test of differences (df=1) between areas of permanent (PA) and occasional (OA) wolf presence.

Year	Interest group	Wolf presence area	Farmer (%)	Pearson's chi square	P (2-sided)
2010	Hunters N= 409	PA	13.6	1.050	0.305
		OA	10.3		
	General public N=605	PA	6.9	0.109	0.741
		OA	7.6		
2012	Hunters N= 330	PA	13.0	4.762	0.029*
		OA	6.0		
	General public N=535	PA	9.0	2.484	0.115
		OA	5.4		

\*the difference is significant at a level of  $p < 0.05$

Table 28: Gender structure for joined samples per interest group with the results of the Pearson's chi squared test of differences (df=1) in the structure between years.

Interest group	Year	Female (%)	Male (%)	Pearson's chi square	P (2-sided)
Farmers N=526	2010	30.1	69.9	1.133	0.306
	2012	34.5	65.5		
Hunters N=749	2010	2.6	97.4	1.531	0.216
	2012	4.3	95.7		
General public N=1134	2010	33.6	66.4	1.460	0.237
	2012	37.0	63.0		



Table 29: Mean age per interest group and year for joined samples with the results t-test for independent samples for differences between years.

	Year	Mean	SD	t	df	P (2-sided)
Farmers	2010, N=254	53.78	13.21	-1.983	519	0.048*
	2012, N=267	56.28	15.39			
Hunters	2010, N=419	49.55	14.31	-0.882	742	0.378
	2012, N=325	50.48	14.18			
General public	2010, N=607	52.36	14.45	-1.714	1140	0.087
	2012, N=535	53.85	15.03			

\*the difference is significant at a level of  $p < 0.05$

Table 30: The rates of participants residing in a city versus countryside for joined samples per interest group with the results of the Pearson's chi squared test of differences (df=1) in the structure between years.

Interest group	Year	City (%)	Countryside (%)	Pearson chi square	P (2-sided)
Farmers N= 526	2010	6.9	93.1	11.643	0.001*
	2012	1.1	98.9		
Hunters N=728	2010	18.0	82.0	2.787	0.114
	2012	23.0	77.0		
General public N=1127	2010	21.9	78.1	2.627	0.108
	2012	26.0	74.0		

\*the difference is significant at a level of  $p < 0.05$

Table 31: Education structure for joined samples per interest group with the results of the Pearson's chi squared test of differences (df=3) in the structure between years.

Interest group	Year	Unfinished primary school	Primary school	Secondary school	Higher education	Pearson chi square	P (2-sided)
Farmers N= 525	2010	5.8	27.5	56.2	10.5	11.716	0.008*
	2012	4.5	40.4	43.1	12.0		
Hunters N=741	2010	1.2	10.7	86.3	19.9	2.638	0.451
	2012	0.9	8.8	65.9	24.4		
General public N=1139	2010	2.2	12.6	54.6	30.6	5.806	0.121
	2012	0.7	10.3	56.6	32.4		

\*the difference is significant at a level of  $p < 0.05$

Table 32: The rates of hunters in the joined samples of farmers and general public with the results of the Pearson's chi squared test of differences (df=1) in the structure between years.

	Year	Hunter (%)	Pearson chi square	P (2-sided)
Farmers N= 527	2010	13.1	0.279	0.586
	2012	11.6		
General public N=1141	2010	6.6	0.008	0.931
	2012	6.7		



Table 33: The rates of sheep and goat farmers in the joined samples of hunters and general public with the results of the Pearson's chi squared test of differences (df=1) in the structure between years.

	Year	Farmer (%)	Pearson chi square	P (2-sided)
Hunters N= 739	2010	12.0	1.266	0.261
	2012	9.4		
General public N=1140	2010	7.3	0.000	0.991
	2012	7.3		

This publication was produced in 2013 with support from the European Union's LIFE Fund and the Ministry of Agriculture and Environment in the framework of LIFE-Nature Project Conservation and surveillance of conservation status of wolf (*Canis lupus*) population in Slovenia (LIFE08 NAT/SLO/000244)



REPUBLIKA SLOVENIJA  
MINISTRSTVO ZA KMETIJSTVO IN OKOLJE