



WORK PACKAGE 5

Report on the state of the art of current mitigation and mediation strategies in mountain areas

Collection of human-nature conflict case studies and mitigation strategies used in the Alps and in other mountain areas with indications on the transferability of results



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Contents

1.	Introduction	2
1.1.	General description and background of the issue.....	3
1.2.	Social acceptance and attitude.....	8
2.	Mitigation strategies	9
2.1.	Most used conflict mitigation strategies in mountain areas.....	10
2.1.1.	Transportation-related conflicts.....	10
2.1.2.	Wildlife damages/predation conflicts	15
3.	Mediation Strategies	17
3.1.	Public participation.....	18
3.2.	Conflict management	21
3.3.	Alternative Dispute Resolution.....	22
4.	What do we mean for conflict resolution?.....	25
5.	Projects on ecological connectivity and human-wildlife coexistence	27
5.1.	The Large Carnivores and the Alps	27
5.2.	The WOLF	28
5.3.	The BEAR.....	28
5.4.	Humans and Large Carnivores conflicts in EU projects in the Alps.....	29
6.	A general overview of conflict cases in mountain areas.....	38
6.1.	Why a case study approach in ALPBIONET2030?.....	38
6.2.	Human - Wildlife conflict cases.....	39
6.3.	Land Use, Sport Activities and New Model of Tourism	43
7.	Conclusions	46
8.	Literature	53

1. Introduction

The ALPBIONET2030 project, ecological connectivity and human-nature conflicts

ALPBIONET2030 is an Alpine Space project aimed at enhancing the current Alpine ecological network, identifying the most important and strategic areas for connectivity (SACAs) throughout the Alpine arc, and realising an integrative concept for the protection of ecosystems and biodiversity, involving stakeholder from several sectoral policies (hunting, forestry, agriculture, tourism, spatial development, etc.) in a local and transnational environment. An integrative and inclusive strategy for the advancement of ecological connectivity in the Alps will show the direct connection between wildlife management and the human dimension in mountain areas, namely the human economic activities, the local traditions and social attitude of Alpine communities towards the natural environment. Humans and wildlife represent two sides of the same coin, sharing a long-term relationship, and mutually influencing each other existence since the beginning of human presence.

The Alps are a socioeconomic and ecological system; therefore, wildlife function is strongly contingent on human acceptance or tolerance. According to Enck et al., (2006) the future of wild species depends as much on human attitudes, emotional responses and behaviours as it does on wildlife ecology. However, how is it possible to define the parameters of this relationship? Analogous to biological carrying capacity, Decker and Purdy, (1988) proposed wildlife acceptance capacity, as the maximum wildlife population level in an area that is acceptable to people. This threshold should depend on damage and nuisance, perceived competition with other species of economic interest to people, the role of a wildlife species in disease transmission and the values humans place on a species of concern, such as economic, aesthetic, ecological, educational, scientific, and intrinsic values (Blewett, 2016). Additionally, human stakeholder groups may interact systemically with each other through social, cultural, economic and legal mechanisms to develop new ways of coexisting with nature and wild species, recognizing the mutual influence and the potential benefits that may appear from the renovation of this ancient relationship. International projects like ALPBIONET2030 want to show that a positive co-development is possible and valuable, by promoting the implementation of the green infrastructure concept using ecological connectivity as a tool able to highlight both the barriers and the benefits integrating the ecological, socioeconomic and legal aspects of human-wildlife relationship.

Ecological connectivity is at the base of ecosystems' health and species protection. Measures and activities toward its implementation on the ground can provide to stakeholders and large public an enlarged view of the landscape and of its functions. It can highlight the ecological needs of wild species and the barriers that reduce their natural dispersal, giving, at the same time, the instruments for protecting humans' activities, improving habitats' health and permeability. Permeability is essentially synonymous with connectivity, referring to the degree to which regional landscapes, encompassing a variety of natural, semi-natural, and developed land

cover types, are conducive to wildlife movement and to sustain ecological processes. Currently, two ways are usually reported to increase connectivity: (1) focusing on conserving areas that facilitate movement, and (2) mitigating landscape features that impede movement, such as roads (Ament et al., 2014).

The recent return (natural or through reintroduction) of large carnivores' species (wolf and bear, respectively) in their original territories in the Alps has provoked several socioeconomic issues, such as cultivation damages, car accidents, predation to livestock and fear, stimulating several retaliations' responses, and worsening stakeholders' groups relationships. Humans and wildlife have always shared the same environment and charismatic wildlife species have been present in stories and traditions of rural populations, and in the imaginary of the large society. The new presence of these old Alpine inhabitants has raised ancient fears in the people and their need to feel protected, both for their personal safety, and for their economic activities.

As conflicts are part of life, the approach used for their resolution can become a powerful factor capable of generating territorial innovation (Gal, 2016). A conflict can change the lifestyle of a community, especially when the object of the conflict is an "external and non-human presence".

Wildlife has always had a big emotional impact on humans; therefore, the conflict with these species includes a social aspect, which needs to be taken into account when managing it.

In the ALPBIONET2030 project, human-nature conflicts will be considered more specifically, in an optic of ecological connectivity and *green infrastructures*, in their capacity to generate innovation and as opportunities for local actors to develop common strategies, identify causes and share their visions about their territories. These visions may be entirely new, innovative or more backward looking, but no less original, and in any case, they will represent an alternative (Attali et al., 2014; Melé et al., 2004).

The human development in mountain areas has to be driven by a new concept of coexistence with nature through the development of multifunctional landscapes. This goal can be achieved through the enhancement of the physical protection of human activities (*prevention/mitigation of conflict*), the enlargement of the direct participation of more stakeholder groups, public authorities and citizens (*participatory processes, social approaches*), in order to provide the necessary space and benefits (ecological, legal, economic and social) for all the inhabitants, being humans or wildlife species.

1.1. General description and background of the issue

Human-Nature conflict in a mountainous environment has a broad definition that may be applied to any political, social, economic, ethnic, religious or territorial conflict, or over resources of national interest (Libiszewski, 1992; Cohn, 2002). Conflicts in mountain areas usually develop when different needs compete with each other over space and time and on a more severe level, when international boundary

issues arise in remote areas. From a political and geographical point of view, mountains represent a special environment in terms of topographic, social and economic constraints. The main characteristics of mountain areas are fragility, diversity, marginalization and often inaccessibility. Mountain areas are regarded as especially important and difficult to manage. Geographic influence and morphology describes a way of thinking that prioritizes the physical features of a region in explaining its culture, history, and development. Geographic influence of mountain areas is also known as environmental or climate determinism and its influence on this research is significant. Moreover, human activity and agency, including language, religion, and trade customs, contribute to a region's development and culture.

Nature has as well a broad definition, since it can refer to the landscape use, to wilderness, to fauna and to plants populations. The Oxford dictionary defines Nature as "*the phenomena of the physical world collectively, including plants, animals, the landscape, and other features and products of the earth, as opposed to humans or human creations*". Nature is defined as opposed to humans or humans' creations. This view has allowed, on one hand, the identification of the cumulative effects on the natural environment that the increase in human-related infrastructures for transports, mass tourism, housing, hunting, forestry and intensive agriculture, has caused (Slingerberg et al., 2009), but on the other hand, it has created a polarization effect (*humans against nature*) in the perception of the natural environment.

The significance of conflicts and their resolutions in mountain areas is well known since the late middle age, especially in the context of communication among communities and political power regarding "land use". In fact, although individual communities and peasants continually tried to enhance the shared management of pastures and other natural resources in the valley for peaceful use, they often skirmished and at times disputes escalated into armed violence against neighbouring communities. Communities themselves closely related conflict resolution and the political autonomy of communities because the self-government of medieval communities greatly depended on the effectiveness and the intensity of communication within and among them and such communication probably facilitated conflict resolutions by the communities themselves.

In this perspective, conflicts and their resolutions among communities represent the process of intensive communication in local societies, and how conflicts are resolved reflect a region's political and social structures. Often conflicts occur at the interface between traditional, primary activities and new developing economic activities that have a less environmentally sustainable approach towards natural resources. Nowadays the strain on sharing resources accelerates the tip-over point towards conflicts. There are many sources of conflicts in mountain areas and they have a number of common sources. Conflicts characteristically occur at a small scale, because of increasing population pressure or from new problems associated with climate variability and uncertainty, coexistence with wildlife, ski resorts localisation problems, etc. They are typically caused by a lack of cooperation

between the public and private sector and enterprises as well as opposing economic and ecological values. Moreover, long term versus short-term visions can hide the dimension of a conflict that is becoming every day bigger.

Bruggers et al. (2002) identified five main factors that contribute to an increased number of wildlife related conflicts:

- Increasing suburban development, including roads, railroads, waterways or energy networks
- Presence, return or overabundance of adaptable species,
- A shift in public attitudes from utilitarian views of wildlife to those concerned with animal welfare and rights,
- Increased media interest in wildlife issues,
- Advances in wildlife science and technology that enable recovery of previously low-density wildlife populations.

Transportation and human infrastructures are significant drivers of the global biodiversity loss and cause several cumulative spatial and temporal impacts. Even if they may occupy a small portion of an area, they affect the entire landscape by modifying natural processes, altering surrounding habitats through soil destruction, pollution, noise and introduction of alien species, isolating populations, and causing the death of many wild animals.

The presence, return and overabundance of adaptable species (mainly wolves, but also humans), has found many stakeholders and administrators unprepared. Humans are a highly adaptable species with tendency to occupy the complete available territory, with little or no concern for other species, especially if they are not economically advantageous. In the Alps, the greatest human-wildlife conflicts happen with bears and wolves – but other wildlife species are affected by human presence like roe and red deer, hedgehogs and birds. Human presence and expansion in Alpine territories inflict pressure on mobile wildlife species, putting them in the middle of growing conflicts with humans.

Shepherds and livestock breeders, due to the absence of large carnivores in the Alps for decades, got used to leave sheep herds and other productive animals without protection. Now, throughout their range, brown bears and wolves may attack unprotected livestock, raid beehives, orchards, rubbish bins, and occasionally food storehouses. These situations have caused many retaliation responses, expressed through deliberate killing of problematic individuals and the emerging of a bad attitude towards large carnivores. Due to these kind of responses, the human-wildlife relationship needed to be re-thought and adapted to the new ecological situation. Several European projects (*i.e.*, *LIFE WOLFALPS*, *LIFE DINALPBEAR*) and local activities have promoted the use of mitigation and prevention measures in order to protect the mountain economic activities and reduce the bad attitude of rural people. Electric fences and guardian dogs were given free to local shepherds,

although this “new” activity is creating new conflicts with tourists and hikers, who are afraid of encountering not only bears and wolves, but also the guardian dogs. Moreover, also hunters show some concern regarding large carnivores’ return. Wolves and bears can be unwelcomed competitors for deer and other prey animals, and hunters fear the reduction of their quotas if large carnivores’ populations grow. Wildlife non-huntable species, such as bear and wolf, are perceived as untouchable and useless for the mountain economic activities (*utilitarian view of nature*). The utilitarian view of nature is an obsolete view, but still present in many Alpine communities. Due to an incompatibility between economic interests, opinions and principles, and to a certain level of ignorance and short sight, wild species are seen as “useless” or pests and treated accordingly. As long as human activities and welfare are protected, there is no real conflict with wildlife. However, when wildlife presence is not perceived as a potential drive of development or innovation, the disturbance it may create is scarcely tolerated. The shift we are assisting to, following a more welfare-oriented view of wildlife (*an example is the recent pro-wolf campaign in Italy in response to the proposed new action plan for the wolf*), may actually exacerbate conflicts. If wild species are only “accepted” (*because we “HAVE TO”*) instead of being “integrated”, their presence will be object of discussion, creating the basis for new conflicts but also for the potential development of local innovation.

Media (TV, newspapers, journals) are highly attracted by wildlife-related conflicts, since they know the emotional grab they have on large public. The “*big bad wolf*”, such as the “*cute little Teddy bear*” are high-selling news, especially when these species are “*accused*” to create problems/damages/harm to humans.

Media undoubtedly can have an effect on people’s perception, and spectacular news clearly improve sales. For this reason, the more the media report emotionally influencing news regarding nature, the more conflicts will arise or increase. Wildlife management has shown its ability to recover and bring back low-density populations to valuable ones. The reintroduction of the Brown Bear in Trentino (Mustoni et al., 2003), of the Lynx in Germany (Kramer-Schadt et al., 2005) and the natural recovery of the wolf from the Italian Apennines to the western and central Alps (Marucco, 2016), are good examples of how wildlife management is able to bring-back native alpine populations to their original ranges and territories. The problem arises when wildlife management concentrates only on pure technical aspects, without cooperating with social scientists, who could provide the necessary knowledge for taking into account the human dimension (*namely, the psychological and social impact of these charismatic species on the equilibrium of a rural community*) and work together to find common and shared solutions.

Therefore, the recovery and the return of wild species is a victory in ecological terms, but if not inserted in a framework of human-wildlife connectivity and coexistence, it can become a source of conflict, lowering the ecological value of a landscape and the socioeconomic potentials of a community. This kind of conflict touches not only conservationists and wildlife managers, but also local stakeholders,

directly economically and psychologically affected by it. Due to a lack of food and disruption of movements, wild animals come out of forest areas and attempt to feed on agricultural fields or other economic activities. People lose their crops, livestock, property, and sometimes are wounded. The animals, many of which are already threatened or endangered, are often killed or trapped to prevent future conflicts or as retaliation (Treves et al., 2006).

The concept of ecological connectivity is still unknown to many stakeholders, people and public authorities. Therefore, the implementation of restoration and protection activities may appear as useless and as a waste of money. The same may happen with conflict resolution approaches. Often, the resolution of a conflict is a punctual and short-term activity, aiming only to cease the symptoms of a conflict, but not working for the resolution at its roots. Wildlife managers have not given much emphasis to the human dimension of wildlife populations, concentrating only on the mitigation systems to avoid new conflicts with wildlife individuals (mainly large carnivores and herbivores). The inclusion of social scientists in wildlife studies may show the direct implications of the human society in relation to wildlife, allowing the identification of long-term shared local solutions, while having an eye on the global situation of wildlife movements and presence. In view of this, local/national governments understand the urgent need to reduce the levels of human-wildlife conflict to ensure that where people do live with wildlife the benefits may be greater than the costs.

It is important to take into account that:

- Many citizens do not understand (or have just a brief idea of) the methods, tools and options currently available to resolve a conflict.
- Many people do not know the legal restrictions that limit response options (i.e., bears and wolves are strictly protected species that must not even be disturbed by human presence)
- Many people do not have a clue on what a “population dynamic” and ecological connectivity are and the role they play in active management
- Many people do not accept responsibility for being part of the problem and blame only the wildlife/nature for the conflicts

Making ecological connectivity an interactive and ongoing topic in places where conflicts with wildlife occur may also be a tool for resolving them, by understanding the local importance of each Alpine area ecosystem in the Alpine-wide ecological network. By highlighting not only the ecological importance of connectivity, but also the socioeconomic and legal barriers and opportunities at stake, wildlife/nature integration in human environment could increase. A greater understanding among stakeholders, wildlife managers and large public will help to develop strategies to minimize and mitigate conflicts and allow a more efficient allocation of resources through targeted management activities.

1.2. Social acceptance and attitude

When it comes to ecological connectivity, humans' attitude and acceptance are two distinct components of the social dimension of a conflict with nature. Attitude and acceptance have an impact on the degree of the conflict; they can be related to its causes but also be determined by the conflict damaging consequences. Moreover, these two social reactions can influence each other. For the purpose of the ALPBIONET2030 project, and particularly the WP5 contribution, it is necessary to clarify this distinction, in order to choose a relevant way to manage the social dimension of the conflicts.

The dictionary defines "*Acceptance*" as a "*general agreement that something is satisfactory or right, or that someone should be included in a group*". In the framework of ecological connectivity, social acceptance could be defined as the general agreement of a population concerning positive activities that should enhance the local ecological connectivity. This agreement among stakeholder, public authorities and the population, leading to the recognition of the right of living of wildlife species, and of the ecological and economic benefits provided by EC (*ecosystem health, ecosystem services, tourism*), may increase the feeling of personal safety and encourage a common work for the reduction of negative experiences with wildlife (*which influences personal attitudes*).

People build up their attitude towards wildlife species as a response to their personal experiences. The dictionary defines "*Attitude*" as "*a feeling or opinion about something or someone, or a way of behaving that is caused by this*".

In the 1984 study of Kellert (1984), attitude of people towards animals is explored via personal interviews and questionnaires. Attitude, on one hand, is built up through the personal experiences of the respondent and, according to Kellert's study, is directly connected to the level of education. Attitude is influenced by the personal experiences with wildlife; it is a personal belief and opinion about the wildlife presence in an area and drives the behaviour towards these species.

Actually, it seems to be regardless of the level of education owned because it is directly related to the personal experiences with wildlife.

Education may influence the attitude, but it seems to be more related to the social acceptance, because knowledge about wildlife ecology, ecological connectivity and the ecosystems' health benefits can stimulate the people's openness to the welfare and animals' right, regardless of personal (bad) experiences.

The social acceptance of wildlife is an agreement to accept somebody/someone in a group. This indicator does not deal with past personal experiences with wildlife in general or with a specific species. In a framework of ecological connectivity, in rural areas, the personal attitude may be increased especially through an increase in

positive experiences with wildlife and/or by the expectations of gaining new economic benefits coming from this acceptance (which actually would change attitude). In this terms, a positive change in attitude will influence positively also the social acceptance.

We can expect that a high-educated person, living in a city, with no direct personal experience with wildlife and wilderness, will have a positive attitude towards wildlife and connectivity, because he/she is not directly involved/influenced by the presence of wildlife species. This person may also show a high level of social acceptance, due to his/her level of general knowledge.

The main problem that could emerge is that certain powerful stakeholder groups (*i.e., hunters, livestock breeders, farmers*) can influence the general social acceptance of a whole community (*and the subsequent local activities/behaviour*) spreading their bad attitude coming from the negative experiences they had with wildlife, even if the general social acceptance of local people may be positive.

It is fundamental not to confound social acceptance with attitude. The first refers to the whole community, which aims to enlarge the "*accepted living groups*"; the second is a personal opinion, driven mainly by the personal and direct experiences with wildlife species.

In the ALPBONET2030 project, the social acceptance may contribute to the establishment and enhancement of the general and local ecological connectivity.

In order to increase the general social acceptance of a community, it is important to know the attitude of stakeholders groups and of large public towards ecological connectivity, understand their relation and influence, and define a strategy to increase the general level of education and awareness, highlighting the opportunities for local people to have new positive experiences with wildlife.

2. Mitigation strategies

Definition of a mitigation strategy

There is a wide diversity of values associated with wildlife. Intrinsic values are those values associated with nature itself, independent of any direct usefulness to humans. Benefits to humans are commonly expressed in social and economic as well as emotional, spiritual and physical terms.

While most people have interacted with wildlife, both in a positive and negative way, not all agree on how human-wildlife conflicts should be addressed. Achieving consensus on strategies to prevent and manage human-wildlife conflicts will be challenging in light of the diversity of interests. Finding specific approaches to mitigating human-wildlife conflicts will require consideration of the wide range of values associated with different wildlife communities and the environment.

In terms of ecological connectivity and human-wildlife conflicts, a mitigation strategy can be defined as the way to prevent potential (and avoid existing?) negative effects of wild species' presence and roaming (damages, roadkills,

encounters in nature, livestock predation etc.). For example, a mitigation strategy would reduce the ecological effects of human linear infrastructures, such as roads. Mitigation measures have to avoid negative human-wildlife experiences, keeping separated, in specific locations, the overlapping of interest by the two “*conflicting parties*”.

2.1. Most used conflict mitigation strategies in mountain areas

Ecological connectivity should ensure a more holistic approach towards the landscape, working with local people appreciating their traditions and constraints, in order to determine the most relevant and appropriate strategies to overcome a current or emerging conflict. In order to lower the level of conflict between humans and wildlife, enhancing the level of social acceptance and ensuring a higher participation of people to wildlife management, it is fundamental to identify the most appropriate mitigation measure for any kind of conflict and for any addressed region.

Effective conflict mitigation will depend upon a two-side approach, with efforts to increase the cost-benefit ratio of wildlife presence on one side, and work to ease social and political tensions on the other. This will require much more investment, time and understanding than simply attempting to resolve conflict by reducing wildlife attacks/damages/social impact, but is vitally necessary if easier human-wildlife coexistence is to be achieved long-term in the Alpine environment.

There is the need to find feasible short-, medium- and long-term strategies such as the adoption of a Human Nature (Wildlife) Mitigation policy; to revise the local/national/international legislation; to organize Problem Animals Control Units, to keep records of the conflicts on a database and GIS mapping and to organize species-related approaches. The problem is that if solutions to these conflicts are not adequate, local support for conservation of the species also declines. In a period of economic crisis, people want to see their money spent concretely, in solutions developed with local communities and not coming to them through a “top-down” approach. An enlarged approach, as seen in recent projects and specific cases (see *below*) may benefit both the animals and local human communities.

In order to list the most used mitigation strategies, we should first define the most occurring situations where humans and wildlife/nature enter in negative contact.

2.1.1. Transportation-related conflicts

Animal-vehicle collision (AVC) is a serious environmental, socioeconomic, health and traffic issue all over the World, due to the increasing wildlife populations and to habitat fragmentation due to transport infrastructure. Every year, approximately 500 human fatalities occur due to animal-vehicle collisions in the United States and Europe. Especially heavy-bodied animals affect road safety. For this reason, road ecology is receiving growing concern among ecologists and civil engineers.

Much data have been gathered, giving evidence of the complex impact of linear infrastructure on wildlife and landscapes. Roads, railroads, and their traffic disrupt ecological processes; they can be an unsurmountable barrier for wildlife attempting to disperse, therefore increasing mortality in animals; they lead to a degradation, loss and isolation of wildlife habitat, and cause a fragmentation of the landscape in a literal sense (Seiler, 2001). Mitigation strategies (Fig. 1) should facilitate road crossing or should prevent animals from crossing roads - although this use could have a counter effect since it deteriorates the general permeability of landscape (Collison and Patterson, 2016).

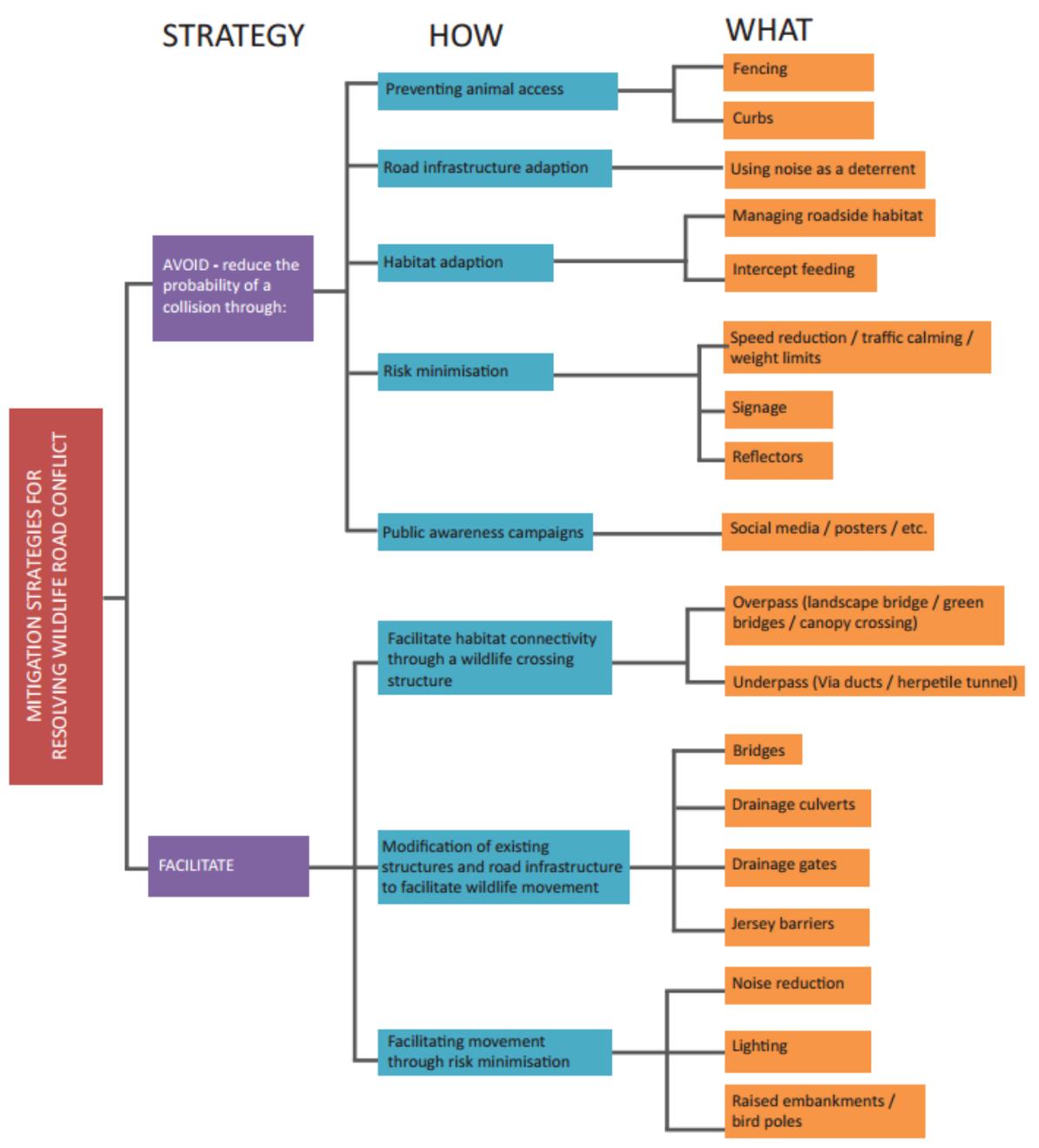


Figure 1 - Classification of strategies to mitigate Animal-vehicle collisions (Collison and Patterson, 2016)

Avoiding strategies

a) Fencing

Keeping animal off the road is the simplest and easiest way to avoid transportation-related conflicts. Fences allow the complete physical separation of the linear infrastructure from the natural environment, but may create an increased habitat fragmentation if not used in combination with animals' crossing structures (i.e., underpasses, green bridges and culvert). Fencing should extend far enough on each side of a crossing structure to promote guidance to the structure. The target species and the surrounding terrain often dictate the length of fencing. Fences' use should imply to foresee the presence of one-way gates and earthen ramps to provide an escape route, in case of accidental overcoming of the fence by an animal. Fencing, with or without crossing structures, reduce wildlife-car accidents by 54% (Ritwynski et al., 2016). Because there is no universal design that works well for all roads, we recommend that transportation officials work together with wildlife biologists to customize fencing regimes.

b) Noise

Noise produces multiple effects on ecosystems and it influences habitat use by vertebrates near roads. This mitigation measure may reduce habitat connectivity, as animals will be unlikely to cross the road, in case roads hinder important ecological corridors. Acoustic deterrents were installed on electric poles along the railway sections Rakek - Postojna and Postojna - Prestranek, where it was stated by field inspection that crossing of wildlife (especially brown bear) is possible (Petkovšek et al., 2015).

c) Reflectors

Light-reflecting devices (LRDs) are considered a promising tool to reduce the number of AVCs. These are specifically designed mirrors or warning reflectors mounted on posts along the side of roads, scattering the headlight of cars onto the roadside, thereby possibly alerting and deterring deer earlier of approaching vehicles. For more than 50 years, light-reflecting devices such as wildlife warning reflectors have been employed to alert animals to traffic when crossing roads during twilight and night. Numerous studies addressed the effectiveness of light-reflecting devices in reducing collisions with animals in past decades, but yielded contradictory results (Brieger et al., 2016).

d) Diversionary and supplementary feeding

Diversionary feeding is defined as the use of food to divert the activity or behaviour of a target species from an action that causes a negative impact, without the intention of increasing the density of the target population. In contrast, supplementary feeding is defined as the use of feeding as a conservation method to

improve the population viability or density of a particular species or population (Ewen et al. 2014). Food is used to draw animals away from problem activities or locations (such as roads and crops), and it is sometimes proposed as a socially acceptable conservation action, but little information exists on its success or what influences its efficacy (Kubasiwicz et al., 2016).

Facilitating methods (Collison and Petterson, 2016).

a) Road regulation

Road regulation measures are mitigation techniques that intervene on the drivers' behaviour and awareness to allow successful crossing by animals. They are elaborated in order to facilitate animals' crossing of a road, in the absence of crossing dedicated structures.

➤ **Signage**

Signage is a common approach to alert drivers to the presence of animals near to the road. Signage can be used to slower speed of vehicles when approaching a highly frequented wildlife area, or ecological pathways, in order to allow the animal to cross the road as well as providing the driver with more time to see and react to the presence of an animal.

➤ **Traffic reduction**

Existing studies in Sweden have shown that animals often avoid roads when traffic volumes are high (~2000 vehicles/day) because high traffic volumes effectively act as a barrier to wildlife crossing roads.

➤ **Limiting weigh**

Recent roadkill research studies in South Africa have shown more roadkill occurring when there were heavy trucks (5-6 axles) using the road. This would suggest that in some areas it might be appropriate to implement traffic control measures, which limit the axle load of vehicles using the road.

➤ **Dynamic traffic signs**

Solar power signage is used in Switzerland and Finland. It utilizes motion sensors that flash when an animal breaks the infrared beam between signs, therefore alerting drivers to animal presence. With the help of sensors, which are positioned near the road, the presence of animals along the road is detected. This triggers an electronic traffic sign "game on the road". The system warns drivers about the presence of wildlife on the road when they are approaching the problematic section. As a result, the possibility of a collision of the vehicle with animals should decrease.

b) Wildlife crossing structures

Wildlife under- and overpasses are used extensively in Europe and America. When there is suitable habitat leading to these passes, they are effective for a wide variety of animal species including invertebrates.

➤ Overpasses

Wildlife overpasses have been constructed in Europe, the U.S., and Canada. The most effective overpasses range in width from 50 m wide on each end narrowing to 8-35 m in the centre, to structures up to 200 m wide. Soil on these overpasses, ranging in depth from 0.5 to 2 m, allows for the growth of herbaceous vegetation, shrubs and small trees. Some contain small ponds fed by rainwater. Wildlife overpasses appear to accommodate more species of wildlife that do underpasses. Primary advantages relative to underpasses are that they are less confining, quieter, maintain ambient conditions of rainfall, temperature and light, and can serve both as passage ways for wildlife and intermediate habitat for small animals such as reptiles, amphibians and small mammals. By providing intermediate habitat, overpasses may provide the only feasible means for allowing various species of moles to cross highways. The major drawback is that they are expensive (Jackson and Griffin, 2000).

(Ministry of Agriculture, Food and Environment, 2016)

➤ Underpasses

Underpasses (up to 30 m wide, 4 m high) provide relatively unconfined passage for wildlife. These structures provide plenty of light and air movement, but are may be too dry for some species of amphibians. Wildlife underpasses with open medians provide a certain amount of intermediate habitat for small mammals, reptiles and amphibians. However, open median designs are much noisier than continuous bridges and may be less suitable for species that are sensitive to human disturbance. Human activity within or around underpasses may significantly reduce their effectiveness for wildlife (Clevenger and Waltho, 2000). While less expensive than overpasses, wildlife bridges are also fairly costly.

➤ Rope bridges

Rope bridges across roads have proven successful for a number of arboreal species across the world. Rope bridge overpasses in Australia were effective in restoring rainforest habitat connectivity for the Lemuroid Ringtail Possum (Goldingay et al., 2013). These bridges may be particularly effective for squirrels in the Alps.

➤ Bird poles / Raised embankment

The down-draught from traffic sometimes 'sucks' birds in and results in being killed on the road. Unlike terrestrial species, flying birds are unlikely to use wildlife passageways. The construction of high embankments on either side of the road to

force birds to fly higher and avoid being pulled into the downdraught of vehicles may be an effective deterrent (Jacobson, 2005).

2.1.2. Wildlife damages/predation conflicts

Conserving wildlife that damage crops or livestock, potentially harm humans, or take game poses a special challenge for policy makers and managers (Sillero-Zubiri et al. 2007). The traditional human response is to clear wildlife habitat or retaliate against wild animals for real or perceived threats (Woodroffe & Frank 2005). Worldwide efforts to balance human needs with those of wildlife have fuelled interest in the alternatives to retaliation. Among these are nonlethal management and ways to raise human tolerance for wildlife. Attention has also focused on the participation of affected households in planning responses to conflicts with wildlife and inclusion of a range of interest groups and values (Treves et al. 2006). Striking an optimal balance requires solutions that are scientifically sound and politically acceptable. After a literature review, we describe distinct types of methods used to mitigate human-wildlife conflicts (interventions). Then we classified these methods as *direct interventions* that aim to reduce the severity or frequency of encounters between wildlife and property or people and *indirect interventions* that aim to raise people's tolerances for such encounters (from Treves et al., 2009).

Direct Interventions

➤ Barriers

Barriers include those interventions like buffer zones, fences, moats, nets, trenches, and walls. They are generally familiar and popular among those who feel threatened. For its cost-effectiveness and impact on connectivity, see "*Fences*".

➤ Guards

Guards are referred to interventions foreseeing the supervision by dogs, humans or other animals. They are generally familiar but time required may limit acceptance; risk to guards and indirect costs or unintended effects (barking dogs or wandering dogs) may reduce acceptance.

➤ Repellents

Repellents use acoustic: sirens, explosions, and predator sounds or chemical: odor/taste repellents and conditioned taste aversion (CTA), plus visual, colors, lights, and predator mimicry. They are directed to circadian behavior, intelligence, and the visual and acoustic acuity of target, non-target wildlife, people, and domestic animals. The acceptance of these methodologies vary due to the loud sounds, lights at night, noxious odors and toxic chemicals.

➤ Manipulate problematic animals (lethal/permanent)

It foresees culling, eradication, hunting, relocate to captivity, selective removal, or sterilization of problematic animals. They are among the most socially accepted

methodologies from stakeholders because they concretely remove from the environment those individuals that create damages/problems, but provoke opposition by common interest groups.

➤ **Manipulate problematic animals (nonlethal/temporary)**

Non-lethal approaches foresee the capture of problematic animals followed by deterrence, release or relocate. The capture may be familiar but not the subsequent handling of the animals. It is generally more accepted by urban and wealthy populations.

➤ **Manipulate habitat or other wildlife**

This approach alter resources required by problematic wildlife (food, shelter, breeding sites, etc.) to discourage use of human areas. It demands information on behavioural ecology of problematic wildlife or comparisons of affected and unaffected properties/people. It is suitable for endangered wildlife if habitat is improved (e.g., restoring wild prey), but there are unpredictable consequences for wider ecosystem.

➤ **Protect wildlife or habitats**

It prevents retaliation against wildlife or habitat destruction via law enforcement, interdiction, or physical barriers to access. It is generally familiar but opposed when traditions or broader policies allow access to and the use of natural resources; enforcement may generate political clashes and local ill will.

➤ **Reduce attractiveness of property/ people**

This approach removes attractants (e.g., food and garbage), relocate property or activities, or switch contested resource to less desirable varieties. It reduces attractiveness of property/people; demands information on behavioural ecology of problematic wildlife and comparisons of affected and unaffected properties/people; foresees change in locations, timing, or attributes or vulnerable property/people. Socially, this measure could be not well accepted because it implies a change in the life style of people.

Indirect Interventions

➤ **Co-management (collaboration in planning, intervention, or monitoring)**

Co-management foresees the collaboration in planning, intervention and monitoring of interest groups, including affected households. Co-management aims at building consensus stimulate social learning; define long-term investment in relationships, through a fair representation of affected households, technical experts, and legal “owners” of wildlife

➤ **Compensation/ insurance reimbursements**

It foresees payments for damaged property or injury to people (cash or equivalent). It may be vulnerable to fraud, corruption, inefficiencies, and moral hazards. Acceptance varies with political clashes between donors, payers, and recipients; acceptance may decline as costs rise; payments do not turn recipients into pro-wildlife advocates; some recipients may reject payments in favour of wildlife control.

➤ **Incentives/ performance payments**

Incentives add value to live wildlife as a commodity or through direct payments for live wildlife. This approach wants to stimulate the valorisation of wildlife species and individuals as a touristic attractor, but currently, in the Alps, this approach is still not known. Tourism can have negative impacts on wildlife if not designed with the behavioural ecology of wildlife in mind

3. Mediation Strategies

Mitigation measures seek to affect animals' behaviour, by applying a concrete and physical pressure, which directly affects its behaviour. They can be very useful especially for preventing conflicts but they are not sufficient to manage all kind of issues related to the coexistence between humans and wildlife. Mitigation measures have to be integrated into a broader and shared strategy, built through the interaction with local stakeholders and the collaboration with communities.

An effective strategy is a multi-stage process that combines different techniques and approaches among mitigation, conflict management and public participation (Bobbio, 2006). Depending on the type of conflict to deal with, the stage of progress (latent, manifest, escalation, post conflict, etc.) and the context, it is appropriate to choose one technique rather than another, or combine them together.

To facilitate the understanding of the difference between "public participation" and "conflict management", in order to better guide the choice of the most useful, Figure 2 outlines the decision-making processes in four main areas, highlighting when it is best to use participative methodologies, and when to deal with conflict management.

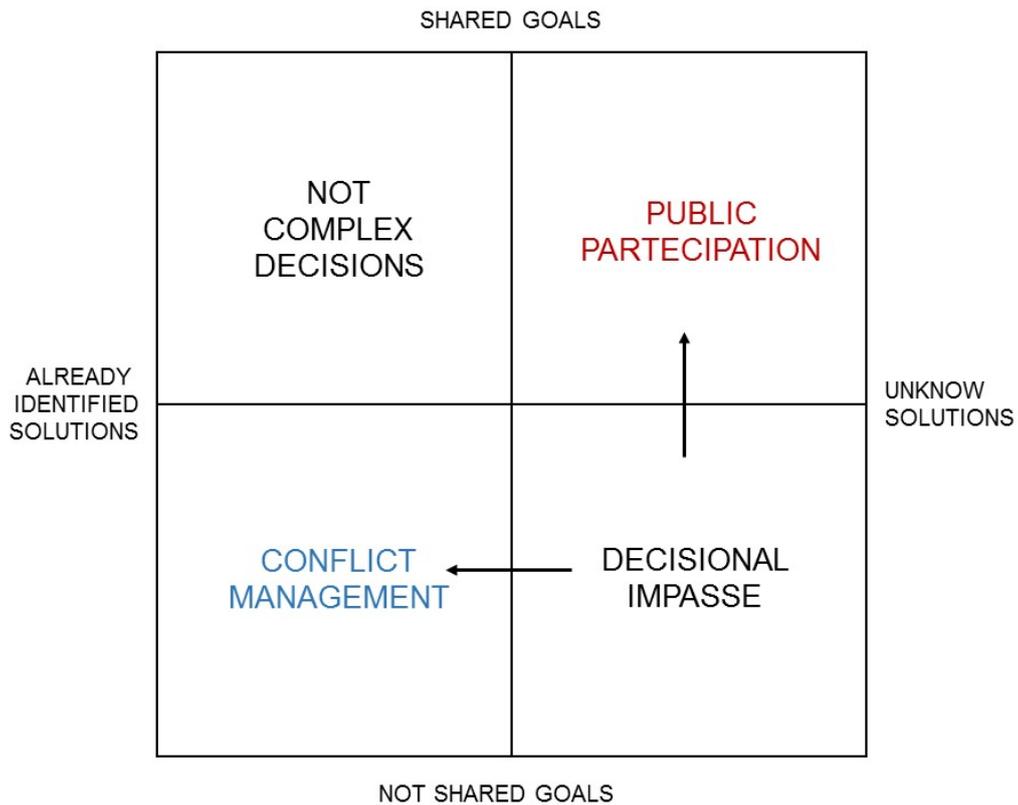


Figure 2: Public participation and conflict management

3.1. Public participation

In literature, there are many different techniques available to involve stakeholders in the decisional-making processes. Figure 3 shows some of them grouped according to the degree of openness of the decision making process in the “Ladder of public participation”: at the lowest step there are information and awareness-raising techniques, such as education methods; at the highest level there are techniques that involve stakeholders since the definition of the problem to be addressed (e.g. scenario analysis).

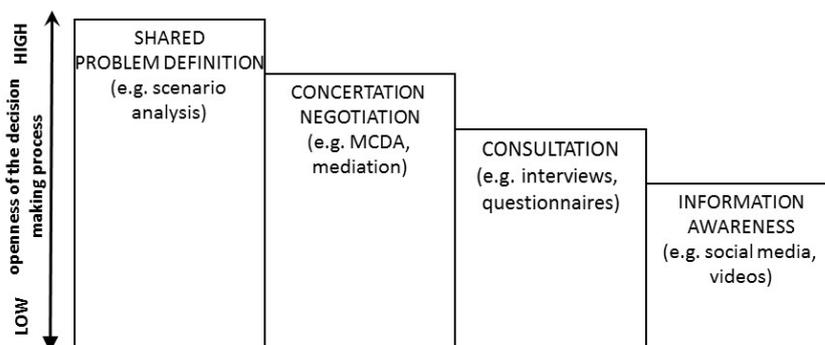


Figure 3 - Ladder of public participation [Source: Arstein (1969), Wilcox (1994) and Fareri (2009), modified]

Hereunder the description of some techniques.

➤ **Education**

A recent survey about bear management showed that education methods, namely about changing people daily behaviour, reduced the number of human-bear conflict by decreasing the amount of food conditioning bears (Marley et al., 2017).

➤ **Awareness**

The personal attitude to wildlife and its understanding is likely to influence the will of stakeholders to use mitigation strategies (AFNAE, 2015). In the meantime, it is assumed that people's knowledge influence their social acceptance. It is indeed suggested that wolf acceptance increases with knowledge about wolves, and that irrational fear of wolf is more important in areas where knowledge is low (Skrbinšek et al., 2015). Therefore, the educative process is needed where people wrongly understand wildlife-related impact because of a lack of knowledge (e.g. an increasing number of attacks on livestock is generally automatically perceived as the result of a growing population of predators, while it can be explained in other ways, such as predators' differing behaviours due to reduction in natural preys). These assumptions can easily lead to the will of regulating the species using hunting, which could even worsen the conflict instead of solving it (IPRA, 2014). However, in many cases related to large carnivore conflicts, education alone could be insufficient due to an already too high and embedded bad attitude towards them. In those cases, the use of mediation strategies could fill the gap between personal attitude and social acceptance.

Mediation strategies add the social part to the management of conflicts with nature and wildlife that in many cases consider only the ecological part of it, pointing at protecting the economic activities, but missing the psychological side of the conflicts.

➤ **Focus Group:**

Small group, but demographically representative of local stakeholders or people whose reactions are studied in guided or open discussions to determine the reactions that can be expected from a larger population. Questions are asked in an interactive group setting where participants are free to talk with other group members. Researchers should select members of the focus group carefully for effective and authoritative responses. This approach is suggested when the topic of the conflict involve stakeholder groups or citizens' associations. The representatives of these groups are supposed to bring the point of view of all their members.

➤ **Stakeholder Workshop:**

The discussion is structured and facilitated with selected value chain participants who are responsible for critical market functions, service provision and the legal,

regulatory and policy environment - the purpose of the workshop is to develop an action plan.

➤ **Interviewing Key Stakeholders:**

The semi-structured approach is suited for doing scoping interviews at the preparatory or initial stages of a research project or during proposal development. They can be used to engage stakeholders in dialogue about potential research avenues and the issues and concerns most relevant to those likely to use the research. Interview provide the opportunity to get the personal point of view of key stakeholders on a certain issue, without the direct confrontation with others. People feel freer to express their knowledge and ideas.

➤ **World Cafés:**

Simple, effective, and flexible format for hosting large group dialogue - structured in thematic tables with moderators. After the small groups (and/or in between rounds, as needed), individuals are invited to share insights or other results from their conversations with the rest of the large group. These results are reflected visually in a variety of ways, most often using graphic recording in the front of the room. This approach is useful to share different knowledge and points of view among the participants. World Cafés allow the understanding of the others' issues and promote a constructive dialogue among the parties.

➤ **Scenario analysis:**

Stakeholders are asked to define different scenarios for the resolution of a certain conflict. This approach asks for a great participation from local stakeholders, enabling management choices, strategic planning and decision-making taking into account the needs of the others. The process of mapping out different scenarios and what may be required to implement them, can help stakeholders consider the implications of a range of options when the future is uncertain. This approach is useful when "new" issues emerge in a certain territory and local people and stakeholders are not ready/used to face it (i.e, the return of the wolf).

➤ **Social Media, videos:**

Powerful and highly professional way to communicate messages to broad audiences - inform public debate and decisions in policy and practice. Social media enables the rapid spread of concepts through peer-to-peer learning. People pay attention to what their trusted information sources and friends have to say. A social analysis limited to a certain area (Facebook, YouTube, twitter, Vimeo ecc) can help identifying what do local people post in reaction to a certain issue (i.e., bear or wolf conflicts, car accidents etc.) that can be used subsequently during a stakeholder meeting.

3.2. Conflict management

An initial comparison of the conflict management approach distinguishes between “Judicial Methods” and “Alternative Dispute Resolution” (ADR). The main variables, which differentiate them, are listed in Table 1 and shown in Figure 4:

Table 1: Judicial and ADR methods [Source: Mazzucato, 2003, modified]

	Judicial Methods	ADR
Decision process	DAD (decision, announcement, defence)	inclusive
Role of the third	judge	mediator
Role of the parties	passive	active
Participation of the parties	indirect	direct
Interlocution between the parties	contradictory	dialogue
Final act	judgment	agreement

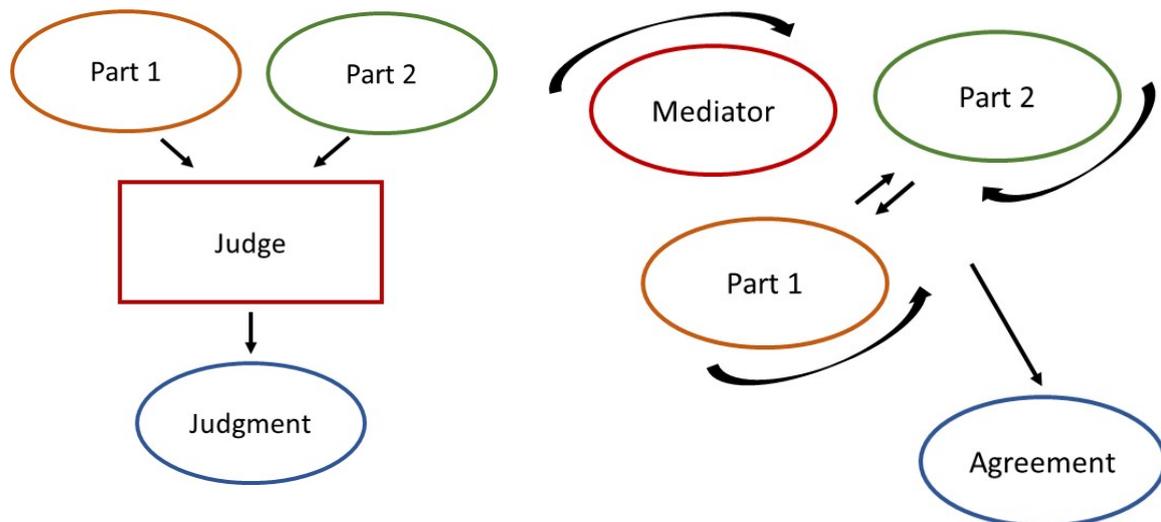


Figure 4: Comparison between role of the judge and role of the mediator

The judicial proceedings is, by its nature, a fundamental tool, yet partial. Judgments establish and ascertain the responsibilities of the involved parties, but, within a conflict in environmental matters, they only offer a partial solution to the problem. It is an approach widely used in the United States; a clear example of that can be found in the procedure that brought to the reintroduction of the wolf in the Rocky Mountains (Fitzgerald, 2015). The “mens rea” in an environmental conflict is very unlikely to be one party only. The judicial proceedings identify the legal infractions, because that is its role, but it does not support the development of any constructive dialogue among the parties; moreover, it can worsen the relationships among stakeholders. The ADR, which include activities of mediation, negotiation

and participation of the parties involved in the conflict, derive from the need to respond to a conflict in an effective and exhaustive manner, which the judicial system is incapable to provide. A decisive step towards the application of ADR tools has been the increasing awareness that the environmental conflicts include aspects related to social, cultural, ideological and economic features. These aspects are decisive and distinctive and have to be taken into account. However, they cannot be interpreted and solved only through the narrow ways of law and ordinary justice (Dini, V., 2016). A significant impulse in this respect was provided by the Aarhus Convention, a European pillar on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (United Nations Economic Commission for Europe, 1998).

3.3. Alternative Dispute Resolution

There are various techniques and methodologies to manage a conflict, which can be divided into two main categories:

a) Deliberative techniques → to achieve a shared point of view

The deliberative techniques aim at achieving a common conflict resolution through dialogue. The dialogue is obtained with a clear and impartial submission of the argumentations, and stimulating the achievement of a shared point of view, which is obtained with a continuous adjustment of the points of view, considering the reasons and needs of the participants (e.g. citizens' jury; consensus conference; deliberative polling; multiple-criteria decision analysis).

b) Negotiation techniques → to achieve an agreement

The negotiation processes aim at achieving an agreement/compromise, adjusting the needs and requirements of one party to the ones of the counterpart. The negotiation techniques imply that the parties reach a sort of accommodation, losing or exchanging something (e.g. Distributive Negotiation; Integrative Negotiation; Consensus Building Approach - CBA)

Hereunder the description of some techniques.

➤ Multiple-Criteria Decision Analyses (MCDA):

Evaluates multiple conflicting criteria in decision-making. MCDA is concerned with structuring and solving decision and planning problems involving multiple criteria. The purpose is to support decision-makers facing such problems. Typically, there does not exist a unique optimal solution for such problems and it is necessary to use decision-maker's preferences to differentiate between solutions.

➤ Distributive negotiation (also called Win-Lose negotiation)

This technique refers to a process where one party's gain is another party's loss. Both parties are competing to get the most value from the negotiation, looking only at their own interest. The distributive negotiation used - and often inevitably - when what is at stake is very simple and made of a single subject matter. The final result is compromised. Under more complex circumstances, where many subject matters are at stake, the distributive negotiation is not a valid negotiation method, because the general interests remain on the background and it thus produces less satisfactory and creative agreements than what would be possible.

➤ **Integrative Negotiation (also called Win-Win negotiation)**

The idea of this kind of negotiation was developed during the Seventies, by the Harvard Negotiation Project of the Harvard University and then synthesized in 1981 by Fisher and Ury (1981). Differently to a distributive negotiation which focuses on the respective positions and thus reduce the possibility to reach mutually satisfactory agreements, in an integrative negotiation the parties have reached an agreement after fully taking into account each other's interests. In an integrative negotiation it is fundamental to step up to more general interests, which are almost always implicit, upon which the explicit claims and requests (i.e. positions). In this kind of negotiation the interests of the collectivity are more important than the interests of the individuals.

➤ **Consensus Building approach (CBA or conflict mediation)**

This method, which is also known as "conflict mediation", was developed in the United States at the end of the Eighties by Larry Susskind of the Massachusetts Institute of Technology (Susskind & Cruikshank, 1987; Susskind et. al, 1999), and further refined thanks to the contribution of Marianella Sclavi (Sclavi & Susskind, 2011). This approach is particularly suitable in complex and controversial situations, which risk to develop a conflict escalation. The CBA resumes the principles of the integrative negotiation, and it develops them in the field of complex negotiations, which involve many parties and numerous problems. Further, this approach also integrates the emotional elements, to be considered as knowledge tools to apply a creative management of the process. The greater potential of this approach is due to the capacity to explore, together with the main involved parties, all the resolution opportunities, to reach an agreement which should as consensual as possible. This method is used in many countries and for conflicts of different kinds. In particular, it is very often applied in environmental conflicts.

In the management of ecological connectivity (EC) projects, whose main feature is its multi-functional nature, the involved parties are usually numerous. Some of them represent thousands or millions of people; the problems to face are numerous and complex and they deal not only with tangible ecological, social and economic features, but also involve values, and cultural and emotional elements. Therefore, we need to explore the problem from different points of view, identify the primary issues, look for solutions capable to satisfy many interests, invent multiple options

and favor cooperative dynamics aimed at a shared solution of the problem, in order to achieve an integrated package of agreements, which is acceptable for all. In this sense, the CBA is able to respond effectively to different conflicts, which may be encountered in EC projects. This method has a well-defined structure. At the same time, as all approaches which are suitable to face complex situations, it has a large and continuously evolving “toolbox”, which is precisely created so that every case, every context can be evaluated and enhanced also because of its individual characteristics and thus subject of an ad-hoc process.

4. What do we mean for conflict resolution?

A central logical principle of conflict resolution is that there is a need to have a good understanding of the nature of the specific conflicts that one is trying to resolve. Without this understanding, it is much harder to design effectively targeted prevention, mitigation or resolution actions. In the best case, such untargeted actions may have little impact, but in the worst case, clumsy or untargeted actions may actually increase conflict levels. Human-wildlife conflict impacts species conservation, jeopardizes human livelihood and safety, and requires increased resources from managers (Woodroffe et al., 2005). During the last 20-30 years, there has been an enormous amount of research conducted on large carnivores in Europe and the rest of the world, focusing both on the species themselves and on their interactions with humans. The majority of large carnivore research has been ecological in nature. Research devoted to solving human-wildlife conflict has tended to focus on managing wildlife, instead of considering also the human dimension. Nevertheless, there is an increasing recognition that solutions focused on wildlife alone limit managers' ability to effectively resolve conflicts, implying a need to focus management solutions on humans as well (Baruch-Mordo et al., 2009).

Recently, large carnivores' ecological studies have been joined by an increased diversity of disciplines. This is both because they provide interesting case studies for disciplinary orientated academic research and as arena where their discipline can contribute to real world social and conservation debates. The result is that we can now draw on contributions from fields as diverse as ecology (including aspects like genetics, parasitology, behaviour, community ecology and demography), veterinary science, economy, history, human-dimensions, sociology, anthropology, folklore studies, psychology, philosophy, political science and law. Between them, the contributions from this diversity of points of view have begun to give us a comprehensive picture of the complexity of the relationships and interactions between people and large carnivores or nature. This has led to a dramatic development in our understanding of conflicts, forcing a realization that they are highly complex and very context specific. The cross-fertilization of case experience with conceptual insight creates a unique dialogue on lessons learned and strategic gaps in our understanding of the conditions that need to be met to move from conflict to collaboration. It shows that conflict management is a critical but constructive way of looking at natural resource problems, involving two basic steps: conflict analysis and planned multiparty intervention. Conflict analysis involves the study, conducted by those directly involved and those seeking to assist in this endeavour, of the various dimensions, levels, and consequences of conflict, with a view to understanding the causes. Multiparty interventions, when based on study of the conflict, involve the use of a variety of techniques, such as mitigation, mediation and negotiation, leading to changes in the management of natural resources and to the changes of human behaviour.

Conflicts over natural resources have many negative impacts. However, people who study conflict also recognize its value as a catalyst for positive social change. Conflict is an intense experience in communication and interaction with transformative potential. Although confrontation can lead to violence, avoiding and shunning, conflict can be equally dangerous, as unresolved problems may flare up with renewed vigour. Misunderstandings or confusion regarding rights to natural resources and management responsibilities can escalate into more intense conflicts as the number of people involved and the problems multiply.

Conflicts are only fully resolved when the underlying sources of tension between parties are removed, a state of affairs that may be antithetical to social life. For those who view conflict as a normal and potentially positive feature of human societies, conflict should not be altogether eliminated through “resolution” but rather “managed” so that it does not lead to violence but can achieve change. The field of conflict management draws many of its principles from North American experiences with alternative dispute resolution (ADR). In contrast to litigation and other confrontational modes of conflict resolution, ADR refers to a variety of collaborative approaches including conciliation, negotiation, and mediation. Although these approaches to conflict management are appealing, do the principles really work in conflicts involving natural resources? Techniques of ADR depend on both cultural and legal conditions, such as a willingness to acknowledge publicly a conflict, and administrative and financial support for negotiated solutions. They also depend on the voluntary participation of all relevant stakeholders. These conditions are not present in many contexts in the Alps. Enlightened self-interest among stakeholders may not be apparent or sufficiently urgent in situations involving the interests of national elites or others with coercive measures at their disposal. These local mechanisms of conflict management are not always equitable and effective, especially in conflicts involving multiple dimensions and increasing intensity. Some may hinder equitable and sustainable development and can be legitimately challenged. Nevertheless, conflict management needs to be balanced with the systematic study of local practices, insights, and resources used to manage conflict. Cultural, symbolic, and psychological factors that emerge from this analysis can be used to strengthen the integrity of local strategies and redress inequities in local forms of conflict management. Moreover, attention to local strategies is important because the diversity they embody is needed to keep methodological debates open to alternative voices and experiences. In a homogenizing world, diverse local insights and methods are critical sources of innovation (Buckels and Rusnak, 2005).

5. Projects on ecological connectivity and human-wildlife coexistence

5.1. The Large Carnivores and the Alps

The Alps are one of the best-known mountain ranges as well as being one of the richest in biodiversity; it is, however, also one of the most densely populated. The traditional tool used to conserve biodiversity and the natural environment has always been the creation of protected areas. However, it has become increasingly obvious that a majorly important aspect in the conservation process is to connect protected areas to one another to allow the dispersal of species across the entire Alpine range. Moreover, wildlife and biodiversity conservation through connectivity cannot exclude the human dimension part, in its social, economic and legal aspects. The Alps are currently interested by the return of the three large carnivores' species, the Wolf, the Bear and the Lynx, in their original territories, now occupied by an expanding human population, which has provoked the background for several situations of negative human-wildlife interactions.

The historic decline and eventual eradication of the large carnivores in the Alps between 1800 and the early 1900 proceeded in parallel and was related to the expanding human population and the over-exploitation of natural habitats and resources, including forests and game. Increasing numbers of sheep, goats, cattle and horses affected the forests negatively due to browsing and out-competed the wild ungulates. The large predators were forced to kill livestock and were therefore persecuted, encouraged by governmental bounties. However, hunting alone did not lead to the eradication of the large carnivores. Only the massive intervention at the level of the landscape (forests) and the substantial reduction of wild ungulates led to the final eradication of large carnivores. A radical change in forest management and the growing sensitivity of people for the protection of nature in the first half of the 20th century were the basis for the recovery of the forests. Wild ungulates started to recover and expand from remnant source populations after they were granted a certain legal protection (change of hunting legislation). Their renaissance was supported by numerous translocations and reintroductions. A swift increase in all wild ungulate populations - which is continuing for roe deer, red deer and wild boar in many regions - was the result. The ecological recovery was facilitated by industrialization, which drew people away from rural areas. Therefore, the number of goats and sheep in the Alps declined drastically in the first half of the 20th century. All these factors prepared the ground for the return of bear and wolf to the Alps. Currently, the majority of human-wildlife conflicts having a direct connection with ecological connectivity are those happening with the bear and the wolf. The lynx is much less addressed as a cause of conflict, due to its ecological needs and behaviour, which keep this solitary animal far away from human activities.

5.2. The WOLF

The return of the wolf was a consequence of the improved protection of the remnant populations in the Apennine, in the Dinaric Range and in Eastern Europe. The first wolves arrived in the early 1990s from the Italian Apennine population and settled the southwestern Alps of France and Italy. The recovery and expansion of the wolf population in the Alps had and have a negative impact on several human activities. Predation on livestock is one of the most important consequences undergone by local populations, although wolf may also attack pets, and compete with hunters on wild game. Human-wolf conflict represents an economic issue when it relates to predation and the damage it creates, although the number of predated livestock, compared to the actual numbers, is currently not the main problem the wolf is creating. This specific conflict includes a subsequent social aspect which makes it unique, and one of the most striking in the Alps. People seem to be more scared than angry because of damages and the conflict seems to be more related to psychological aspects than to economic ones. Humans have lost their knowledge for positively coexist with large carnivores, and in front of an unstoppable situation with uncertain solutions, they react pointing at the wolf as the enemy to fight, using economic damages as a pretext. On the wolf side, on the other hand, such a conflict represents a threat for the survival of the species, although current wolf population numbers show that the species is not at risk. As for ecological connectivity in general, the presence of the wolf has a prominent and rather positive impact on ecosystems.

5.3. The BEAR

As regards human-bear conflict cases, they are multiple and mainly caused by human activities attractiveness as well. The main conflicts occurring between humans and brown bears in the Alps are due to the damage bear create on human property, and the predation on livestock. Habituated bears will approach residential areas in order to feed themselves, mostly from garbage, crops, orchards and beehives.

In addition, in this case, as seen with the wolf, human reactions may be violent and reasonless. The bear holds a different image in people's mind, and its level of social acceptance, compared to the wolf one, is definitely higher. Some people are scared of encountering the bear during hiking or outdoor activities, and ask for an increased protection of personal safety. Currently, as seen in several projects (ursus, arctos, dinalp bear), mitigation of the human-bear conflict is focusing not only on the protection of economic activities, but also on the human dimension. Researchers and public authorities involve local people and stakeholder to know their thoughts and fears and discover, in a participative approach, the best way to manage bears, making them positive actors for regional development and avoid conflicts with humans.

5.4. Humans and Large Carnivores conflicts in EU projects in the Alps

Large carnivores are an important part of wildlife species, both for their ecological roles, and for the (social) impact, they have on human populations, currently dis-habituated, in the Alps, to coexist with them. The current situation in the Alps, which shows numerous economic activities, among which livestock breeders and shepherds, was not prepared to the return of these species, although enough time was available to do that. In addition, humans are expanding in the Alps. Since 1871, the resident human population in the Alps has almost doubled, from 7.8 million to 15.2 million people. However, the population development has varied hugely within the Alps and the population distribution became much more uneven: the majority of people live below 500 m. Areas along major transport routes have become urbanized and cities at the edges of the Alps have become “commuter towns” for the metropolises surrounding the Alps. Tourist destinations have grown, too. The population has increased especially in the western parts of the eastern Alps. The population in higher elevation areas has decreased, mostly because agriculture has become unprofitable due to limited mechanization. The population decrease was most prominent in the Italian Alps (except South Tyrol), eastern Austrian Alps, and some regions in the French Alps. Young people and families moved away, and the population in these communities is considerably overaged. A further population decrease is expected in areas with unfavourable economic conditions. Considering these factors together, the state of human-wildlife coexistence is a fundamental parameter that needs to be considered when locally managing ecological connectivity. Indeed, the quality of coexistence influences the effectivity of lands’ connectivity, since on one hand it enables species’ movements and dispersal, and on the other, it may ensure the reduction / prevention of human-wildlife conflicts. The occurrence of human-wildlife conflicts, if not well managed, considering the human dimension, can result in the worsening of species populations’ size, in habitat degradation or in retaliation activities against wildlife, and therefore be a serious cause of low quality of ecological connectivity within an area. For this reason, the management of ecological connectivity certainly has to be undertaken alongside improving human-wildlife coexistence. As stated before, the present conjuncture set the stage for new and expanded conflicts in mountain areas, as human and fauna population both increase. This situation has driven to the emergence of many initiatives directed at improving nature conservation and human wildlife coexistence. These initiatives are very diverse and operate at different levels. Some of them are carried out on a local level, by small organizations and associations; others operate on a national or international level spurring cooperation between stakeholders facing a common problem in different zones. In mountain areas, where nature conservation and human-wildlife coexistence are particularly intense ongoing issues, a consequent number of national and transnational projects to implement conservation measures have emerged in the last decades, many of which are supported by European funding. The LIFE program for example is an EU funding instrument for actions that strive for nature conservation and climate issues in all

Europe, supporting 35 projects operating in mountainous areas within the last five years. The first objective of those projects is to implement concrete actions in order to mitigate environmental issues and implement conservation measures.

The following selection of EU projects addressing large carnivores' management issues at different scales, and focusing on different aspects of human-wildlife relationship, wants to show the growing interest of researchers, public authorities and stakeholders, to ameliorate the current level of human conflicts with large carnivores.

There is indeed a great number of issues to be dealt with even when considering only one species within an area. Depending on their scale and means, projects and initiatives will either focus on a specific aspect of the species issue, or implement different approach to deal with several aspects of the problem in a more holistic way. The activities carried out through projects involve specific stakeholders directly concerned by the problem such as farmers, hunters and landowners. In many cases, a larger portion of the community including local population and tourists has been targeted through awareness campaigns.

European funded projects generally create a certain dynamism and interest around their conservation purpose since they operate for 2/3 years on the same territory, with communication strategies and relatively consequent means to implement mitigation and conservation strategies. When considering the social dimension of human-nature relationship, the maintenance of educational and collaboration activities with the population and stakeholders' groups is of a major importance. If large carnivores are the subject matter of the initiative, it has been established that the public felt reassured by the idea that local authorities were managing the issue. In this way, people are more likely to accept the idea of a coexistence with these species because they feel less endangered. Projects not only provide financial means, they also broaden and allow new forms of collaboration between organizations that are generally already involved in the management of the issue (e.g. local authorities, national parks, NGO's, associations).

For these reasons, it is quite desirable to have a succession or multiplication of projects of a similar thematic over time, namely because it allows to maintain and develop the framework built up by the previous initiatives, and avoid to lose the outputs it generated.

CONFLICT TYPE:	Human-bear conflict
Project name and website	Life Ursus I & II http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=120#E1
<p>Project Overview: A remnant nucleus of the brown bear survived in the Adamello Brenta park, the only one in the Alps. Estimates put the number of individuals at only five and, as no births was recorded since 1989, the population was clearly and inexorably headed for extinction. For years the park authority and the Autonomous Province of Trento have been working for conservation of the bear habitat and for keeping the animals sheltered from disturbance by encouraging moratoria on forestry exploitation, prohibiting the opening of new roads and forestry tracks and banning any activities, which might lead to disturbance for the bears. The specific objective of the project was to avoid the definitive loss of the last brown bears population of the Alps. The main action to be undertaken was the release of brown bears taken from the wild in Slovenia, which appeared to be genetically compatible with the Trentino bears. The “Life Ursus” project was initiated in 1996 to reintroduce brown bears in Trentino and was completed in 2000. Three bears were released during the course of the project, to be monitored with radio-tracking techniques following their movements and behaviour. The programme needed to be supported by education and information activities, to seek the involvement and support of conservationists, hunters and local residents and reinforce the already favourable attitude of the local population towards the bears. Under its second phase, this project aimed to continue the actions already started under the earlier project, which ran from 1996-2000. Specifically, this follow-on project aimed to help the species reach a so-called “minimum viable population” (MVP), estimated at between 40 and 60 individuals.</p>	
<p>Mitigation approaches: Compensation of damages to beehives and domestic stocks. The monitoring activity was carried out on a daily base and the park made available to the people regular information on the movements and behaviour of the bears. This gave the people the feeling that the bears were followed carefully ensuring the security of humans and human activities and helped in reinforcing the local positive attitude towards the LIFE project.</p>	
<p>Mediation approaches: Local population, farmers and livestock breeders were involved through awareness raising measures carried out efficiently, through meetings, distribution of paper materials and information to tourists visiting the park.</p>	
<p>Key stakeholders: local population; farmers; tourists;</p>	
<p>Ecological connectivity activities: Bear reintroduction and monitoring is directly related to ecological connectivity. Scientific research on habitat suitability, habitat use, bear movements and ecological requirements is the base to build a strategy for human-bear coexistence and social acceptance, which directly favor the establishment and maintenance of ecological connectivity.</p>	
<p>Recommendations: Increase the implementation of monitoring activities and scientific research in order to inform authorities on adequate measures to prevent conflicts. Enhance public involvement in order to increase social acceptance and personal attitude.</p>	
<p>Questions/items for further research: Monitor the viability and movements of reintroduced individuals with radio collars in order to facilitate the re-establishment of an Alpine Bear population and prevent/ reduce conflicts with human activities</p>	
<p>Relation to ALPBIONET2030</p>	
<p>Wildlife: LIFE Ursus was the first project in the Alps aiming at reintroducing and sustaining a viable brown bear population. This project is directly related to ALPBIONET2030 since it has shown that it is extremely difficult to foresee the development of human-wildlife conflicts, especially with large carnivores, and how the social acceptance and attitude towards these animals is subjected to radical changes, once that some problems start to appear.</p>	
<p>Human Dimension: Monitoring activities were carried out, and the large public was regularly updated on bears behaviour and movements in order to reinforce the positive attitude toward them</p>	
<p>Comments: this project had a natural continuation in the LIFE Arctos and LIFE DinalpBear, where the issues highlighted in Ursus were taken into account and new monitoring and protection strategies have been developed and implemented.</p>	

	Human-bear conflict
Project name and website:	Life Arctos http://www.life-arctos.it
Project Overview:	The Life Arctos project was a national level project carried out between 2010 and 2014 in the Italian Alps and Apennines, to sustain further the brown bear conservation. It developed a series of structural interventions in these two areas, getting together different entities working on bear conservation.
Mitigation approaches:	Donation of electric fences to protect livestock, beehives, crops, residential areas; Capture potential problem bears; Make residential area unattractive (e.g. installation of bear-proof waste bins)
Mediation approaches:	Information and awareness campaign; Educational activities in schools, or performed by the Adamello-Brenta park; Spreading best practice for administrators external to the core area.
Key stakeholders:	Local population, livestock owners, farmers, tourists
Ecological connectivity activities:	species monitoring, development of common guidelines for monitoring and personnel training, bear conservation measures
Recommendations:	To grant long term conservation, the project came to the following conclusions and recommendations : Opportunities should be created for expansion in new areas; Any available tool should be implemented to improve the coexistence between humans and bears; Innovate public involvement means to increase acceptance; Implement monitoring and scientific research in order to inform authorities on adequate measures to prevent conflicts
Questions/items for further research:	Monitor inbreeding rate among individuals Reduce mortality rate, either from natural or anthropic causes Increase support from local communities
Relation to ALPBIONET2030	
Wildlife:	The brown bear, such as the wolf, is one the main and most important Alpine inhabitants. Its reintroduction has positive effects in ecological connectivity terms, but it has also many social implications, that need to be taken into account. The bear reintroduction and subsequent expansion, as the wolf one, has shown, and it is showing, that much work has to be done in Alpine remote areas to increase wildlife acceptance, knowledge and ameliorate attitude.
Human Dimension:	The project aimed at a high level of involvement of local community through innovative management of conflict in at least the protected areas encompassing the core bear range; The effectiveness of mitigation strategies have alleviated the discontent of farmers arising in response to attacks by predators, and reduced the gap between farmers and involved administrations.
Comments:	This project is directly related to ursus I & II, since it gave a great contribution in the process of human-wildlife coexistence, making a step forward in the avoidance of human-bear conflicts, mainly with farmers and livestock breeders, providing mitigating tools and knowledge to increase social acceptance and improve personal attitude.

	Human-bear conflict
Project name and website :	LIFE DINALP BEAR http://dinalpbear.eu
Project Overview: “Life Dinalp bear” is a European funded project running from 2014 to 2019, which aims to conserve and manage brown bears (<i>Ursus arctos</i>) population in Croatia, Slovenia, Austria and Italy. The targeted populations are the Northern Dinaric Mountains and the Southeastern Alps ones. Long-term conservation of brown bears depends mostly on possibilities to ensure coexistence with people. Therefore, “Life Dinalp bear” takes concrete conservation actions and elaborate management and action plans. Interactive info-points are set up in human-bear conflict hot spots in order to inform and communicate with public and visitors.	
Mitigation approaches: <ul style="list-style-type: none"> - Damage on human property: organic waste management (use of bear-proof organic bins); use of devices for the protection of livestock, beehives, orchards or individual fruit trees, fields, and garden; providing breeders with livestock guarding dogs; supplemental feeding - Conservation measures: providing road crossing and electrification of fences to reduce vehicles-bear collisions 	
Mediation approaches: Public awareness raising and education campaigns are carried out on local and national level. Guidelines are published, paper material is spread, and deeper education measures are taken as workshops, mainly targeting young public. Mediation techniques are also carried out such as round-table discussions with hunters or lectures.	
Key stakeholders: local population, livestock owners, land managers, the public in general	
Ecological connectivity activities: <ul style="list-style-type: none"> - Establishment of a brown bear emergency team to resolve emergencies when people are directly or have the feeling to be threatened by bears. - Internet-based population-level monitoring geo-database that will enable direct access to current bear-related data at transboundary level to managers and decision makers - Ecotourism: implementation and promotion of the non-consumptive use of brown bears - Land management: provide correct information for environmental impact assessment (EIA) that would include habitat connectivity for bears in spatial planning, and conserve the most critical locations 	
Recommendations: Spread the knowledge of managing human-bear conflicts in areas that were more recently re-colonized by bears. Avoid presence of anthropogenic food sources (e.g. slaughter remains, organic waste, garbage) and unprotected extensive orchards, which may act as attractants that draw bears closer to the settlements.	
Questions/items for further research: identify which areas are likely to be importantly affected by socially- and politically-related parameters, due to the presence of bears.	
Relation to ALPBIONET2030	
Wildlife: This project is in line with <i>Ursus</i> I & II and with <i>Arctos</i> , aiming at not only providing space for bears and the recovery of a viable population, but also at avoiding conflict situations with humans.	
Human Dimension: The project analysed the occurrence of human-bear conflicts throughout the project area and identified most important factors that influence human-bear conflicts, including stakeholders in the process of prevention and mitigation.	
Comments: Long-term conservation of brown bears depends mostly on possibilities to ensure coexistence with people. In this regard, the Life Dinalp Bear project has a very broad and integrated approach: they drive activities to improve this coexistence on a very large scale, taking mitigation, mediation and conservation measures.	

CONFLICT TYPE:	Human-wolf conflict
Project name and website:	Life MED-WOLF http://www.medwolf.eu/
<p>Project Overview: The project takes place in Italy, in the territory of Grosseto province and in Portugal, in the Guarda and Castelo Branco districts. The project goal is to decrease the conflict between humans and wolf in rural areas where cultural traditions of coexistence where lost, in order to promote the stable presence of wolves. The project duration is from September 2012 to November 2017. There are two main project objectives: to reduce conflicts between the needs of large carnivores and human activities; and to promote the stable presence of wolves in rural areas in Western Mediterranean Europe, by restoring cultural habits that allow coexistence between people and wolves.</p>	
<p>Mitigation approaches: electric fences, fixed conventional fences, high quality and well-trained livestock guarding dogs, and the management of livestock in order to reduce wolf predation risk. All these techniques being studied when implemented.</p> <p>Poisoning control and anti-poaching activities. Assessment of the efficacy of damage prevention structures and livestock guarding dogs.</p>	
<p>Mediation approaches: Awareness campaigns for the general public and livestock owners. Guards' and staff training about damage evaluation and trust building</p>	
<p>Key stakeholders: livestock owners, local population</p>	
<p>Ecological connectivity activities: Development of reliable and trustful surveys of wolf presence and status; training of the local actors involved in wolf conservation; monitoring of wolf population; assessment of damages; anti-poaching activities using GIS techniques</p>	
<p>Recommendations: Continue the monitoring of wolf populations in areas with high risk of conflicts with economic activities. Evaluate the efficiency of mitigation strategies and of communication campaigns.</p>	
<p>Questions/items for further research: Understand the causes of current conflicts with farmers and breeders in Tuscany, learning from Alpine activities and encouraging knowledge exchange.</p>	
<p>Relation to ALPBIONET2030</p>	
<p>Wildlife: As in LIFE WolfAlps and SloWolf, this project will provide important results to be discussed and potentially implemented during ALPBIONET2030 in the project-working areas.</p>	
<p>Human Dimension: Assessment of the ecologically best wolf areas where social conflicts exist and represent barriers to expansion</p>	
<p>Comments:</p>	

CONFLICT TYPE:	Human-wolf
Project name:	Life Slowolf http://www.volkovi.si/?lang=en
<p>Project Overview: The project started with planned activities on 1 January 2010 and continued until the end of 2013. It represents the first large-scale project aiming at the long-term conservation of the wolf population in Slovenia. The goal of the project is the long-term conservation of the wolf population, its main prey and habitats in Slovenia, and improvement of their coexistence with humans. The project area covers some of the best-preserved forests in the country and in Europe. The Dinaric region is considered one of Europe's biodiversity hotspots. Together with the neighboring region of Gorski Kotar in Croatia, this is the largest non-fragmented forest complex in central Europe and one of the few European regions where the three species of large carnivores still coexist.</p>	
<p>Mitigation approaches: Best practice demonstration of wolf-damage prevention measures. Damage "hot-spots", locations that suffer a large amount of wolf attacks on livestock, were selected and anti-predator protection measures were installed. These locations were monitored using video surveillance to provide direct demonstration of effectiveness. Effectiveness of anti-predator livestock protection measures was directly demonstrated through near-real-time GPS-GSM telemetry of individual wolves, as their movements with regard to protected and unprotected pastures was very precisely monitored</p>	
<p>Mediation approaches: Analysis of attitudes of the public, hunters and sheep farmers toward wolves and wolf management; Public awareness and education campaign about wolves on national and local levels, Promotion of coexistence of wolves with agriculture, Education campaign on wolves for hunters in wolf areas.</p>	
<p>Key stakeholders: public, hunters, sheep herds</p>	
<p>Ecological connectivity activities: As in LIFE WolfAlps, the project aims at improving the recovery of wolf populations in the Alps, preventing, at first glance, negative contacts with humans and promoting coexistence.</p>	
<p>Recommendations: Continuous monitoring of the population according to the standards set up in the project and defined in the wolf population action plan. Maintain positive attitudes toward wolves and its conservation among the inhabitants of wolf area.</p>	
<p>Questions/items for further research:</p> <ul style="list-style-type: none"> - Elaboration of wolf population action plan - Implementation of surveillance of wolf population conservation - Training of inspectors for recognition and evaluation of large carnivore damages to agriculture - Involvement of volunteers in the wolf population monitoring activities. Hunters will continue to participate in wolf monitoring activities after the end of the project 	
<p>Relation to ALPBIONET2030</p>	
<p>Wildlife: The wolf management and promotion of coexistence is directly related to ALPBIONET2030's activities. The results of this project will be used during the meeting with stakeholders in the eastern alps (Prealpi Giulie Natural Park and Triglav National Park) in order to check the effectiveness of the implemented coexistence activities in the last 4 years, after the end of the project.</p>	
<p>Human Dimension: The human-dimension approaches used to manage a building conflict between opposing interest groups, bringing them to participate in production and support a conservation-oriented Wolf Action Plan, can be applied to arrange of other issues where a solution for building conflict over a conservation or natural resources issue needs to be resolved. As opposed to the top-down approaches typically used in such cases (e.g. a political or expert team proposes a solution that nobody agrees with), participation of all stakeholders from the beginning of the process helps to build trust, and to provide final solutions that are supported in the field and have a chance to actually be put in practice.</p>	
<p>Comments:</p>	

CONFLICT TITLE:	Wolf predation
Project name and website:	Life WOLFALPS http://www.lifewolfalps.eu/
Project Overview: Life WOLFALPS project intends to implement and coordinate wolf conservation actions in the Alps ecosystem to support the natural wolf alpine recolonization process. The project is running from 2013 to 2019. Project actions are implemented in Italy and Slovenia, and shared with other alpine countries.	
Mitigation approaches: Livestock guarding dogs, fences. Testing the various systems of prevention and the development of ad hoc grazing strategies, combined with the analysis of the vulnerability of the pastures	
Mediation approaches: training of local actors involved in anti-poaching actions; awareness campaigns for the general public, locals, hunters, livestock owners; educational programs with schools; conferences; Increase of technical knowledge of land managers through workshops	
Key stakeholders: general public, locals, hunters, livestock owners, schools, land managers	
Ecological connectivity activities: Several surveys will evaluate the conservation status, which will lead to the implementation of concrete actions to decrease conflicts; The control of poaching action will be carried out through a coordination of strategies; Preventive measures will be adopted in recent recolonized areas; Develop local land management plans to protect the species habitat in coexistence with human activities; Develop effective wolf ecotourism; Detection and control of wolf-dog hybridization events; Evaluate the genetic status of the new alpine population and support genetically important wolves with eco-tourism campaigns	
Recommendations: Decrease livestock predation: Between all the strategies, the use of livestock guarding dogs seems to be the most effective. However, the best way to prevent the attack is to combine the use of several techniques. The recommended integrated system is to use LGD, electric fence, and human presence.	
Questions/items for further research: Increase knowledge about wolf biology and behavior in all the Alpine areas to increase social acceptance. Prepare the social ground for wolf recolonization in areas where it is still not stably present, but approaching. Increase cooperation between research, stakeholders and policy to increase protection of economic activities, and to identify potentials for the wolf to be a driver of regional development.	
Relation to ALPBIONET2030	
Wildlife: The wolf is an unpredictable predator having the potentials of generating contradictory emotions in rural and urban people. In regards of ALPBIONET2030, the wolf presence will be examined in all the project-working areas in order to understand the current knowledge and attitude of rural people to its return. The results of LIFE WolfAlps will be extremely valuable for ALPBIONET2030, which will use them to define, together with local stakeholders, the best strategy to avoid conflicts and increase social acceptance.	
Human Dimension: Surveys carried out by the project showed that in general, knowledge about wolves has a positive effect on support for wolf conservation; Age and education have considerable effects on support for wolf conservation, with young people being considerably more inclined towards wolf conservation than older people; Hunters on general have considerably lower support for wolf conservation than the public, and are apart from farmers / livestock breeders the only group with a negative average attitude. Furthermore, one of the project goal is to develop wolf ecotourism, which could play a subsequent role in the population acceptance.	
Comments: The results of those surveys, by providing data on stakeholder's willingness and sensitivity toward wolf are of a great interest in order to elaborate approaches and target relevant people to involve in conservation measures.	

CONFLICT TYPE:	Wolf predation on livestock
Project name and website :	CanOvis http://ipra-landry.com/projet-canovis
Project Overview: In France, Provence-Alpes-Cote-D'azur region suffers the largest number of wolf attacks which represented in 2015, 75% of the predations on the national scale. In the Mercantour National Park and Canjuers areas located in the most southern parts of the Alps, the Institute for Promotion and Research into livestock guardian Animals (IPRA) have been conducting research on the effectiveness of livestock guardian dogs (LGD) through monitoring operations. The purpose of this project is to improve and give concrete recommendations to shepherds to make LGDs an optimized and effective mitigation strategy. The IPRA seeks to learn more about "wolf-LGDs-Livestock" relationship in places where there is a significant predation pressure. This should bring answers to a very critical situation, where mitigation techniques, though necessary, reveal their limits, at least in the present conditions.	
Mitigation approaches: Livestock guardian dogs	
Mediation approaches: Participatory approach. Shepherds were asked to bring their own experience in order to find appropriate and shared solutions	
Key stakeholders: Livestock breeders	
Ecological connectivity activities: The protection of livestock is an indirect activity for ecological connectivity. An increased and effective protection of livestock reduce the possibility for humans and wildlife to be in negative contact, prevent the habituation of wildlife to humans as source of food, and limits the retaliation response of livestock breeders, increasing the personal attitude and influencing the general social acceptance.	
Recommendation: CanOvis project highlights the fact that the wolf and the dog are genetically the same species and this has an impact on the effectiveness of LGDs as a mitigation technique. Preliminary results suggest that encounters between LGDs and wolves are much more complex than expected, not only because they are close relatives and share the same environment for months, but also because dogs have to be properly trained in order to avoid negative interactions (i.e, hybridization, killing of dogs).	
Questions/items for further research: CanOvis fits perfectly with the current needs of shepherds in the Alps and try to respond to their main issues. The project aims and results have to be broaden to other Alpine territories, encouraging the exchange of experiences with other realities, getting more insights on the pastoralism context and the breeding and training of dogs. Moreover, the issue of potential conflicts between LGDs and tourists has to be further studied and deepen, using also theoretical models in order to better understand the relationship among different indicators (LGDs, wolf, tourism and vulnerability features). The project's results have to be spread in communication and education activities to inform the large public, the tourists and wildlife specialists.	
Relation to ALPBIONET2030	
Wildlife: The wolf is one of the most important and addressed wildlife species in the Alps, even if it does not follow the regular connectivity rules. The wolf is unstoppable in its recolonization of the Alps. This kind of projects give a great contribution (although indirectly) to ecological connectivity and human-wildlife conflict resolution, since they provide mitigation strategies for economic activities and do not work for increasing spaces for wildlife, which can be seen as useless from many stakeholders.	
Human Dimension: The project is made in collaboration with livestock breeders, on an equal footing with the IPRA experts, who could be easily integrated on the field. This participation does not only address farmers to improve their mitigation techniques, but has been used to develop a common protection and awareness strategy, using their own experience to develop LGDs activity. CanOvis project acts in the way of valuing breeders work and increasing shepherds' attitude and social acceptance of wildlife.	
Comments: The projects' strategies have been defined through field surveys, focusing on the local characteristics of sites and considering the local human-wildlife history, involving and valuing farmers' activities throughout the project.	

6. A general overview of conflict cases in mountain areas

6.1. Why a case study approach in ALPBIONET2030?

Case studies can provide very detailed information about a particular conflict that it would not be possible to acquire through another type of experimentation or empirical research. Conflicts cases can have only a local impact and being managed at local level by local actors. Such a local scale carries on disadvantages due to the impossibility to generalize the findings to the wider Alpine area, until the theories have been tested in others and more controlled conditions. Nevertheless, any conflict case happening in the Alpine arc can be considered as an important indicator of the “state of the health” of the area.

Case studies could be especially effective when joined to a reading assignment introducing the concept or explaining the analytical method applied to the case. The following case studies about human-nature conflicts are presented in a narrative way, in order to put the basis of the following WP5's future work and start a discussion with relevant actors in the Project Working Regions (PWR). The cases hereby collected represent a source of information in order to organize properly, with an innovative approach, the upcoming meetings and workshops with local and transnational stakeholders in each of the PWR.

Specific techniques for building consensus using constructive dialogue will be used, in order to engage actively local stakeholders, keeping in mind their disaffection showed during past European Projects in some of the investigated areas (i.e., Econnect, GreenAlps), and to encourage their understanding of the issue and of the other people's reasons.

Communication materials, such as videos, posters, or even field trips showing the venue in which the case is situated, will help local communities to visualize the conflict that they need to solve and the involved people. This kind of approach wants to enlarge stakeholders' view of their own territory and the people thereby living, encouraging a mutual understanding and awareness of the “connections” existing among people, people and nature, and people and wildlife species.

Case studies' “stories” are known to have the power to stimulate people's empathy and helping them to “think outside the box”.

The current situation of emerging conflicts with nature or wildlife species in the Alps needs a different approach to be solved and to generate a positive return to local communities. Case studies, although providing very little basis for scientific generalisation since they refer a specific area and not the whole alpine area, can help to understand that the management of a conflict has to be done at local level, keeping in mind the global issue of human-nature conflicts.

The research conducted until now, has detected two different “pillars” of case-studies conflicts in alpine areas.

6.2. Human - Wildlife conflict cases

Human-wildlife conflict is a major conservation and management issue wherever people and wildlife coexist. It can take many forms, including the destruction of crops and property, and competition for natural resources, but even cases of sickness transmission to domestic animals and humans and vehicle collisions. Commonly the people the most affected by conflicts are rural communities, mainly farmers and livestock breeders (damages to crops and orchards, killing and predation of livestock), but also common citizens during their daily life (i.e., wildlife vehicle collisions, encounters in nature). In many low-income countries, human-wildlife conflicts may have an adverse effect on the wellbeing of communities that closely interface with wildlife. Even though communities may be tolerant ("*social acceptance*") of wildlife, the hidden impacts of conflicts, mainly due to the personal experiences with wildlife ("*personal attitude*"), jeopardize various components of global wellbeing. Compensation payments for livestock lost to predators or crops raided by ungulates are a widespread mitigation strategy used to reduce economic impacts. They are broadly viewed as efforts to increase community tolerance of problem species. However, compensation schemes often have unforeseen effects. They may lead to a neglect of preventive measures, or make people dependent on payment. So far, we do not exactly know how these conflicts affect nutrition, physical and psychological wellbeing of communities living in mountain areas. Studies examining transaction and opportunity costs should be implemented across a range of human-wildlife conflict context. However, "wildlife" does not mean just "bear and wolf". Large parts of the Alpine Region are experiencing increasingly high densities of ungulates (Italy, Germany, Austria, Slovenia and Switzerland). At the same time, human-wildlife conflicts in managed ecosystems, such as production forests or agricultural lands, are increasing and ungulates are disproportionately influencing the functioning of ecosystems that are more natural. How is ecological connectivity affected by these events? Could a good assessment of ecological connectivity help to mitigate human-wildlife conflicts?

The research analysed some specific cases concerning human-wildlife coexistence conflicts, which can well represent the framework of the investigated general issue and help the understanding of the dimension of the problem:

- In 2012, a wolf pair settled in *Lessinia (Veneto, Italy)*, in the eastern Italian pre-Alps. One year later they had formed a reproductive pack in this area, where wolf had been absent since the 19th century (cit. LIFE WolfAlps). It resulted in consequently increasing predation on livestock; even suggesting it had become a habit in the wolves' diet. Dairy cattle farming predominates in Lessinia, where grazing is organized to minimize labour costs. Therefore, the situation rapidly raised in an intolerance among farmers who were used to practice continuous free-grazing and very low protection strategies. In Lessinia, livestock predation is not only a matter of productivity and economic

losses. Pastoralism is an embedded tradition, up to be the cultural symbol of the region. Therefore, predation is viewed as challenging the image and legitimacy of the land. This explains why the population is more likely to support farmers in the conflict. Relying on the fact that husbandry activities are necessary to conserve biodiversity, many local stakeholders today stand up against wolf conservation, claiming it compromises the wellbeing of mountain landscapes and ecosystems. Several local citizens and stakeholders, supported also by few local administrators, have suggested a proposal for a solution to this issue, meaning the physical capture and translocations of the Lessinia pack in areas farer from economic activities. This idea was not implemented because of the capability of wolves to return to the areas from where they have been captured. Currently, in order to reduce the impact the wolf pack is creating on local stakeholders, the Regione Veneto is following two different strategies: The first foresees the compensation of damages provided by wolves, in order to reduce the hostility against this species and encourage a positive coexistence. The second one aims at spreading the knowledge of fencing and deterrent facilities among farmers and livestock breeders in order to discourage wolves from attacking. Currently, a mediation strategy involving local stakeholders, experts and public authorities is missing.

- *In France*, wolf was exterminated from the territory between 1923 and 1929 after having been chased for centuries. Its official come back from Italy in 1992, in the Mercantour national Park area was the subject of heated controversy. Sixty years of absence have obviously not been enough to change people's mind about the so-called "human killer" that have been feared for centuries, even though, meanwhile, the species had become protected. For having suffered, in the past centuries, the largest number of attacks upon human, French population and politics are confused about the position to take. Like in many other countries, there is, on one hand, the animalist-related tendency to visualize wolf as a supreme creature, holding "more rights" compared to other wildlife species and whose protection is not object of discussion. On the other hand, in the French countryside where wolves are currently present, the common vision is to see the species as not being jeopardised or threatened but highly unwanted. Farmers see its protection as a non-sense and as a deliberate act of authorities against pastoralism in their region. Researchers aim at demonstrating how decision makers, when elaborating the management options to reach such a controversial balance, may use science-based data (wolf distribution and demographic dynamics). They address the question of monitoring designs in order to (1) assess the conservation status and its temporal dynamics (2) identify the relevant factors that drive the underlying biological mechanisms and (3) provide a tool

for risk analysis when considering legal wolf removal as one management option.

- In 2005 a brown bear reappeared after 100 years in the southeastern part of *Switzerland*. This bear immigrated from the Trentino population of Italy, counted in more than 40 individuals. In the last 10 years, 10 different individuals from this population have dispersed to Switzerland, where they permanently stayed in the area bordering Italy. Although three of these juvenile bears overwintered in Switzerland, no bear stayed longer than 2 years. The local authorities, due to their problematic behaviour close to villages and human activities, preventively shot two problem bears. The damages caused by the brown bears concentrated mainly on the small domestic animals (sheep and goats) summering on alpine pastures and on beehives, both in the valley and in the alpine area. An average of 20 domestic animals (mostly sheep) and 10 unprotected apiaries were killed/damaged by bears. Other conflicts with humans came from the bear being attracted by anthropogenic food sources such as waste bins and compost heaps. However, there were no incidents where people were injured by bears. The preventive killing of two bears was justified by the Swiss management plan to prevent any kind of bear attacks on humans. A participatory approach, since 2007, has started in the Graubünden Canton, mainly with beekeepers. The participatory approach since the first damages until the institutional anchoring at the legislative level has proven to be a successful model.

A few factors to emphasize were critical to the successful process:

1. Good networking and organization of beekeepers through beekeepers associations;
 2. Evidence of efficiency of the measures for motivation and sustainability;
 3. Local and national political will to support the finances and technical support;
 4. Willingness of technical support unit to offer simple and non-bureaucratic solutions;
 5. Amount of work for any possible maintenance and adjustments to the measures that is reasonable for long term;
 6. Appreciation of the engagement and exchange of information between beekeepers and the public.
- On the 15th August 2014, close to the village of Pinzolo (Trentino, Italy), a mushroom picker inadvertently approached within a few meters a bear that was resting with two cubs of the year (Signorile, 2014). This bear, named Daniza, aged 19 years was considered a problematic bear since she had caused damage to livestock, beehives and orchards, and was often near to human activities. Since 2007 she was fitted with a GPSVHF collar to monitor her movements and to implement aversive conditioning when necessary.

According to the witness of the man, as soon as he realized he immediately started to move away but was followed and attacked by the bear. During the scuffle that followed, the man was wounded, requiring 40 stitches to the injuries that were taken care of on that day at the hospital. Later on, he had to stay for several days in the hospital due to a subsequent infection. Despite the behaviour of the bear has been considered not abnormal (female defending her cubs), it was decided to capture the bear for reasons of public safety, following an order of the President of the provincial government. The Ministry of the Environment supported this decision and ISPRA (National Wildlife Institute) too, as it was in accordance with the provisions of the PACOBACE (AA.VV. 2007) (National Alpine Action Plan on Bear Management). Almost three weeks were required to capture the bear. During this time, forestry staff patrolled the area where Daniza occurred, to reduce further unpleasant encounters. On the 10th September, Daniza was captured darting her while feeding on a carcass of a preyed sheep, but died during the capture. Subsequent investigations showed that the tranquilizer and the dosage used as well as the shot fired with the tranquilizer gun were adequate, but for unknown reasons the female did not tolerate the anaesthesia.

The Provincial Administration of Trentino has carried on, since the reintroduction of the bear, a continuous informative campaign for the local population in order to minimize the potentials for negative encounters with the bears. Every year, a "bear report" informs experts, stakeholders and population on the current size of the bear population, its distribution and on damage prevention and compensation.

- In some parts of *Austria*, considering sickness transmission, classical swine fever and brucellosis have been a problem. Some cases of swine fever were registered in 2002. Tuberculosis is currently at a low level, but is increasing, particularly in red deer, as well in roe deer and ibex. The giant liver fluke (*Fascioloides magna*), an alien species from America, was first registered in Austria in the year 2000. Since then, various data concerning the epidemiology in snail intermediate hosts and cervid final hosts have been reported. *Galba truncatula* acts as snail intermediate host, and red deer, roe deer and fallow deer act as final hosts. *G. truncatula* is abundant throughout the region, especially along muddy shores of slow-flowing branches of the river system. Prevalence in deer (20-100 %) is much higher than in snails (0.03-0.2 %). Despite medical treatment of parts of the deer population, the parasite has successfully established itself on both sides of the Danube floodplain environments southeast of Vienna. During last years, it has become an increasing problem in eastern parts of Austria. Particularly, roe deer have died though the impact of this parasite and there is danger of transmission to domestic animals. However, the dominating and most important concern

associated with the management of ungulates in Austria and in Italy, is the damage caused to forestry and agriculture (Apollonio et al., 2010).

- The number of ungulates found killed by collision with motor vehicles within the “Dolomiti Bellunesi” National Park (*Province of Belluno, Italy*), has conducted local authorities to develop an interesting project finalized to prevent the number of accidents in 2017 (<http://corrierealpi.gelocal.it/belluno/cronaca/2014/01/24/news/sensori-intelligenti-per-segnalare-la-presenza-di-animale-1.8536222>). The Park hosts the most famous representatives of the alpine fauna, with the only exception of the Alpine ibex. In addition to chamois, deer and roe deer, in the 1970s also mouflons arrived because of their introduction in the territory for hunting purposes, carried out before the establishment of the Park. Among carnivores it is worth mentioning the bear, the lynx and the wolf and, since 2014, the wildcat has been also observed. Vehicle collisions are a serious environmental, socioeconomic, health and traffic issue all over the Alpine Region. Roads can affect wildlife in numerous different ways, both direct and indirectly. Habitat loss, degradation and fragmentation, as well as high speed of cars are acknowledged as direct effects of this problem. The results of the current experimentation of preventing and mitigating strategies in the Dolomiti Bellunesi National Park will be available in autumn 2017.

6.3. Land Use, Sport Activities and New Model of Tourism

A large part of the biodiversity of the Alps is linked to an interaction between the natural environment and traditional/new human practices. At present, the change in land-use, with both intensification and abandonment, and other environmental and socioeconomic processes at different scales (urbanization, new models of tourism, pollution, global change, etc.) are important forces of conflicts.

- *The expansion of renewable energies* is regarded as a key way to mitigate global climate change and to ensure the provision of energy in the long term. However, conflicts between these goals and local nature conservation goals are likely to increase because of the additional space required for renewable energies. This is particularly true for mountainous areas with biodiversity-rich ecosystems. Little effort has been undertaken to systematically compare different renewable energy sources and to examine their environmental impacts using an interdisciplinary approach. A famous case held in Val Venosta (*Alto Adige, Italy*), shows how a strong opposition to a political decision has conducted local community to remove windmill blades from a beautiful site. Considering ecological connectivity, common eiders reacted strongly to the presence of wind turbines. The number of flying birds was significantly related to flight corridor location and position of the decoy group. That behavioural reaction was interpreted to be a consequence of

their high speed and low-maneuvrability flight occurring within the vertical height range of the wind turbines. The number of landing birds also reacted to the position of the decoy group in relation to proximity to the turbines, with the greatest effects observed within the wind park. Such avoidance behaviour might decrease use of otherwise suitable habitat. The movement and noise of rotors affected neither the number of common eiders flying within corridors nor the number of birds reacting to decoys. This suggests that the avoidance behaviour observed was caused by the presence of the structures themselves and that eiders use vision when avoiding human-made structures. A similar case has been detected in **Kalkalpen National Park**.

- Since *mountain bikers* have become one of the dominant groups of public land users in the last 10 years, many new challenges and concerns have arisen. Previous research suggests that the social compatibility of this new user group with the existing pedestrian and equestrian groups is of largest concern. The nature of the issues that exist between the user groups generally are of interpersonal conflict, dealing with the relations and social exchanges between users based on their activities. Interactions between users are a major issue for the land managers; this especially becomes an area of interest when it pertains to conflict between users. The occurrence of conflict in a recreational situation may be a result of what an individual does as well as what an individual fails to do (<http://www.ladige.it/news/cronaca/2017/04/30/sat-non-arretra-fronte-biker-pressioni-forti-ma-sentieri-si-fanno-piedi>). Competition resulting from the limited resource of trails and the growing population of mountain bikers has also forced hikers to become aggressive in maintaining their stake. Hiking groups nationwide have lobbied to reduce trail access to bikers. It seems as if these closures are more of a social issue than an ecological one and that hikers, the original and more established user group, are using their pull to get what they want. This kind of conflict is well known in the Alps and in mountain areas (<https://www.outsideonline.com/1976586/are-trails-big-enough-both-mountain-bikers-and-hikers>).
- The variety of reasons people give for disapproving of *sportive activities (especially running) in mountain areas* can be summarised in three types of impact issues. First of all, from perceptions of physical impacts on the environment. Second, from social impact perceptions of safety hazards. And third, from social impact perceptions that biking is inappropriate in many natural settings. Perceptions of these types of impacts lead to conflict between riders, other track users, and track managers. Based on current knowledge, the perceptions and realities of these impacts are well discussed in Mont Blanc area. Mountain and rural areas may be very sensitive to a large afflux of seasonal visitors, since they host numerous wild species (namely

endemic species and therefore vulnerable species). Both human presence and touristic facilities can be an impediment for ecological connectivity. Besides being likely to disturb wildlife, the increasing influx of tourists also creates issues in terms of sustainability, in those places that are originally managed by considering a relatively small population. Sporting events in mountain areas, such as trails, occurring in remote places where there is hardly any human presence usually, are very likely to disturb wildlife. These events are not regular and are organized during all the year. They also sometimes take place at night, requiring very strong lights and therefore creating a non-regular light pollution. Outdoor events in France are regulated, and subject to authorization, when they require crossing a road. When they are organized on protected areas, they are also subject to authorization. In case their location includes a Natura 2000 site, they are subject to the Natura 2000 impact assessment. In the **Department of Upper Savoy**, where the Mont Blanc is located, 322 sporting events were subject to authorization in 2015, which means that the actual number of events was higher. Moreover, it must also be considered that inside the same event, several outdoor activities can be organized. Between 2010 and 2015, the number of trails increased by 32%. Although there are no survey available establishing the actual impact of these activities, one can reckon that considering their nature, occurrence and current expansion, they are very likely to have an impact on the environment and ecological connectivity. In this regard, the Conservatory of natural areas of Upper Savoy (Aster), together with Upper Savoy Department bodies, created a guidebook for the organization of sporting events in mountain areas, in order to reduce the potential impact of these activities (http://formations.univ-smb.fr/plugins/odf-web/odf/_content/program-master-agrosciences-environnement-territoires-paysage-foret.pdf). The goal of this manual is to help the organizers to improve environmental consideration when they plan an event. The guidebook provides information on legal and administrative obligations, and recommendations referred to the type of natural area that are gone through during the event.

- **Tourism in rural spaces** is a modality that stands out from many other forms of tourism such as urban tourism, for being a highly space-consuming form. Thousands of routes and paths cross-hills and mountains, waiting to be covered by tens of thousands of hikers. **Winter sports, hunting, mycological tourism, horse riding or 4x4 routes** catch the attention of thousands of visitors annually. Hundreds of rural areas have turned into a physical support for touristic practice in rural areas. However, rural tourism has been characterized, in several of its modalities, by the free use of such huge spaces. People responsible for tourist management try to organize this activity, which takes place in mountain areas available for public use. Nevertheless, this task is not always possible to fulfil, being property conflicts

one of the greatest source of problems regarding rural tourism activities. So much so that, the increase of public use in certain spaces led private owners to make a decision on enclosing their estate so as to prevent tourism practice. This fact not only suggests the compatibility of property rights with a respectful use and enjoyment of nature, but also expresses the owners' right to receive compensation or securities for using their properties. In some cases, owners, assuming responsibilities that do not belong to them, have to provide some highly tourist attraction places with infrastructures and services. This occurs without any direct financial compensation, and despite representing risks for other traditional uses, that are a profitable priority. Thus, new conflicts erupt and involve groups from a very diverse nature and interests, not always easy to reconcile.

7. Conclusions

Conflict between humans and wildlife is one of the most widespread and intractable issues that conservation biologists are facing today. This issue encompasses a huge diversity of situations and species, from the deer to hedgerows, from the bear to the wolf, in a variety of situations having different impacts and implications from ecological, economic, social and legal points of view. Living alongside such species can impose a variety of significant costs upon local people, including depredation upon livestock or game. But the cost, as seen in the present report, should be not only calculated in economic terms, but also emotionally and psychologically, due to the fact that living nearby wildlife species that cannot be totally controlled by humans (as they are used to do) imposes an additional issue of personal insecurity. As seen in many cases related especially to large carnivores, the response to these costs is often lethal control, and human-wildlife conflict may pose a significant threat to species' survival. In many places, human-wildlife conflicts are increasing, since human populations move further into previously uninhabited areas and some species recolonize parts of their range. Concomitantly, the interest for this topic has increased among conservation biologists, with a significant rise in the number of scientific articles published about human-wildlife conflict (HWC) between 1998 and 2008, as judged by citations in BIOSIS (Fig. 5).

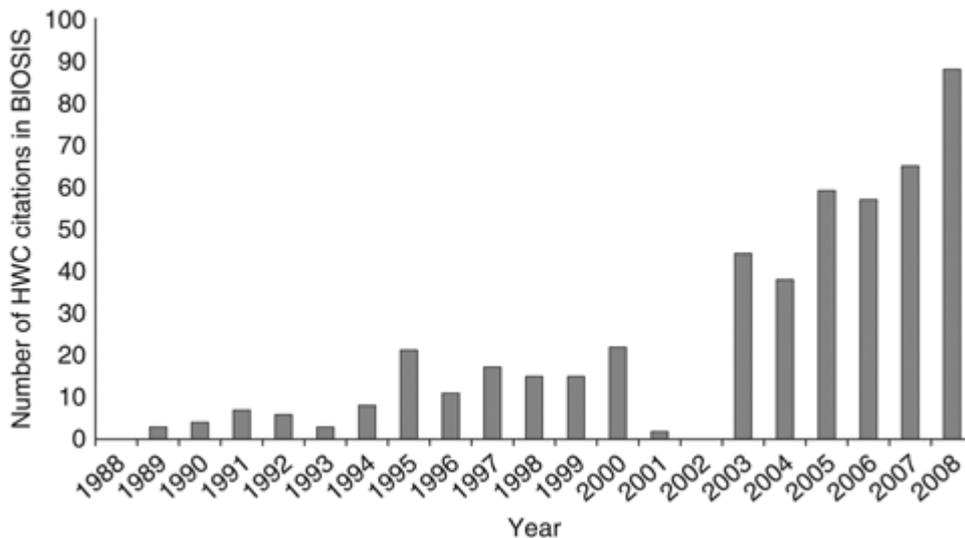


Figure 5 - Number of BIOSIS citations from 1998 to 2008, containing the keywords 'human-wildlife conflict' (from Dickman, 2010).

This increasing number of studies about conflicts are highlighting the deep connection existing between humans and their environment, in all its aspects. Conflict studies, cases and projects are showing, all over the world, that the only way to solve current and new conflicts is to consider all the phenomena connected and mutually influencing, instead of considering them separated and disconnected. Nature protection and wildlife conservation cannot be implemented without considering the human dimension - ecological connectivity and the green infrastructure concept are addressed as the way to consider the landscape as multifunctional for the needs of all living beings. Ecological connectivity goes beyond the single purpose to connect green areas for the sake of wildlife species, but points at the rediscovery of the humans - nature connections.

Human-nature/wildlife conflicts are the way in which this connection is expressed and, although they may appear as negative consequences of human expansion and/or wildlife return, they are stimulating local people and stakeholders in finding a new equilibrium among the different economic categories and between humans and the rest of nature. Conflicts are not fixed features - they change together with humans and wildlife species. Role of research is to keep itself neutral, highlight this continuous change and help local people to find new equilibria to transform the conflict in an opportunity.

In the present report we have showed that effective mitigation strategies are urgently needed in order to resolve (although partly) this issue, and a wide range of technical approaches exists for damage limitation (see *chapter 2*).

If we consider only the mitigation part of the conflict (namely "reduce the damage"), conflict resolution should be a relatively simple endeavour, with the expectation that once the appropriate strategies have been put in place to deal with the reported issue, animosity towards the species concerned should abate.

Unfortunately, evidence suggests that complete, long-term conflict resolution is rare, even where such strategies have been implemented.

Conflicts need to be managed, instead of being solved.

There are numerous reasons why conflict mitigation efforts might fail to achieve the desired long-term results, and the issues will vary substantially according to local conditions. Conservation biologists often make important assumptions about human attitudes and behaviour when deciding how to tackle conflict, but often the mismatch between assumed and actual behaviour is startling. It is almost impossible to generalize peoples' responses to events. The responses vary significantly, due to local ecological, social and economic conditions. That is why several factors need to be considered, including:

- How accurately the level of damage is assessed
- How severe such damage is considered to be and how does it affect the perceived level of conflict
- The intensity of an individual or group's response to that conflict;
- Whether or not the management of that/those species is directly linked to the reported conflict.
- The social relationship of local population to that/those species and the traditional use of landscapes
- The local history of human-wildlife relationship and the level of knowledge owned by local people in this regard
- The current activities for promoting public participation and shared management and their results

Conservation biologists should examine their local situations in-depth and carefully consider which of these factors might influence conflict, before deciding which mitigation strategies are likely to be most successful under those conditions. Often biologists start from the assumption that people are reasonably aware of the actual risk posed by wildlife, but this may be untrue. Understanding how people perceive risks is usually of interest mainly to policy makers dealing with safety issues, but such studies can also be valuable in examining the complex nature of human-wildlife interactions and can help inform our understanding of conflict. A seminal study by Starr (1969), on how people perceive, tolerate and accept risks, revealed that people were on average 1000 times more likely to accept risks they undertake voluntarily as opposed to risks imposed externally. This can be of great importance in human-wildlife conflict scenarios, where people may blame external agencies for imposing wildlife and its attendant risks upon them: for instance, in France and Norway, many farmers suspect that 'naturally recolonizing' wolves were actually secretly bred before being reintroduced (Skogen *et al.*, 2008).

People who are dependent upon a single livelihood strategy tend to be particularly antagonistic towards dangerous animals, as the potential consequences of resource

destruction are intensified by a lack of alternative assets or income strategies. This is because being at risk from a threat is not necessarily the same as being vulnerable to it. Humans tend to consider the current situation as “stable” and fixed, showing great difficulties in adapting to an external and “new” factor. We often see people’s response as disproportionate in relation to the level of wildlife damage, because people base their perceptions and attitudes not only upon facts and personal experiences, but also upon a myriad of factors such as wider societal experiences, cultural norms, expectations and beliefs.

These social factors can play an extremely important role in human-wildlife conflict, yet are relatively rarely considered. Animals play important roles in folklore in almost all cultures, and attitudes towards species can be substantially influenced by such means: for instance, mythology about vampirism is related to negative attitudes towards bats. Human-wildlife conflict is a complex issue. Reported studies, also in the current report show that reducing wildlife damage alone will often fail to produce long-term conflict resolution. Therefore, it is vital for conflict professionals to consider the assumptions they are working under, and test their veracity in the site concerned. When examined in-depth, conflict scenarios are rarely simple, and the particular dynamics of any situation must be carefully considered and assessed in order to develop the most effective mitigation strategies. Rather than the simplistic conceptual framework often assumed complexities of the human-nature relationship means that there are usually many different elements affecting the extent of negative interactions between humans and wildlife, the perceived and actual costs of those interactions, the human responses to those costs, and the consequences for wildlife of those responses. Examples of some of the elements, which can affect the intensity of human-wildlife conflict (Fig. 6), are showed below.

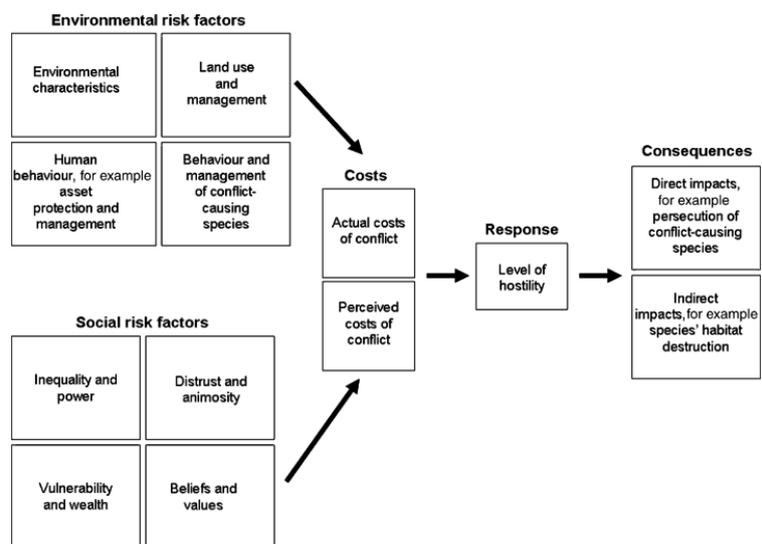


Figure 6 - Conceptual framework of some of the factors likely to affect the intensity of human-wildlife conflict (from Dickman, 2010).

The behaviour of both humans and wildlife within a particular environment obviously has important implications for the magnitude of wildlife damage experienced. Humans can effectively decrease the risk of wildlife damage by better protecting their assets, for instance by using dogs, herders and enclosures to protect livestock from predators (Woodroffe et al., 2007). Meanwhile, patterns of animal behaviour often affect conflict intensity - for instance, in Luxembourg, the territorial behaviour of stone martens *Martes foina* results in increased incidences of them damaging car engines, which is a common source of human-wildlife conflict in central Europe (Herr et al., 2009). All these environmental factors can play a major role in determining the actual level of wildlife damage caused, and therefore the costs of conflict to local people. However, despite the importance of the environmental factors in determining the level of actual damage, it is critical to realize that perceptions of that damage are often shaped by a myriad of other factors. Antipathy over perceived inequalities and imbalances of power can play an important role here - for instance, rural communities often feel particularly aggrieved by damage caused by wildlife that they perceive as being protected or imposed by more powerful urban elites (Skogen et al., 2008). Such issues are intensified by antagonism and distrust between groups. It is this complex interaction of cultural, social and personal factors that ultimately determines how costly conflict-causing species are perceived to be, and therefore the level of hostility felt towards them. Either this hostility can have important consequences, directly, by persecuting the species concerned, or indirectly, by altering habitats to reduce their suitability for such species, so it is vital that these social determinants of conflict are examined in-depth and better understood.

Our work in the present report was to show that current human-wildlife and nature conflicts are addressed in a great variety of methods. Although it can be useful to select just a couple of the main factors (mainly ecological) and examine the relationship between them, achieving long-lasting conflict resolution will need a much broader and more holistic approach. Although not all of these factors may be relevant in every conflict scenario (and in many scenarios there will be numerous other additional factors) these are the kinds of dynamics that should at least be considered and investigated by conflict researchers, in order to truly understand the nature of that specific situation and how it can best be addressed. Furthermore, there are substantial gaps in our understanding of the relationships between several of these different elements, which could be very informative to explore further in all conflict scenarios. These include (from Dickman, 2010):

- *Relationship between levels of wildlife damage and perceptions of conflict, at individual and community levels.*

One of the main problems of research is the limited time and resources to collect data on reported (and therefore perceived) conflict and on the 'actual' damage caused. However, information on the relationship between perceived and actual costs of wildlife could help mitigate conflict, as sensitive research and education

programmes might help reduce antagonism towards species, if it can be demonstrated that they are not as damaging as previously thought. It is also important to consider that in many situations, conflict studies are extremely hard to conduct in a way that does not risk inadvertently raising conflict, especially as researchers are rarely able to implement mitigation measures for everyone in an area. Therefore, locations with particularly intense reported conflicts are often targeted for mitigation, but the problem may only be displaced onto neighbours who have not had help in implementing mitigation measures. This displacement of conflict, although it may decrease antagonism at the original target location, is likely to inflame tensions elsewhere, and may even raise overall levels of conflict across the wider community. In situations where wildlife and conservation organizations are already viewed negatively, this can be a difficult side effect of well-intentioned intervention.

- *Relationship between wildlife damage, human perceptions and retaliation*

Numerous studies detail hostility towards wildlife, but researchers are often constrained in their ability to quantify independently the effect such conflict has on wildlife at a population level. Studies that simultaneously measure conflict perceptions, independently quantify 'actual' wildlife damage and monitor rates and causes of wildlife mortality are rare, but would paint a far more complete picture of how significant a threat conflict really poses, to both communities and wildlife. Furthermore, examining the characteristics of the relationship between conflict and retaliation across different sites would reveal any key factors that frequently intensify retaliation levels, and therefore highlight the most important issues to address. Moreover, when examining the consequences of conflict on wildlife, most studies focus on direct persecution, but it would also be useful to investigate indirect consequences of conflict as well, such as the clearing or burning of habitat to make it less attractive to certain species, as over a wide scale that could also have significant consequences for wildlife conservation.

- *Evidence-based examination of conflict mitigation's conservation effects*

Numerous mitigation and mediation strategies have been implemented in order to understand the roots of conflicts and reduce them, with the apparent assumption that reducing conflict will have a measurable conservation effect. However, the veracity of this assumption is rarely tested, and there is a need for rigorous studies examining the conservation effects of mitigation, both at a household and community level, and in terms of direct and indirect consequences of conflict. For instance, the displacement of conflict due to mitigation at a few locations could inflame community-wide perceptions of risk and fail to reduce overall conflict or retaliation. Furthermore, if work is mainly done with local elites (as is often the case), it may inadvertently heighten local jealousies and create more antagonism towards conservation groups and wildlife than is resolved. Lastly, established

attitudes may mean that people still kill conflict-causing species regardless of reduced problems with them, so a detailed examination of how often and under which circumstances different conflict mitigation strategies produce significant conservation benefits would be extremely useful for best directing future efforts.

- *Broadening the approach: from species to societies*

Ultimately, effective conflict resolution will require a broad, multifaceted and truly interdisciplinary approach, and conservation biologists must move beyond examining species-based conflicts towards considering the wider socio-economic, ecological and cultural conditions under which intense conflicts arise. As conservation biologists rarely have the training needed to adequately assess these anthropological factors, such studies would necessitate the involvement of numerous collaborators in order to ensure the best chance of success. Such collaboration would involve not only the individuals and communities affected by conflict, and the conservation biologists investigating that conflict, but also donors, fellow conflict researchers and professionals from other areas, such as anthropology, psychology and economics, in order to obtain the most complete picture of how humans interact with wildlife and nature in general in a certain scenario. Although this conclusion is well-accepted among many conflict practitioners, examination of the published literature and local case studies reveals relatively few cases where this kind of diverse, interdisciplinary conflict mitigation is attempted and critically assessed. Although some projects undoubtedly do take this approach (e.g., Hazzah, 2006), the increasing intensity and scope of conflict and the threat that it poses to both human and wildlife populations, highlights the pressing need for developing such projects, which are likely to produce the best chance for effectively resolving one of the most significant conservation problems in the modern world.

Further steps in Work Package 5 of ALPBIONET2030

The present report is the first step of the activities of the Work Package 5 “Alpine mediation strategy for Human-nature coexistence”. This general collection of projects and case studies about human/nature-wildlife conflict management wants to provide a first overview of the potential strategies that can be implemented in the Project Working Regions, according to the different conflicts. This report does not want to be exhaustive, but want to help local partners of ALPBIONET2030 to identify which mitigation and mediation strategy could fit to their area and to the kind of conflicts their communities are currently facing.

The following activity of WP5 will be done in the Project Working Regions, analysing with local people and stakeholders the current conflicts that are affecting their areas, in order to work together, either to start a new process of public participation for conflict management, or to evaluate the work done up to now for a known and already analysed conflict.

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