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Europe as a model for large carnivores conservation: Is the glass half empty or half full?

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ABSTRACT

At first sight, the increasing trend of many large mammal populations in EU Member States are the results from successful application of EU environmental legislation. In this perspective a 'rewilding' Europe appears as a laudable conservation goal. It has been therefore suggested that the EU model of carnivores-humans coexistence could be of interest to several other regions of the Planet. In the present paper we critically review alleged successes of the EU conservation policies. Our conclusions suggest that some optimistic reports should be taken cautiously. Firstly, one should not lose sight of the heterogeneity of 'Europe' and the different histories and socio-ecological situations of the 28 Member States. Furthermore, we doubt whether the positive status of large carnivores in Eastern Europe is attributable exclusively to EU conservation policies. Long time spans necessary for demographic recovery in large carnivores sharply contradict the quite recent entry of these countries into the EU. The EU model is possible owing to the unique socio-economic development that Western Europe experienced after the Second World War. Economic growth, urbanization, rural abandonment and reforestation are the main forces behind the increase of large mammals in some areas of Western Europe. Yet this has been possible only through a considerable input of natural resources from outside EU (food, raw materials, oil, gas etc.). Therefore, although there are examples that could be considered good experiences, we are of the opinion that the EU policies as a general model is unlikely to be exportable world-wide and may have negative consequences for wildlife, even in Eastern Europe.

1. Introduction

Large carnivores represent a charismatic and ecologically important mammal group (Gittleman, Funk, Macdonald, & Wayne, 2001) with species considered worth of extraordinary conservation efforts either *per se,* or as proxies for ecosystems integrity (focal, umbrella, keystone and flagship; Andelman and Fagan, 2000; Amori and Gippoliti, 2000; Caro, 2010; Caro, Fitzhebert, & Gardner, 2004). It is widely recognized that for their ecological role, perceived value and critical demographic status and trends, conservation of large carnivores at a large scale represents a global priority (Ray et al., 2005), also with implications for other species (Fuller and Sievert, 2001; Okarma, 1995; Skogland, 1991).

Conservation and management of large carnivores requires a thorough knowledge of their demographic trends, population status and dispersion dynamics. This should optimally be achieved at various spatial levels, from (meta)populations to landscape, regional and continental levels. Consequently, international organizations and public agencies support research in this sense (e.g. Dalerum, Cameron, Kunkel, & Somers, 2009; de Heer, Kapos, & Ten Brink, 2005). The causal analyses and interpretation of temporal trends and spatial patterns represent a strategic step in predicting the extinction risk and consequently adapting conservation strategies and policies (e.g. Boitani et al., 2015; Liberg et al., 2011; Purvis, Gittleman, Cowlishaw, & Mace, 2000).

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At the global level, the status of large carnivore species is constantly monitored (Bauer et al., 2015; Henschel et al., 2014; Ripple et al., 2014; Stirling and Derecher, 2012). Chapron et al. (2014) recently synthesize current trends of four species (brown bear, *Ursus arctos*; Eurasian lynx, *Lynx lynx*; grey wolf, *Canis lupus*; wolverine, *Gulo gulo*) in the European Union (EU). The authors based their considerations on a large amount of expert data. They concluded that increase in distribution range of all four species is the result of suitable and effective European policies towards their conservation. The authors therefore invite to consider the application of the EU coexistence model for large carnivores in other geographical contexts.

We agree that the proposed 'coexistence model' is a laudable goal, but we are not convinced that Europe, considered as a single study unit, provides such a clear-cut example of successful cohabitation between humans and large carnivores. More importantly, we are not convinced that the EU model is a universal and broadly exportable model. Moreover, we aim to critically assess the role of EU policies as the main driving force of the recently improved status of large carnivores on this continent. Below, we analyze point-by-point advantages of the EU policies and their drawbacks.

2. 'Europe' as a single sample unit? The need to stratify heterogeneous data

Advocates of the effectiveness of the EU conservation model (e.g. Chapron et al., 2014) developed their conclusions considering 'Europe' as a single sample unit. Nevertheless, even a rough review of mapped species distributions at the continental scale, shows how variable patterns of species-specific fragmentation are within the Continent. From this point of view, 'Europe' appears as a heterogeneous area that might be more realistically subdivided into at least four macro-regions (as sub-samples for study): Fenno-Scandia; Eastern Europe; Southern (Mediterranean) Europe; and, Central-Western Europe (Fig. 1). Each of these units is characterized by its own distinct environmental parameters that have led to different socio-economic systems, leading in turn to markedly different local human-wildlife histories and trajectories. Context-specific history is vital in applied ecology and in conservation case studies (Swetnam, Allen, & Betancourt, 1999). In 'Europe' these historical and geographic differences are reflected as differences in the amount of habitat availability for the carnivore species selected as targets in the EU Member States. Viewing these spatial patterns, there are major differences in the level of range fragmentation, and consequently in the level of isolation of sub-populations, among the macro-regions. A primary coarse-grained cause of this range fragmentation is the differential forest loss and fragmentation in Western Europe that has had a strong negative effect on the present occurrence of large and/or specialised species (Mikusiński & Angelstam, 2004). For making generalizations, we still have very small amount of empirical data on species responses to habitat fragmentation (Zanin, Palomares, & Brito, 2015). Large carnivores (particularly for brown bear and Eurasian lynx), with their particular ecological traits like low densities, high trophic level, low reproduction rate, large body size and limited dispersal ability (Ewers & Didham, 2006; Saura, Estreguil, Mouton, & Rodríguez-Freireb, 2011) respond erratically to landscape forest pattern changes. Habitat loss, fragmentation and degradation due to the effect of surrounding anthropogenic matrix are the greatest threats to mammals everywhere (Mortelliti, Amori, Capizzi, Rondinini, & Boitani, 2010), and the isolation of fragmented populations can be a proxy of extinction threat (Fischer & Lindenmayer, 2007).

Forest fragmentation apart, it is arguable that each species exhibits significantly different trends in individual macro-regions due to other context-specific threats like recreational harvesting, conflicts with

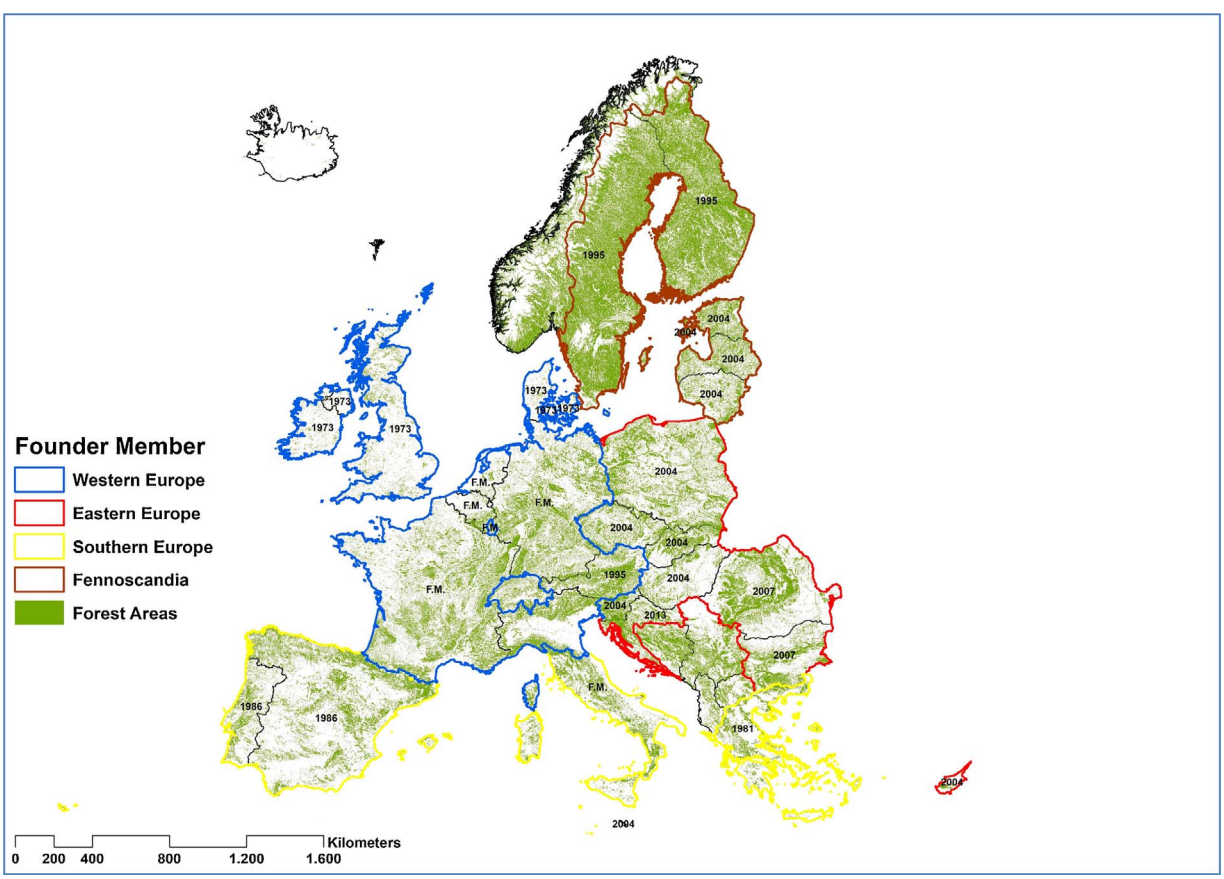

Fig. 1. Europe as a stratified sample (Western Europe, Eastern Europe, Southern Europe and Fennoscandia) and related forest cover. For each Member State the year of entrance in EU has been reported (F.M. = Founder Member State).

humans and poaching, vehicle collisions, and human-related changes in prey availability (e.g. ungulates; Apollonio et al., 2010). For these reasons, there is nothing like a single status or trend for all the species throughout 'Europe'. In this sense, it looks improbable to restore large landscapes for maintaining viable (meta)populations of these sensitive species in 'Europe'. Besides, one must consider the addition of further feedbacks indirectly related to range fragmentation, such as risk of vehicle collisions with dispersing animals due to pervasive road networks (Kowalczyk, Górny, & Schmidt, 2015; Kramer-Schadt, Revilla, Wiegand, & Breitenmoser, 2004), and the lack of broad-scale habitat connectivity at the landscape scale (Schadt et al., 2002). Independently of positive conservation policies of the EU, it seems improbable that populations of large carnivores in Western Europe will soon be safe from local extinctions because of high human population density and a plethora of related socio-economic factors which generate threats and conflicts (Cardillo et al., 2004; Woodroffe, 2000). Even if the situation will not continue to deteriorate, sudden population collapses may yet occur due to lag effects (Ceballos & Ehrlich, 2002; Peterson, Vucetich, Page, & Chouinard, 2003) and intensified conflicts with local communities (e.g. Essen & Hansen, 2015). The situation in Western Europe is quite different to Eastern Europe and, to a lesser extent, the Fenno-Scandia macro-region, where the level of human density, anthropogenic effects (particularly, forest fragmentation), and historical socio-economic situations have been profoundly different (Fennoscandia: Kouki, Löfman, Martikainen, Rouvinen, & Uotila, 2001; Eastern Europe: Prishchepov, Radeloff, Baumann, Kuemmerle, & Műller, 2012). Although there is merit in planning conservation strategies at a wider scales (Rouget, Cowling, Lombard, Knight, & Kerley, 2006), we should consider that conflicts and failures at a smaller local scale can have deep consequences at national and international level.

The heterogeneity of 'Europe' as a single sample unit may be observed also from the EU policy point of view. Healthy populations of some large carnivores (mainly brown bear and Eurasian lynx) persisted in countries that only quite recently entered the European Union, such as Slovenia (2004), Romania (2007), and Croatia (2013). Interestingly, lynx seems to be in decline in Slovenia and Croatia – this decline mainly happened after joining the EU (Slovenia: Kos, Koren, Potočnik, & Krofel, 2012).

Although environmental legislations had certainly a role in facilitating wolf recolonization in some of the early EU Member States, we have some doubts about whether the positive status of large carnivores in Eastern Europe may be attributed to the EU conservation policies.

The EU's policies span a few decades, but for such long-lived species, with large generation times, significant population responses may occur at large time frames from many decades to few centuries (Armbruster, Fernando, & Lande, 1999). Therefore, the rise in numbers observed during the last decade or two might be due to stochastic population dynamics alone and not related to responses to EU policies. Our ignorance on the natural dynamics of population fluctuations (see the Prestonian shortfall in Hortal et al., 2015) seriously impairs the capacity to evaluate the outcome of environmental policies. These less optimistic considerations are particularly relevant to brown bear and Eurasian lynx (see Basille et al., 2009; Zedrosser, Dahle, Swenson, & Gerstl, 2001). The wolf is locally stable or in expansion in Southern and Central-Western Europe (Chapron, Legendre, Ferrière, Clobert, & Haight, 2003).

In Slovenia, bear conservation was based on pillars which were all eliminated by the EU legal (or partly, the moral) system. Paradoxically, Slovenia changed a proven successful bear strategy, largely to adopt itself to the EU standards; abandonment of supplementary feeding with carrion is the most notable example (Krofel, Jonozovič, & Jerina, 2012; Kryštufek, Flajšman, & Griffiths). In Slovakia a 30 years moratorium on bear hunting was established already in 1932 and compensation for bear damages has been paid since 1962 (Rigg & Adamec, 2007). We suggest that Slovenia and other East European countries now in the EU will serve as effective case-studies to effectively evaluate the long-term results of EU policy on large carnivores populations.

We agree with Linnell et al. (2001) that conservation of large carnivores is possible at high human densities if management policy is favourable. Nevertheless, we stress a great future uncertainty of a complex socio-ecological context, and the stochasticity of processes or context-specific threats, which may compromise any policy strategy at a continental scale (Liberg et al., 2011). Ironically, although human-carnivore coexistence was more easily achievable in some East-European regions (Dorresteijn et al., 2014; Kaczenshy, Blazic, & Gossow, 2004; Lescureux et al., 2011), the existing EU model has been imposed to these new Members instead of adopting their positive practice.

3. 'Europe' as a representative and exportable model?

From a broader perspective, 'Europe' has a particularly intense history of human-wildlife interactions. Moreover, when considering the human population density, 'Europe' is a 'full world' (Farina, Johnson, Turner, & Belgrano, 2003), contrary to other 'empty' continents (Africa, large sectors of Americas) where human density is low. Furthermore, average EU cultural attitude to nature conservation (not necessarily that of local rural communities), well depicted by the richness of its conservation policies and programs, is different to the perfectly licit cultural attitudes in other regions of the world. Most of the non-European governments (especially in Asia and Africa) generally lack a long-standing, culturally-ingrained environmental ethos (Fahn, 2003; Rajamani, 2003). These differences (i.e. between EU and G77) are well represented when one follows negotiations on these issues within international fora (Brett, 2007; Vaughan, 1993).

In view of that, we call for caution in transmitting aspects of a case study from a single, peculiar and heterogeneous continent to several other geographical areas. Perhaps, the EU policy towards large carnivores should be perceived as an interesting and very data rich case study. Moreover these political and management efforts may be contributing to mitigate threats and conflicts and in favoring species persistence. However a cautious approach should be applied when these experiences would be exported as an universal model.

Indeed, we believe that there is a danger in believing that since socio-economical model (and political processes) that originated high human density, conflicts and fragmentation maintain species for long time, ergo these models can be exported to other contexts. In the short-term, it seems to us there is an urge to offer positive models integrating population growth, economic development, capitalism and charismatic large carnivore conservation while the data might be quite ambiguous. Rather we should focus on contact points in each continent where some approaches that may seem to be successful in one context are tested in others. For example, the current increase in mechanized techniques to improve production in tropical contexts (e.g. Brazil; Cabral & Brito, 2013) yet this trend occurred several decades ago in Europe. Thus, the European experience may help to predict the effects of these changes in tropical carnivores, to see what strategies were used to minimize the effects and which was more successful. By learning from the European experience, countries that are now suffering the same trends may well adopt some of the tools more appropriate to fight the biodiversity crisis.

'Europe' has a long history of large carnivore extinctions (Woodroffe, 2000). From a policy standpoint, we are analysing a reasonable but limited time frame of few decades. Large carnivores observed today in regions of the 'full world' with a long history of wildlife conflicts (Europe, and to a lesser extent Asia), might be considered the survivors from the Late Pleistocene megafauna that is separated from our times by a very short period. Therefore, the large carnivores found today in Europe, and in analogous countries where these animals have co-existed with humans for centuries of millennia, had time to evolve some degree of avoidance to anthropogenic threats. Indeed surviving carnivore 'stocks' have had time enough to limit conflicts with humans through 'cultural' acquisition and behavioral plasticity, favored by local environmental, climatic, and biogeographic circumstances (e.g. in

brown bear: Zedrosser, Steyaert, Gossow, & Swenson, 2011). We contend that ease of coexistence may differ greatly accordingly to different geographic ecotypes, which would make misleading even comparison with apparently similar biotas.

Finally, a general comparison of prey-predator trophic systems between temperate and tropical regions does not make sense, given the large differences in richness, diversity, and ecological relationships between these contexts (Ripple et al., 2014). There are obviously interesting similarities regarding conflicts between domestic animals and carnivores (cattle/jaguar in tropics vs. wolf/cattle in 'Europe': Rabinowitz, 1986; Michalski, Boulhosa, Faria, & Peres, 2006), but, we think that these are single techniques, not a conservation model or paradigm. Even the patterns and causes of poaching and other human-induced threats are very different between 'Europe' and other countries (see the 'empty forests' in tropical contexts; Wilkie, Bennett, Peres, & Cunningham, 2011) and make comparisons difficult.

Range expansion by some species (e.g. wolf) in recent decades could have been aided and abetted by particular and transient socio-economic determinants established across Western Europe since World War II, such as abandonment of the countryside (Falcucci, Maiorano, & Boitani, 2007). Yet there are signs of severe crisis in this unique socio-economic model (e.g. changes in agronomic incentives, or in growth economic models; Habermas, 2012) that could result in future economics-driven landscape transformations (Couch, Petschel-held, & Leontidou, 2007; Palang et al., 2006; Urbanc et al., 2004). Furthermore, considering the high input of energy and resources imported from outside Europe to maintain the system, we consider it is highly unlikely to duplicate the EU model elsewhere on a wide scale.

4. An optimistic point of view that is not valid for all large carnivore taxa

Conservation status of a highly threatened endemic taxa, such as the Apennine brown bear (*Ursus arctos marsicanus*) (Ciucci & Boitani, 2008; Falcucci, Maiorano, Ciucci, Garton, & Boitani, 2008; Gippoliti, 2016) or isolated populations such as the Sierra Morena wolf (López-Bao et al., 2015) cannot be comfortably nested into the success story of the EU environmental policy (Chapron et al., 2014). Endemic taxa must get priority in conservation policy, which is particularly true for Southern Europe, with its complex paleo-ecological history and high endemism (Gippoliti & Amori, 2002). Moreover, the potential conflict between the Carpathian lynx introduced on the Alps and the autochthonous Balkan lynx is another example of contradictory EU policy (Linnell, Breitenmoser, Breitenmoser-Wursten, Odden, & von Arx, 2009). The introduced population is under protection by the EU legislation although it is clear that it is posing a threat to the integrity of a highly endangered autochthonous subspecies. We believe that Mediterranean hotspots of biodiversity present crucial test to measure the possible value of EU-like legislation approach to other species-rich areas of the world. The IUCN Critically Endangered Iberian lynx *Lynx pardinus* shows evident signs of recovery thanks to EU funded Life projects (Simón et al., 2012). These projects highlight actions such as captive breeding, translocations, gene banking, and recovery of rabbit *Oryctolagus cuniculus* as the main prey. As such they depart, at least in our view, from traditional EU policy highlighting protected areas, ecological networks and so on. If successful, in the end, it should be a proof that the conservation science can win.

5. Conclusions

The analysis of the EU environmental policy as a model for large carnivore conservation (Chapron et al., 2014) suggests an optimism on the status and coexistence between these large mammals and humans in 'Europe'. Optimistic attitudes are important in conservation policy by facilitating positive and creative approaches and feedbacks (Beever, 2000). Nevertheless, realism and reliability should also characterize the work of conservation practitioners and scientists, to avoid dogmatic attitudes and appealing conceptual shortcuts. EU policies have surely had an important effect on the status of many biodiversity targets. For example, EU regulations have mitigated threats, changed unsustainable attitudes, limiting conflicts (but see von Essen & Hansen, 2015). Unfortunately, directives and regulations can have a limited impact in preventing irreversible processes leading to the collapse of many local populations (e.g. extinction vortex for many isolated populations). Moreover, in many cases the EU approach appears somewhat dogmatic without paying due attention to increasing scientific knowledge and evolving ecological paradigms (Battisti and Fanelli, 2015; Wesolowski, 2005). EU policy can also be contradictory; development projects especially in Eastern Europe are posing a big threat to biodiversity (Kindlmann & Křenová, 2016).

So, in the end what is the impact of EU policy on its biodiversity? Is the glass half-empty or half full? From the latter perspective, surely, a large number of EU directives, regulations and strategies have had positive effects for particular species in the European contexts, and single experiences might be exported to other parts of the world (European Commission, 2015). Moreover, despite Europe's burden of a long history of human-wildlife conflicts, and despite the high human density in this 'full world', at least some wild populations survived. Nevertheless, from the glass half empty perspective, the role of EU policies in conserving large carnivores and other large mammals should be more carefully considered in the light of very different environmental, historical, and political contexts within a heterogeneous 'Europe'. Due to the short time since inclusion of some countries of Eastern Europe into the EU (about ten years at maximum), it is very improbable that the current status of the local populations of large carnivores can be due to the effects of EU policies. Moreover, the introduction of a 'Western' model of economic development (increase of road infrastructures, land use changes, industrialization and economic growth, change in lifestyles) may at times harm the landscapes and their animal populations (for lynx in Poland, see Kowalczyk et al., 2015).

Furthermore, it is quite instructive that by 2030, globally, an additional 47 million ha of land will be needed for food and animal feed production, 42–48 million ha for large-scale afforestation and 18–44 million ha for producing biofuel feedstock (ERD, 2012). Several EU governmental and private companies have increased investment in 'land grabbling' mainly for biofuel production, in Eastern Europe, Asia, South America and especially Africa (Antonelli, Siciliano, Turvania, & Maria Rulli, 2015), with unknown but possibly highly negative consequences for environmental and social sustainability. It has been calculated (von Witzke & Noleppa, 2010) that at the time the currently occupied arable land utilised by EU in third countries was about 35 million hectares (the size of Germany). Thus, we doubt the current 'Western' European approach can be exported successfully as a general model to other parts of the world. The Old Continent should contribute to world conservation of large carnivores exporting only the 'half full glass' experiences. Then it should develop a self-critical and cautious vision towards the 'half empty' components of the EU policies, by developing a pragmatic approach to biodiversity conservation that recognises the mutual value of culture, history and ecology in a framework of democracy and respect of local communities.

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