

Indirect Effects on Heathland Conservation and Wolf Persistence of Contradictory Policies that Threaten Traditional Free-Ranging Horse Husbandry

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Abstract

Conservation agencies within the European Union promote the restoration of traditional land uses as a cost-effective way to preserve biodiversity outside reserves. Although the European Union pursues the integration of the environment into strategic decision-making, it also dictates sectoral policies that may damage farmland biodiversity. We illustrate this point by outlining the socioeconomic factors that allow the persistence of traditional free-ranging horse husbandry in Galicia, northwestern Spain. Free-ranging Galician mountain ponies provide ecological and socioeconomic services including the prevention of forest fires, the maintenance of heathlands and wolves, and the attenuation of wolf-human conflicts. This traditional livestock system may have persisted because it entails negligible costs for farmers. Wolf predation upon Galician mountain ponies does not threaten farmer's economies and seems to be tolerated better than attacks to more valuable stock. Recently, European Union's regulations on animal welfare, carcass management, or meat production put new economic and administrative burdens on farmers, make free-ranging horse rearing economically unsustainable, and incentivize its abandonment. The aim of the European Union to integrate environmental policies may be successful to preserve farmland biodiversity only through careful anticipation of the side effects of apparently unrelated regulations on the fragile equilibrium that sustain traditional land uses.

Introduction

In Europe it is widely acknowledged that the conservation of cultural landscapes and traditional land uses is of paramount importance to retain biodiversity outside reserves (Bignal & McCracken 2000). Therefore restoring traditional uses, or mimicking their ecological effects through management, lies at the core of current conservation efforts in European farmland (Kleijn & Sutherland 2003; Whittingham 2011).

Conflicts of varied nature surround the implementation of environmental policies, including disagreement between governments and people, between stakehold-

ers, or even between conservation goals (Table S1). To face the reduced efficiency of nature protection that these conflicts induce, the European Union pursues the integration of environmental policies into the higher and most strategic decision levels (Sheate 2003). However, difficulties arise when environmental integration has to be implemented. Concerning the ecological restoration of the European farmland, efforts to recreate cultural landscapes clash with long-lasting opposed social and economic trends such as the abandonment of the countryside, the intensification of agriculture, and the globalization of commodity markets (Cramer *et al.* 2008; Norris 2008).

For example, the European Union's Common Agricultural Policy (CAP) initially helped to corner traditional uses by supporting productivity and penalizing extensification (Donald *et al.* 2002). Later, agri-environmental measures emerged partly as instruments to reduce the abandonment of low-intensity traditional farming practices, but agri-environmental subsidies were often not as attractive to farmers as payments incentivizing intensification (MacDonald *et al.* 2000). Successive reforms of the CAP tried to give more weight to conservation but failed to deter the decline of extensive agriculture because, among other factors, an increasing amount of direct subsidies are needed to retain people in marginal lands (Strijker 2005; Henle *et al.* 2008).

The environmental tension between contradictory policies within the European Union needs to be resolved. To help accomplish this aim it may be useful to document the subtle, indirect effects of apparently innocuous policies on the preservation of fragile traditional agricultural uses. As a marginal agricultural system is by definition on the verge of economic viability (Strijker 2005), we examine whether administrative details related with aspects such as fiscality, public health, animal welfare, or legal liability may impose additional costs to low-intensity farming, coming thus into conflict with the goals of environmental conservation policies.

In particular, to illustrate how recent regulations, resulting from the transposition of European Union directives to national or regional laws, have the potential to displace threatened key traditional land uses that still provide ecological services, we discuss the factors that favored the persistence and the conservation prospects of free-ranging horse husbandry in northwestern Spain. Among the potential consequences of the decline of this traditional activity, we highlight the risk of further biodiversity loss in ecosystems of conservation concern in Europe (heathlands) and the rise of a currently attenuated conflict with farmers due to an expected increase in the rates of *Canis lupus* L. (wolf) predation on livestock.

Traditional free-ranging horse husbandry

The Galician mountain pony is an ancient horse breed that occurs in upland heathlands with poor acid soils and low-quality pastures of northwestern Spain (Sánchez-García *et al.* 1996). Shrub cover in such marginal areas is dominated by *Ulex* L. (gorse), *Calluna* Salisburi, and *Erica* L. (heaths) whose low content in proteins and other nutrients may support these horses but not more productive stock breeds, especially in dense heathlands (Mosquera-Losada *et al.* 2004). Mountain ponies form

small herds that roam and breed freely and unattended in communal lands all year round (Pose-Nieto & Vázquez-Varela 2005). As these horses feed on low-quality forage and usually do not receive any additional food from farmers, mare body mass may be as low as 250 kg and fertility rates as low as 23% (Sánchez-García *et al.* 1996).

Until the arrival of mechanization these horses were crucial to the local agriculture as draught animals (Pose-Nieto & Vázquez-Varela 2005). Slaughtering old individuals produced little additional income, but by the early 20th century meat demand increased and foals began to be extracted and sold (Figure S1). Poor feeding and lightness did not make mountain ponies apt for meat, which prompted occasional crossbreeding with heavier horses. However, crossings resulted only in a limited improvement in weight and meat quality, and hence negligible economic gains (Sánchez-García *et al.* 1996).

Besides the scarcity of profitable alternative livestocking in poor, dense heathlands, the main reason for the persistence of Galician mountain ponies might have been that farmers obtain some benefits, much larger in the past than in recent times, from a minimal investment (Vázquez-Varela 2006). Farmers have the right to keep horses in communal lands for free. When ponies were valuable working animals, farmers occasionally conducted wolf hunting to alleviate predation and, only during exceptionally harsh winters, could supply food (Vázquez-Varela 2006). Finally, responding to recent efforts to preserve the genetic integrity of the Galician mountain pony breed, farmers were initially reluctant to build an inventory and register the animals they owned, despite economic incentives for declared animals, because they were afraid of being taxed (Pose *et al.* 2001). The insignificant costs of labor and management that characterize the husbandry of mountain ponies were a common feature of stock-raising across European heathlands (Webb 1998).

Ecological and socioeconomic services provided by free-ranging horses

Nearly 60% of Galicia is covered with forest plantations, scrublands, and natural managed forests, whereas crops and pastures cover 17% and 16% of the land, respectively. Although most land belongs to the rural realm, agriculture makes only 2.6% of the Galician economy (Galician Institute of Statistics; www.ige.eu, accessed November 30, 2012). Main crops include in decreasing order of importance potatoes, corn, wheat, and rye. Livestock raising is a major farming activity, with 1 million cows, 80% of which in the northern half of the region, and 280,000 sheep and goats, 70% of which in the

eastern half. No similar figures are available for mountain ponies. Pony husbandry scarcely contributes to the economic income of Galician farmers but provides a number of ecological and socioeconomic services.

Heathland conservation

European open heathlands are small-scale heterogeneous, species-rich, and threatened ecosystems that originated mostly from the operation of complex traditional farming systems that combined livestock grazing with cutting, burning, and other practices (Webb 1998). High species diversity in heathlands is associated with an open structure and a low concentration of soil nutrients. In many European countries, decreasing economic viability prompted the discontinuation of traditional farming (Vandvik *et al.* 2005) and the abandonment of heaths followed by tree or shrub encroachment (Bartolomé *et al.* 2005). Vegetation succession eventually results in the loss of the open structure typical of the heathland cultural landscape. On the other hand, the deposition of atmospheric nutrients, which favor grass invasion to the detriment of shrubs, also threatens heathland composition and structure as well as plant and animal diversity (Hardtle *et al.* 2006).

Grazing has proved effective to reduce shrub encroachment (Canals & Sebastià 2002), has the potential to compensate for atmospheric nitrogen loads (Fottner *et al.* 2007), and prevents the invasion of grasses better than cutting (Calvo *et al.* 2005). Galician mountain ponies tolerate dense scrublands, consume more shrubs, and seem to maintain or restore the open structure of heathlands better than other stock (Izco *et al.* 2006).

In combination with burning or cutting, livestock grazing promotes the diversification of plant communities in open heathlands (Bokdam & Gleichman 2000; Vandvik *et al.* 2005). Grazing increases spatial heterogeneity and creates opportunities for additional plant species to coexist. Ponies disperse seeds of many species from high productive to low productive parts of the grazed areas (Mouissie *et al.* 2005). Seed spreading is enhanced because free-ranging horses defecate less in latrines (Lamoot *et al.* 2004). Grazing also increases the diversity of animal communities in heathland (García *et al.* 2009).

Fire control

About 20% of the forest cover in Galicia was burnt during the 2000s decade, and the regional government spends 2% of its budget in forest fire prevention (Mosquera & Rigueiro 2009). Horses, especially native breeds, can control woody plant fuel in the undergrowth of forest plantations thus cost-effectively reducing the risk of forest fires in both plantations and adjacent semi-natural

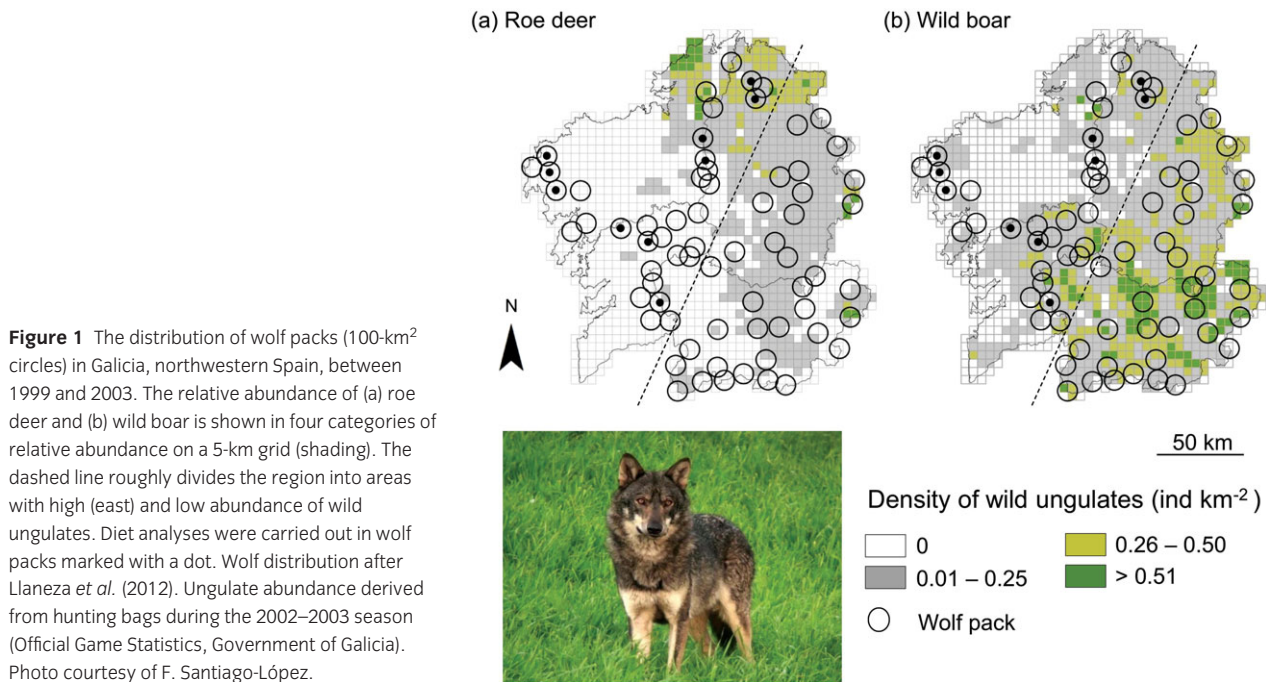
forests (Rigueiro-Rodríguez *et al.* 2005). Confined mountain ponies remove 80% of the foliar biomass of *Ulex europaeus* L. under a variety of grazing regimes (Rigueiro-Rodríguez *et al.* 2004; Mosquera & Rigueiro 2009). When gorse has been grazed out horses can control other abundant but less palatable genera such as *Rubus* L. (brambles; Rigueiro-Rodríguez *et al.* 2005).

Supporting a wolf population

The wolf is a species of conservation concern in Europe (Linnell & Boitani 2012). Once widely distributed across the continent, only four isolated populations persist in west Europe, and one of them occurs in the northwestern quarter of the Iberian Peninsula (Linnell & Boitani 2012). In west Galicia, two different observations suggest that mountain ponies make a significant contribution to support this wolf population. First, wolf distribution seems to be independent of the density of wild ungulates (Llaneza *et al.* 2012). In west Galicia 26 out of 33 wolf packs (79%; i.e., over 200 wolves assuming a mean pack size of eight wolves; authors' unpublished data) occur where wild ungulates (*Capreolus capreolus* L. and *Sus scrofa* L.) are absent or their density is quite low (Figure 1). Second, wolves of western Galicia consume mostly livestock which makes 95% of the overall diet composition of 10 different wolf packs living in areas where mountain ponies occur (Figure 2, Appendix S1). The Galician mountain pony was the most important food source, appearing in at least half of wolf fecal samples collected in the territories of individual packs (range: 54–95%) and occurring in 72% of the samples overall ($n = 329$). Wolves tend to prey upon ponies where present, as suggested by the inverse relationships between the frequencies of occurrence of horses and the frequencies of occurrence of other livestock (cattle, sheep, and goats) in the diet of wolves ($r_s = -0.903$, $P < 0.001$), and between the frequency of occurrence of horses and the number of other livestock types in the diet ($r_s = -0.695$, $P = 0.025$). Where mountain ponies were present, their prominent role in the diet of wolves was already reported in the mid-1970s (Figure 2), suggesting that horse relevance in supporting wolves might be a consistent interaction across space and over time. The exact reasons for low wolf predation pressure on outdoor farmed cattle and sheep in areas where ponies occur are unknown. One possible explanation is that cattle and sheep are guarded somehow whereas ponies are not.

Tolerance of farmers to horse predation by wolves

We gathered a few hints that wolf cannot currently be considered a major source of socioeconomic conflict in



rural Galicia, at least not to the degree it reaches elsewhere (Treves *et al.* 2004; Boitani *et al.* 2010). First, a relatively dense wolf population (2.25 packs·1,000 km⁻²; Llaneza *et al.* 2012) coexists with a relatively dense human population (148 people·km⁻²) in west Galicia. Second, lasting media campaigns by farmers claiming wolf control, which may be an indicator of severe predation events, are less frequent than one would expect considering the widespread distribution of wolf packs (Figure 1), the abundance of livestock in Galicia and, therefore, the potential for a more intense wolf-human conflict. Third, wolf is a game species and hunting, which requires administrative permission, is also used to manage discontent derived from predation on livestock. However, only three wolves were legally hunted between 2004 and 2007 (Xunta de Galicia 2009). If the number of hunting permits were proportional to the claims of livestock producers on wolf predation, the low rate of legal control during that period (<1 individual hunted per year) would suggest a remarkable tolerance of wolves by farmers. This relatively high tolerance has also been noted by Blanco (2003) who suggests that it may be the result of the traditional scheme of wolf management in Galicia where livestock losses to wolf predation were never compensated before 2003 but where, on the other hand, the wolf has always been listed as a game species which was hunted with little administrative restriction. Farmers could then defend themselves from wolf predation largely through unregulated hunting until a very recent past. Further ev-

idence on these indicators, as well as the assessment of the magnitude of poaching, may help to test the hypothesis that wolf tolerance in Galicia is actually higher than elsewhere.

Although the degree of tolerance to wolves might result from a complex interaction of cultural, social, and economic factors, we believe that the attenuated wolf-human conflict in west Galicia can be largely attributed to the persistence of free-ranging mountain ponies through two different mechanisms. First, the features of pony husbandry suggest that wolf predation on ponies may not entail a relevant economic loss for farmers. Indeed, horses account only for 1.8% of the average annual livestock heads that farmers claim as killed by wolves (before administrative inspection of the actual causes of deaths; Xunta de Galicia 2009), in clear contrast with the dominance of horses in the diet of wolves (Figure 2). This marked discrepancy suggests that the presumed affordability of the costs of wolf predation might not be the only reason for low rates of damage claims. Farmers might also abstain from declare horse losses to wolves if the costs of administrative control (i.e., accepting to be the owner of a number of identified free-ranging horses, and the associated liability established by regulations) were higher than the benefits of applying for economic compensations upon predation events.

Second, and also pending a formal analysis, the high figures of ponies in the diet of wolves seem to be at odds with the large number of cattle, sheep, and goats raised in

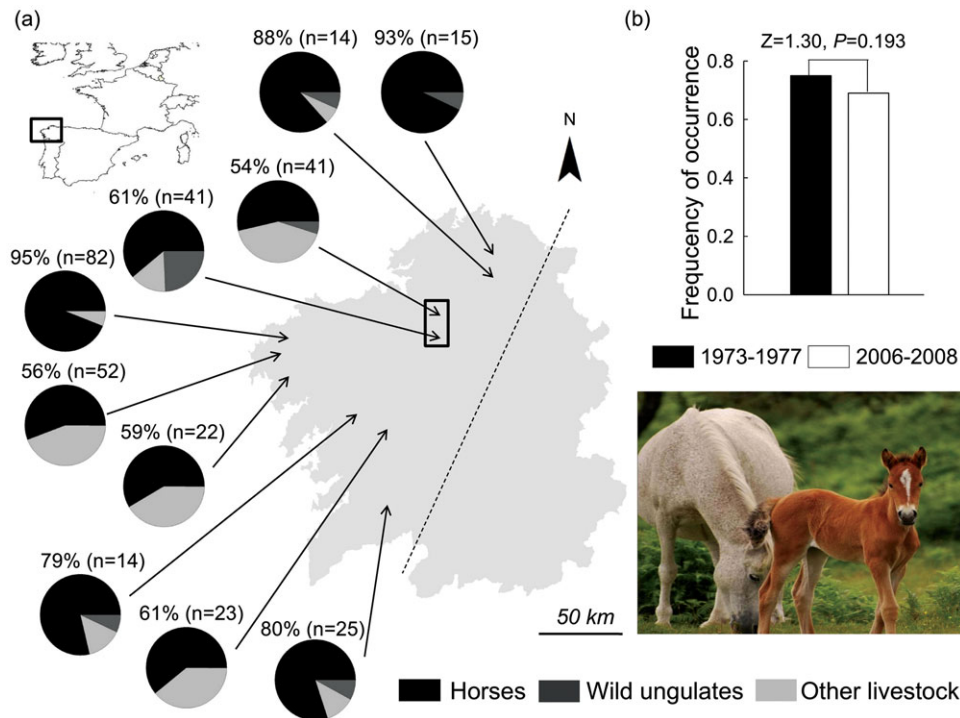


Figure 2 (a) Frequency of occurrence of major prey types in the diet of wolves living in areas of western Galicia where free-ranging mountain ponies occur. Wolf scats were collected between 2006 and 2008. Sample size and the percentage of occurrence of ponies in the diet are shown for each of 10 different wolf packs. (b) Comparison of the frequency of occurrence of mountain ponies in the diet of two wolf packs living within the rectangular area (see map) analyzed in 1973–1977 (Gutián *et al.* 1979) and 2006–2008.

Galicia, which might indicate that horses could be either more available than, or preferred over, other livestock. Whatever the factors underlying this possible prey selection, high predation pressure on horses might divert wolf predation from stock types with a higher economic value which, in turn, might help wolves to be better tolerated.

Contradictory policies affecting free-ranging horse husbandry

A number of policies directly or indirectly promote the persistence of traditional rearing of Galician mountain ponies. Public regional subsidies to horse owners (Pose *et al.* 2001) endorse the need to preserve local livestock breeds across the world (Hall & Ruane 1993). Following the recommendations of the Bern Convention, the Galician wolf management plan pursues wolf conservation and explicitly highlights free-ranging horses as a key resource (Xunta de Galicia 2009). Heathlands are protected by the European Union Habitats Directive (92/43/EEC), and considerable efforts are devoted to their restoration (Pywell *et al.* 2011). In Galicia, the European “Nature 2000 network” includes some nature reserves with heathland, but the conservation of this habitat de-

pends upon pony grazing outside reserves (Díaz-Vizcaíno 2005). Even the current CAP should theoretically help pony husbandry to persist as it supports farmers whose production systems comply with certain environmental standards as, for example, the conservation of ecosystems listed in the Habitats Directive (Henle *et al.* 2008).

On the other hand, recently passed regulations inadvertently threaten the persistence of free-range horse husbandry and the ecological services this traditional activity provides. Most regulations result from the transposition of European Union laws, and we focus on two of them. First, the Commission Regulation EC 504/2008 is described with a title apparently as innocuous as “methods for the identification of equidae.” However this legal text imposes many conditions to adapt equine production to former European Union regulations on animal breeding, meat production, traceability of human food, or animal health and welfare. It was transposed as a regional decree that also regulates horse grazing and the liability upon damages caused by horses (Xunta de Galicia 2008). Collectively these new rules create substantial administrative burden (permissions, frequent horse monitoring, bookkeeping, and regular reports) and significant new costs (veterinary care, fencing, facility building, and at

least four new taxes). The regional government has recognized that these costs may be disproportionate regarding the profitability of horse husbandry and has published yearly calls to help farmers to support part of the expenses in which they should incur (e.g., Xunta de Galicia 2012). In practice legal enforcement drives the owners of ponies to become professional herdsmen (79% of them are not; Barciela *et al.* 2007) and spend most of their time in the mountains, close to their horses. This may be unfeasible considering the economic returns of pony husbandry, the abandonment of which could be a more likely outcome.

Second, in 2000 the health crisis surrounding the bovine spongiform encephalopathy (BSE) outbreak in Europe prompted a strict ban of dumping or abandoning livestock carcasses outside processing plants where they should be incinerated. As a result of the European regulation EC 1774/2002, food availability for necrophagous birds greatly decreased, also clashing with widespread efforts to protect these species (Margalida *et al.* 2010). The situation has been partly amended with recent derogations (EC 1069/2009 and EC 142/2011) that allow avian scavengers to feed on dead stock left in situ, especially in extensive farming systems. Feeding is also authorized for the carnivore species listed in the Annex 2 of the Habitats Directive which, however, excludes the Spanish wolf populations north of the Duero river. As avian scavengers of conservation concern do not occur in west Galicia, little changes are expected there regarding post-BSE regulations of the management of livestock carcasses. As traditional pony husbandry was almost unregulated, until now the bodies of dead free-ranging horses remained in the field, but the emerging administrative control on this activity may constrain farmers to seek and remove horse carcasses, which may greatly reduce the amount of carrion available to wolves. Keeping the availability of dead horses and other carrion low, in combination with the relative scarcity of wild ungulates and the probable decline of free-ranging horse husbandry, could lead wolves to switch their predation from horses to more valuable livestock species as cattle. In turn, increased predation on cattle will have negative economic consequences for farmers and may have social consequences too, worsening farmers' attitude toward wolves. In summary, the decline of traditional husbandry of mountain ponies may awake the dormant conflict that seems to preserve Iberian wolves, cause higher rates of legal and illegal wolf mortality and, eventually, increase the risk of wolf decline in areas of west Galicia where ponies will disappear.

The story of the Galician mountain pony illustrates how stock breeds that produce a negligible economic profit can persist in marginal areas for agriculture in the fragile equilibrium imposed by two conditions: no

alternative, profitable land uses will outcompete horse rearing, and no additional costs will be imposed to horse husbandry. Conceivably, preserving existing open heathlands by keeping free-ranging horse husbandry might be more efficient than recreating these ecosystems through long-term management once they have been degraded or have disappeared (Pywell *et al.* 2011). Likewise, conserving wolves in western Galicia in the absence of mountain ponies could be more problematic than it is today. However, what we anticipate here are no more than scientifically informed, plausible guesses, and these indirect effects of potential horse decline need to be documented through empirical studies. This case study indicates that more effort to foresee unintended environmental side-effects should be made when designing sectoral policies. Our study also highlights the difficulties to coordinate regulations even when ultimately issued by the same institution. Finally, it also tells about the pitfalls of developing a genuine environmental integration of policies in the European Union, as nonevident environmental side effects of apparently unrelated policies may alter tightly intertwined ecological and traditional socioeconomic systems.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web site:

Table S1: Classification of conflicts concerning environmental policies.

Figure S1: Further details on the management of Galician mountain ponies.

Appendix S1: Methods used to determine the diet of wolves.

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