Restoration of a wild grey partridge shoot: a major development in the Sussex study, UK

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Abstract

Restoration of a wild grey partridge shoot: a major development in the Sussex study, UK.— The scientific basis of wild grey partridge management has been known for a generation. This includes controlling nest predators, providing nesting cover, having sufficient insect food for chicks and appropriate rates of shooting. More recently, measures such as providing food for adult birds and habitats for protection from birds of prey have also been considered important. Habitat provision can be expensive, but in the UK costs can be partially recovered through governmental agri–environment schemes. The landowner still needs to pay for the essential gamekeeper. Since 2003/04, one part of the Game & Wildlife Conservation Trust's (GWCT) Sussex Study area has put these principles of environmental management into practice with the aim of restoring a wild grey partridge shoot to this part of Southern England. Results have been impressive, with the spring pair density increasing from 0.3 pairs/100 ha in 2003 to nearly 20 pairs/100 ha in 2010 on an area of just over 10 km^2. Over the past two years a wild grey partridge shoot has taken place, and the landowner and his team have gained national recognition for their conservation work.

Key words: Grey partridge, *Perdix perdix*, Predator control, Agri–environment measures, Population recovery.

Resumen

Restauración de la caza de la perdiz pardilla: un importante progreso en el estudio de Sussex, Reino Unido.— Desde hace una generación se conoce la base científica de la gestión de la perdiz pardilla. Ésta incluye el control de los depredadores de nidos, la provisión de material para la nidificación, tener suficientes insectos para alimentar a las crías, y un control adecuado de la caza. Más recientemente también se ha considerado importante proveer alimento para las aves adultas y y hábitats para protegerlas de las aves rapaces. El abastecimiento del hábitat puede ser caro, pero en el Reino Unido los costos pueden recuperarse parcialmente mediante proyectos agro-medioambientales. El propietario de la tierra aún tiene que pagar por los servicios de los guardabosques. Desde 2003/2004, una parte del área de estudio de Sussex de la GWCT ha puesto en práctica estos principios de gestión ambiental, con la intención de restaurar la caza de la perdiz pardilla en esta zona del sur de Inglaterra. Los resultados han sido impresionantes, con un aumento de la densidad de parejas en primavera de 0,3/100 ha en 2003 hasta casi 20 parejas/100 ha en el 2010, en un área total de más de 10 km^2. Durante los últimos dos años se ha practicado la caza de la perdiz pardilla y los propietarios de las tierras y sus equipos se han ganado el reconocimiento nacional por su labor conservacionista.

Palabras clave: Perdiz pardilla, *Perdix perdix*, Control de predadores, Medidas agro–medioambientales, Recuperación de la población.

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Introduction

Across Europe, grey partridges have shown a long–term decline, amounting to 82% since 1980 (PECBMS, 2011). As a widespread farmland bird it is included in the European Farmland Bird Index (EFBI), a biodiversity indicator in the suite of EU Structural and Sustainable Development Indicators.

In the UK the number of grey partridges has declined by over 90% since the mid–1960s (Risely et al., 2011), resulting in the species appearing on the Red List of Birds of Conservation Concern (Eaton et al., 2009). The grey partridge is also a priority species identified by the UK Biodiversity Action Plan (Anon., 1995) and is one of 19 species included in the Farmland Bird Indicator, one of the UK government biodiversity indicators for the natural environment (DEFRA, 2011).

The partridge declines have continued despite the fact that the contributing factors in the UK and elsewhere are well understood (Potts, 1986; Aebischer, 1997; Aebischer et al., 2000). The management needed to reverse these declines includes various habitat improvements and the control of the predators of clutches and incubating hens. There is experimental verification of the effectiveness of providing nesting and brood–rearing habitats. For example, grey partridge brood sizes nearly doubled where 'conservation headlands' (the outer 6 m of cereal fields selectively sprayed with pesticides) were used (Sotherton, 1991). Grassy mid–field strips ('beetle banks') are a means of providing appropriate mid–field nesting cover (Thomas et al., 1991; Sotherton, 1995). Many of these habitat improvements have been included in English agri–environment schemes. The success of these schemes in helping the grey partridge depends on implementing all the options that restore the multiple habitat requirements of the partridge (Ewald et al., 2010), including the legal predator control directed at reducing nest predation (Tapper et al., 1996).

In this paper we describe how targeted management on one part of the long–running Sussex study in Southern England has resulted in the re–establishment of a wild grey partridge shoot, after a period of 48 years.

Material and methods

The Sussex study area is located on the Sussex Downs between the rivers Arun and Adur in West Sussex. The soil type is chiefly chalk rendzina, with clay caps on the higher ground. The land is mainly managed through arable farming, with cereals, oilseed rape/peas/linseed interspersed with grass fields and a few scattered patches of traditional chalk grassland. Since 1968, the Game & Wildlife Conservation Trust (GWCT) has monitored grey partridges using post–harvest stubble counts (Potts, 1986; Potts & Aebischer, 1991, 1995). We record the number of young in each covey, as well as the number of adult males and females. This allows us to calculate the autumn density of grey partridges on the area. Spring breeding density is calculated from these autumn counts, with each male and any single female representing a spring pair. Additional parameters used in the analysis of grey partridge demography are also calculated from these autumn counts. We concentrate here on the two that were targeted by the management taking place on the study area, the percentage of chicks that survive up to six weeks of age (chick survival rate) and the percentage of spring pairs that successfully produced a brood (brood production rate).

Following Potts (1986): if the geometric mean brood size is less than 10,

$$\text{Chick survival rate} = 0.03665\left(\begin{array}{c}\text{geometric mean}\\ \text{brood size}\end{array}\right)^{1.293}$$

otherwise:

$$\text{Chick survival rate} = \frac{\text{Geometric mean brood size}}{13.84}$$

From the chick survival rate the number of chicks that would have hatched can be calculated as:

$$\text{Chicks hatching} = \frac{\text{Number of young counted}}{\text{Chick survival rate}}$$

Brood size at hatching is remarkably constant, at 13.84 (Potts, 1986) so:

$$\text{Broods hatched} = \frac{\text{Chicks hatching}}{13.84}$$

$$\text{Brood production rate} = \frac{\text{Broods hatched}}{\text{Spring pairs}}$$

The calculation of brood production rate depends on how the calculated number of broods hatched compares to the actual number of spring pairs counted. In the occasional case where more broods are calculated to have hatched than there are spring pairs accounted for in the autumn then the number of broods is made equal to the number of spring pairs.

$$\text{Chick survival rate} = \frac{\text{Young counted}}{\begin{array}{c}13.84 \times \text{Number of broods}\\ \text{calculated to have hatched}\end{array}}$$

Throughout the course of the Sussex study the GWCT has also monitored farm practices and game management undertaken by the farmers. Changes in land use, including the cropping pattern, location of beetle banks, conservation headlands and other changes in boundaries are recorded on an annual basis.

Management

In 2003, one of the landowners within the study area set out to restore grey partridge numbers on an area of 220 ha, extending this to 1,052 ha in 2007, utilising all possible habitat and legal predation control measures. The remaining 22 km^2 of the study area forms what is termed here the 'conventional area'.

Habitat management included increases in nesting, brood–rearing and over–winter covers. Nesting habitat has been improved through the addition of 25 km of beetle banks and hedgerows. The beetle banks have been planted mainly with cock's–foot (*Dactylis glomerata*) with the addition of hawthorn (*Crataegus monogyna*) and blackthorn (*Prunus spinosa*) bushes and some other species such as holly (*Ilex aquifolium*)

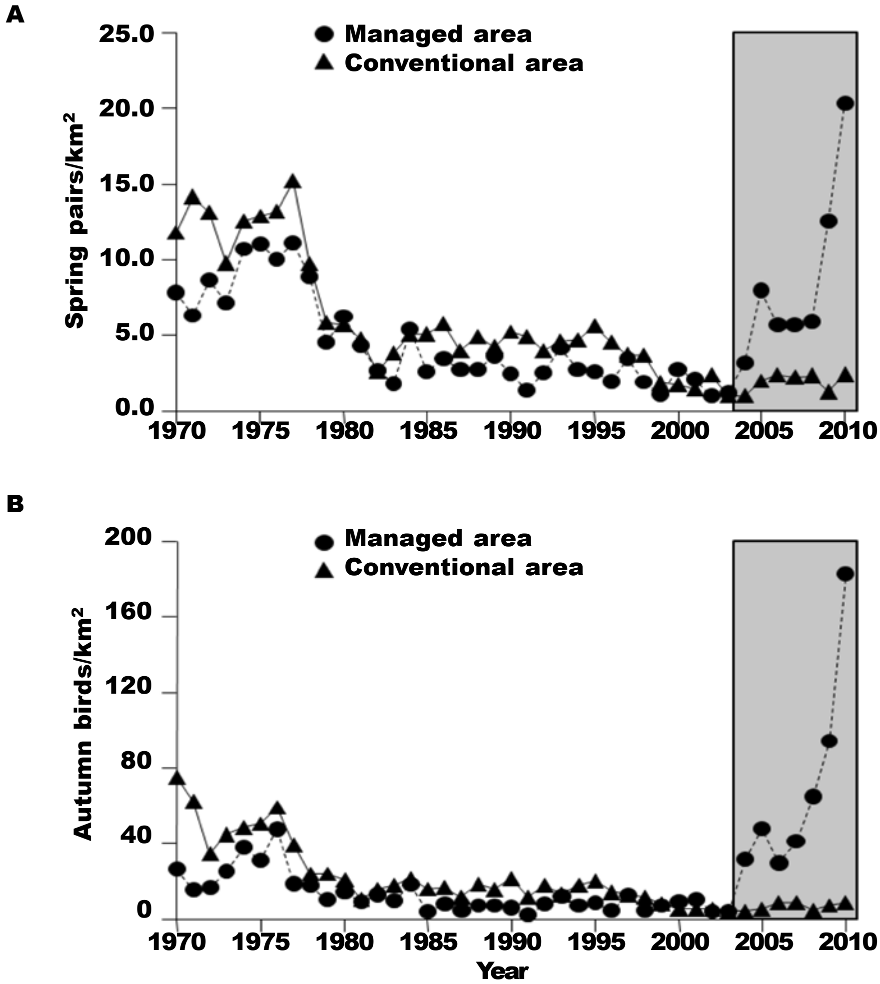

Fig. 1. Spring pair density (A) and autumn density (B) of grey partridges on the Sussex study area. The dashed line indicates the situation on the 10 km^2 area managed since 2003/2004; the black line is the remaining 22 km^2 area. The shaded area indicates the period when management was taking place on the managed area.

Fig. 1. Densidad primaveral (A) y otoñal (B) de parejas de perdiz pardilla en el área de estudio de Sussex. La línea punteada indica la situación en el área de 10 km² gestionada desde 2003/2004; la línea continua negra es el área de 22 km² restante. La zona sombreada indica el periodo durante el cual se estaba gestionando el área intervenida.

at intervals for cover. This additional nesting cover means that the managed area now has 8.2 km of nesting cover for each square kilometre.

Brood–rearing cover has been expanded to nearly 9% of the area, with a total of 97 ha of conservation headlands put in place with no application of herbicides or insecticides and no fertiliser. In addition, there is no summer use of insecticides on cereal crops and one third of the conservation headlands are not harvested, providing some cover and seeds into the autumn where spring crops are to follow. As well as the winter cover provided through the unharvested conservation headlands, 2.1 km/km^2 of wild bird cover strips were sown, incorporating kale (*Brassica oleracea),* chicory (*Cichorium intybus)*, millet (*Panicum miliaceum)* and canary grasses (*Phalaris canariensis* and *P. arundinacea*). These provide cover through the winter months as well as some food resources throughout the year. Cropping patterns have been adjusted to ensure that there is a different crop on either side of a field boundary or beetle bank. Where possible, fields are sown in autumn on one side of a field boundary with spring sowing on the other side, ensuring that on at least one side of a boundary there is vegetative cover at all times of the year. Feeders containing wheat are placed at intervals along the beetle banks and field boundaries, at a rate of two feeders for every pair of

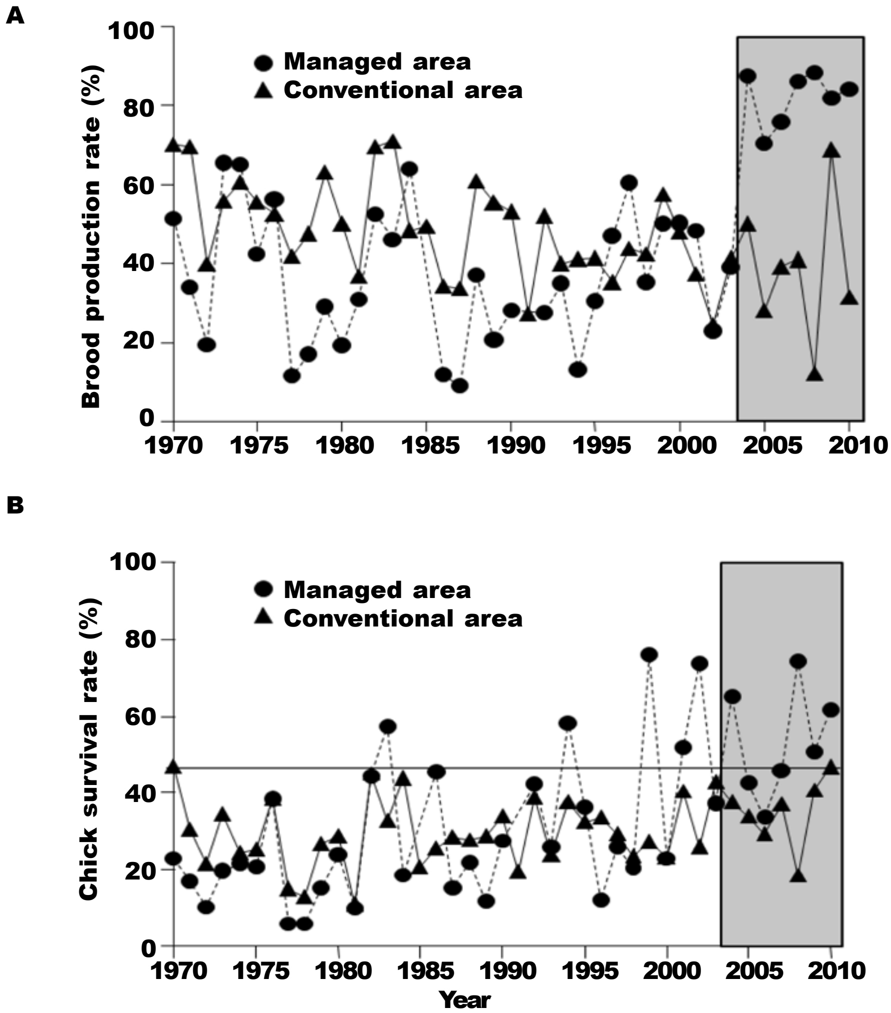

Fig. 2. Brood production rate (A) and chick survival rate (B) of grey partridges on the Sussex study area. The dashed line indicates the situation on the 10–km^2 area managed since 2003/2004; the black line is the remaining 22 km^2 area. The shaded area indicates the period when management was taking place on the managed area.

Fig. 2. Tasa de producción de crías (A) y tasa de supervivencia de pollos (B) de perdiz pardilla en el área de estudio de Sussex. La línea punteada indica la situación en el área de 10 km^2 gestionada desde 2003/2004; la línea continua negra es el área de 22 km^2 restante. La zona sombreada indica el periodo durante el cual se estaba gestionando el área intervenida.

grey partridges or 40/100 ha. Feeders are filled from October into June. Grain is provided through spring in the belief that it allows female grey partridges to leave the nest and quickly eat their fill, reducing the chance of nest and hen predation. Grit (1.5 mm) is also provided at each feeder. Some of the new habitat has been financed through the use of agri–environment options, particularly the provision of conservation headlands and beetle banks through the Higher Level Scheme (HLS, Natural England, 2010).

Further to these habitat improvements, three gamekeepers are employed. From February to July, most of their time is devoted to legal predation control targeted at reducing predation on grey partridge adults, eggs and chicks. This consists of controlling numbers of foxes (*Vulpes vulpes*), stoats (*Mustela erminea*), weasels (*Mustela nivalis*), rats (*Rattus norvegicus*), carrion crows (*Corvus corone*) and magpies (*Pica pica*). Methods include shooting with a rifle at night, stopped snares (with a breakaway for non–targets) and Larsen traps (specifically for corvid control). In autumn and winter, the gamekeepers are in charge of establishing the specially created habitats and provide the supplementary food.

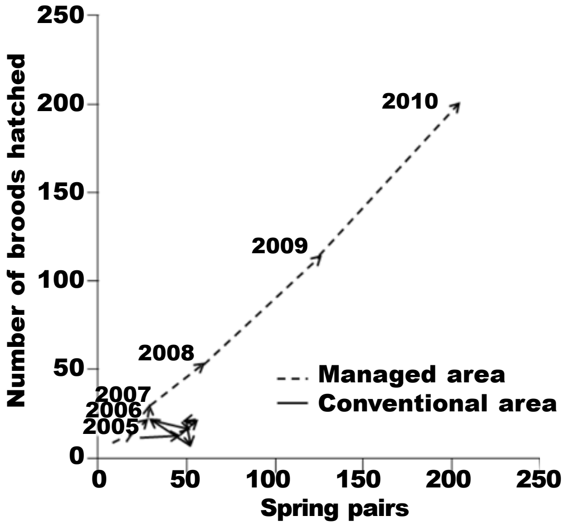

Fig. 3. The effect of breaking the density dependence between number of broods hatched and spring pairs through predation control is illustrated by the dashed line, with the number of broods hatched increasing almost in line with increases in the number of spring pairs. The continued density dependence in brood production on the conventional area is illustrated with the black lines, where the low brood production rate with higher spring pair density does not allow for a year–on–year increase in numbers.

Fig. 3. Se ilustra el efecto de romper la dependencia de la densidad entre el número de nidadas empolladas y las parejas en primavera, debido al control de la depredación. Mediante la línea de puntos, con el número de nidadas empolladas aumenta con el incremento del número de parejas en primavera. La dependencia continuada de la densidad, de la producción de nidadas en las áreas convencionales, viene ilustrada por las líneas continuas. En ellas la baja tasa de producción de nidadas con una mayor densidad de parejas en primavera no tiene en cuenta el aumento de año en año de las cifras.

Results

The breeding pair density on the conventional area increased marginally, from 0.9 pairs per km^2 in 2004 to 2.4 pairs/km^2 in 2010 (fig. 1A). Breeding density on the managed area increased from 5.2 pairs/km^2 to 20.1 pairs/km^2 in the same time frame, a 3.8 times increase and a density higher than that seen in the early 1970s. The autumn densities on the managed area now exceed those from the early days of the Sussex study, with densities nearly four times the highest seen in the 1970s (fig. 1B). On the managed area the increase in nesting habitat, combined with the control of predation at the nest, has resulted in brood production rates (77%) that are double what they were before the management began (38%; fig. 2A). On the conventional area, brood production rates remained unchanged, averaging 49% from 2004 to 2010 compared to 48% before 2004. Comparing chick survival over the managed area to the rest of the Sussex study area from 2004 to 2010 showed that the rate on the managed area was 58% on average, while on the conventional area it was 35% (fig. 2B).

An increase in brood production rate is a feature of the predator control instigated on the managed area. Earlier work on the Sussex study and on other UK areas has shown that k–factor nest loss increases with nest density, i.e. that it is density–dependent, and that this relationship with density is removed by predator control (fig. 4.2 in Potts, 1986). Therefore, where no gamekeeper is present, nest losses increase steeply as nesting density increases. When a gamekeeper is employed the relationship between nest losses and nest density disappears, allowing the density of spring pairs to build up, as has been the case on the managed area (fig. 3).

Since 2009, the landowner undertaking the management has reinstated sustainable grey partridge shooting on the area. The bag amounted to 12% and 25% of the autumn stock in 2009 and 2010, respectively. The shooting revenue, combined with the income generated from the agri–environment payments, helps offset the cost of management. The landowner has indicated that these two income streams, combined with the enjoyment he gets from his own shooting, balance out his investment in grey partridge conservation.

Discussion

The turnaround in grey partridge numbers on this part of the Sussex study area is a testament to the hard work of the landowner and his team. In the space of just seven years, the grey partridge has gone from nearly extinct on this area to densities that support sustainable driven shooting. The hard work of the landowner and his team has not gone unnoticed. In 2010 they received the prestigious Purdey's Gold Medal for Game and Conservation. When conferring the award the judges commented that the project was a shining example of how shooting and conservation could work together for the good of biodiversity. The landowner himself sees this project as a means of encouraging others, indicating that the funds currently available for agri–environmental work would allow others to put in place the habitat management required to turn around the fortunes of the grey partridge.

How do the results reported here compare to other areas where specific partridge habitat management has been put in place? The 2010 spring pair density on the managed area matches the densities (18 pairs/km^2) found on the GWCT's demonstration project in Hertfordshire, where both habitat management and predator control were used (Aebischer & Ewald, 2010). It is double the density on the Salisbury plain experimental area, where only predator control was used to boost grey partridge numbers (Tapper et al., 1996). It does, however, fall far short of the densities (80 pairs/km^2) locally reached in some hunting estates in northern France, where similar habitat management and predator control appropriate for the region is practised (Bourdouxhe, 2002; Bro et al., 2005).

The English grey partridge model (Potts, 1986) shows that predation control approximately triples the equilibrium population level expected from increases in insect–rich habitat and nesting cover alone (Aebischer, 1991). At 20 pairs/km^2, the results on the managed area are in line with what the model predicts for a fully managed shot population. Without the predation control, the expectation would be around 7 pairs/km^2.

The chick survival rates seen on the conventional portion of the Sussex study area are slightly higher than the long–term average reported for the post–decline era (32.3%; Potts & Aebischer, 1995), indicating that the situation on conventional sites has, at least, not deteriorated. Chick survival rates on the managed area are back to the level recorded before grey partridges began declining in number with the onset of herbicide use in cereals (48.6%; Potts & Aebischer, 1995). They surpass those of the original experiments that verified the ability of conservation headlands to provide chick–rearing habitat, resulting in increases in grey partridge chick survival (average brood size on the managed area is 8.5 chicks, compared to 6.4 on the original conservation headland areas: Rands, 1985). The cereal area covered by conservation headlands in the managed area exceeds the recommendations first made when conservation headlands were developed (6%; Boatman & Sotherton, 1988) and this surely explains the higher chick survival rates.

How likely is it that the management described here could become widespread throughout England? Given the agri–environment options available in England, the habitats established in Sussex could all be incorporated into farming regimes through the use of the Higher Level Stewardship scheme. In the case of the GWCT's Partridge Count Scheme (PCS), increases in chick survival rates on the area managed by PCS members are associated with their use of in–field agri–environment options that are designed to provide chick–rearing and nesting habitats, namely conservation headlands and beetle banks (Ewald et al., 2010). The area managed does not have to be of the order of 10 km^2 and could be made up of ground owned by one landowner or several working together. However, our experience is that at least one dedicated gamekeeper is needed for every 400 ha. The Salisbury plain experiment has shown that, in the absence of habitat management, predation control alone on an area of between 4 to 5 km^2 can increase densities to allow for a shootable surplus of grey partridges (an average of 23%; Tapper et al., 1996) but with numbers too low to provide revenue. Having a shootable surplus of partridges allows some return on a landowner's dedication towards grey partridge conservation and ensures the long–term viability of the management. It is crucial that the landowner is motivated to carry on this work, whether through conservation interest or though shooting, and this is the driving force behind the success of the Sussex project.

The message that the GWCT's PCS is trying to convey to its members across England is that it is possible to restore a wild grey partridge shoot on a modern, productive arable farm, provided about 9% of the total area is given over to partridge management. The agri–environment options available to help with this have never been better and all that remains is for more farmers and landowners to take up the challenge and restore grey partridges on their ground. The English agri–environment programme is considered to be one of the most complex in Europe, with its system of options allowing for greater flexibility than might be the case in other European countries. This complexity can be used to good effect for wildlife generally. A review of EU–wide agri–environment options found that just under half of all rural development programmes had options directed at management for wildlife including actions specifically aimed at providing food, nesting and breeding areas (Keenleyside et al., 2011). Only a quarter of the programmes in the newer EU countries had such options. The results here indicate how useful these options can be in restoring grey partridge numbers and the need to include them in deliberations on the post–2013 Common Agricultural Policy.

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long run, they and land managers like them are responsible for the future of grey partridge conservation across Europe.

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