

# The impacts of commercial woodland management on woodland butterfly biodiversity; can woodland management improve biodiversity

D. L. Taylor\*<sup>1</sup>, A. Ramsey<sup>1</sup>, I. Convery<sup>1</sup>, A. Lawrence<sup>2</sup>, A. Weatherall<sup>1</sup>

<sup>1</sup>University of Cumbria, Centre for Wildlife Conservation, National School of Forestry, Penrith, Cumbria, UK;

<sup>2</sup>Forest Research, Northern Research Station, Midlothian, EH25 9SY, UK.

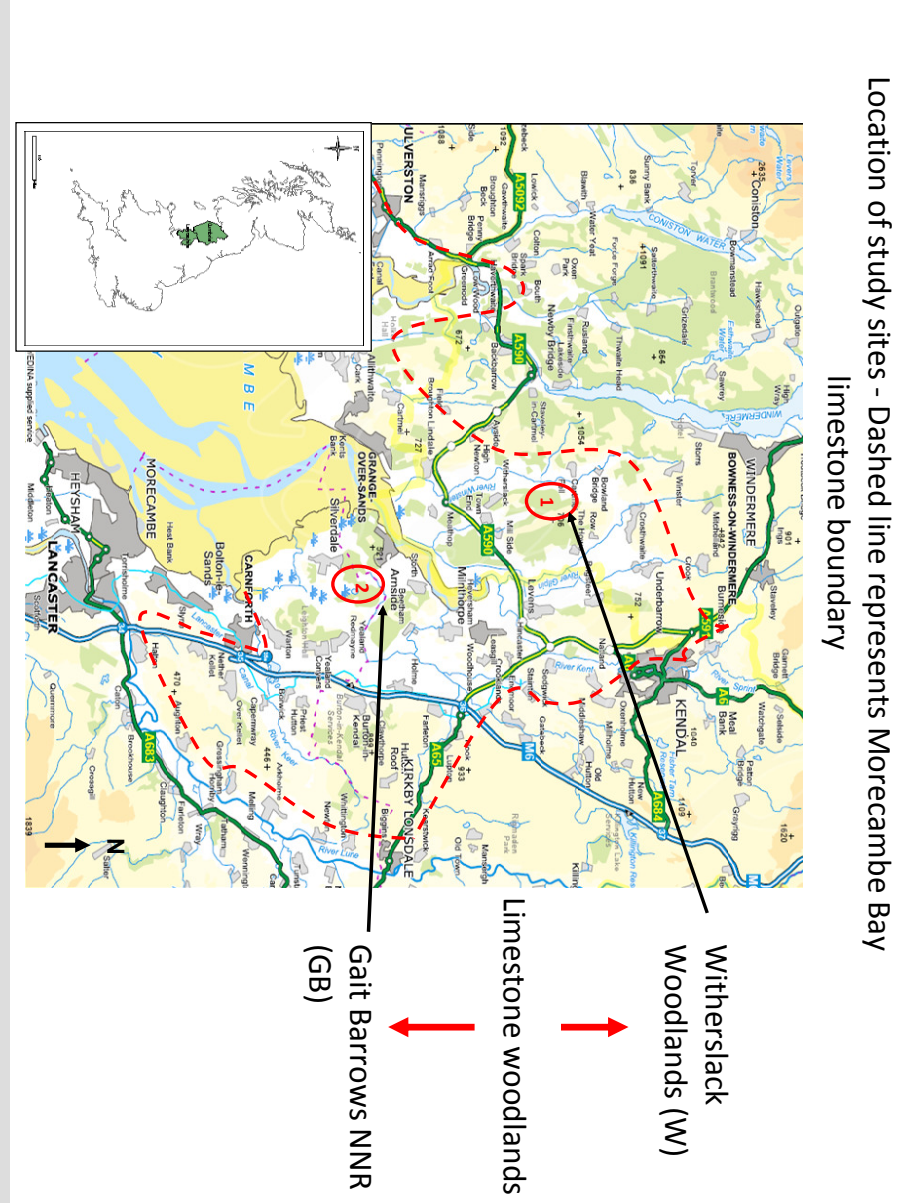
## Introduction

About c. 350 000 ha of privately owned woodland in Great Britain is undermanaged (Forest Research, 2003), with woodland under active management accounting for only 52% in England (Forestry Commission England, 2011). The impact is such that many woodland species reliant on early to mid-successional stages are now in decline (Mason, 2007).

Key indicator butterfly species such as the high brown fritillary (*Argynnis adippe*) and pearl bordered fritillary (*Boloria euphrosyne*), limestone woodland specialists, are amongst some of the fastest declining species (Botham et al., 2008); seeing distribution declines of 49% and 43% respectively between 1995 – 2009 (Fox et al., 2011).

Development of a UK woodfuel industry has the potential to alleviate biodiversity declines associated with under-managed woodlands, whilst contributing to our renewable energy commitments. This study investigated the impact of three different woodland management scenarios on species richness and abundance of diurnal butterflies in limestone woodland.

## Methods

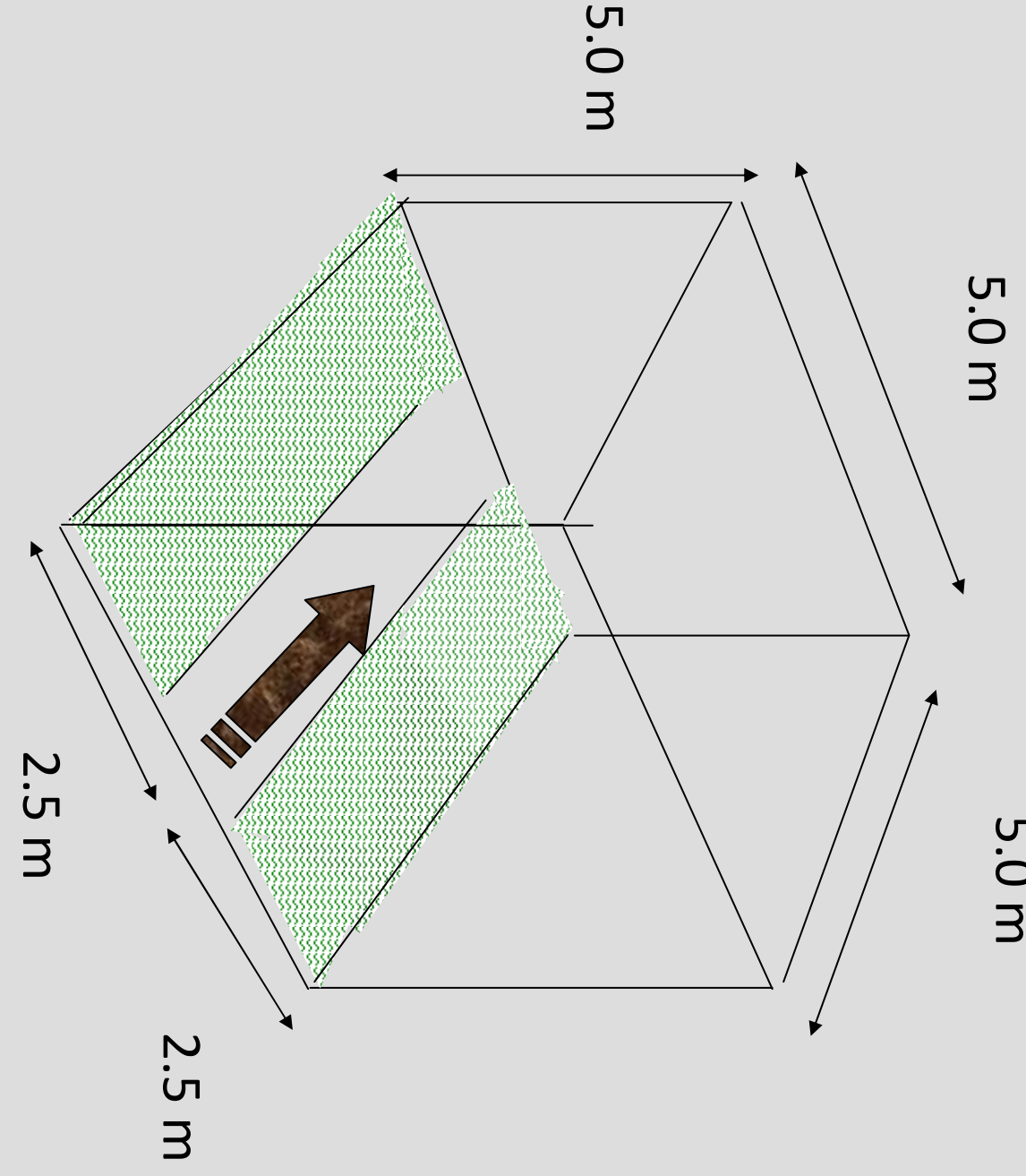


Butterflies were sampled at two sites; Gait Barrows NNR (54°11'N, -2°47'E) and Witherlack Woodlands (54°16'N, -2°52'E), and comprised three woodland management scenarios:

- (1) Under-managed woodland (woodland with no recent intervention);
- (2) Traditional coppice management for conservation;
- (3) Commercial woodland management

The study followed the transect method (Pollard, 1977), observing butterflies between 1st April - 30th September.

- Between 10:00 and 16:00 hours;
- Temperatures of 13 - 17 ° C with at least 60% sun-shine, or above 17 ° C if overcast but not raining.

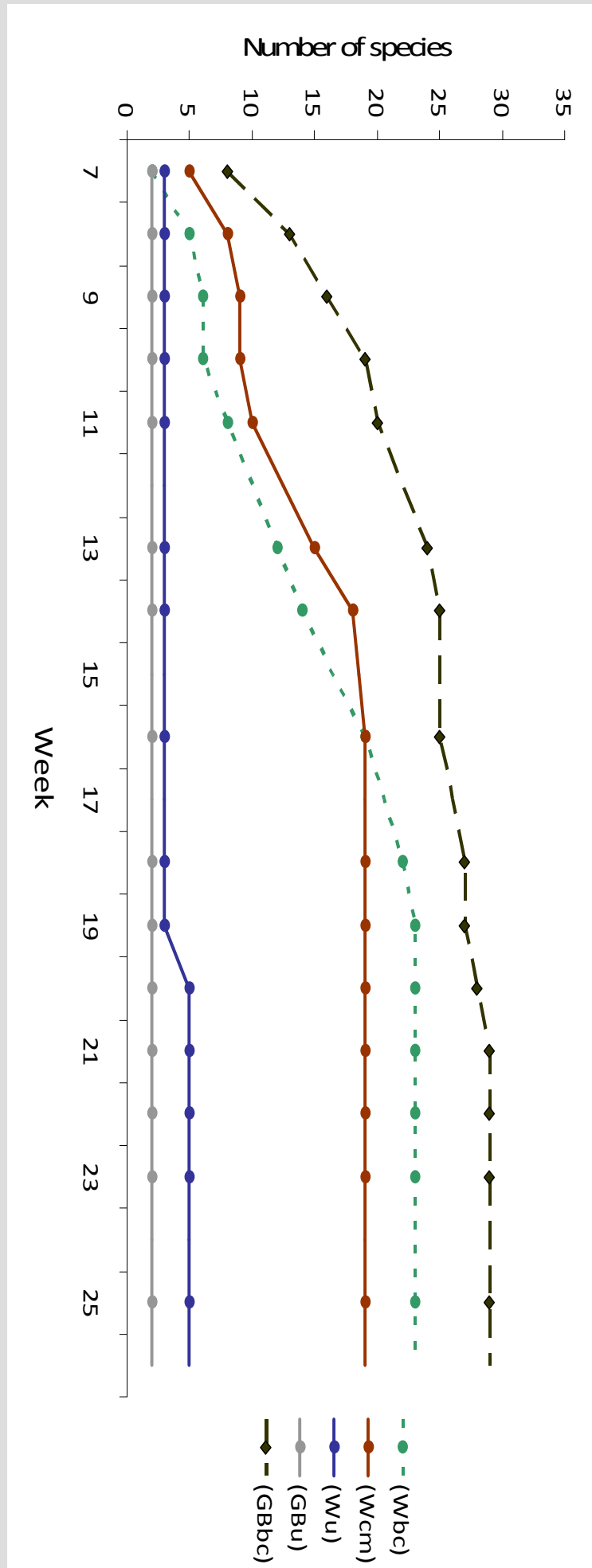


## Results

Cumulative species graphs (Fig. 1) indicate that a high proportion of the probable species present at each transect have been observed.

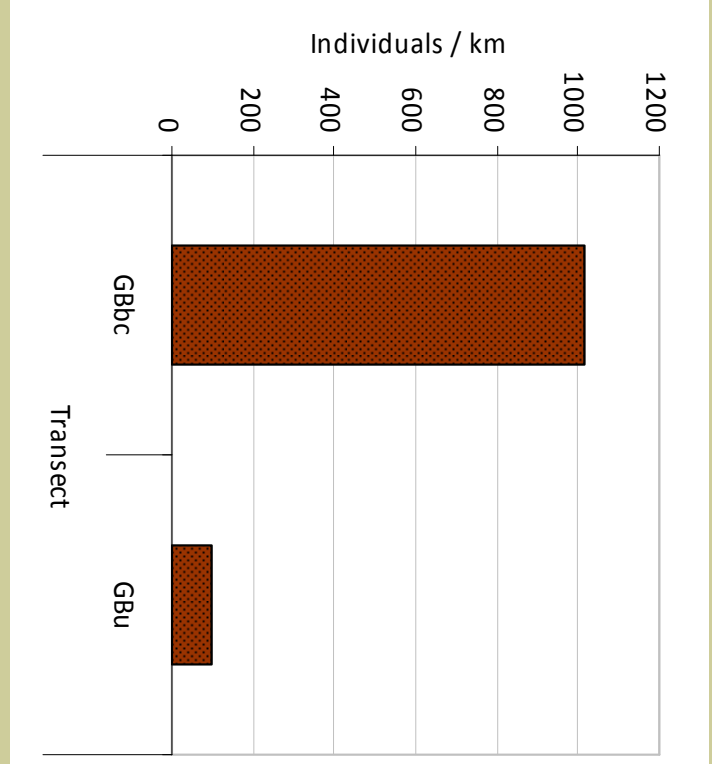
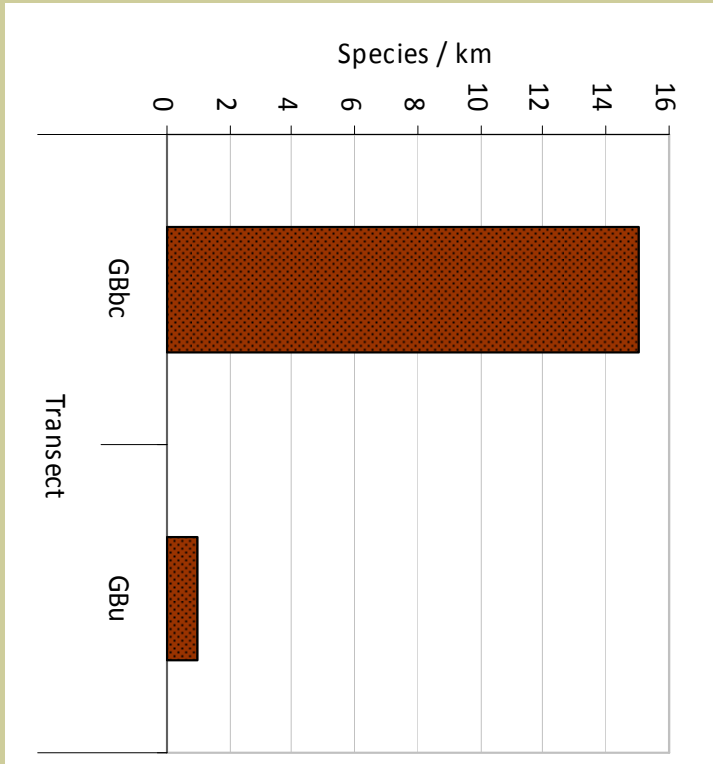
Conservation areas at Gait Barrows NNR demonstrated the highest levels of butterfly biodiversity. The Mann Whitney test at Gait Barrows revealed that species richness ( $Z = -3.273$ ,  $P < 0.001$ ) (Fig. 2a) and butterfly abundance ( $Z = -2.924$ ,  $P < 0.01$ ) (Fig. 2b) was significantly higher at the conservation transect compared to under-managed habitat.

The Mann Whitney test for management regimes for commercial woodland management and coppicing for butterfly conservation both significantly increased butterfly biodiversity when compared to under-managed woodland at Witherlack ( $P < 0.01$ ) (Fig. 3a & b). All species observed at the under-managed site were also recorded in woodland managed for both butterfly conservation and commercial woodland management. Both total butterfly species richness and abundance, and UKBAP fritillary species richness and abundance ( $P > 0.05$ ), were not significantly different between butterfly conservation and commercial management sites at Witherlack.

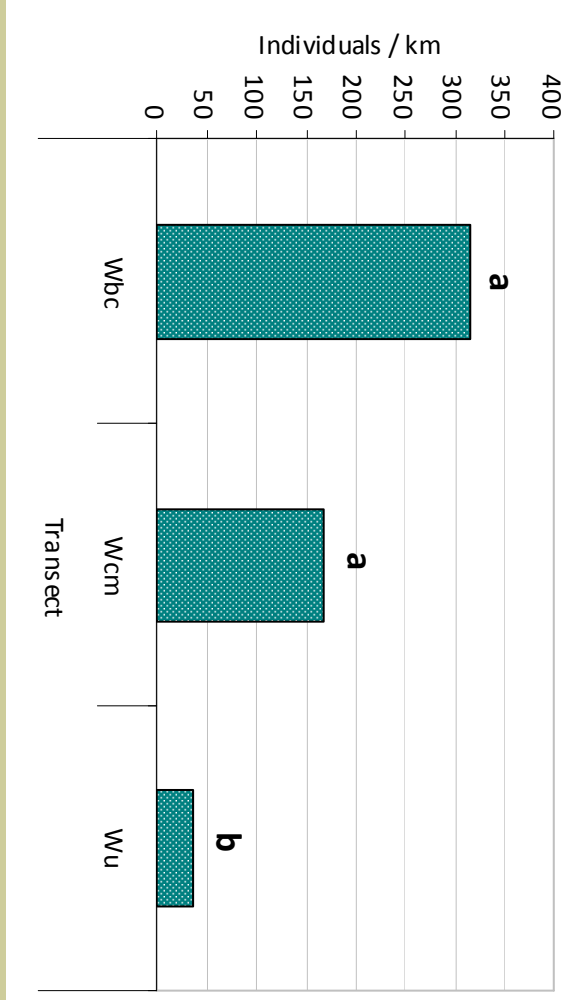
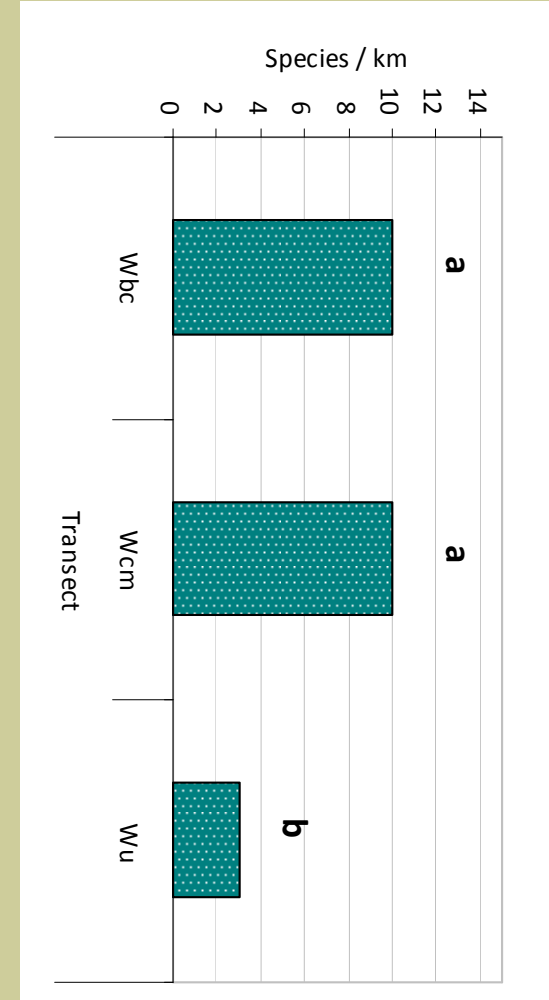


**Fig. 1** Species accumulation curves: Witherlack butterfly conservation transect (WBC); Witherlack commercial management transect (WCM); Witherlack under-managed transect (WU); Gait Barrows butterfly conservation transect (GBBC); and Gait Barrows under-managed transect (GBU). Weeks with no data point indicate weeks when a transect wasn't walked

## Results



**Fig. 2** A comparison of species richness  $p < 0.001$ , measured as the total number of species divided by the total length of the transect in kilometres (a) and abundance  $p < 0.01$  (b) in transects at Gait Barrows measured as the mean number of butterflies per kilometre per section, using only data from the 15 weeks when all five transects were walked. GBBC = Gait Barrows butterfly conservation transect; WU = Witherlack Barrows under-managed transect.



**Fig. 3** A comparison of species richness, measured as the total number of species divided by the total length of the transect in kilometres (a) and abundance (b) at Witherlack, measured as number of mean species per kilometre per section, using only data from the 15 weeks when all five transects were walked. Values that differ significantly  $p < 0.0169$  do not share any letter: WBC = Witherlack conservation transect; WCM = Witherlack commercial management transect; WU = Witherlack under-managed transect.



Photographed by the author, Witherlack commercially managed Spring 2011



(a) Pearl bordered fritillary (b) high brown fritillary. Available at: [www.butterfly-conservation.org](http://www.butterfly-conservation.org), accessed 2011.

## Conclusions

The findings suggest that increased commercial management, in line with targets on renewable energy, has the potential to significantly improve butterfly biodiversity in the UK; a pattern that is likely to be reflected in a range of other taxa.

## Future work

Continued observations and monitoring of butterfly patterns and trends to look at the long term impacts of woodland management. The economic evaluation of woodland management scenarios combining both use and non-use values.

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Author for correspondence (email: [donna.taylor@cumbria.ac.uk](mailto:donna.taylor@cumbria.ac.uk))

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