

Predator-prey relationships in protected areas of Pisa Province, Central Italy

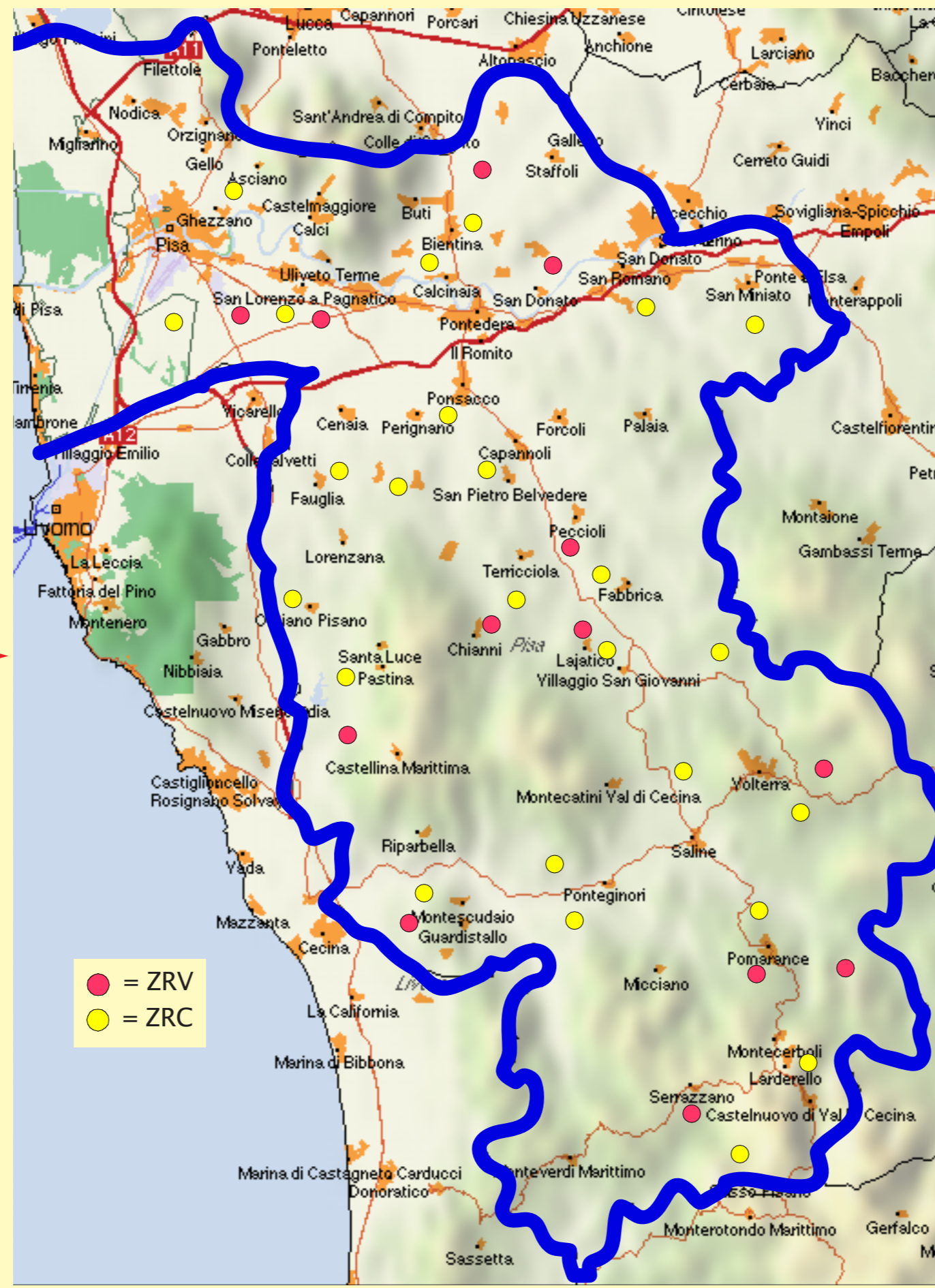
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We analysed predator-prey numerical relationships in 39 protected areas (14 with pheasant releases, size 50-760 ha, hereafter ZRV; 25 without releases, 350-1370 ha, hereafter ZRC) in the Pisa Province, Tuscany, Central Italy, by means of linear transects.



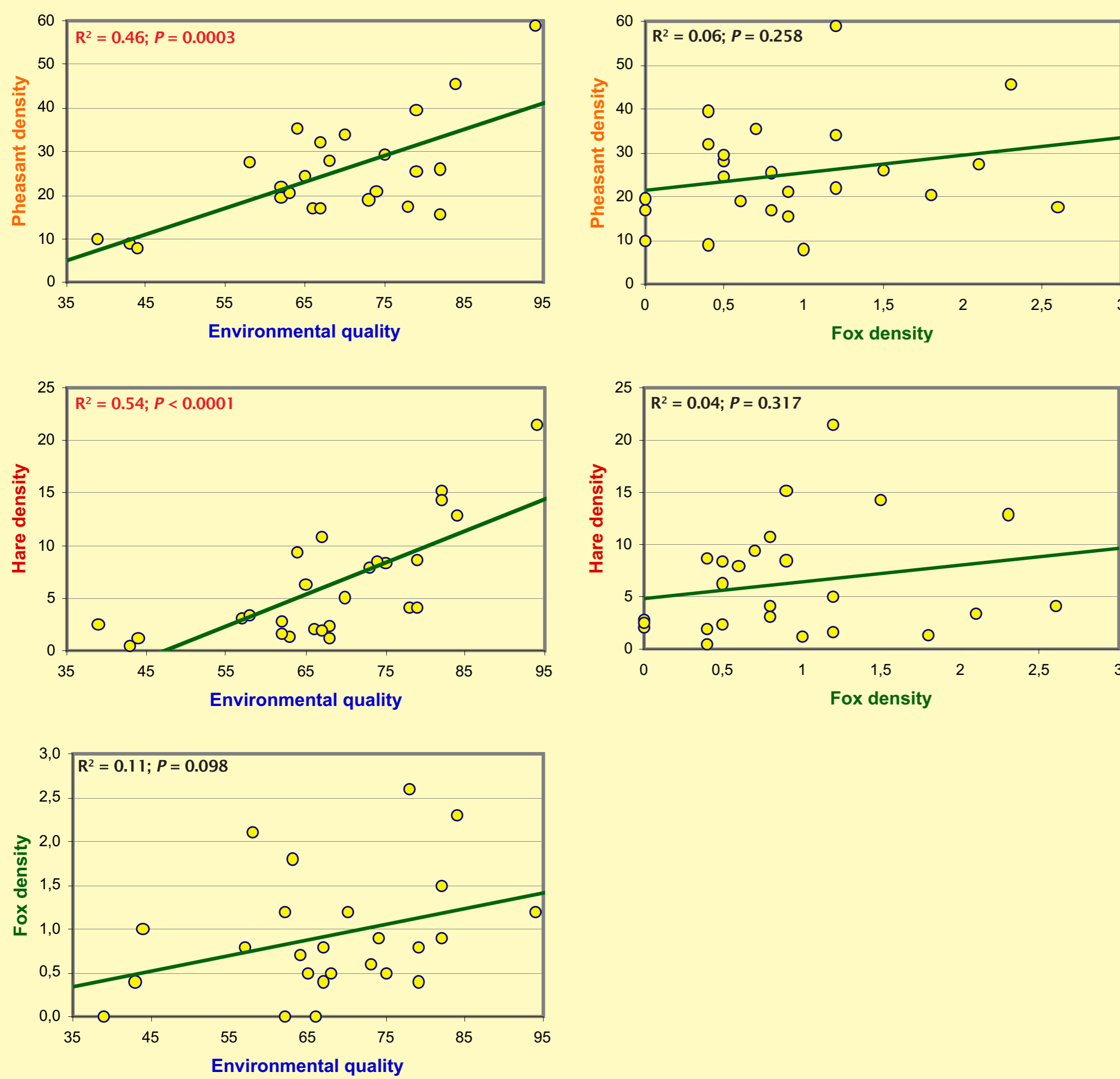
In the ZRV, censuses were conducted in 1999-2000 by the authors. Hares *Lepus capensis* and predators (mainly foxes *Vulpes vulpes*, but also feral cats *Felis catus*) were censused by night, with the aid of spotlights; pheasants *Phasianus colchicus* were censused in the early morning. Density was estimated by means of distance sampling with the use of the software DISTANCE 3.5.

Buckland, S. T., Anderson, D. R., Burnham, K. P. & Laake, J. L. 1993. Distance sampling: estimating abundance of biological populations. London, UK: Chapman & Hall.

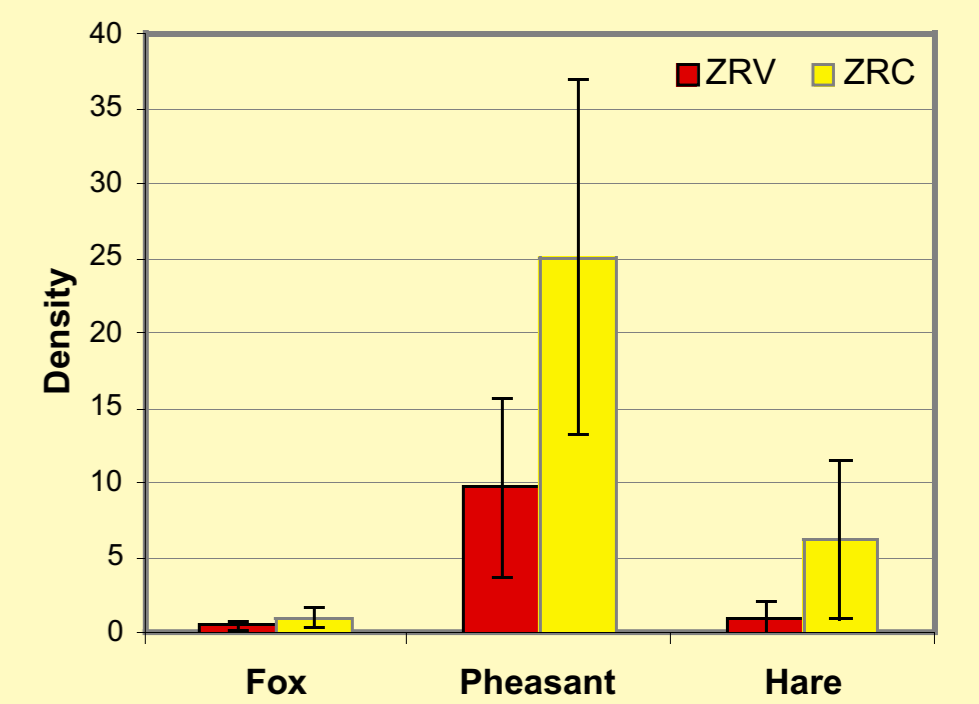
In the ZRC, censuses were conducted in 1995-1999 (hare) and 1997-1999 (pheasant and fox) by Prof. A. Poli of the University of Pisa. Density was estimated by means of strip censuses (dividing the total number of animals observed by the total surface explored). In the ZRC, a simple index of environmental quality for hares and pheasants has been calculated, taking into account land use. Data were analysed by means of simple and multiple linear regressions.

High scores were given to agricultural areas with small fields and many hedges, lower scores to areas with intensive agriculture and large field size and lowest to urban and other unproductive areas. Results were then averaged over the whole area, and standardized as percentages.

In ZRC, environmental quality explained well hare and pheasant densities (multiple linear regressions, hare: $P = 0.00004$, pheasant: $P = 0.00074$), whereas fox density did not (hare: $P = 0.74$, pheasant: $P = 0.94$). Fox density was also related to environmental quality, although not significantly so (linear regression, $P = 0.098$). The same results were obtained analysing each year separately.

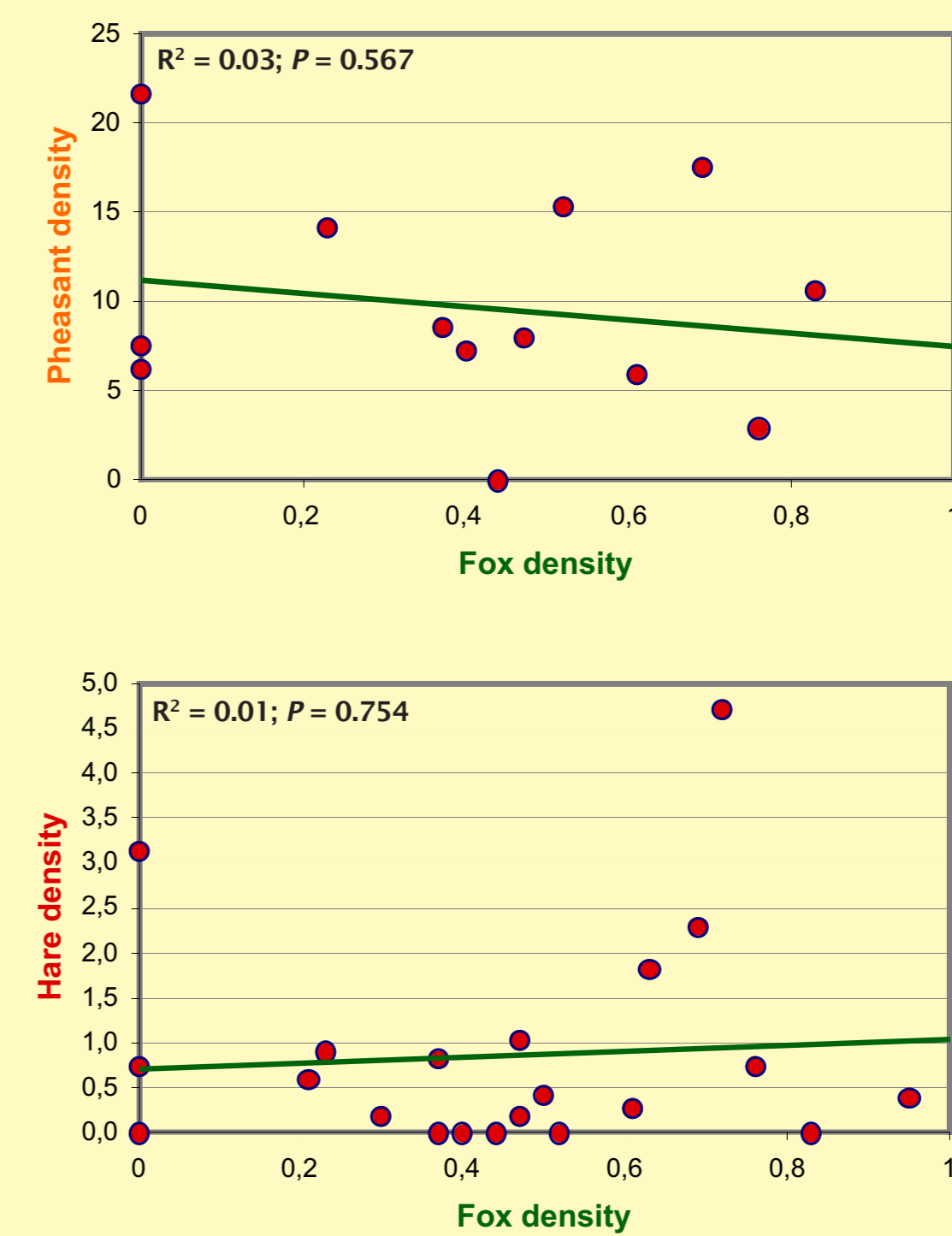


In the ZRV, average density (N per 100 ha \pm SD) was 0.45 ± 0.27 foxes, 2.1 ± 0.7 feral cats, 9.66 ± 6.04 pheasants, 0.87 ± 1.21 hares. Other predators (stone martens *Martes foina* and feral dogs *Canis familiaris*) were rarely observed.

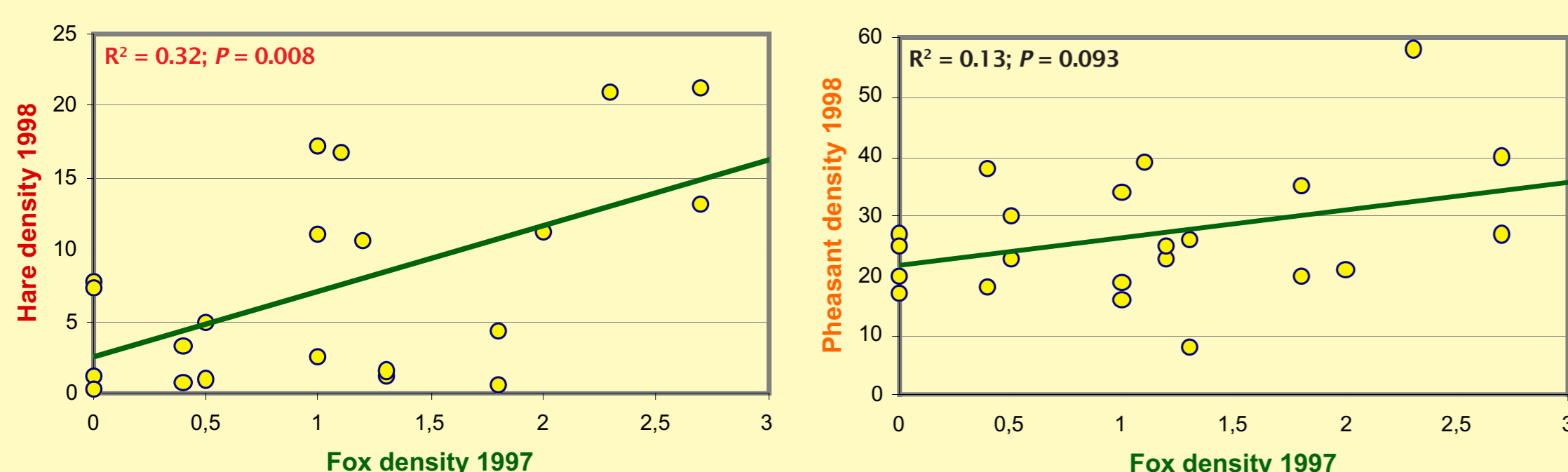


In the ZRC, average density was 0.92 ± 0.69 foxes, 25.1 ± 11.83 pheasants, 6.22 ± 5.3 hares.

In the ZRV, in both years, hare and pheasant densities are not related to the density of either fox or all predators pooled.



Surprisingly, a high fox density in one year was related (together with environmental quality) to a higher density of hares the following year (foxes: $P = 0.03$; environment: $P = 0.008$); the same trend was apparent for pheasants, although significance was not reached ($P = 0.26$; environmental quality $P = 0.057$).



In conclusion, natural fox abundance does not seem to determine low prey numbers in either type of areas. It must be stressed that no fox numerical control was carried out during this study. It is therefore still possible that an artificial reduction in fox numbers could result in increased hare or pheasant density.