



# Investigating the change in the pattern of crop dominance in Iranian agricultural ecosystems



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## Introduction

Human have made fundamental changes in his environment in many aspects, and agriculture is no exception. We are witnessing the simplification of agricultural ecosystems, which has affected the biodiversity of agricultural products in different parts of the world, and ultimately human behavior has changed the natural patterns of several thousand years and its effects are the instability of agricultural ecosystems. Furthermore, biodiversity can lead to increase productivity by several procedures such as pest control and soil fertility. Eventually, biodiversity brings economic stability (Asrat et al., 2010; Di Falcao et al., 2010). The loss of biodiversity in agroecosystems is a serious threat to the survival of ecosystems and global food security (Altieri, 1999, Stefani et al., 2017). The aim of this study, was to calculate crop dominance using the biodiversity indices in Iranian agroecosystems.

## Materials and methods

In order to investigate the predominance of some species in Iranian agricultural ecosystems in terms of biodiversity, a study was conducted in the period 1991-2018. We used time series of crop area data from 1991 to 2018 for Iran. Also, some biodiversity indicators, including Shannon and dominance and were used to determine the status of biodiversity.

Pi is the ratio of the total area under cultivation of species "i", S is the number of species; D is the value of Simpson index and  $\lambda$  is the dominance index (Shannon, 1948; Simpson, 1949). Index calculation has been performed using Ecological Methodology software.

Indexes	Equations
Shannon	$H' = -\sum p_i \ln p_i$
Dominance	$\lambda = \sum_{i=1}^s p_i^2$

## Results

The results showed that wheat and barley species are cultivated in almost all parts of Iran (97% of agricultural areas). Wheat and barley in Iran have about 6.2 and 1.7 million hectares of cultivated area (66.11% of the total area under cultivation of crops and orchards), respectively (Figure 1). The trend of Simpson dominance index fluctuated in the study period but was not generally affected by the area of wheat and barley (Figure 2). Also, the Shannon diversity index was strongly influenced by the area of wheat ( $b = -0.41$ ,  $r = -0.51^{**}$ ) and barley ( $x = -0.09$ ,  $r = -0.34$ ), so that by increasing the area of wheat and barley, Shannon index decreased (Figure 3).

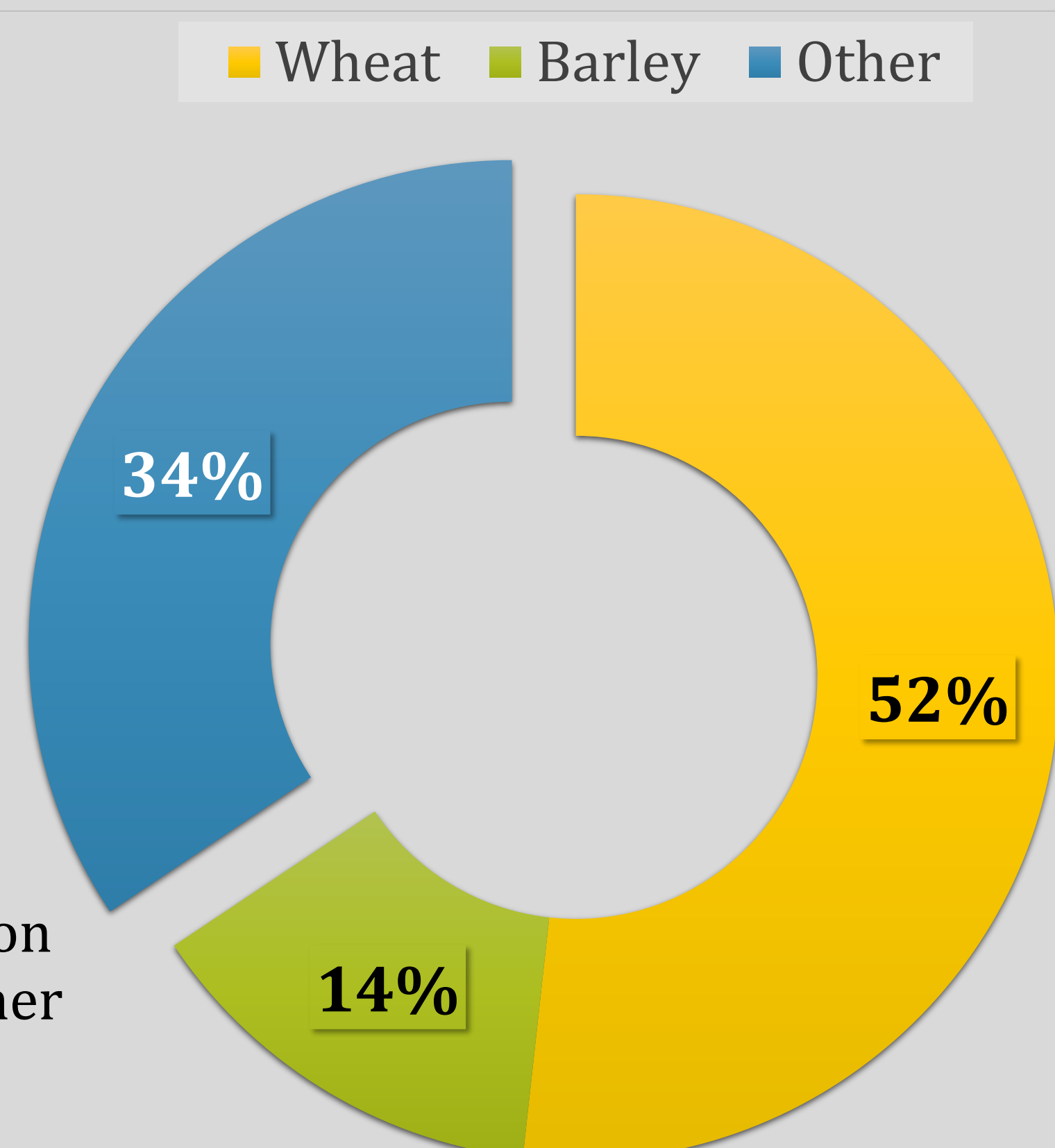


Figure 1. Percentage of the area under cultivation of wheat, barley and other crops in Iran between 1983 and 2018.

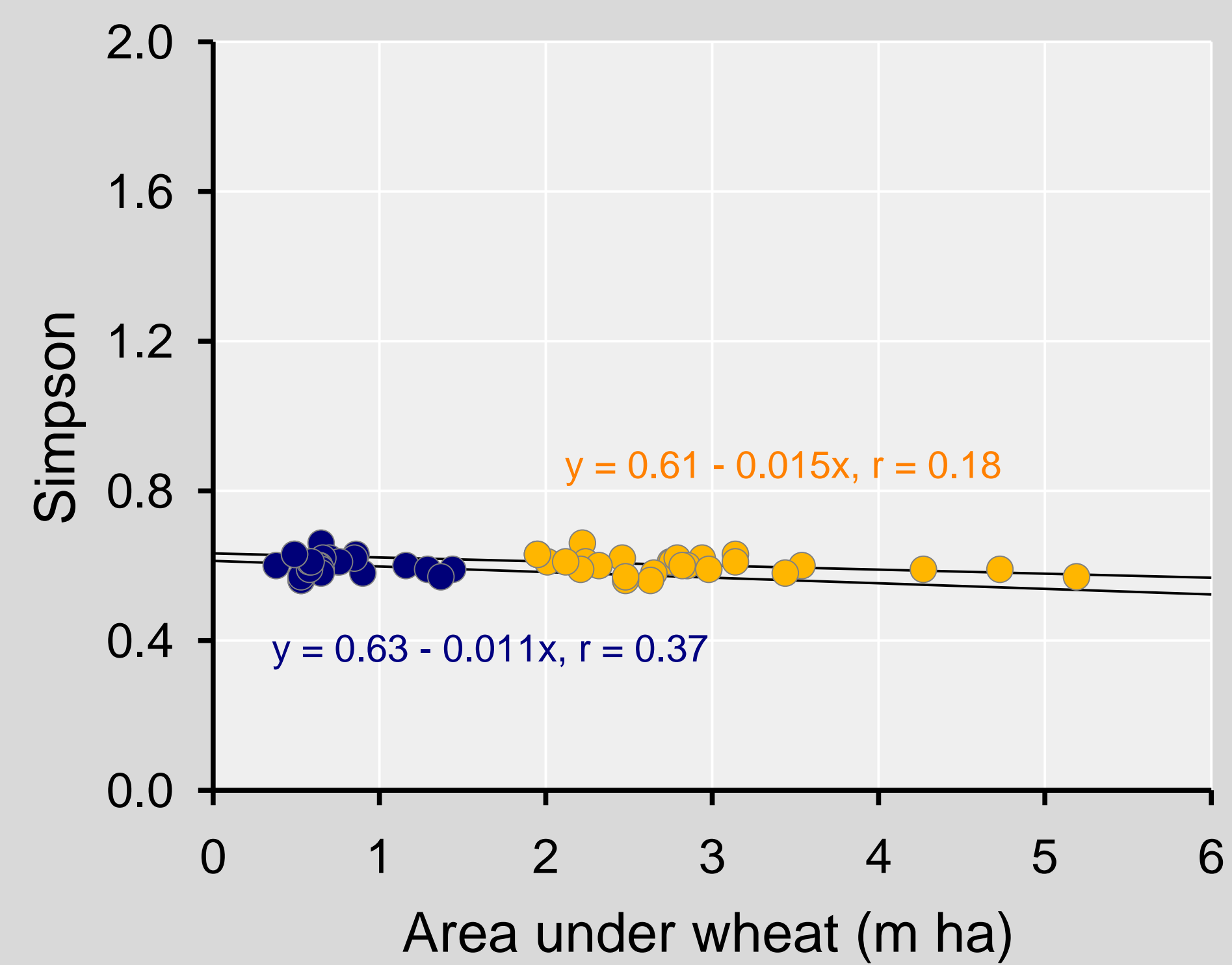


Figure 2. The relationship between Simpson diversity index and area under wheat and barley cultivation in Iran between 1991 and 2018. The solid line is the linear regression fit to the blue points (n=28).

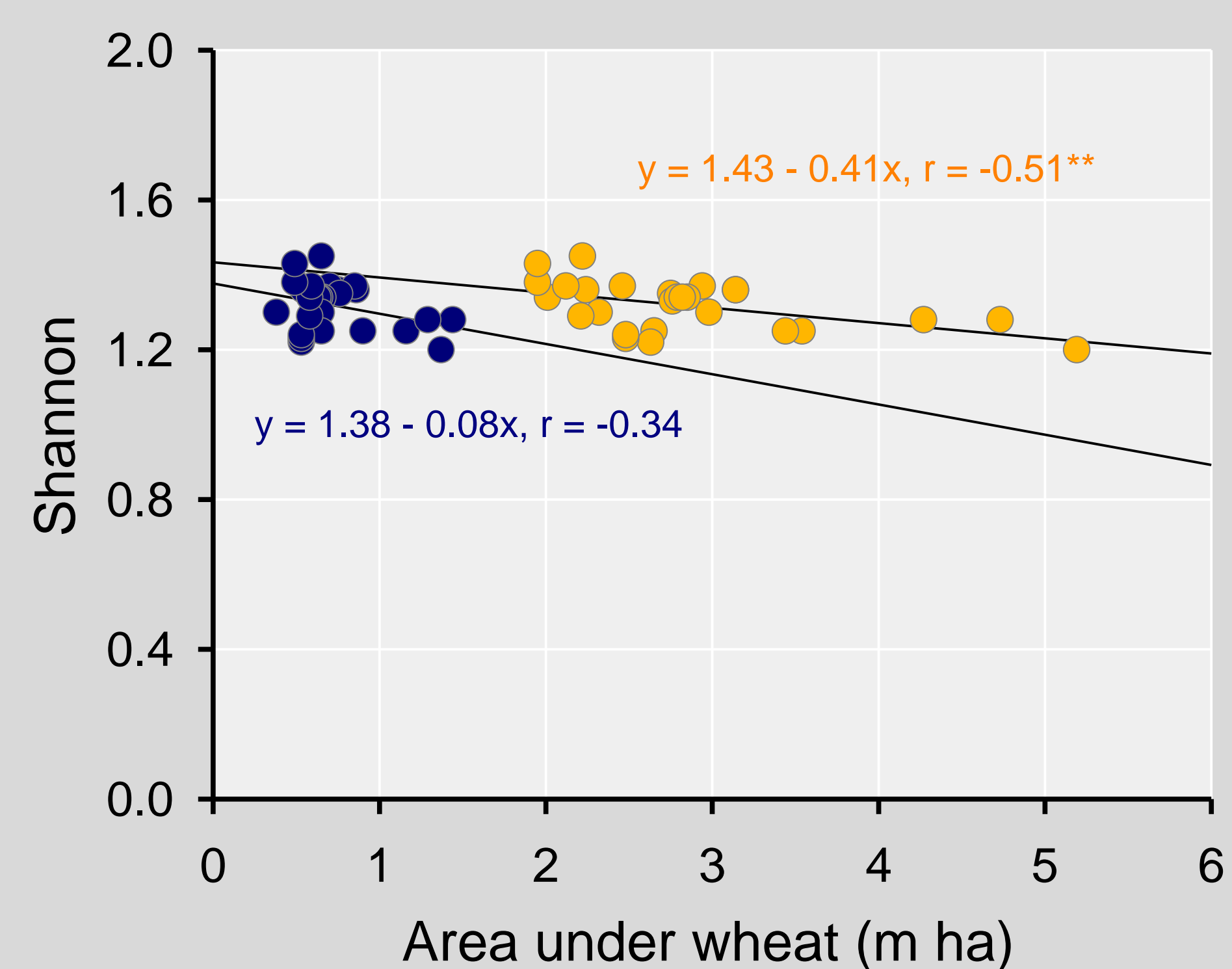


Figure 3. The relationship between Shannon diversity index ( $H'$ ) and area under wheat and barley cultivation in Iran between 1991 and 2018. The solid line is the linear regression fit to the blue points (n=28). Significant trends ( $p \leq 0.01$ ) shown by \*\*.

## Results

The results show the dominance of these plants and the prevalence of monoculture in Iran, which results in instability and vulnerability of agricultural ecosystems. Due to Iran's arid and semi-arid climate, the dependence of these crops on seasonal rainfall has increased the vulnerability of the agricultural system and food security. As the occurrence of drought in some years studied, the amount of wheat and barley production in Iran decreased significantly. In general, the biodiversity trend of crops in Iranian agricultural ecosystems was a function of the amount of dominance or area of wheat and barley cultivation. In other words, when the area of these two crops in this period decreased due to climatic or political reasons, the amount of diversity indices increased.

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