# Field characteristics in Czech Republic

## 1 Introduction

Soil erosion is one of the major agricultural issues in Czech Republic. Czech fields are quite large as the result of agriculture collectivization in 1950s and 60s. Due to the hilly nature of Czech landscape and large field size, any precipitation will result in large runoff and related soil erosion.

This is escpecially a problem after the harvest, when nothing is growing in the field. Various techniques can be employed to reduce erosion during that time, e.g. harvesting only the grain of cereals. This has to be taken into account when dealing with erosion, but the challenge of efficient path planning for agricultural machinery is relevant only to the growth period.

Efficient path planning in agriculture can be expected to minimize erosion by reducing the average incline of plant rows while not significantly increasing other factors (e.g. fuel consumption or time spent driving). Path planning can therefore be considered as one of the most important issues for precison farming in Czech Republic.

To be able to assess just how complicated path planning for Czech fields is, some notion about the field properties is necessary. For the field analysis described in this article, three sources of data will be used – field geometries, digital elevation model and agricultural machine telemetry data. This introductory section is concerned with the first source, field geometry, available from Czech LPIS (land parcel identification system).

LPIS data are distributed in the form of Shapefiles, one per each cadastral unit (of which there are 13 092 in Czech), which was gathered with a script written in GNU Make to be easily replicable.

As fields with regular shapes are easier to navigate than complex ones, it is beneficial to know how complicated are the shapes of Czech fields. Oksansen (2007, [1]) uses in his thesis a range of spatial indices to evaluate the compactness and shape of fields in Finland, a similar approach has been taken in this article.

To bolster the claims made in the first paragraph, the mean field incline in Czech is 4.6 °, slightly lower for arable land at 3.16 °. The mean arable field has an area of 10.3 ha. Some of the first results in this analysis include the figures below, histograms of field area, circumference to area ratio and Polsby-Popper score (PP-score).

$$PP(D) = \frac{4\pi A(D)}{p^2} \tag{1}$$

Some conclusions can be made even from these simple graphs, for example, figures 3, 4, 5 show the histogram for PP-score of all fields, arable land and grasslands respectively.

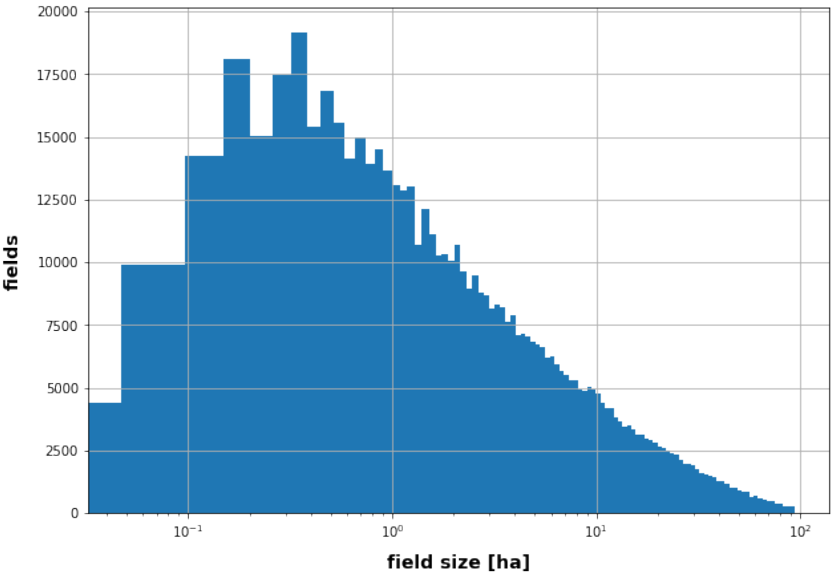


**Figure 1:** Histogram of field area in Czech Republic.

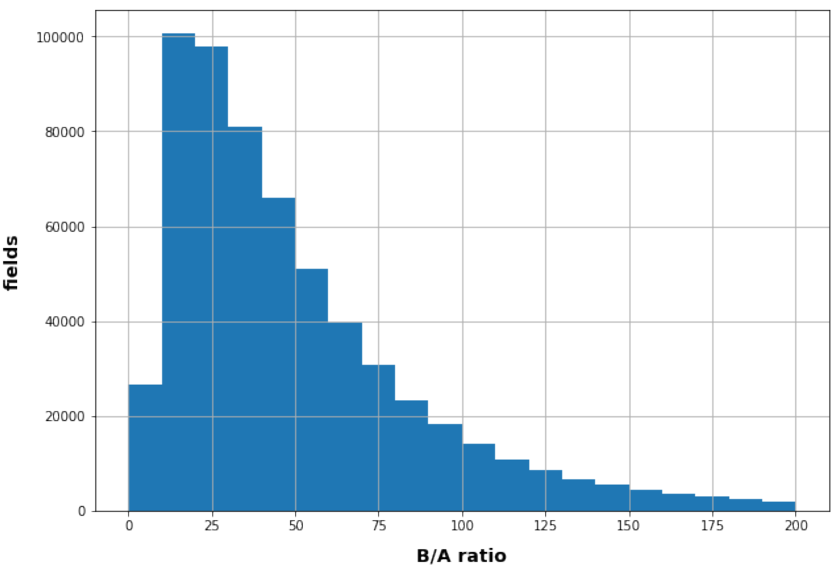


**Figure 2:** Histogram of field border/area ratio in Czech Republic.

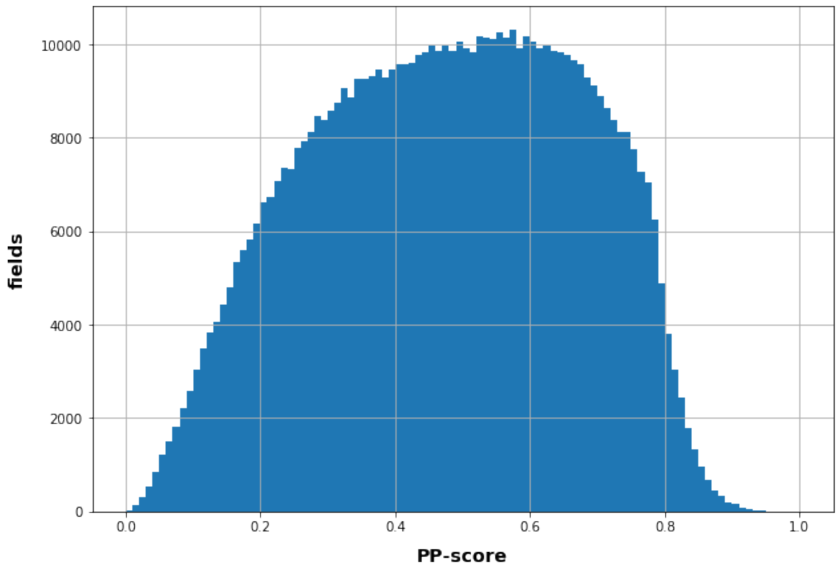


**Figure 3:** Histogram of field PP-score in Czech Republic.

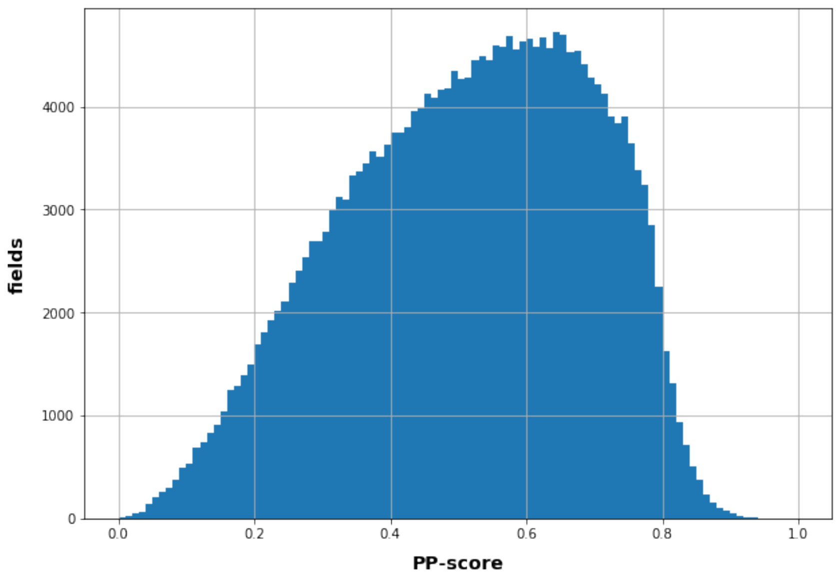


**Figure 4:** Histogram of arable land PP-score in Czech Republic.

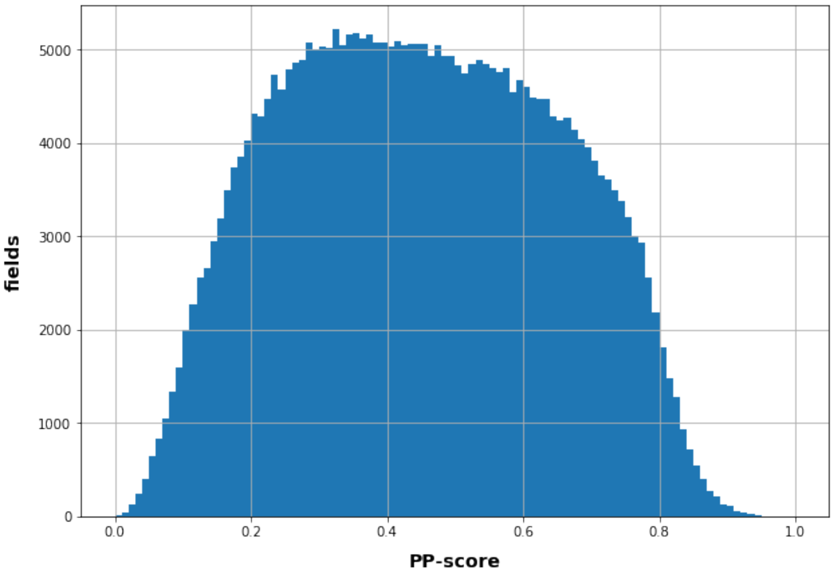


**Figure 5:** Histogram of grassland PP-score in Czech Republic.

Polsby-Popper test (equation 1) is used to measure the compactness of shapes on the scale from 0 to 1, 1.0 being a circle. Figures 4 and 5 compared show that arable fields tend to be slightly more compact than grassland.

# References

[1] OKSANSEN, Timo. *Path planning algorithms for agricultural field machines.* Helsinki University of Technology, 2007.