

# How does shade influence coffee production?

## Trade-offs between yield and quality



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### 1. Background

- Tanzania aims to improve coffee production<sup>1</sup>
- Climate change poses a significant threat to coffee production<sup>2</sup>
- Shade may reduce some of the impacts of climate change<sup>3</sup>

### 2. Justification

- High shade density reduces yield<sup>4</sup>
- On the other hand, shade trees might improve coffee quality and bean size<sup>5</sup>
- Small-scale production might be especially sensitive to these trade-offs
- The aim of this study is to evaluate the effect of shade density on coffee yield and quality in Homegardens at Mt. Kilimanjaro

### 3. Methods

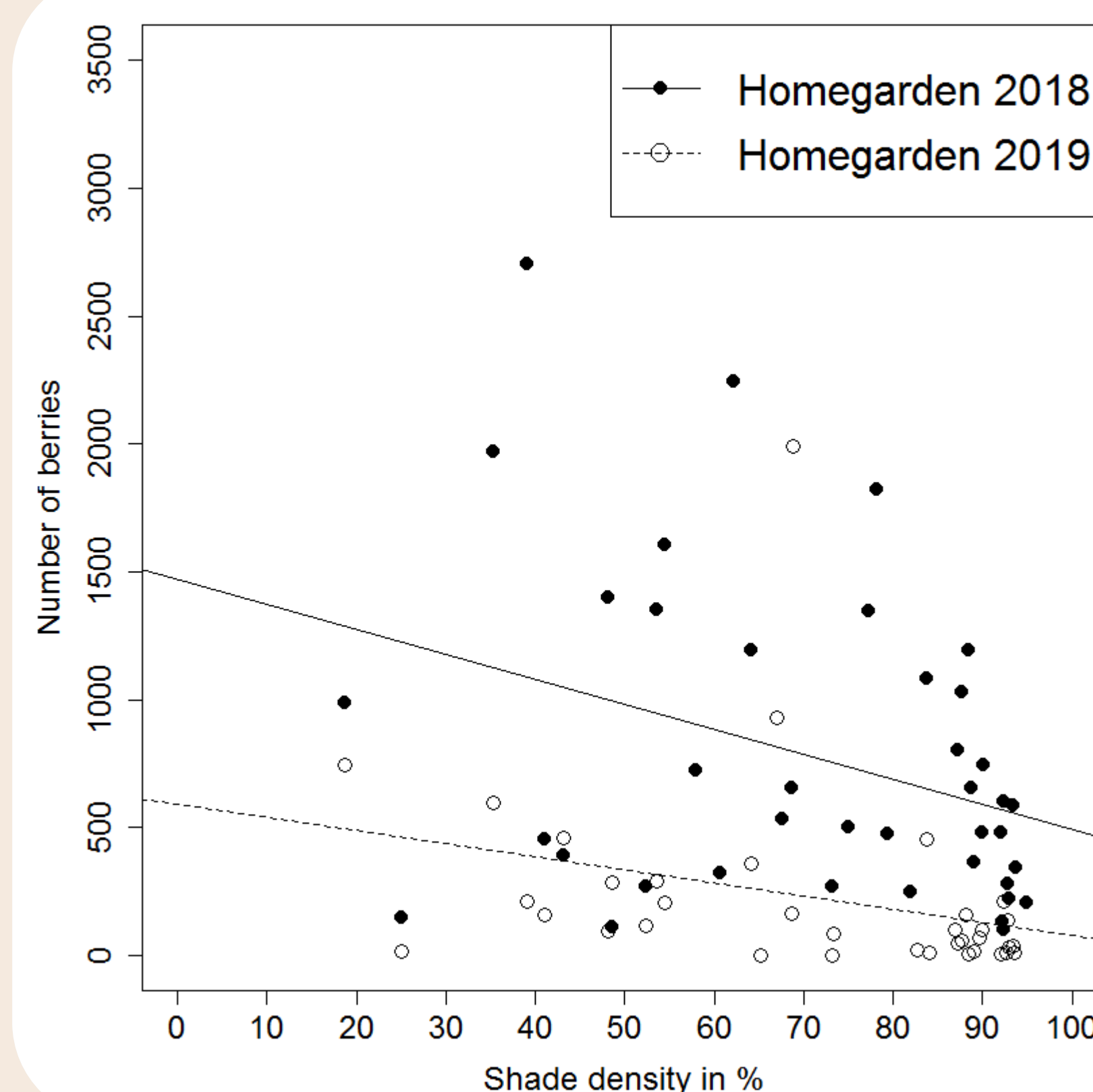
- 40 study plots in Homegardens (*Figure 1*)



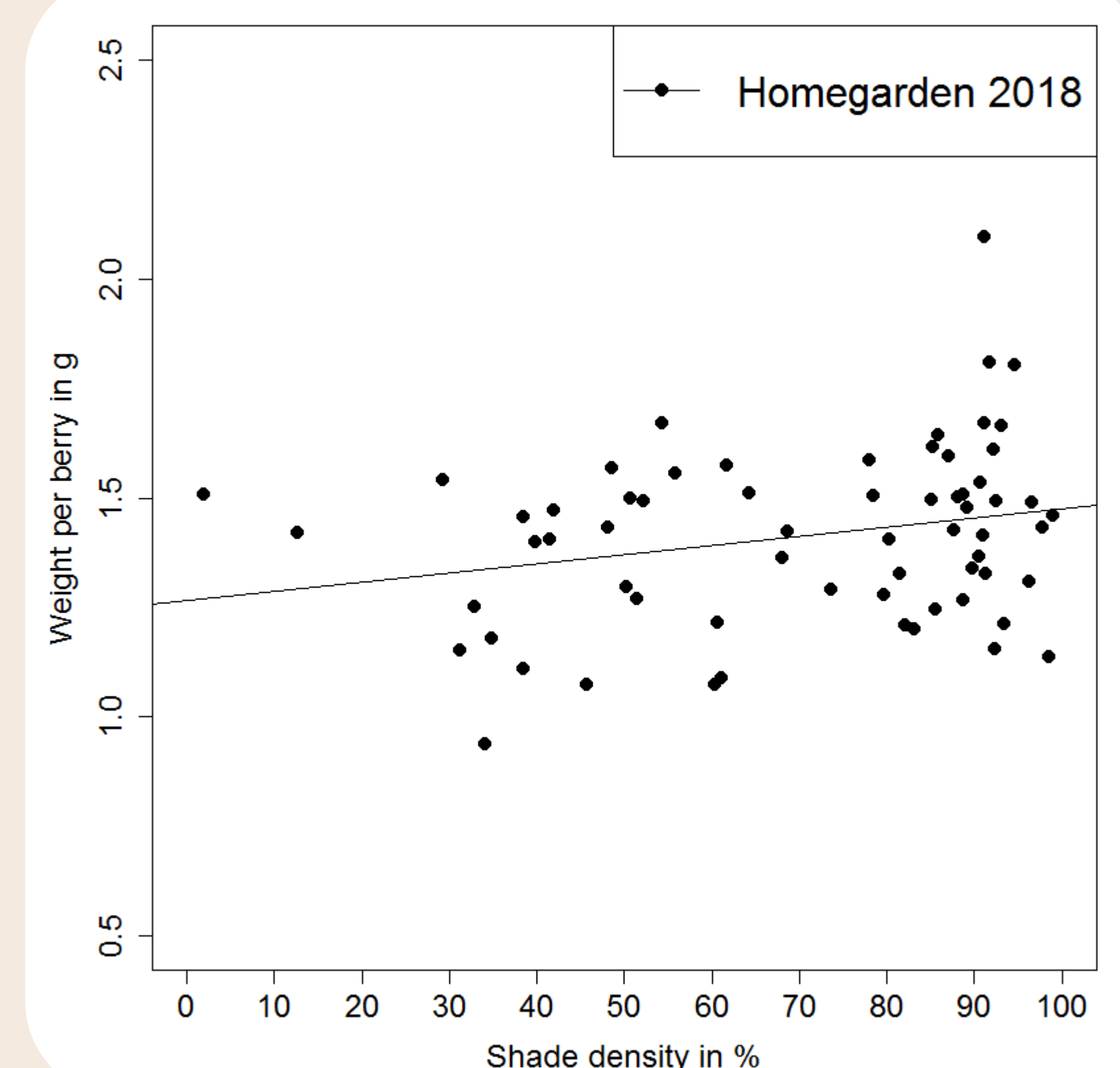
**Figure 1:** Homegarden at Mt. Kilimanjaro

- A range of shade density (15-95%)
- The total number of berries per plant counted to estimate yield
- Red berries harvested, weighed and opened to record number of beans and bean quality
- Correlations and regressions between shade density and response variables calculated

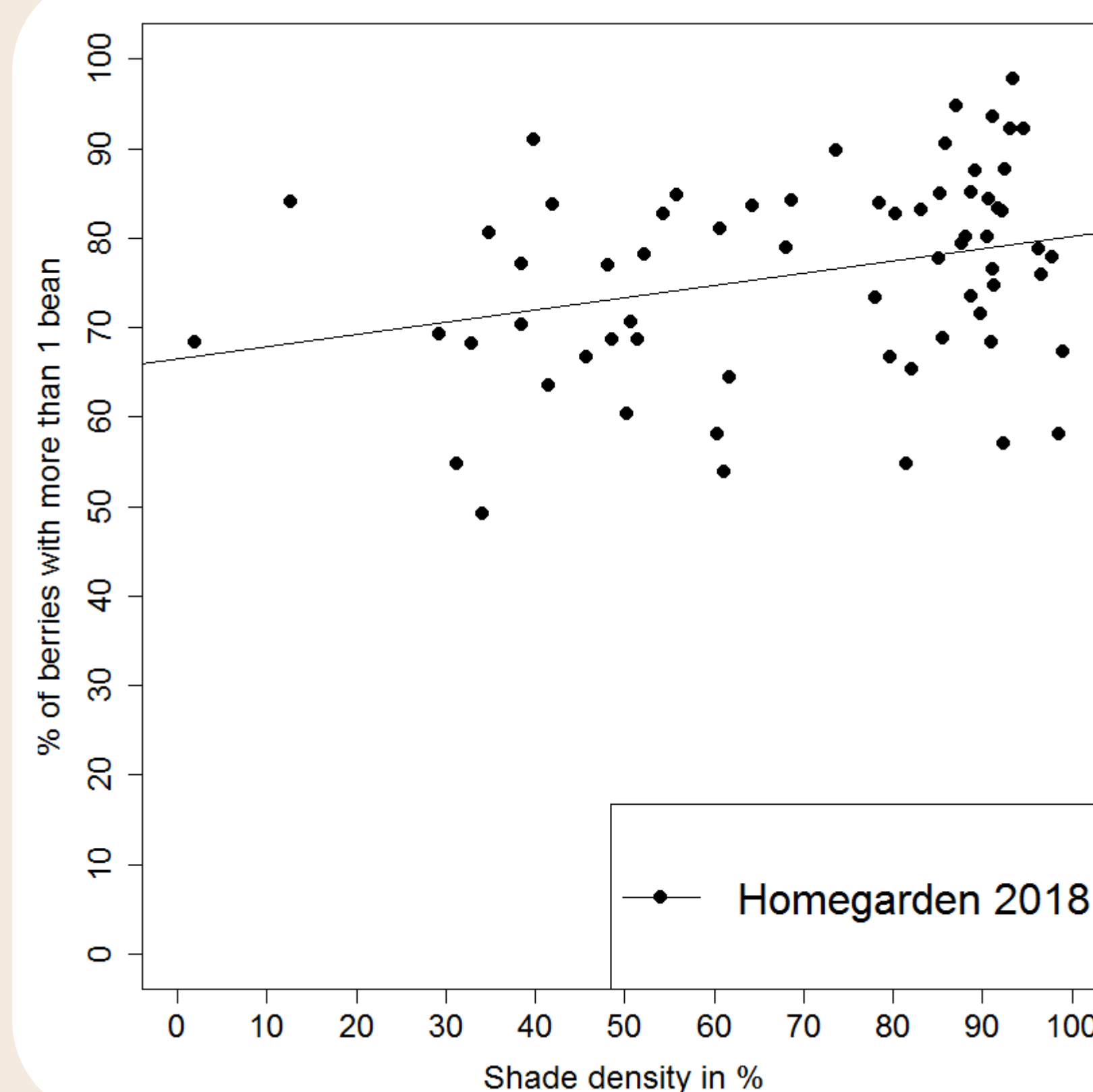
### 4. Results



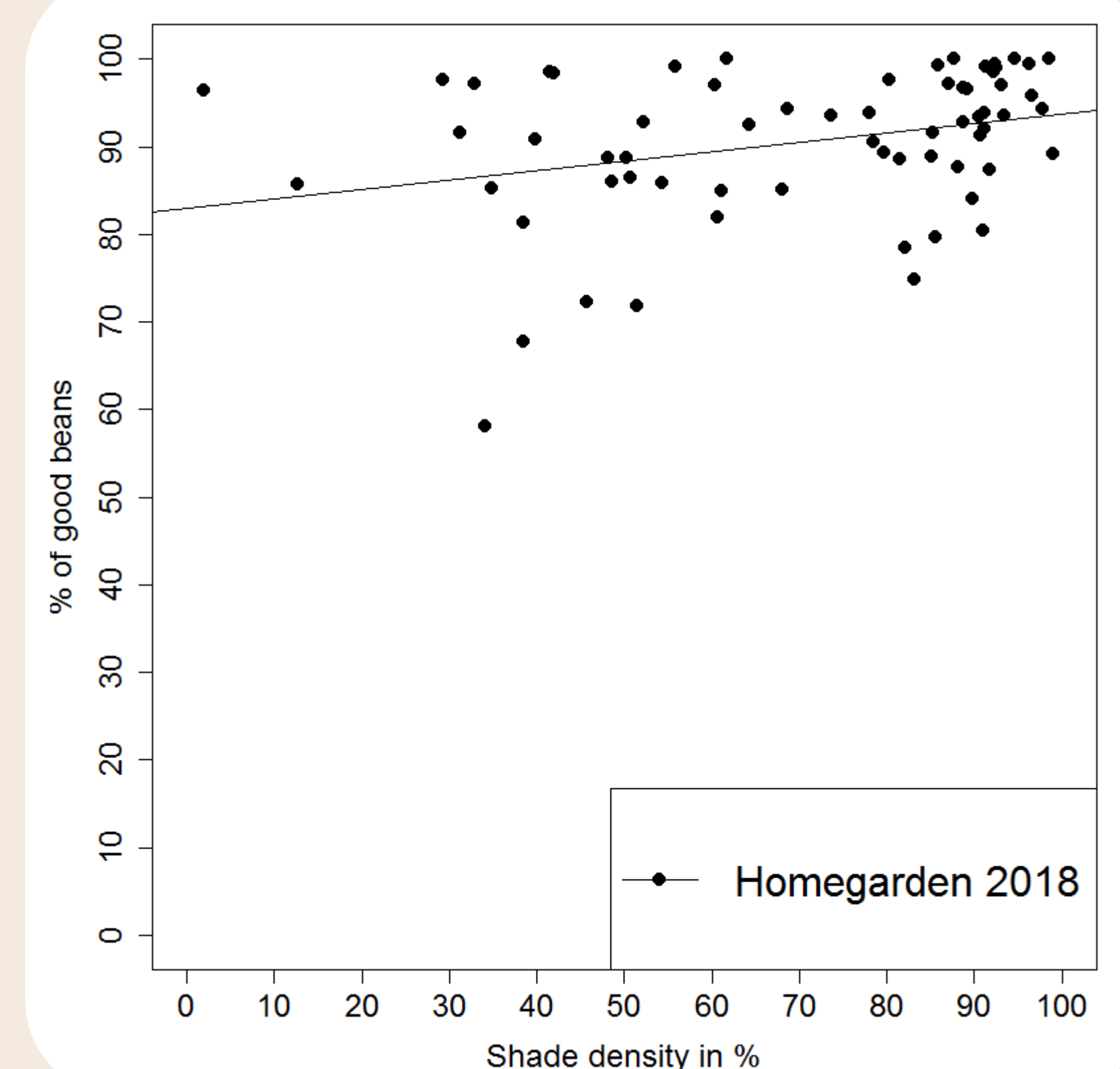
**Figure 2:** Number of berries and shade density are negatively correlated. (2018:  $-0.34$ ,  $P = 0.035$ ; 2019:  $-0.30$ ,  $P = 0.072$ )



**Figure 3:** Average berry weight and shade density are positively correlated. ( $0.25$ ,  $P = 0.044$ )



**Figure 4:** Proportion of berries with more than one bean and shade density are positively correlated. ( $0.29$ ,  $P = 0.017$ )



**Figure 5:** Proportion of good quality beans (high density and good colour) and shade density are positively correlated. ( $0.30$ ,  $P = 0.015$ )

2018 was an extremely wet year in the Kilimanjaro region. Farmers reported that shade is usually more beneficial during drought conditions. That notwithstanding, a positive effect of shade on quality was observed (*Figure 3-5*).

### 5. Conclusions

Shade density:

- Decreases yield (number of berries)
- Increases quality (weight per berry, proportion of berries with more than one bean, proportion of good quality beans)

Under climate change it will be essential to consider positive and negative effects of shade

#### References

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