Comment on esd-2022-18
Anonymous Referee #1

The study is comprehensive with relevant details regarding research focus, methods, results, and concluding remarks presented. However, the background of the research focus could be improved to highlight the novelty of the present study. Some parts of the manuscript need improvements.

Introduction
Line 50: “Therefore, the extent of the boreal forest response to climate change is still not fully understood”. The author should point out why? What current research has been done, what are the important methods, and what main conclusions are related to this aspect?

Line 60: I guess there are studies that have used Landsat to quantify the spatiotemporal changes occurring in the boreal forests in Siberia or other places. It would be nice to see more backgrounds related to this here.

In general, the introduction needs to be improved and the contextual description is weak.

Study area
Adding a layer of DEM and Landsat RGB images for the study area is necessary.

Input data
How many tiles of Landsat images could cover the study area? "Mainly in the years 1985, 1995, 2005, and 2015", Why did you use this ten years interval? Why did you choose level1 data? USGS also provides level-2 datasets that have been atmosphere corrected, which could significantly reduce the workload in data processing. Why are most of the images acquired from June to September, and what
about the others? Please specify them!!

Line 102 What is the spatial resolution of ERA5-land?

Data processing
The description of the data processing is very shallow. Given that spatial and temporal change is the key part of this paper, how to proceed with cloud, anomalies, and alignment correction of images is very critical.

Forest cover and species classification
Why not use random forest classification directly, but use rule-based classification first, and then random forest? I am very skeptical about the final classification result. Due to the large latitudinal differences in the study area, using NDVI threshold classification may result in some forests being removed incorrectly. In addition, there will be subtle differences in NDVI values over the years. Anyway, the threshold classification method should be used with caution in applying large spatial scales and change detection. How many training samples were used for the classifications? Did you use the same training samples for different years?

Accuracy validation
What about the accuracy for other years? Yes, I agree that the collection of validation samples is difficult in earlier years. But you only classify forest and non-forest, the collection of samples directly from Landsat images is also possible in the early years.

Results and discussion
Overall, the results and discussion are overloaded with descriptions of the methods and results, but lack analysis of the results. It is not recommended to put the results and discussion together. The discussion needs to be improved. The results need to be better integrated with the context of the study. E.g., what is the significance of your results? Rather than simply describing the results. Specifically,

1. Where can I find the classification accuracy?
2. Did the authors ever consider the collinearity between climate variables? From Fig 10, the curve of TEM_Growmax is very similar to the curve of TEM_Grow.
3. From Fig 11, it seems like the relationship between the forest cover and species changes and climate variables was conducted at a regional scale, not a pixel scale. Why?
4. Why did not contain coniferous forests in Fig 11?
5. Where is the $Q^2$ value for each PLS regression model?
6. The correlation coefficients in Table 5 are too low to account for the impact of climate on forest cover changes. In the text Line, 289 is correlation coefficients, and the title of Table 5 is standardized regression coefficients, please check regression coefficients and correlation coefficients are not the same thing and should not be used in confusion, this puzzled me.
7. It is possible to compare whether the local temperature exceeds the vegetation’s optimum growth temperature.