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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Influence of Hydrometeorological Hazards and Sea Coast Morphodynamics onto Unique Coastal Vegetation Sites Development – *Cephalanthero rubrae – Fagetum* on Wolin Island (the Southern Baltic Sea)" *by* Jacek Tylkowski et al.

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Dear Mr. Wolski, Thank you very much for your review. We send answers to 3 questions.

1 The climate indicators AI, EQ, FAI, MT are described in the cited literature (lines 89-94). For Fagus Silvatica, the optimal and development-threatening threshold values of these indicators are also presented. The threshold values (1960-2019 climate data)

are also presented in Figure 4. Optimal weather conditions in individual years (AI, EQ, FAI, MT index values) favor the development of Fagus Silvatica. On the other hand, the values of these indicators outside this range are unfavorable for the development of the beech forest and may even cause the stand to disappear. It should be emphasized that episodic (in individual years) exceeding the optimal threshold values of the AI, EQ, FAI, MT indicators will not cause immediate beech degradation. Clustering of such events is more dangerous, and especially the long-term trend. Based on the analyzes of the AI, EQ, FAI, MT indicators in the period 1960-2019, no clustering of such unfavorable cases (several consecutive years) was found. The occurrence of unfavorable temperature and precipitation conditions (years) for the development of the beech forest was accidental. However, unfavorable climatic trends of these indicators were found, towards values unfavorable to the development of Fagus Silvatica. This situation will continue in the coming years in the 21st century. We give formulas for climate indicators (they will be placed in the article, in the methodological chapter):

De Martonne aridity index: IA = P/(T+10) (De Martonne 1926), where P = the amount of the annual precipitation, T = average annual temperature. IA< 30 = silvosteppe, 30 < IA< 45 = climate favourable for the forest, with an optimal for beech in the range 35 - 40 (Satmari, 2010). De Martonne aridity index - classification Tabari et al., 2014: IA<5 extremely arid 5<IA<10 arid 10<IA<20 semi-arid 20<IA<24 mediterranean 24<IA<28 semi-humid 28<IA<35 humid 35<IA<55 very humid 55<IA extremely humid Ellenberg Quotient Index: EQ=Tw/P$\times$1000 (Ellenberg 1988) where Tw represents the temperature of the warmest month of the year, P = annual precipitations (Stojanović et al., 2013). Ellenberg (1988) has set a threshold of beech favourability for EQ values lower than 30, and at EQ values that are higher than 40, the beech disappearance occurs. Forestry Aridity Index (FAI): FAI = 100 x (TVII-VIII / (PV-VII + PVII-VIII) where TVII-VIII is the average temperature of the months July and August, PV-VII represents the amount of precipitations during May-July and PVII-VIII is the amount of precipitations during July-August (Führeret al. 2011). Mayr Tetratherm Index: MT = (TV + TVI +TVII + TVIII)/4 where tV – tVIII represent the mean temperature for the May-August period.

Tetratherm values indicate a climate restrictiveness of an area for some plant formations. Values between 13 and 18 degrees are optimal for the beech (Satmari, 2010).

2. There is no contradiction in the article between the results and the conclusions. The results in lines 181-184 and the conclusions in lines 286-288 are not inconsistency. The annual volatility of the AI, EQ and MT indicators from the 1960-2019 period shows an unfavorable trend of the deteriorating climatic conditions for Fagus Silvatica. However, no clustering (unfavorable conditions for consecutive years, e.g. 1965-1969 etc.) was found in this period. The occurrence of such years was accidental. When analyzing long-term regularities (trends 1960-2019), one should expect a deterioration of climatic conditions for Fagus Silvatica in the following years of the 21st century.

3. Of course, the threat to the development of the orchid beech on Wolin Island is both climate change (thermal and precipitation) and increased erosion of cliffs. However, climatic trends indicate that the adverse change in thermal and precipitation conditions will continue in the 21st century. The climatic factor will be dominant in the changes of the forest. Of course, climate change, its warming and the consequent rise in sea levels are likely to increase coastal erosion as well. However, there is currently no established trend in cliff erosion. The reversal of the cliff coast is mainly due to extreme hydrometeorological events that are episodic and random in nature. It is difficult to forecast at the moment about the dynamics of the recession of the cliff edge. Therefore, among the factors threatening the orchid beech, climate change plays a leading role in comparison with the erosion of the cliff coast.

Yours sincerely Jacek Tylkowski and co-authors of the article

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