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Interactive comment on "Primary productivity and its correlation with rainfall on Aldabra Atoll" *by* J. Shekeine et al.

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Authors' Response to Reviewer 2

We thank the reviewer for careful reading and consideration of our manuscript. Below, we outline in a point-by-point response on how we will address the raised concerns through additional data analysis.

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Point 1 (C184)

Abstract: P982 L4: I agree that local rainfall trends are important. However I m expecting that climate extreme events should have a much more important impact on

Aldabra's ecosystem as compared to the long term decreasing rainfall trends, as vegetation potentially might adapt. The impact of such extreme events on primary production has been recognized (Reichstein et al. 2013 in Nature). The authors refer in their discussion to studies that relate such an extreme event to decreases in tortoises population dynamics due to the loss of important shade trees for tortoises (Bourn et al. 1999, P995 L5). However, the authors mainly focus on trends and ignore the possible impact of such extreme events on this ecosystem.

Response 1 : We will add an inter-annual rainfall variability analysis, in addition to the long-term temporal trend as recommended.

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Point 2 (C184)

P983 L24 (and further): I guess you mean here net primary productivity (NPP and not GPP) as you refer to studies that have investigated NPP.

Response 2 :

Yes, we will correct this and ensure the productivity measure used in the cited papers corresponds to the text it is meant to support.

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Point 3 (C185)

P984 L9-L16: I think that this section should be discussed more in detail as this is of interest for the reader to frame your results. Don't you have more references that observed correlation between tree ring growth? Here you refer to dramatic fluctuations in rainfall (L12) which I agree is of greater importance than long term decreases in rainfall.

Response 3 :

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We will extend the discussion and references relating to land surface phenology, including the paper by Guan et al., 2014 (doi:10.1002/2013JG002572). As we will de-emphasize the dendrochronological work in the manuscript (in response to Reviewer 1), we do not intend to extend that part of the discussion any further.

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Point 4 (C185)

P985 L6. would be good to mention dimensions (interesting to know for satellite analysis) here cause not everybody knows about the Aldabra atoll.

Response 4 :

Aldabra is about 34km long and 14km wide. This information will be added to the revised manuscript.

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Point 5 (C185)

PP986 L10 P987 L4: Is is interesting to give such a description for a method that only provided little information? I think the authors should be clearer that the treering analysis did not give the data they hoped for.

Response 5 :

We will make the outcome of the tree ring analysis clear from the beginning and shift most of this section's content to the supplementary materials as recommended.

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Point 6 (C185) P 986 L12-14. I assume you mean radial stem cross sections. Why did you only select 32 out of 45 samples?

Response 6 :

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Yes, these were radial cross-sections. We selected those 32 out of 45 samples that were viable for dendrochronological analysis. Samples affected by rot, severe structural deformities such as multiple fractures, wide cavities in the wood sample and growth anomalies such as knots were excluded, as they did not allow for the identification and measurement of tree rings. This information will be added to future revisions of the manuscript.

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Point 7 (C185)

P987 L5- P989 L17: I think is not that well structured and more information should be given for non-specialists which are not familiar with MODIS data analysis and terminology (like TIMESAT, Savitzky-Golay filter and STL analysis...).

Response 7 :

We will extend this part and restructure as recommended. We will provide more background information on MODIS data analysis, filtering and metrics derivation, and restructure where we see fit.

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Point 8 (C185) P991 L1: I don t see why 1998 should be left out. Such transition from extreme wet years to dry years could provide insightfull information in ecosystem functioning for this atoll.

Response 8 :

1998 was exceptionally wet (wettest year in the rainfall record). We presented both models (with and without this year) to illustrate the potential outlier effect of this year i.e. its inclusion might mask an underlying declining trend as demonstrated by the analyses.

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Point 9 (C185) P991 L15-17: This is more a discussion sentence so move to that section.

Response 9 :

Will be amended as recommended.

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Point 10 (C185)

P991 L19: which clear tree-ring wood anatomical structures would you mean?

Response 10 :

By this, we mean the tree-rings themselves as well as other cambial features that sometimes occur in association with the rings. For example, all samples were diffuse porous i.e. pores did not exhibit marked variation in diameter with respect to distance from the ring edge. In other species where the phenomenon (referred to as ring porous species) is observed, e.g. in Quercus species (Zimmerman & Brown, 1971: ISBN: 0-387-05367-0), the pore diameter is much larger in the earlywood than in the latewood thereby acting as an additional diagnostic tool in annual ring identification.

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Point 11 (C185)

P991 L22: Absolute age of trees could be determined using 14C bomb analysis of your sampled cross stem sections.

Response 11 :

This can be done and will be considered in future dendroecological work with Ochna. For research aims of this study, annual tree rings are a prerequisite to relate secondary growth to the dry-wet seasonality. A monthly pinning experiment was recently performed to establish the periodicity of tree-ring formation in the species, revealing

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very limited growth of Ochna during 2013, and no clear annual ring formation during this very dry year. As the discernible tree rings are not annual, knowing the absolute age of the trees would only provide a mean annual growth rate, whereas annual growth relations to climate could not be established unfortunately.

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Point 12 (C186)

P993 L5-L10: In the way you mention it now, it is like you have left out year 2007 on purpose to have that correlation between NDVI and wet season rainfall. I would rephrase this and include the 2007 in the dataset (and give correlation analysis data) and hence better explain why 2007 data is left out. this way the reader will better understand this was an objective selection.

Response 12 :

In the paper, we admit that there are methodological challenges with rainfall data from this year (p993, L13-18). Following Reviewer 1's recommendations, we shall revise the method used to relate seasonal performance in NDVI to rainfall so that this problem with 2007 is resolved (See Reviewer 1's response, Response 13).

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Point 13 (C186)

P994 L12-L15: These rooting depths are merely based on assumptions. Would have been interesting to check on rooting networks of the woody species as compared to the tortoise turf. Moreover 18O analysis of plant samples (like your stem cross sections) and ground and rain water could provided very interesting precipitation on the potential contrasting plant physiology. Now your reasoning is just based on assumptions and you're unsure wheter O. ciliata uses ground water or not (see P995 L20)

Response 13 :

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It is correct that we unfortunately do not have any corresponding measurements available. We will change the following sentences 'These differences can in turn be assigned to differences in plant physiology. Being more deeply rooted, shrub and woody species, e.g., O. ciliata, are likely to be less vulnerable to droughts than the shallower rooted species that comprise the tortoise turf' to "How far these differences relate to rooting depths of woody species versus grasses in tortoise turf should be tested."

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Point 14 (C186)

P994 L19: I don t see how Aldabra's susceptibilty to drought is evident across its entire landscape? Moreover it is important to mention that you only measured rainfall and no real parameters that are generally used to assess drought impact on NPP like soil water potential, sap flow and transpiration.

Response 14 :

Indeed, the statement that "Aldabra's susceptibility to drought is therefore evident across its entire landscape." might be too strong and will be rephrased. We shall as well add an explicit mention that we did not measure drought parameters from individual plants.

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Point 15 (C186)

P995 L16: Is there something known on the resprouting capacity of O. ciliata?

Response 15 : Yes, of the 45 trees that were cut, 35 were visited in 2014. 32 of these 35 trees have re-sprouted (91% re-sprout rate). Figure 1 (attached herein) shows 3 of the re-sprouted trees. We will add this information to the revised version.

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Point 16

Table 3: write LOS in full for Grande Terre east.

Response 16 : This will be amended as recommended.

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Fig. 1.

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