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## RESPONSE & REPLY

### REPLY TO RESPONSE: NON-INVERSE J - SHAPED POPULATION DISTRIBUTION

Chenchu Ankalaiah, Thondaladinne Mastan & Mullangi Sridhar Reddy

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The article in JoTT (Ankalaiah et al. 2017) was a well-framed study, with regards to the current status of Red Sanders. The authors had the geographical advantage of studying the population in its native range, i.e., Andhra Pradesh. The study has once again pointed out the significance of protected areas (PA). Even though, the Sri Lankamalleswara Wildlife Sanctuary was not mainly intended to the conservation of the Red Sanders, the sanctuary has helped in the good regeneration of the species. The credit has to be given to the authors for proving that PAs are a significant concept in conservation efforts; the book written by Joppa et al. (2016) provides a similar conclusion. The book portrays a large number of case studies to support the conclusion. This study has indirectly provided the evidence as stated in the book but in an Indian context. Including this aspect in the conclusion will add a jewel to the article.

Red Sanders belong to Family Leguminosae and sub-family Faboideae (CAMP Workshops on Medicinal Plants, India (January, 1998). It has unique wood properties, which made the mature trees a target for poachers. The data in the article reports the same phenomenon, where trees with relatively bigger dimensions are few. There are, however, few statements in the paper that need better explanation. For instance, the statement “linear regression between gbh midpoint  $\ln(m_i)$  and density of individuals in each gbh class  $\ln(N_{i+1})$  was done to determine the recruitment status by analyzing the slope and regression coefficient”. How did the regression aid in the assessment of recruitment status? A small explanation, as well as graphical representation, would make it easier to comprehend. Similarly, the

## NON-INVERSE J - SHAPED POPULATION DISTRIBUTION: PECULIARITY OF RED SANDERS FORESTS

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statement “Horizontal spread of canopy (D1) and vertical spread from the first joint of the target tree (D2) were added (D1+D2) and a relation with respect to tree height was analysed”. Here, the authors have to explain the necessity of measuring the vertical spread and the usage of the term ‘vertical spread from the first joint of the target tree’ - a very uncommon usage in the forest mensuration. Based on the measurement of canopy parameters, a well-established fact has again been highlighted .i.e. multiple stem trees produce a more horizontal spread. Is that so significant which has to be restated.

Furthermore, in the result section, the authors have stated that Figure 1 indicates that 30–50 cm is the most representative gbh class in NPK1 and NPK2, while in LKM1 and LKM2 the 51–70 cm gbh class has a high number of trees”. But as given in figure 1: LMK2 and NPK1 do have a high number of trees in 51–70 cm gbh. This necessitates relooking the result section.

In the discussion section, the findings of the study was linked to the inverse ‘j’ shaped concept. It is a very relevant and significant way to interpret the result. The paper published by Gonzalez-Rivas et al. (2006), however, does conclude that there was inverse j shaped curve in the species abundance pattern. On the contrary, in the present study, the size population did not go in agreement with the trend (inverse j-shaped). Hence, there is a need for detailed explanation. It is stressed here because there is a study in the disturbed tropical forests of Assam where the population follows inverse j-shaped (Dutta & Devi 2013). This cited study was also subjected to heavy exploitation as similar to that of the present study. This brings greater contradictions to the article.

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## REPLY TO RESPONSE: NON-INVERSE J - SHAPED POPULATION DISTRIBUTION

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We sincerely thank the reviewers for providing the suggestions in the study and these will be helpful for not only enhancing the understanding of the present paper but also for the progress of research in future. In this regard we attempt to submit the answers for the suggestions of the reviewers (Ramanan & Kunhamu 2018).

I. The correlation between gbh midpoints and the total number of individuals in the respective gbh classes was done to generate the baseline information to compare with other populations of Red Sanders growing in different areas and to know changes in the Red Sanders population overtime in Sri Lankamalleswara Wildlife Sanctuary. Similar study was carried out on the *Elaeodendron transvaalense*, a medicinally important tree being harvested for bark (Tshishikawe & van Rooyen 2013).

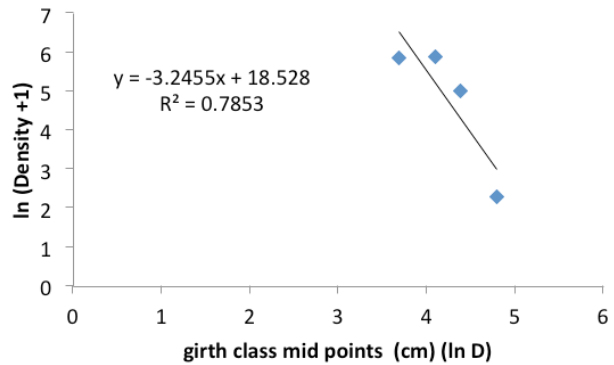


Figure 1. The regression of relationship between girth class midpoints and the number of Red Sanders tree individuals in the corresponding girth classes.

II. Red Sanders profusely produce multiple stems both naturally as well as mainly after the main stem is cut. In order to know the difference in canopy spread between trees with single stem and trees with multiple stems, this exercise of measuring D1 (Horizontal spread of the crown) and D2 (Height of the crown vertically) is undertaken (Fig. 1). The assumption is that the variations in the canopy spread may lead to the deviations in the number of flowering branches, number of mature fruits and the number of seedlings that can survive when they fall under the mother tree canopy.

III & IV. Majority of the Red Sanders trees are in the 30-50 cm (40%; range of 33% - 49.8%) and 51-70 cm gbh classes (41.3%; range of 41% - 43%) and only 18% of trees are in the larger girth class (>70 cm). As rightly pointed out by the reviewers there is only a slight difference in the number of individuals in the 30-50 and 51-70 cm gbh classes and this condition did not revealed the inverse J shaped population curve which indicates the continuous recruitment of young stems (Condit et al. 1998). Although the population structure depicted reverse J shaped curve when the density of all trees in

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the tropical dry deciduous forests of Sri Lankamalleswara Wildlife Sanctuary was considered as also observed in tropical moist deciduous forests of Assam (Dutta & Devi 2013) for the whole forest. The prevailing non-reverse J shape population curve of Red Sanders would be due to the selective logging of the large girth sized trees and slow growth from 10–30 cm gbh to 30–50 cm gbh class. Further, the multiple stems that arose from the past selectively logged large size trees over time have progressed into 30–50 and 51–70 cm gbh classes only.

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