Author's response to the Interactive comment of Referee #1 on the manuscript "Shape still matters – rockfall experiments with deadwood reveal a new facet of rock shape relevance"

Dear Louise M. Vick,

We thank you for the positive conception of our experimental rockfall campaign within a deadwood-containing forest. We highly value your opinion, that the presented findings are an important step in the research of natural hazards, both in terms of process understanding and rockfall simulation accuracy.

We appreciate the recognition of appropriately presented and discussed data. We understand your main criticism relates to our introduction and methods, which we will address in a revised version of the manuscript. We will mindfully expand the introduction and include the missing sections.

Regarding the title, we can understand the criticism that it does not fully capture the scope of the study. Therefore, we will consider a slight adaptation or extension to better reflect the study's complete range.

However, we disagree with the notion that rock shape is a small part of the experiment and results. Although initially intended as a side story, the observed inverse shape effect within forests compared to open land is a novel and unexpected finding, with significant implications for rockfall hazard assessments. While the rock shape may have been underrepresented in the introduction, we expect that this discovery will have a considerable impact on future requirements for rockfall hazard assessments, highlighting the often neglected importance of rock shape.

Further, we will amend the experimental design section. Here we address your particular questions:

- The $EOTA_{111}$ rock shape is the original test block geometry used for certification tests of flexible rockfall protection systems (e.g. Volkwein et al., 2019). This rock has three symmetrical axes, represented by the index 1 per axis. The $EOTA_{221}$ rock shape is the platy version of the $EOTA_{111}$ with two longer axes and one shorter axis, as described (l. 74-75) and illustrated (Fig. 4) in the original manuscript.
- "tree mass classes" was a typo. We used t**h**ree different mass classes, consisting of roughly 200 kg, 800 kg and ≥2600 kg rocks of both shapes. The ≥2600 kg class is a class, as it consists of 2600 kg and 3200 kg rocks. But also the other mass classes are correctly entitled as classes, as slight mass differences between the rock shapes were noticed.
- In total, we released 106 artificial concrete rocks with masses > 200 kg into the forest. Therefore we cast different rocks in 8 different molds ($EOTA_{111,200\,kg}$, $EOTA_{111,800\,kg}$, $EOTA_{111,2600\,kg}$, $EOTA_{111,3200\,kg}$, $EOTA_{221,200\,kg}$, $EOTA_{221,800\,kg}$, $EOTA_{221,2600\,kg}$, $EOTA_{221,3200\,kg}$). Here comes the advantage of this approach: It is irrelevant how many different samples we used per mold, as they were standardized shapes, and their mass was within minor variances. But
- The number of released rocks per mold and the state of the forest are indicated in the table below and will be (slightly adapted) also in the next version of the manuscript:

Table 1: Overview of the conducted experimental runs. bold: reconstructed trajectories.

	DW org	CLR	DW installed
$EOTA_{111,200\ kg}$	12	8	
$EOTA_{111,800\ kg}$	**10**	**10**	
$EOTA_{111,2600\ kg}$		**2**	**2**
$EOTA_{111,3200\ kg}$		**2**	**2**
$EOTA_{221,200\ kg}$	11	12	
$EOTA_{221,800\ kg}$	**10**	**13**	
$EOTA_{221,2600\ kg}$		**3**	**3**
$EOTA_{221,3200\ kg}$		**3**	**3**

- The number of 13 trajectories mentioned (l. 190) arose from all $EOTA_{221,800\ kg}$ runs within the CLR forest state. This is the one, with the most single experimental runs per shape/mass and forest state.

Additionally, the response to the minor comments are given below:

Can the authors define early on what is meant by deadwood in this particular case- trees which have died but remain fully standing, or trees which are broken?

As we are talking of wind**thrown** forest, we had lying deadwood in mind (as depicted in Fig. 1.g). Indeed, we did not explicitly mention the state of the deadwood, and we will address this in a revised version of the manuscript.

Figure 1a. Why are the green points not displayed according to size like the blue?

Although we already included the different DBH classes within the legend, the icon size was - by mistake - not varied between them. We will adapt this shortcoming in a new manuscript version.

L182: How is this consideration threshold derived?

The threshold itself is set based on field observations. The rocks impacting deadwood logs with a diameter < 20 cm did a) easily break or b) roll over them. The breakages are plausible, as rather low rock velocities of 11 ms^{-1} fulfill the stated breakage condition, assuming the smallest rock mass (200 kg). This velocity is even reduced~~,~~ to 6 ms^{-1} or roughly 3 ms^{-1} for the larger rock masses 800 kg and 2600 kg. Also, the overcoming of deadwood logs with a diameter < 20 cm seems likely, as the center of mass is even for the smallest rock ($EOTA_{111,\ 200\ kg}$) 25 cm above the ground.

L183-4: What is a root plate and what is the purpose of this step?

Root plates are discs of soil and ground material~~,~~ formed by the root system of an overturned tree. During some experimental runs, we observed~~,~~ that deadwood breakage happened, but never the less, the rock was stopped behind a root plate. As it is not common in forestry practice to clear the root plates we left them not only during the CLR-experimental campaign but also in their simulations.

L191: How were these parameters calibrated? What field data went into this?

The calibration was based on a manual assessment. Of the mentioned parameters (l. 190). We aimed for a reproduction of the deposition pattern, both, the longitudinal (maximum run-out length across the river), and the lateral (several rock depositions in the adjacent terrain chamber). Based on the reconstructed trajectories we knew that maximal velocities of >30 ms^{-1} occurred for those rocks, with barely any tree impacts. This allowed us to fine tune already known forests soil parameters from other studies (e.g. Ringenbach et al., 2022)

L201: Does MDH mean resting elevation of the block? Unclear

As stated in l. 161 – 164 we analyze the median deposition heights. However, we neglected to introduce the abbreviation in that section, which we will rectify in a future manuscript.

L311: How can it be a pattern and also not statistically significant?

A pattern in itself could be statistically insignificant. However, in this case, we based our statement of insignificance on the overlapping boxplot notches of the 0.256 and 0.302 VWC. We recognize that this analysis is incomplete, and we will provide a more comprehensive statistical analysis in the revised manuscript.

F9: What are the white lines crossing the slope?

The white lines depicted in the figure represent the deadwood logs, which are included within the RAMMS::Rockfall model. While the current caption lacks detail, we will address this issue and provide a more comprehensive caption in the revised manuscript.

L482: This is untrue. See for example https://doi.org/10.5194/nhess-19-1105-2019

Thank you for pointing out this study. We will adapt the corresponding sentence, amend the whole paragraph, and shift parts of it into the introduction.