Response to Reviewer 1

We would like to thank the reviewer for his constructive comments on the manuscript. We have considered the reviewer's comments and provide the following responses.

Statistical Representativeness

This study was designed to investigate the claim frequently made by non-scientific bodies that sand dams revitalize the entire ecosystem. This is a claim sometimes repeated, although to a lesser extent, in the introductory sections of sand dam journal articles, but the current body of literature has not tested nor necessarily supported this claim. We do not intend to dismiss the existing sand dam work of various researchers. Rather, we want to challenge the unverified claims about sand dams made by invested parties, primarily NGOs. In having built our study on the foundations laid by the handful of published sand dam studies, we recognize and value the contributions of prior studies. We have altered the language of our primary objective so as to make clear that we are not dismissing the scientific work published to date but rather investigating the claims made by nonscientific bodies.

P2L5-6 has been updated to read: This has been the case with sand dams in sub-Saharan Africa. Sub-Saharan Africa is home to over 3000 sand dams, yet approximately 50 % of sand dams are essentially non-functioning (de Trincheria et al., 2018; Viducich, 2015). [A recent publication, de Trincheria et al. (2018) corroborates Viducich's (2015) claim that there are 3000 sand dams, not 1500 sand dams in sub-Saharan Africa.]

P2L20-21 has been updated to read: This study examines claims made by non-scientific bodies about sand dam impacts by investigating how diverse sand dams influence macroinvertebrate habitat, vegetation, erosion, and groundwater recharge in the riparian zone.

P2L24-25 has an additional statement: Answering these questions will provide some insight into the validity of the claim that sand dams revitalize the entire ecosystem (Reversing Land Degradation and Desertification, n.d.; Sand Dams, n.d.).

P2L28-29 has been updated to read: This diversity of features provides a broad representation of the sand dams found throughout the region, and this study will therefore create a better understanding of how a sand dam interacts with the local environment.

We thank the reviewer for drawing our attention to the broad conclusions in the manuscript that were not adequately supported by the discussion and/or strength of the data. In some instances, we agree that the language should be softened to ensure that we do not make claims that cannot be fully backed by the literature and statistical representativeness of the data. We will include additional discussion in the manuscript to support some of the conclusions that we believe are justified and adjust other conclusions to ensure they align with the representativeness of the data collected.

P13L10-12 have been updated to read: Holding all other variables constant, building a sand dam in a flat area would likely maximize the positive impact of the sand dam on local vegetation. However, this needs to be further explored to see if the trend holds when more sand dams are examined.

Modelling Efforts and Conclusions

An important distinction must be made concerning the motivation for developing a water balance model. The field data of the groundwater levels around the sand dams provide how much water the sand dams are losing over time. The model is being employed to inform the estimate of the various *causes* of those losses. This distinction was clarified in the article.

P6L24 has been updated to read: To help determine the various causes of water loss from the sand dam and their relative magnitude, a water balance was calculated …

The reviewer's issues with the model are addressed by number.

1. **The model calculates Qout based on the other terms, it therefore accumulates all errors in Qout, including errors because of terms not included in the model**
   There is uncertainty in the model, because the water balance is a simplified representation and the forcing data (FLDAS) is largely modelled data itself. Despite the uncertainty, the authors are confident that the relative magnitude of the terms in the model is reliable. The relative magnitude of the terms is the primary focus of the conclusions drawn from the model. We added an explicit statement noting the uncertainty in the model.

   P7L1-4 has an additional statement: The theoretical volume of water resulting from Eq. (1) has a high degree of uncertainty, because it is a simplified representation of water loss that utilizes modelled FLDAS data. However, the relative magnitude of the loss terms is likely reliable, and this is the primary focus of the conclusions that will be drawn from the model.

2. **I assume from figure 7 that the authors start the dams "full". This is not made explicit in the article.**
   The analysis displayed in Figure 7 begins in the middle of the rainy season, so it is assumed that the sand dams are full at this point. However, this will change as a result of our model changes resulting from point 3, below. A sentence indicating the initial condition of the model was added to the manuscript.

   P6L29 has been updated to read: $Q_{out,dry\ season}$ is the rate of water loss from the sand dam after the end of the rainy season…

   P6L31-P6L33 has been updated to read: Eq. (1) is integrated over time and subtracted from the volume of water in the control volume at the end of the rainy season to create a theoretical volume of water curve for the sand dam area.

   Figure 7 (now Figure 8) caption has been updated to read: The theoretical line, initiated at the end of the rainy season, shows the cumulative theoretical amount of water in the study area…

3. **The inflow term 0.038CP(t) accounts (I think, not made clear) for the amount of rain water that falls on the dam itself and is subsequently stored? I would argue that during a rain event all water from upstream would be routed over the stream-bed thus re-filling it. The 0.038 term from Aerts 2007 relates to the total amount of water a sand dam saves from annual discharge to see if dams have an impact on downstream water availability. This factor cannot be used as the authors do.**
   You are correct. The 0.038 term, hereafter capture ratio, from Aerts (2007) is the maximum proportion of annual discharge that a sand dam is expected to capture and store. In the water balance model proposed in the manuscript, the inflow term, 0.038CP(t), accounts only for the runoff that is expected to occur from the study areas indicated in manuscript Figure 1c,d. The area included in the model, therefore, is greater than the dam itself, but smaller than the upstream watershed. The watershed upstream of the Chididimo sand dam is 3.3 km^2 and relatively uniform. This allows the watershed to be modelled relatively well using the rational method for overland flow with a capture

ratio of 0.038. The watershed upstream of the Soweto sand dam, however, is 262.1 km^2 and includes commercial farmland and an 18.6 km^2 wetland area. The Soweto sand dam is much too small to capture 0.038 of the runoff generated by such a large watershed. To more accurately represent the volume of water captured by the Soweto sand dam, the capture ratio would need to be reduced to around 0.00025 and adjusted for seasonal variability. However, such a methodology seems somewhat speculative, and we would prefer to be consistent in our methodology. In summary, the inflow term proposed in the water balance model is insufficient for accurately representing the volume of water captured by the Soweto sand dam. To address this issue, we initialized the water balance at the week of last rainfall. Therefore, there are no inflows to the theoretical model. The model now solely describes the loss factors, which is our primary interest (see Eq. 1 and Fig. 3, below).

4. **The 0.15 factor from Kumar 2018 relates to the percentage of evap that is canopy evap in the Noah LSM, which, if I recall correctly, was not calibrated for the region that the authors use it for. I would guess that on the African regions of interest here, the amount of canopy versus other evap would be different.**

While the Noah LSM may not have been calibrated for East Africa, there are examples of Noah LSM being used over East Africa (Anderson et al., 2012; Yilmaz et al., 2014). Further, the evapotranspiration (ET) data used in the theoretical model presented in this paper is from FLDAS. The iteration of FLDAS used was developed based on the Noah LSM, but is specifically designed for use in sub-Saharan Africa (McNally et al., 2017). Furthermore, we believe the 0.15 factor for ET partitioning described in Kumar et al. (2018) to be appropriate. The climate in Dodoma, Tanzania is classified as hot semi-arid, which is also the climate in parts of the southwestern US and northern Mexico. From the figure below, included in the Kumar et al. (2018) paper, you can see that the canopy ET partition fraction for much of the southwestern US and northern Mexico falls between 0.1 and 0.2.

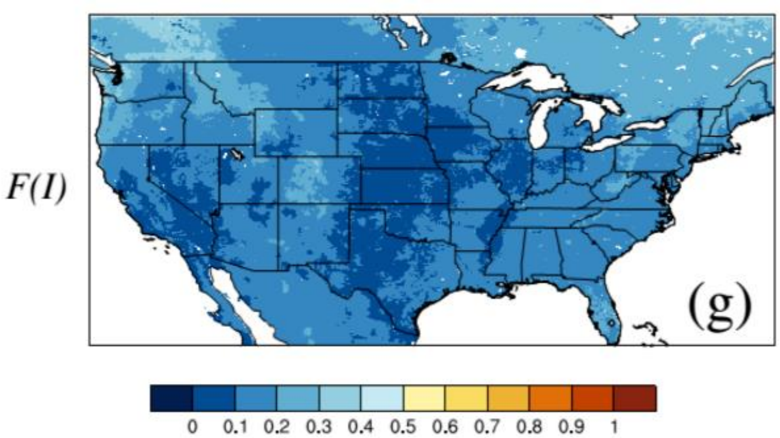

Figure 1: Mean of the ET partition fraction of canopy ET (unitless; from Kumar et al., 2018).

We recognize that the 0.15 ET partition fraction may not be perfectly accurate, but a study such as Kumar et al. (2018) has not been performed for East Africa. There is no better estimate available.

To more accurately represent the amount of water lost to ET within the control volumes, the ET will be multiplied by a factor of 0.85 for the area within the sand dams and will be multiplied by a factor of 1 outside of the sand dams. There is potential canopy ET outside the sand dams but within the control volume.

P6L29-30 has been updated to read: E(t) is total evapotranspiration modified by α, which is 0.85 for the area within the sand dam and 1.00 for the area outside of the sand dam.

P7L10-11 has been updated to read: Therefore, total evapotranspiration is reduced by 15 % in Eq. (1) for the portion of the control volume that is occupied by the sand dam.

In addition, we realize that our manuscript is not clear on the size of the control volume to which the theoretical model is applied. Figure 2, below, provides the control volume for the Chididimo and Soweto sand dams. The control volume includes the sand dam and all area enclosed by the water table monitoring wells (WTMW) installed around the study area. Figure 2 was not added to the manuscript, but a statement clarifying the extent of the control volumes was added.

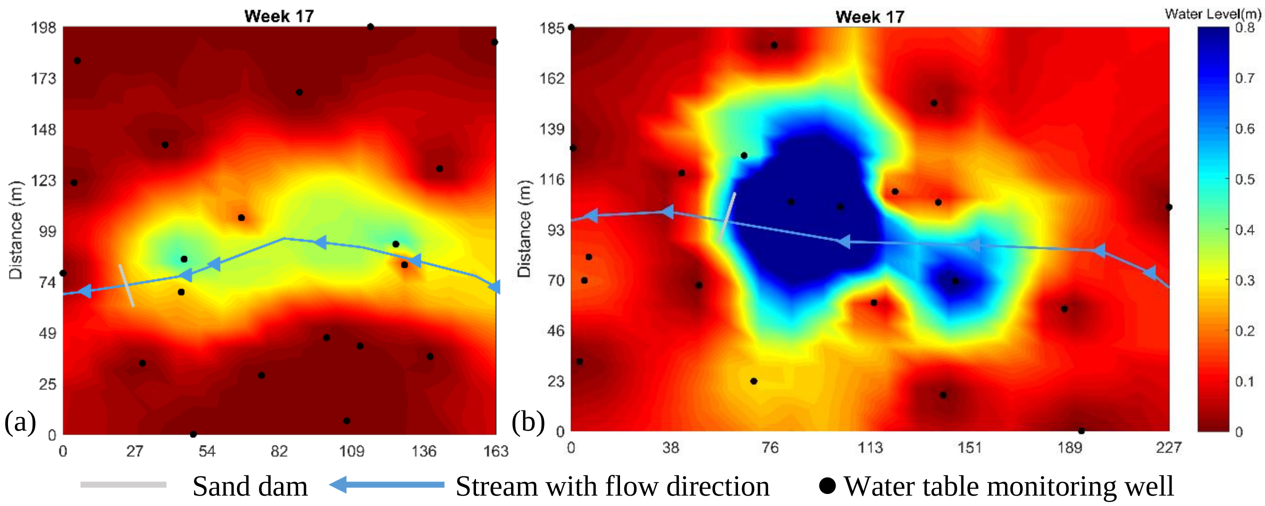

Figure 2: Height of subsurface water around the (a) Chididimo sand dam and the (b) Soweto sand dam.

P6L33-P7L1 has an additional statement: The control volume to which Eq. (1) is applied is the portion of the study area that is enclosed by the installed WTMWs (see Fig. 1 c,d). For Chididimo, this area is 32 274 m^2, while it is 41 995 m^2 for Soweto.

5. **The Qcomm term is estimated based on conversation with locals. This is understandable given the constraints of the research, but introduces a very large uncertainty. In my own research we observed that some people living close to the dam would, against the deal with the entire community, use a machine pump to irrigate their lands from the sand reservoir, draining the reservoir very fast (Hut 2008).**

   We appreciate and understand the concern regarding the uncertainty of the community withdrawals variable. We added a sentence to the manuscript indicating that the estimate of community withdrawals has an unknown degree of uncertainty. We, however, have no reason to believe that the community members were engaging in machine pumping of the water. The Soweto sand dam did have many areas under cultivation near the dam, but we did not see any evidence of machine pumping. Also, the community water group was very strict with its members regarding withdrawals under the guidance of the local chairman, including such measures as locking access to the hand pump. The Chididimo sand dam was much more difficult to access, and only had one small area nearby under cultivation. These reasons coupled with the lack of evidence lead us to believe that machine pumping was not a significant factor in the rate of water loss in the Soweto and Chididimo sand dams.

P7L12-15 has an additional statement: The estimate of the community's use of water from the sand dam has an unknown degree of uncertainty. At least one sand dam researcher has noted that unsanctioned machine pumping of water from sand dams can cause rapid drawdown of stored water (Hut et al., 2008). However, no evidence was present at either Dodoma site to indicate the community was drawing significantly more water from the sand dams than they indicated.

Given the above, Eq. (1) was modified to:

P6L28-33:

$$Q_{out,dry\ season}(t) = -\alpha \times E(t) - Q_{sb}(t) - Q_{com}(t)\ , \qquad (1)$$

where $Q_{out,dry\ season}$ *is the rate of water loss from the sand dam after the end of the rainy season,* $E(t)$ *is total evapotranspiration modified by* α*, which is 0.85 for the area within the sand dam and 1.00 for the area outside of the sand dam,* Q_{sb} *is baseflow-groundwater runoff, and* Q_{com} *is the community's water use. Eq. (1) is integrated over time and subtracted from the volume of water in the control volume at the end of the rainy season to create a theoretical volume of water curve for the sand dam area.*

Given the changes to Eq. (1), Figure 7 (now Figure 8 in manuscript) was modified to:

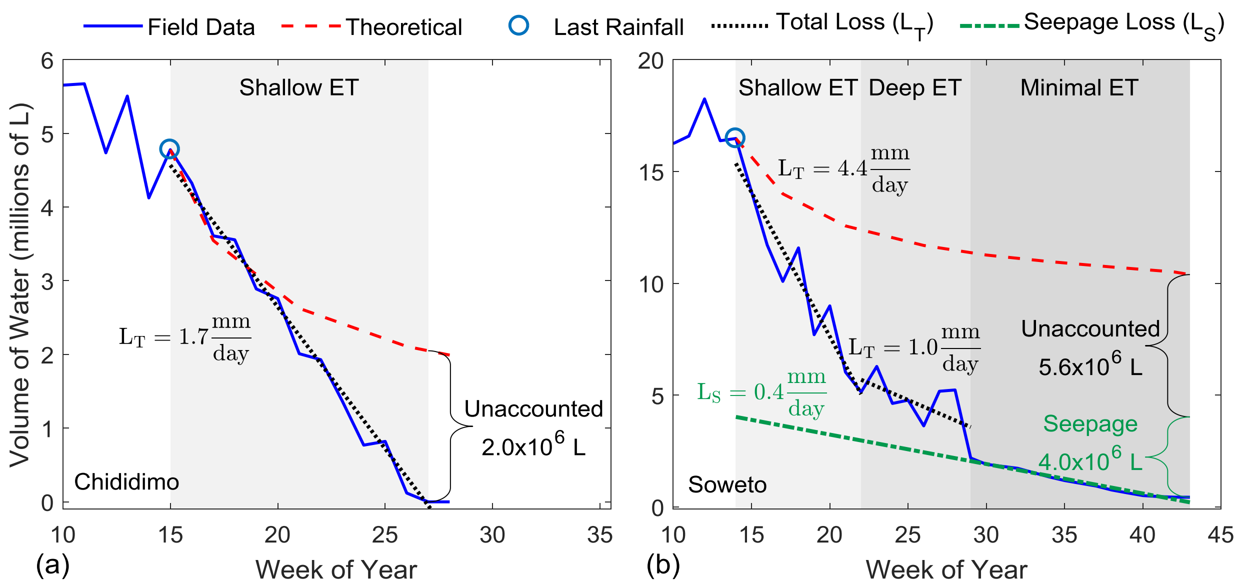

Figure 3: Volume of water in the area enclosed by the WTMWs of the (a) Chididimo and (b) Soweto sand dams. The field data line shows the volume of water in the study area during the specified week. The theoretical line, initiated at the end of the rainy season, shows the theoretical amount of water in the study areas, calculated by integrating equation (1). The theoretical line accounts for losses due to evapotranspiration, baseflow-groundwater runoff, and community use.

The changes to Eq. (1) result in the following loss partitioning (summary of changes, not for inclusion in manuscript):

Table 1: Sand dam stored water loss partitioning during the dry season

Loss Partition (%)	Chididimo		Soweto	
	Old Eq. (1)	Updated Eq. (1)	Old Eq. (1)	Updated Eq. (1)
Evapotranspiration	85	53	51	35

Baseflow-groundwater runoff	1	1	1	1
Community use	5	4	8	4
Seepage	-	-	-	25
Unaccounted	9	42	40	35

From Table 1, above, you can see that the loss partitioning for the Chididimo sand dam did not change much as a result of updating Eq. (1), with the exception of the unaccounted fraction which is still understood to be primarily ET losses. The loss partitioning for the Soweto sand dam did change significantly with the inclusion of seepage losses. The Soweto sand dam does lose water as a result of seepage, as evidenced by the scoopholes community members dig just downstream of the dam from which they collect water. Community members did not exhibit the same behavior at the Chididimo sand dam, therefore we do not believe that there is significant seepage occurring at the Chididimo sand dam. At Soweto, the community members expressed an inability to abstract water from the sand dam after approximately the 30th week of the year. Therefore, we believe that the water lost from the Soweto sand dam after the 30th week is likely due primarily to seepage losses. Assuming seepage is relatively constant, we can extrapolate this portion of the plot back to the end of the rainy season and get an estimate of total seepage losses from the Soweto sand dam during the dry season (Fig. 3b). There is likely minimal ET loss occurring after the 30th week, because the water is deep underground at that point (Hellwig, 1973).

P11L31-P12L5 now reads: The Soweto dam exhibits three distinct phases of water loss: shallow ET, deep ET, and minimal ET (see Fig. 8b). The minimal ET phase occurs during the period in which the community water group indicated they were no longer able to abstract water from the sand dam. At this point, the water table has retreated too far underground for the community to draw water and, at this depth, the rate of ET is likely negligible (Hellwig, 1973). Therefore, most of the water lost during the minimal ET phase is lost due to seepage under the dam wall and/or through the streambed. Unlike Chididimo, the Soweto sand dam does exhibit evidence of seepage—the community members dig scoopholes just downstream of the dam from which they collect water. The seepage loss at Soweto occurs at a rate of approximately 0.4 mm day^{-1} and accounts for 25 % of the water stored by the sand dam at the end of the rainy season, leaving only 35 % of Soweto's water loss unaccounted. The seepage rate essentially remains constant throughout the shallow and deep ET phases (see Fig. 8b).

In regards to your estimate of the mm/day rate of evapotranspiration from the sand dams, the estimate is quite high due to the misunderstanding about the size of the control volume from which the field data line is determined for Figure 3. From Figure 2, above, there is clearly a great deal of seepage from the sand dam through the streambanks, so the area from which evapotranspiration is occurring is significantly greater than simply the surface area of the sand dams. The updated estimates for the rate of evapotranspiration losses from the Chididimo and Soweto sand dams are: 380 000 L/week and 1 117 000 L/week (slope of total loss-seepage loss, Fig. 3), respectively. With this understanding, the rate of evapotranspiration losses can be calculated as follows:

$$Total\ Loss\ Rate(L_T)\,\frac{mm}{day} = \frac{Slope\ of\ Total\ Loss\ Line\,\frac{L}{week}}{7\,\frac{days}{week} \times Control\ Area\ (m^2)}$$

$$Avg.Evap\ Rate\ \left(\frac{mm}{day}\right) = Total\ Loss\ Rate\,\frac{mm}{day} \times (Evap + Unaccounted\ Fraction)$$

$$Avg. Evap\ Rate_{Chididimo,shallow}\ \left(\frac{mm}{day}\right) = \frac{380\ 000\,\frac{L}{week} \times (0.53 + 0.42)}{7\,\frac{days}{week} \times (163\ m \times 198\ m)} = 1.56\,\frac{mm}{day}$$

$$Avg. Evap\ Rate_{Soweto,shallow}\ \left(\frac{mm}{day}\right) = \frac{1\ 300\ 000\,\frac{L}{week} \times (0.35 + 0.35)}{7\,\frac{days}{week} \times (227\ m \times 185\ m)} = 3.09\,\frac{mm}{day}$$

The above evapotranspiration rates are in general agreement with the sand dam sub-surface evaporation rate of 2.4 mm/day found by Borst and de Haas (2006). It should also be noted that the Soweto estimate is valid only for the rate of ET when the sand dam is relatively full. As is clear in Figs. 3b and 4b, the rate of ET decreases as the volume of water in the sand dam decreases.

Response to Reviewer 2

We would like to thank the reviewer for the constructive comments on the manuscript. We have considered the reviewer's comments and provide the following responses.

It is therefore a bit disappointing that only three dams are considered in this study, and also that there is no attempt to understand the communities' perceptions of the sand dams.

This study's success relied on active participation of community water groups to help collect long-term datasets. Of the 15 sand dams in Tanzania known to us, only three still have active community water groups maintaining the dams. This, in addition to funding limitations and long travel times, prevented us from performing in-depth field studies for more than three sand dams.

We worked very closely with the community water groups over the course of the study and developed a good understanding of their perception of their sand dam. From day one, the communities expressed frustration that the sand dams did not serve as a water source throughout the dry season. One community, Soweto, went so far as to lock the handpump at the sand dam to limit easy access to the water. However, the social aspect of sand dams is not the focus of this study, so any related commentary has been omitted.

I am curious as to why FLDAS is selected, there is no justification.

FLDAS was selected as a proxy for climate data, because there is not a consistently reliable source of climate data available for Dodoma or Longido, Tanzania. FLDAS is not the perfect substitute, but it has been specifically designed and validated for use in sub-Saharan Africa. A line was added to the manuscript explaining the choice of the FLDAS dataset.

P6L25-26 now contains the following statement: FLDAS data was used as a proxy for climate data, because there is not a reliable source of climate data freely available for Dodoma, Tanzania.

It seems to assume that all water loss must be through evaporation rather than considering that there may be leakage from the trapped sand, either under the dam wall or through the riverbed. This could help explain some of the results (e.g. p. 8 line 16-18, p. 10 lines 1-4, p. 10 line 10, p. 10 line 20-21. p. 11 line 2, p. 12 line 16, p. 12 line 19) and would have a big impact on the conclusions. The established literature on evaporation is only referenced right at the end of the discussion (p. 12 line 25).

Based on the relative magnitude of loss terms in Eq. (1) in the manuscript and the prolonged availability of near-surface water resulting from storage in the sand dam, we believe that most of the unaccounted losses are due to evapotranspiration at the Chididimo sand dam. However, we have considered the comments of Reviewer 1, and updated our conclusions regarding water loss at the Soweto sand dam. Unlike the

Chididimo sand dam, the Soweto sand dam did exhibit signs of seepage under the dam wall. We added a statement to the manuscript acknowledging that seepage through the streambed could be contributing to the unaccounted water loss.

P11L11-12 has been updated to read: The unaccounted water loss could be due to seepage through the streambanks or streambed or possibly a higher rate of evapotranspiration than simulated by FLDAS.

P11L18-21 has been updated to read: The unaccounted water loss could be due to seepage under the sand dam wall, through the streambanks, or streambed or possibly a higher rate of evapotranspiration than simulated by FLDAS.

P11L25-29 now reads: When evapotranspiration occurs from a sub-surface water table, the rate of evapotranspiration is lower than would be expected if the water table was at the ground surface (Hellwig, 1973). The rate of sub-surface evapotranspiration reduces as the water table retreats farther underground, and the rate of reduction is dependent upon depth and grain size (Hellwig, 1973). Seepage could be contributing to the total loss rate at Chididimo, but there was no evidence of seepage under the dam wall. However, seepage through the streambed could impact the total loss rate at Chididimo.

In order to calculate the storage in the sand dam (p.6 line 30-31), why not just assume that it is fully saturated at the end of the wet season? This could be supported if you observe water ponded on top of the trapped sand.

Thank you for your suggestion. In response to comments from Reviewer 1, we have updated Eq. (1) and initiated the theoretical water loss model at the end of the rainy season. This was updated in the manuscript.

I am curious as to why the WTMWs were the only attempt to measure water levels the sand dams. Piezometers or even excavated holes in the sand dam could have provided a more comprehensive picture. In my experience observing the water depth in scoop holes that the communities dig can be an excellent indicator of overall water levels, but I don't know if there were present here.

Borst and de Haas (2006) installed piezometers in the sand dam itself, so we did not think it necessary to repeat this arrangement. Instead, we wanted to focus on how the sand dam affects the water table outside of the stream channel, since the idea that sand dams raise the local groundwater table has really only been explored via modelling (Hut et al., 2008; Quilis et al., 2009). Therefore, we installed WTMWs in the streambanks and the surrounding area to track how the water table was changing over time. We did not consider tracking water levels in the scoop holes dug by community members but will consider this as a viable methodology for future studies.

I am also not surprised by the results of the macroinvertebrate study. That a dry river bed in an arid region contains no macro invertebrates seems hardly to be a surprise. This methodology seems to be more suited to perennial rivers.

Boulton et al. (1992), Stubbington et al. (2009), and Verdonschot et al. (2014) all successfully used variations of the methodology described in the manuscript to sample dry river beds. Boulton et al. (1992) even sampled an ephemeral river in the Arizona desert. We believe that we used the appropriate methodology for collecting macroinvertebrates from an ephemeral streambed. If sand dams were less homogeneous and therefore more suitable habitats for macroinvertebrates, we believe we would have been successful in our sampling attempts.

Macroinvertebrate sampling in perennial rivers is most often conducted by placing a net, typically a surber sampler, facing upstream on the streambed and then disturbing the upstream streambed to release any macroinvertebrates nestled there. The flowing stream then carries the macroinvertebrates into the net, where they are captured and identified.

There are results on the sediment grain size (p 7 line 19) but no methodology to measure it.

A formal sediment grain size analysis was not performed. A statement was added to the manuscript to clarify this point.

p. 7. Line 29-31 has been updated to read: The sand within the sand dam, with the exception of Kimokouwa, was largely a mixture of fine- and coarse-grained sand, as determined by a visual and tactile assessment of the material.

p. 8 line 4 – I am struggling to see how the vegetated cover is correlated to the land slope in figure 3. Could this be confirmed through a statistical test?

The paragraph immediately preceding (p. 7 line 25-p.8 line 2) discusses the relationship between land slope and vegetated cover in the context of Figure 3. This relationship is not immediately apparent from the figure alone. The statement on p. 8 line 4 was edited to reduce the chance for reader confusion, and Pearson's Correlation Coefficient has been calculated and added to the discussion to validate the claim.

P8L12-19 has been updated to read: That Soweto, the flattest site, and the two transects located in the flattest part of Chididimo display significant increases in vegetation between the dry and rainy seasons suggest that the average percent vegetative cover at a sand dam is correlated to the land slope near the sand dam. The Pearson Correlation Coefficient, ρ, corroborates this observation. The change in vegetative cover between the dry and rainy seasons is negatively correlated (ρ=-0.73) to increasing land slope at the two functioning sand dams, Soweto and Chididimo, indicating that as the land slope increases, the improvement in vegetative cover decreases. The same correlation is not observed at the non-functioning Kimokouwa sand dam (ρ=0.04), which is expected because the sand dam is not contributing to a locally raised water table.

p. 8 line 8-9 – point 1 is poorly explained, and again on p. 11 line 29-32. A figure would help here.

Figure 5, below, was added to the manuscript to help clarify the point. In addition, further discussion of how flat land can generally support more vegetation than steeply sloping land was added to the manuscript. Shemsanga et al. (2018) was added to the manuscript in support of using healthy vegetated cover as an indication of groundwater in Dodoma.

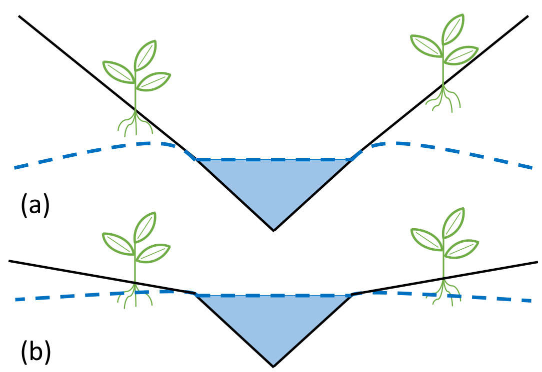

Figure 5: The roots of plants growing on a (a) steep slope will be farther from the locally raised water table created by a sand dam, and therefore have less access to soil water, than vegetation growing on a (b) gentle slope.

P8L24-29 have been updated to read: First, at low elevations above the streambed, groundwater seepage through the streambanks creates a raised water table that is close to the land surface (see Fig. 5). The raised water table has a positive impact on the soil moisture of the unsaturated soil layer, and this additional moisture supports vegetation growth. Second, a lower elevation above the streambed implies a gentler land slope. Gentle slopes give rainwater more time to infiltrate into the soil, because storm surface runoff travels slower over a gentle slope. Increased infiltration results in increased soil moisture and increased recharge of the water table.

P8L32-P9L1-7 contain a new paragraph: That the dry season shows a consistent relationship between elevation above the streambed and vegetative cover indicates that the vegetation at Soweto and Chididimo has at least some level of groundwater dependence (see Fig. 4a). The dependence of vegetation on groundwater in arid and semi-arid regions has been well-documented (Elmore et al., 2008; Mata-González et al., 2012; Naumburg et al., 2005; Seeyan et al., 2014; Stromberg et al., 1996; Wang et al., 2011). In arid and semi-arid regions where rainfall is minimal, vegetation often relies on groundwater to supply the additional water needed for plant growth and transpiration (Naumburg et al., 2005). In semi-arid Dodoma, local communities use their knowledge of the relationship between vegetation and groundwater to inform their decisions on where to dig shallow wells (Shemsanga et al., 2018). Therefore, it is reasonable to expect that the vegetative cover at the Soweto and Chididimo sand dams is improved, in part, by the locally raised water table being near the ground surface.

p. 9 line 21-25 – this is hard to follow.

These lines were updated to remove unnecessary detail and clarify the point.

P10L16-19 have been updated to read: The sand dam at Kimokouwa has a 1.2 m thick silt layer beginning at a depth of 0.5 m that acts as a capillary barrier, inhibiting the infiltration and, therefore, storage of water in the sand dam. As a result, the community is unable to use the sand dam as a source of domestic water. Silt layers formed at the Kimokouwa sand dam, because the dam was improperly constructed for the type of topsoil present in the area (Nissen-Petersen, 2006; de Trincheria et al., 2015).

p. 9 line 24 – how can soil be assessed properly in advance to avoid this type of failure?

A statement with this information was be added to the manuscript.

P10L19-22 has the following statement added: While the literature on this topic is not well-developed, the soil composition of the streambed before a sand dam is constructed can likely be helpful in determining the distribution of grain sizes a sand dam is expected to capture. This information, coupled with knowledge of the sediment load typically carried by the stream, can inform the need to construct a sand dam's spillway in stages to prevent siltation.

p.10 line 31 – by "subsurface water reservoir" do you mean the underlying aquifer of the trapped sand?

Yes, we mean the water stored between the grains of sand in the sand dam. The wording of this statement has been altered to reduce reader confusion.

P12L9-10 have been updated to read: However, the dataset does not account for the additional water available in the perched aquifer created by the water stored in the sand dam.

p. 12 line 6 – please be more specific on why the stream channel migration is important.

Noted. We added a few sentences to the manuscript explaining how increased erosion and stream channel migration can lead to the failure of a sand dam.

P13L18-19 has an additional statement: Severe streambank erosion and/or stream migration can lead directly to sand dam failure by weakening the soil supporting the structure. When this happens, the dam may break or be washed downstream.

Additional References

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