Just a reminder of the scenarios:

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| --- | --- | --- |
| Scenario | Type | Description |
| 1 | Pessimistic null | Manager budget remains constant, user budget increases |
| 2 | Optimistic null | Manager and user budget increase, with the same slope |
| 3 | Sine wave | Manager budget increases and decreases in a predictable/regular way above and below a mean (like a sine wave), user budget increases linearly |
| 4 | Sine wave | As above, but the wavelength is shorter (higher frequency) and the amplitude is smaller |
| 5 | Random complex wave | Manager budget increases and decreases unpredictably (using Fourier series to create random complex waves), user budget increases linearly. There are currently 10 waves that constitute this scenario |

Chart, histogram

Description automatically generated

**Figure 1. The User and manager budgets for all scenarios. The user budget is the same across all.**

Firstly, I don't think that there are sufficient trees being lost. On average, only 7,755 trees were cut down across all scenarios, and assuming approximately 50 trees/cell (which is what we have assumed), that’s only 155 ha (or 1.55km2) being lost over the entire 50 years! This is not realistic, nor is it particularly easy to see differences. If this was in real life, that would be a huge conservation success, regardless of the scenario! I think this is because there are too many trees and not enough users. Because we are assuming a single user is a village, we only have 20 users. But in GMSE terms, this means that there just aren't that many trees being cut down. I think we need to reduce the size of the landscape, and therefore the number of trees, and perhaps increase the number of villages too.

Chart, line chart

Description automatically generated

**Figure 2. The number of trees remaining at each time step for the 5 simulations. There are error ribbons around the lines, but they are difficult to see. Error ribbons are the 2.5 and 97.5% quantiles taken from the 10 runs.**

The shape of the tree curve is remarkably similar in all scenarios. Scenario 2 is the only different one - it is a linear slope. This makes sense as the manager and user budgets track each other. If you look at the scenario 2 plots (Fig 6), you see that the cull count remains stable all the way along - both user and manager are using their budgets, but the difference in budgets never changes and so one never gets the upper hand over the other. Scenario 2 does not perform well overall, it is the 2nd worst result (Fig 3). This is not what I was expecting.

Chart

Description automatically generated

**Figure 3. The number of trees remaining for each scenario over the last 5 time steps. This shows which scenario performed better or worse. I have not included the error ribbons here as it makes it too difficult to see what’s going on.**

Chart, box and whisker chart

Description automatically generated

**Figure 4. The final number of trees remaining at time step 50 from each scenario. The error bars are the 2.5 and 97.5% quantiles for the final time step.**

I had assumed scenario 1 would be the worst, but it is in fact the best! This is likely caused, at least in part, by the fact that for the first 25 time steps of scenario 1, the manager has a higher budget than the user (Fig 5). This is reflected in the cull count - it starts on 120 whereas for scenario 2 it starts on 160. I think I need to change it so that the manager budget is on 400, otherwise that is not fair. I am not entirely sure why I made the manager budget in this scenario start at 500. The user budget starts as 400 in every scenario, and so this one should match, I think.

The next best is scenario 5. Surprisingly not that much variation (seen in the ribbons). If you look at the cull count split up by run (i.e. each new random complex wave) (Fig 10), there is a lot of variation in the cull count (way more than the other scenarios) and so I am not sure why there is less variation than, say scenario 2, which I would have assumed would have the least variation as the budgets are the same. Am I missing something?

The third best is scenario 4. When you look at the manager budgets for scenario 3 and scenario 4 (the two sine waves, Fig 1), they are actually too similar in terms of magnitude. Scenario 4 is supposed to be much smaller peaks (i.e. smaller grants). I think I need to change this to make the difference between scenario 3 and scenario 4 larger. I think that the difference was reduced when I standardised all of the budgets to a total cumulative budget of 25,000. I suspect this increased the value of the peaks.

Scenario 3 is in fact the worst - which is interesting from a conservation funding perspective, as this is the dominant funding model! Hopefully after doing he tweaks, this will remain as the result, as this would make for the key message of a paper!

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**Figure 5. Plots for Scenario 1.**

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**Figure 6. Plots for scenario 2.**

Chart, histogram

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**Figure 7. Plots for scenario 3**

Chart, histogram

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**Figure 8. Plots for scenario 4**

Chart, histogram

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**Figure 9. Plots for scenario 5**

Schematic

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**Figure 10. The cull cost plots for each of the runs for scenario 5. Each run represents a different random complex wave.**