

Systemic analysis of the management of Invasive Alien Plants in the Tsitsa River catchment, South Africa



Background and Problem Statement

- ▶ Invasive Alien Plant Species (IAPS) have been identified by stakeholders as one of the three biggest concerns within the Tsitsa catchment area.
- ▶ Working for Water is one of South Africa's main groups managing IAPS. They have seen success and failure while managing this complex problem, especially with systems where there is high dependence on IAPS.
- ▶ Due to the high demand of charcoal produced from Invasive Alien Plant species, particularly from species that have invaded large areas of land in South Africa, such as Black Wattle, there is a big potential for a charcoal industry in South Africa. This would increase the clearing of these invasive species, as well as provide an important household income.

Problem Statement

- ▶ An ecological problem that is tightly connected with social issues guarantees friction when it comes to decision-making. Thus, system dynamics is the appropriate approach to explore the tightly coupled social-ecological problem in this study to aid better management.

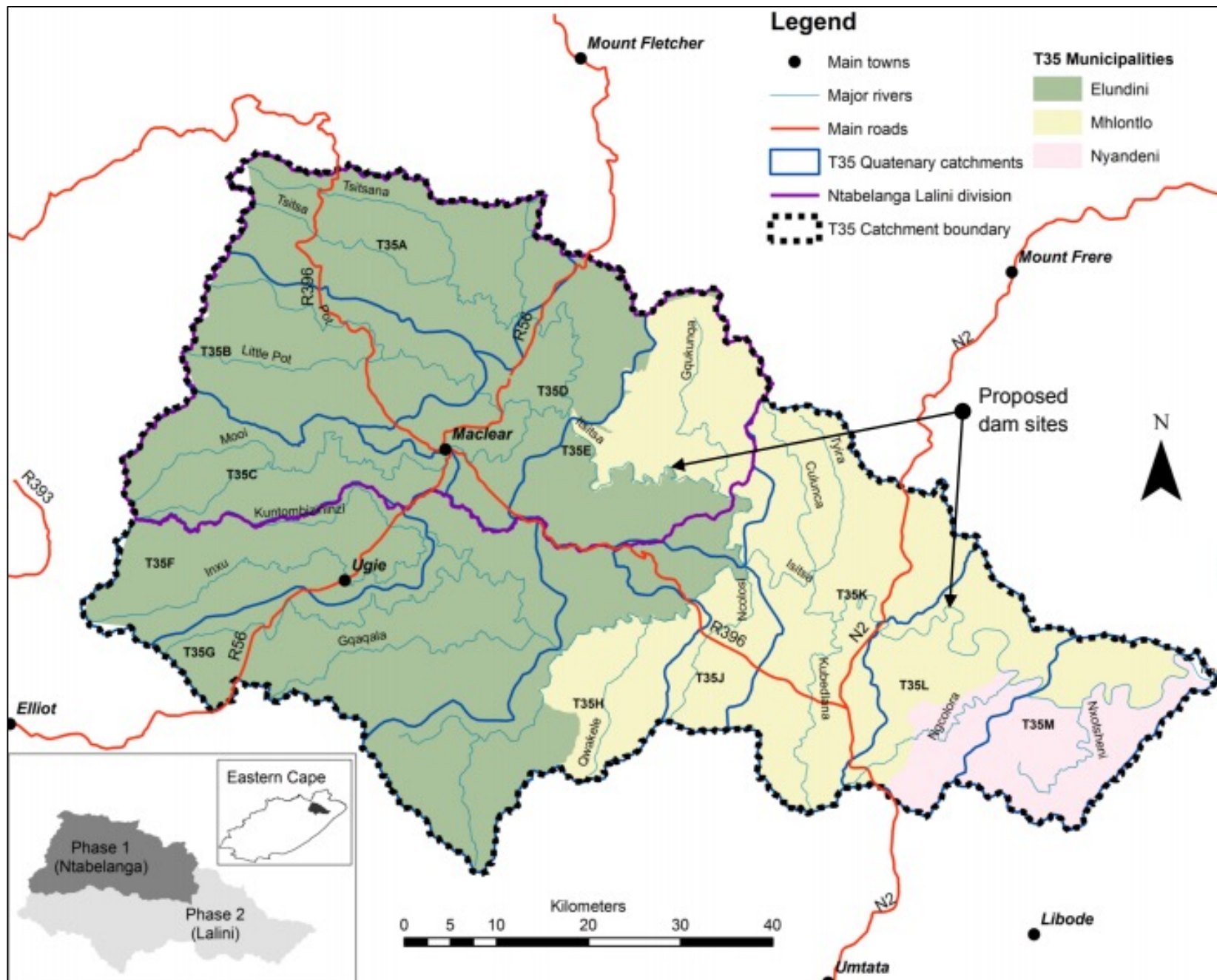


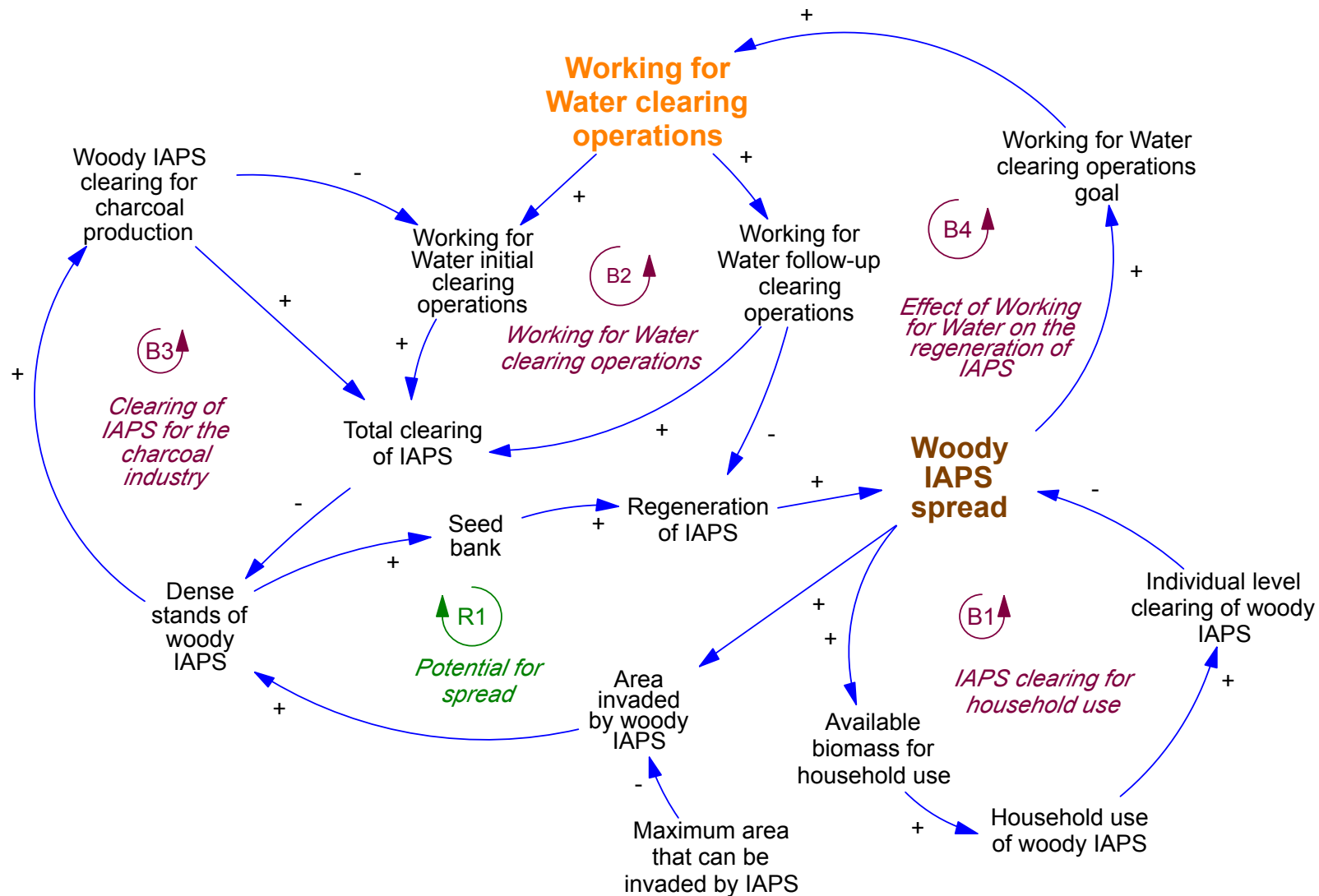
Figure 1: A map showing the Eastern Cape province in relation to South Africa.

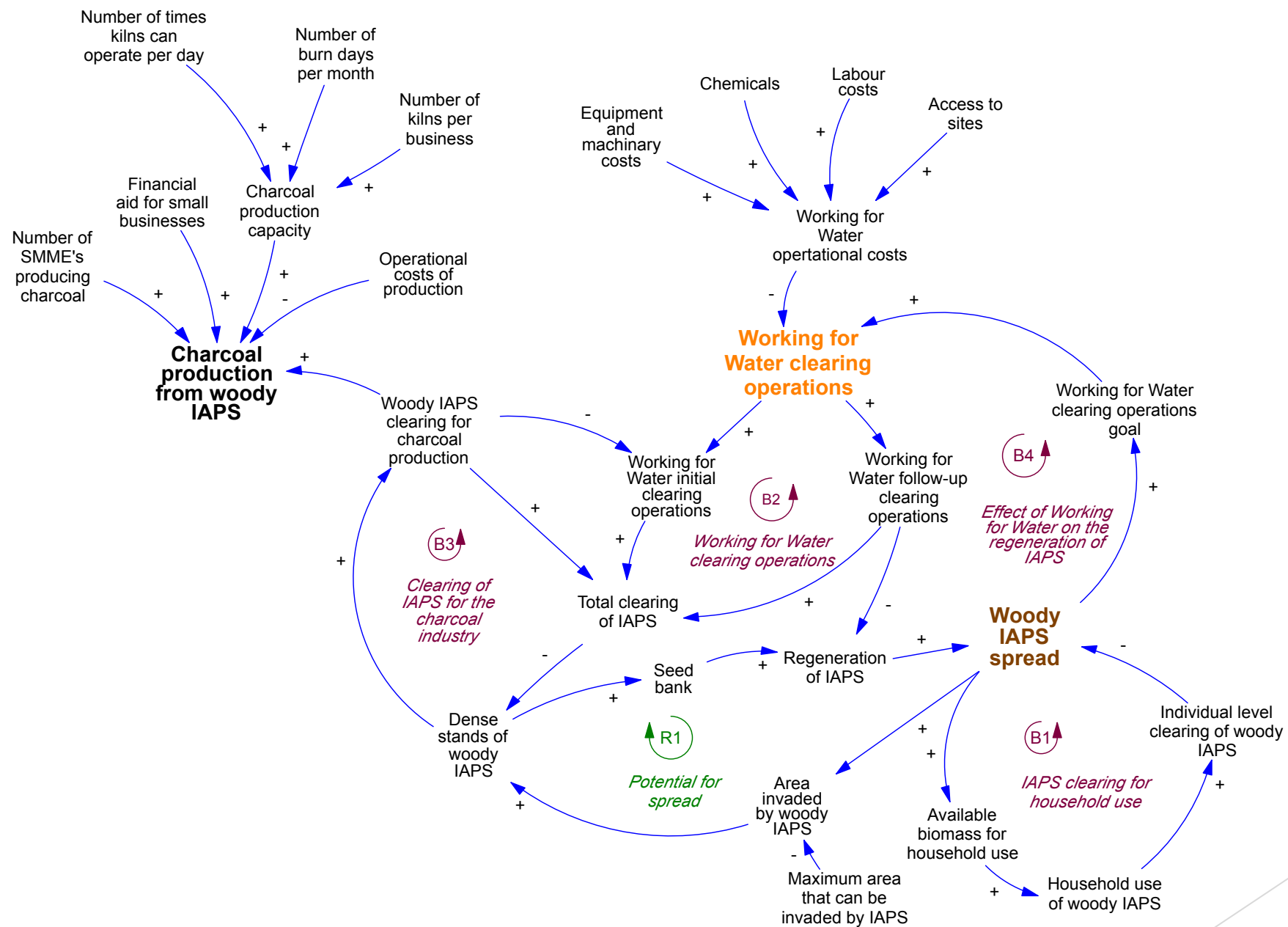
Figure 2: A map showing the Tsitsa catchment provided to the Tsitsa Project by Kyra Lunderstedt

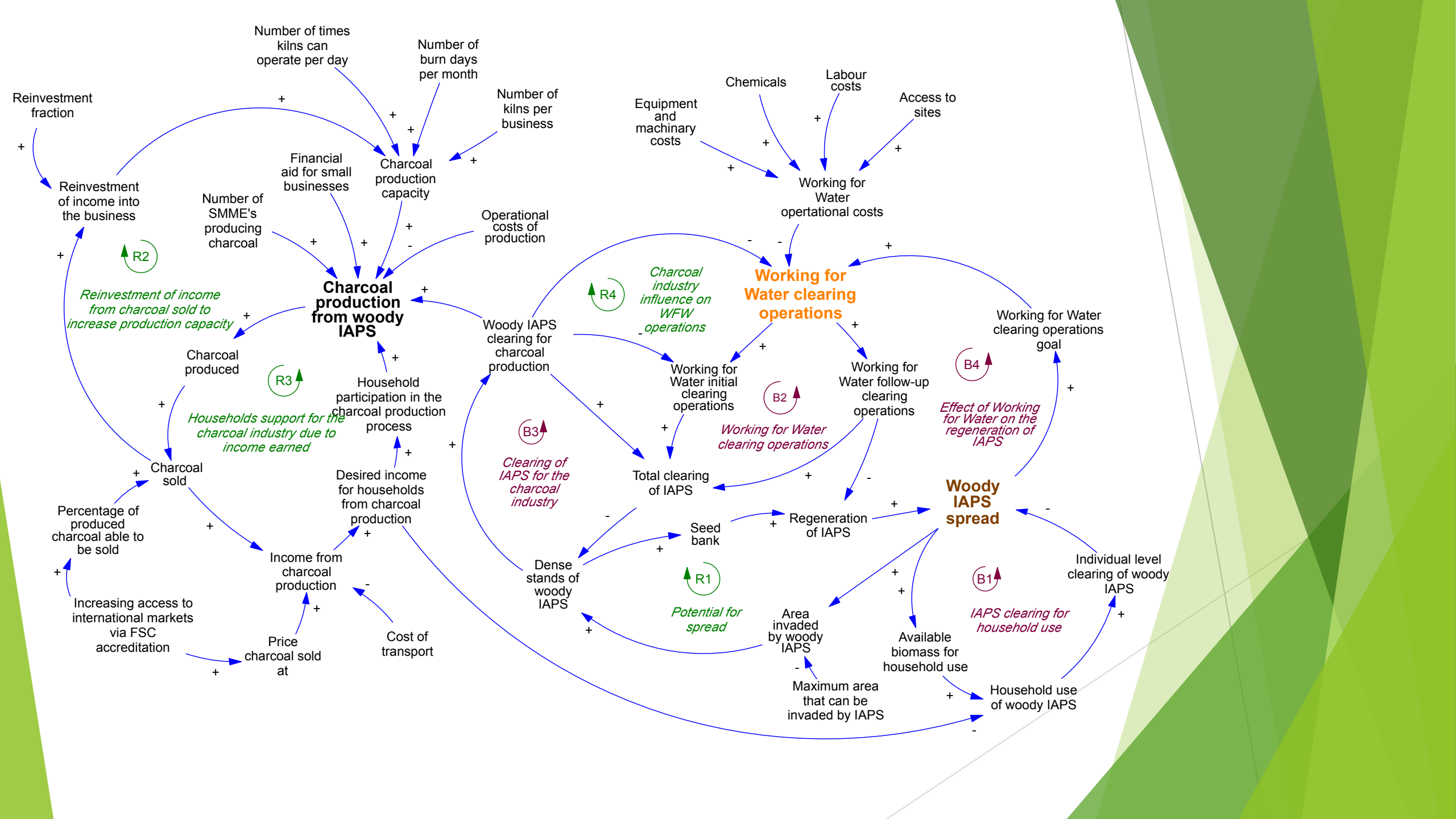
Methodology

- ▶ The System Dynamics approach allows for very successful interdisciplinary modelling and extrapolation.
- ▶ It is a process that can combine different perspectives from different disciplines, which is especially useful (Ford, 2010). This makes it particularly useful for this study as it will be combining two disciplines, namely Invasive Alien Plant Species and social-ecological systems, into one model.

Dynamic hypothesis



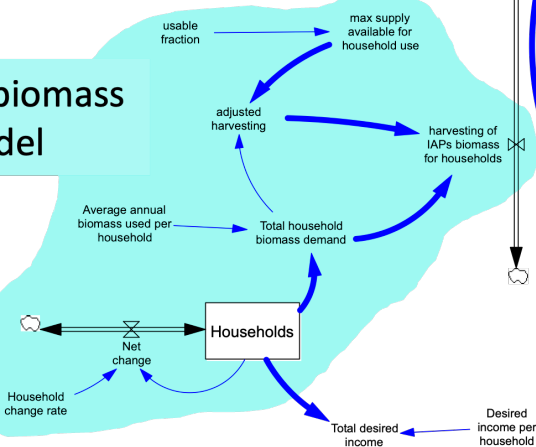




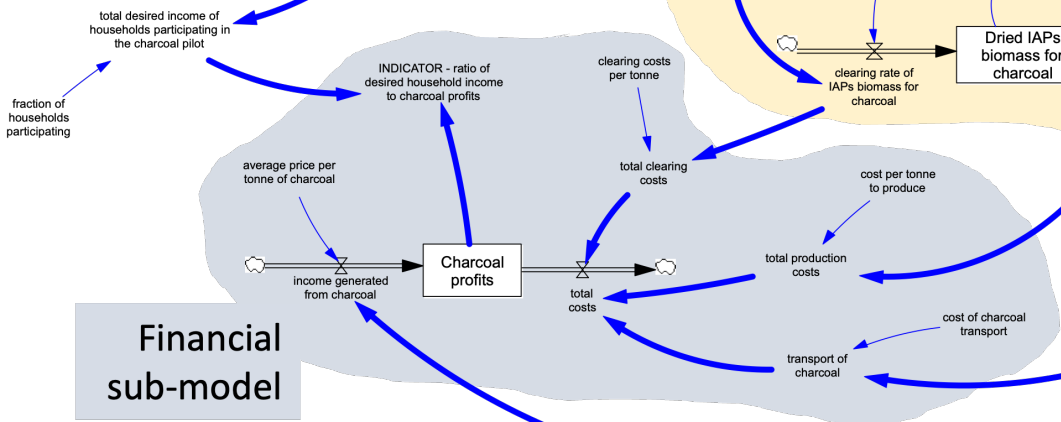
Simplified model structure

(showing the main feedback loops between the 5 sub-models)

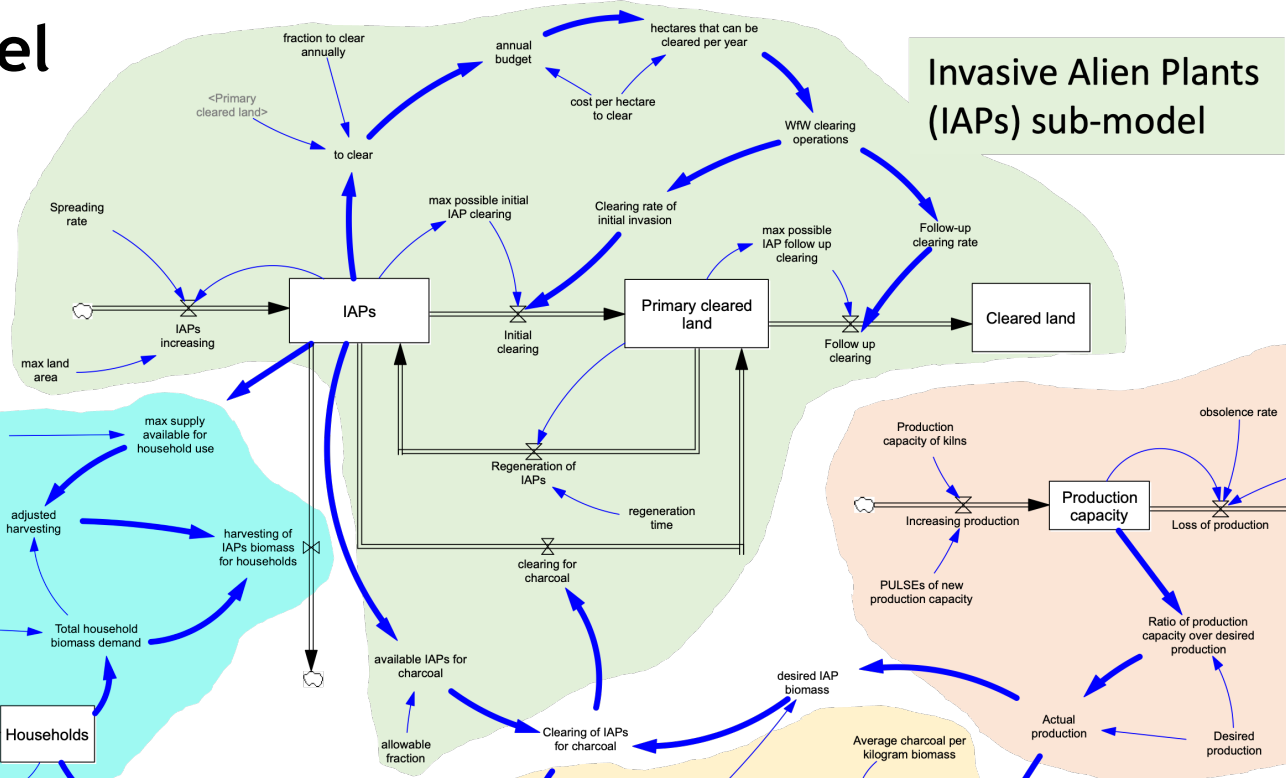
Household biomass use sub-model



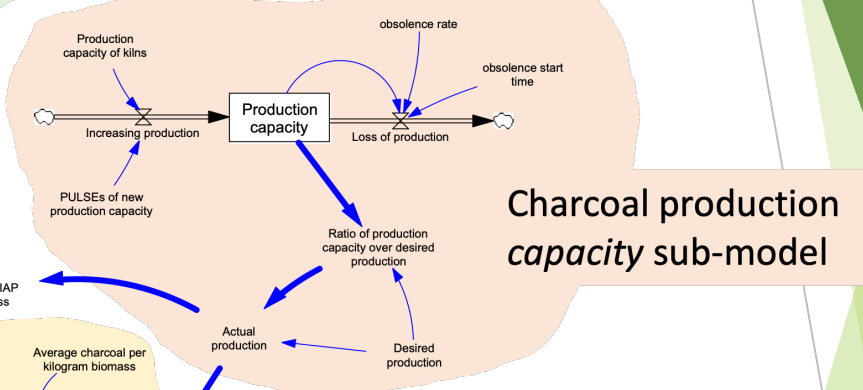
Financial sub-model



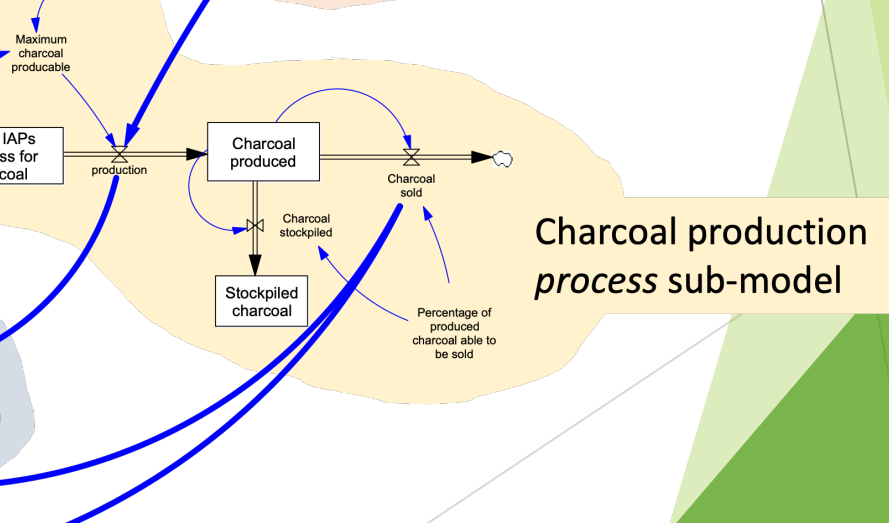
Invasive Alien Plants (IAPs) sub-model



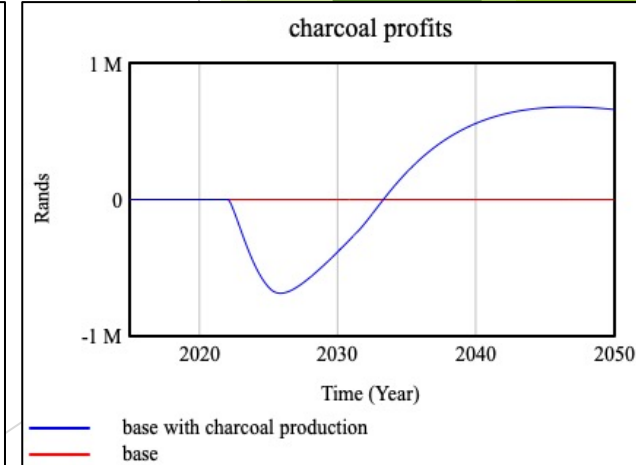
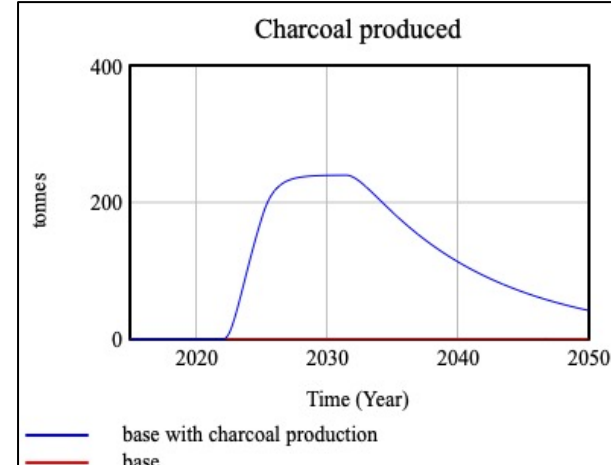
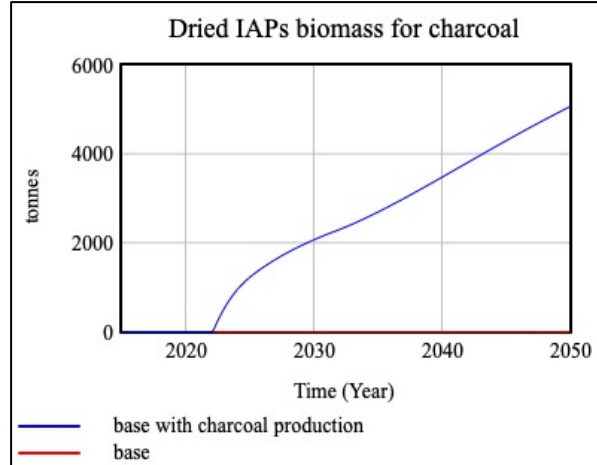
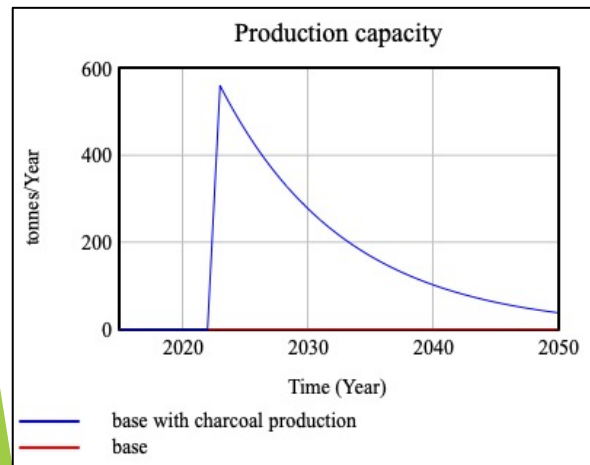
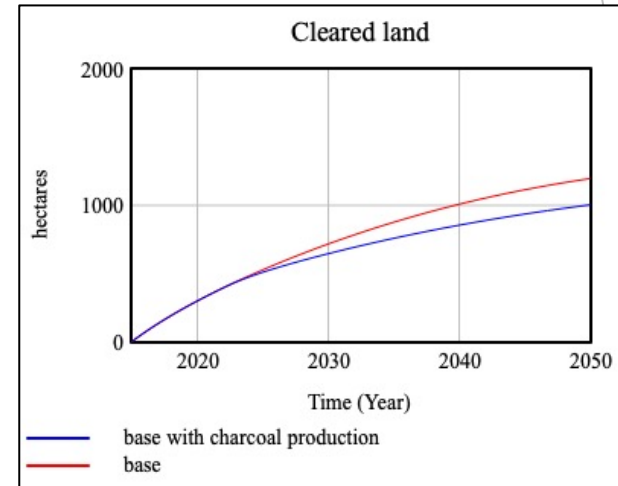
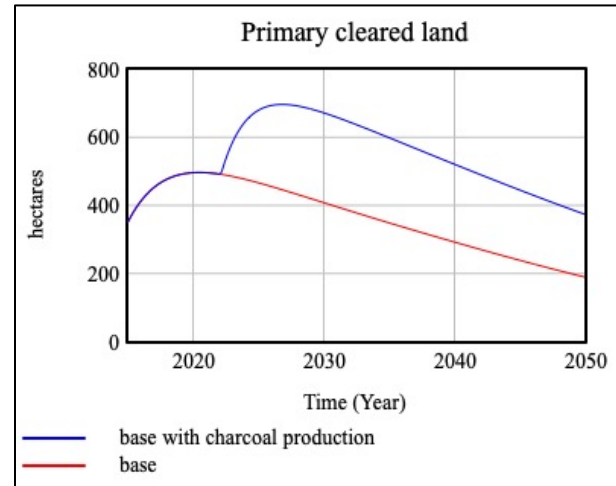
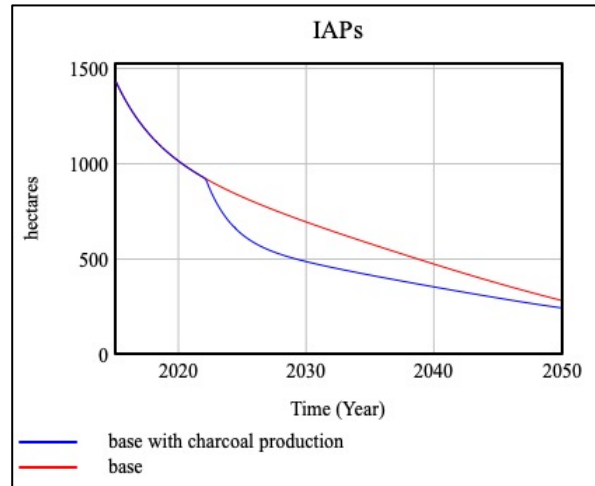
Charcoal production capacity sub-model



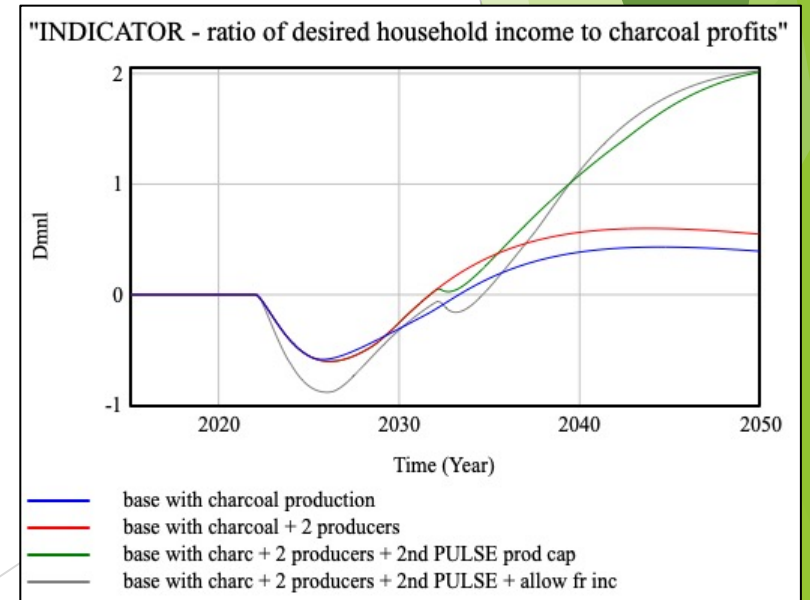
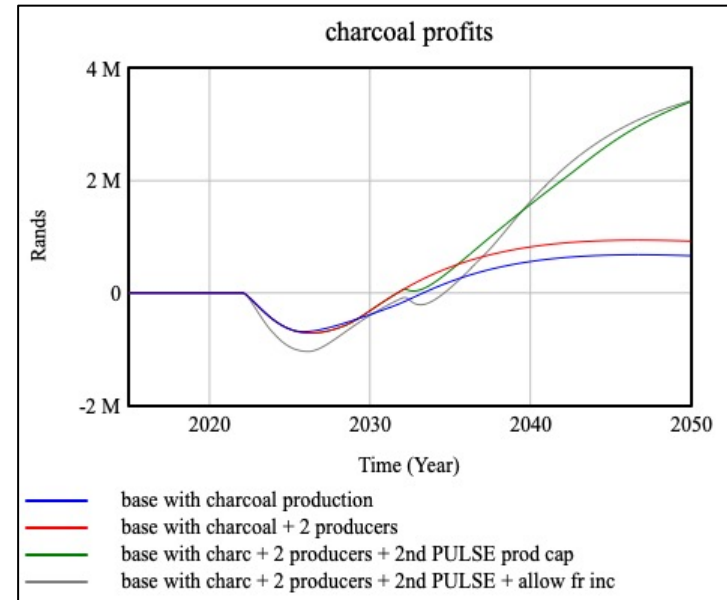
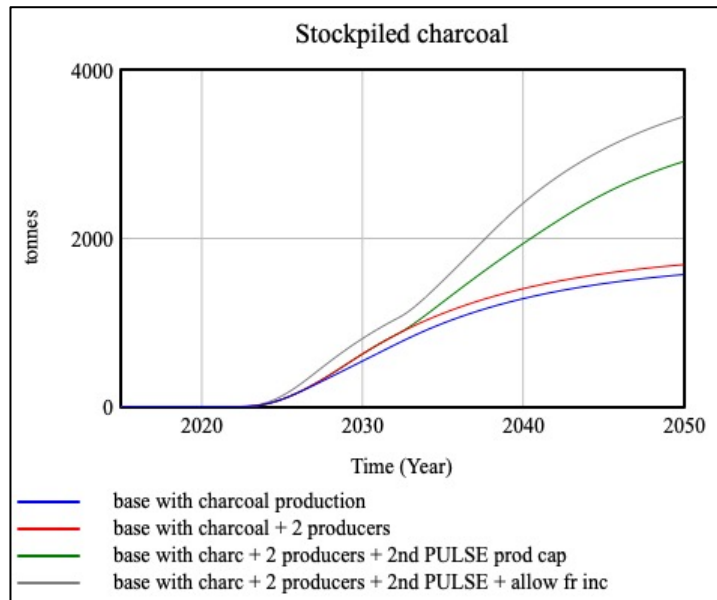
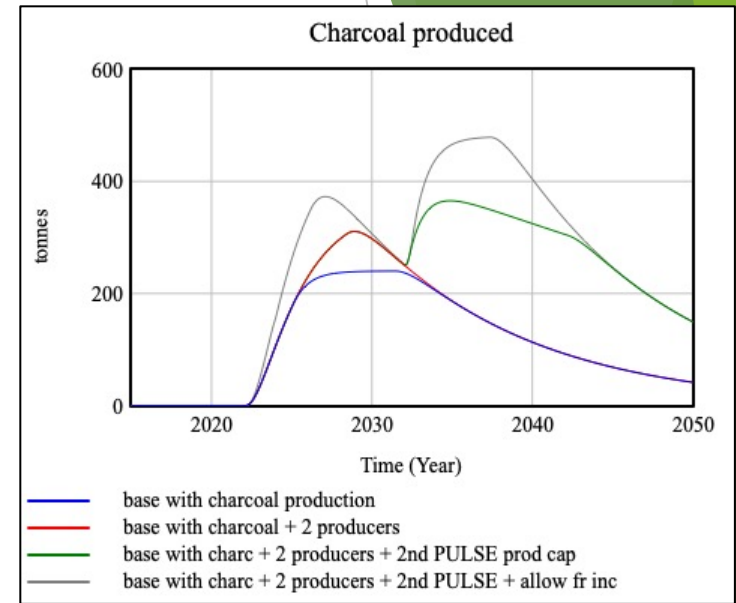
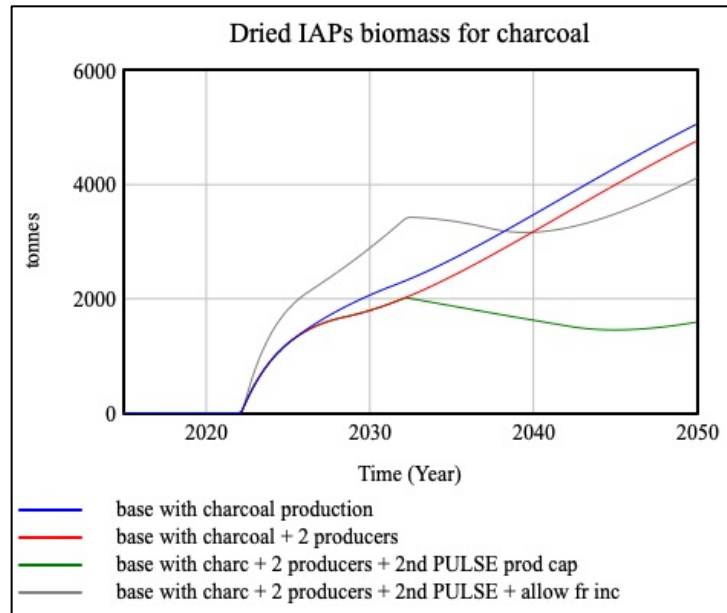
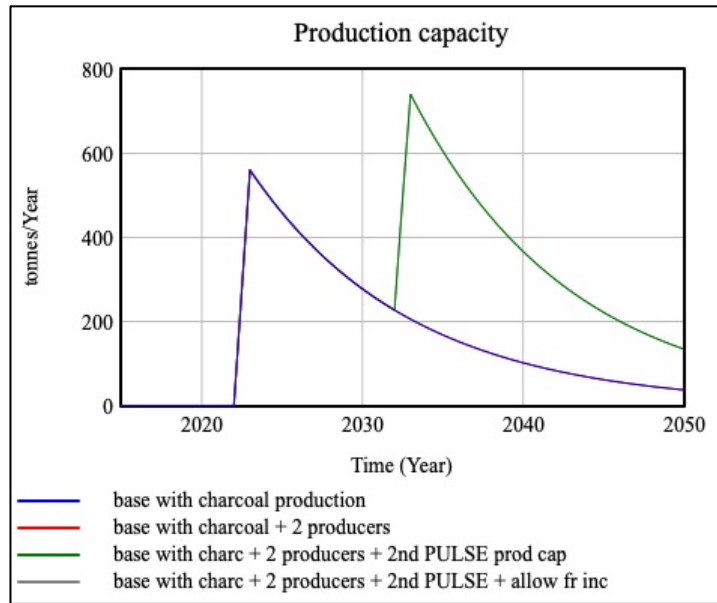
Charcoal production process sub-model



Preliminary results



Additional results (Charcoal production)



Future Work

- ▶ The next steps for the model will be to verify the data and adjust where needed.
- ▶ The validation phase follows, where the model goes through the necessary steps to verify and validate all aspects.
- ▶ Following this, the various scenarios and policies we have decided upon will be run and the results written up. Some of the scenarios and policies:
 - ❖ One scenario could be looking at if charcoal production meets the communities income needs, then more community members would want to become involved in the charcoal production process, thereby increasing the amount of IAPS that are harvestable.
 - ❖ A policy to test would be to look at increased market demand of charcoal and the associated increase in the desired production of the charcoal, which could then result in an increase in the actual production.
 - ❖ Another policy to look at would be the reinvestment of some of the income from charcoal sold back into the business and how that would increase production capacity of the business.
- ▶ An aim of the completed model would be to create an interface that can be used as a strategizing tool by groups, such as Avocado Vision, who could utilise it for their decision-making processes when piloting charcoal production in the Tsitsa river catchment area.

References

- ▶ Ford, A. (2010) *Modeling the Environment*. Second. Washington, D.C.: Island press.

Acknowledgements

- ▶ We would like to thank the Department of Forestry, Fisheries and the Environment, who funded the overall research group, the Tsitsa Project.
- ▶ We would also like to thank Stellenbosch University and the Tsitsa Project team at Rhodes University for the support.
- ▶ Thanks must also go to Lima, Avocado Vision, Inhlabathi, and all the individuals that supported this project in any way.