Research article

Participatory Modelling to inform Rural Development: Case studies from Zimbabwe and Australia

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Received 10 March 2010 Accepted 25 July 2010

Abstract Participatory modelling is one of several techniques that can help communities to share and test ideas, and to agree on the 'best bet' for improving livelihoods of individuals and communities. A case study from Africa illustrates how participatory modelling can help change livelihoods, by informing communities, by providing an objective way to conduct 'risk-free' experiments and explore scenarios, and by helping people to gain the confidence needed to make changes. This case study highlights how participatory modelling can inform communal decisions about shared rights to avoid 'the tragedy of the commons'. The example illustrates how a shared understanding of a resource, coupled with a rigorous framework to consider its dynamics, leads to better decisions and sustainable outcomes. The resulting model is not an endpoint, but a disposable 'stepping stone' in developing the confidence needed for communities to take action. Thus for many participatory models, success means being momentarily inspirational in the search for solutions, rather than being a permanent monument to a static concept.

Keywords participatory modelling, best bet, adaptive management, simulation

INTRODUCTION

Systems thinking embraces a range of techniques that can help to provide a careful and systematic examination of a project, and this paper presents an example in which participatory modelling helped to reveal development strategies that were not initially foreseen. The example relies in part on the Simile visual modelling environment (as described by Muetzelfeldt and Massheder 2003, Vanclay 2003), a package which makes advanced modelling tools accessible and relatively easy to use. With Simile, a model is not hand-crafted with hundreds of lines of computer code, but is assembled using intuitive icons to create a model diagram that is not merely an image of the model, but is a working model able to complete simulations and explore scenarios.

Despite good intentions, it is not always easy to work out what should be done to improve rural livelihoods. The history of development assistance has too many examples of projects that have not only failed to improve livelihoods, but have failed to create any improvements, because of ill-conceived projects and unforeseen side-effects (Easterly 2006). Fortunately, there are also examples of successes, and it is instructive to examine why and how these examples came to be successful. This is not the place for a comprehensive review of the successes and failures of development assistance projects, so this paper confines itself to one technique that can help to explore possible consequences (beneficial or otherwise) and avoid unforeseen dangers.

PARTICIPATORY MODELLING AND BROOMGRASS PRODUCTION IN AFRICA

Participatory modelling (Hare et al. 2003, McGurk et al. 2006) can be a useful approach to engage and inform stakeholders in natural resource conflicts. The present example deals with broomgrass on communal lands near the village of Batanai in the Mafungautsi region of central Zimbabwe (Standa-Gunda et al. 2003). Brooms made from this grass make a substantial contribution to household income in this region, so management of the *vlei* where this grass grows is an important issue involving

ecology, equity and social justice.

The people of Batanai village knew that their broomgrass harvest was not sustainable, but could not devise a more sustainable alternative − there were few other ways to earn a cash income, and many difficulties in dealing with common-property resources. Engaging the community through structured learning and participatory modelling helped them to gain a new understanding of the resource and of the opportunities for marketing their products. Guided by Richard Nyirenda, broomgrass workers developed a shared vision, formulated a model that allowed them to explore options, brainstormed to find innovative options, and devised a strategy to realize their vision (Haggith and Prabhu, 2003). Together they gained the confidence to put these ideas into practice, and empowered themselves to create and adhere to new communal rules to achieve fair and wise use of their communal resources. As a result, the broomgrass on the common is now more productive, people are making better brooms, reaching new markets, and are earning more money. In Batanai, structured learning through participatory modelling has been the catalyst that has helped the community to change its destiny.

The full story of the Batanai broomgrass is told elsewhere (Mutimukuru et al. 2006, Vanclay et al. 2006); this paper highlights some insights from the discoveries arising through the participatory modelling approach. Like many models, the broomgrass model started from humble beginnings, with field-based discussions in the shade of a tree. Later, brainstorming sessions led to a 'flipchart' model (Fig. 1) that was the basis for a series of simple computer simulation models implemented in the Simile (Muetzelfeldt and Massheder 2003, Vanclay 2003). The flipchart image illustrates an early stage of the model-building process, and reflects the outcome of brainstorming rather than critical reflection. It reveals the issues that were under discussion, including some that were omitted along the way (e.g. 'good rains', bottom left of Fig. 1), some that required more development before they could be implemented in Simile ('Strengthening the relationship between RMCS and Gokwe Council', top right of Fig. 1), some that proved ineffective ('Increasing the number of forest guards', top centre of Fig. 1), and some that reflected 'best bets' that subsequently showed promise ('Broomgrass quality', 'Number of harvesters', 'Time of harvesting', bottom right of Fig. 1).

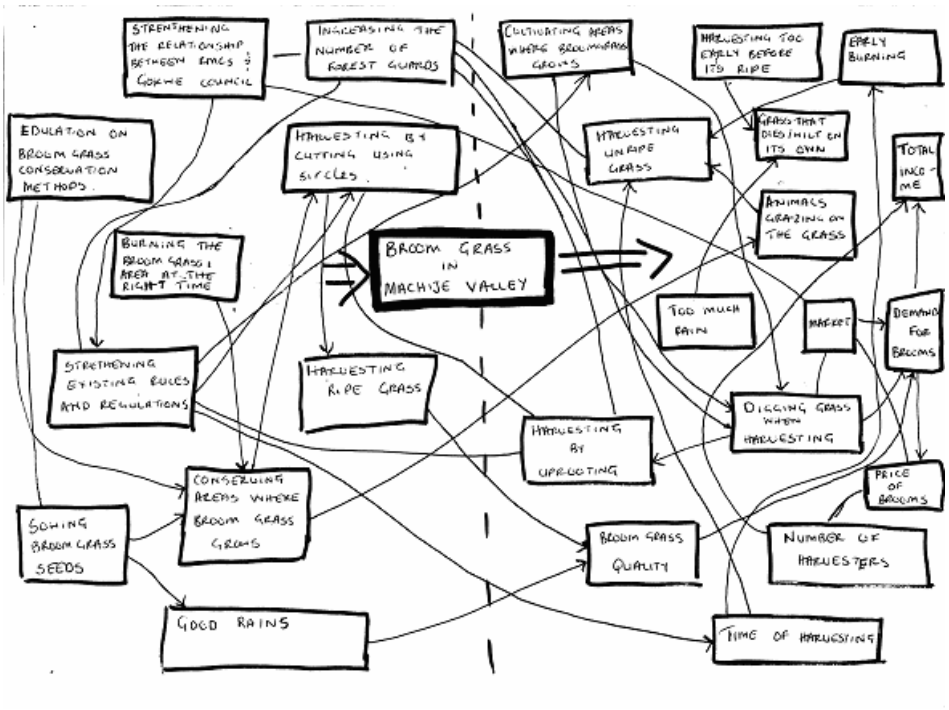

Fig. 1 Initial flipchart model of the broomgrass resource (Standa-Gunda et al. 2003)

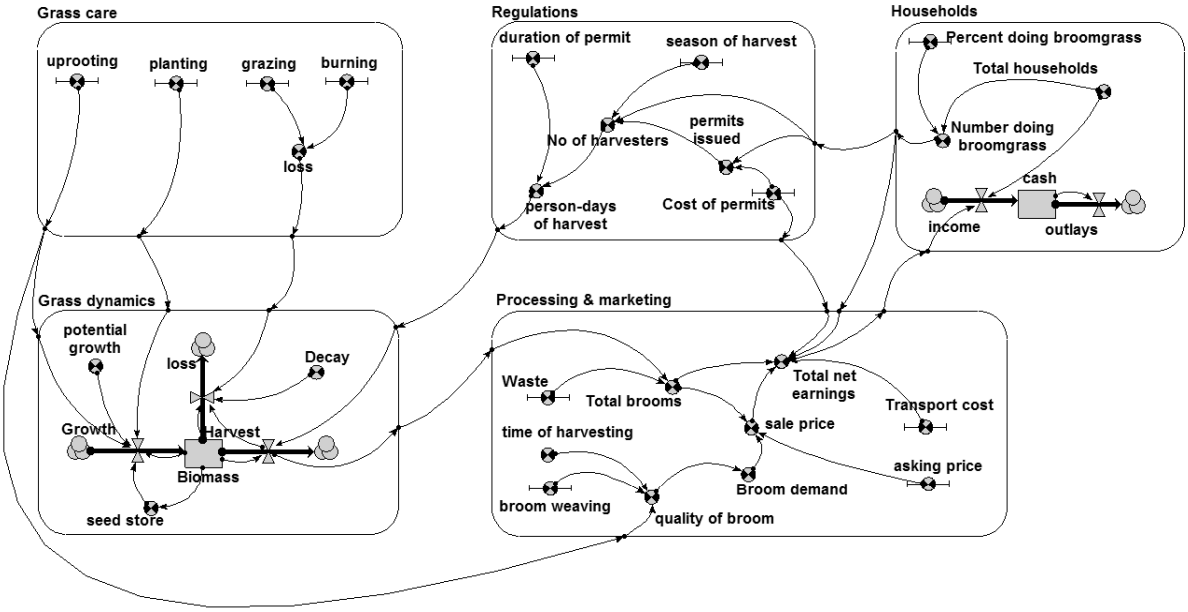

Fig. 2 The presentation version of the broomgrass model (Vanclay et al. 2006)
Model constructs have been labelled clearly, grouped into submodels that reflect function, and components have been arranged for greatest clarity.

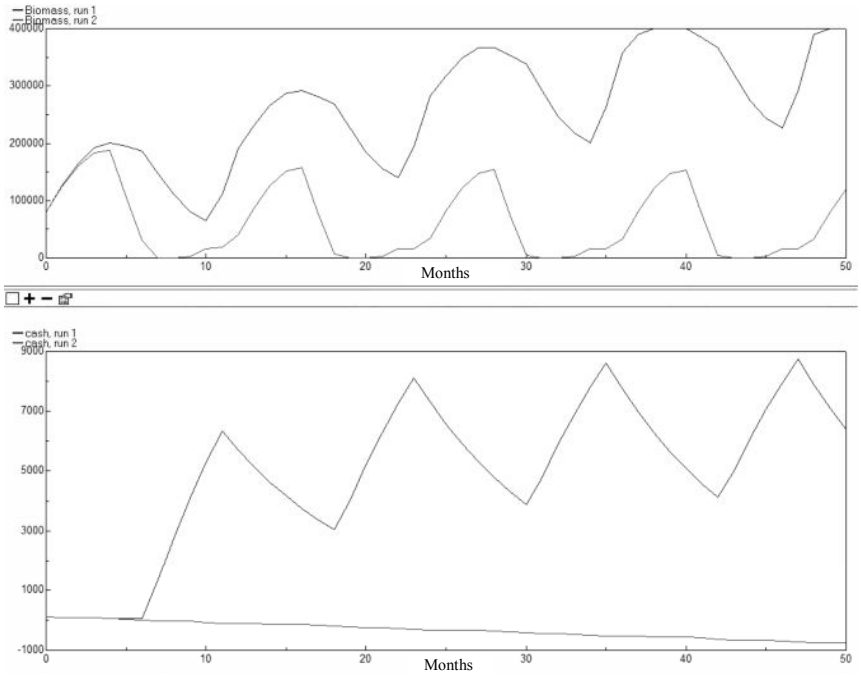

Fig. 3 Simulation output from the broomgrass model
It shows how new initiatives (top line in both panels) increase both grass biomass (top panel) and household income (bottom panel).

The flipchart model gradually evolved through a series of Simile models that explored various alternative ways to express the issues and frame potential solutions. Participants discovered the way forward while the model was still in a relatively crude state (illustrated in Standa-Gunda et al. 2003), and by the time experienced modellers had 'tidied up' the model to make it appear more elegant and accessible, the broomgrass workers had no further use for it. The model illustrated in Fig. 2 was never

used by the broomgrass workers, and was created merely to allow others an insight into the conclusions that participants had already reached. It was the process of building and testing the model, not the model itself that gave the participants the insights and confidence they needed to put new management practices into place on their common lands.

Some of the findings of the participatory modelling process seemed counter-intuitive to people not intimately involved in the process. The broomgrass workers wanted to increase the number of households involved in cutting grass on the commons. To the foreigners involved in the exercise this seemed illogical: more harvesters must surely mean more harvesting and lead to overexploitation. But the broomgrass workers realized that greater participation in this money-making enterprise would lead to greater adherence to community codes of practice, to fewer stray cattle trampling the grass, to a reduction in wasteful harvesting practices, and would provide more opportunities for mutual assistance. Collectively, their new code of practice would lead to sustainable harvesting and increased household incomes (Fig. 3).

The broomgrass workers also realized that financial viability required consideration of all three components of what is commonly called the triple bottom line. They examined, modelled, and included in their code of practice, issues relating to ecology (season of harvesting, cutting with a sickle versus uprooting; Fig. 2, top), economics (quality of broom, transport cost; Fig. 2, bottom left) and social aspects (patch harvesting, with harvesters only allowed to move to a new patch after completing the previous patch, to allow widows, orphans and other slow harvesters to participate without fear of losing access). All of these aspects can be, and were examined within the Simile model.

DISCUSSION

This illustration about the use of participatory modeling to address a problem is not intended to advocate for broomgrass or for the visual modeling environment Simile. Rather, it is about the analysis, the brainstorming and the discussion that can arise from this approach. It is not about the solution that the people of Batanai devised, but about the utility of finding shared problems, bests bets and of adaptive management. Readers should not assume that their solution may be found by emulating the focus on the grass of the *vlei,* but should collaboratively analyze their own problem, and find their own solution.

Enthusiasm for this approach may vary according to the issues and people involved. A recent attempt at participatory modeling to resolve fire concerns in eastern Australia (Leys and Vanclay 2010a) was not fully developed because participants showed a reluctance to engage in modeling with Simile, preferring to explore issues in other ways (e.g., discussions, guest speakers). There are two possible explanations for this difference, namely that Woodenbong participants had busy lives and were more reluctant to invest time, in contrast to African participants who evidently had time for such interaction (at certain times of the year) and that Woodenbong participants were more trusting of government officials and their ‘black boxes’ than their African counterparts who showed scepticism and wished to understand every aspect. Evidently scepticism is a healthy prerequisite for effective participatory modeling. Nonetheless, despite this reluctance to engage in model-building, an evaluation showed that the participatory process had changed views about land use change in the neighbourhood (Leys and Vanclay 2010b).

The ‘tragedy of the commons’ (Hardin 1968) is a well-documented phenomenom of shared-property resources that afflicted the *vlei* beforehand, but that was resolved through participatory modeling. It may be that participatory modeling helped to engender a greater sense of custodianship over the resource, or it may be that the broomgrass workers were correct in realized that greater participation would lead to greater adherence of community codes of practice.

CONCLUSION

Participatory modelling cannot solve a problem, but it can inform, offer new insights, and allow experiments to be simulated and scenarios evaluated. Together, these may give communities the confidence needed to adopt new initiatives to improve the triple bottom line. Exploring the options and

building confidence may mean building and testing many versions and variants of a model, but this is part of the learning process. Some of the strengths of a systems approach are that they (1) offer a structured way to work towards a solution, (2) help to focus on pivotal issues (3) allow risk-free experiments with computer simulations, and (4) give people confidence to take action. The outcome from such a systems approach is the action, not the model, so modellers should resist becoming attached to their models, because the model is simply a stepping stone along the path to enlightenment. Participants may not bother to finish their model once they gain the insights they sought (Leys and Vanclay 2010a, b). Success in participatory modelling means being momentarily inspirational in the search for solutions, rather than providing a monument to a static concept. Facilitators of participatory modelling exercises must inspire confidence, so that participants are willing to propose diverse scenarios for evaluation and simulation. A focus on 'modelling the best bet' rather than 'modelling the problem' can be an effective way to progress towards viable solutions.

Participatory modeling is not a panacea, but it is a useful tool with which to effect reform. However, like many other approaches to natural resource management, it generally benefits communities by generating positive change at community and higher levels, rather than by delivering benefits directly to poor and marginalised households (McDermott and Schreckenberg, 2009).

ACKNOWLEDGEMENTS

Ideas presented in this paper rely on inspiration offered by many colleagues, including Mandy Haggith, Andrea Leys, Robert Muetzelfeldt, Ravi Prabhu, Fergus Sinclair and the Mafungautsi 'broom grass team'. Some of the work reported here was supported by the UK Department for International Development (DFID) FRP projects R7315 and R7635, and by the Australian CRC Forestry Program 4.3.4.

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