USING QUALITATIVE REASONING TO MODEL THE EFFECT OF AN ALIEN GRASS IN NATURAL AREAS OF BRAZILIAN SAVANNA

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INTRODUTION

The molasses grass (*Melinis minutiflora*) is an aggressive invader able to modify completely in few years a natural vegetation physiognomy, and its development and growing is well even on acid and low fertility soils, as the Cerrado's.

The key issues and concepts involving in invasion and management processes are the following:

(1) Invasiveness: After initial successful colonization, the next stage is the establishment of a viable, self-sustaining population that will expand;
(2) Equilibrium and disturbance: invasive species occupy new areas since it was disturbed (commonly by human activity). Protected areas confer bigger resistance to occasional invasive species.
(3) Management of invasive specie: when management strategy was effective, the population of invader can be reduced or can be eliminated.

This work describes a model to represent fundamental aspects and demonstrate the invasion process by a alien grass in a savanna, as well as the management to control the invader.

MODELING APPROACH AND IMPLEMENTATION

The model was built using Qualitative Reasoning techniques and the ontology provided by the Qualitative Process Theory (QPT) (Forbus, 1984).

To implement the model it was used the DynaLearn (DL) workbench software (www.DynaLearn.eu). DL provides 6 different modelling environment or layout, so called *learning spaces* (LS), and each of them has different number of QPT modelling primitives of increasing complexity (Liem *et al.* 2010).

Model ingredients

In this modelling approach the main ingredients used to build DynaLearn models are: entities (objects of the system modelled); quantities (variables of each entity) and quantity spaces (a range of possible qualitative values of each quantity).

The research of Martins *et al.* (2011) was used to validate this model.

RESULTS AND DISCUSSION

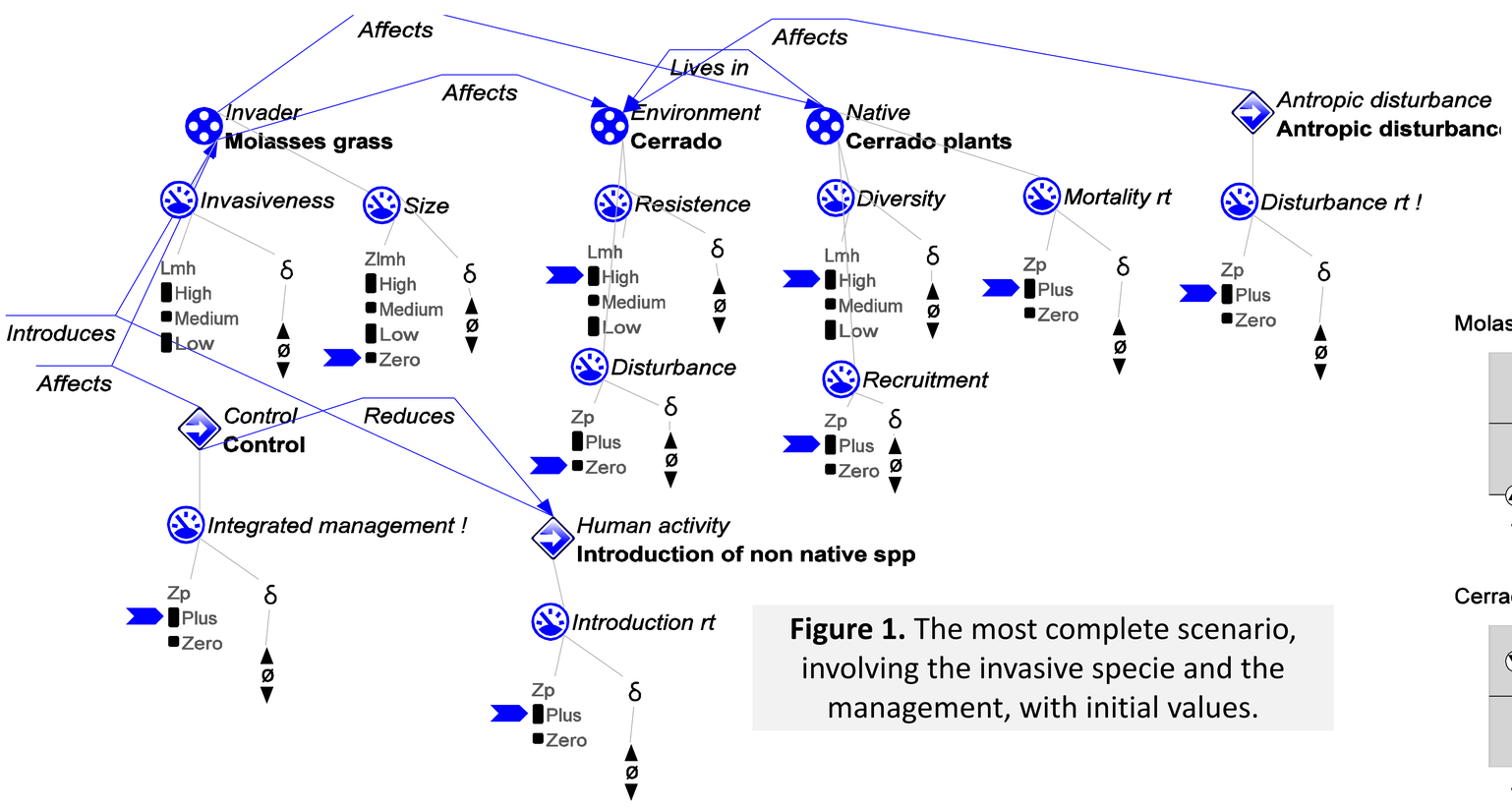

Figure 1. The most complete scenario, involving the invasive specie and the management, with initial values.

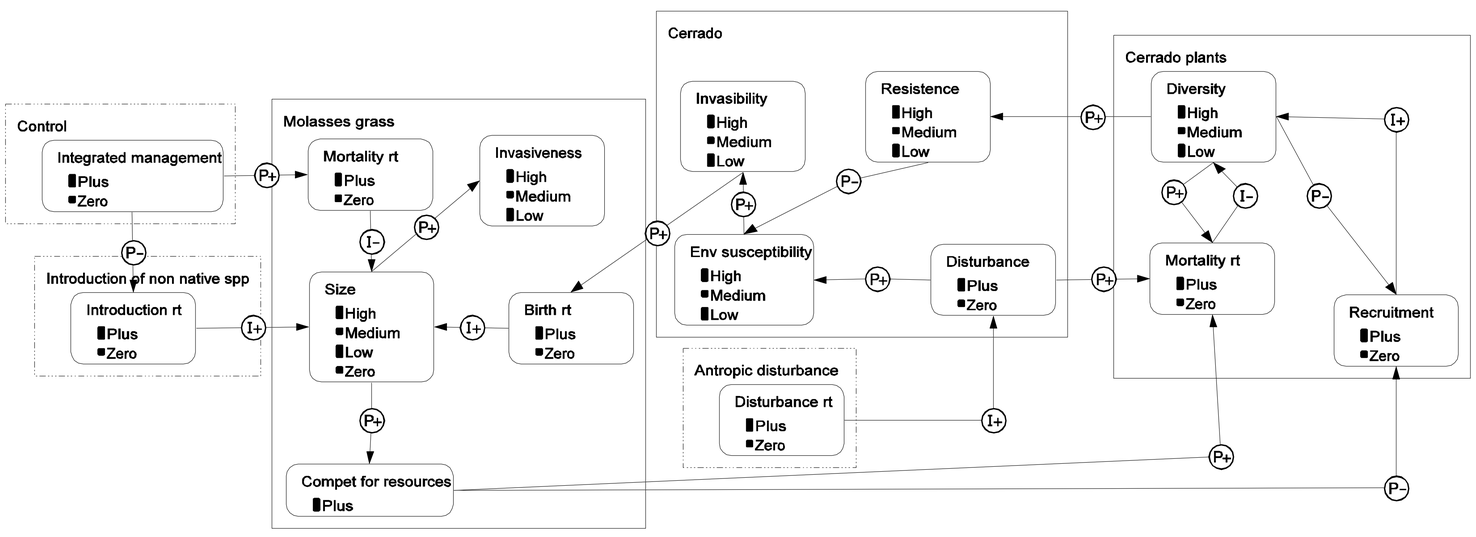

Figure 2. Causal model.

Scenarios and simulations

Scenarios represent initial situations, including configurations of the system of interest, and initial values of the quantities. The most complete scenario in this work is shown in Figure 1.

The simulation was run and the result can be seen in Figure 2 and 3.

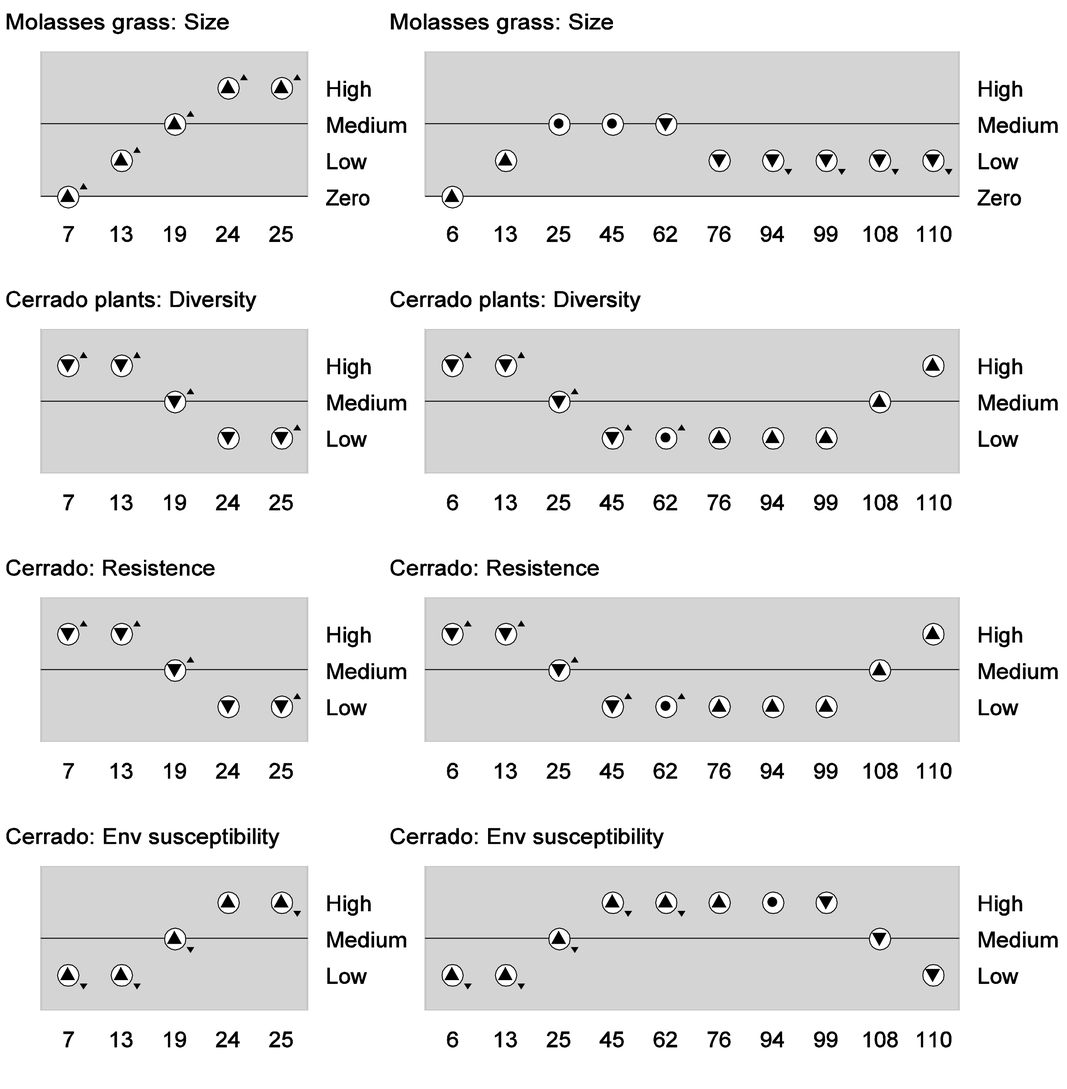

Figure 3. Value history diagram for simulation of two scenarios, without management (left) and with management (right).

CONCLUSION

The model shows the effects of the invasion and the management to control the invasion. The model built is dynamic, so different scenarios can be mounted to simulate real or experimental situations, creating a casual chain that helps the understanding of the invasion process and may be used as a teaching tool at schools and universities, as well as stakeholders for prevention and management.

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