

Using geospatial intelligence to assess the invasive threat of Chilean needle grass (*Nassella neesiana*)

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Summary Chilean needle grass (*Nassella neesiana* (Trin. & Rupr.) Barkworth) is an exotic perennial tussock grass that favours temperate regions with high rainfall. It is a Weed of National Significance as it is threatening native grasslands and productive pastures. Chilean needle grass (CNG) was discovered in the Clifton area on the Southern Darling Downs region of Queensland. It was believed to have originated from the show grounds in 1998. An emergency response to contain the outbreak included an aggressive surveillance program and eradication campaign. This summary outlines a research project for a weed surveillance decision support system using the above outbreak as a case study.

From a surveillance perspective the aim is to demonstrate that discovery and control efforts pay off to efficiently: i) contain the spread of the weed, or ii) eradicate the weed. We adopted a risk assessment approach with a qualitative model constructed for spatial attributes using a Bayesian Belief Network (BBN) and a GIS.

Risk assessment is formulated as the product of likelihood and consequence. The likelihood that CNG will infect a location depends upon how susceptible it is, and the probability of the incursion being detected. We assume that once a weed infestation is detected the area is immediately treated and the weed eradicated. Detection is highly influential as a management response for containing the spread of CNG. Consequences measure costs of discovery and eradication.

BBN's evaluate the potential of a threat by treating decision variables as belief probabilities. The main decision variables in the model relate to the physical spread of the weed, detectability for various surveillance practices, and costs for surveillance.

A BBN model was developed from interviews with the CNG Taskforce for the Darling Downs. The major land uses at risk from CNG are grazing, watercourses, road sides and stock routes. Each of these having different susceptibilities related to physical dispersal vectors for roadside slashing, vehicles, cattle and flooding. A BBN model for the most apparent mechanism, namely roadside spread, is shown in Figure 1. The model captures attributes for the current state of invasiveness of CNG. In particular we are able to represent the spread of CNG along roads based

upon their level of traffic, distance from last known infestation and adjacency to other land uses. The probabilities for risk variables are trained from occurrence data obtained as GPS locations for infestations from 2005 and 2006. The outputs for the model can be mapped as susceptibilities as shown in Figure 2.

To date the findings for our model show the causal relationship between susceptibility and the extent of invasion, but poorly captures relationships to management practices. Further data is needed to understand surveillance practices and the relationship between detection effort and discovery success. Future efforts will focus on incorporating this relationship in the BBN model.

Keywords GIS, Bayesian belief network.

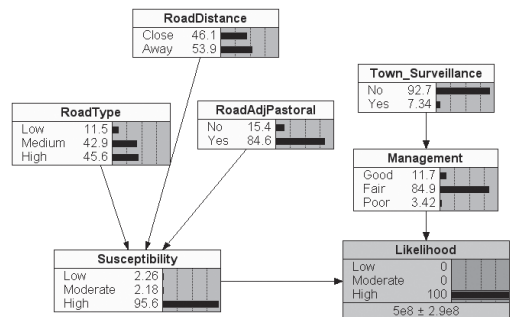


Figure 1. BBN showing influence of variables given a high likelihood of CNG invasion.

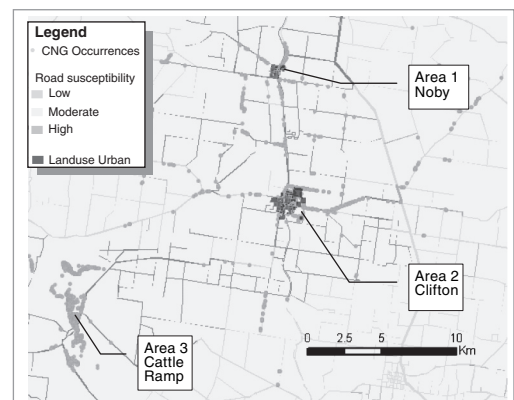


Figure 2. Mapped susceptibility of BBN model.