

# Data science and AI models for deploying biological control approaches

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# FAW management



## Problem

Synthetic pesticide widely used is ineffective (Niassy et al. 2019)

## Challenges

Replicability due to fragmented agroecological zones and socio-cultural multiplicity (Kyalo, 2019).

## Approach of solution

Biological control using natural enemies such as predators and parasitoids (Niassy et al. 2019), and biopesticides (Akutse, 2019)

## Opportunities

Data science (DS) and computer intelligence (CI) algorithm advancements



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# FAW management



## Goal

Data science (DS) and computer intelligence (CI) algorithms for the deployment of biological control (BC) technologies against FAW in maize farms



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# FAW management modelling



## Objective

**Develop**

*Develop a hybrid modelling approach to assess suitable sites for the optimal release of BC agents with a focus on parasitoid and biopesticides to counter the threat of FAW in maize*



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# FAW management modelling



## Approach



Predicting pest infestation at localized sites using AI models (evolutionary adaptive neuro-fuzzy inference system: GA-ANFIS)



Identification and mapping of the two candidate technologies deployment sites



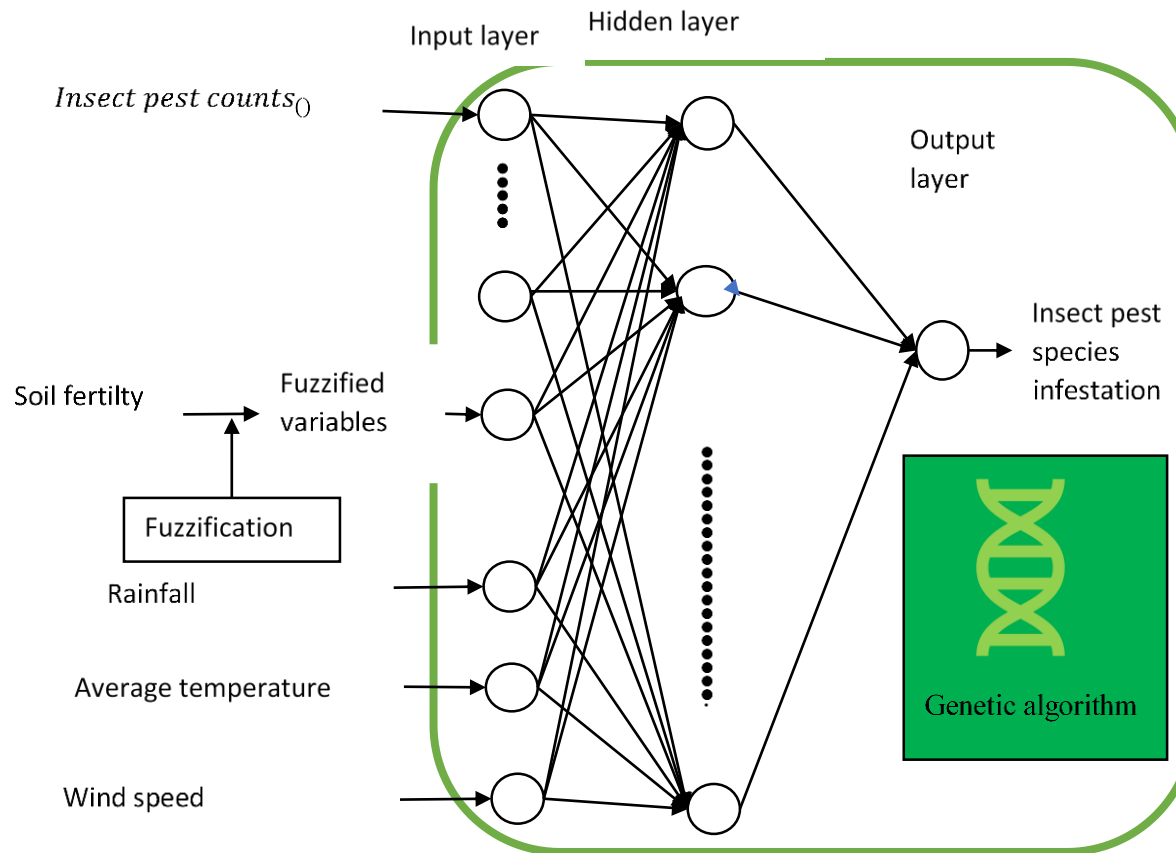
Extrapolation of candidate technologies for mapping the recommendation domains in Africa



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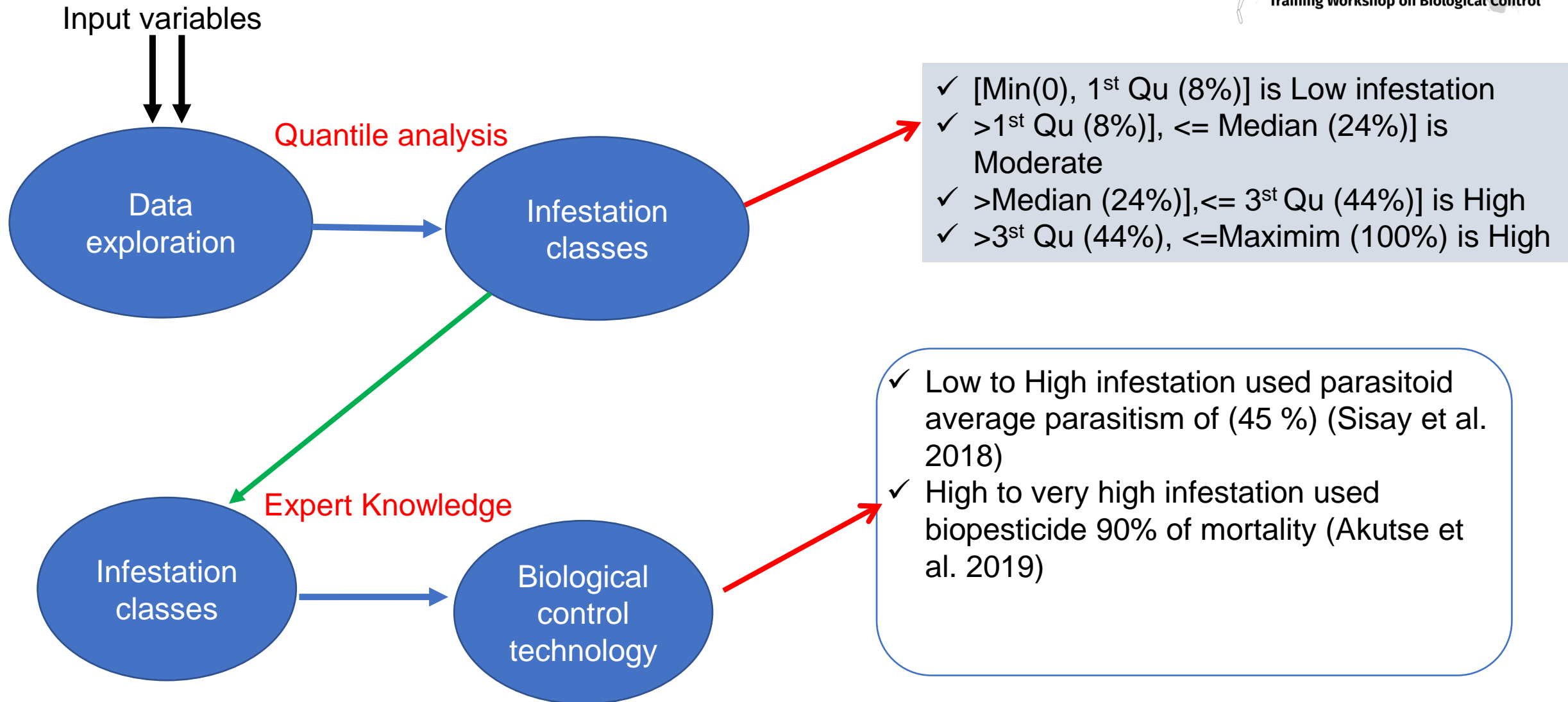


# Predicting pest infestation



Assess models performance

# Mapping sites for the two technologies





# Extrapolation of candidate technologies for mapping

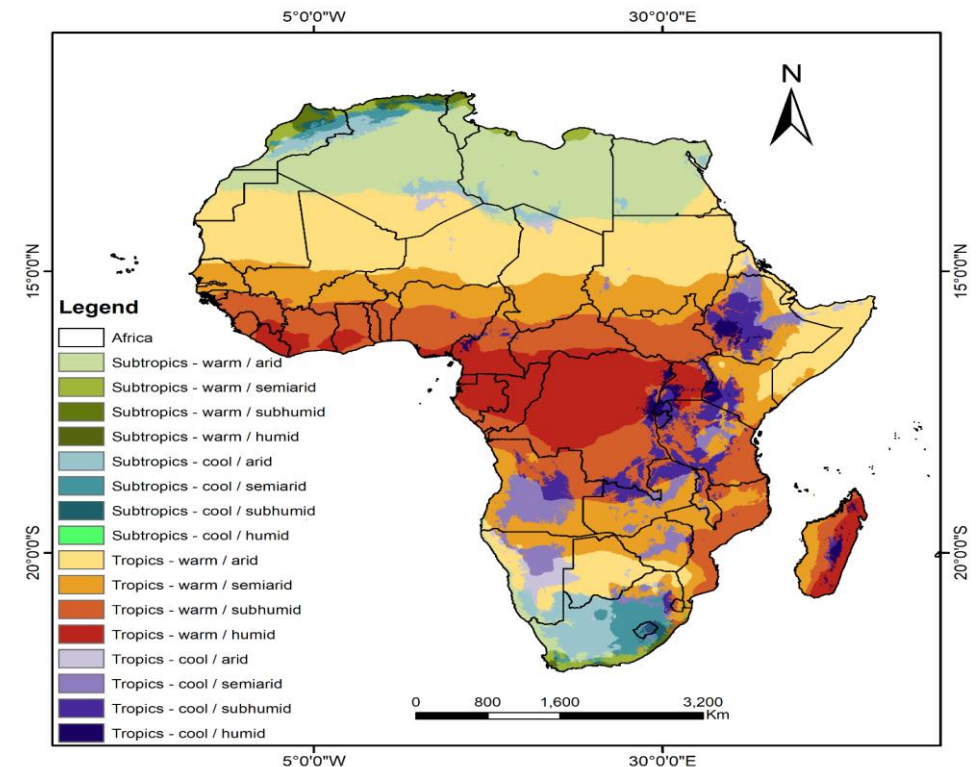


Physics principle entropy using socioeconomic layer and agroecological layer with AUC for accuracy assessment

$$L = S - (\alpha - \log_2 e) \left( \sum_i p(A_i) - 1 \right) - \beta \left( \sum_i g(A_i) p(A_i) - G \right)$$

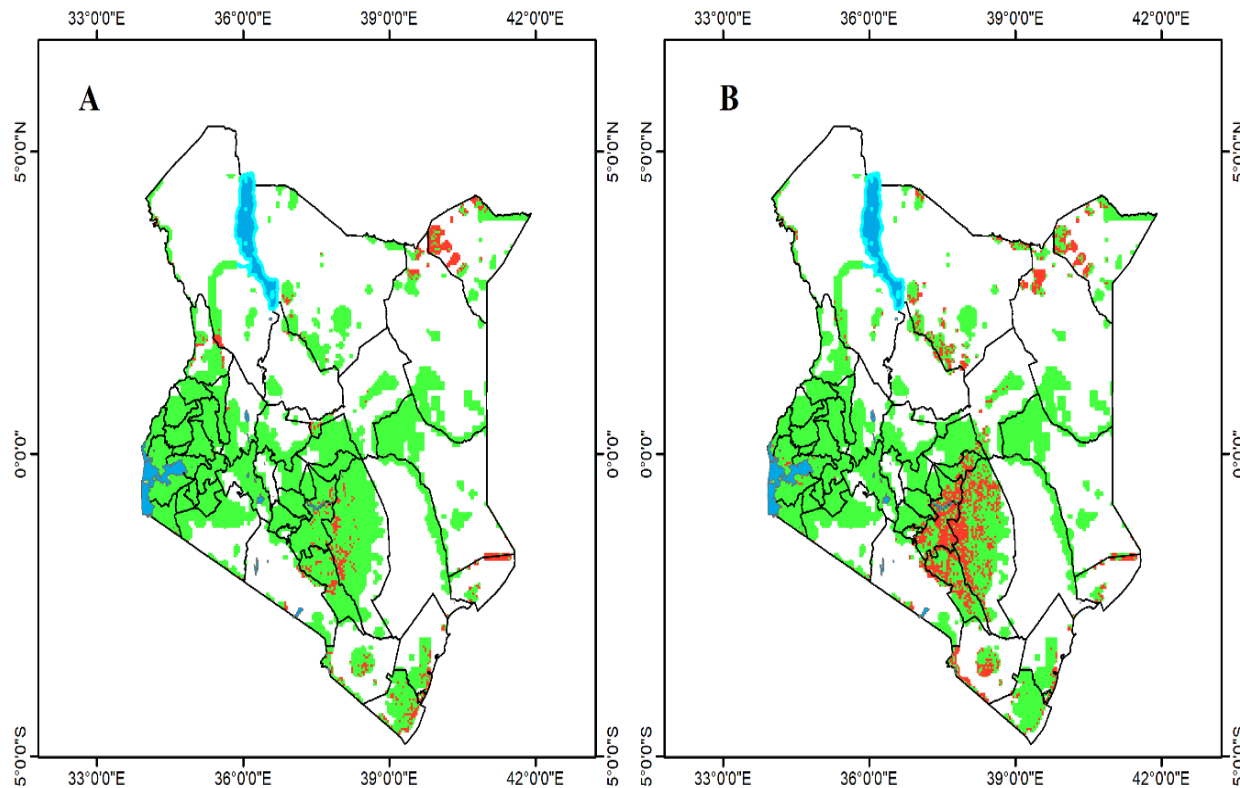
Here,  $e$  is the base of the natural log, 2.7183, so  $\log_2 e$  is just 1.4427.

To find unknown probabilities in a case like the above, we solve our collection of equations so that  $L$  is maximized. This also maximizes  $S$ , entropy.





# Results



## Legend

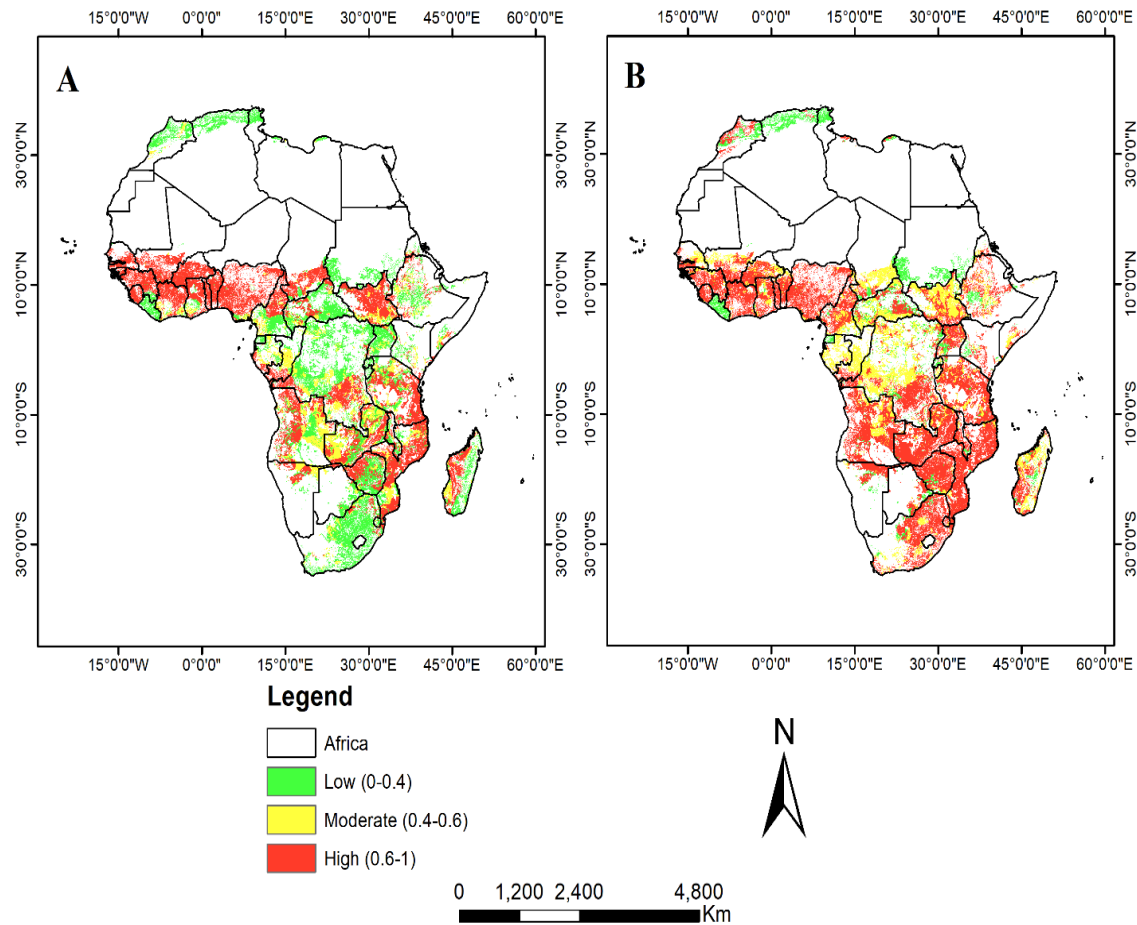
- Counties boundaries
- Lakes
- Area without maize
- Parasitoids
- Biopesticides

0 155 310 620  
Km



A is the first season from April to July  
and B represents the second cropping  
season from September to March.  $R^2$   
is 0.87

# Results

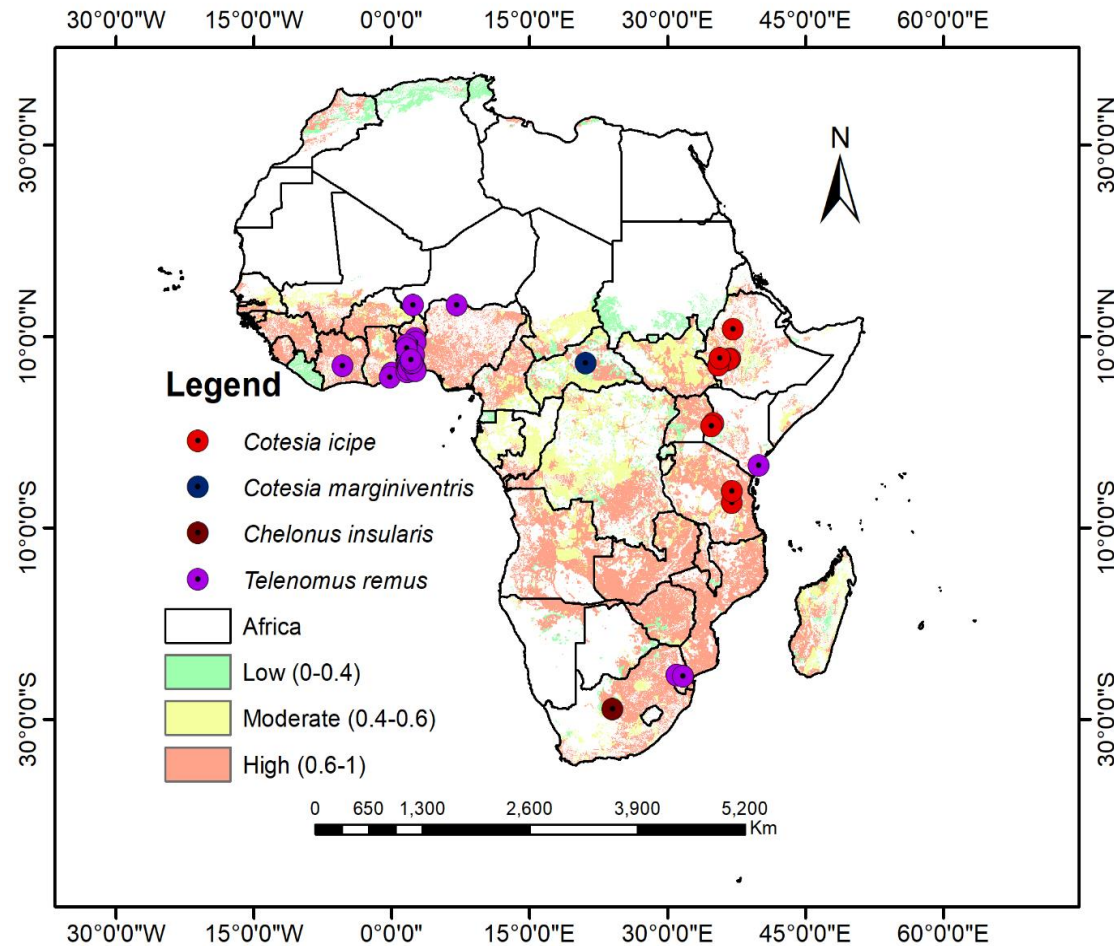


A represents biopesticides, B represents parasitoids. **Accuracy is 80%.**

# Results



## Validation



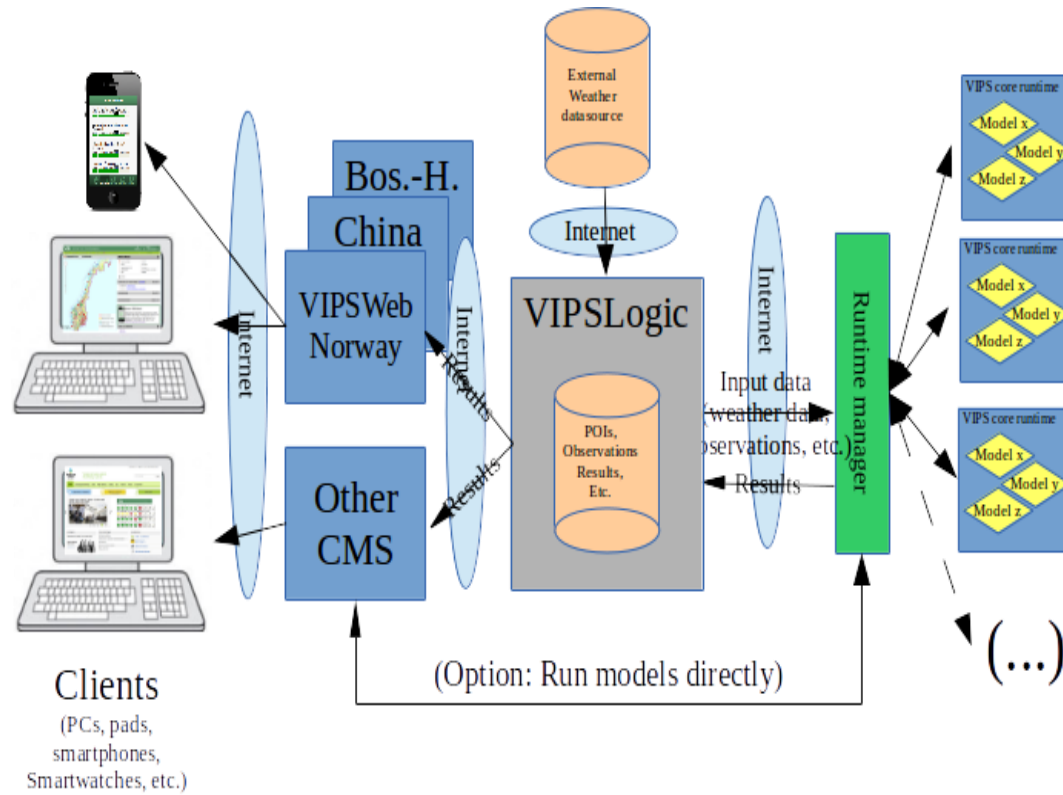
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# Results

## Expert system: traffic light (DSS)





# Thank you

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