

Horizon Scanning of Invasive Plant Pests Endangering Zimbabwe's Agriculture Sector Based on Insights from Neighbouring Countries

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One Health impact statement

- Horizon scanning and early warning systems facilitate prevention, early detection, rapid response, and collaborative strategy development to mitigate invasive pest impacts.

Introduction

- Zimbabwe's agriculture is threatened by invasive plant pests present in neighboring countries, with entry risks posed by waste (DWP), passenger luggage (PLP), and food contaminants (FCP) pathways; exacerbated by smuggling and unofficial border crossings (Mudada et al., 2022).
- Over 500,000 pest species have entered territories through cross-border pathways (Tshikhudo et al., 2025), costing Africa more than US\$65.58 billion yearly—about 2.5% of its GDP (Eschen et al., 2021).
- This study offered the first systematic identification and prioritization of invasive plant pest threats for Zimbabwe, focusing on species present in neighbouring countries (Botswana, Mozambique, South Africa, and Zambia) but not yet in Zimbabwe, hence, establishing a critical evidence base to guide proactive biosecurity policy and investment.

Methods and materials

- This desktop study (conducted on 11th of June 2025) applied CABI's systematic horizon scanning methodology (CABI, 2025b) to model and rank the likelihood of invasive pest introductions into Zimbabwe, using geospatial data to assess risk based on pest presence in neighbouring regions.
- The pest threat sources were Zimbabwe's four neighbouring countries, while other SADC countries (Figure 1) functioned as pest buffers (CABI, 2021c, 2021b).
- The HST queried DWP, PLP, and FCP; pathways often neglected at ports of entry are subjects to smuggling.
- Figure 2, show the climate-matched geographical area modeled for Zimbabwe
- The likelihood of pest entry and establishment was determined using the procedure described by FAO (2007b) and CABI (2025a).
- The EPPO method for likelihood of entry and of establishment were ranked on a scale of 1 (very unlikely); 2 (Unlikely); 3 (Moderately Likely); 4 (likely); and 5 (very likely), also as described by Tshikhudo et al., (2025).
- Scoring was done by experts from the Plant Health Authorities in Zimbabwe.

Data analysis

- The Microsoft Excel and SPSS vs. 25 were used for Exploratory Data Analysis (Exploratory Data Analysis, 2016).
- Simpson's Diversity (1-D) and Shannon (H') indices were applied, bringing a new dimension to Pest Risk Analysis in which the indices, captured meaningful ecological patterns relevant to invasion risk helping identifying pest organisms overwhelmingly dominant, signaling key risk neighbors and guiding for a further, more granular analysis.

Results

- The HST revealed 114 invasive plant pest species currently absent but present in Zimbabwe's four neighbors dominated by invertebrates (58 invertebrates, 29 weeds, 17 fungi/chromista, 4 bacteria, 4 viruses, and one vertebrate) (Table 1).
- South Africa accounted for the highest proportion of pest threats (87%) (Table 2).
- 73, (64%) pest species had entry and establishment score of 3 or higher, dominated by invertebrates' species (46 invertebrates, 3 bacteria, 9 fungi, 11 weeds/plants and 4 viruses).
- Pest risk diversity increased with scale—neighbours ($S=6$, $H^2=1.37$, $\lambda=0.70$), SADC ($S=6$, $H^2=1.41$, $\lambda=0.72$), global ($S=9$, $H^2=1.63$, $\lambda=0.78$)—with invertebrates and plants as dominant threats and global data revealing protozoa and unknown pathogens.
- The pest pathway PLP was associated with the highest pests' threats (104) whilst FCP and DWP were associated with 94 and 93 pest threats, respectively.
- Threats to urgently guard for includes *Fusarium oxysporum f.sp. cubense* (score of 4), *Amaranthus retroflexus* (score 4), *Solanum torvum* (score 4), and Maize Chlorotic Mottle Virus (MCMV) (score 4) based on EPPO standard.

Discussion

- The presence MCMV threat signals serious biosecurity risks to Zimbabwe's cereal sector (Kimani et al., 2024).
- The PLP pathway posed the highest threat (104 pests), followed by FCP (94) and DWP (93) (Augustin et al., 2012) suggesting a call for rapid, specific diagnostic systems that enable efficient customs clearance while thoroughly screening for pests, and minimizing disruption to cross-border traffic.
- Given pest presence in neighbouring countries and the expanded trade under agreements like the African Continental Free Trade Area (ACFTA), vigilance is critical—as increased trade volume creates more opportunities for pests to hitchhike on goods and packaging (Epanchin-Niell et al., 2021; Youm et al., 2011).
- The dominance of the PLP pathway demands enhanced border surveillance and public awareness campaigns, not only for ACFTA but for all free trade areas that may facilitate pest spread (Padhiyar & Thakar, 2022).

Conclusion

- This first systematic horizon scan for Zimbabwe identified 73 significant invasive plant pest threats from neighboring countries—primarily 58 invertebrates—providing a critical evidence base for proactive biosecurity policy and resource allocation.

Recommendation

- Zimbabwe should immediately conduct Pest Risk Analyses for PLP and FCP pathways, enhance luggage inspections—especially from South Africa—prioritize invertebrate biosecurity at borders, and invest in broad-spectrum systems for global pest threats.

Limitation of the study

- The HST is limited to pest species recorded in its queried databases, excluding threats outside this framework.