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Simulating damages from biosecurity risks on the sea container pathway

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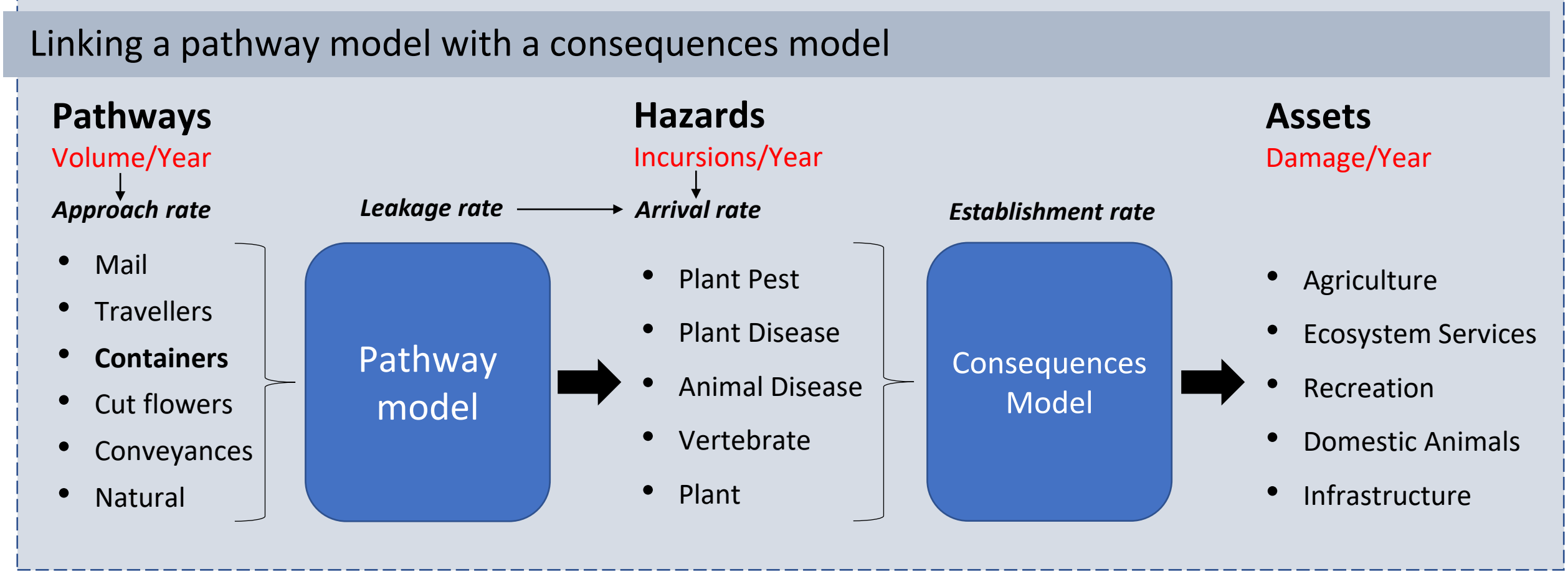
Question

Can we estimate the global damages caused by leakage on the container pathway?

Estimating damages for a pathway

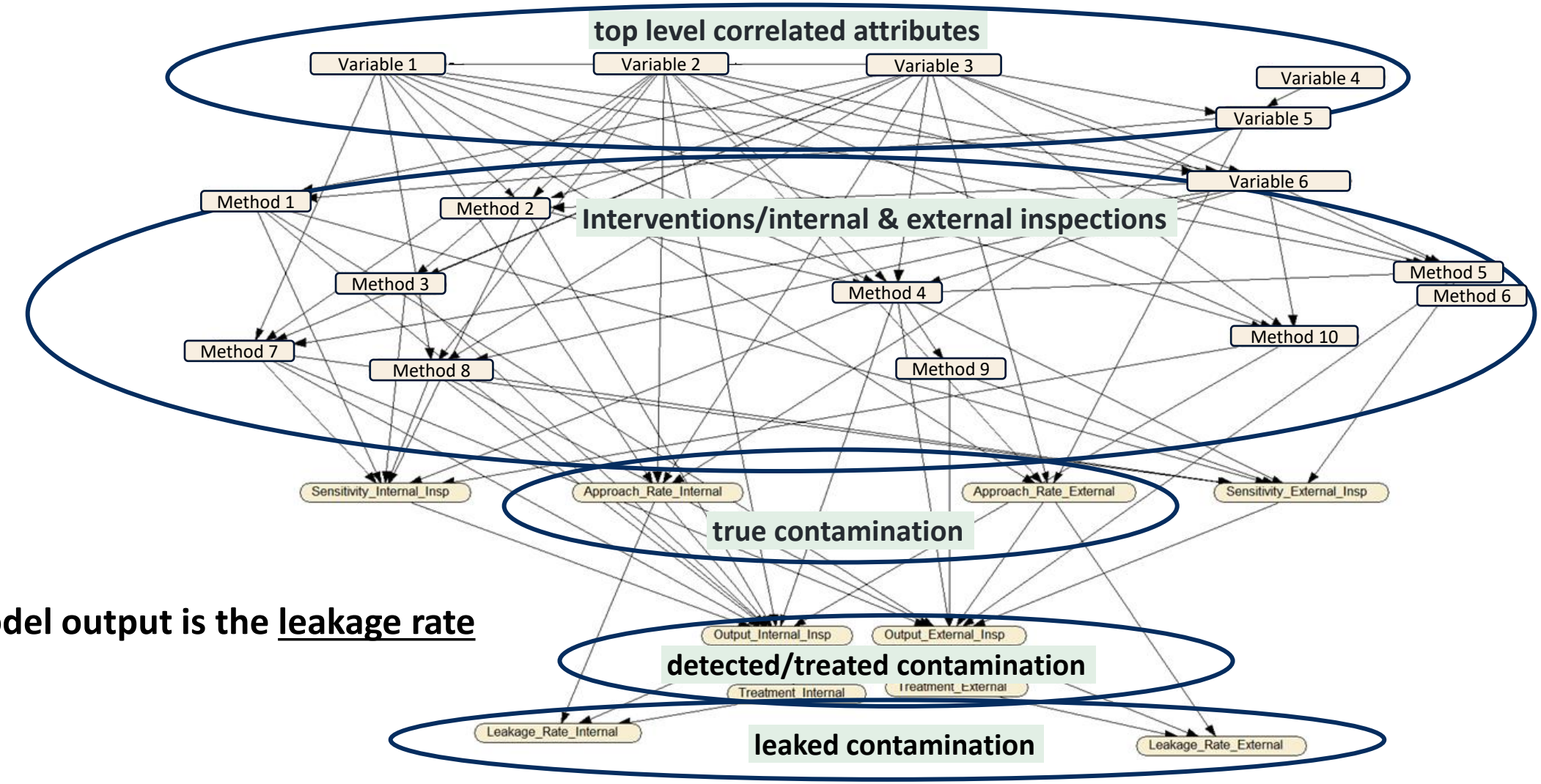
Linking a pathway model with a consequences model



Case study: container pathway in Australia

- Conceptual diagram of the container pathway
- Model structure

Model structure



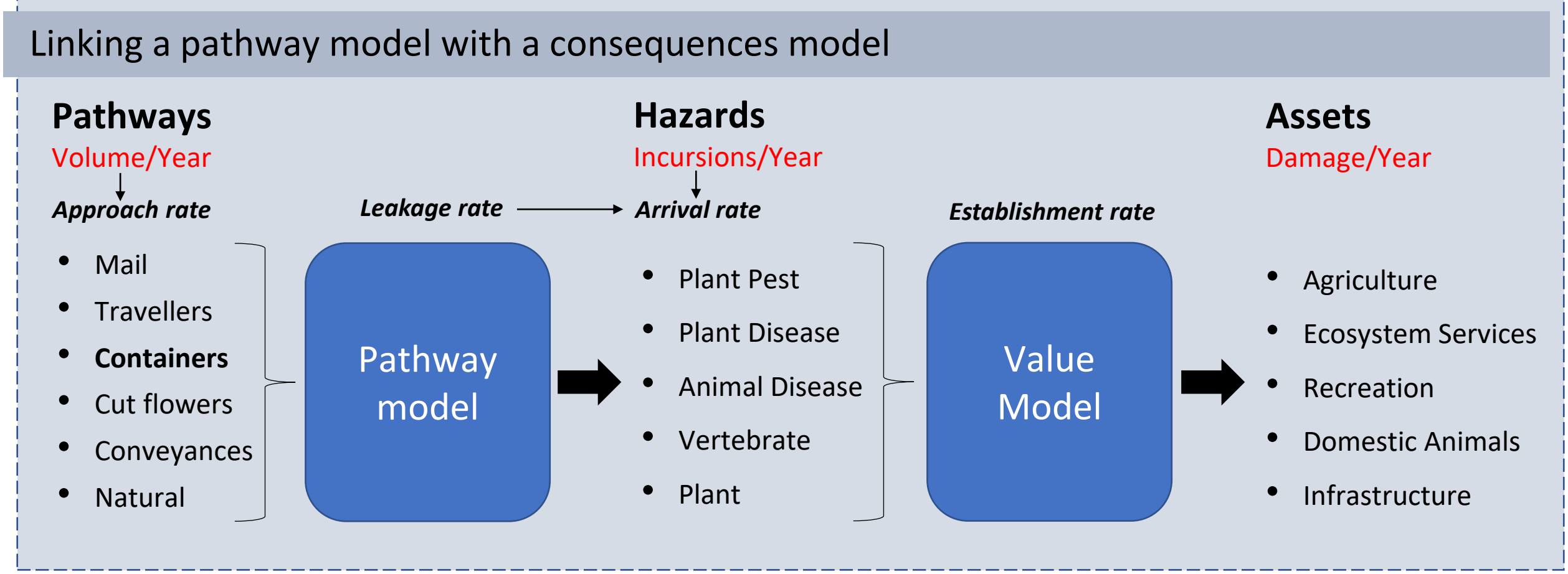
Model output is the <u>leakage rate</u>

Case study: container pathway in Australia

- Conceptual diagram of the container pathway
- Model structure
- Import management and interception data
- Conditional probability tables
- Parametrise the model → Simulation model

Estimating damages for a pathway

Linking a pathway model with a consequences model



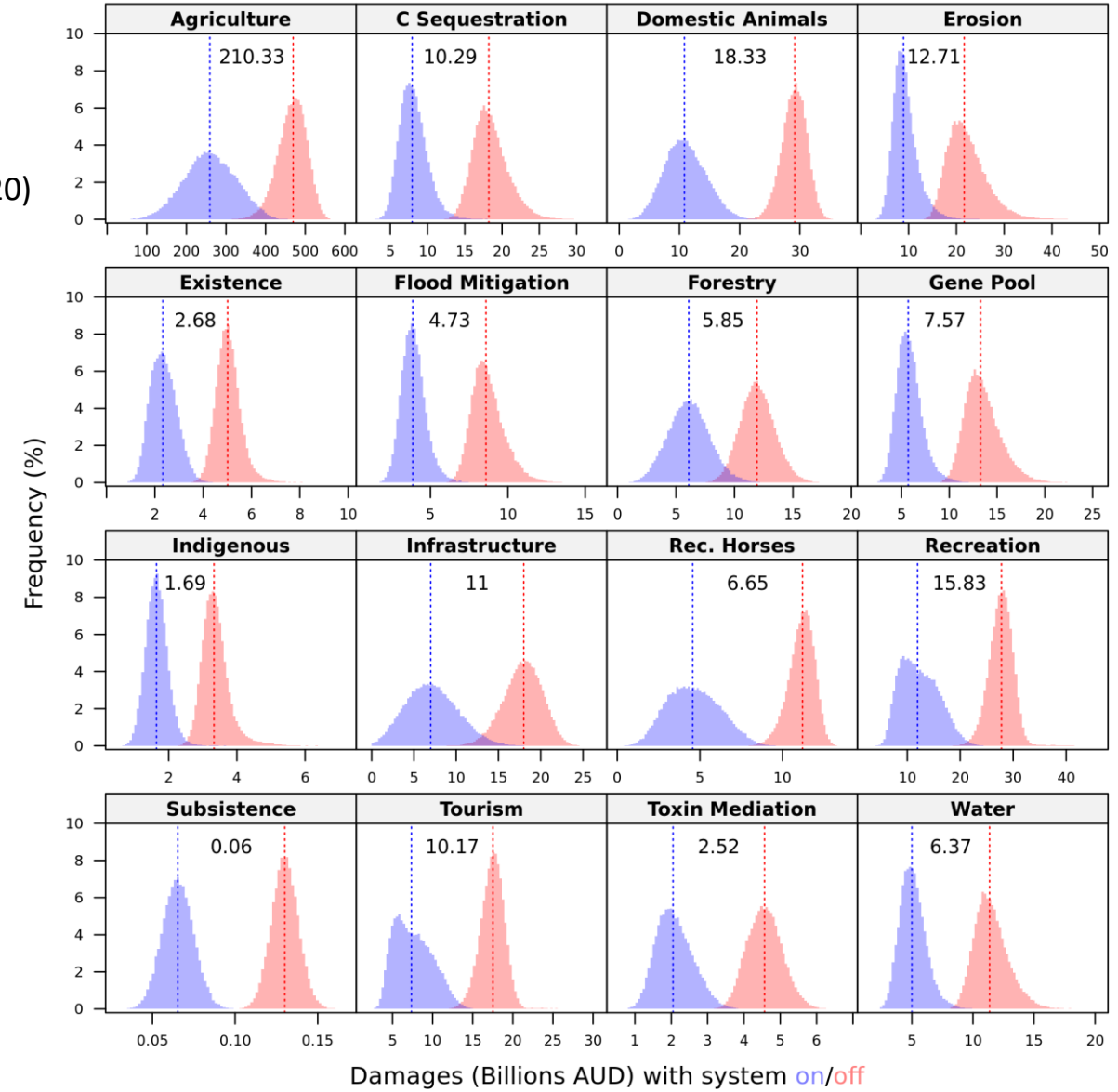
The 'Value' Model

- Spatio-temporal simulation model (see Dodd et al. 2020)
- Developed for valuing AUS biosecurity system
- Models arrival, spread, and impact
- No double-counting of damages

Parameter	Setting
Spatial resolution	AUS, 2500m x 2500m (1.3M pixels)
Assets at risk	16
Biological hazards	40 functional groups
Temporal resolution	50 years, 1-year intervals
Iterations	50,000 of each state (on/off)
Discount rates	5% financial, 3% environmental

$$Damage\ per\ pixel\ =\ \%\ yield\ reduction\ \times\ asset\ value$$

(If asset and species are present in pixel)



Dodd et al. (2020) Final report for CEBRA project 170713, The University of Melbourne, https://cebra.unimelb.edu.au/__data/assets/pdf_file/0020/3535013/CEBRA_Value_Docs_KeyResultSummary_v0.6_Endorsed.pdf

Summary of needed inputs

- **A parametrised model of the container pathway**
  - Conceptual model of the pathway
  - Import management data (volumes, container attributes, directions)
  - Interception data (contamination rates: BRM or per hazard)
- **Value model (consequences)**
  - Distribution of cells susceptible to a hazard (land use layer)
  - Establishment rates for functional groups
  - Spread characteristics per hazard
  - Asset values (see Stoeckl et *al*., 2023)
  - Damage functions

Stoeckl et *al*. (2023) *Ecosystem Services* 60: 101509, https://doi.org/10.1016/j.ecoser.2023.101509

Challenges and potential extensions

- Challenges
  - Collecting and cleaning of data
  - If no interception data, find alternative data sets
  - Computational resources
- Potential extensions
  - Include post-border management (e.g., eradication)
  - Changes in container volumes between countries over time
  - Changes in the susceptibility of landscape over time (climate change)

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Thank you

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