

Applying search theory to hunting

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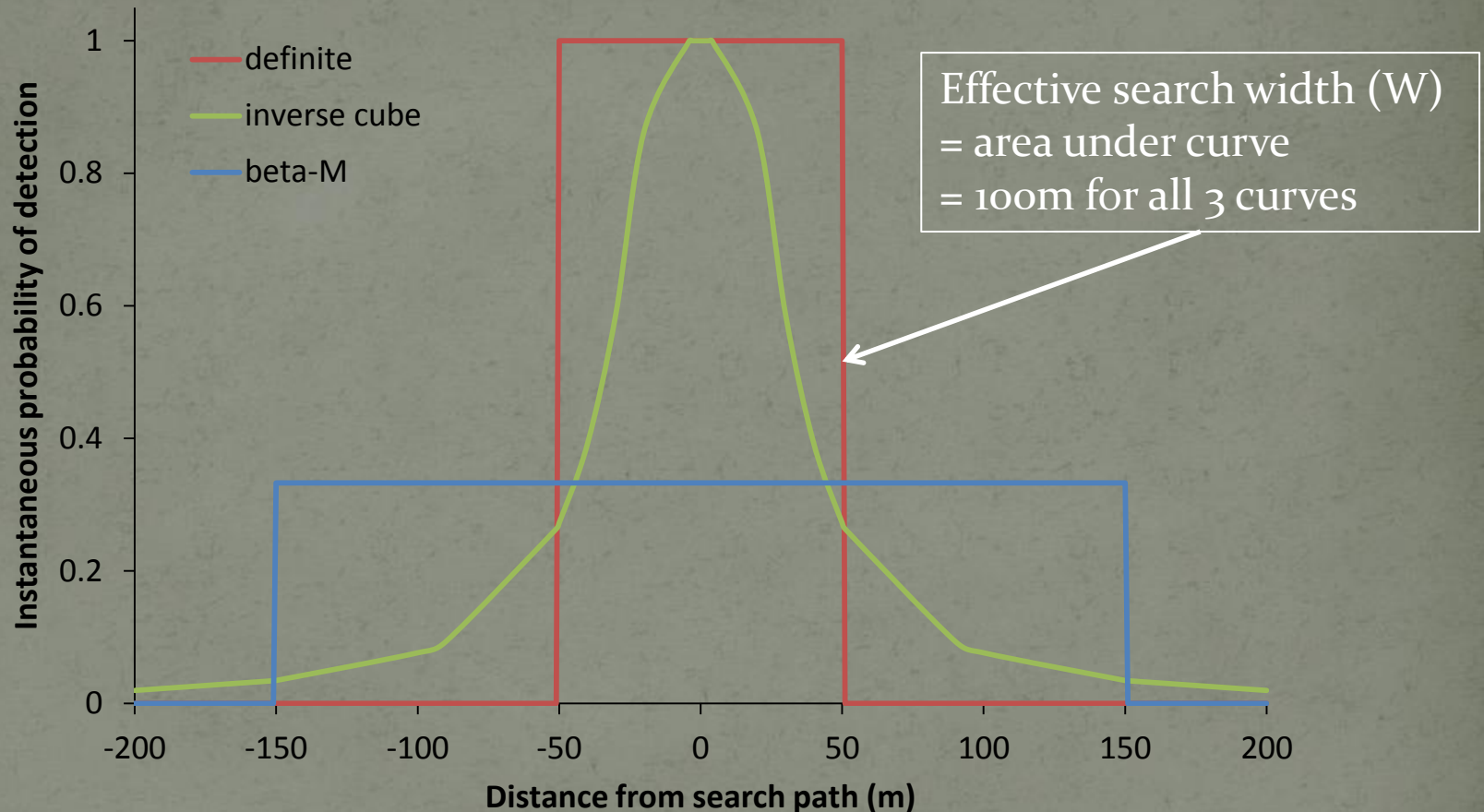
Landcare Research
Manaaki Whenua

Search theory

- Developed during World War II by B.O. Koopman
- Search targets enemy ships and submarines
- Elements of optimal search:
 - A prior probability density distribution on target location (probability of containment, POC)
 - A detection function relating search effort density (Coverage) and the probability of detecting (POD) the target if it is in a searched area
 - A constrained amount of search effort
 - An optimization criterion of maximizing probability of finding the target (probability of success, POS) subject to the constraint on effort



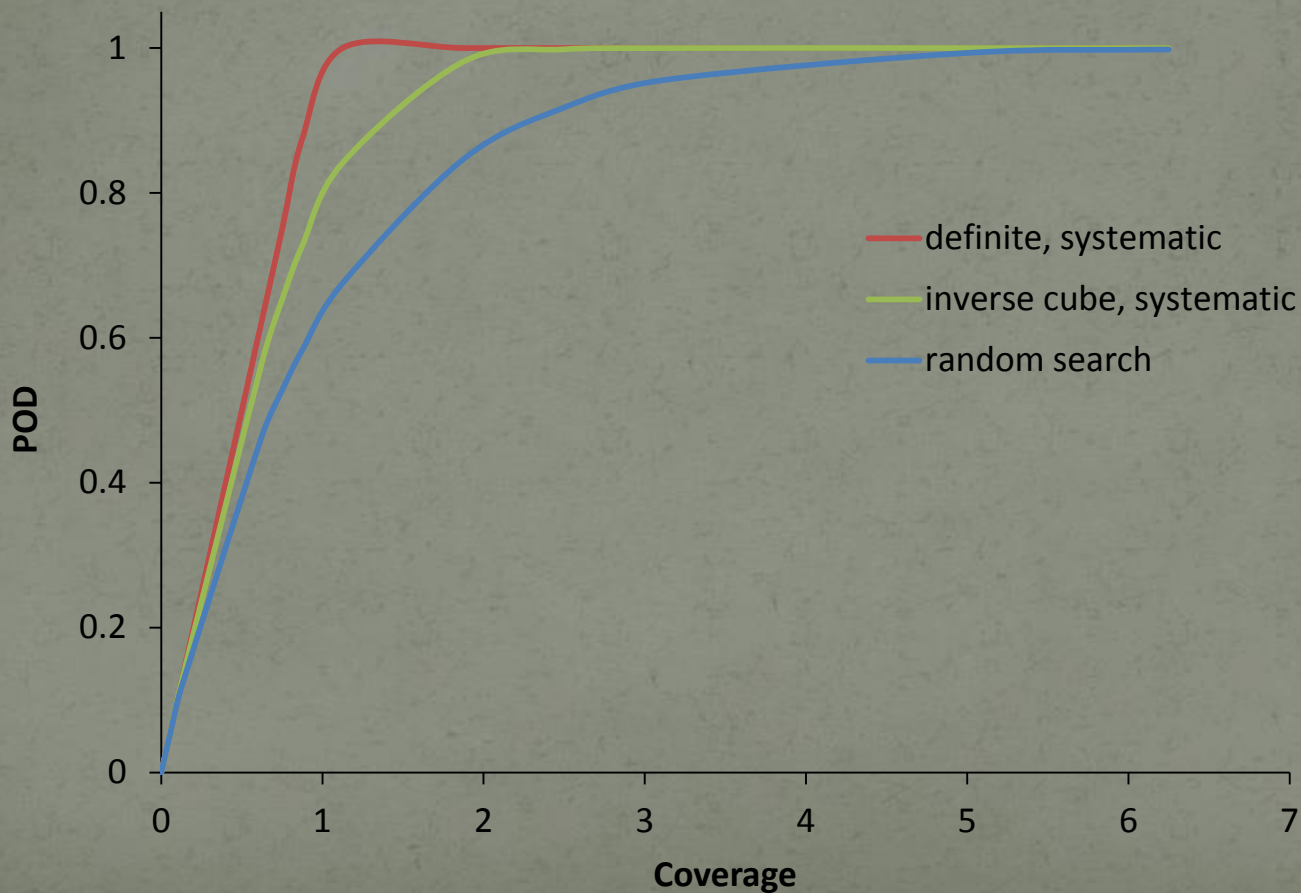
Search coverage – Effective search width



- Coverage (C) =
$$\frac{\text{Effective search width (W)} * \text{distance travelled (L)}}{\text{Area to be searched (A)}}$$

Probability of Detection (POD)

- A function of coverage and search path layout

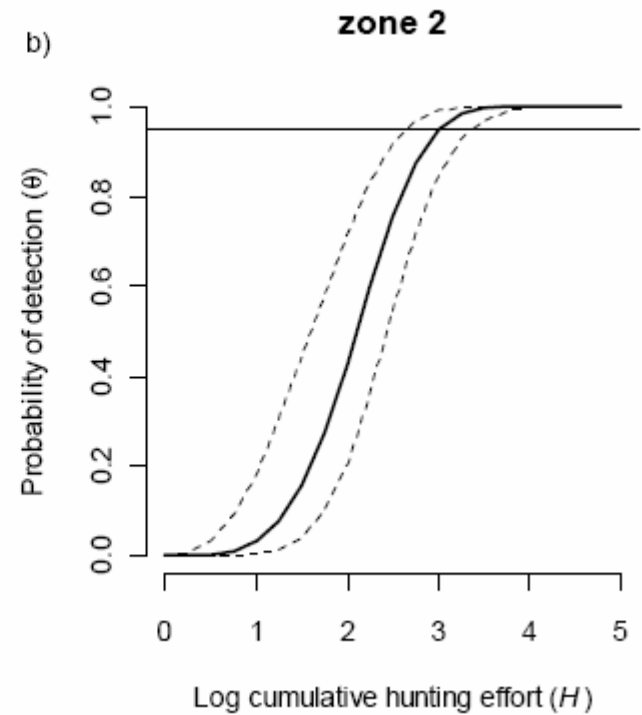
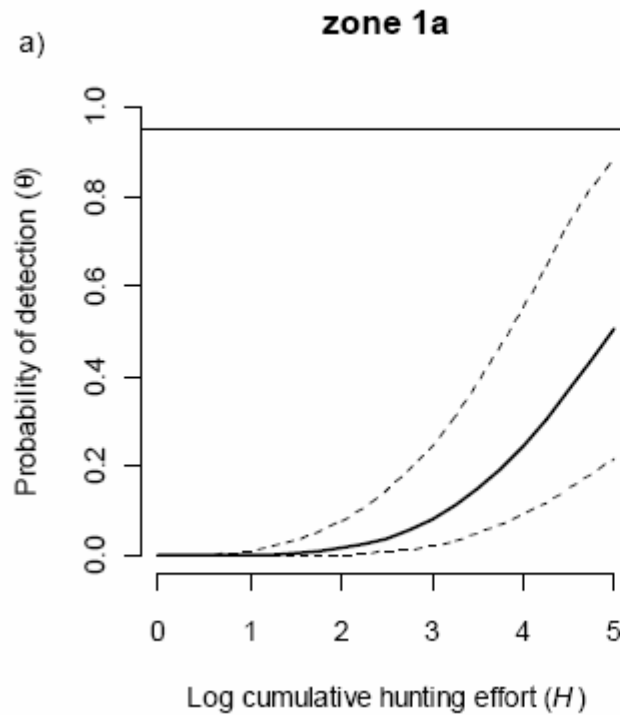
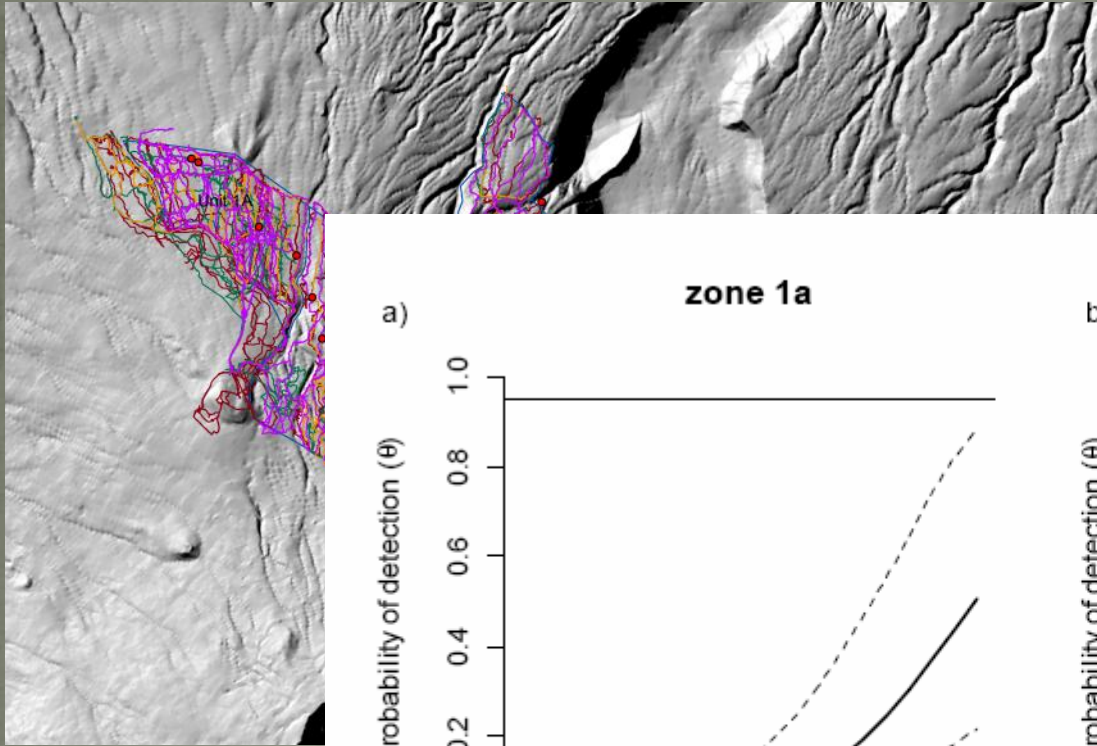


How does this relate to pest control or eradication using hunting?

- Probability of detection (POD) can be used to:
 - Estimate how much effort required to detect target individuals
 - How much effort (with no detection) to achieved desired level of confidence in eradication of target population



Hawaii local eradication of pigs



Other considerations

- Random search assumes targets independently and identically distributed – social animals clustered in space
- Assumes stationary target – later developments in theory accounted for moving target but need to know something about rate of movement
- Optimisation of search across landscape requires knowledge of probability of finding targets in different areas – habitat suitability maps?