Landcare Research
Manaaki Whenua

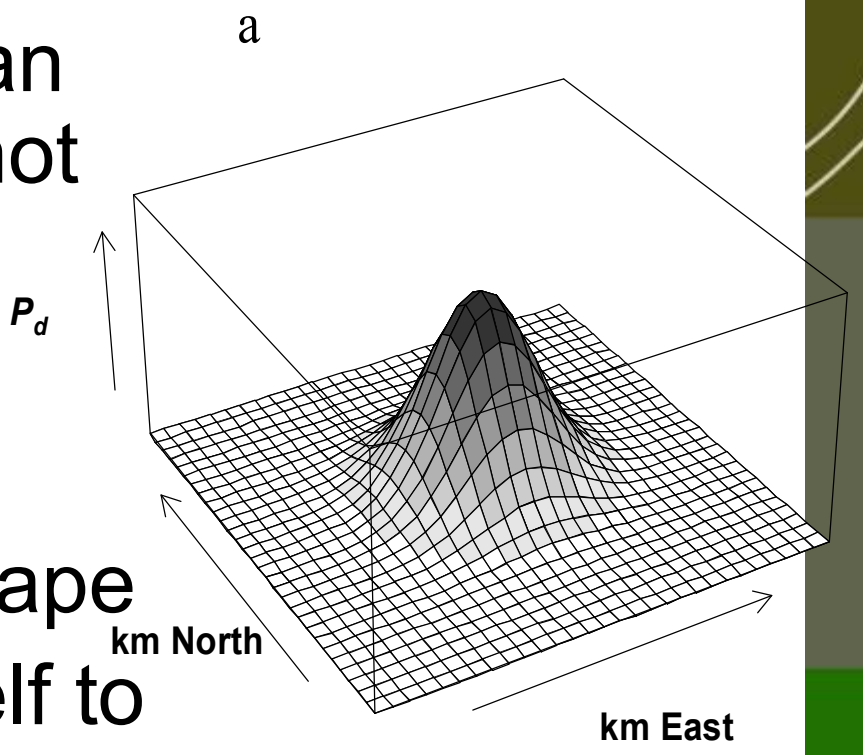
Probabilities of Detection

Why are they important?

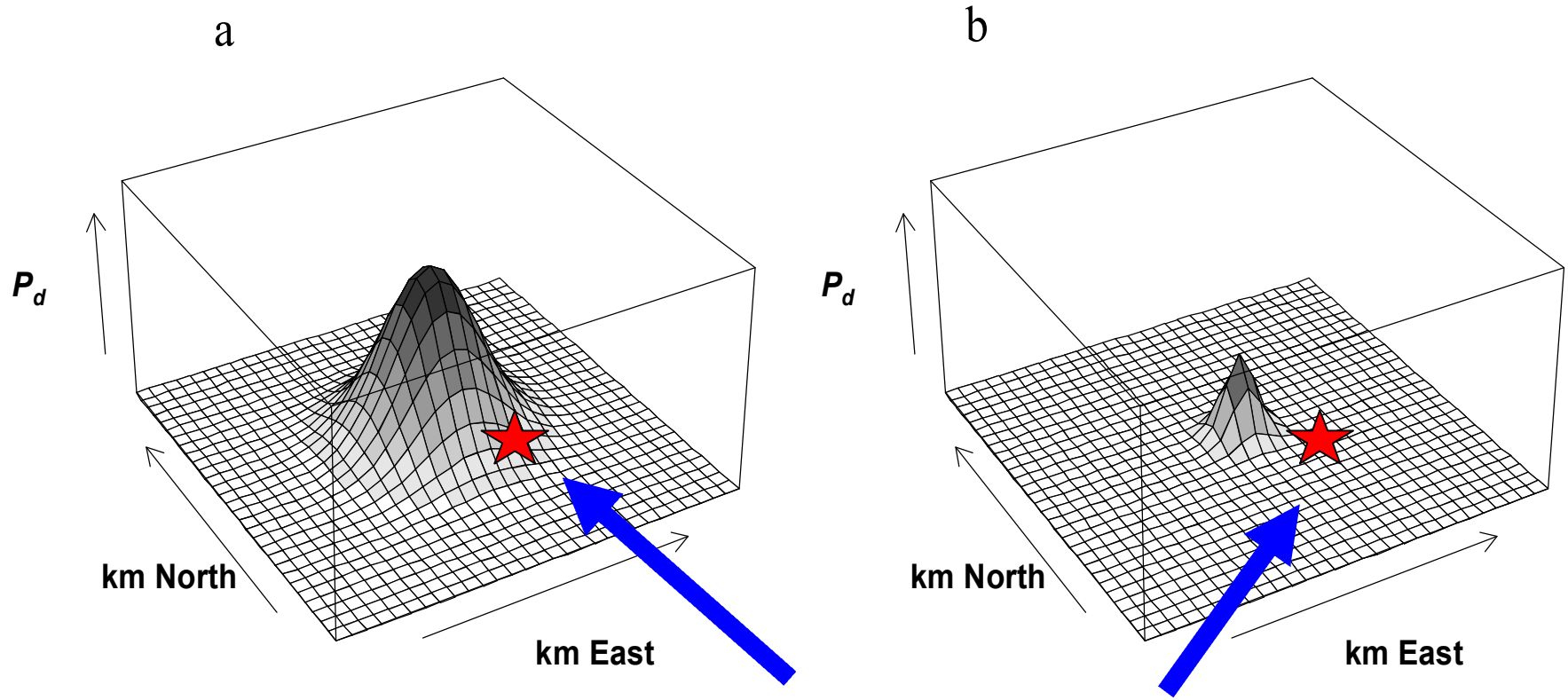
Andrea Byrom, Dave Ramsey, John Parkes,
Dean Anderson, Richard Clayton, Dianne Gleeson
(with thanks to Grant Norbury)

What do we mean by ‘probability of detection’?

- The probability that a pest or disease persists in an area given that it has not been detected
- Search theory
- Pests on islands
- Disease (Tb) in landscape
- The problem lends itself to Bayesian approaches because of uncertain data



Detection probability: home range coverage



Greater coverage
Higher probability of detection
Smaller coverage
Lower probability of detection

Device (trap) in home range

Probability of detection

Two examples

- Feral pigs, Santa Cruz Island, California
- Stoats, Resolution Island, Fiordland

Why eradicate pigs from Santa Cruz?

- Direct impacts – vegetation, rooting
- Trophic cascade
  - remove sheep = more grass = more pigs = golden eagles = predation on kit foxes = extinction of foxes a secondary prey

Santa Cruz Island

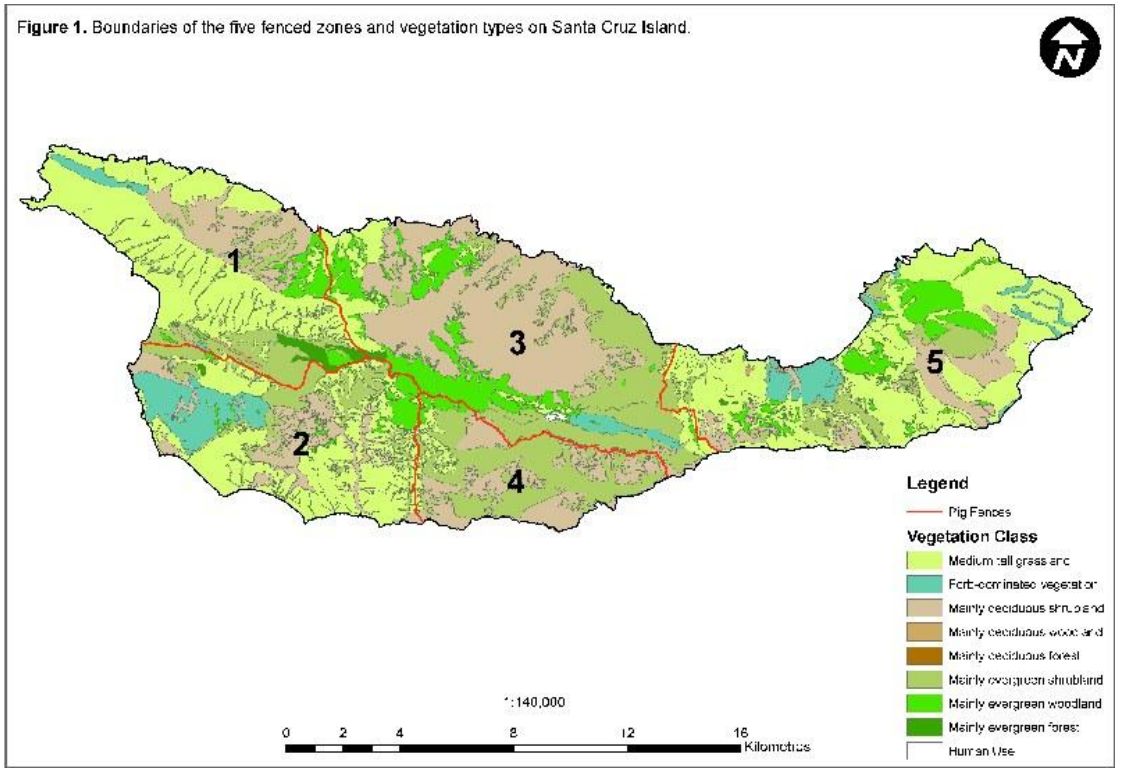
- 25 138 ha
- 480 plant species (8 endemic)
- 3 amphibians, 6 reptiles, 42 birds, 12 mammals (5 endemic)

Pigs

- Even less chance when eradication is achieved by successive culls
- But, Prohunt led the way in aiming for as close to 100% at first encounter as possible
- Sequential use of control tools with those ‘teaching’ survivors most used last

Santa Cruz methods

- Fenced into five zones
- Trapped
- Aerial shooting
- Ground hunting with dogs
- Judas pigs

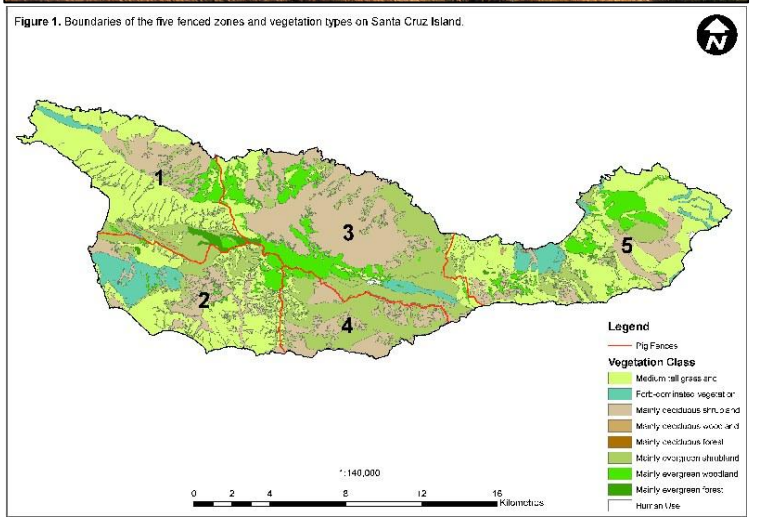


Total number pigs killed on Santa Cruz (just over 1 year of eradication)

- March 2005 to June 2006
- 5042 pigs killed
- 64% of 3457 sexed were males
- (tough conditions for sows?)

Fences

- 42.6 km (5 zones)
- $42 000/km
- (Up to $200 000 /km for fences that exclude from mice upwards)



Trapping

- 102 traps set
- 814 pigs caught (16.1% of total)
- Traps caught 40% of the pigs living within their ‘catchment’ areas
- All trap locations GPSd and trapping effort recorded

Aerial shooting

- 3875 pigs shot from the helicopter (77%)
- 67–94% of pigs under the helicopter were detected and shot
- Flight paths all GPSd

Ground hunters with dogs

- Used team hunting (ProHunt)
- 2 sweeps of each zone + ‘hotspotting’
- 12 hunters and 23 dogs
- Dogs trained to avoid non-targets
- All with GPS collars

Ground hunting results

- 211 pigs killed in first sweep
- 46 pigs killed in second sweep
- 4 pigs killed in ‘hotspotting’

Judas pigs

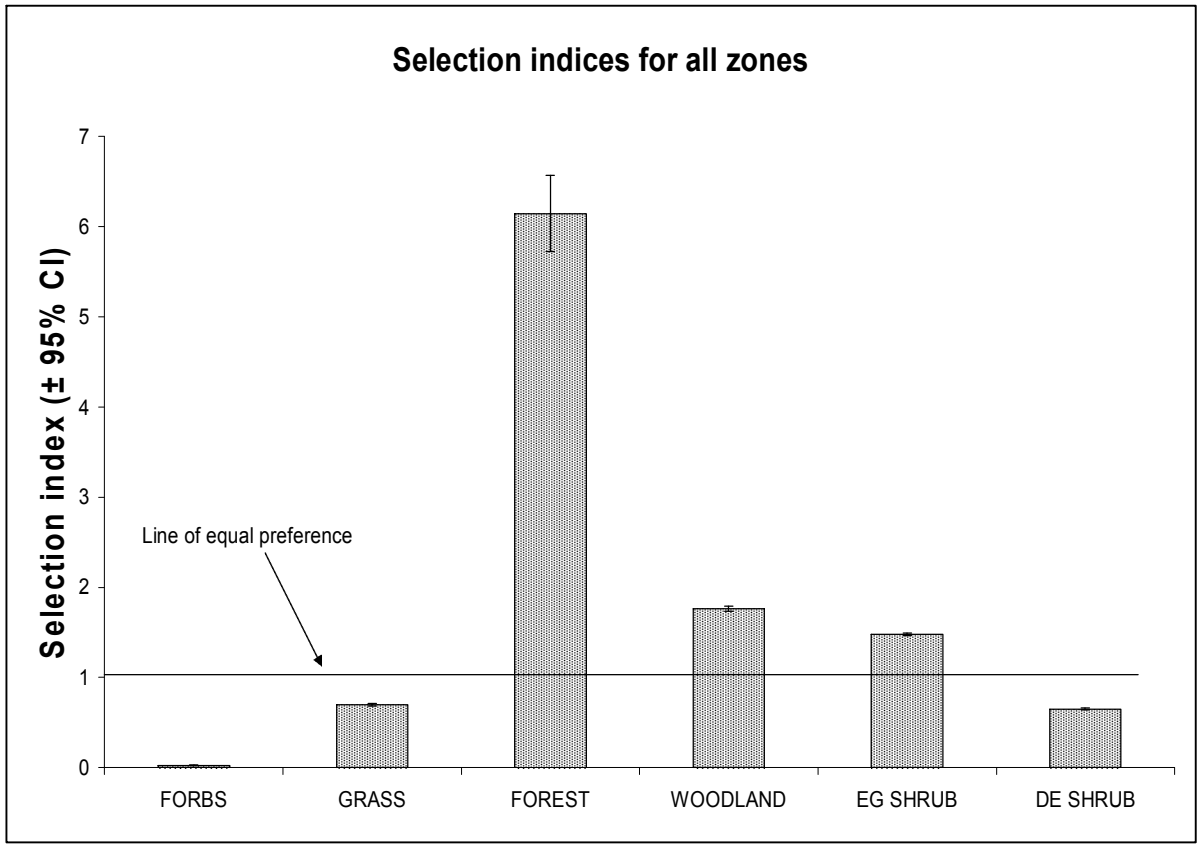
- Final method: VHF and GPS collars
- Radio-collared or GPSd pigs were located in all 5 zones
- 27 boars and 41 sows (sterilised and induced into oestrus) used as Judas pigs
- 16 wild pigs killed with boars
- 73 wild pigs killed with sows
- Judas sows largely attracted wild boars

How were the last (63) pigs killed?

- 33.3% were shot from the helicopter
- 61.9% were killed by ground hunters
- 1.6% was trapped
- 3.2% were shot as ‘miscellaneous’
- Only 11.8% were as a result of associating with a Judas pig

- In a separate part of the study, 99 pigs had GPS collars attached
- Either released into home zone
- Or translocated between zones
- Some examples ►

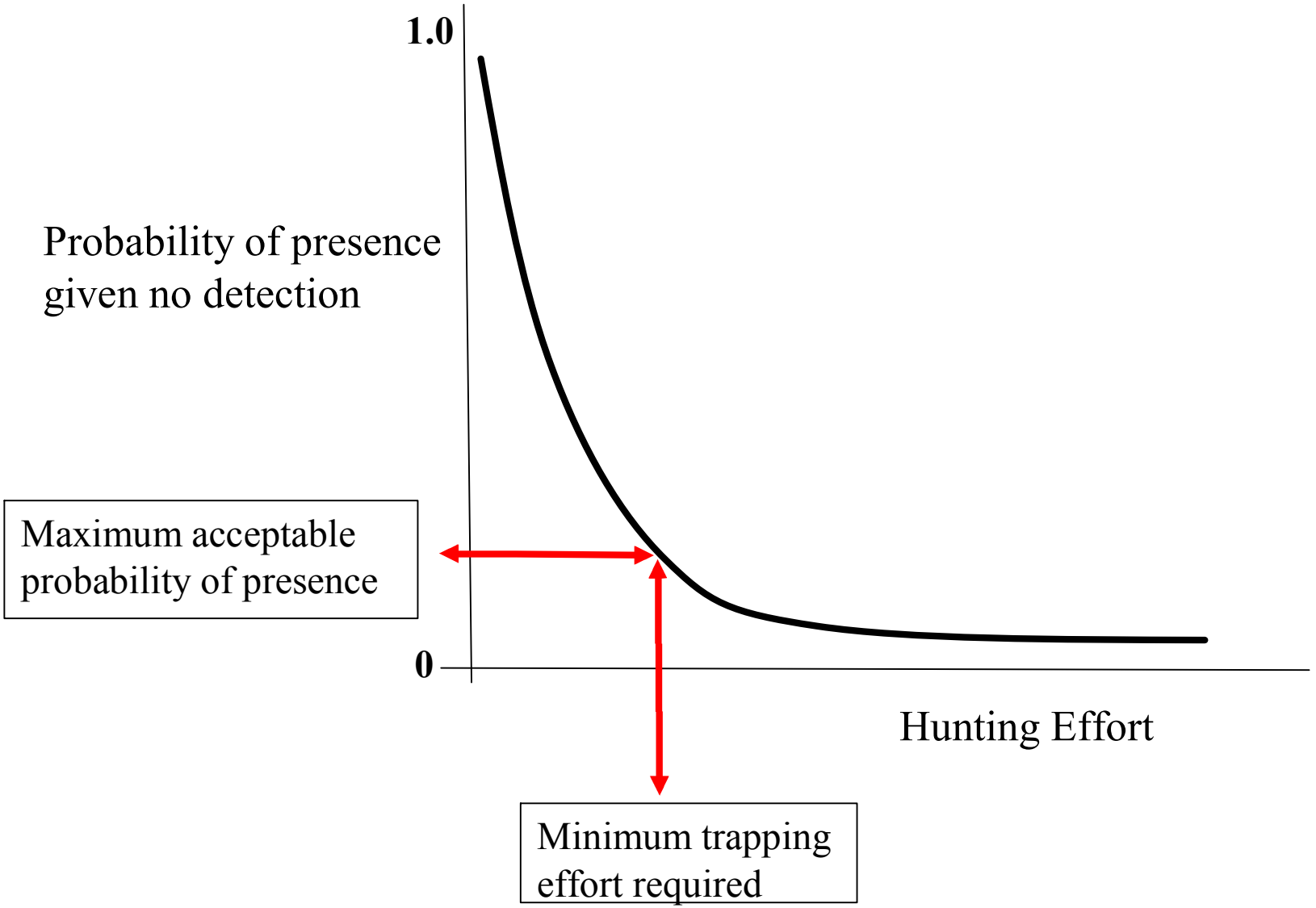
Habitat preferences of pigs



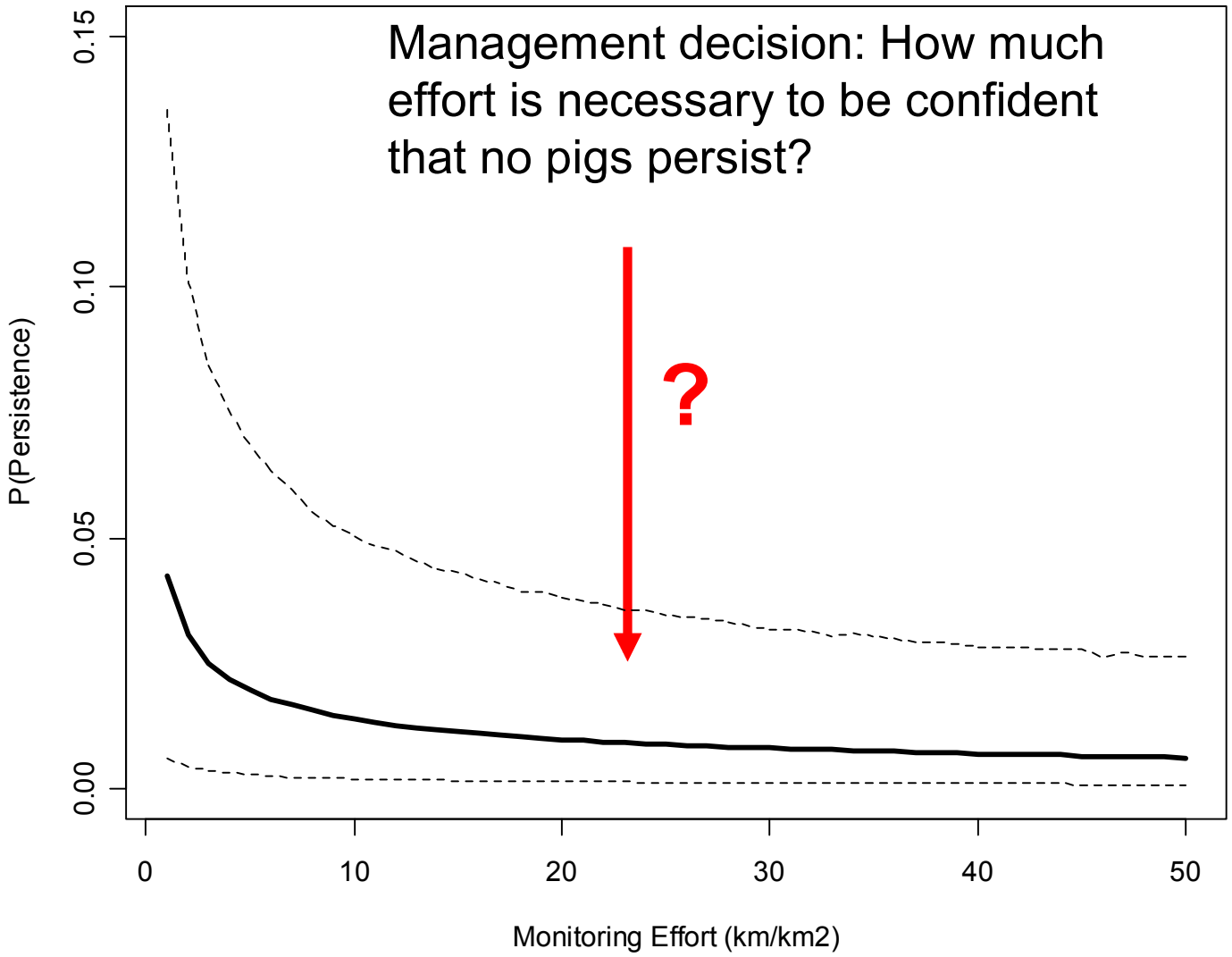
- Preferred forest, woodland and evergreen shrub habitats
- Avoided forb (=fennel) habitats

All useful information for estimating probability of detection

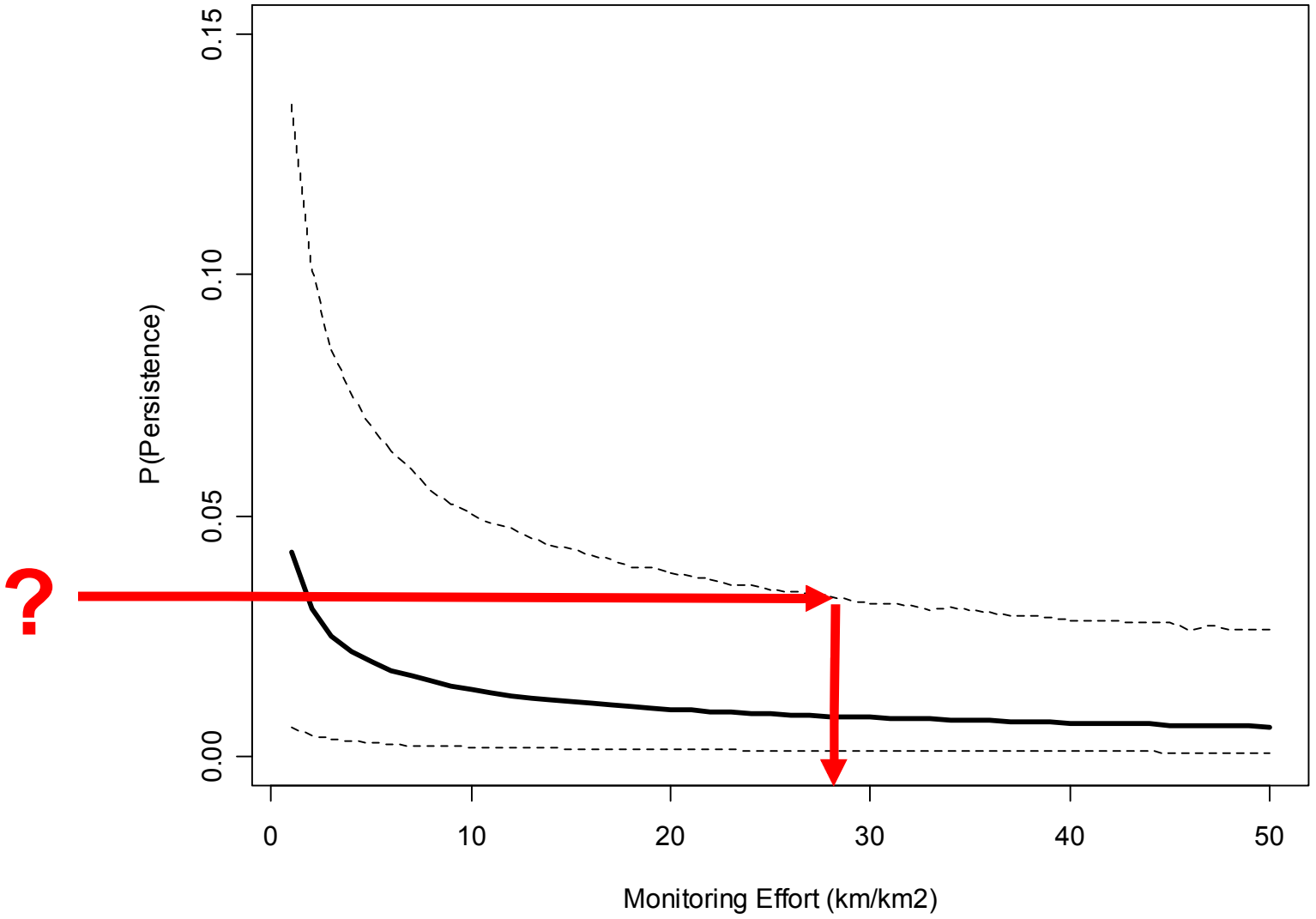
Thinking in probabilities



When to stop monitoring?

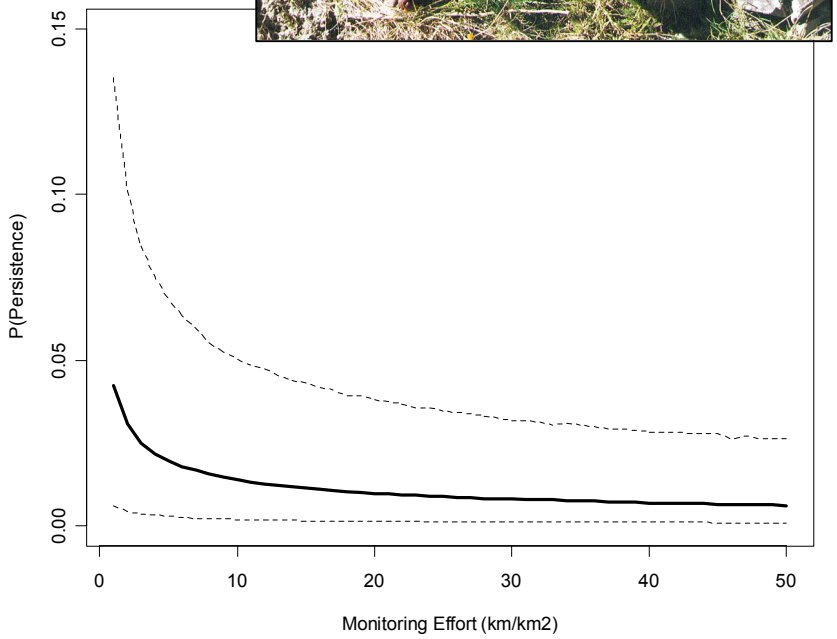


Management Goal:
The highest acceptable level of probability of persistence determines minimum monitoring effort



When to stop monitoring?

- You can never be sure that there are NO pigs left on Santa Cruz
- But you can be sure, with 95% or 99% or 99.9% certainty that there are no pigs
- The longer you monitor, the greater your certainty
- But it costs more
- This is true for any eradication attempt on any species

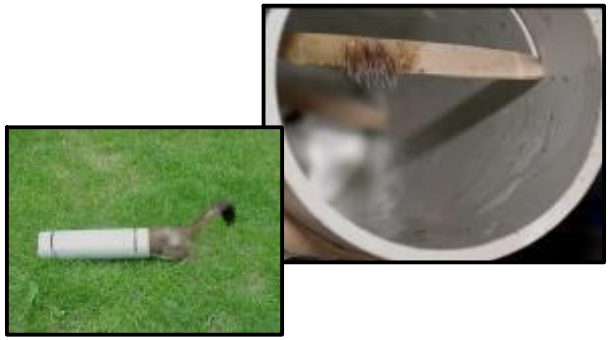


Stoat detection probabilities

Resolution Island

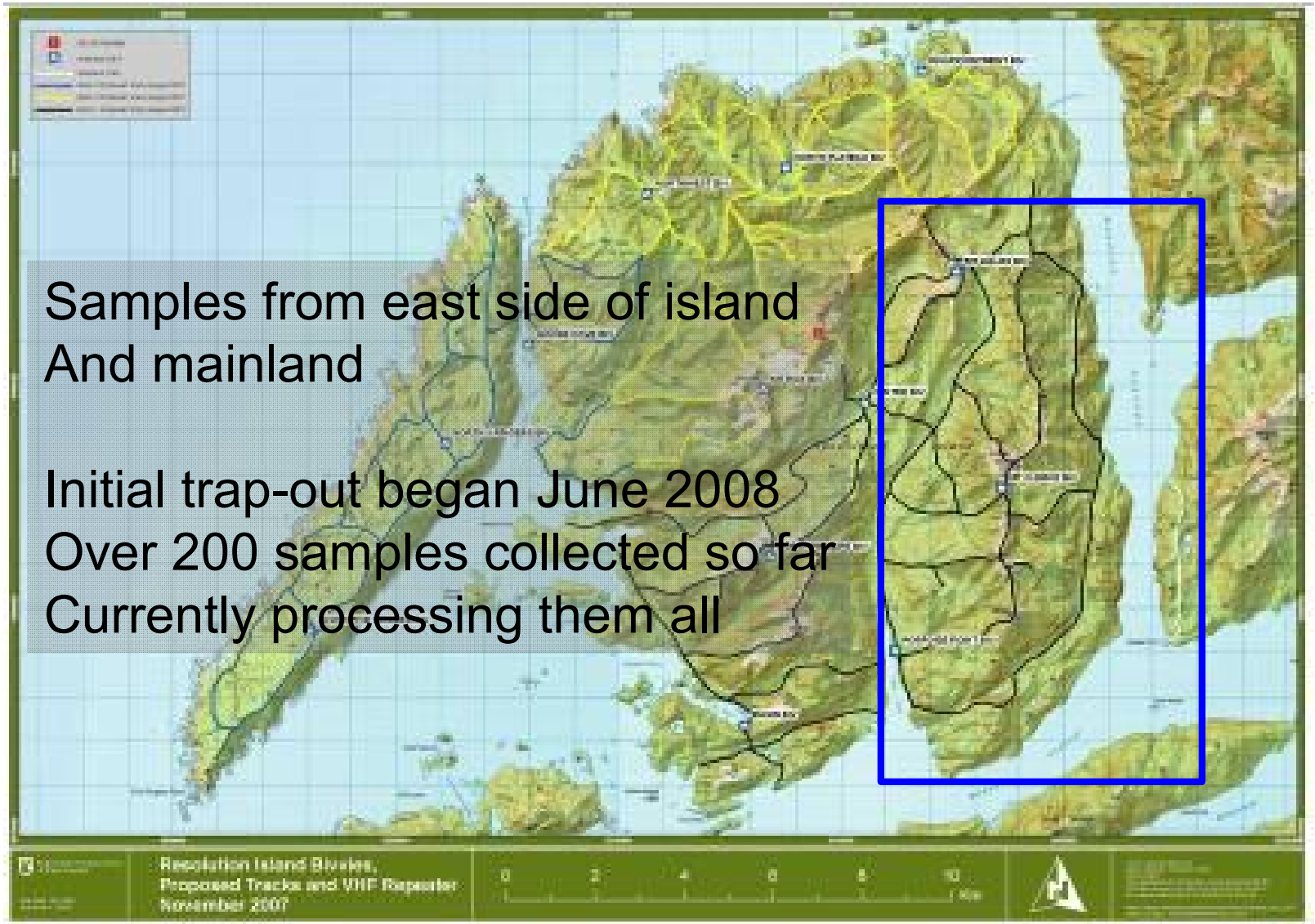
Use of DNA to detect immigration after stoat control

- Joint project with DOC
- Post-eradication stoats will be immigrants or survivors
- Genetic relatedness: can provide 'probability of assignment' based on particular suites of alleles
- Probability of detection – traps vs hair tubes



Stoat detection probabilities

Resolution Island



Stoat detection probabilities

Resolution Island

- Kill traps placed May 2008 (DOC)
- Hair tubes placed & sampling occurred June 2008 (LCR)
- Continued sampling of kill traps and hair tubes until November 2008
- High – low population density of stoats

How can YOU estimate the probability of detection?

- This is a new field of research
- We are still working out the complex statistics behind it all

- Some simple things to do:

Record types of devices (traps, bait stations) you use

Record total number of devices

Spatially-reference (GPS) devices you use, as well as the total area covered

Record habitat type if possible

Use of multiple methods is good (e.g. traps and hair tubes)

Advances in pest detection

- Chew cards (rodents & possums)
- Wax baits
- Other bait types
- Traps
- DNA (saliva, hair, scats)
- Dogs
- Tracking tunnels
- Scavenging carcasses
- Cameras

Thank you

- Foundation for Research, Science & Technology (stoats)
- And The Nature Conservancy, USA (pigs)
- DOC: logistical support for Resolution Island