Landcare Research
Manaaki Whenua

# Computer games as a novel medium for knowledge transfer

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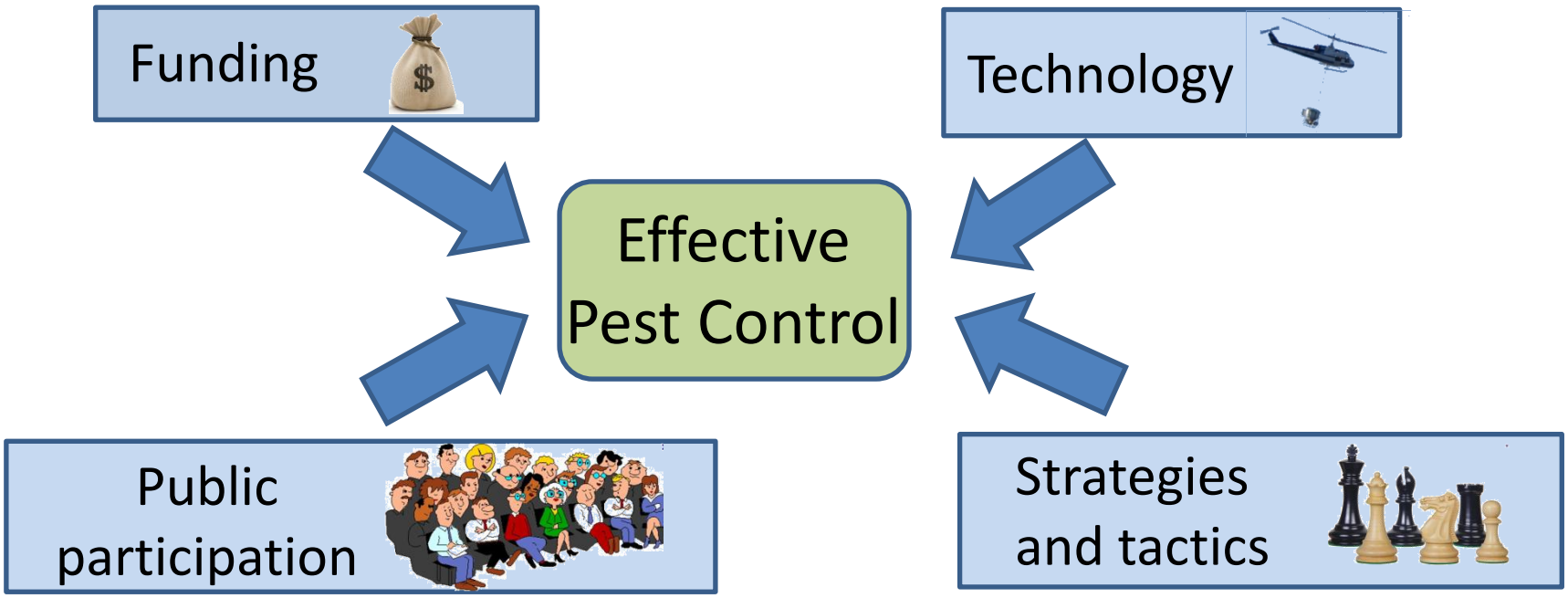
Human Interface Technology Laboratory New Zealand
www.hitlabnz.org

driedfrog
software & game development

# Industry Context




Department of Conservation
Animal Health Board
Regional Councils

# Research Context

MBIE funded programme:

**Strategic Technologies for Multi-Species Pest Control**

RA1 Reduce costs of aerial and ground-based control

RA2 Reduce adverse impacts (residues, welfare, non-targets)

RA3 Increase community participation

# RA1: Reducing costs...1

**Aerial control:**
(collaborative with DOC and Wanganui Aerowork)

- Reducing 1080 bait sowing rates
- Shifting from broadcast bait applications to strip sowing enabled use of fixed-wing aircraft to reduce costs and carbon footprint
- Required re-engineering of hoppers to handle sowing rates ≤1kg/ha (CAA approvals)

# RA1: Reducing costs...2

**Ground-based control**

- Developed low-cost stoat and rat trap (passed NAWAC trap testing for both species)
- Develop wireless networks for remote monitoring traps and cameras as sensors (Wireless Research Centre: University of Canterbury.)
- Increasing trap capture  and detection rates through improved understanding of encounter and interaction probabilities

# RA2: Reducing impacts

- **Anticoagulant residues**: Using *in-vitro* liver microsome assays to assess synergy between 1st and 2nd gen anticoagulants to develop products with lower persistence.
- **Non-targets:** Anthroquinone and de-pulegone as kea repellents for 1080 baits.

- **Improve 1080 welfare** by addition of physiological stimulants to shorten time to death.

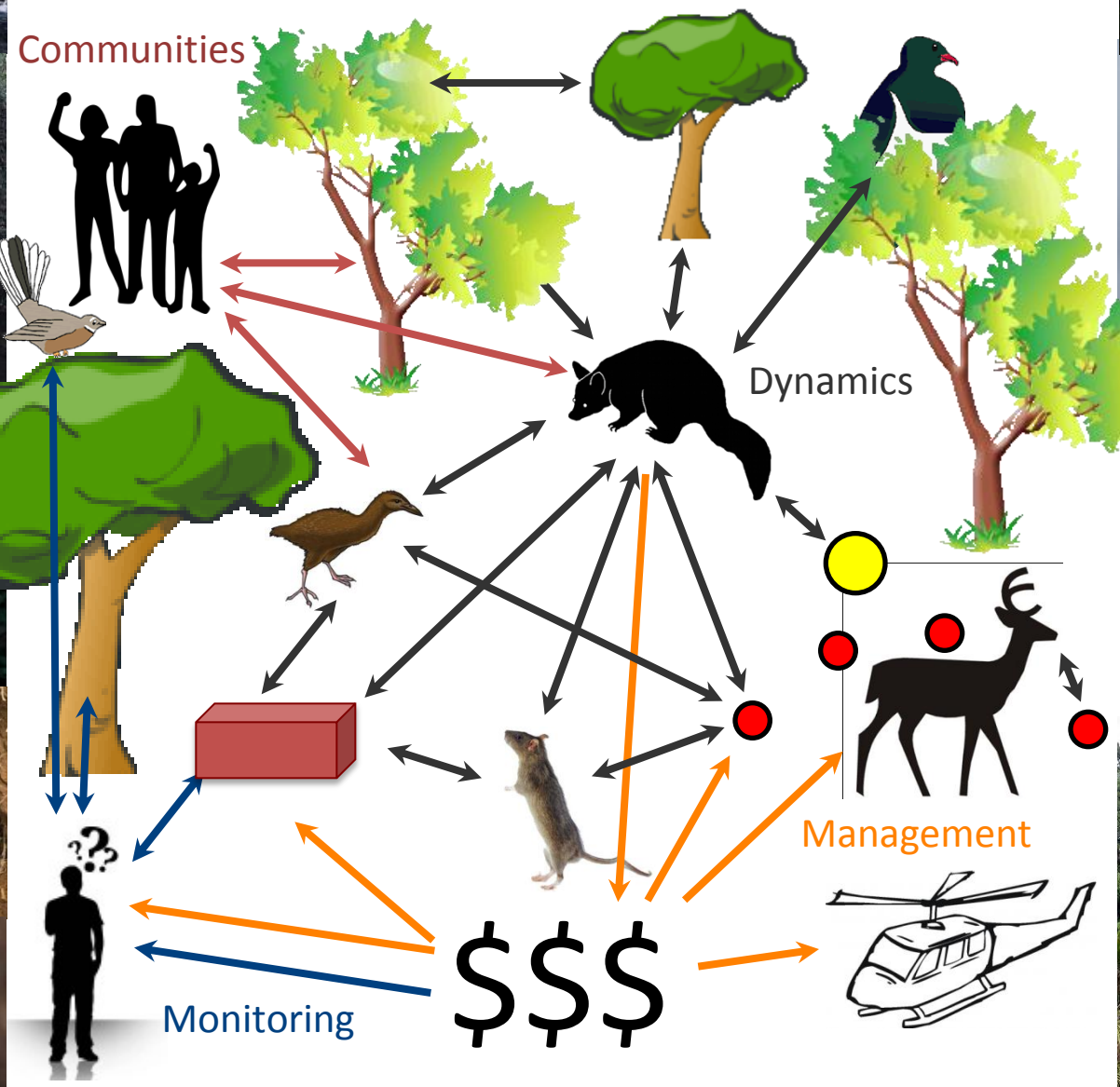
# RA3: Increasing community participation

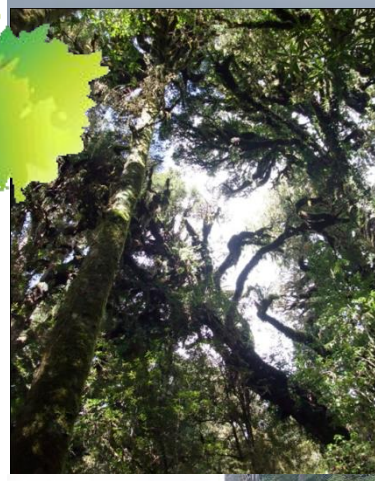
- Three case-studies to:
  - Determine appropriate approaches for community engagement
  - Apply these approaches to local pest control decisions (Kumara, Auckland, Eastern BOP)

- How best to get all participants informed?
  - Can computer games help???

# Pest control for biodiversity



# A Wicked Problem

Strategic technologies for managing pests

- Complex interactions
- Restricted resources
- Multiple stakeholders
- Conflicting views

# A Wicked Problem

Strategic technologies for managing ~~pests~~ people

- Scientific knowledge transfer
- Communicating complexity
- Community engagement
- Accepting compromise

# Engaging people with science

*Austral Ecology* (2001) **26**, 571–581

**BMC Ecology**

BioMed Central

Commentary

Open Access

**Troublesome toxins: time to re-think plant-herbivore interactions in vertebrate ecology**

Robert K Swihart*[1], Donald L DeAngelis[2], Zhilan Feng[3] and John P Bryant[4]

Heterogeneity in vertebrate and invertebrate herbivory and ts consequences for New Zealand mistletoes

LAURA A. SESSIONS* AND DAVE KELLY

*Plant and Microbial Sciences, University of Canterbury, Private Bag 4800, Christchurch, New Zealand (Email: l.sessions@botn.canterbury.ac.nz)*

*Ecology*, 89(3), 2008, pp. 621–634


WHAT CAN WE LEARN FROM RESOURCE PULSES?

LOUIE H. YANG,[1,3] JUSTIN L. BASTOW,[1] KENNETH O. SPENCE,[2] AND AMBER N. WRIGHT[1]

[1]*Section of Evolution and Ecology, University of California, One Shields Avenue, Davis, California 95616 USA*
[2]*Department of Entomology, University of California, One Shields Avenue, Davis, California 95616 USA*

*Wildlife Research*, 2000, **27**, 69–74

**The role of non-toxic prefeed and postfeed in the development and maintenance of 1080 bait shyness in captive brushtail possums**

*J. G. Ross*[A], *G. J. Hickling*[A], *D. R. Morgan*[B] *and C. T. Eason*[B]

[A]Ecology and Entomology Group, PO Box 84, Lincoln University, Canterbury, New Zealand
[B]Landcare Research, PO Box 31-011, Lincoln, Canterbury, New Zealand

*Abstract*. Shyness to sodium monofluoroacetate (1080) in cereal bait can persist in sub-lethally poisone (*Trichosurus vulpecula*) populations for at least 2 years. We investigated the use of non-toxic cereal 'pr 'postfeed' as ways of inhibiting and overcoming such shyness. The postfeed result was also compared w

CSIRO PUBLISHING

www.publish.csiro.au/journals/wr

*Wildlife Research*, 2007, **34**, 67–76

**Optimising bait-station delivery of fertility control agents to brushtail possum populations**

*l M. Tompkins*[A,C] *and David Ramsey*[B]



SHORT COMMUNICATION

Large-tree growth and mortality rates in forests of the central North Island, New Zealand

Sarah J. Richardson[1*], Mark C. Smale[2], Jennifer M. Hurst[1], Neil B. Fitzgerald[2], Duane A. Peltzer[1], Robert B. Allen[1], Peter J. Bellingham[1] and Peter J. McKelvey[3]

**The evaluation of indices of animal abundance using spatial simulation of animal trapping**

*Dave Ramsey*[A,D], *Murray Efford*[C], *Steve Ball*[B] *and Graham Nugent*[B]

[A]Landcare Research, Private Bag 11052, Palmerston North, New Zealand.
[B]Landcare Research, PO Box 69, Lincoln, New Zealand.
[C]Landcare Research, Private Bag 1930, Dunedin, New Zealand.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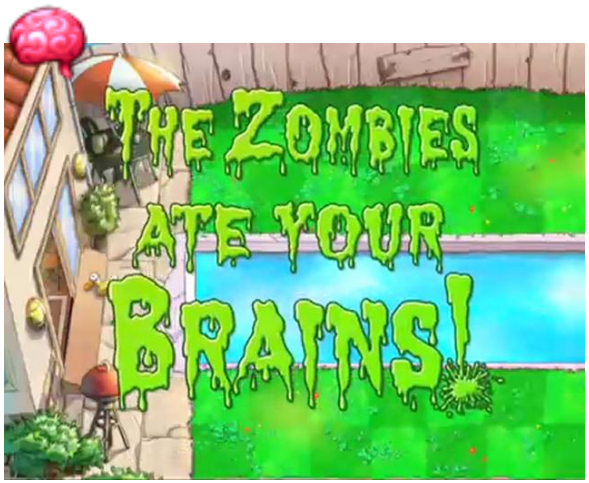
CHOOSE YOUR PLANTS!
Squash
Squashes zombies
Menu


PLANTS
VS.
ZOMBIES


575
Menu
$6070
Level 3-9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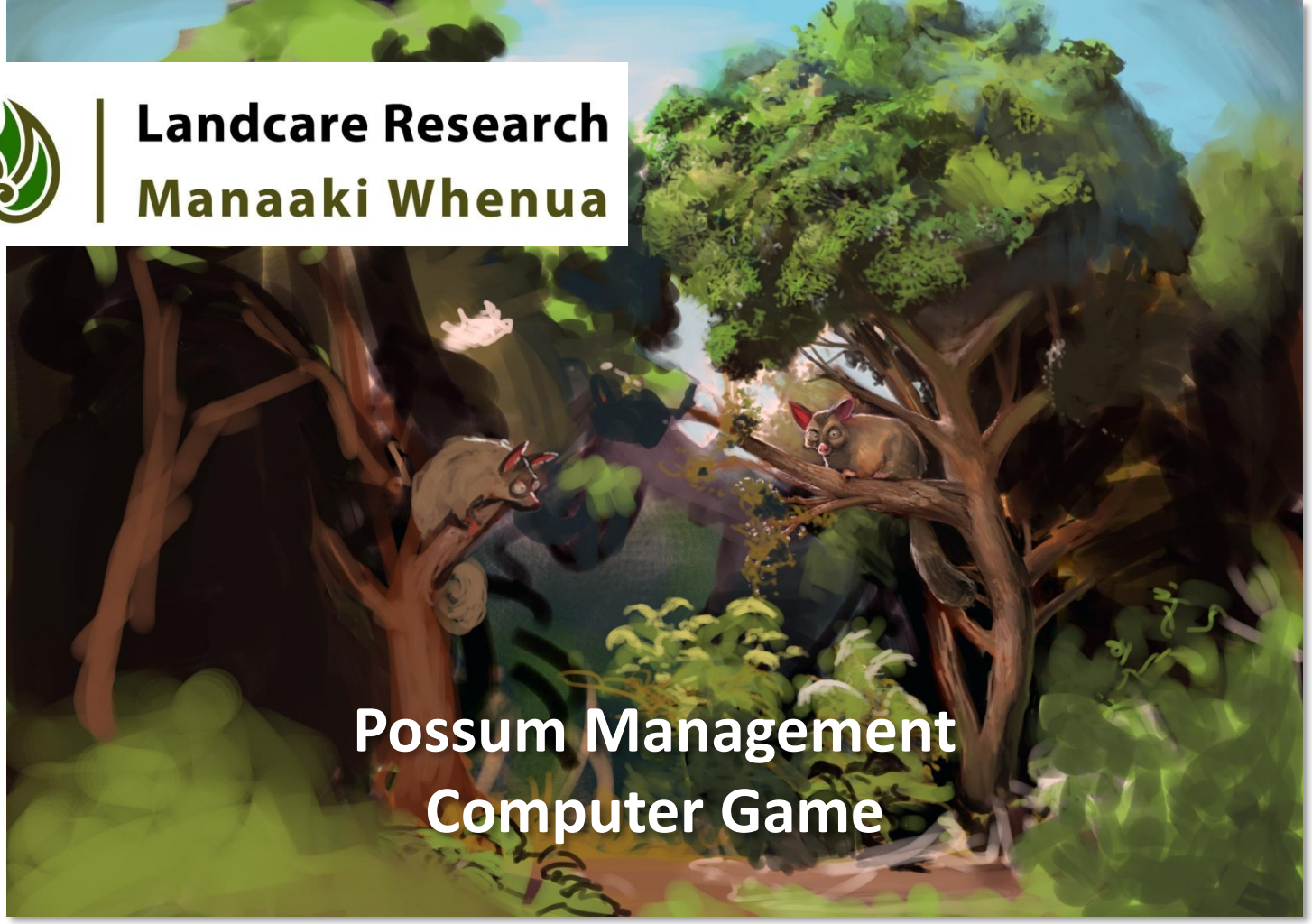


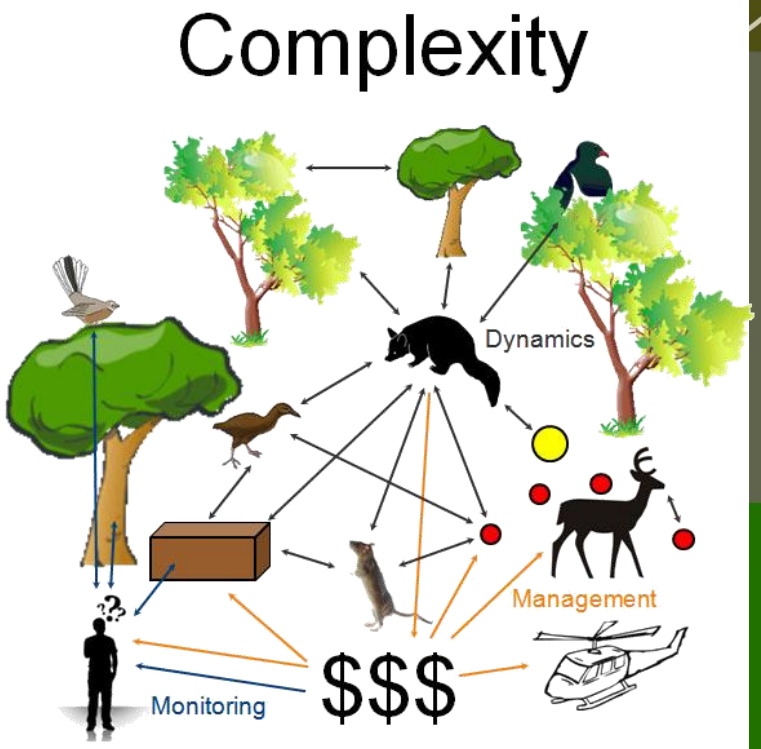

*A PhD research collaboration*
*with Hazel Bradshaw*
*of HITLab NZ & Driedfrog Ltd*

HITLabNZ
Human Interface Technology Laboratory New Zealand
www.hitlabnz.org

driedfrog
software & game development

# Rationale

- An aid to public dialogue and engagement with a complex problem
- Scientific knowledge transfer
- The use of novel media to present environmental information
- Innovative and engaging ways to implement and present research findings



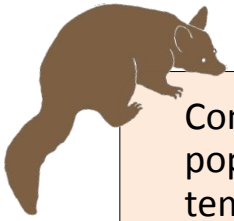
# Motivational Drivers

***Scientific*** ***Public***

Intrinsic motivation

Maintaining and restoring the eco system of NZ forests based on biodiversity conservation

extrinsic motivation



Controlling possum population dynamics temporal and spatial

Promote understanding and awareness of the effectiveness of available control options

Native bird recovery

Native tree recovery

100% NZ pure perception

Preserving game species

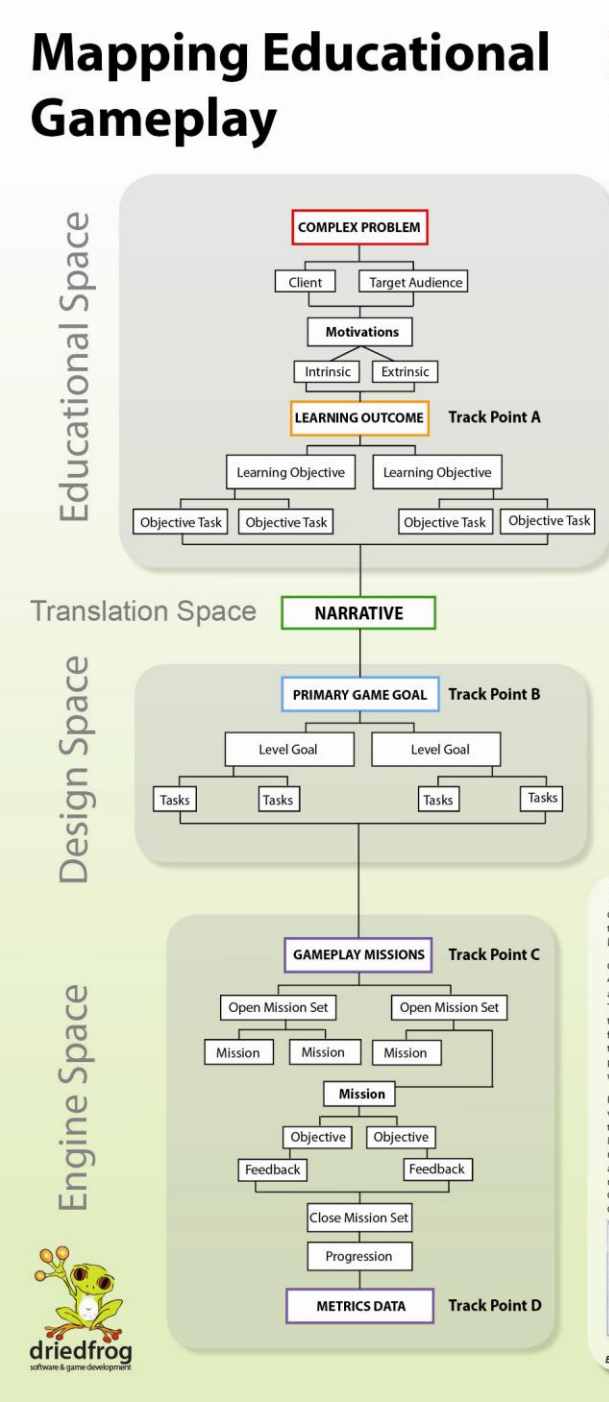
# Educational Purpose

- *Learning Outcome:* To gain a realistic appreciation that management of an ecosystem is a complex problem
- *Learning Objective:* Maintaining and restoring the ecosystem of NZ forests based on biodiversity conservation
  - *Objective Tasks:*
    - Monitor environment
    - Manage environment

# Research Purpose

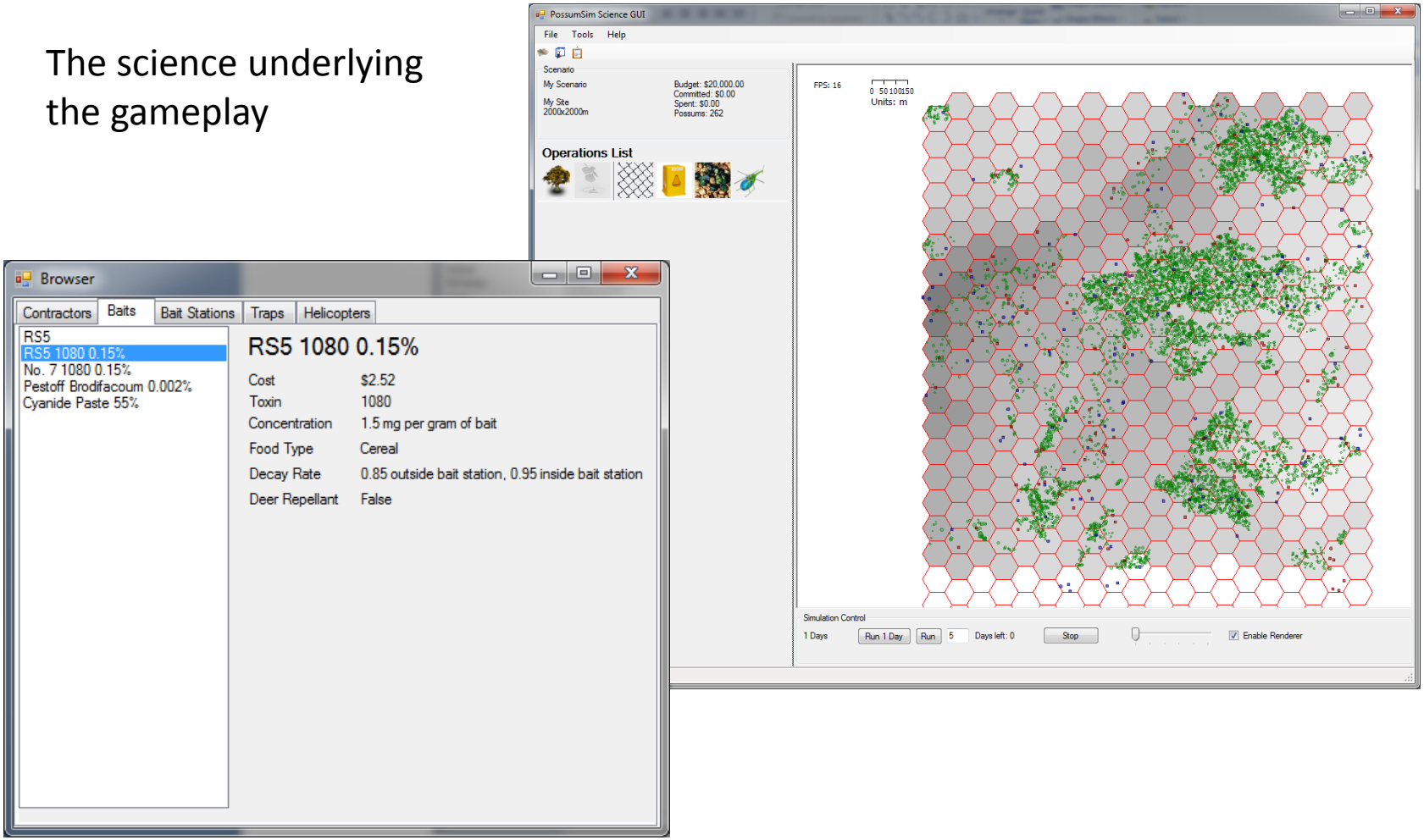
## Engaging Games for Learning & Knowledge Transfer

- Computer games provide **context based learning**
- Applies **systematic approach** for development of educational gameplay
- **Cost effective** design with maximum **educational impact**
- **Generalisable** across educational domains
- Appropriate for any game genre or gameplay environment – **2D or 3D**

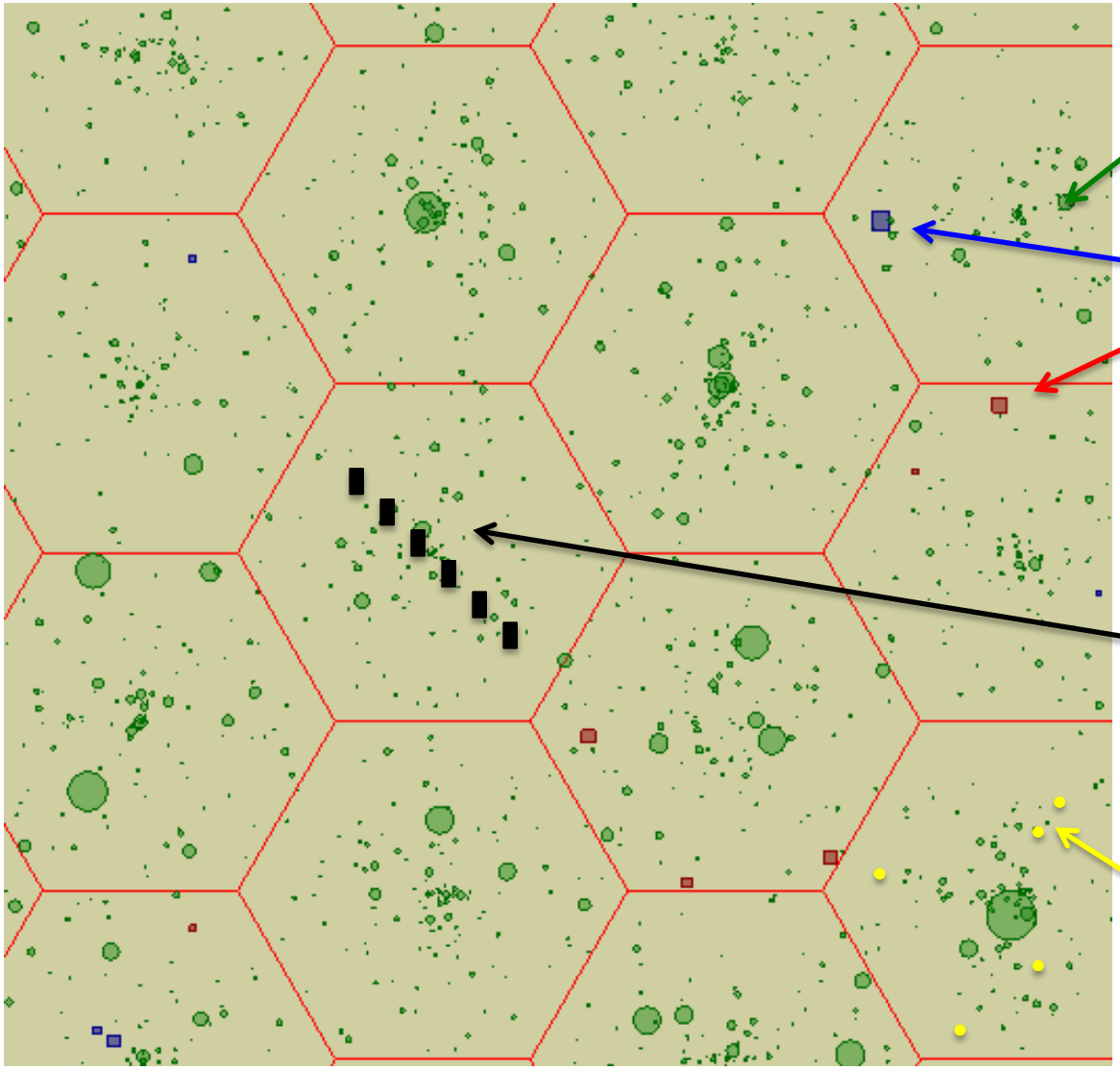


# Science Simulation

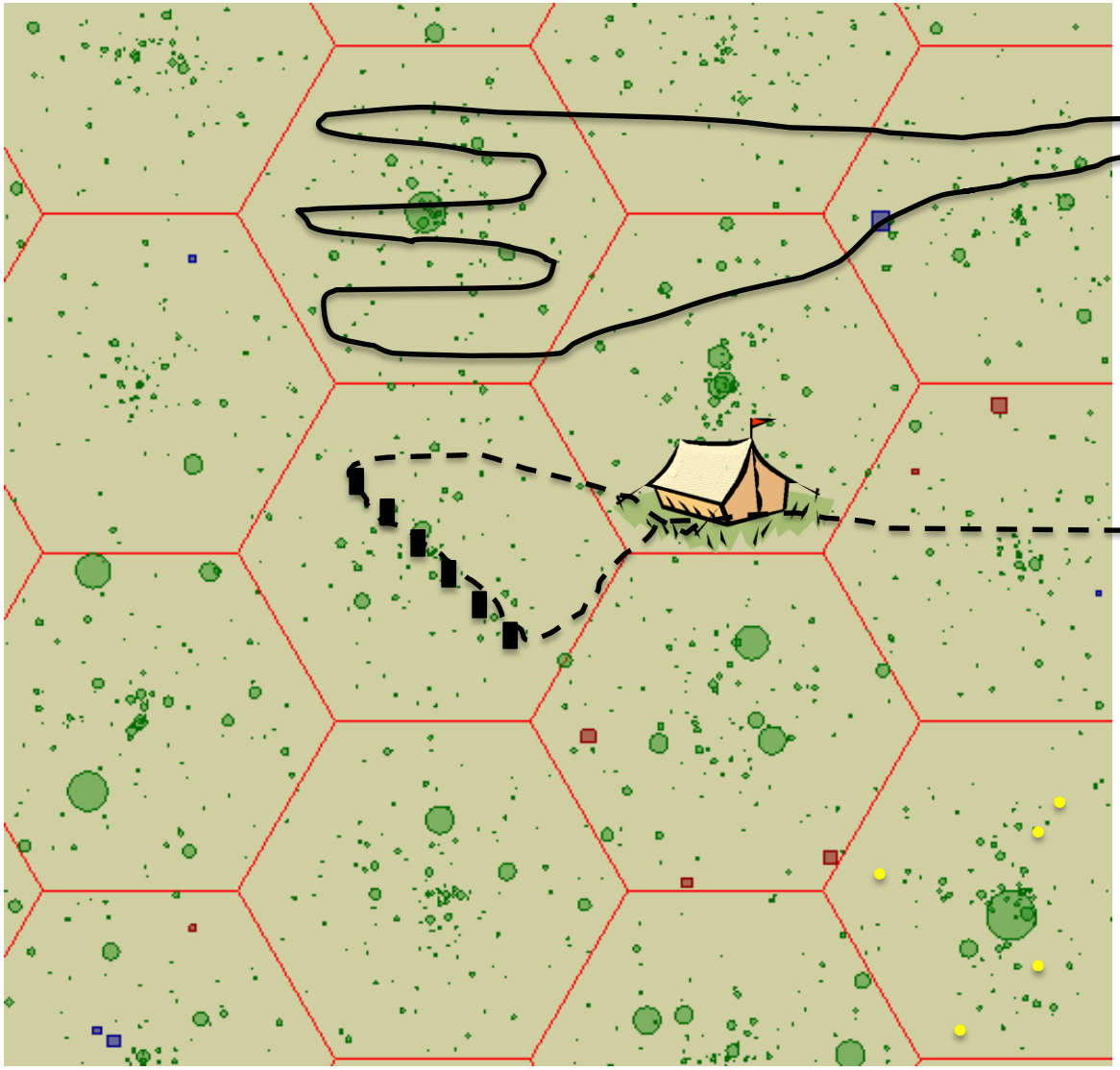
The science underlying the gameplay



# A spatial model



# A spatial model



Flight time

Contractor costs

Best routes

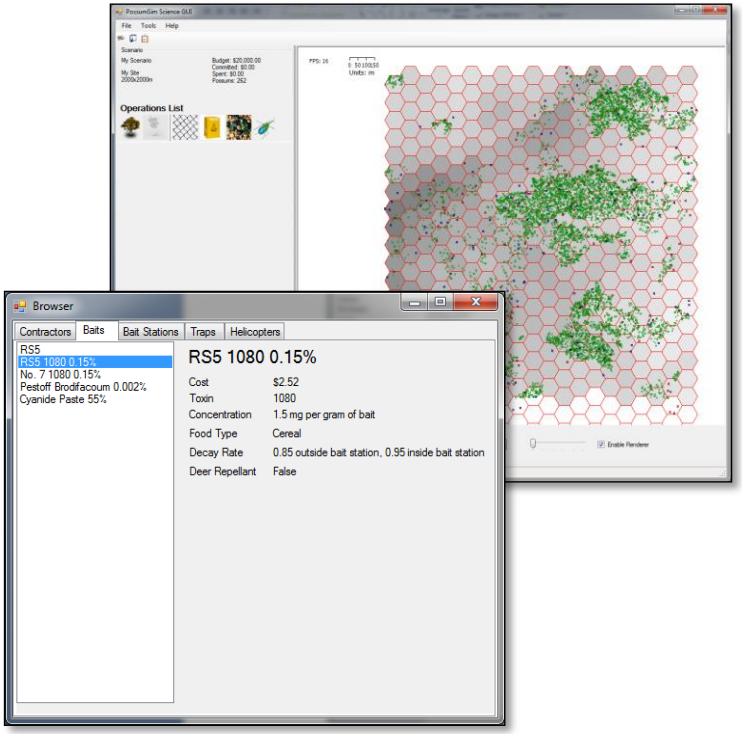
Equipment costs

# Demonstrations

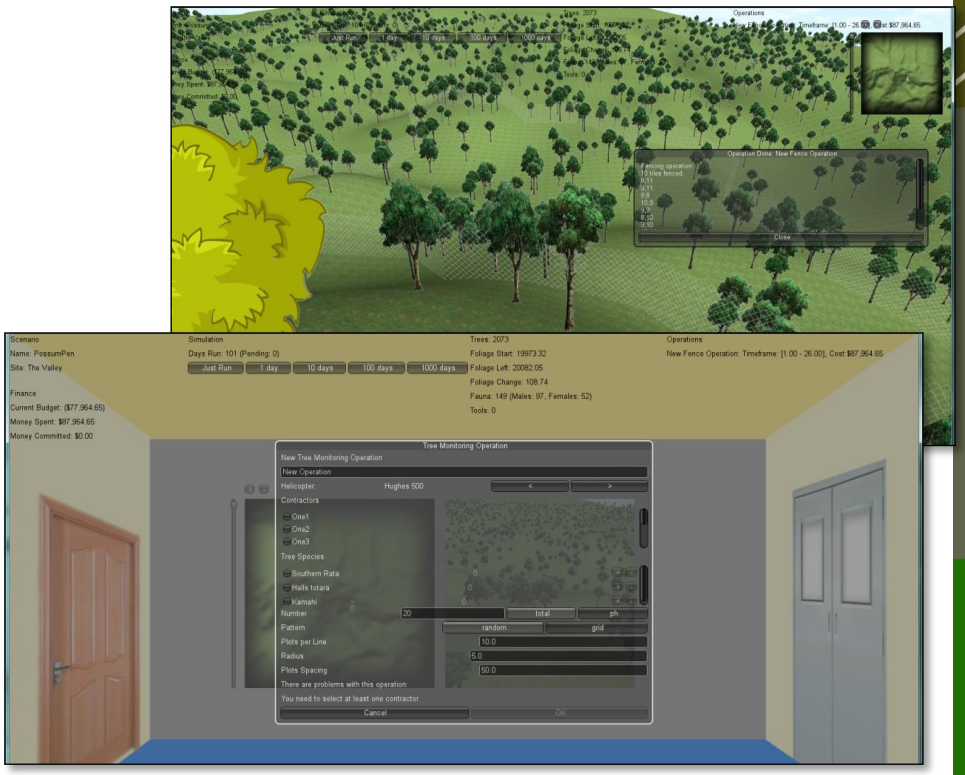
**Expert User**

**Pest Management**

**General Public**




Science Simulation GUI



3D Unity Game Engine simulation

# Computer Game

## The Story

- The public is the hero saving the fragile, beautiful but resilient ecosystem from the jaws of the invasive Brushtail possum.

## Gameplay goals

1. Save the native flora and fauna,
2. By repelling an army of mammalian pests led by marauding possums,
3. To restore the forest ecosystem to its former glory.

# Possum Game Structure

## Multi Level expandable gameplay

- **Level 1** – Ground operations
- **Level 2** – Aerial operations
- **Level 3** – Managing stakeholders
- **Levels 4+** Combination of levels 1-3 across multiple land sections

## An adaptive design system

- In-game ‘patching’ of new scientific research
- Expansion of science simulation for other invasive species control
- Direct delivery channel for public engagement with science concepts

# Level 1

**Level goal**: To create an area of forest suitable for a kiwi sanctuary.

**Outcome:** Show positive tree health and a healthy bird population.

**Action**: Reduce the Possum numbers in the area

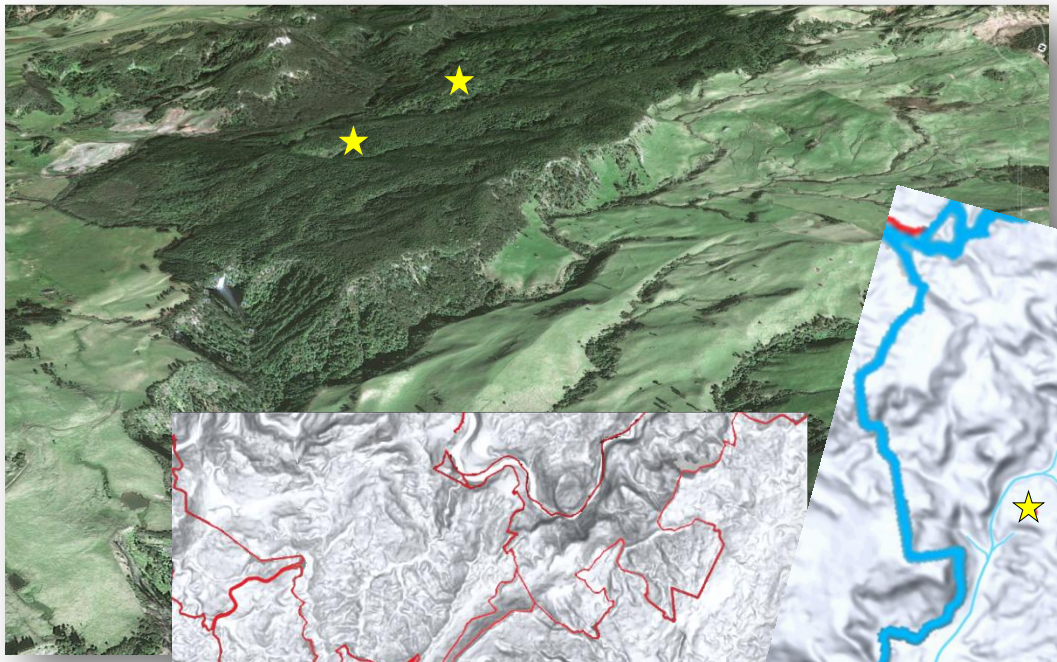
**Level Epic Win State** – All possums dead inside the fenced area, trees at 80% health or more and release of nurtured Kiwi bird.

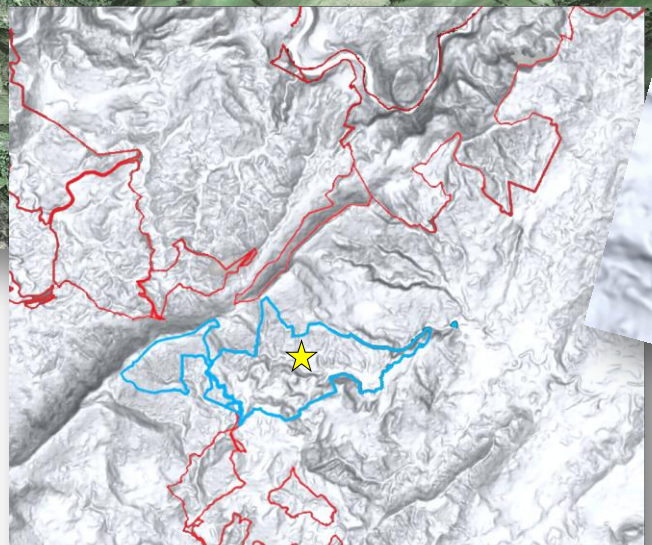
**OR**

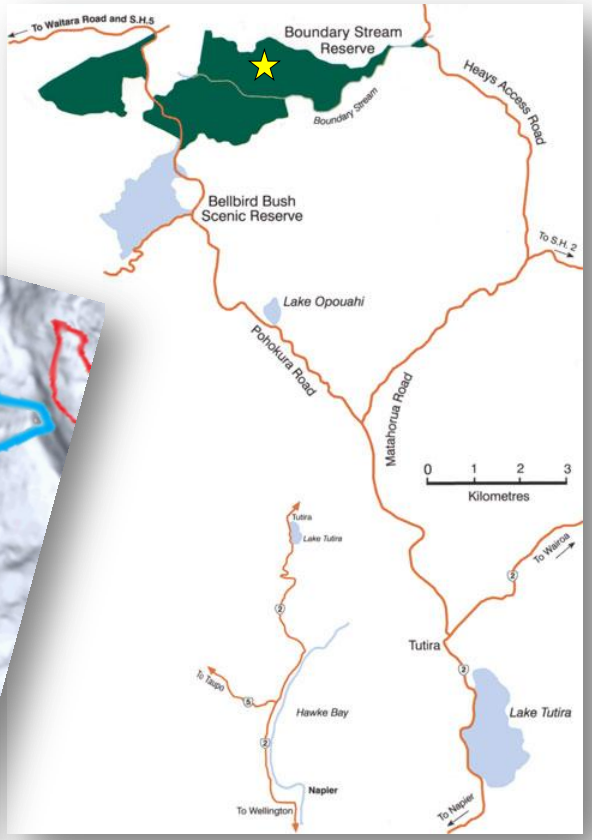
**Level Epic Fail State** - 100% possum health, 20% tree health and/or unhatched egg or released Kiwi.

# Setting – Level 1

## Boundary Stream Mainland Island – Hawkes Bay





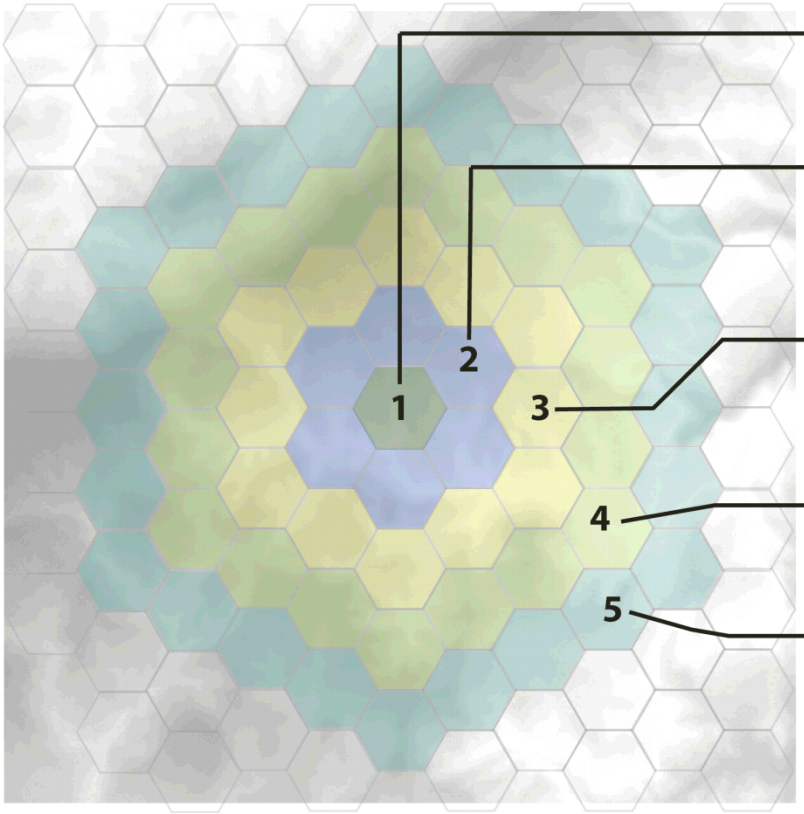



★ Indicates the gameplay area

# Level 1 – Kiwi Sanctuary

**Possum Management Game - Level 1 outlined in 5 skill stages**

Overview of the active gameplay space of Level 1 - Boundary Stream




1km$^2$ fenced area where the player is taught the basics required to monitoring and managing the eco sytem

**Skill Stage 1**: monitor flora to establish health of environment

***Keyskill: basic environment monitoring***

**Skill Stage 2**: continued flora monitoring with nonlethal intervention for fauna density
i.e. Trapping for population density (non-toxic)

***Key skill: trapping methods***

**Skill Stage 3**: continued monitoring and the use of lethal intervention to impact possum population
i.e. baited trapping (toxic)

***Key skill: baits and toxins***

**Skill Stage 4**: continued monitoring with active managment goal of lethal intervention to reduce possum numbers

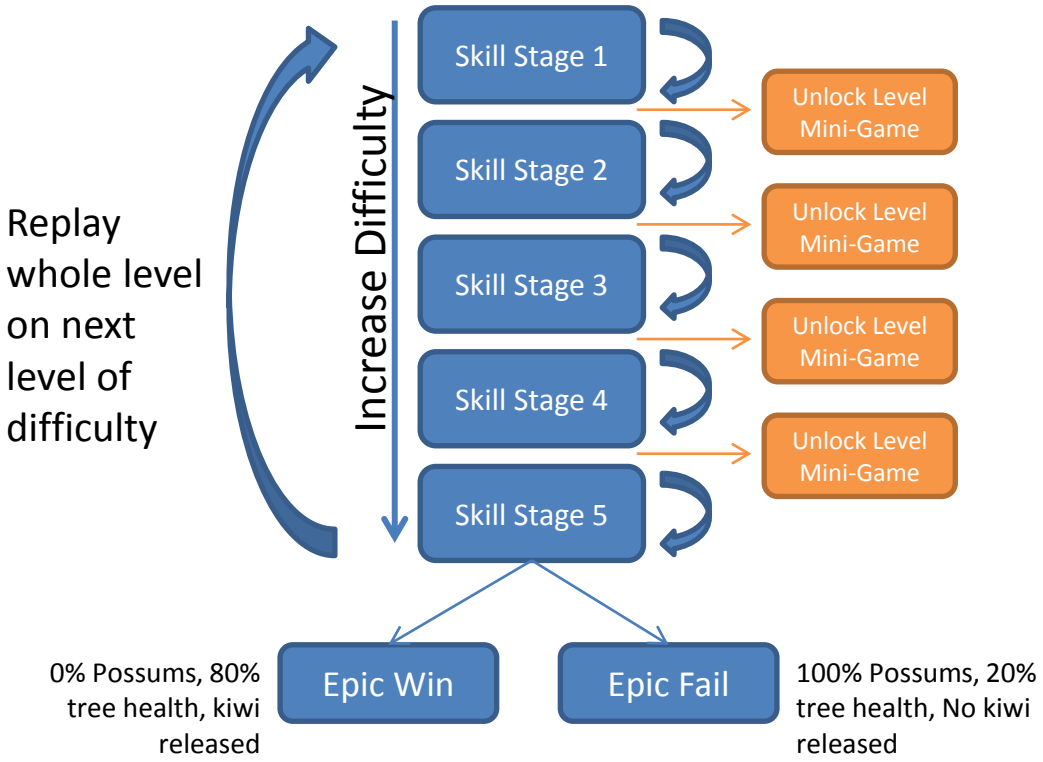
***Key skill: strategies for traps, baits and toxins***

**Skill Stage 5**: Total intervention, combined use of all learnt skills to clear the fenced gameplay area of possums.
Monitoring of the environment to establish rate of recovery.

***Key skill: applied managment strategies and tool use***

# Replayability

## Level 1 – Kiwi sanctuary




**Three possible levels of difficulty for level 1**

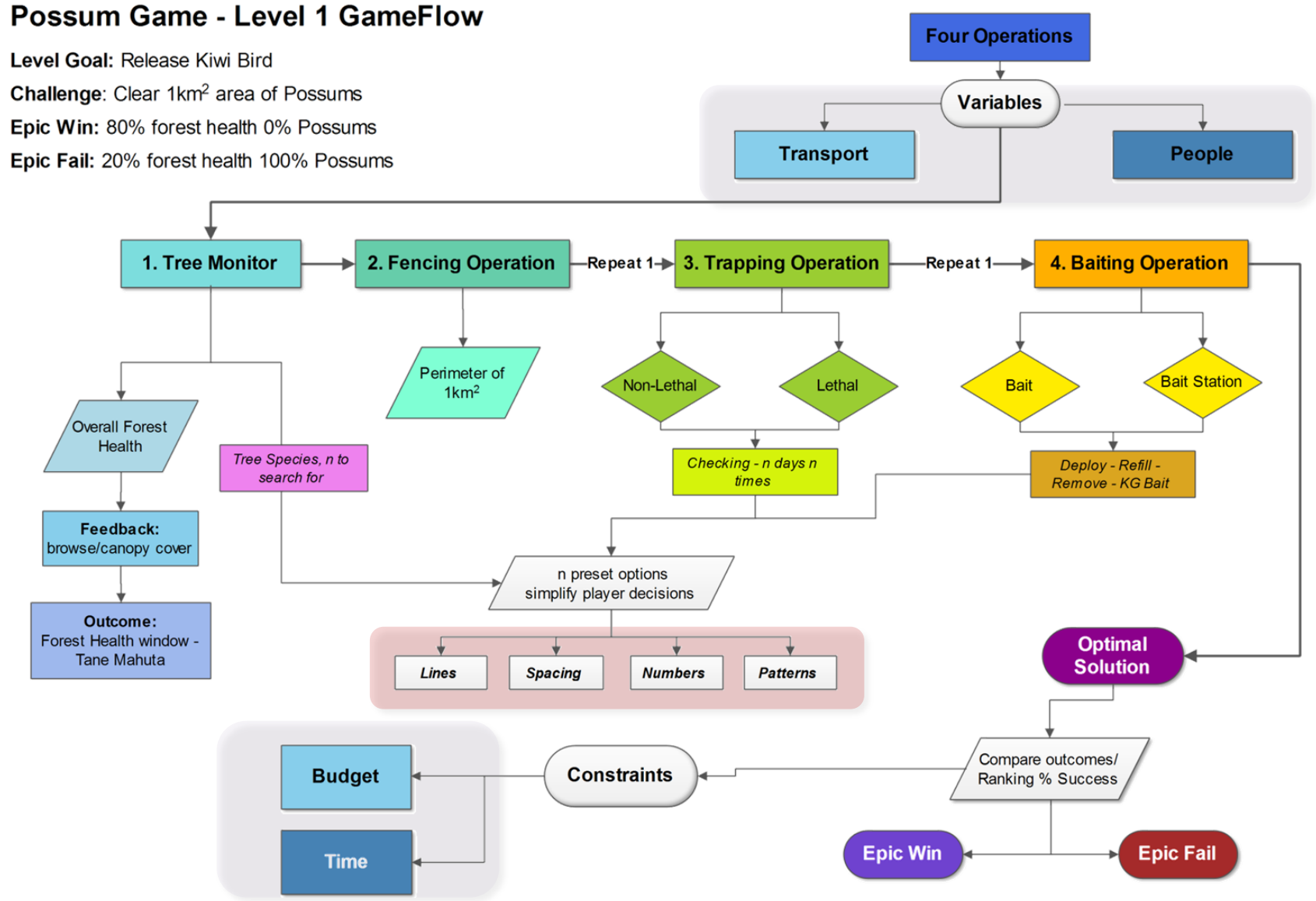
**Easy:** pre-cooked operational variables

- Basic skill of controlling the science model
- Basic understanding of management operations (mechanics)
- Basic ability to comprehend feedback for further decision making

**Medium:** release more control of operations variables

**Hard:** release all control of variables

# GameFlow Structure



# Mini Game


**Purpose:**

• mini-game teaser to promote the main possum management game

•Un-lockable level for main possum management game

**Playing style:**

Nest defense – Angry kiwi stomps on zombie possums coming to steal it's eggs

**Platforms:**

PC

Mac

Mobile

Tablet

Possum Stomp!

# Development - Games

## Preproduction

- Design Doc drawn-up
- Playable proof of concept/Vertical slice demo created
- Technology and tools initiated
- Art direction finalised
- Funding &materials (e.g. Dev kits) obtained

## Production

- Team scaled up to full size
- Producer oversees scheduling & logistics
- Programmers create tools & finalise technology: Physics, AI, Renderer
- Artists create & animate characters, textures, backgrounds, vehicles etc.
- Level designers create levels & missions
- Sound Designers work on background music, audio etc
- Playable game is tested by testers
- Console approval met

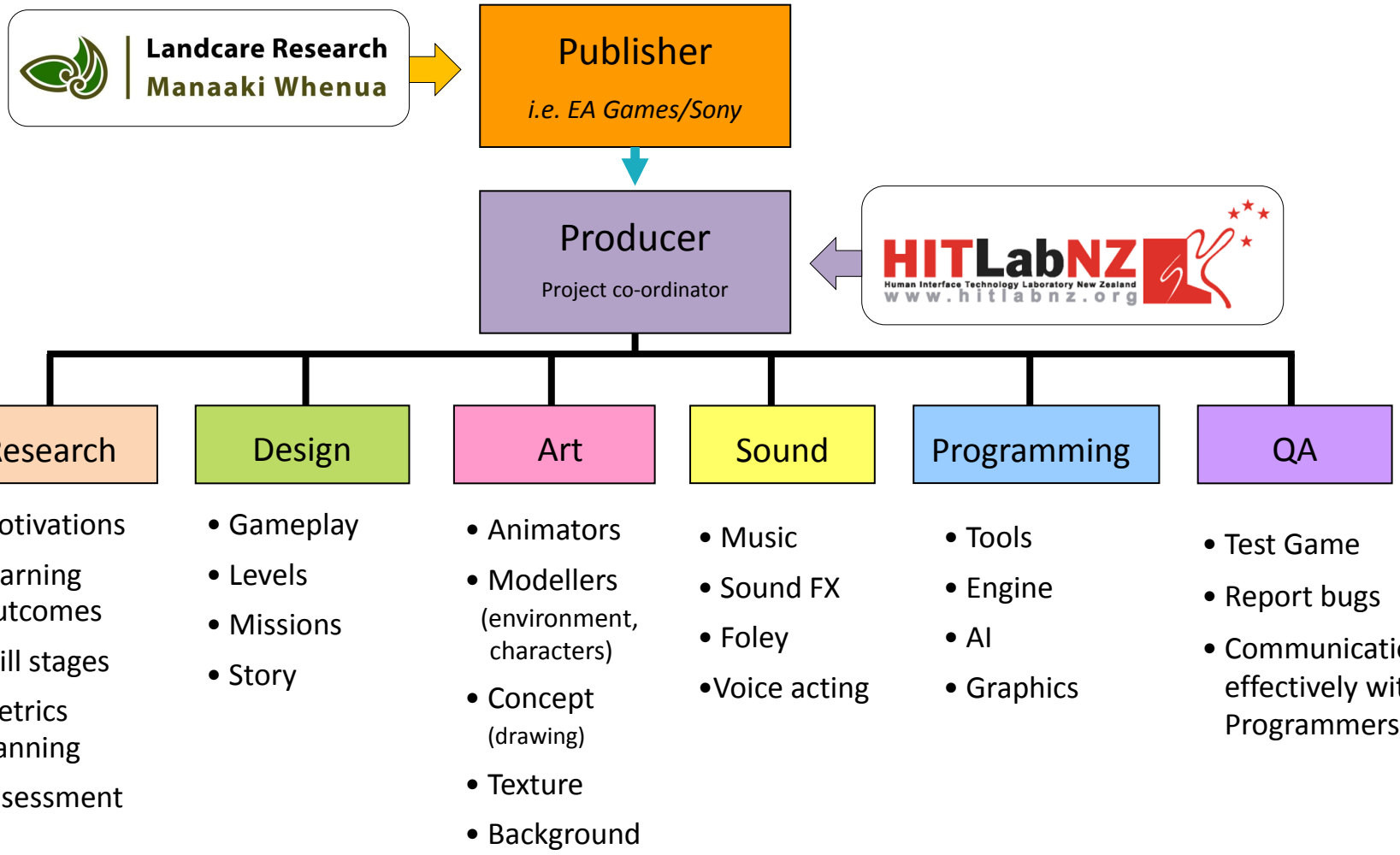
ALPHA

## Postproduction

- Playable game is localised for foreign territories
- Planning for sequels & expansions
- Game is advertised & distributed

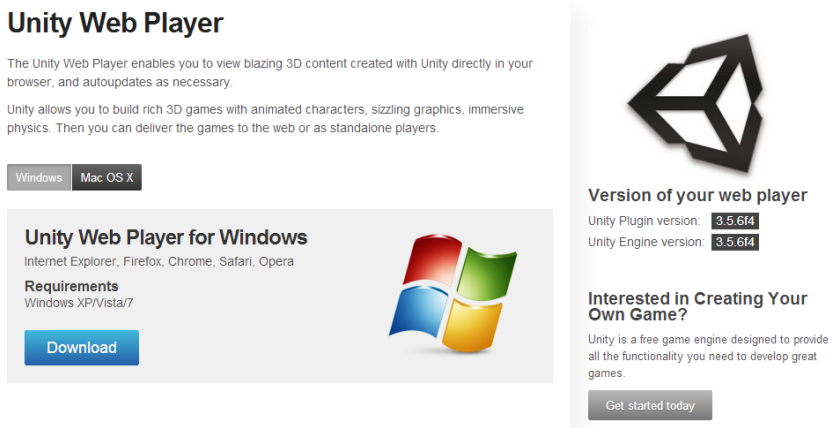
BETA

# Serious - Production Team

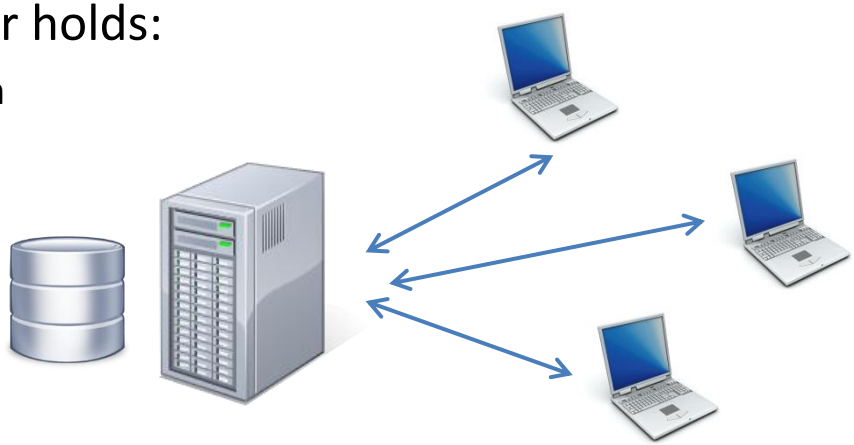


# Distribution

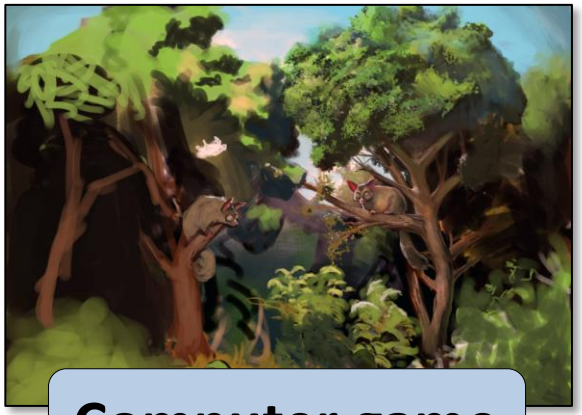
- Game is played in the web browser
  - Windows and Mac OS supported
  - Game updates seamlessly

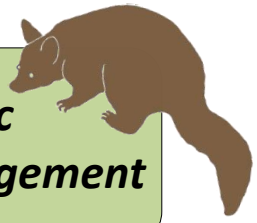



- Web server provides:
  - Web page presenting the game
  - Player registration and logins
  - Database on server holds:
    - Player information
    - Saved games
    - Gameplay logs



# Research Tool





*Scientific Research*

**Computer game**

*Public Engagement*

**Metrics Data**

**Emergent Behaviour:**
Providing pest centred solutions