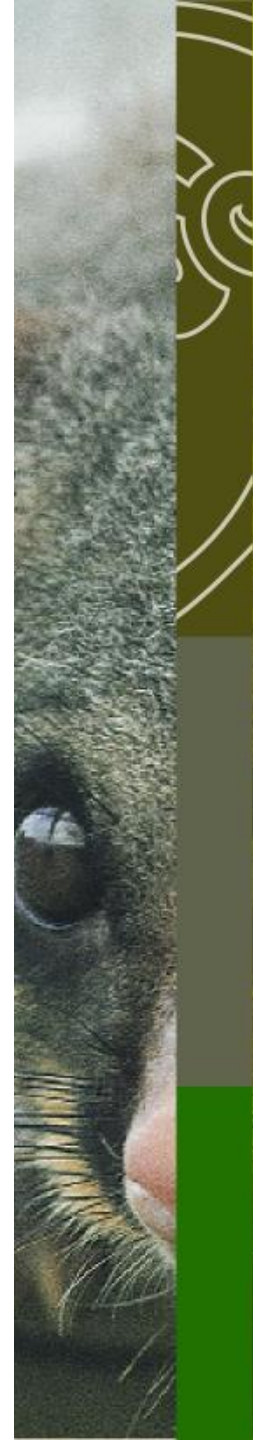




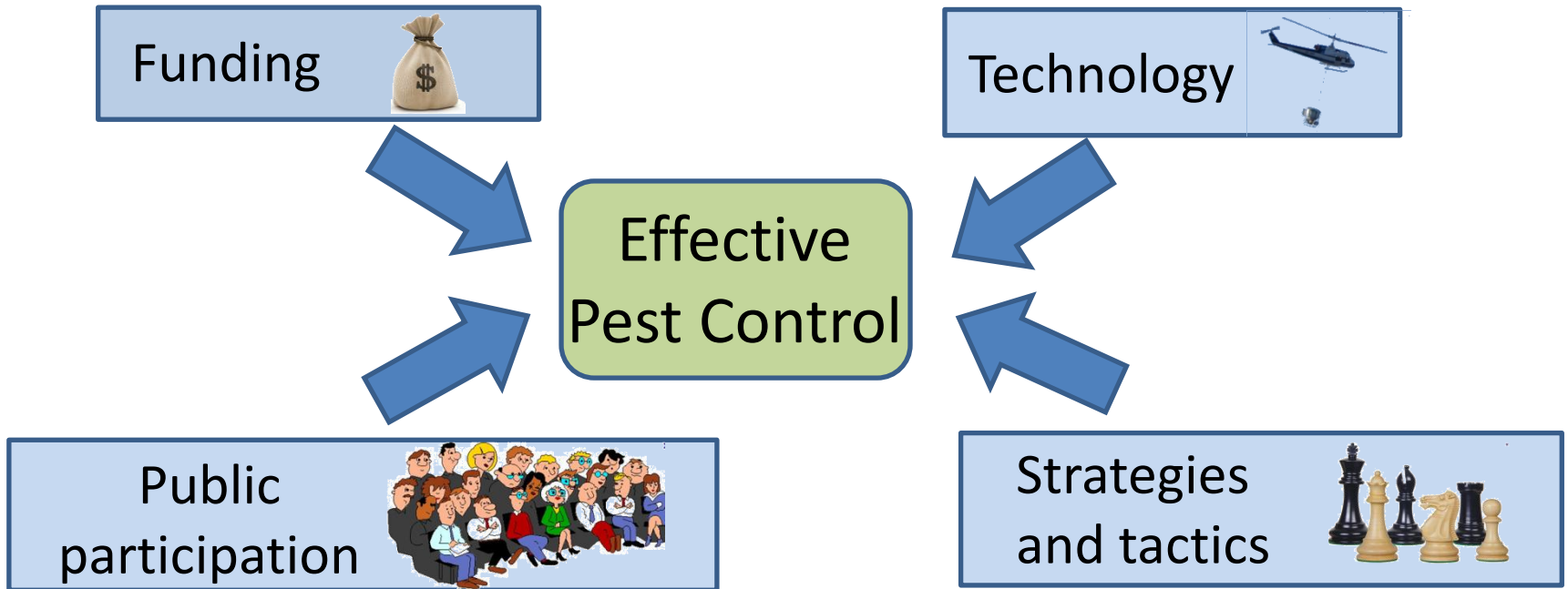
Landcare Research
Manaaki Whenua

Computer games as a novel medium for knowledge transfer

Bruce Warburton, Hazel Bradshaw
Pen Holland, Julian Looser,



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 $\leq 1\text{kg/ha}$ (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.

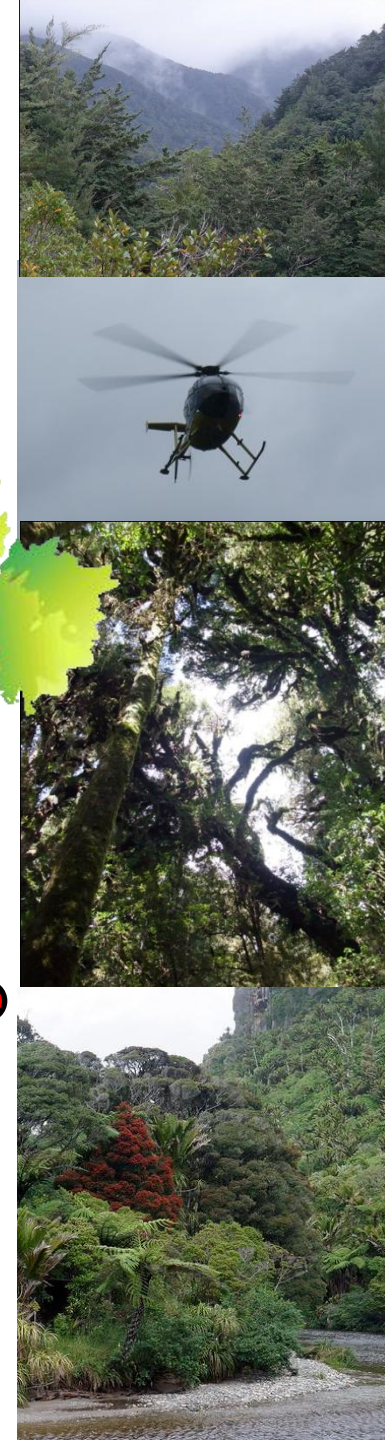
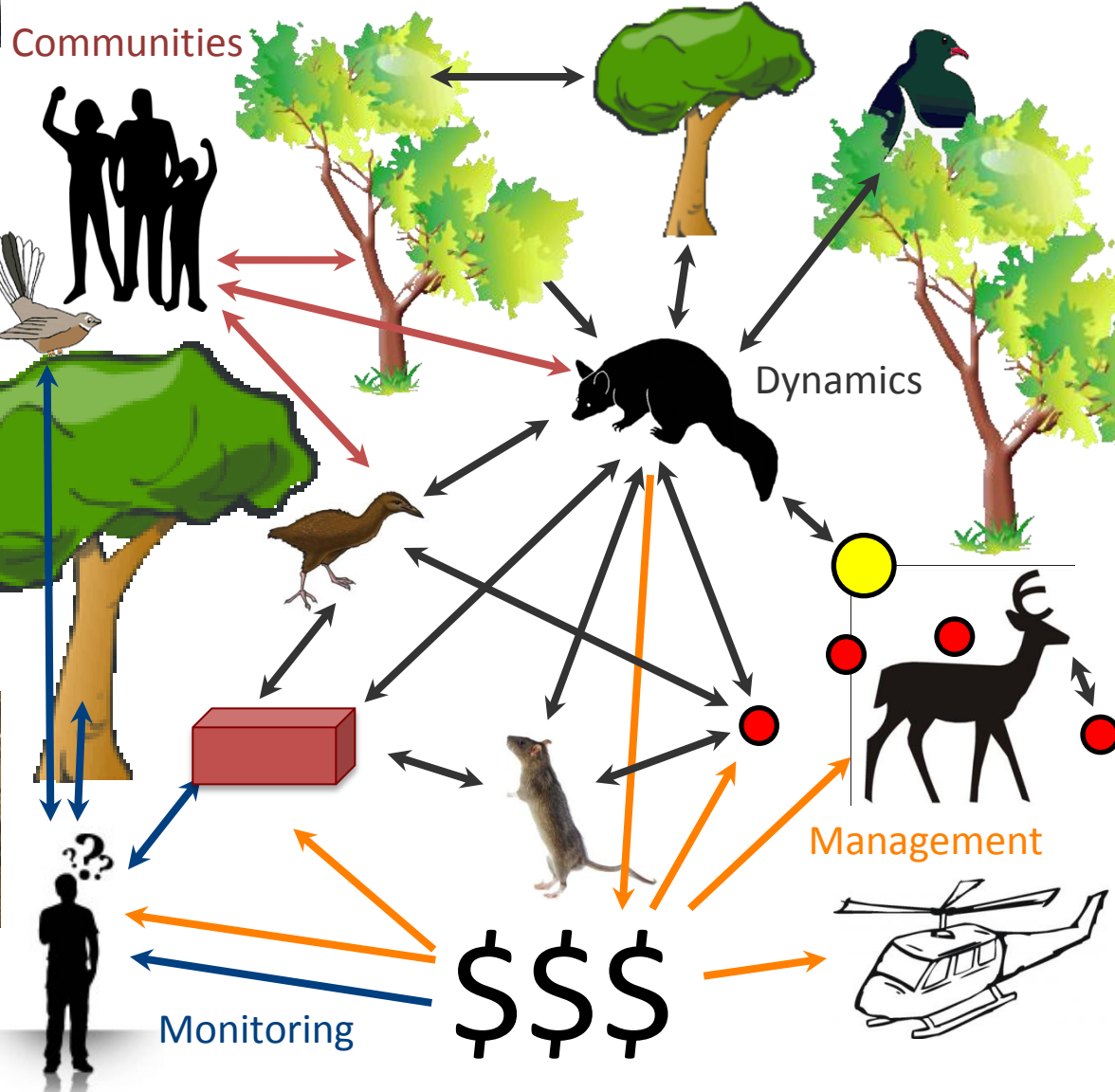


RA3: Increasing community participation

- 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



Commentary

Open Access

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

Robert K Swihart^{*1}, Donald L DeAngelis², Zhilan Feng³ and John P Bryant⁴

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

AURA 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
© 2008 by the Ecological Society of America

A
S
E
C
E

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

^AEcology and Entomology Group, PO Box 84, Lincoln University, Canterbury, New Zealand

^BLandcare Research, PO Box 31-011, Lincoln, Canterbury, New Zealand

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

WHAT CAN WE LEARN FROM RESOURCE PULSES?

LOUIE H. YANG,^{1,3} JUSTIN L. BASTOW,¹ KENNETH O. SPENCE,² AND AMBER N. WRIGHT¹

¹Section of Evolution and Ecology, University of California, One Shields Avenue, Davis, California 95616 USA

²Department of Entomology, University of California, One Shields Avenue, Davis, California 95616 USA

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

I. M. Tompkins^{A,C} and David Ramsey^B

208

Available on-line at: <http://www.newzealandecology.org/nzjec/>

SHORT COMMUNICATION

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

Sarah J. Richardson^{*1}, Mark C. Smale², Jennifer M. Hurst¹, Neil B. Fitzgerald², Duane A. Peltzer¹, Robert B. Allen¹, Peter J. Bellingham¹ and Peter J. McKelvey³

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

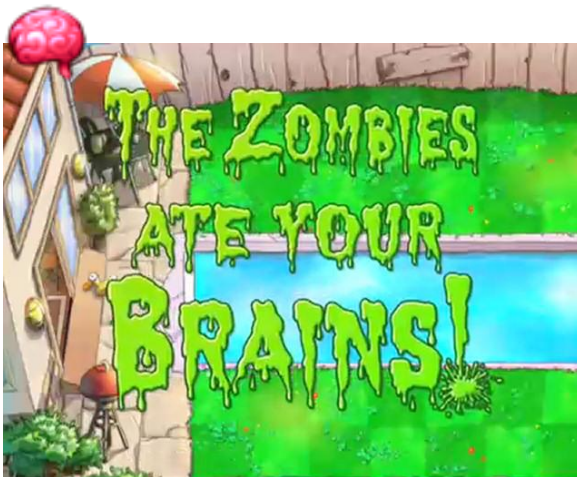
Dave Ramsey^{A,D}, Murray Efford^C, Steve Ball^B and Graham Nugent^B

^ALandcare Research, Private Bag 11052, Palmerston North, New Zealand.

^BLandcare Research, PO Box 69, Lincoln, New Zealand.

^CLandcare Research, Private Bag 1930, Dunedin, New Zealand.

^D





Landcare Research
Manaaki Whenua

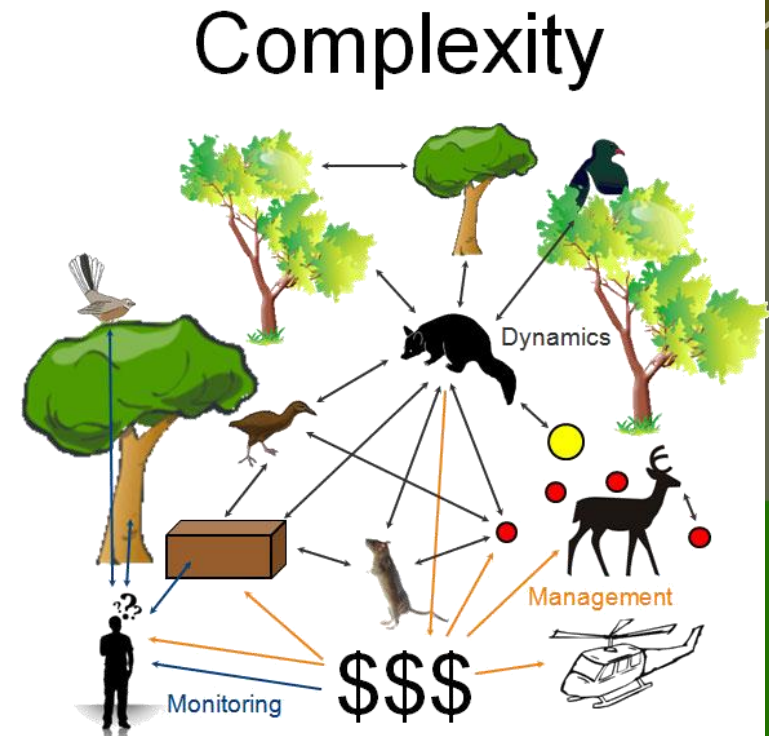


Possum Management Computer Game

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

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

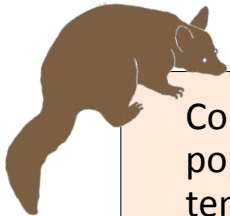
Promote understanding and awareness of the effectiveness of available control options

Native bird recovery

Native tree recovery

100% NZ pure perception

Preserving game species



Educational Purpose

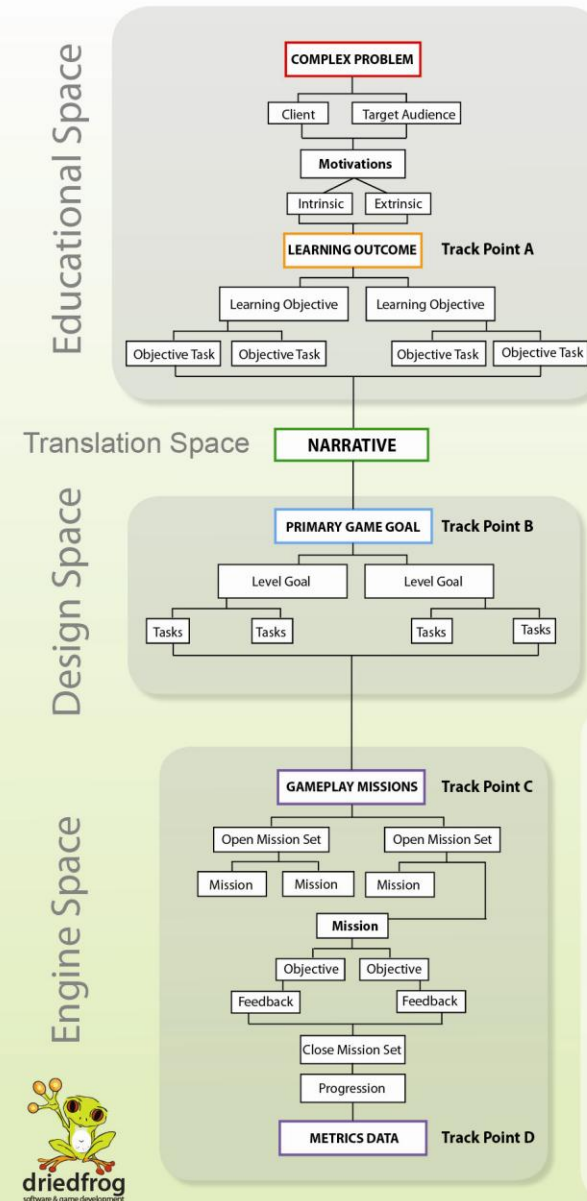
- *Learning Outcome:* To gain a realistic appreciation that management of an ecosystem is a complex problem
- *Learning Objective:* Maintaining and restoring the ecosystem of NZ forests based on biodiversity conservation
 - *Objective Tasks:*
 - Monitor environment
 - Manage environment

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**

Mapping Educational Gameplay



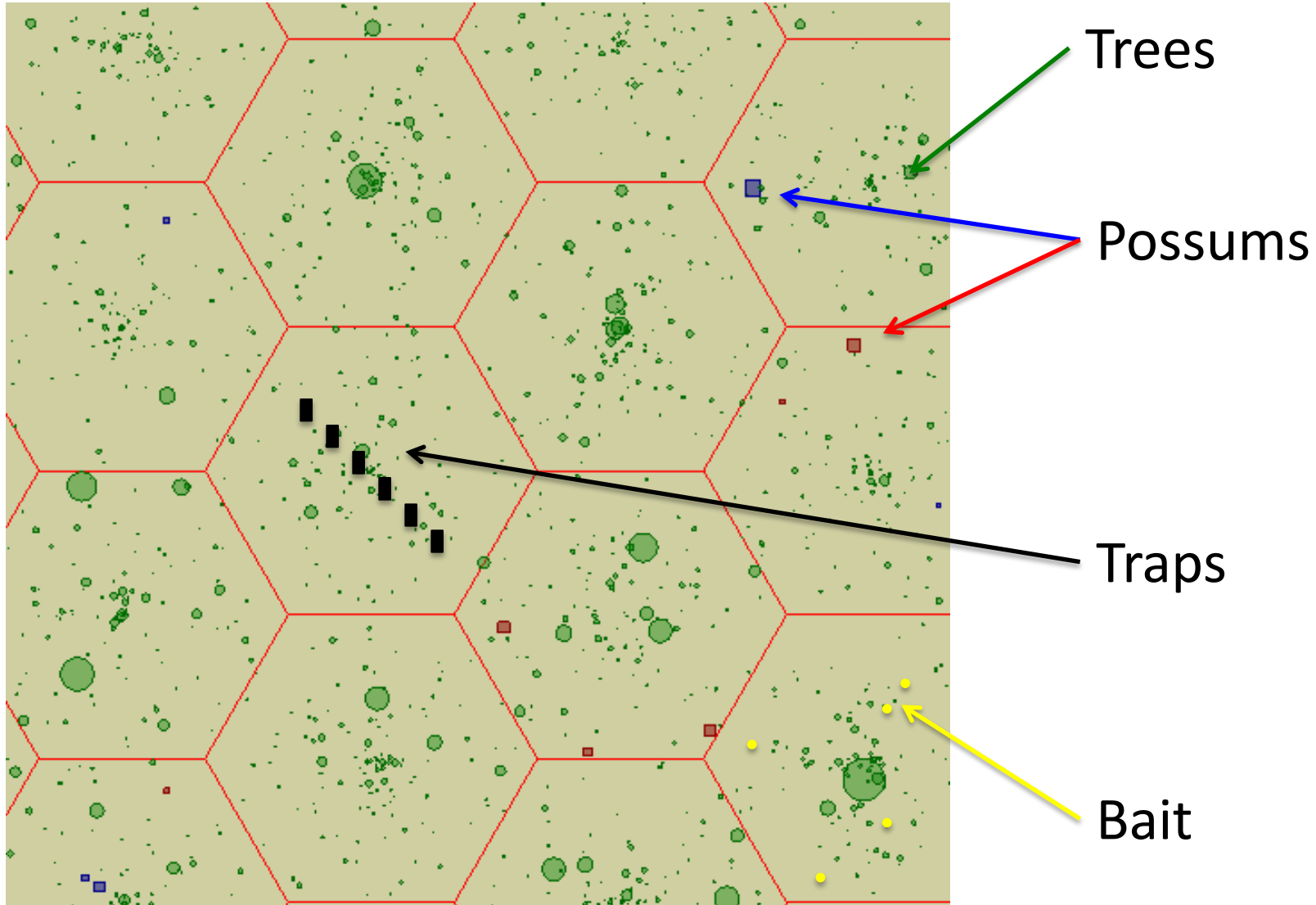
Science Simulation

The science underlying
the gameplay

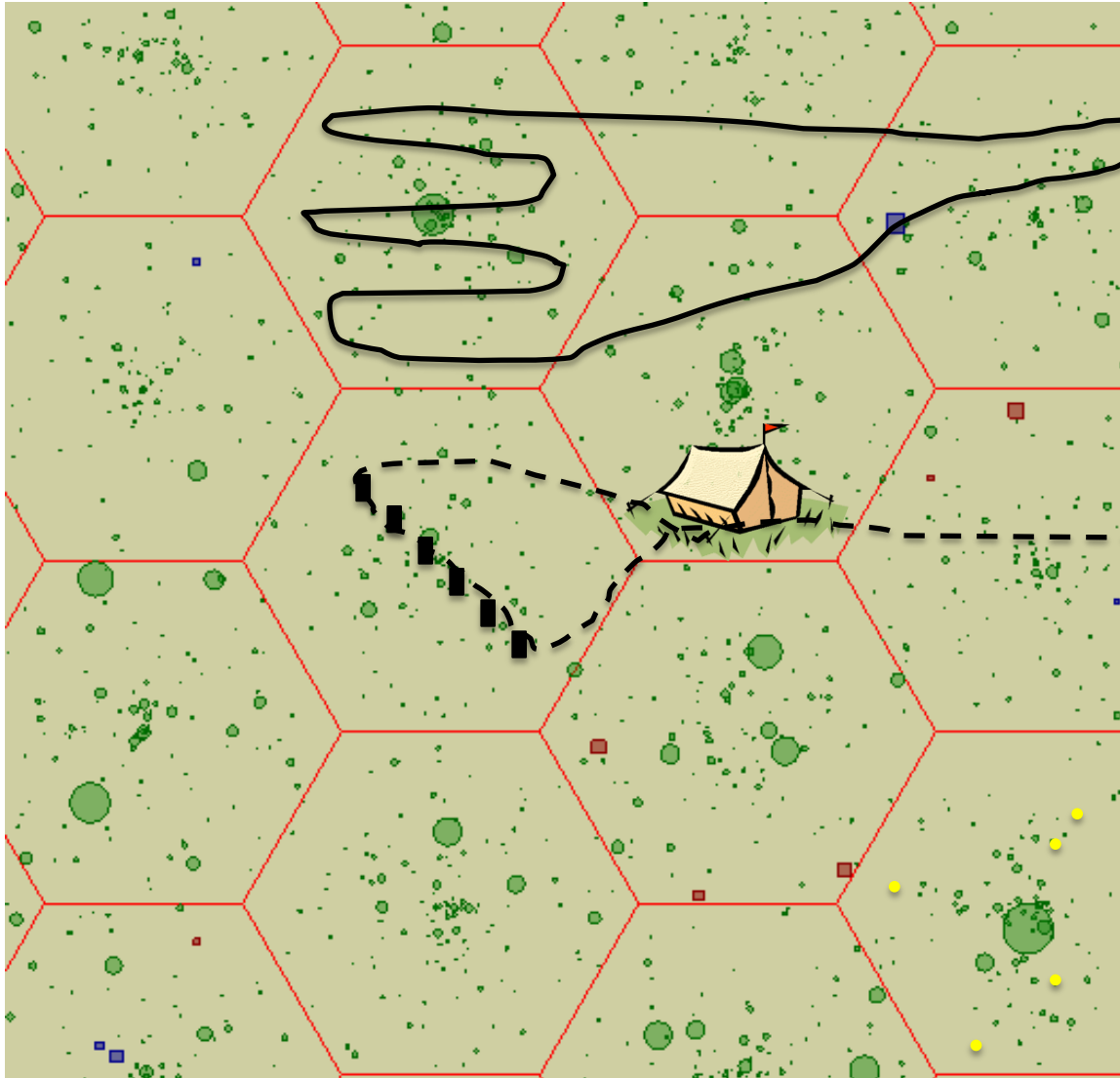
The screenshot displays the PossumSim Science GUI, which is used for simulating pest control operations. The interface is divided into several key sections:

- Main Simulation Area:** A large hexagonal grid representing the landscape. Green clusters indicate the presence of possums. A scale bar shows 0 to 50 units in meters. The simulation is running at 16 FPS.
- Scenario Information:** Located in the top-left corner, it provides details about the current simulation:
 - Scenario: My Scenario
 - My Site: 2000x2000m
 - Budget: \$20,000.00
 - Committed: \$0.00
 - Spent: \$0.00
 - Possums: 262
- Operations List:** A horizontal strip below the scenario information, featuring icons for various operations such as traps, baits, and helicopters.
- Browser Window:** A separate window titled "Browser" is open, showing a list of bait options under the "Baits" tab. The selected item is "RS5 1080 0.15%".
- Bait Details:** A detailed view of the selected bait, showing the following properties:
 - Cost:** \$2.52
 - Toxin:** 1080
 - Concentration:** 1.5 mg per gram of bait
 - Food Type:** Cereal
 - Decay Rate:** 0.85 outside bait station, 0.95 inside bait station
 - Deer Repellent:** False
- Simulation Control:** Located at the bottom of the main window, it includes a "Run" button, a "Stop" button, and a "Days left" indicator set to 0.

A spatial model



A spatial model



Flight time



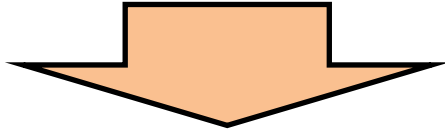
Contractor costs

Best routes

Equipment costs

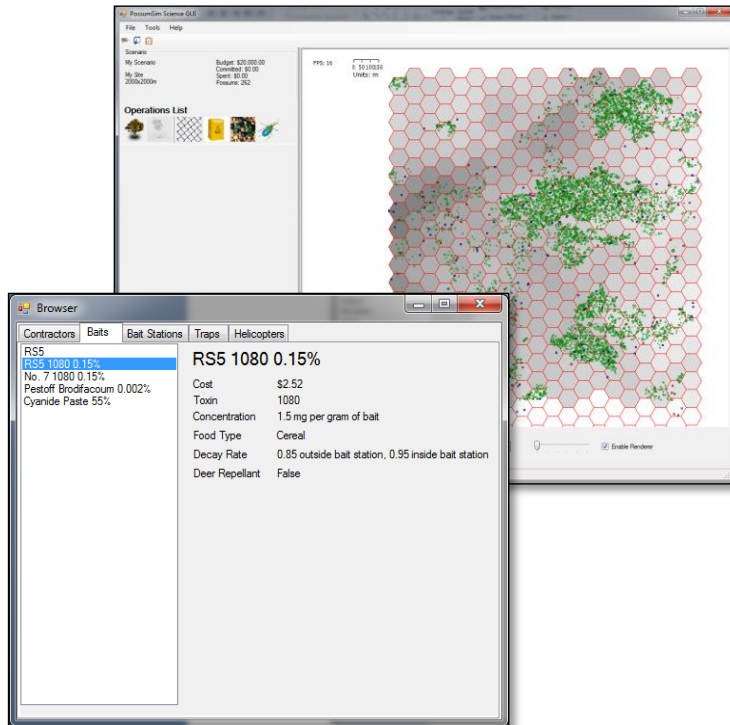
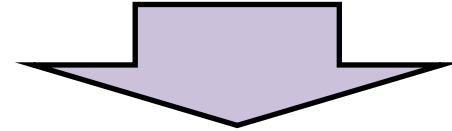
Demonstrations

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.

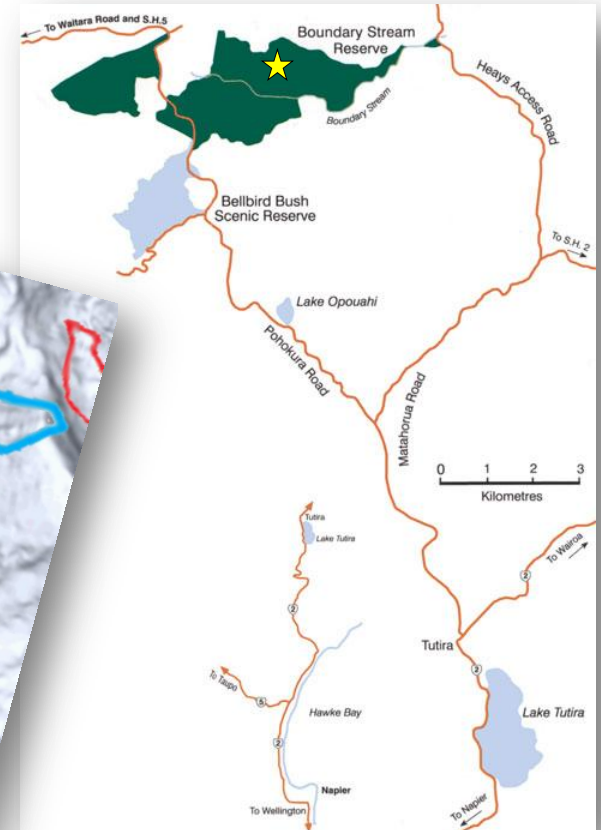
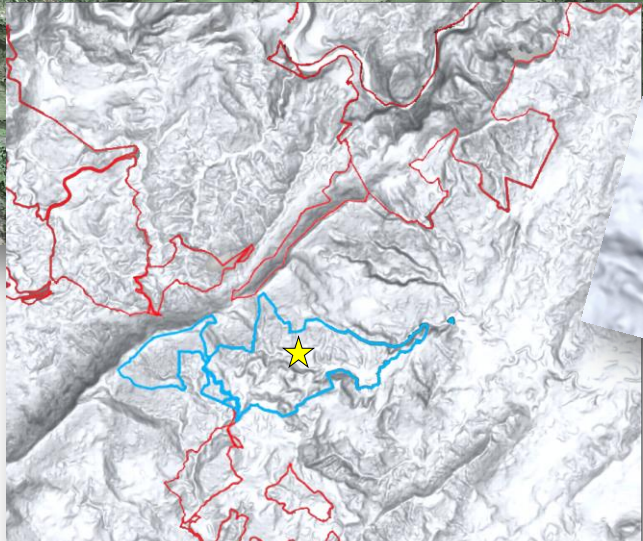
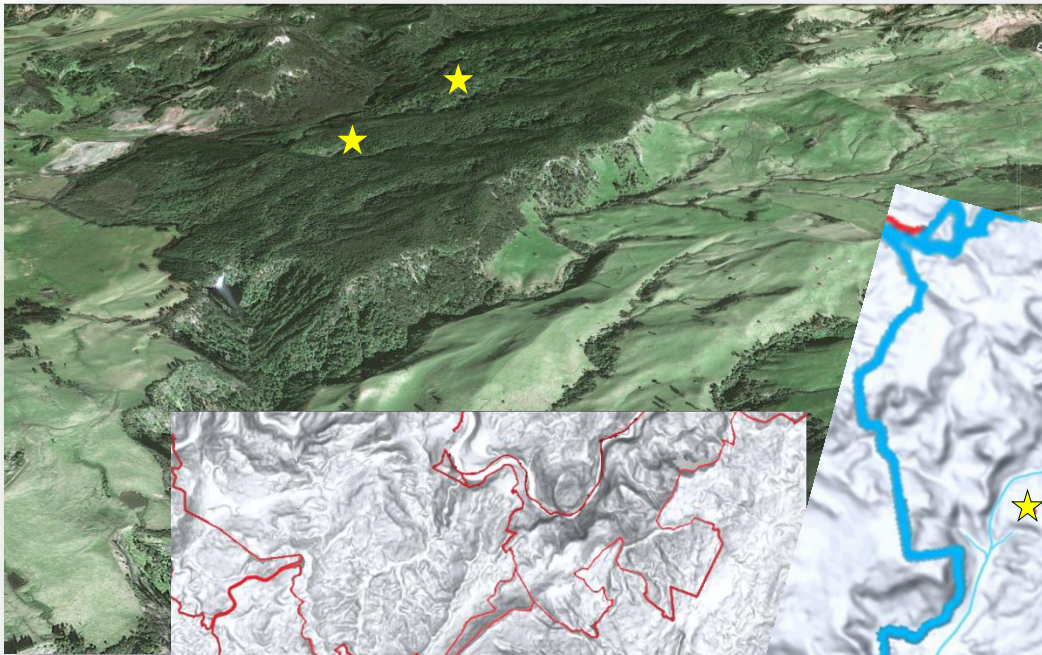
OR

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

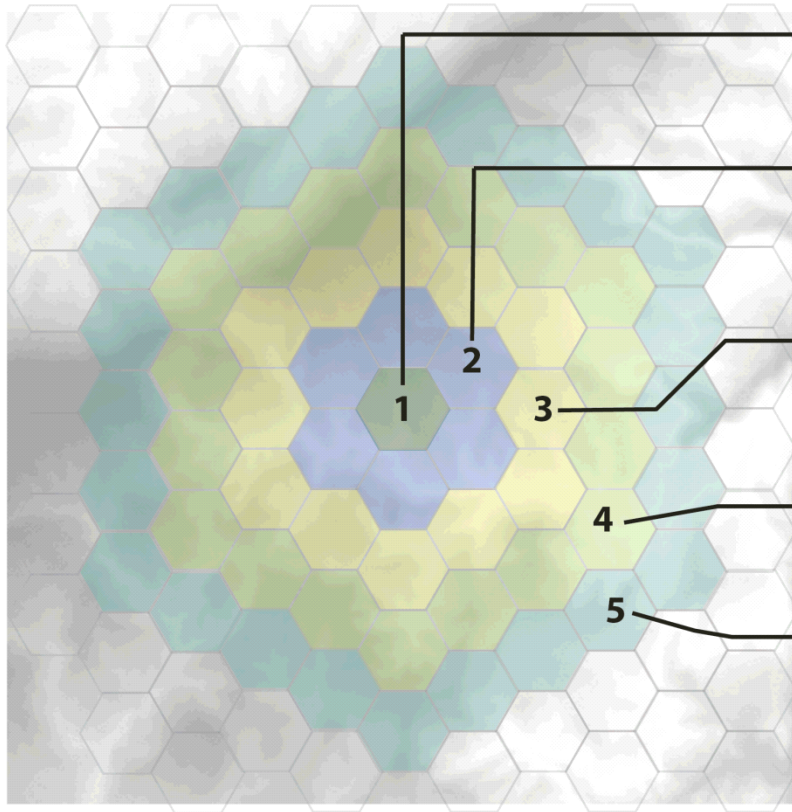


★ Indicates the gameplay area

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



Skill Stage 1: monitor flora to establish health of environment

Key skill: *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 management
goal of lethal intervention to reduce possum numbers

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

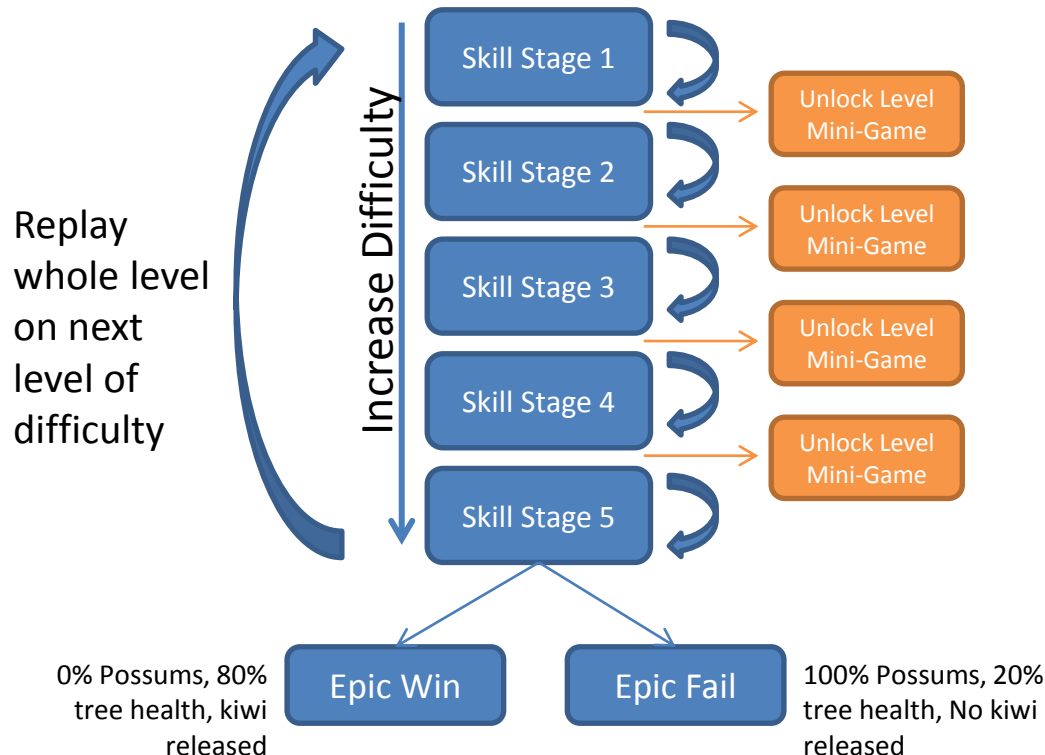
Skill Stage 5: Total intervention, combined use of all learnt skills to clear the fenced gameplay area of possums.
Monitoring of the environment to establish rate of recovery.

Key skill: *applied management strategies and tool use*

1km² fenced area where the player is taught the basics required to monitoring and managing the eco system

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

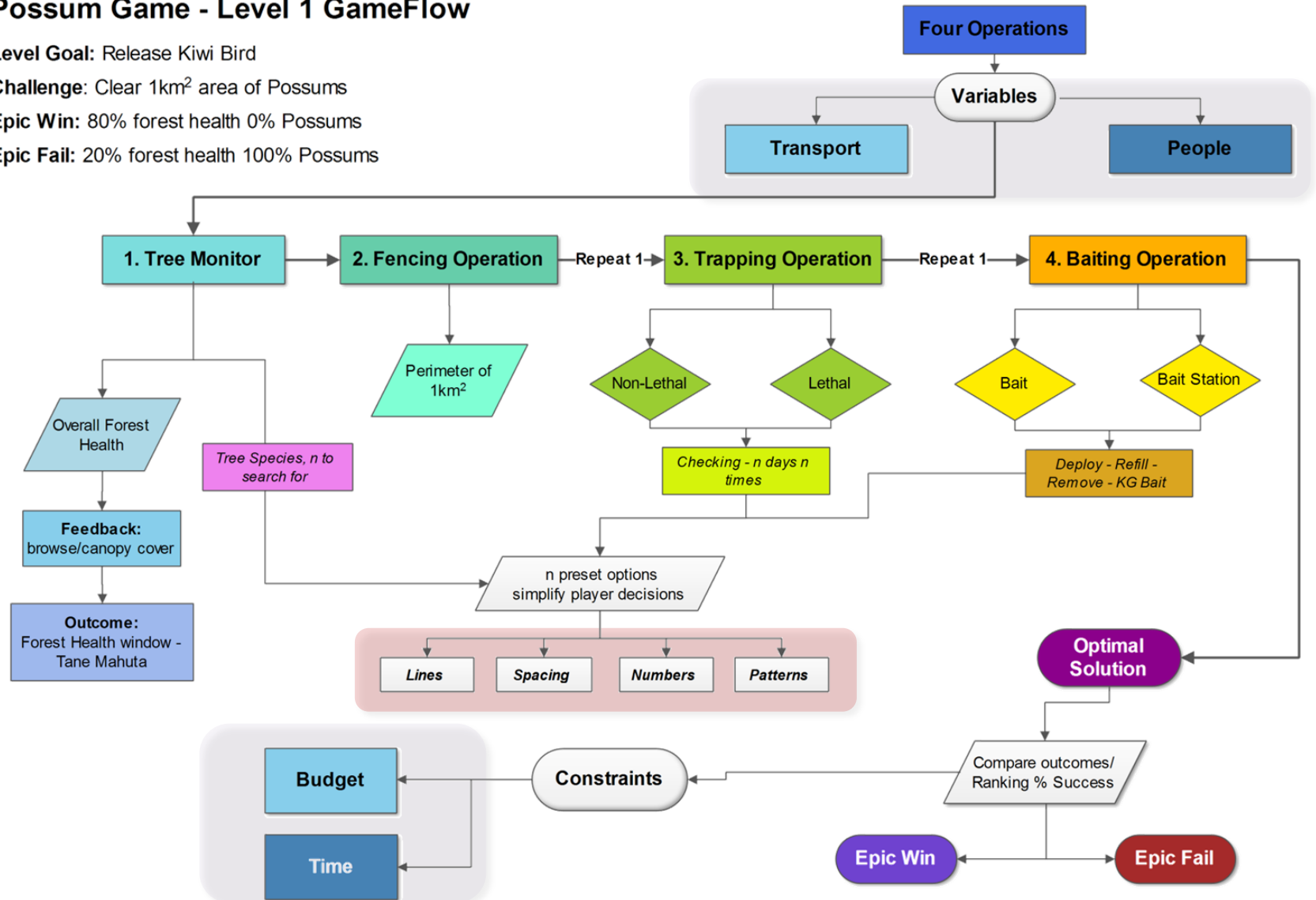
Possum Game - Level 1 GameFlow

Level Goal: Release Kiwi Bird

Challenge: Clear 1km² area of Possums

Epic Win: 80% forest health 0% Possums

Epic Fail: 20% forest health 100% Possums



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

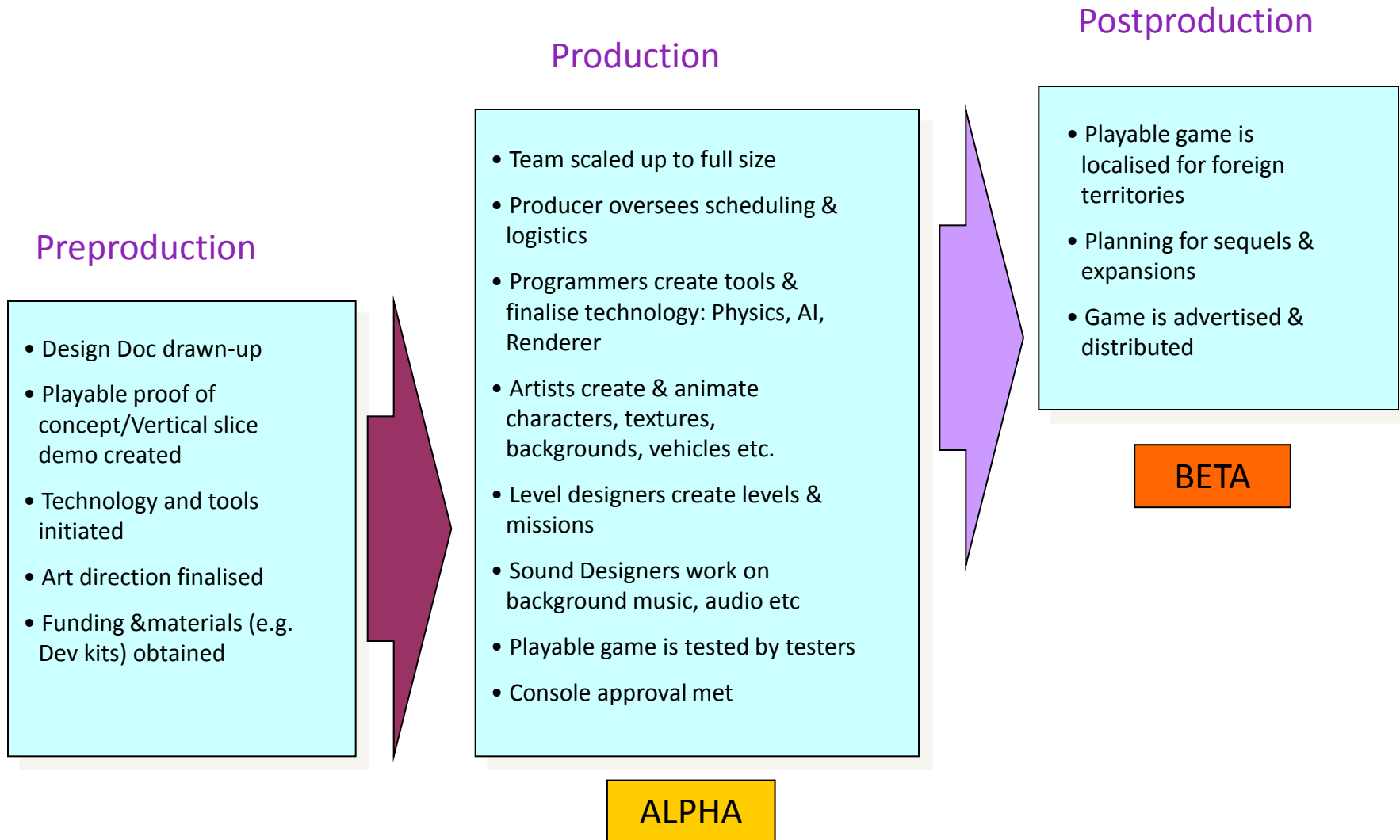
Mac

Mobile

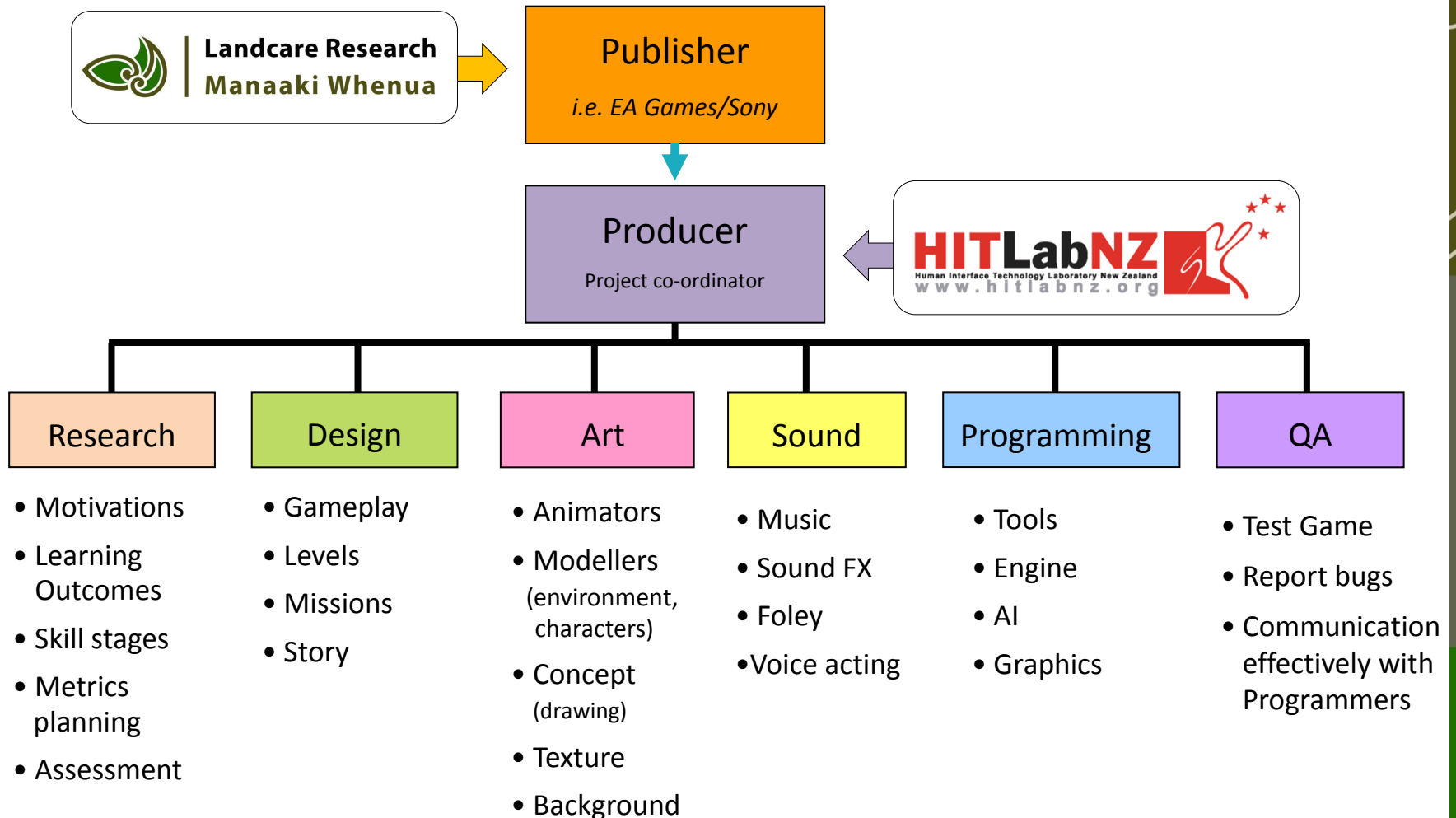
Tablet

Possum Stomp!

Development - Games



Serious - Production Team



Distribution

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

Unity Web Player

The Unity Web Player enables you to view blazing 3D content created with Unity directly in your browser, and autoupdates as necessary.

Unity allows you to build rich 3D games with animated characters, sizzling graphics, immersive physics. Then you can deliver the games to the web or as standalone players.

Windows Mac OS X

Unity Web Player for Windows

Internet Explorer, Firefox, Chrome, Safari, Opera

Requirements

Windows XP/Vista/7

Download



Version of your web player

Unity Plugin version: 3.5.6f4

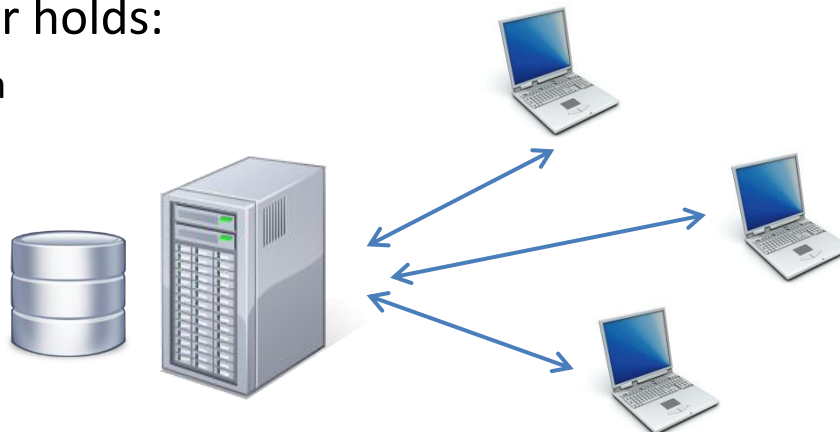
Unity Engine version: 3.5.6f4

Interested in Creating Your Own Game?

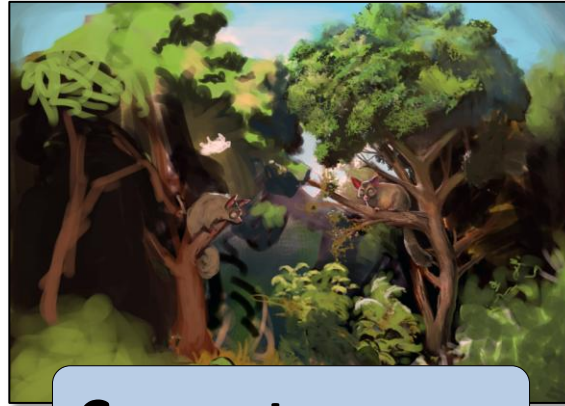
Unity is a free game engine designed to provide all the functionality you need to develop great games.

Get started today

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



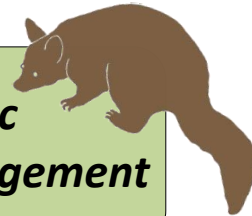
Research Tool



*Scientific
Research*

Computer game

*Public
Engagement*



Metrics Data

Emergent Behaviour:
Providing pest centred solutions

