

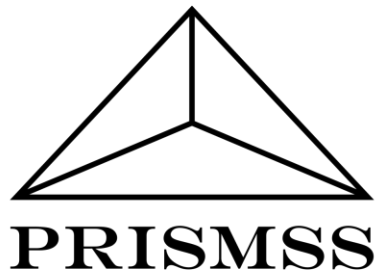
Increasing resilience through invasive species management

Morgan Marshall



NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Manatū Aorere

Late Island, Tonga rodent eradication



PRISMSS



Department of Conservation
Te Papa Atawhai



SPREP

Secretariat of the Pacific Regional Environment Programme



ISLAND CONSERVATION

Preventing Extinctions

New Zealand Government



Intensified
species
exacerbate
the impacts
of climate
change

- Increase severity of extreme weather events
- Increase erosion
- Reduce food and fish production



Cyclone Gabrielle flood damage



Port hills wildfire



Caulerpa smothering seabed



Soil erosion following severe weather

Rodents are a commonly introduced invasive species

- Compete with native species for food
- Alter forest composition
- Predate on native species



Kiore introduced to many offshore islands



Rat eating a bird's egg



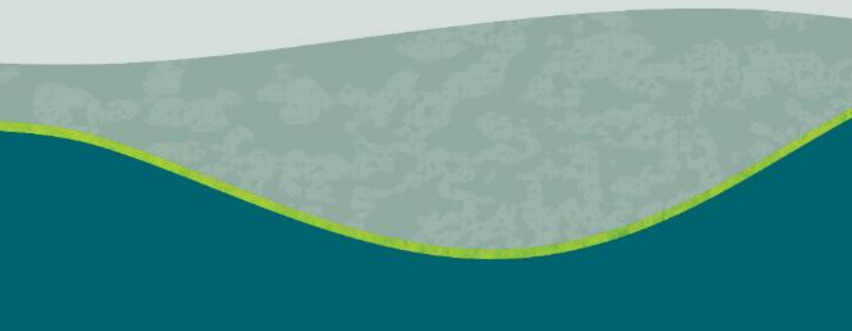
Healthy rodent free island forest



Healthy productive coral reef

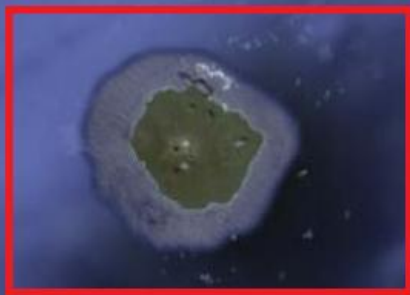
Late Island, Tonga

Rodent eradication
July 2023



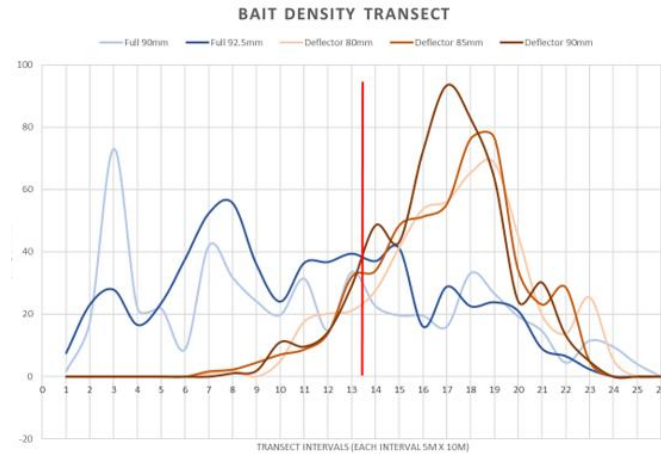
- Current agreed best practice is aerial application of toxic baits
- Every individual is required to be exposed to a toxic bait to be successful
- To ensure success of the operation GIS support is required throughout all stages of the operation





Planning phase

- Bucket calibrated to required application rate
- Bait quantity calculated through creating model swaths
- Areas requiring supplemental baiting identified through analysis of terrain



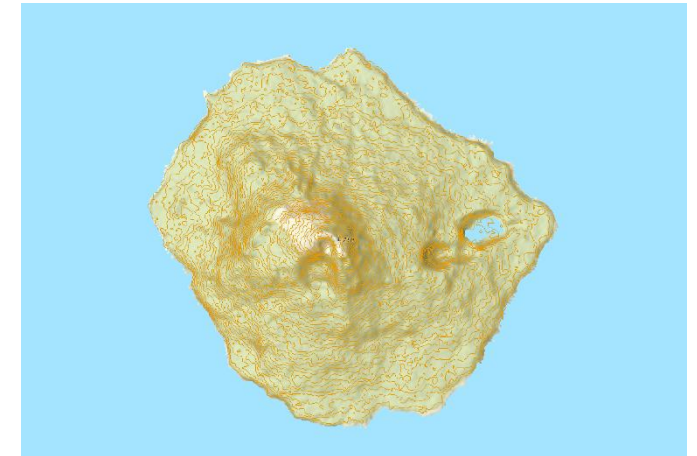
Bucket calibration results for 90m broadcast and 45m deflector



Generated flight swaths to calculate required bait



Late Island application area



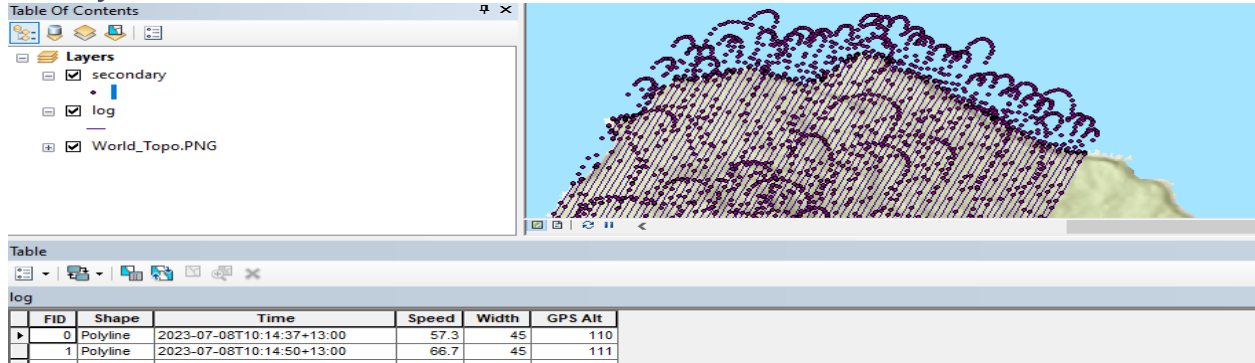
Late contours analysed for supplemental baiting

Preparation

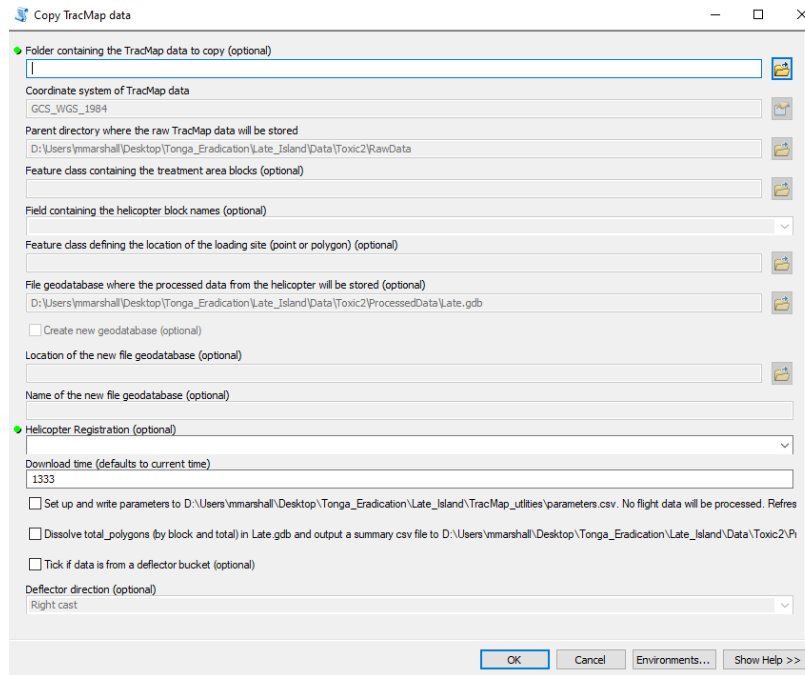
Toolbox parameters

- Swath widths
 - 90m broadcast
 - 45m deflector
- Projection
 - WGS UTM 1S

- Data from the helicopters GPS data needs to be processed to be able to analyse.



- To do so a custom python arcmap toolbox has been created to transform the data.



```
# Use this when the sow lines are overlapped to ensure there are no gaps in the sowing.  
# i.e the bucket is calibrated for 160m swaths and the swath width in the gps is set to 80.  
if row[0] in (40,45,50):  
    row[4] = row[0]  
elif row[0] in (80,90,100):  
    row[4] = row[0]/2  
row[3] = 'Overlap sow'  
bufferType = 'FLAT'  
lineSide = 'FULL'
```

```
parameters - Notepad  
File Edit Format View Help  
PROJCS['WGS_1984_UTM_Zone_1S',GEOGCS['GCS_WGS_1984',DATUM['D_WGS_1984',SPI
```

Logistics

- Specialised equipment and supplies had to be transported to Late
- 64 drums of fuel
- 152 bait pods
- Food and camping equipment



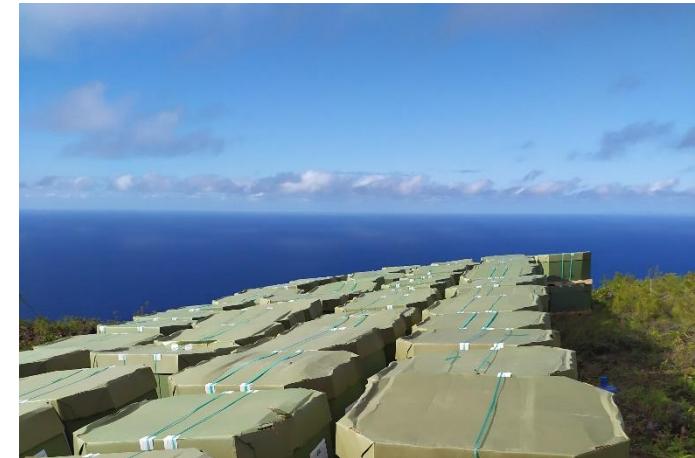
Helicopter being unloaded in Tongatapu



Bait pods being loaded on cargo ship



Fuel delivered on Late Island



Bait pods stacked for loading into the bucket



Living arrangements

- All waste collected and removed
- Special attention to not leave food scraps for alternative food source



Camp site



Shower being set up



Camp kitchen



The office

Application

- Bait manually loaded into the bucket
- Evenly distributed from underslung bucket
- Tracmap GPS data run through GIS to track application rate and bait quantity



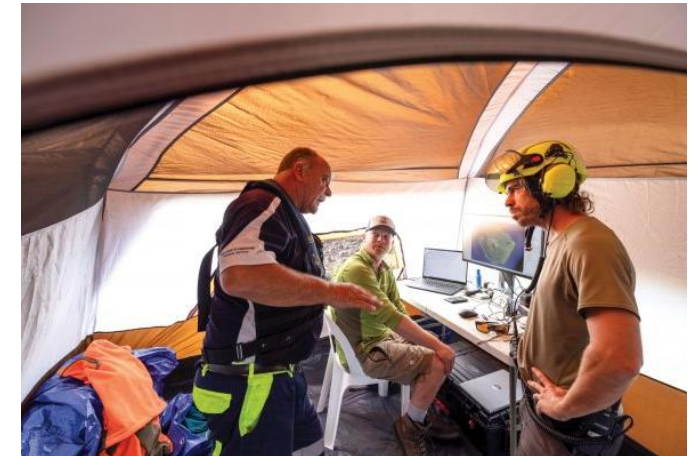
Bait loading team in-between loads



Operational area layout



Helicopter spreading bait near the crater

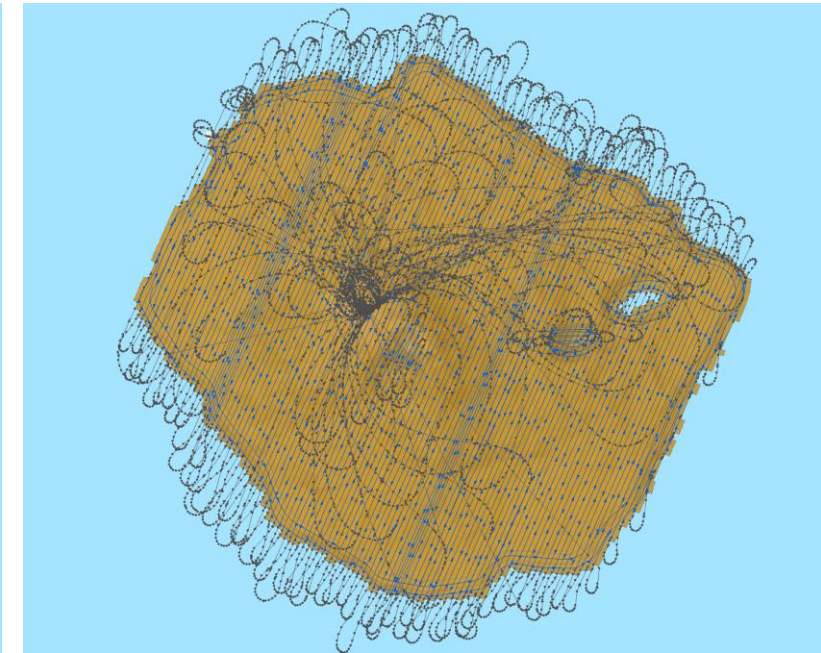
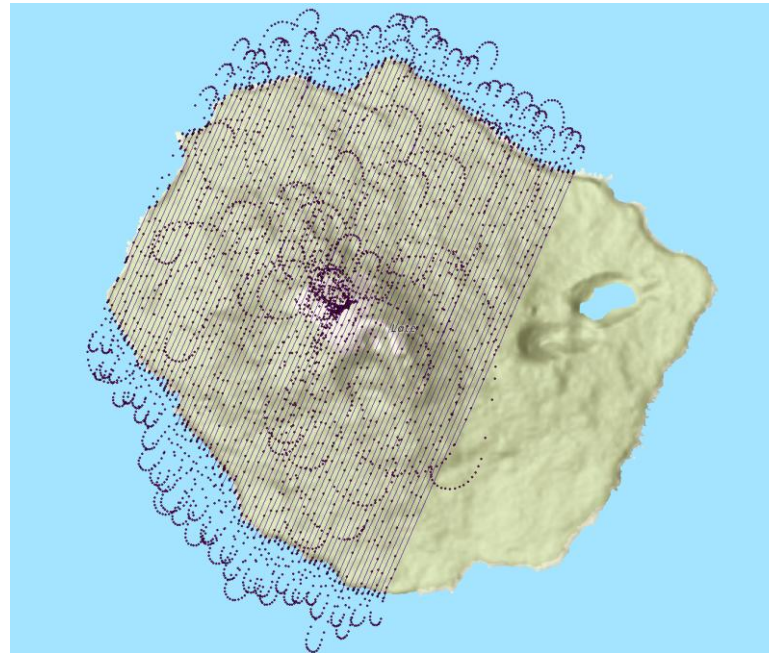


Discussing flight plans and application in command centre



Data analysis

- Raw data received from the helicopter is processed
- Application rate calculated and adjusted throughout operation



Copy TracMap data

Folder containing the TracMap data to copy (optional)

Coordinate system of TracMap data

GCS_WGS_1984

Parent directory where the raw TracMap data will be stored

D:\Users\mmarshall\Desktop\Tonga_Eradication\Late_Island\Data\Toxic2\RawData

Feature class containing the treatment area blocks (optional)

Field containing the helicopter block names (optional)

Feature class defining the location of the loading site (point or polygon) (optional)

File geodatabase where the processed data from the helicopter will be stored (optional)

D:\Users\mmarshall\Desktop\Tonga_Eradication\Late_Island\Data\Toxic2\ProcessedData\Late.gdb

Create new geodatabase (optional)

Location of the new file geodatabase (optional)

Name of the new file geodatabase (optional)

Helicopter Registration (optional)

Download time (defaults to current time)

1424

Set up and write parameters to D:\Users\mmarshall\Desktop\Tonga_Eradication\Late_Island\TracMap_utilities\parameters.csv. No flight data will be processed. Refres

Dissolve total_polygons (by block and total) in Late.gdb and output a summary csv file to D:\Users\mmarshall\Desktop\Tonga_Eradication\Late_Island\Data\Toxic2\Pr

Tick if data is from a deflector bucket (optional)

Deflector direction (optional)

Right cast

OK Cancel Environments... Show Help >>

- Late
 - Application1
 - Processed_Flight_Data
 - Tracmap_HeliA1_LateEradication_Application1_08072023.gdb
 - bucket_info
 - helicopter_info
 - load_info_from_operation_log
 - non_sow_flight_path
 - operation_start_end_time
 - total_lines
 - total_points
 - total_polygons
 - totals_by_download
 - GIS bait log template for add load no and calc app rate toolbox - DOC-5437485 (3).xlsx
 - Raw_Flight_Data
 - IUU
 - 0748
 - 0859
 - 0900
 - 0927
 - 0930
 - 0956
 - 1019
 - 1037
 - 1117
 - 1119
 - 1122
 - 1130
 - 1134
 - 1207
 - 111c

Application rate calculation

- Manual calculation for monitoring app. rate between downloads
- Spatial analysis through python toolbox

TimeOut	HeliReg	LoadK	Block	Pilot	Bucket and delivery method	ApertureShape	Discharge aperture diameter mm	DeerRepellentUsed	DeliveryMethod	Machin eLoadN	LoadNo	Runnin gTotalK gs
1010	IUU	363	Broadcast	Davin Mudford	HA1-C1:Broadcast sow	Round disc	92.5	Not used	Broadcast sow	1	1	363
1028	IUU	716	Broadcast	Davin Mudford	HA1-C1:Broadcast sow	Round disc	90.0	Not used	Broadcast sow	2	2	1079
1045	IUU	726	Broadcast	Davin Mudford	HA1-C1:Broadcast sow	Round disc	90.0	Not used	Broadcast sow	3	3	1805
1102	IUU	726	Broadcast	Davin Mudford	HA1-C1:Broadcast sow	Round disc	90.0	Not used	Broadcast sow	4	4	2531
1129	IUU	726	Broadcast	Davin Mudford	HA1-C1:Broadcast sow	Round disc	90.0	Not used	Broadcast sow	5	5	3257
1149	IUU	726	Broadcast	Davin Mudford	HA1-C1:Broadcast sow	Round disc	92.5	Not used	Broadcast sow	6	6	3983
1205	IUU	726	Broadcast	Davin Mudford	HA1-C1:Broadcast sow	Round disc	92.5	Not used	Broadcast sow	7	7	4709

Add load no / calculate application rate

Geodatabase containing the processed TracMap data

Excel sheet containing the bait load, helicopter and bucket data from the operational log

Map all target fields to a column in the excel sheet

Target fields (load_info_from_operation_log table)	Available columns from the excel sheet

Tick if this is the final update to the load table

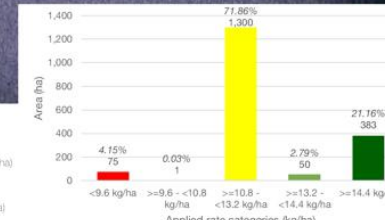
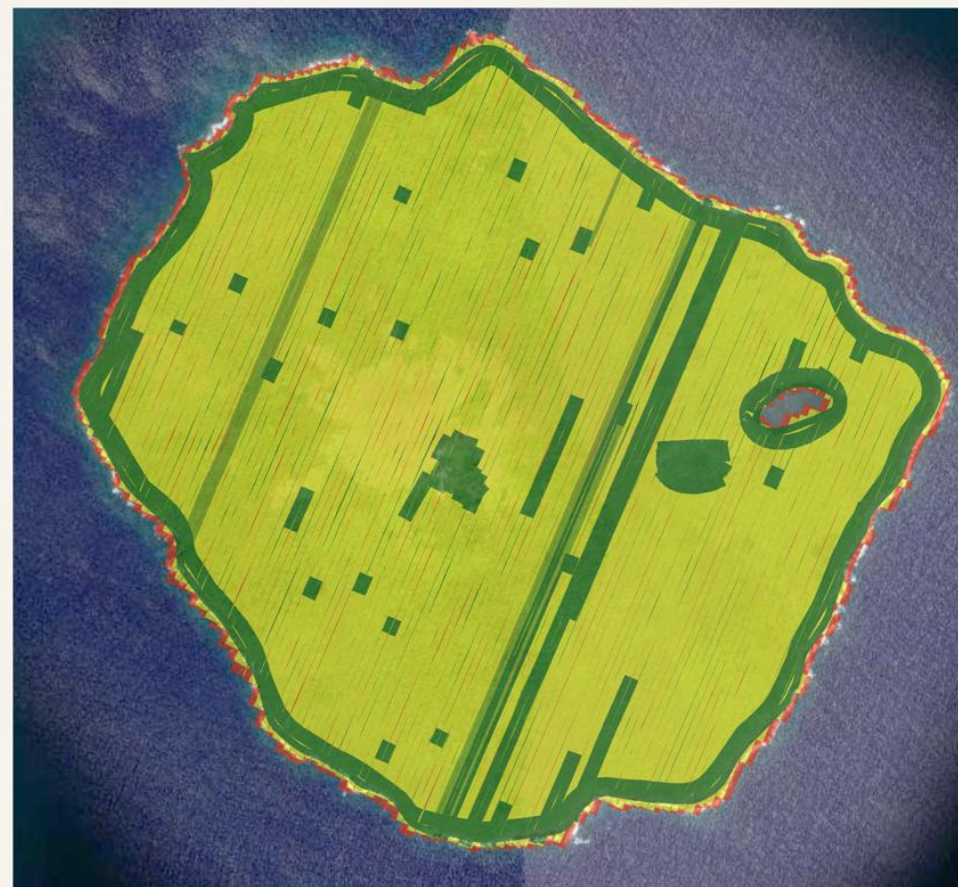
Add data to or update the helicopter info table from the excel spreadsheet (existing data will be overwritten)

Add data to or update the bucket info table from the excel spreadsheet (existing data will be overwritten)

OK Cancel Environments... Show Help >>

Analysis

- Overlapping swaths require accumulative app. rate
- Gap analysis



Total kgs applied (bait log)	24,822				
	Aerial application area (bait log)	Nominal area (broadcast - flat buffers)	Nominal area (deflector - flat buffers)	Dissolved broadcast area (GIS)	Dissolved deflector area (GIS)
Kgs Applied	24,822	23,496	1,326	23,496	1,326
Hectares	1,754	4,088	84	1,808	79
Overall applied rate (kg/ha)	14.15	5.75	15.8	13	16.78

Count_overlaps_v1.3a

Input data

Place output in existing file geodatabase (optional)

Existing file geodatabase (optional)

New file geodatabase folder location (optional)

New file geodatabase name (optional)

Output featureclass name

OK Cancel Environ



Results

- Operation went smoothly good coverage and application rate
- Monitoring next year will confirm if the operation was successful
- Possible re-introductions of endangered species



Questions?

mmarshall@doc.govt.n