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NGA-PU-TORU PANDANUS SURVEY (Ara Pepe) (MAUKE).

The following report is a brief summary of the Nga-Pu-Toru Pandanus (Ara Pepe) Survey that was carried out in Mauke by Natural Heritage Trust (NHT), National Environment Service (NES), Atiu Mokoero Caretaker and Te Ipukarea Society (TIS) from the 19th – 22nd September 2017.

Report completed by:
Benjamin Maxwell (Environment Officer - Advisory & Compliance Division)
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Introduction:
The Natural heritage Trust (NHT) with the support of the National Environment service (NES) Ridge to Reef project conducted a survey of the Nga-Pu-Toru Pandanus (Ara Pepe) of Mauke, which took place on the 19th - 22nd of September 2017. The survey was planned to provide information of the following specie including the Ara Tai (Pandanus). The team (figure 1) that flew over to Mauke included the director of the CKINHT Gerald McCormack, NES Environment Officer Benjamin Maxwell, Mauke NES Environment Officer Basilio Kaokao Snr and volunteers George Mateariki (Atiu Mokoero Caretaker) and Liam Kokaua (TIS).

Background:
Cook Island Natural Heritage Trust has taken the lead in many of these assessments by mapping location, interviewing local communities and collecting other relevant data. The Ridge to Reef project is looking to provide support to these activities as they fall within Activity 1.2.4 - Implement targeted Species Conservation Plans which looks to developing conservation activities of species of high priority and designing potential methods of addressing the main threats of invasive species and habitat destruction. The project document identifies specific flora and fauna species to be a key focus of these activities looking towards the development of management plans on the mentioned species. The key species include the Nga- Pu-Toru Pandanus (Ara Pepe).

The collecting of information is to generate a baseline of information for the mentioned specie, type of information include locations and approximate population numbers so they can be compared to past or future assessments.

The report includes the various survey methodologies that were undertaken by the survey team and some results on what was observed. The survey was from the 19th – 22nd September 2017, which was very quick.

Key Outcomes of the assessment:
- Mapping locations of the Nga-Pu-Toru Pandanus (Ara Pepe) on Mauke
- Population densities of the mentioned specie.
- Using a DJI Drone to take photos of each surveyed site and GPS points to plot location.
Nga-Pu-Toru Pandanus (Ara Pepe) census:
The Nga-Pu-Toru Pandanus is a Native and Endemic on two islands in the Cook Islands which is Mauke and Atiu. The Pandanus is only found within areas of makatea (raised limestone rock) which encircle each island, which very few other plants are able to survive and grow in. On Mauke the ara pepe grows alongside one of the common species of pandanus known as ara tai. To the untrained eye it is very hard to tell the two plants apart unless the fruit of the ara pepe is present. The ara pepe fruit is dark reddish brown, compared to the fruit of ara tai which is varies from green to yellow to orange.

Aside from the general characteristics which are common to both ara tai and ara pepe, the ara pepe has much softer fruits, which enables them to be threaded straight through when making ei’s, unlike the fruit of ara tai which are very hard to put a needle through.

Methodology:
The survey was conducted in the morning from 8.30am to 12.30pm and recommence at 1.00pm to 6pm. The survey sites which was undertaken for the Nga-Pu-Toru Pandanus (Ara Pepe) (figure 2) Areas Vaimutu, Anua, Ana O Kae sites Teunu, Tepariaanga, Anaiti, Anaraura, Arapaea, Te Rua Okiu, Aanga are the main areas and site of makatea which the Nga-Pu-Toru Pandanus is found growing in large clusters alongside the Ara Tai which is a common Pandanus in the Nga-Pu-Toru and Mangaia islands.

- Group stayed together and commence survey from the main coastal road.
- Record GPS location at each 100m Distances point along a transit line of 400m.
- Record numbers of Ara Pepe & Tai at a 10m radius of the GPS Location.
- Note down main herbs, shrubs, trees and bare Makatea within the area.
- Using a DJI Drone to take photos of the surveyed area.
First Nga-Pu-Toru Pandanus (Ara Pepe) Survey Site (Tuesday 3pm):

The first survey site (Figure 3) were conducted by walking the makatea and setting a transit line due North at a 400m distance at 100m interval to take GPS coordinate and record the numbers of ara pepe and ara tai within a 10m radius. The team also had to record the height in metres of the tallest ara pepe and ara tai they can see also recording the % of bare makatea, main herbs, main shrubs and trees.
Methodology of Survey:

- The assessment provided an opportunity for the team to see the ara pepe and provide baseline for locations of the ara pepe and habitat. The location in reference to the Mauke ara pepe are located on the southwest side of the Island located within the Makatea.
- The sites were roughly about 100m from the main road and Basilio Kaokao Snr guided the team to the first point to conduct our survey.
- The numbers of ara pepe that was counted for each GPS point taken is shown in (Figure 3).

Results:

Coordinates were recorded (Figure 3) which was converted onto GIS software and placed on a satellite Image from 2015. Similar looking clusters were identified on the image providing locations of the Nga-Pu-Toru Pandanus.

- As you can see with in (Figure 3) the team did not stick to the 400m transit line due north as Gerald instructed us to head west because his GPS is showing that north was in the direction of west hence the result in (Figure 3).
- The team recorded each point by physically counting the ara pepe clusters and the ara tai in a 10 meter radius. Gerald explained that this method is a good way in calculating the average percentage of ara pepe within Mauke.
- The team found it challenging tramping over the makatea in Mauke and time consuming in trying to complete surveying of all the allocated sites in just three days.
Furthermore we also discussed in using the DJI Drone to also try and do the survey by taking photos from a birds eye view and map the coordinates using it’s built in GPS and Satellite system.

![Figure 4: Photos of the team physically surveying the first site in Ana-O-Kae.](image)

**Wednesday 20th September Survey of Ara Pepe in (Vaimutu):**

The team headed out to Vaimutu to test whether the drone option will be able to capture all the important features of each site and whether we may be able to analyse the footage and identify the Ara Pepe and the Ara Tai from a birds eye view. Teunu was the first site we used the drone then Tepariaanga, Anaiti and Anaraura. The drone Pilot was Benjamin Maxwell with the rest of the team on standby to retrieve the drone. The team got straight into analysing the footage after lunch time using Basilio’s project.
**Wednesday Drone Survey**

![Drone Survey Sites](image)

*Figure 5: Wednesday Drone Survey Sites*

**Methodology of Survey:**
- 3 Sites were visited (Figure 5) to test the DJI Drone take footage at a 400m or 300m transit line with three to four 100m interval to take GPS coordinate and footage.
- The site surveyed were sites that Basilio and Gerald had done at the beginning of the year.
- The Drone took 4 photos in rotation of each GPS point at each 100m and at a height of 5m to 18m depending on high tree cover.
- The footage and data collected by the drone will determine on how the rest of the survey will be conducted whether by drone or we will have to tramp the makatea.
- Analyse the data from the drone to a laptop and have it projected for analysing.

**Results:**
The Drone surveyed 3 sites (figure 6) and when the data was analyse after lunch the team was satisfied with the outcome of the drone footage. The ara pepe and ara tai are clearly easy to identify from a birds eye view and also the GPS coordinates on each photo can also be mapped on any GIS mapping system.

- Gerald was also convinced that we can continue using the drone for the rest of the survey sites.
- The Ara Pepe are also captured in the footage in very large clusters along the Makatea in the 3 sites we surveyed.
- The photos are also very clear in detail to see even the smallest shrub cover along the makatea.
When analysing the footage you can zoom in to get a closer view of the area to clearly identify the ara pepe and the ara tai also the herbs and shrubs within the area shot.

Figure 6: Images of the three Wednesday Drone sites.

Drone Surveyed for all Allocated sites;
Throughout Thursday and Friday the team conducted 12 surveyed sites which using the drone to capture all the necessary data for recording back in Rarotonga. The drone was used for all 12 sites and the rest of the team manage to assist Gerald with collection moss specimen for analysing and recorded in to the database.
Survey of tall growing Ara Pepe Site;
During Thursday we visited a site where the Ara Pepe growth are very different compared to the ara pepe found in the open makatea. This site is covered in huge Tamanu trees and it’s a well-known area for the locals to go and get tamanu timbers for their traditional drums etc. The Ara Pepe with in this area are very tall and all most similar to the Ara Tai (Figure 8).

The team had a Discussion with Gerald in regards on how to identify the Ara Pepe from the Ara Tai especially when it grows as tall as the Ara Tai? George and Basilio pointed out that the Ara Tai has no aerial roots (kai ara) growing from the branches but the Ara Pepe has aerial roots growing from each of its branches. Further to our discussions we spoke about the difference of the leaf for both Pandanus (Figure 8) on the left is the Ara Pepe leaf and on the right is the Ara Tai. Gerald has taken all the suggestions, samples and will take further look into the different characteristics of both plants.
Recommendations:

1. Increasing Education and awareness on the endemic species of Mauke. The local community use the Ara pepe during the fruiting season to make ei’s and know how to access the paint, but the lack of awareness they have about the importance’s of the species is present on the island.

2. Looking to involve the local community more in assessments and other planned activities to increase awareness and the provision of local advice to protection initiative.

3. Looking to build on the local community to support the development of the management initiatives of the endemic specie of Mauke.

4. The use of the DJI Drone can also carryout conservation surveys from a different angle and capturing of important data is also recorded.

Conclusion:

This survey provided National Environment Service (NES), Ridge to Reef (R2R) project the opportunity to work in partnership with the Natural Heritage Trust (NHT). The Ridge to reef project looks to support current conservation activities such as the continuing to collect information on the endemic specie the main specie of Mauke Nga-Pu-Toru Pandanus (Ara Pepe). The survey Methodology by using a DJI Drone to carryout surveys from a different point of view was a huge success and may be the new way forward for collective surveying in areas rough and hard to access by foot. The conducting of assessment of the Nga-Pu-Toru Pandanus (Ara Pepe) was a lot easier and we manage to complete all the allocated sites on time.