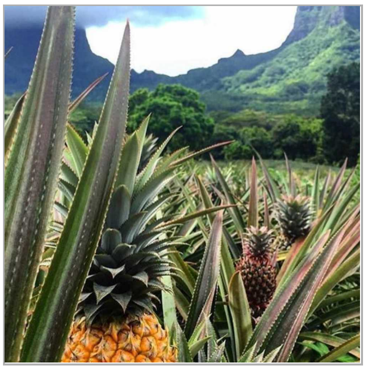

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ISP Research Proposal

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DISCLAIMER

This was for a class assignment, and this proposal is purely theoretical.

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We are still developing and optimizing this protocol

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ABSTRACT

The island of Mo’orea is the heart of French Polynesia’s pineapple production. Ever since farmers advocated for the opening of the Rotui Juice Factory in 1981, production has increased to support growing demand for the factory’s tropical fruit juices. Today, pineapple (Ananas comosus) persists as the primary cash crop, accounting for 140 hectares of the island’s agricultural land (PROTEGE, 2021). Pineapple cultivation on Mo’orea is concentrated in the slopes of ‘Opunohu Valley where pineapple producers generally follow conventional agricultural production methods, such as monocropping, application of toxic synthetic fertilizers and pesticides, and tilling. In fact, pineapple plantations score lowest for soil health among crop production systems surveyed throughout French Polynesia (Surchat et al., 2021). Conventional methods notoriously cause soil compaction, decreased water infiltration, decreased soil microbiomes, decreased soil organic matter, decreased biodiversity, and leave large areas of land without living cover for extensive periods, leading the topsoil to become critically vulnerable to erosion. On pineapple farms, one study identified the bare access corridors and roads between fields as the most at-risk sites for erosion (Binnet & Gonnot, 2005). In addition, researchers estimated soil loss in recently cleared fields to be 400 T/ha/year (Gonnot et Binet, 2004). Notably, the island experiences periods of heavy precipitation that exacerbate on-farm soil erosion. Sediment runoff from the fields contributes to the estimated 388.5 /sediment/day that feed into the ‘Opunohu Bay from the ‘Opunohu River (Taiarui et al., 2017). Erosion control is crucial for ‘Opunohu Bay because sedimentation becomes another stressor for Mo’orea’s reefs. Multiple studies demonstrate that increased sedimentation and turbidity negatively impact coral health and lead to decreased biodiversity in the fringing reef (Morancy, 1994). Sediment smothers corals and decreases light availability for symbiotic algae, thus reducing photosynthetic efficiency (Fabricius, 2005; Tuttle & Donahue, 2022). Corals also experience decreased gamete fertilization, reduced larval settlement, decreased growth rate, and mortality.The impacts of agricultural erosion on marine life should be a concern for local authorities and could be mitigated by decreasing the amount of exposed soils (Boutillier & Duane 2006). If conventional production methods also degrade marine ecosystems then: **How can incorporating agroecology-based farming principles into the Opunohu Valley’s pineapple producing-sites benefit coral reef management and conservation in Mo’orea, French Polynesia?**

GUIDELINES

For soil sampling, make sure the tools/equipment are cleaned of any residues between samples.

MATERIALS

field notebook
colorful marker flags
small steel rod
soil probe
spade/shovel
labeled sample bags
buffer plant species
timer/stopwatch
steel soil infiltration cylinder (150 mm diameter; 75 mm depth)
plastic wrap (optional)
mallet (optional)
wooden block (optional)
2 liters of water per sample site
2 clear jars
ruler or yardstick

BEFORE START INSTRUCTIONS

In order to involve the community and address local needs, an integral part of this project includes partnering with the Rotui Juice Factory, the cooperative of Mo'orea pineapple farmers (CoPAM), and the Opunohu Valley Agricultural School. These three entities are key stakeholders for agricultural production on the island, thus they are likely the most knowledgeable about possible ways to manage erosion as well as potential challenges. This study will commence by hosting an informational meeting and an open-invitation to all interested producers. Participating local stakeholders will guide this study based on their specific knowledge and needs.

Identifying Plant Species For Field Buffers

1 Meet with the participating pineapple producers and the agricultural school officials to listen and discuss which plant species they think may be suitable to use as a mulch, cover crop, or field buffer on their farm.

2 Conduct site visits with the producers and identify the field corridors that are most at-risk or that are actively undergoing erosion using marker flags and a small steel rod.

3 Once the producers have selected a plant species to use as, plant them along the problem areas.

4 Collect soil samples at all the sites before the field buffers are planted and continue after three months of growth.

4.1 At each field site, take 5 randomized 0-15 cm depth samples and combine to create a composite sample (try not to break any soil aggregates) : Insert the soil probe into the soil, pull it out, and pour the soil core into a labeled plastic bag.

4.2 Using the composite samples, conduct a slake test. Select a dry soil aggregate from the composite sample and place into a clear glass container filled with water. Once the soil is submerged, start a 5 minute timer and observe whether the soil disintegrates or stays intact. After the 5 minutes, assign the sample an aggregate stability score using a slaking score guide.

4.3 To Conduct a water infiltration test (protocol from Soilmentor):
1. remove all debris, weeds and vegetation where you aim to set the tube – either trim down or cut through with a knife.
2. Insert the steel cylinder into the bare ground, to 75mm depth
3. Firm the soil gently on the inside of the tube. If using plastic wrap, cover soil and inside of tube with wrap to protect soil surface
4. Either measure out 450ml of water, or insert ruler into the cylinder, ready to record 25mm of water added
5. Pour water into cylinder and start timer (if using one, gently pull away the plastic sheet before starting the timer)
6. Pour water into cylinder and start timer (if using one, gently pull away the plastic sheet before starting the timer)
7. Stop timer when all the water has disappeared into the ground and the surface is just glistening. Record the time in your field notebook to the nearest half minute under 'Infiltration rate – 1st inch (mins)'
8. Repeat steps 5-7. Record this second time in your field notebook under 'Infiltration rate – (2nd inch) mins'. **Only this 2nd inch reading will be used, as it gives a better indication of your soil's 'real' infiltration rate, less affected by recent weather**– the first test may be just wetting the soil. If the soil is already saturated you may find there is little difference between the times.

4.4 To quantify erosion, use the Universal Soil Loss Equation A=RKLSCP where
A = loss of soil (t/ha•year),
R = rain erosivity factor (MJ.mm/ha•h),
K = factor of soil erodibility (t•h/MJ•mm),
L = slope length factor (dimensionless),
S = slope factor (dimensionless),
C = land cover factor and cultural operations (dimensionless),
P = factor of conservative practices (dimensionless).

5 Repeat Step 4 and all of the substeps every 3 months (for every stage of the pineapple plant's phenological growth or as the canopy grows and the plant matures)