EUROPEAN UNION

SPREP
Secretariat of the Pacific Regional Environment Programme

PacWastePlus
PACIFIC WASTE MANAGEMENT

This initiative is supported by **PacWastePlus**-a 72 month project funded by the European Union (**EU**) and implemented by the Secretariat of the Pacific Regional Environment Programme (**SPREP**) **to sustainably and cost effectively improve regional management of waste and pollution.**

INTRODUCTION TO COMPOSTING

Organic Waste

PACWASTE PLUS PROGRAMME

REGIONAL ORGANICS MANAGEMENT PROJECT

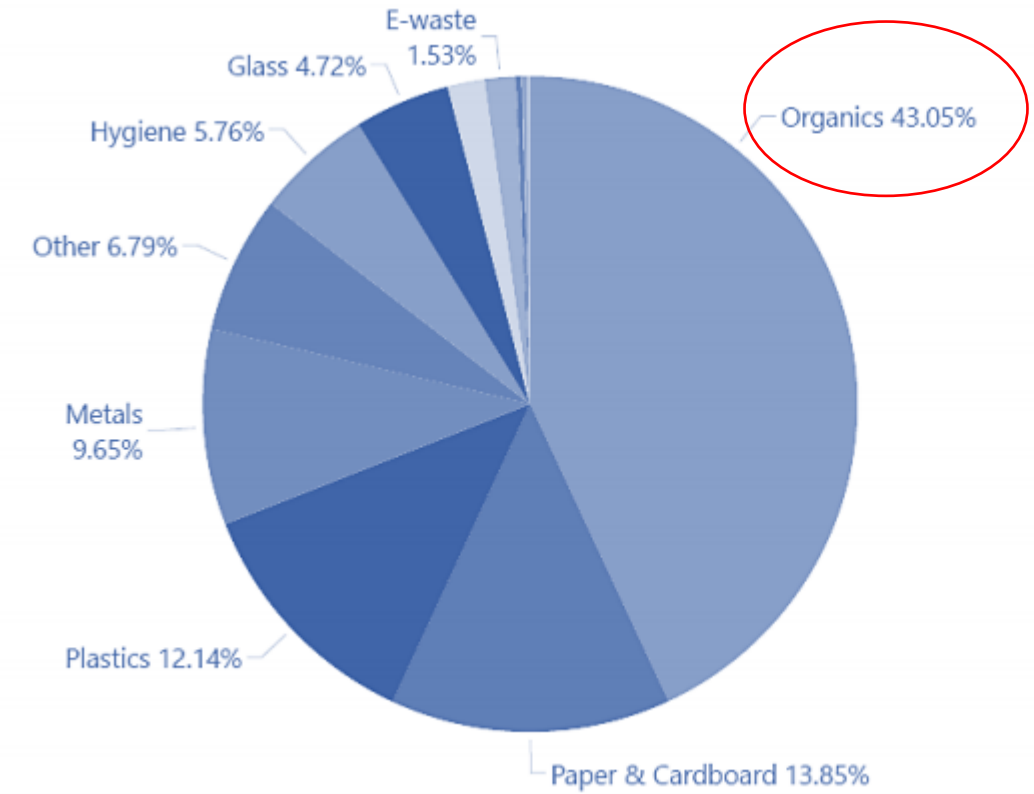
The PacWaste Plus Programme

www.pacwasteplus.org

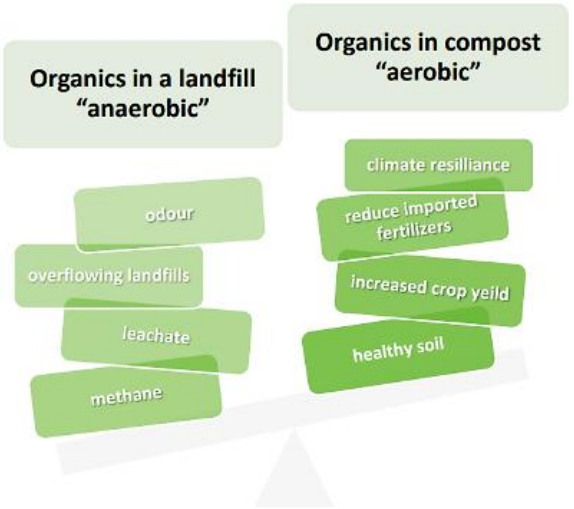
- The Pacific – European Union (EU) Waste Management Programme, PacWaste Plus
- Implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP)

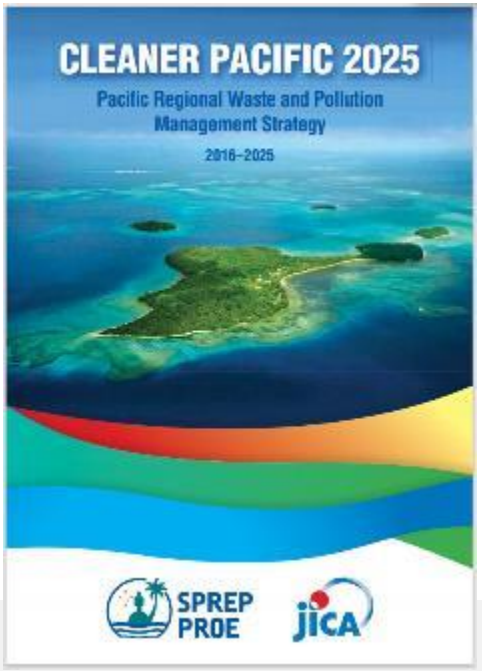
- Aims:
  - Improve economic, social, health, and environmental benefits.
  - Enhancing existing activities
  - Building capacity and sustainability into waste management practices.

Context

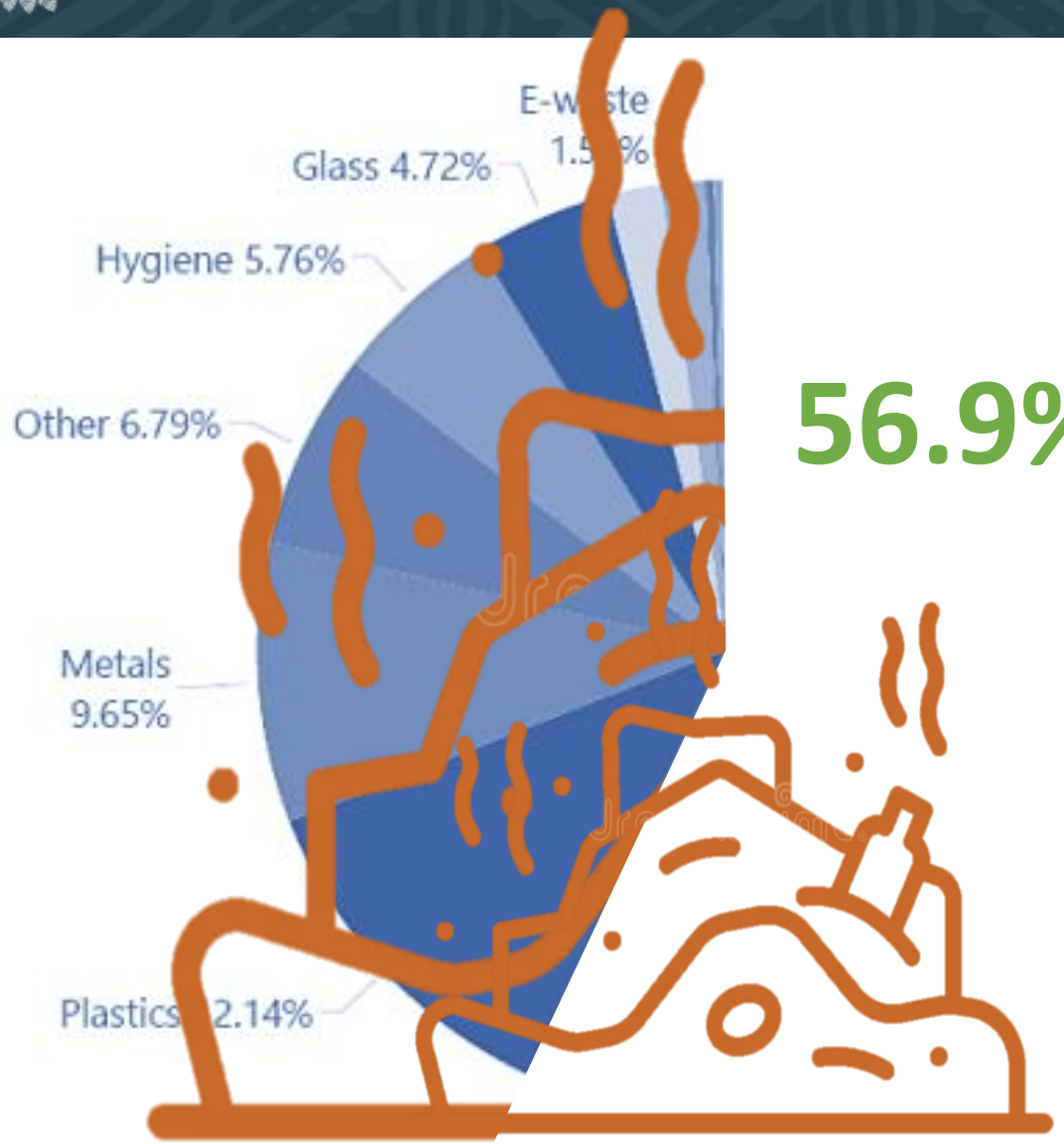


Average MSW composition for the region (% by weight)





- Odour
- Methane
- Leachate
- Landfill capacity
- Cost



56.9% =

- Returning nutrients
- Healthy soil / crop yield
- Employment
- Climate resilience
- Savings
- Less chemicals

Regional Waste Audit Analysis Report 2023
https://pacwasteplus.org/resources/regional-waste-audit-analysis-report/

Where can we be?

Activity:
Current Composting Process / Understanding Existing Knowledge

Activity Time: **15 mins**

Principles for Effective Composting

Composting: Terminology

Organics or Organic Material

Materials that were once part of a living thing.
Can include: garden cuttings, grass and branches

Mulch

Woody and garden organic materials, once shredded,

but before undergoing a composting process

Composting

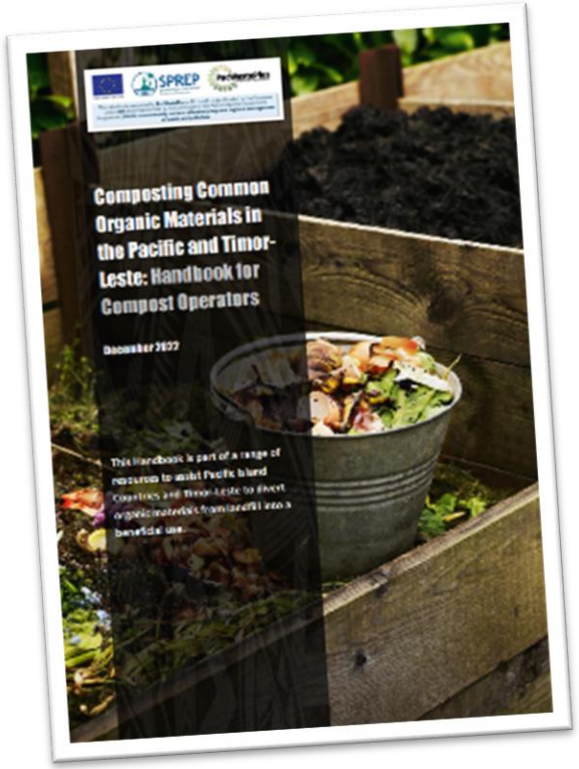
A natural biochemical process - naturally occurring microorganisms transform raw organic materials into compost products

Compost

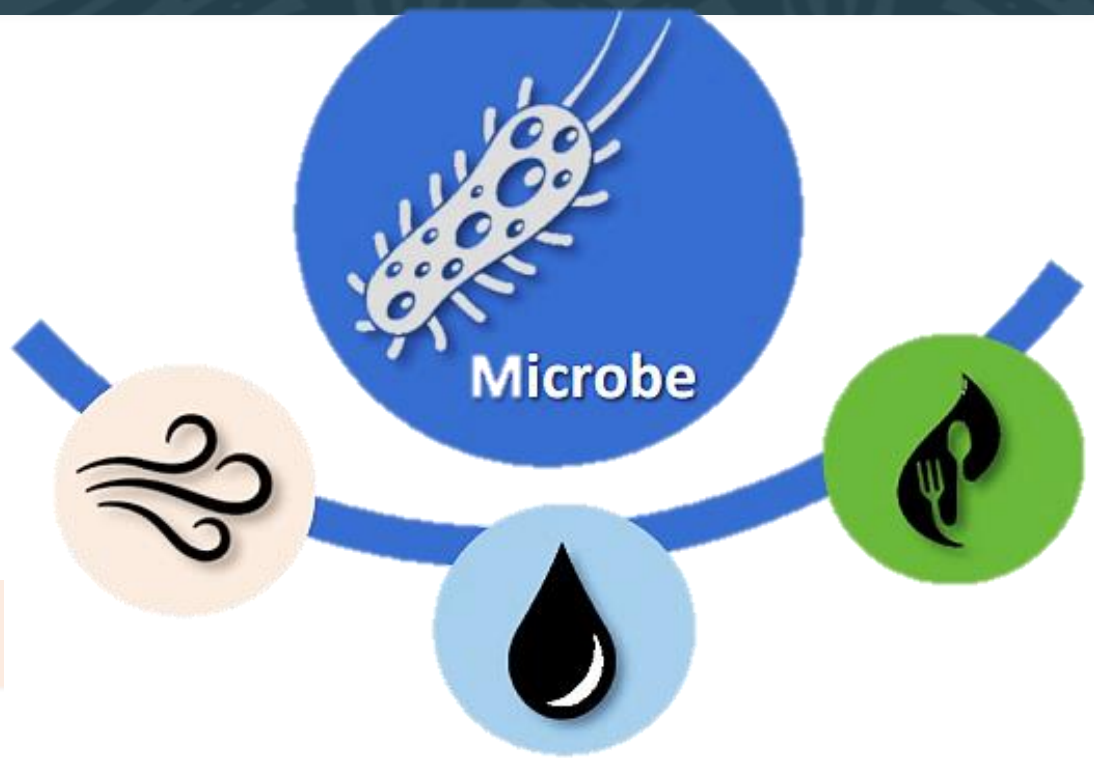
Organic material that has been broken down during composting, looks and smells like dark, fertile garden soil

Compost is more than the sum of its parts; *it is an ecosystem.*

Common Organic Materials found in the Pacific



How Does it Work?



Air

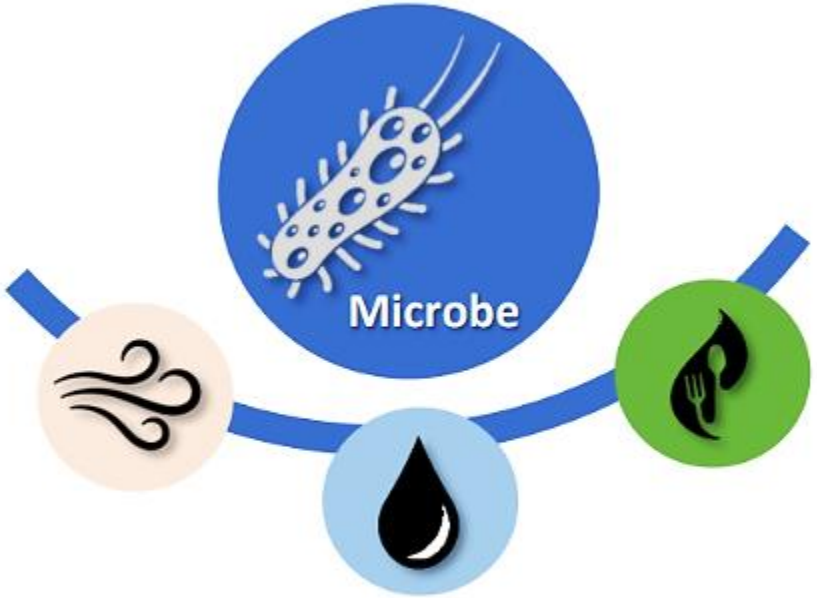
Oxygen provides microbes air to breath. Oxygen makes the composting process work faster and more effectively, and it also reduces likelihood of a compost pile producing bad odour.

Water

Water provides the microbes liquid to drink. Microbes will dehydrate if the compost pile is too dry but will drown if the compost pile is too wet, slowing down the microbes and producing bad odour.

Food

Microbes eat organic material to create compost. Microbes need the right sort and balance of food to be effective at creating compost, the two key nutrients are “carbon” and “nitrogen”

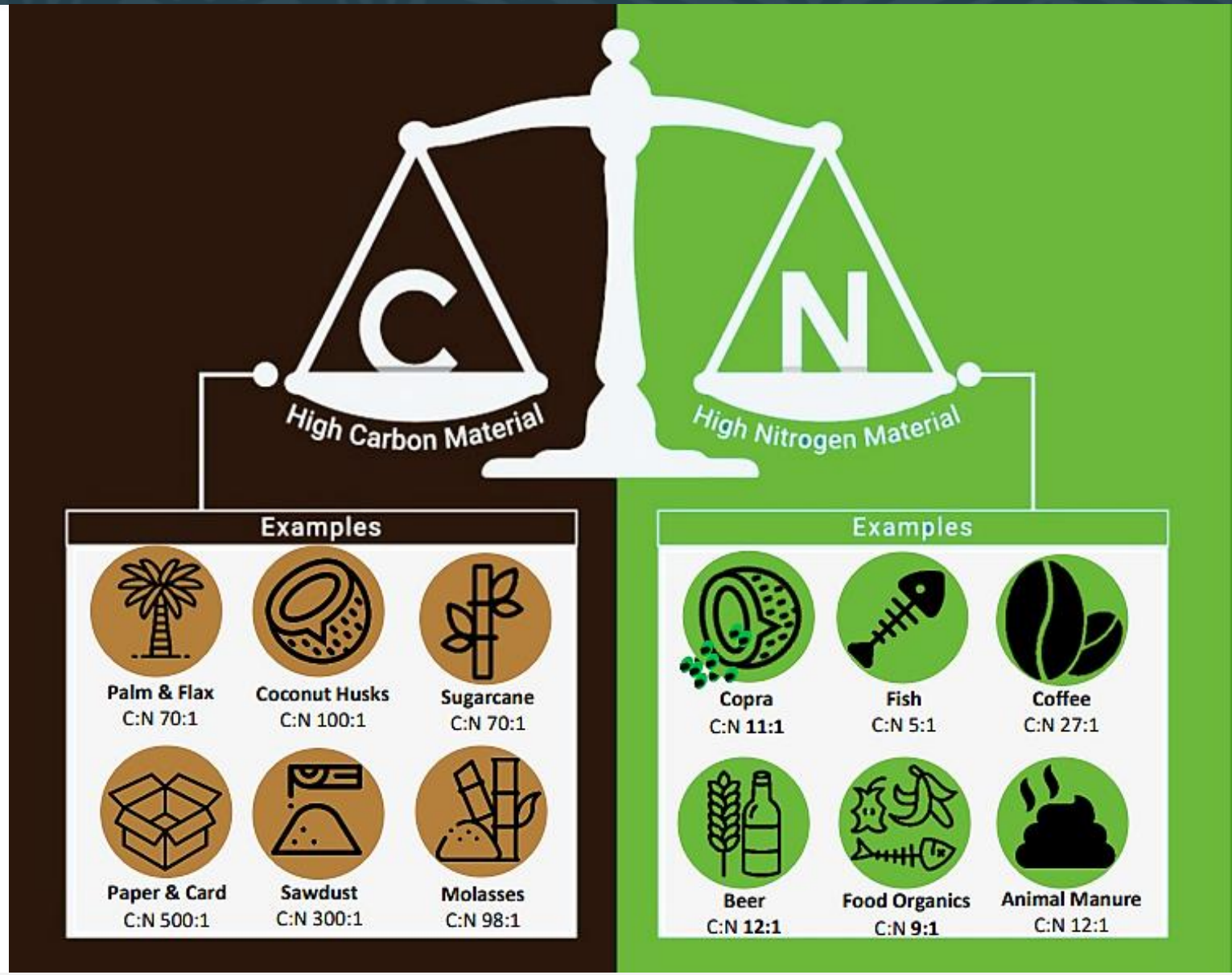


Air | Water | Food

TIME

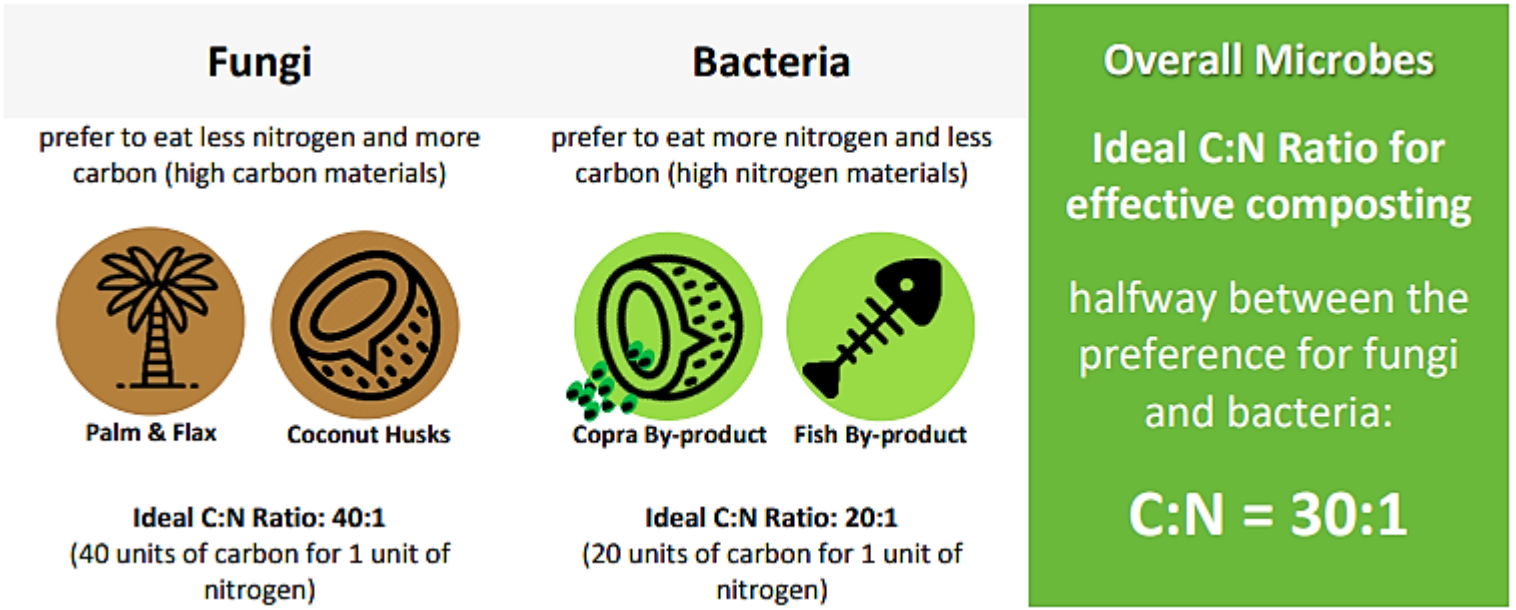
How do we add: Food

The Carbon to Nitrogen Ratio



The Carbon to Nitrogen Ratio

- Calculating correct C:N Ratio for effective composting
- This helps to understand how microbes behave
- Two main groups of microbes:



Microbes in a compost pile use carbon as a source of energy
Nitrogen for building cell structure

How do we add:

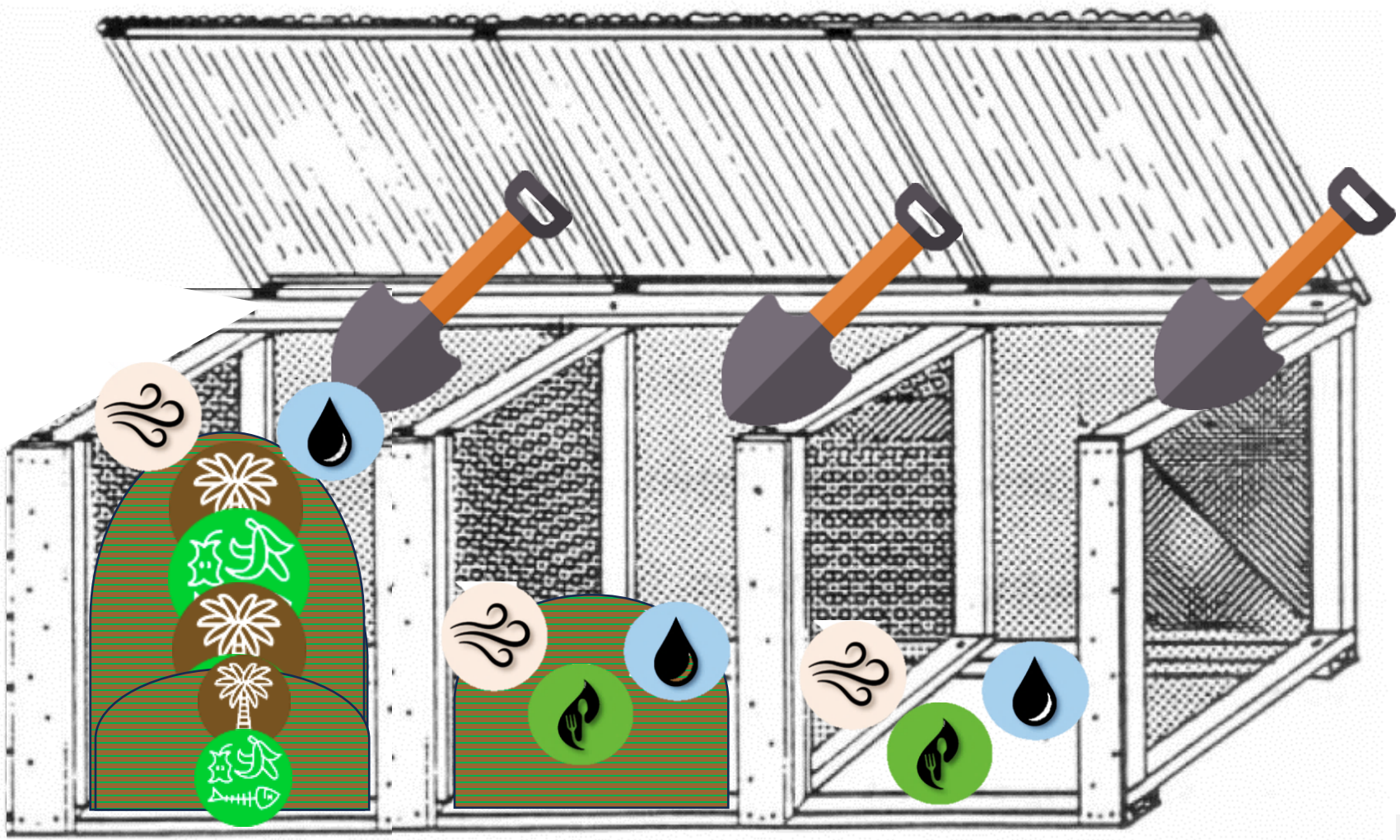
Water

- Add in “damp” materials e.g. leaves, food scraps
- Add water at the start of the process
- Add water during the process if the bay gets dry

- Several options:
  - Bucket
  - Hose
  - Sprinklers, etc
- Don’t forget to mix

How do we add: Air

- Variety of particle sizes – small and large
- Turning during the process to “fluff up” the bay



How do we add: Air
Turning the Pile

How do we add: Air
Mixed Particle Sizes

- Variety of particle sizes – small and large
- Shredding larger material assists the microbes and provides air pockets in the compost piles

Shredder Selection: Drum Shredder

Suitability of "Drum" Shredders over Disk Shredders in the Pacific

Power and Durability: strong motors and durable components, less prone to wear and tear

Faster Processing: continuous and more efficient shredding

Safer Processing: drum blades do not get "caught up" with fibrous vegetation (common in disk shredders) – less need for staff to interact closely with the blades

Lower Maintenance: rugged design and fewer moving parts, requiring less frequent maintenance

Material focus

Palm and flax

AIR

Helpful for aeration

WATER

May impede water retention

FOOD

High in carbon

Material focus

Coconut husks

	Whole coconut husks or shredded	Powdered coconut husks
AIR	Helpful for aeration	Impedes aeration
WATER	Helpful for water	Impedes water retention
FOOD	High in carbon	High in carbon

Source: Coconut husk, biomass from coconut: fibers are known as coir (lampoonmagazine.com)

Source: The Benefits of Coconut Husk as a Growing Medium – Unsolicited Plant Talks - Online Store (gengoodmk.shop)

Material focus

Yard / community clean- up

AIR

Helpful for aeration

WATER

Helpful for water

FOOD

Carbon/ neutral

Material focus

Animal manure

May impede aeration

May impede water retention

High in nitrogen

Source: [Animal Manure - POD | Easy Edible Gardening (podgardening.co.uk)]

Material focus
Fish processing by-product

- Size of input to be considered

May impede aeration

Helpful for water retention

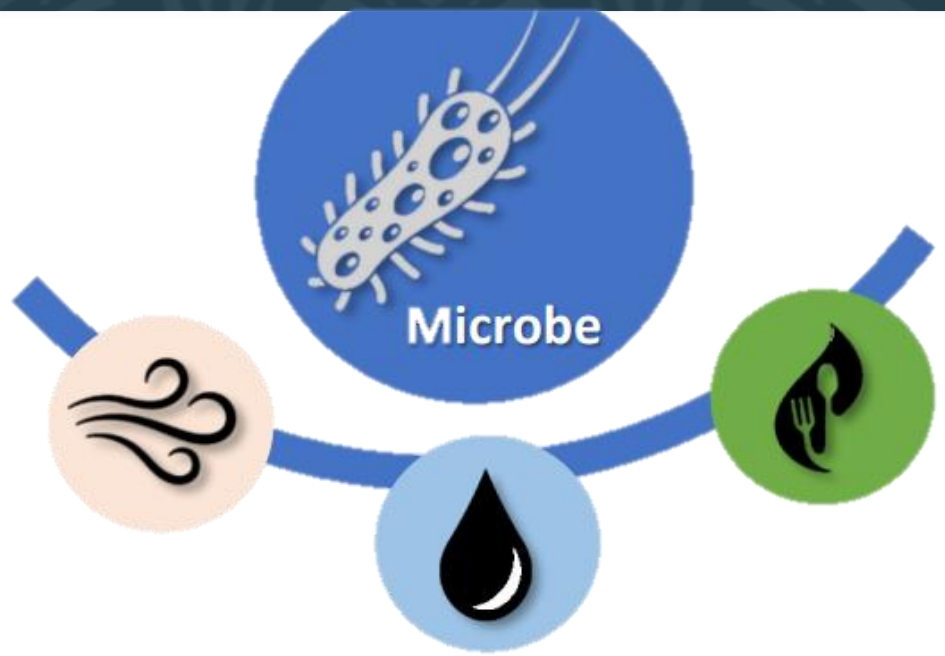
High in Nitrogen

Source: [The new hybrid? Blending plant-based proteins with fish by-products, algae, and insect larvae (foodnavigator.com)]

Source: [BLUEPEACE blog » FISH WASTE: POTENTIAL REVENUE DUMPED INTO THE SEA (bluepeacemaldives.org)]

Monitoring and Reporting

Checking on compost



Air

Visually inspect the compost pile to confirm it has a mix of large and small items, with large pieces (enabling air to flow through).

If there is a foul odour, it may indicate insufficient airflow.

If there is a foul odour and/or the compost material is clumped together, turn the pile and add additional items that are "Helpful for aeration" (*from **Section 3***)

Water

Compost should be damp to the touch but not too wet. To assess water content, collect a handful of material and squeeze-if a just few drops of water are released the moisture content is about right.

If there is a foul odour, it may indicate too much moisture (*restricting airflow*).

If the compost is too dry, add water or additional items that are "Helpful for water retention" (*from **Section 3***)

If the compost is too wet, turn the pile and add additional dry items that are "Helpful for aeration" (*from **Section 3***)

Food

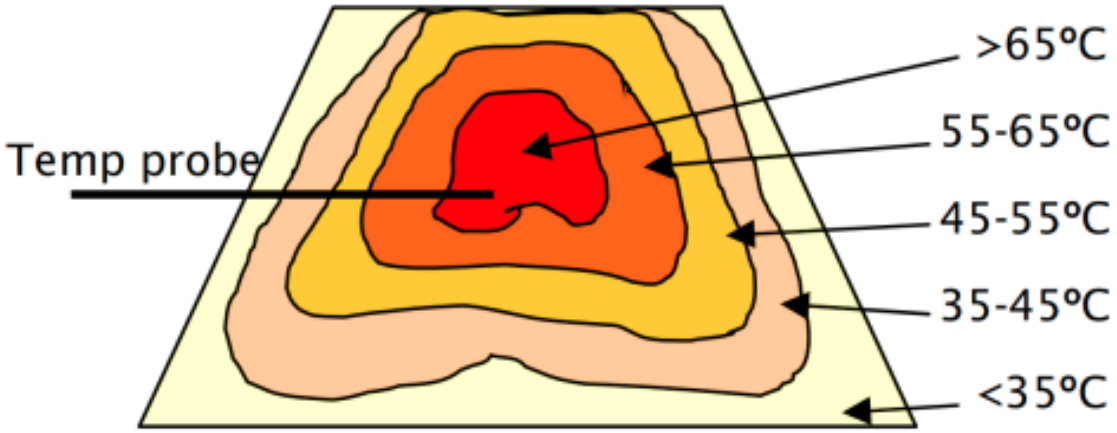
If too much **nitrogen** the compost may appear wet and soggy (*due to an excess of nitrates*). There will also be a bad ammonia-like smell. Excessive nitrogen may be detected through monitoring temperature, too much nitrogen will have a high temperature.

If there is a foul odour and/or a surplus of **high-nitrogen** materials (*i.e., materials that are fresh, flexible, and moist*), turn the pile and add additional items that are "High Carbon" (*from **Section 3***)

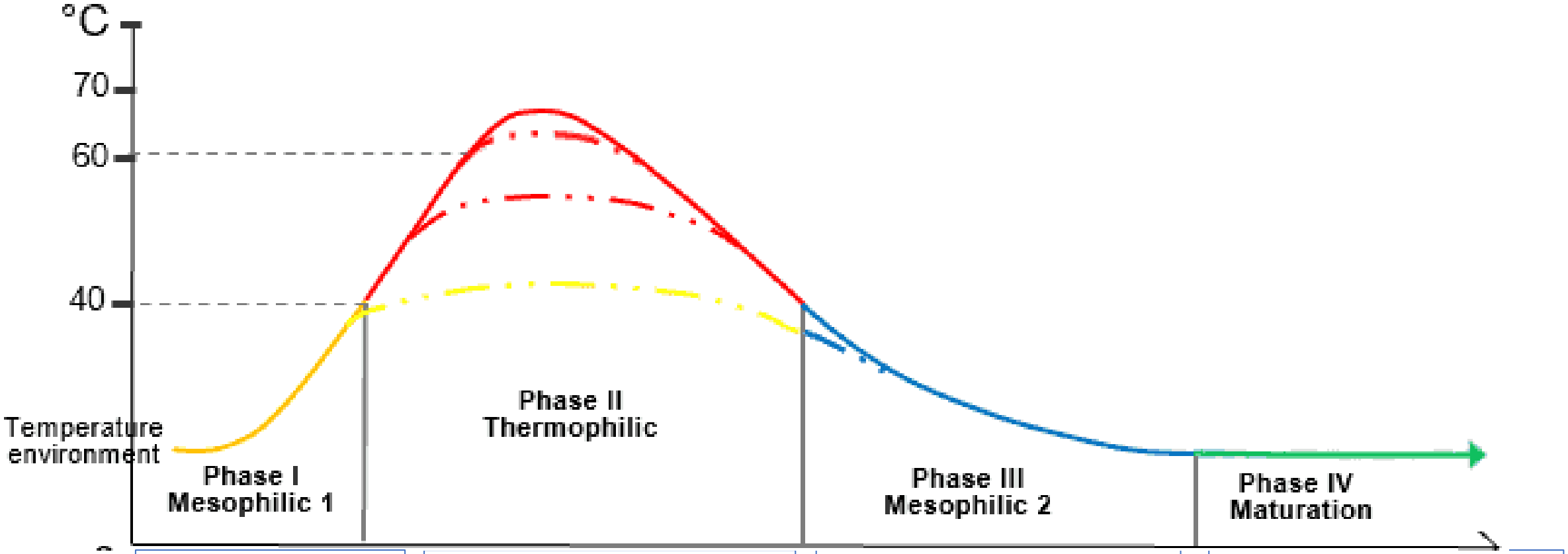
If too much **carbon**, the compost in the pile will be dry and be very slow to decompose. Excessive carbon may also be detected through monitoring temperature, too much carbon will have a low temperature.

If the composting process has stopped and there is a surplus of **high carbon** (*i.e., materials that are old, rigid, and dry*), turn the pile and add additional items that are "High Nitrogen" (*from **Section 3***)

Monitoring – temperature and moisture



Composting phases

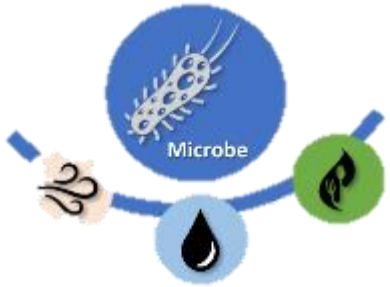


I. Microbes working hard = heating up	II. Heat loving Microbes = stays hot	III. Cooling, food running out	IV. Cool, **Stable**, cool soil

Monitoring and reporting – hands on

Why monitor?

What and how?



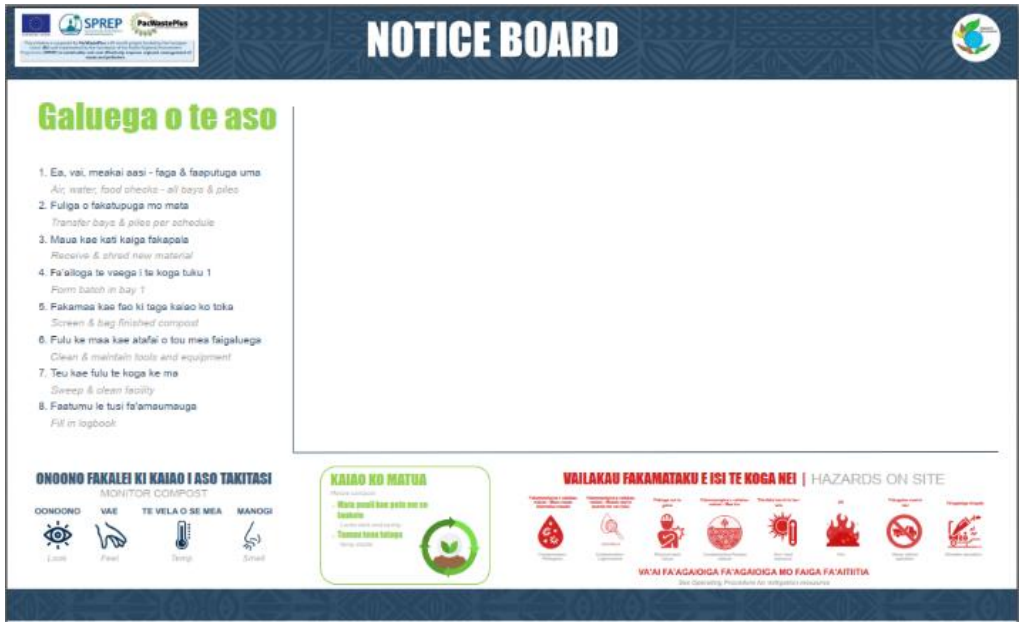
Checking Performance

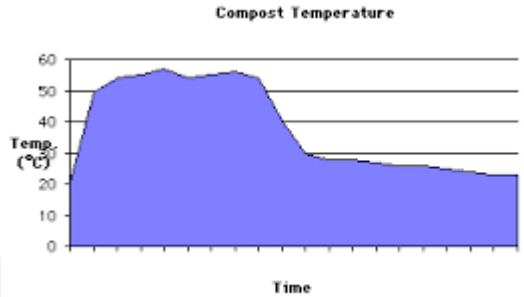
LOOK Visually inspect the pile	 Does it look...	dry & crispy	loose, mixed sizes	wet & soggy, clumped
FEEL Squeeze a handful of material	 Does it feel...	dry & crispy	moist but not too wet	wet & soggy
TEMP Measure with probe or spade	 Does it feel...	cool (<115°f)	warm (~130°f)	hot (>150°f)
SMELL Carefully smell the material	 Does it smell...	like "nothing"	good like "earthy"	"bad" like rotten egg

Checking Temperature

Reporting / Documenting Composting Process

- Recording sheet / notice board
  - Volume in
  - Date last turn
  - Date last Air, Water, Food check
  - Volume out
- Check Bays
  - Air, Water, Food
  - Contaminants
- Check Dumping Areas
  - Visually inspect
  - Noxious weeds, plastic, rocks present?





Data Collection

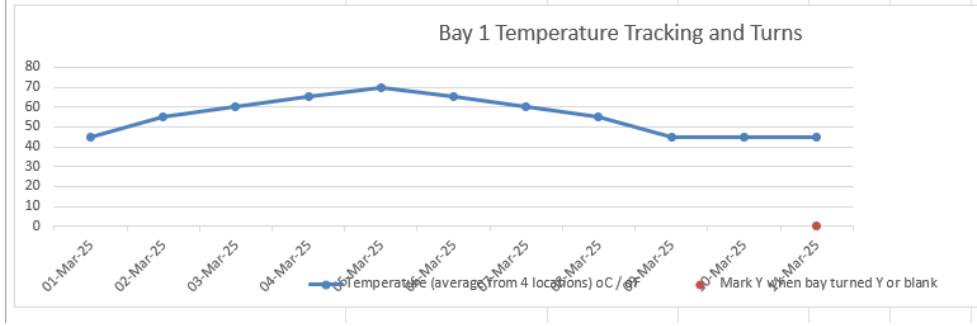
Organcis Management and Composting Daily Data Collection Template

Daily Data Collection Template

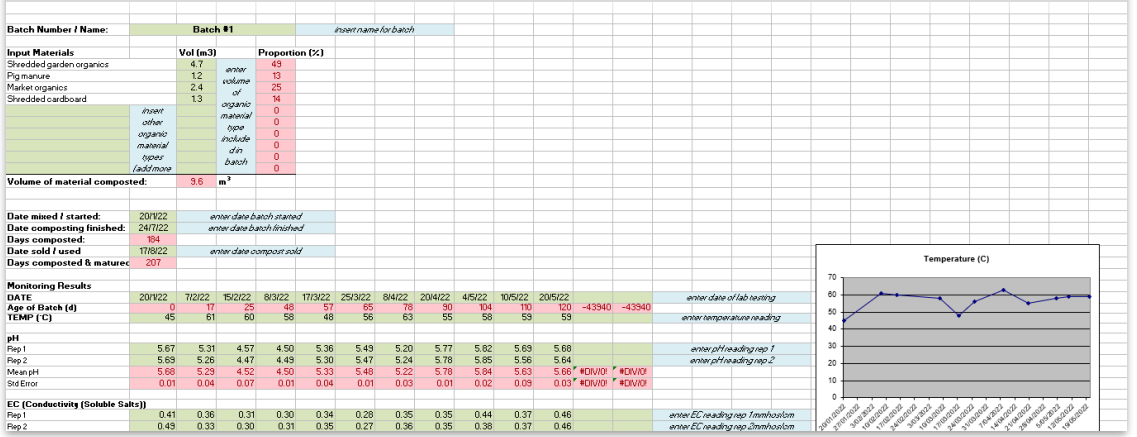
Facility Name						
Date						
Staff on duty						
Chipper Operation						
Chipper operating hours	hours					
Comments / maintenance needed						
Estimated pre chipped volume	estimated m3 / y3 / truck volume					
- % material type						
- Dry, rigid, brown material	%					
- Fresh, flexible, green material	%					
Estimated post chipped volume	estimated m3 / y3 / truck volume					
Comments						
Other Actions						
Was equipment maintained today?	Y/N					
Types of maintenance complete						
Maintenance issued detected						
Describe other tasks complete	i.e., litter pick up					
Issues to raise / actions for follow-up						
Compost produced						
Compost Made / Bagged	estimated m3 / y3 / # bags					
	estimated m3 / y3 /					

Compost produced	
Volume added to Bay 1	364
- Dry, rigid, brown material	57%
- Fresh, flexible, green material	43%
Compost Made / Bagged	87
Compost Sold	52

Composting Process
Bay 1



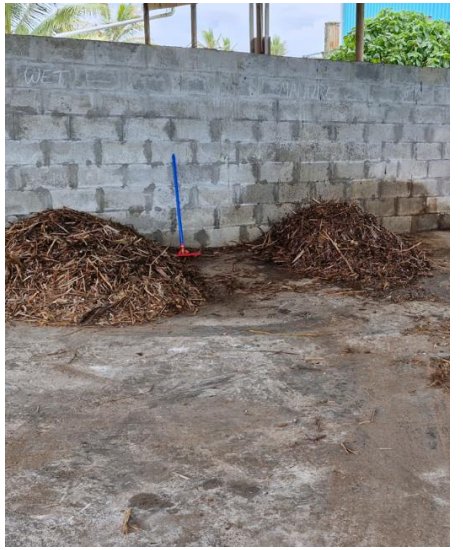
Template for Monitoing Compost Process Static Pile



https://pacwasteplus.org/resources/organics-composting_data-collection-monitoring/

Activity: Setting Up Compost Pile

Activity Time: **60 mins**



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	estimated m3 / y3 /					

Trouble-shooting

Trouble-shooting

LOOK Visually inspect the pile	Does it look...	dry & crispy	loose, mixed sizes	wet & soggy, clumped
FEEL Squeeze a handful of material	Does it feel...	dry & crispy	moist but not too wet	wet & soggy
TEMP Measure with probe or spade	Does it feel...	cool (<115°f)	warm (~130°f)	hot (>150°f)
SMELL Carefully smell the material	Does it smell...	like "nothing"	good like "earthy"	"bad" like rotten egg

any Brown?
May need:
1: Add Water
2: Add "nitrogen"

any Red?
May need:
1: Turn Pile
2: Add "carbon"

all Green?
No action needed

Activity: Compost Scenarios

1. Go through each scenario

2. Discuss what is out of balance from the 3 key components (air, water, food) and brainstorm how you could fix it.

Activity Time: **30min**

Source: [What Makes Good Compost? » Direct Compost Solutions]

Managing your facility

Weather

- Why manage?
  - Effective composting

- What we need to avoid
  - Heavy rain
    - Too much moisture in compost
  - Heat
    - Compost will dry out
    - Overheating of compost – fire, composting process stops

- How to manage
  - Cover composting areas/ piles
  - Capture rainwater for use
  - Daily checks for compost

Contamination - Physical and Chemical

- Why manage?
  - Affect compost quality
- What we need to avoid
  - May impact health of staff
- How to manage
  - Reject materials
  - Remove before shredding
  - Stockpile and allow to degrade before being able to cut up
  - Transfer to recycling or landfill

Large / Oversize

Pesticides

Plastics, Metal, Glass

Rocks and soil

Surface Water and Groundwater Contamination

Surface Water and Groundwater

- Why manage?
  - To prevent contamination of waterways and land
  - Capture water (use to keep compost moist)

- What we need to avoid
  - Don’t add to much water
  - Cover composting areas/ piles in bad weather

- How to manage?
  - Daily checks on moisture and adjust
  - Cover composting area (if possible)
  - Install hardstand area and leachate capture

Pathogens and Weeds

- Why manage?
  - Ensure staff and visitors have protective equipment (masks, gloves)
    - When establishing composting mix
    - When turning/moving materials
- What we need to avoid
  - Weeds – remove from incoming material before shredding
- How to manage?
  - Hot composting (to kill pathogens and some weeds)

Odour, Dust and Noise

- Why manage?
  - Ensure staff and visitors have protective equipment
    - When establishing composting mix
    - When turning/moving materials

- What we need to avoid
  - Weeds – remove from incoming material before shredding

- How to manage?
  - Hot composting (to kill pathogens and some weeds)

Fire

- Why manage?
  - Safety of staff and environment

- What we need to avoid
  - Overheating in compost piles
    - Too large (heat can't escape)
    - Too dry
  - Sparks ignition
    - Lightening, equipment

- How to manage:
  - Contingency plan
  - Water onsite
  - Good composting practice

Machinery

- Why manage?
  - Safety of staff and volunteers
  - Longevity of equipment and facilities
- What we need to avoid
  - Stay clear of heavy moving vehicles
- How to manage:
  - Good communication
  - Regular maintenance

General access, site security

- Why manage?
  - Public safety
  - Security of equipment and facilities

- What we need to avoid
  - General public access site and being exposed to safety risk

- How to manage:
  - Secure all gates at the end of each day
  - Clear signage for accessible areas

Litter and site cleanliness

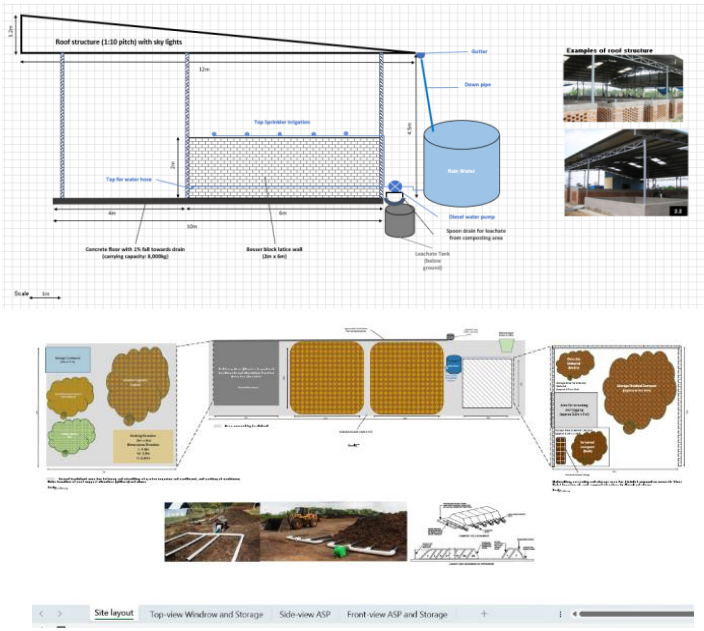
- Why manage?
  - Avoidance of pests
- What we need to avoid
  - Contamination and litter being blown around site
- How to manage:
  - Secure storage of rejected materials
  - Daily site-clean up

Further Reading / Resources Available

	Questions:
1	What is your weight of organic material to be processed daily?
2	What is the "Carbon" v "Nitrogen" ratio of your organic materials?
3	What is your main source of Nitrogen input?
4	How much budget is available for establishing facilities and equipment?
5	How much budget is available for ongoing operations (excluding labour)?
6	How much labour is available (including volunteers)?
7	What level training do your staff or volunteers have?
8	What level of workshop support do you have for equipment maintenance and servicing?
9	How sensitive is your surrounding area?

Ranked - Possible Organics Management Solutions for your Context:

1st	Small Scale Composting (Manual)
2nd	Bay or Windrow Composting (with Mechanical Support)
3rd	Small Scale Anaerobic Digestion
4th	Aerated Static Pile Composting (with Mechanical Support)
5th	Mulch and Woodchip
6th	Animal Feed
7th	In-vessel Compost
8th	Centralised Anerobic Digestion (Dry)



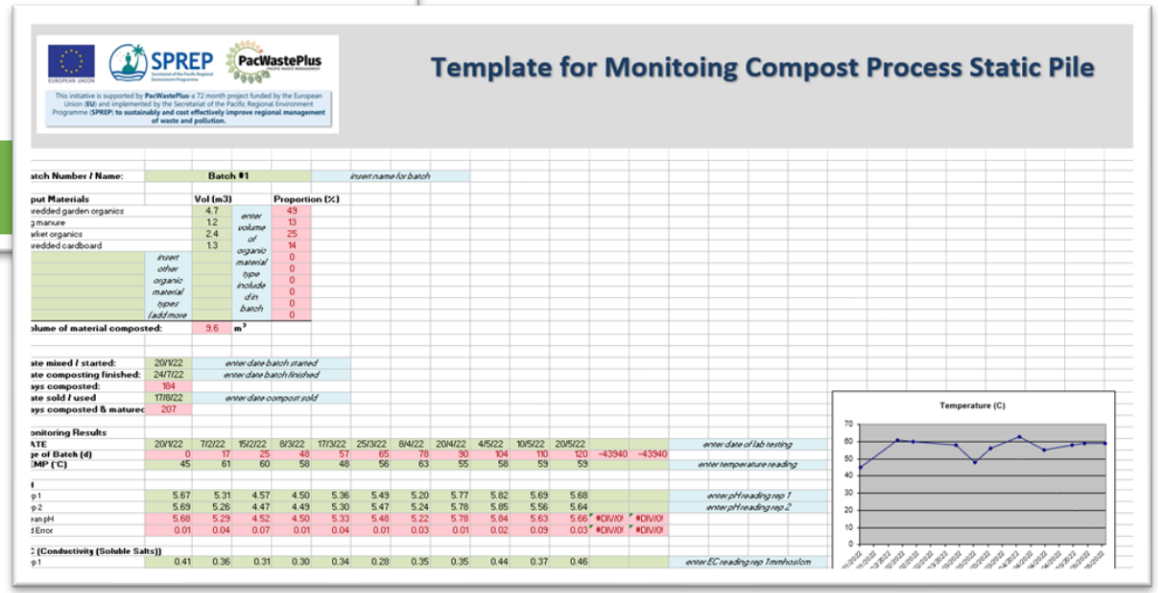
[Resources – Pacific Waste Plus]


FRAMEWORK

Standard Operating Procedure – Bay Composting

[your facility] Organics Processing Facility

Date of last revision: _____


Template for Monitoing Compost Process Static Pile


Composting Common Organic Materials in the Pacific and Timor-Leste: Handbook for Compost Operators

December 2022

This Handbook is part of a range of resources to assist Pacific Island Countries and Timor-Leste to divert organic materials from landfill into a beneficial use


Guidelines and Standards for Composting and Compost Quality for Pacific Island Countries and Timor-Leste

December 2022

This Composting Standard provides an overview of management activities for consideration when planning and designing organics recycling facilities in the Pacific and Timor-Leste.

[Resources – Pacific Waste Plus]

Organics Management

- Course Introduction and Basic Principles of Composting
- Composting Common Organic Materials in the Pacific and Timor-Leste
- Understanding and Selecting Suitable Organic Management Solutions for the Pacific and Timor-Leste
- Using the Decision Support Tool
- Guidelines and Standards for Composting and Compost Quality for the Pacific and Timor-Leste

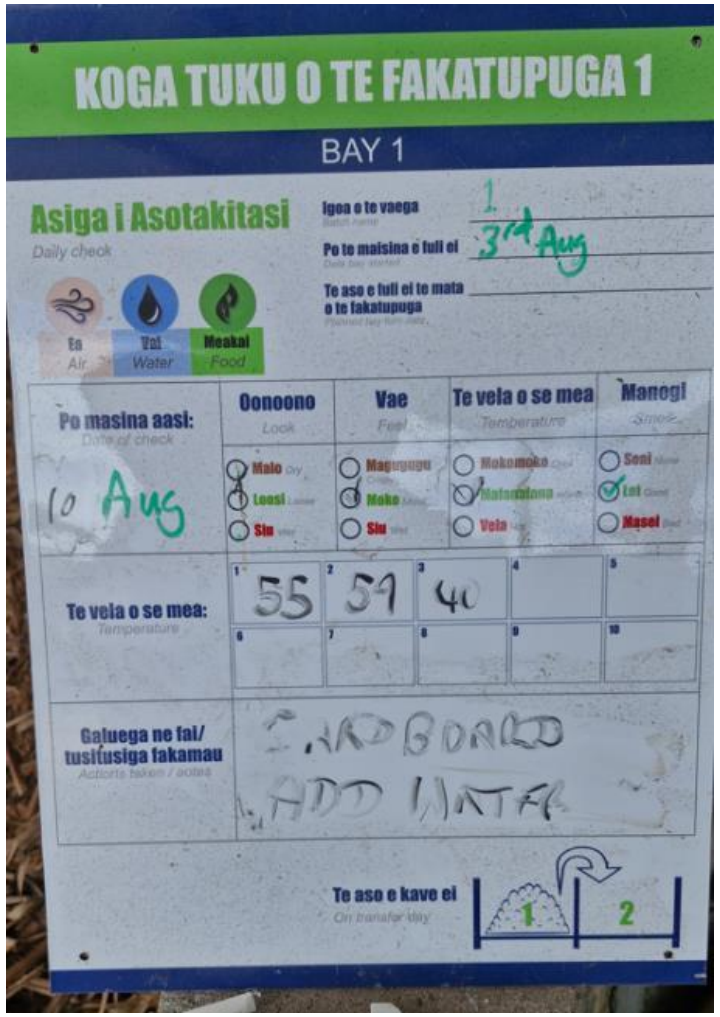
THANK YOU FOR YOUR PARTICIPATION AND HAPPY TO ANSWER ANY QUESTIONS!

Check the programme website for publications, resources and programme updates

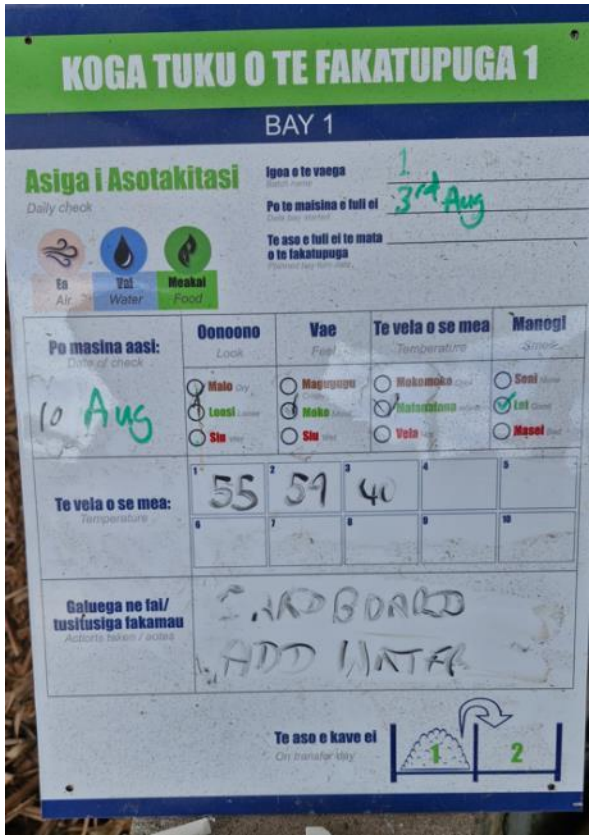
www.pacwasteplus.org

Activity:
Monitoring Compost Daily Checks Record Keeping

Activity Time: **60 mins**



Example: Tuvalu Organics Training



Example: The Marshall Islands

Example: Titikaveka Growers Association – Cook Islands

Example: Port Vila Composting

Other examples