



How to Use Neglected and Underutilized Species: Culture, Food, Nutrition

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OVERVIEW

- Recap NUS
- Key Considerations
- NUS & Traditional Foods
- Locating Food
- Plant Examples
- Food Based Approaches
 - Harvesting & Cleaning
 - Food Preparation Methods
 - Example Recipes
- Case Studies Activity



A woman wearing a purple floral-patterned top and a red shawl with white geometric patterns stands behind a wooden table. The table is covered with a variety of fresh produce, including large green leaves, bunches of green herbs, several purple and yellow corn cobs, and white root vegetables. To the left of the table is a large, round, woven wicker basket. In the background, a garden area is visible with a wire mesh fence and several potted plants, including a large green plant in a terracotta pot. A small blue plastic basket sits on the table near the woman. A white ceramic cup with blue polka dots is placed on the ground to the right of the table. The word "RECAP" is superimposed in white capital letters over the center of the image.

RECAP

Neglected & Underutilized Species (NUS)



Neglected & Underutilized Species (NUS)

- Definition of underutilized crops – “Species with underexploited potential for contributing to food security, nutrition, health, income generation, and environmental services” (FAO-2007).
- Also known as: neglected, minor, lost, promising, alternative, and traditional (Hart, 2007)
- But regarded as underutilized by whom?

Neglected & Underutilized Species (NUS)

- Central to local, informal seed systems.
- Important role in smallholder farmer livelihoods.
- Untapped potential for commercialization (market-driven, science-based)



6 KEY CONSIDERATIONS

Understanding the Agriculture-Nutrition Gap

- Goal: Improved Agricultural Productivity
- Goal: Improved Nutrition

Changes in agricultural production can lead to:	Effect on health and nutrition:	Example:
Increase in household income.	Purchase of good or investment of income that affect health status.	<p>Positive effect: Improved clothing and ability to purchase improved health care. Higher income can be used to purchase more food, higher quality of food with less pathogens, or more diverse diet. Investment in improved shelter will improve health.</p> <p>Negative effect: Higher income can be used to purchase tobacco products that will damage health.</p>

Understanding the Agriculture-Nutrition Gap

- Goal: Improved Agricultural Productivity
- Goal: Improved Nutrition

Changes in agricultural production can lead to:	Effect on health and nutrition:	Example:
Introduction of new crops as a result of innovations in crop breeding (bio-fortified foods like orange sweet potato with increased Vitamin A).	Introduction of new foods into diet that increase nutrition.	Changes in food processing can affect foods consumed, such as foods fortified with micronutrients, or processing with excessive sodium levels that are harmful to health. Actions by private sector, governments or other actors can make existing foods produced within a country available to new markets. Reforms to tariffs and removal of barriers to agricultural trade permit entry of foods produced in the country.

Understanding the Agriculture-Nutrition Gap

- Goal: Improved Agricultural Productivity
- Goal: Improved Nutrition

Changes in agricultural production can lead to:	Effect on health and nutrition:	Example:
Changes in types of crops grown or changes in production processes may make agricultural work more or less physically intensive.	Mechanization will reduce physical demands of agricultural labor, whereas crops that require greater manual weeding will increase it.	These changes affect exposure to pesticides, zoonoses, and work-related accidents.

Understanding the Agriculture-Nutrition Gap

- Goal: Improved Agricultural Productivity
- Goal: Improved Nutrition

Changes in agricultural production can lead to:	Effect on health and nutrition:	Example:
Changes in allocation of resources within the household.	If this results in women earning greater income, then this may affect how households spend money, how food is allocated, and the types of assets that are accumulated.	

Agrobiodiversity

- 30,000 edible plant species
- 150 are produced at a global scale
- 12 provide 75% of the calories in the human diet
- 103 provide 90% of the calories in the human diet (Prescott-Allen, 1990)
- Rice, wheat, maize, and potato provide 60% of human energy supply



Gender Considerations Along the Food Pathway



- Women particularly vulnerable when the price of staples rise.
- Women are 43% of agricultural labor force and more often than men, they experience extreme poverty.
- Poor nutrition of a mother in pregnancy and first two years of childhood has long term consequences.

Gender Considerations Along the Food Pathway



- Healthy women are key agents of change for improving overall household health and nutrition. They cultivate, process, and preserve nutritious and locally adapted food crop varieties.
- When women control assets and decide what to produce, they tend to favor the production of food crops that ensure food security for the family (FAO, IFAD, and ILO 2010).

Gender Considerations Along the Food Pathway



- Agriculture is especially effective for improving nutritional outcomes if it increases incomes of the poorest households and benefits women within these households.

Gender Considerations Along the Food Pathway

From plants growing from soil nutrients to the breakdown of nutrients in our

Stage of Food Pathway	Type of Worker
Production/Storage	Agricultural worker
On-farm processing	Home economist, Nutritionist
Trading	Home economist, Nutritionist
Buying and/or Harvesting	Home economist, Nutritionist
Preparing	Home economist, Nutritionist
Sharing and eating	Home economist, Nutritionist
Using	Health worker

Where on the food pathway do you (the development worker) work?

-(Adapted from Nutrition for Developing Countries)

NUS and Nutrition

- 7 billion people, an estimated 500 million still suffer from protein-energy malnutrition while over 1.6 billion suffer from iron deficiency, 200 million from Vitamin A deficiency, and 400,000 children die each year from effects related directly to zinc deficiency (HarvestPlus, 2011)
- Green Revolution was focused on agricultural development and research to increase crop yields to ensure adequate calories for people
- Less attention paid to nutritional quality, leading to diets deficient in essential vitamins and micronutrients

NUS and Nutrition

- NUS-based food systems can help curb food insecurity of the poorest by complementing more current strategies to address malnutrition that are commonly out of reach for the poorest (Ruel et al. 2005)
- Can also address “hidden hunger” prevalent in South Asia and Sub-Saharan Africa, where populations have achieved caloric intake and so are not considered “hungry” but still exhibit micronutrient deficiencies
- Can improve diets too rich in refined carbohydrates and fats, as the result of a rapid transition from traditional diets based on local foods to a Western-style diet high in fats, salt, sugar, and processed foods. This has led to increased incidents of non-communicable diseases like diabetes, obesity, heart disease, and types of cancer.

Health and Nutrition Considerations



- Adequate nutrition can be obtained by consuming a wide diversity of food groups that provide six classes of nutrients found in food: carbohydrates, lipids or fats, proteins, vitamins, minerals, and trace elements.
- Adequate energy required: to maintain basal metabolism, physical activity, human growth.

Health and Nutrition Considerations

- Acute malnutrition: result of drastic deterioration of nutritional status in a short time and leads to wasting (rapid weight loss) or nutritional oedema that reduces overall disease resistance and can impair whole body functions.
- UNICEF: 20 million children suffer from wasting at a given time.
- Most common in children 12 – 36 months.
- Chronic malnutrition or stunting is a slow-cumulative process caused by insufficient intake of nutrients or repeated infections or a combination.
- 850 million are calorie deficient but 2 billion are deficient of micronutrients (FAO 2013)



Health and Nutrition Considerations

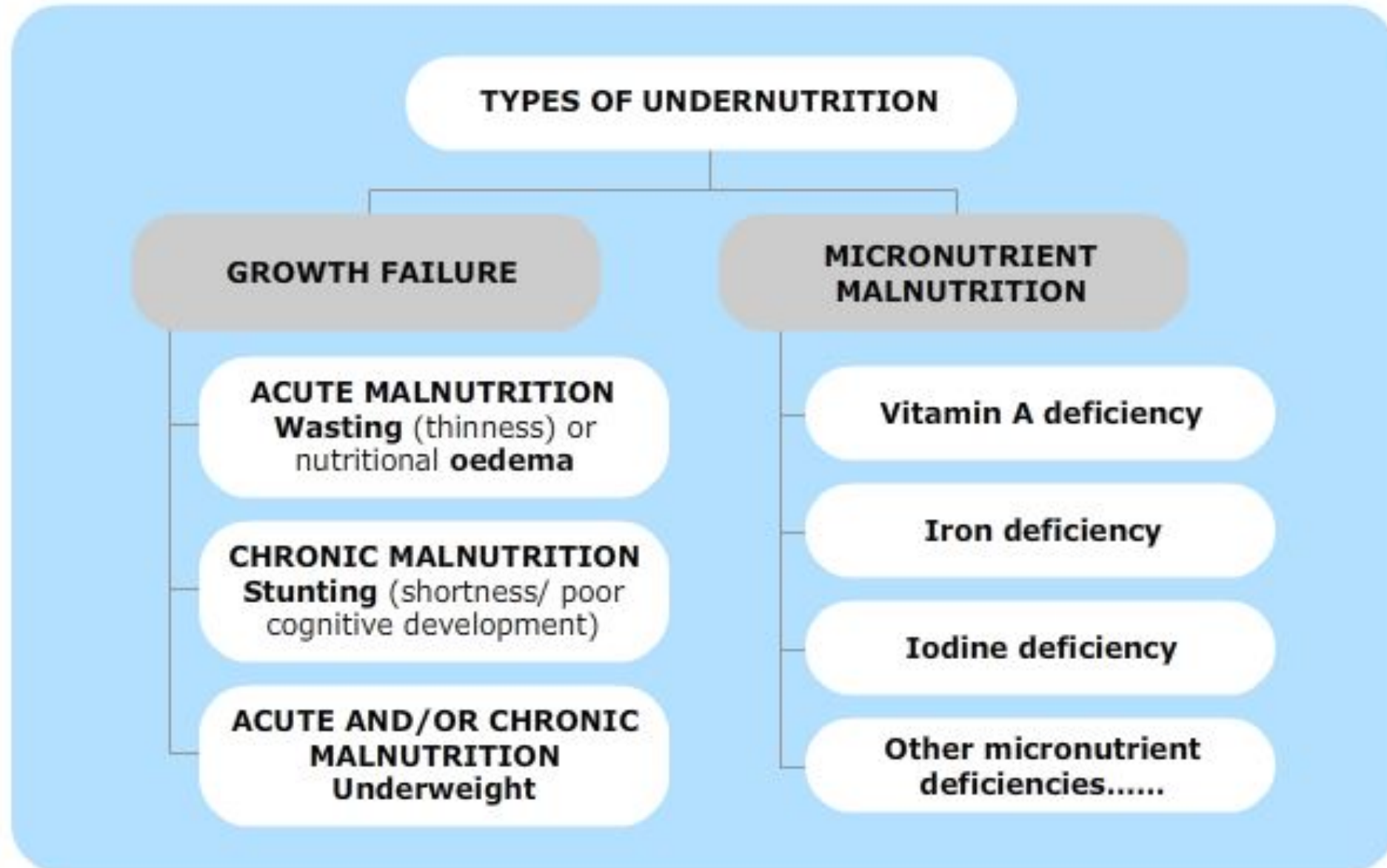
Micronutrients that if deficient lead to Type I Deficiency Diseases (growing with specific deficiency signs)

Selenium	Iodine
Iron	Copper
Calcium	Manganese
Thiamine	Riboflavin
Ascorbic Acid	
Retinol (Vitamin A)	
Tocopherol (Vitamin E)	
Vitamin D	Vitamin K
Nicotinic Acid	Folate
Cobalamin	
Pyridoxine	

Micronutrients that if deficient lead to Type II Deficiency Diseases (reduced growth non-specific signs)

Nitrogen
Sulphur
Essential amino acids
Potassium
Sodium
Magnesium
Zinc
Phosphorus

Health and Nutrition Considerations



Health and Nutrition Considerations

- Anti-nutritive effects in plant foods can prevent absorption of Type I nutrients, as well as iron, that are needed for adequate growth, particularly in early childhood development.
- Example: amaranth is high in zinc and magnesium but is also high in phytates.
- Anti-nutritive effects in grains and beans can be reduced by soaking, germinating, and/or malting.
- Household food-based strategies, including pre-processing methods of plant food, in combination with participatory approaches, important to increase awareness and acceptability of caregivers, while on-going awareness efforts enhance adoption and empowerment of the community to sustain good health and nutrition practices (Gibson et al. 2006)

Food-Based Approaches





Food-Based Approaches

- Diet diversity!
- Considerations for seasonality, cost-effectiveness, long-term sustainability.
- Complex web of selling and purchasing food that is affected by gender and social biases of who controls household income and holds power in the decision-making process.
- On-farm agrobiodiversity can be scaled up, local food chain can be examined for whether farmers can relate environmental issues with nutrients produced in their farming systems.

A woman with dark hair tied in a bun, wearing a red and white striped shirt and green shorts, is crouching on a wooden floor. She is tending to a large, dark, round pot that sits on a traditional wood-burning stove. A fire is burning in the stove's hearth, and a large plume of white steam rises from the pot. To the right of the main pot, a smaller black kettle and another pot are also on the stove. The background shows a rustic kitchen with wooden shelves holding various items like bottles, a green basket, and a red bowl. The scene is lit with warm, natural light, creating a cozy and traditional atmosphere.

NUS & TRADITIONAL FOODS

Traditional Foods



- In a land that has sustained upland and lowland residents for thousands of years, one would expect a diversity of foods from the countless paddies and hill fields, home gardens, as well as from the forests.

Importance of Vegetables in Local Diets

- Centered around rice or staple starch, with a wide variety of vegetables forming the basis of local nutrition and without an emphasis on animal protein.
- The traditional foods of Northern Thailand are not heavy laden with animal protein, but offer more in the form of carbohydrates (such as rice) and vegetables. A wide variety of vegetables forms the basis of local nutrition.



Importance of Vegetables in Local Diets

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Meals

- Lack of documentation about use of indigenous food plants in peasant food culture.
- Literature bias towards lowland people (food-secure) rather than highland minority groups (food-insecure) (van Esterik, 2008)
- Literature also biased towards rice-based meals rather than root-based meals (i.e., taro in upland areas)



Meals

- Cooking oil is expensive or inaccessible due to distance from trading centers
- Steaming, boiling, blanching, grilling is preferred



Diversity of Plants Used in Rural Areas



Diversity of Plants Used in Rural Areas

- Over 1,000 plant species are used by ethnic minorities in Thailand for food and medicinal purposes (Anderson, 1993)
- Food plants used by farmers in Northeastern Thailand: 44% from trees, 18% terrestrial herbs, 15% aquatic herbs, 13% climbers (Cruz-Garcia and Price, 2011)
- Many overlooked during inventories, especially if harvested from the wild vs. from cultivated gardens.
- NUS often critical for providing essential nutrients to small-holder communities (Mayes et al 2012)

Diversity of Plants Used in Urban Areas



Diversity of Plants Used in Urban Areas



- 69 traditional food plants sold in urban fresh markets in Chiang Mai city (Wester, 1997)
- 54 wild and semi-domesticated species in urban markets of Khon Kaen (Sirai and Rambo, 2008)

Diversity of Plants Used in Urban Areas



- Whereas rural farmers are dependent on subsistence farming and wild or local food plants, urban dwellers view these plants as safer and cleaner to eat than commercial varieties.

End of Vegetable Self-Sufficiency?

- Because of such production constraints, vegetables are often purchased from the outside with hard earned cash.
- As people move to urban centers for employment and education, communities fragment, oral transmission of plant knowledge that usually happens over family meals or while working the fields declines, increase knowledge gaps.



Definition of Vegetable:



- A plant cultivated for an edible part, such as the root of the beet, the leaf of spinach, or the flower buds of broccoli or cauliflower.
- The edible part of such a plant.
- A member of the vegetable kingdom; a plant.

Definition of Vegetable:

For the Northern Thai context we offer a broad definition of a vegetable:

- Any edible part of either cultivated or wild plants, typically leaves, shoots, stem hearts, flower and fruits.

Excludes:

- Carbohydrate-rich grains, roots or fruits eaten as staples, e.g., rice and cassava roots.
- Fruits and roots eaten as desserts, e.g., banana fruits and taro roots.
- Dried legume seeds (pulses), e.g., pigeon pea, soybean.
- Portions of certain plants consumed as spices and condiments, e.g. chilies, and black pepper.
- Plant parts consumed as beverages, e.g., tea leaves and coffee beans.

Vegetable or Not?

Whether a plant or plant part is considered a vegetable or not may depend on: (1) the part of the plant to be consumed, (2) the stage of development of the edible plant part or (3) the way the plant part is prepared as a food.

- For instance, a banana can be both a fruit and a vegetable. In Northern Thailand the fruit is generally eaten and/or prepared as a dessert or snack. However, the blossom of some banana varieties is consumed in certain local vegetable dishes such as salads and curries.



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- Fresh, mature jackfruit is typically consumed as a dessert fruit.
- Whereas young jackfruit can also be boiled, curried or cooked in other ways similar to vegetables.



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Cassava, the root crop, can also be...

...cassava the leafy vegetable.



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Pigeon pea (*Cajanus cajan*), the pulse, can also be...

...pigeon pea the pod vegetable.



Two Basic Types of Vegetables

- Annuals, such as upland water spinach
- And perennials, such as cha-om (*Acacia pennata*)



Seasonal Availability of Vegetables



- A greater variety of annual vegetables is available during the rainy season.

Seasonal Availability of Vegetables



- But due to the annual six-month dry season, year round production of vegetables depends on the availability of water for irrigation. Unfortunately, water isn't always available in many locations.

Traditional Vegetable Preservation



- However, limited amounts of certain types of vegetables are sometimes preserved to extend availability, such as these traditionally pickled mustard greens.

Defining Perennials



What makes a perennial a perennial? A perennial is often described as a plant that lives longer than two years. Many perennial vegetable species are obvious, particularly the woody varieties such as this cluster fig (*ficus racemose*).

Defining Perennials

However, some herbaceous (soft-stem) vegetables are less obviously perennial, including:

- Malabar spinach (*Basella alba*)
- and ivy gourd (*Coccinia grandis*).



Introducing Perennial Vegetables

- But because perennial vegetables are generally deep-rooted and drought tolerant, various types of edible perennials offer nutrition even during the driest months.
- Research towards using traditional or wild vegetables to meet macro- and micronutrient needs and to address poverty issues
- Promote vegetables and balanced diet to address mineral and vitamin deficiency
- Promote high-yielding, stress-tolerant varieties and ways to grow vegetables with low input costs and during off-season
- Many of these perennial vegetables, such as *pak wan pa* (*Meliantha suavis*), are indigenous forest species still found in the wild.
- Others, such as sesbania flower (*Sesbania grandiflora*).



WHERE FOOD IS LOCATED

Locations of Where Wild Food Plants are Grown:

- Rice field
- Woody areas (e.g. disturbed forests)
- Home gardens
- Upland fields where cash crops are grown
- Swamps
- Roadsides
- 80 % of food plants cultivated by rice farmers are found in multiple locations (Cruz-Garcia and Price, 2011), indicating plant overlap in food production systems.



Rice-Based Food System



- More than 80 varieties of wild food plants can be found cultivated around rice paddy systems in Northeastern Thailand (Cruz-Garcia and Price, 2011)
- More than 80 different species found in upland rice fields in communities living 500m and higher (Anderson, 1993)

Crop Diversity Preferred by Smallholder Farmers for Many Reasons:

- Plants for food, fibers, and medicines,
- Reduce effects of harmful pests
- To ensure harvest security, as many smallholders still dependent on subsistence farming.
- Diversity is also seen in a single crop, like rice, taros, and yams



Biodiverse Agroforest System Favored by Upland Farmers

- Rich in crop species that boost overall production year-round
- Six integrated species with value: jack bean (semi-perennial), banana (perennial), indigenous (snowflake tree) and introduced (papaya)



Food Crops Planted Around the Home for Easy Access

- Semi-domestication of wild forest species may occur
- Annuals and perennials are mixed around the home, reflecting biodiversity of farmers' agroforests



Cultivation of Favorite Wild Forest Plants Near the Home

- *Zingiberaceae* spp. (type of ginger) root found in highlands
- *Pogostemon auricularius* (type of mint) usually found in upland rice fields or growing wild in forests
- Certain forest varieties are priced enough to be cultivated in small container gardens or in home gardens (process of domestication) – don't need to go into forest.





Collecting vegetables for dinner from perennials found along roadways...

**Collecting vegetables from wild or semi-domesticated perennials along
footpaths of fields...**



A close-up photograph of a bowl of soup. The soup contains chunks of cooked salmon, sliced cherry tomatoes (both red and yellow), and green vegetables like broccoli and green beans. The broth is a light, clear color. The bowl is white with a decorative blue floral pattern on the rim.

FOOD-BASED APPROACH TO USING NUS

Understanding Key Processes



- Collection calendar
- Species management
- Main processes for utilizing key species

Frequency of Plant Part Consumed

-(Cruz-Garcia and Price, 2011)

- Young shoots from roots, stems or tips of plants.
- Fruits – ripe or unripe.
- Flowers or inflorescences.
- Leaves – young and tender; generally eaten raw or cooked.
- Seeds and seed pods.
- Stalk of flower or stem of plant.



Food Preparation Methods

- Vegetables can be eaten raw, steamed, or blanched with or without dipping sauces



Food Preparation Methods

- Salads can be made from boiled or fresh vegetables, and seasoned with roasted sesame seeds, dried chilies, shallots, lime juice, or soy sauce (where available)



Food Preparation Methods

- Boiled curries or soups are common methods of incorporating different types of vegetables that may be harvested during the home before dinner. This method lends itself well in communities that have little or no access to cooking oil. Does not require much preparation or attention paid to the cooking method.



Food Preparation Methods

- Vegetables can be stir-fried with garlic or pork or eggs (where there is no access to cooking oil, too)



Food Preparation Methods

- Spicy chili pastes made with perennial vegetables: stimulate the appetite by adding flavour to bland staple starches



Musa spp.
(banana) –
multiple edible
parts

- Considered both a fruit and vegetable
- Flowers used in salads and soups
- Stems used in soups
- Green fruits can be eaten as a starch staple



Kimberly Duncan



Photo C



Artocarpus heterophyllus (jackfruit)

- Considered both fruit and vegetable
- Mature fruit eaten as dessert fruit
- Immature fruit used as vegetable in soups and salads
- Seeds also boiled and eaten; starchy texture like potatoes

Camellia sinensis (tea) –
young leaves

- Fresh young leaves can be eaten as a salad



Less obvious perennial vegetables are herbaceous plants or fruit-producing vines: *Ipomoea batatas* (sweet potato); *Basella alba* (malar or ceylon spinach); *Passiflora edulis* (passionfruit); *Sechium edule* (chayote)



Phoenix loureiroi
(pygmy date palm)

- Cultivated in highlands as cash crop for its leaves used to make brooms
- The heart is harvested and cooked in soups; favoured for sweet flavour



- Calamus siamensis* (rattan)
- inner heart of young shoots
 - Thorny palm commonly used for baskets and wicker furniture
 - Bitter taste
 - Eaten in curries, pounded as chili paste or as a dipping vegetable



Photo Credit: Kimberly B. Duncan





Jen Smeage

*Colocasia
esculentum*
(taro) – edible
stem

- Eaten raw as a dipping vegetable or cooked in a curry
- Stems have low oxalate content, sweet flavour and spongy texture

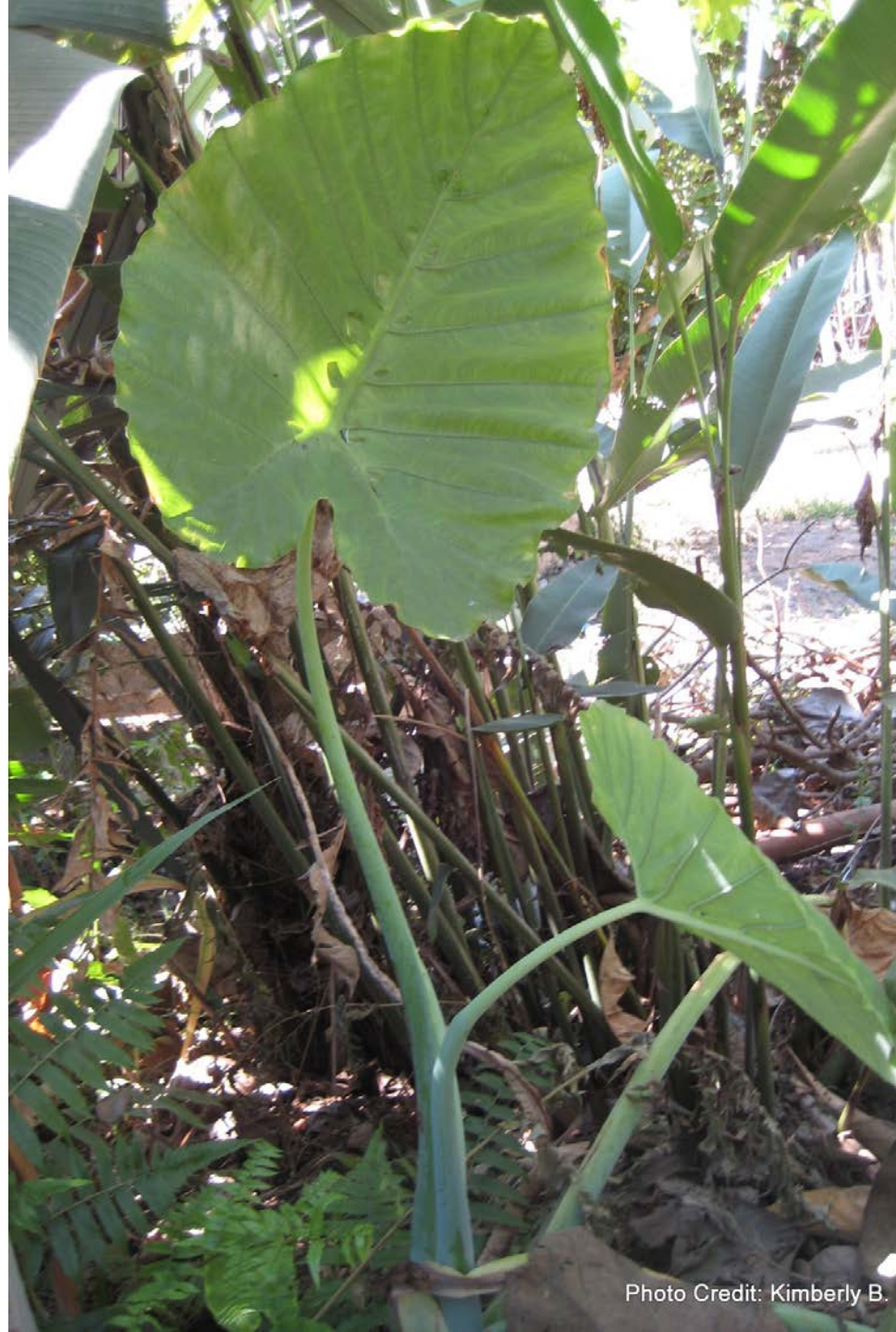


Photo Credit: Kimberly B. [unclear]





Some edible perennial vegetable species cited as having toxic properties including:

- Kassod tree (alkaloid)
- Mango (contact and stomach poison)
- Leucaena (alkaloid mimosine)
- Chaya, cassava (cyanide)

Local knowledge demonstrates cooking preparations that denature or remove toxins. Also, known risky vegetables tend to be consumed in moderation

Importance of Perennials for Development Workers:

Importance of perennial vegetables for development workers:

- Notable pest resistance, (or tolerance) thereby lowering the risk of crop failure in areas where food sufficiency is a concern
- More drought hardy than annual varieties, therefore being more appropriate where, or when, water is in short supply
- Cultivation of perennial vegetables helps to maintain or increase local plant biodiversity, particularly with conserving indigenous or heirloom species.
- Diverse plantings of perennial vegetables can offer a wide range of edible products throughout the year.

A high-angle photograph shows a person's hands washing green leafy vegetables in a large black plastic tub. The person is wearing a blue and white checkered shirt. To the right of the tub is a white ceramic plate with a red floral border and a central floral design. The plate contains a portion of the washed vegetables. The background is a dark, wet wooden surface. A semi-transparent dark grey rectangle is overlaid across the center of the image, containing the text "CASE STUDIES" in white, bold, sans-serif capital letters.

CASE STUDIES

What About Where You are Working?



How does the community where you work view the plants growing around them?