

01999011 Foods for Mankind

# Food Safety

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the microorganisms are killed



Dr. Siriporn Riebroy @ Food &amp; Nutrition Program KU

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## Question

- \* Do you worry about getting sick from the food you eat?

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## Scope

- \* Introduction
- \* Harmful substances in foods
- \* Keeping food safe
- \* Safe food practices

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## Introduction

- \* Food quality;
  - \* Nutrition
  - \* Acceptability – sensorial quality
  - \* Chemical composition – nutrients and other constituents
  - \* Physical properties
  - \* Microbial flora

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# Introduction

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>* Modern technologies → agriculture and living</li> <li>* Waste and sludge from homes and manufactures</li> <li>* Pesticides</li> <li>* Synthesis of new food additives (as preservatives or food characteristic improvement)</li> </ul> | <ul style="list-style-type: none"> <li>* Food safety</li> <li>* nutrients</li> <li>* compositions                             <ul style="list-style-type: none"> <li>* health benefit: prebiotic, probiotic, phytochemicals,</li> <li>* hormones, carcinogenic substances, food allergenic compounds,</li> </ul> </li> <li>* microbial contamination</li> <li>* material contamination</li> </ul> |
|---|---|

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# Introduction

Newspaper and the headline screams

**"POORLY COOKED HAMBURGER MEAT PROVES FATAL."**

- The child's death has been traced to thriving bacteria in undercooked hamburger meat.
- Several adults become sick from the same source.

Well-done meat or blood red and your steak rare!

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# Introduction

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>* Although, food safety advice shows up in many places i.e.                             <ul style="list-style-type: none"> <li>* cookbooks</li> <li>* textbooks</li> <li>* the people press</li> <li>* the classroom</li> <li>* the Dietary Guideline</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>* Microbial contamination of such foods                             <ul style="list-style-type: none"> <li>* hamburger</li> <li>* apple juice</li> <li>* eggs</li> <li>* frozen berries</li> <li>* etc.</li> </ul> </li> </ul> |
|---|---|
- 
- \* Many people seriously sickened and died, especially most susceptible: young children, people with compromised immune systems and seniors

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# Introduction

Consumers are voicing their concerns about food safety issues as well. These including;

- excessive pesticide residues in plant foods
- antibiotics
- hormones in animals used for food
- hidden food allergens
  - milk protein- caseinates
  - legumes
  - Egg



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# Introduction

Many problems related to food safety.

Consumers are voicing their concerns about food safety issues as well. These including;

- physical contamination i.e. glass fragments and other sharp objects, heavy metals
- naturally occurring toxins in seafood and some agricultural products
- microbial toxins
- contaminants arising from anthropogenic activities and environmental pollution

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# Food toxicity

## 1. Acute toxicity

- adverse effect after 2-3 hours consumption (or 2-3 days)
- i.e. food poisoning  
→ diarrhoea
- symptoms:

## 2. Chronic toxicity

- substances has toxic effect on living organism (continuous exposure)
- substance can be accumulated in any organ
- i.e. cancer

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# Food toxicity

## 1. Natural toxins

- (a) Plant toxins
- (b) Seafood toxins
- (c) Microbial toxins

## 2. Contaminant arising from anthropogenic activities and environmental pollution

- (a) Chemicals for agriculture
- (b) Food additives
- (c) Substances from environment
- (d) Compound occurred during cooking
- (e) Others ...packages (paper, foam (styrene), plastics); storage management, transportation

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Food toxicity

Materials



Harmful substances



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## Food toxicity affects on health

- \* Malnutrition –illness and quality of life
- \* Food toxins –health
- \* Bureau of Epidemiology – diarrheas, typhoids, toxins from mushroom
- \* Several microorganisms cause food poisoning
  - \* *Staphylococcus aureus* –vermicelli with spicy soup, pork, fermented fish
  - \* Rotavirus
  - \* *Salmonella*– meat
  - \* *Shigella* –ice cream
  - \* *Clostridium botulinum*
- \* toxin from seafood –tetrodotoxin

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## Food toxicity affects on economics

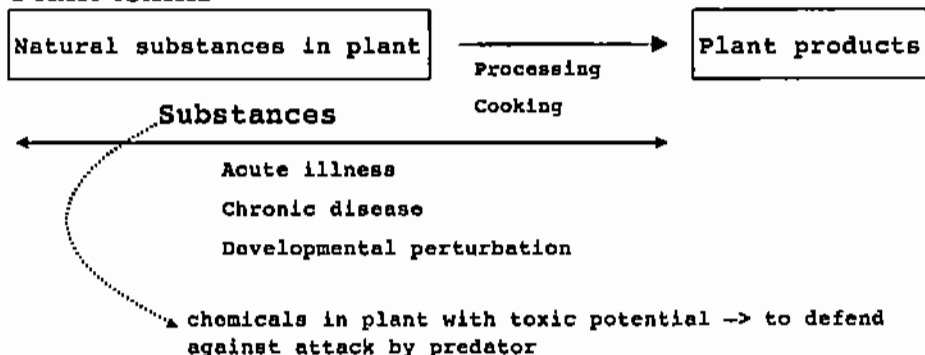
- \* Thailand is agricultural country
- \* Export
  - \* agricultural produces and products
- \* Problems from toxicity and contaminants will be managed by food regulation
- \* Reduce income



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## Harmful substances in Foods

### Plant toxins



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## Harmful substances in Foods

### Plant toxins

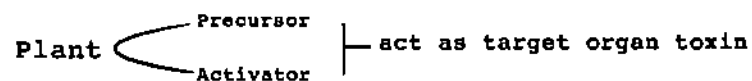
- \* Susceptibility to plant chemical toxicity
  1. the maturity of the plant component
  2. soil characteristics and environmental condition
  3. the potency, dose and duration of exposure to the offending agents
  4. differential (target) organ and cellular susceptibility
  5. sex, nutritional state (intrinsic factors)

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## Harmful substances in Foods

### Plant toxins

#### \* Precursor or activator



The toxin substances during post harvest treatment  
during food processing  
in the gastrointestinal tract  
at stages in intermediary metabolism

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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
  - \* Non-protein amino acid
  - \* Amine and monoamine oxidase inhibitors
  - \* Proteins
  - \* Glycosides
  - \* Alkaloids
- \* Non-nitrogenous compounds
  - \* phyto-oestrogens and anti-oestrogen
  - \* Ptaquiloside
  - \* Alkenylbenzenes
  - \* Coumarin
  - \* Psoralen



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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
  - \* Non-protein amino acid
    - \* amino acids, imine acids, amides = secondary metabolites
    - \* to disrupt the nervous system and others damage the liver, kidney and other organs
    - \* dicarboxylic plant amino acids -mimic the action of glutamate (the principal excitatory neurotransmitter in the human central nervous system (CNS))
    - \* i.e.
      - \* grass pea (thua-kak) - lathyrism -(now GMO)
      - \* ackee and vomiting sickness (litchi can be also found)

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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
  - \* Non-protein amino acid
    - \* i.e.
      - \* ackee and litchi
        - \* arils and seeds
        - \* water-soluble toxic amino acids
          - \* hypoglycin A (hypoglycine)
          - \* hypoglycin B ( $\gamma$ -glutamyl dipeptides)
        - \* violent vomiting
        - \* convulsions
        - \* coma and death

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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
  - \* amines and monoamine oxidase inhibitors
    - \* amines in plants- tyramine, tryptamine and substances (serotonin, adrenaline, noradrenaline and dopamine)
    - \* they can serve as chemical neurotransmitters in the human CNS.
    - \* pineapple, avocado, walnut, plantain, banana, wheat, oats, nuts, tomatoes
  - \* Medications- monoamine oxidase inhibition

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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
  - \* Proteins
    - \* Proteinase inhibitor
      - \* raw plants -heat resistant proteinase inhibitor
      - \* inhibition of action of digestive proteinase reduction normal growth
      - \* seeds (legumes), fruits (avocado, peach, plum, tomato, and aubergine), tubers (potato) and vegetative part (soybean, lucern, barley, maize, and wheat)
    - \* Lectin
      - \* heat- and protease-resistant carbohydrate-binding proteins
      - \* bind to red blood cells and cause haemagglutination
      - \* fresh vegetables (lettuce) fruits, processed food (cereals and nuts)

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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
  - \* Proteins
    - \* nut protein allergens
      - \* Nut allergens-public health problem -cheap protein
      - \* others-sunflower seed, sesame seed, coconut
      - \* Production of IgE antibodies directed toward the plant protein and release of endogenous chemicals from mast cells (e.g. histamine, bradykinin, and serotonin)
      - \* inflammation
      - \* oedema of lip, urticaria, asthma, hypotension, coma and death

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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
  - \* Glycosides
    - \* glycoside--beta-glucosidase--> aglycone (noxious agent)
    - \* cassava and almonds -bitter taste! (bitter cassava)
    - \* cassava (manioc) and multiorgan disease
      - \* root of cassava -animarin and lotaustralin --> cyanogenic (cyanide-liberating) glucosides
      - \* goitre and neurodegeneration
      - \* others-sweet potato, yam, maize, bamboo, chickpea, sorghum

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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
- \* Glycosides
  - \* How to remove hydrogen cyanide (HCN)
    - \* Peeling
    - \* Washing and soaking
    - \* Cutting into small pieces and drying
    - \* Heating at 150°C
  - \* Fermentation by lactic acid bacteria – organic acid can hydrolyse glycoside → hydrogen cyanide (gas)

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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
- \* Glucosinolates and goitre
  - \* sulphur-containing glycoside
  - \* cruciferous plants- mustard, rape, swede, crambe, kale, turnips, cabbage, cauliflower, broccoli, Brussels sprout and radish
- \* Elimination-bruising, cutting
- \* goitre

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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
- \* Alkaloids
  - \* Pyrrolizidine alkaloids
    - \* comfrey- vegetable or tea
    - \* herbs
    - \* PAS-activate at liver –dehydroalkaloid pyrrole → liver damage
  - \* Solanum alkaloids
    - \* potato plant
    - \*  $\alpha$ -chachonine and  $\alpha$ -solanine = saponin-like alkaloids – $\beta$ -D-glycosides →inhibition of cholinesterase → in liver and lung  
→ this enzyme-serve as an important defence against toxic substances



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## Harmful substances in Foods

### Plant toxins

- \* Nitrogenous compounds
- \* Alkaloids
  - \* Lupin alkaloids
    - \* bitter taste
    - \* acute toxicity in human and animals
    - \* 'crooked calf disease'
    - \* flour from lupin -recommendation



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11 8 1988

## Harmful substances in Foods

### \* Plant toxins

#### \* poisonous mushrooms

- \* mushroom can produce toxic substance
- \* toxin —cause stomach upset, dizziness, hallucinations, and other neurological symptoms
- \* lethal toxicity — toxin from mushroom can cause liver and kidney failure, coma, and death

## Harmful substances in Foods

### Pathogens (pathogenic microorganisms)

cause of foodborne illness

microorganisms — bacteria, virus and parasites

Table 1. Common foodborne pathogens and illness

Organisms	Sources	Diseases and Symptoms
<i>Campylobacter jejuni</i>	Raw poultry and meat and unpasteurised milk	Campylobacteriosis Onset: usually 2 to 5 days after eating Symptoms: diarrhea, stomach cramps, fever, bloody stools; last 7 to 10 days
<i>Clostridium botulinum</i> —illness is caused by a toxin produced by this organisms	Improperly canned foods, such as corn, green beans, soups, beans, asparagus, mushrooms, tuna, and liver paste; also luncheon meats, ham, sausages, garlic in oil, lobster, and smoked and salted fish	Botulism Onset: usually 12 to 72 hours after eating Symptoms: nerve dysfunction, such as double vision, inability to swallow, speech difficulty, and progressive paralysis of respiratory system; can lead to death

Table 1. Common foodborne pathogens and illness

Organisms	Sources	Diseases and Symptoms
<i>Escherichia coli</i> O157:H7	Raw or undercooked meat, raw vegetables, unpasteurised milk, minimally processed ciders and juices, water	<i>E. coli</i> infection Onset: 1 to 8 days after eating Symptoms: watery and bloody diarrhea, severe stomach cramps, dehydration, colitis, neurological symptoms, stroke, and hemolytic uremic syndrome (HUS); a particularly serious disease in young children that can cause kidney failure and death

\* see more information in supplementary sheet



## Harmful substances in Foods

**E. coli O104:H4 (May 2011 in Germany)**

Bacteria cause serious outbreak of foodborne illness

50 deaths, 4,075 ill from 7 EU countries, Canada and US

Strain to produce Shiga toxin causing bloody diarrhea with haemolytic-uremic syndrome (HUS)

Detected mainly in fresh vegetable from organic farm

Restrictive action in many countries



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## Harmful substances in Foods

**Salmonella in tainted ground beef (August 2011 in USA)**

Symptom : diarrhea, fever and abdominal cramps

1 death and 77 sick

**Listeria outbreak cantaloupe (September 2011 in USA)**

3 weeks incubation period after consumption of food infected by listeriosis

Symptom: fever, muscle aches, loss of balance, miscarriage, premature delivery

8 deaths, 55 infected people

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## Harmful substances in Foods

Chemical contamination

Pesticides

- Organic alternatives
- Animal drugs
- Pollutants
- Natural toxins
- Acrylamide
- Other Food contaminants

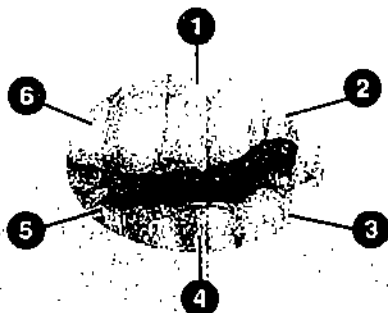
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## Harmful substances in Foods

\* Pesticides

- \* use for controlling plant diseases, weeds, insects and other pests
- \* Pesticide residue in domestic and imported foods will be analysed.

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#### Integrated pesticide management

1. Legal control
2. Biological control
3. Cultural control
4. Physical control
5. Genetic control
6. Chemical control

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#### Integrated pesticide management

##### 1. Legal control

State and federal guideline are designed to limit the spread of pests.

##### 2. Biological control

Beneficial organisms, such as predators, parasites, and viruses, are released into the environment to suppress pest organisms.

##### 3. Cultural control

Rotation, sanitation, and other good farming techniques are employed to help reduce pest populations.

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#### Integrated pesticide management

##### 4. Physical control

Barriers, traps, and the location and timing of planting are all used to control pest infestations.

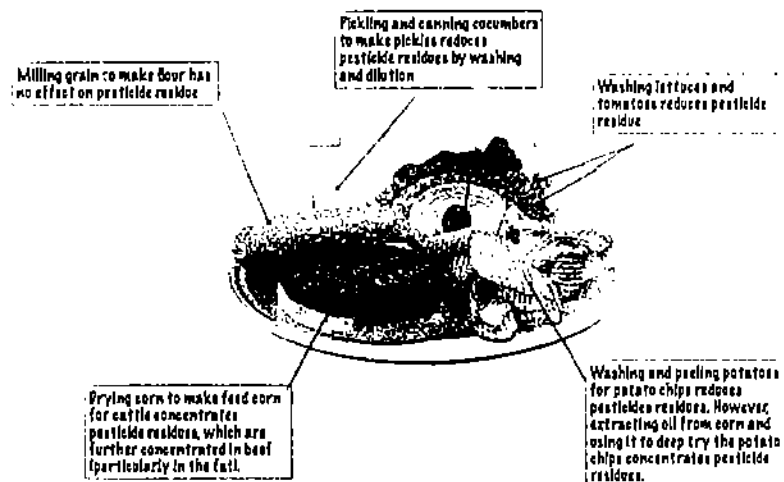
##### 5. Genetic control

Resistant plant strains are developed to reduce the impact of pests.

##### 6. Chemical control

Conventional pesticides, biopesticides, pheromones, and other chemicals are used to prevent or suppress pest outbreaks. The chemical controls are specific to a pest species and are ideally short-lived in the environment. In addition, the chemicals are used at their lowest effective rate and may be alternated to help prevent the development of pest resistance.

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Pesticide pathways to dinner

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## Harmful substances in Foods

### \* Organic alternatives

- \* Organic foods – without synthetic pesticides and without synthetic fertiliser.
- \* The Organic Foods Production Act and the National Organic Program (NOP)
  - \* USA– assurance and certification for organic foods



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## Table 2. Labelling Requirement for Organic Food

### \* Food labels "100 percent organic" and "organic"

- \* Product labeled "100 percent organic " must contain only organically produced ingredients (excluding water and salt).
- \* Product labeled "organic" must consist of at least 95 percent organically produced ingredients (excluding water and salt). Any other ingredients must consist of nonagricultural substances approved on National List maintained by the USDA National Organic Program or non-organically produced agricultural products that are not commercially available in organic form.
- \* Products that meet the requirements may display these terms and the percentage of organic content on their display panel.

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## Table 2. Labelling Requirement for Organic Food

### \* Food labels "100 percent organic" and "organic"

- \* The USDA seal and the seal or mark of certifying agents may appear on product packages and in advertisements.
- \* Food labeled "100 percent organic" and "organic" cannot be produced using excluded methods, sewage sludge, or ionising radiation.

### \* Processed products labeled "made with organic (specific ingredients)"

- \* Products that contain at least 70 percent organic ingredients can use the phrase "made with organic ingredients" and list up to three of the organic ingredients or food groups on the principal display panel. For example, soup made with at least 70 percent organic ingredients and only organic vegetable may be labeled either "soup made with organic peas, potatoes, and carrots" or "soup made with organic vegetables."
- \* Food labeled "made with organic ingredients" cannot be produced using excluded methods, sewage sludge, or ionising radiation.
- \* The percentage of organic content and the certifying agent's seal or mark not be used on the package. However, the USDA seal cannot be used anywhere on the package.

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## Table 2. Labelling Requirement for Organic Food

### \* Processed products that contain less than 70 percent organic ingredients

- \* The package of these products can make no organic claim, except on the information panel, where they may identify the specific ingredients that are organic produced.

### \* Other labelling provisions

- \* Any product labeled as organic must identify each organically produced ingredient in the ingredient statement on the information panel.
- \* The name and address of the certifying agent of the final product must be displayed on the information panel.
- \* There are no restrictions on the use of other truthful labelling claims, such as "no drugs or growth hormones used," "free range," or ~~any other truthful claim~~.

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## Harmful substances in Foods

### \* Organic alternatives

#### \* Drawbacks:

- \* without using synthetic fertiliser
- \* use only manure (more iron, magnesium, phosphorus and vitamin C in organic crops)
  - \* contamination by microorganisms
- \* Cultivation/Farming system
  - \* we cannot control some substances --from lakes and streams.

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## Harmful substances in Foods

### \* Animal drug

- \* The use of drugs in food animal and food-producing animals is raised.
- \* Meat, Milk, Eggs

Producer → use drugs → to maintain animal health and well-being  
↓  
to increase production

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## Harmful substances in Foods

Drug used in animal could enter human food

↓  
increase the risk of ill health in human



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## Harmful substances in Foods

### \* Animal drugs

- \* Antibiotic (overuse): human health effect
- \* five major classes of drugs used in animals raised for foods:
  1. Topical antiseptics, bactericides, and fungicides used to treat skin or hoof infections, cuts, and abrasions
  2. Ionophores, which alter stomach microorganisms to more efficiently digest feeds and to help protect against some parasites

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## Harmful substances in Foods

### \* Animal drugs

#### \* Antibiotic (overuse):

- \* five major classes of drugs used in animals raised for foods:

3. hormones and hormonelike production enhanced (anabolic hormones for meat production and bovine somatotropin for increased milk production in dairy cows)

4. antioarasites

5. antibiotics used to prevent infections, treat disease, and promote growth

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## Harmful substances in Foods

### \* Pollutants

- \* animal manure
- \* factory wastes
- \* human sewage
- \* other runoff



can contaminate food-production areas



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## Harmful substances in Foods

### \* Pollutants

#### \* Dioxins

- \* chemical compounds creates in the manufacturing, **combustion** and **chloride bleaching** of pulp and paper and in other industrial processes
- \* accumulation in food chain
- \* animal carcinogens
  - \* fish (from dioxin-polluted water)
- \* small amount in food packages, paper plates, and coffee filters (made of bleached paper)

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## Harmful substances in Foods

### \* Pollutants

#### \* Dioxins

- \* Vegetable oil used to prepare animal feed found mixed with industrial oil contain dioxin
- \* Closed down 4,700 farms mainly pig and poultry
- \* Some contaminated eggs distributed to UK and Netherlands
- \* Symtoms: in certain animals; cancer, damage to immune and reproductive systems, low sperm count and learning difficulty

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## Harmful substances in Foods

### \* Pollutants

#### \* Nuclear Power Plant in Japan (March 2011)

- \* Earthquake and tsunami Of 9.0 magnitudes with 900 aftershock
- \* 15,813 confirmed deaths, 5940 injured, 3,971 missing
- \* Nuclear Power Plant's explosion with radioactive leakage
- \* Radioactive iodine, cesium, and strontium detected in tap water and some food products in some areas to be above legal limits
- \* Many countries set up a stringent radioactive measure for imported fish and food products from Japan

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## Harmful substances in Foods

### \* Natural toxins

- \* other chemical contamination of food can occur from natural toxins
- \* aflatoxins
- \* ciguatera
- \* methyl mercury
- \* poisonous mushroom
- \* solanine

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## Harmful substances in Foods

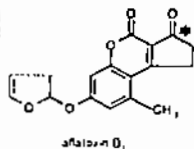
### \* Natural toxins: Mycotoxins

#### \* Aflatoxin

- \* contaminated foods or animal feed



#### \* *Aspergillus flavus* (fungi)



- \* aflatoxin production -temperature and humidity dependent
- \* aflatoxin = hepatotoxin
- \* nuts, peanut, oilseeds (corn and cottonseed)
- \* factor in the development of liver cancer (aflatoxin B<sub>1</sub> is oxidised by cell CYT P450 in the liver into aflatoxin B<sub>1</sub> 8,9-epoxide → hepatotoxic effect)

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## Harmful substances in Foods

### \* Natural toxins: Mycotoxins

#### \* Patulin

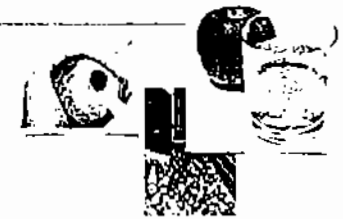
- \* damaged fruits (apples)
- \* apple juice

#### \* Ochratoxin

- \* wheat, corn, oat
- \* meat or milk derived from animal consuming ochratoxin-contaminated grains
- \* Africa and EU

#### \* Zearalenone

- \* grains
- \* Mycoestrogen (steroidal hormone functions)



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## Harmful substances in Foods

### \* Natural toxins: Mycotoxins

#### \* Deoxynivalenol

##### \* "vomitoxin"

\* wheat and barley

#### \* Fumonisin

\* water-soluble mycotoxin

\* corn (maize)

\* Fumonisin B1- leukoencephalomalacia (dissolved brain of horse), human oesophageal cancer

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## Harmful substances in Foods

### \* Natural toxins :Marine foodborne toxins

#### \* Shellfish poisoning

#### \* Ciguatera poisoning

\* Dinoflagellate: *Gambierdiscus toxicus*

\* tropical fish

\* after ingestion -> serious problems

\* paralysis

\* amnesia

\* nerve toxicity

\* Cooking dose not destroy these toxin

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## Harmful substances in Foods

### \* Natural toxins :Marine foodborne toxins

#### \* Shellfish poisoning

#### \* Paralytic shellfish poisoning

\* Dinoflagellates (*Alexandrium*, *Gymnodinium*, *Pyrodinium* and *Saxidomus*)

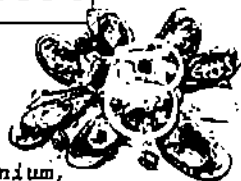
\* saxitoxin (heat-resistant and lethal toxin): lethal dose ~ 2 mg

\* Illness: tingling, nausea, respiratory paralysis and death

#### \* Diarrhetic shellfish poisoning

\* Dinoflagellates

\* Illness: mild gastroenteritis



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## Harmful substances in Foods

### \* Natural toxins :Marine foodborne toxins

#### \* Shellfish poisoning

#### \* Neurotoxic shellfish poisoning

\* Dinoflagellates: *Gymnodinium breve* (brevetoxin)

\* Illness: gastrointestinal illness

#### \* Amnesic shellfish poisoning

\* "domoic acid poisoning"

\* Diatom: *Pseudonitzschia*

\* Illness: gastroenteritis -> neurological symptom, coma and death

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## Harmful substances in Foods

### \* Natural toxins :Marine foodborne toxins

#### \* Shellfish poisoning

##### \* Scombroid (or histamine) poisoning

- \* Tuna, mahi-mahi, mackerel ..high level of histidine
- \* Bacteria (*Proteus* sp.) – histidine into histamine by decarboxylation (allergenic response)

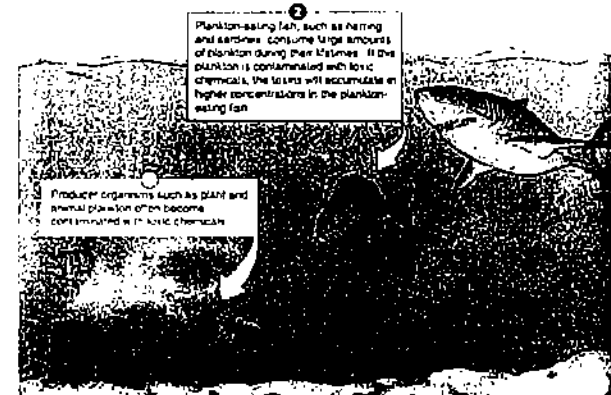
##### \* Puffer fish (fugu) poisoning

- \* tetrodotoxin (lethal neuroparalytic toxin) produced by Gram negative bacteria (*Vibrio*, *Alteromonas*, *Aeromonas*, *Plesiomonas*, *Pseudomonas* and *Escherichia*) –liver and internal organs of puffer fish

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Food chain 2: the  
transfer of toxins  
upward

Carnivorous fish, such as shark  
and tuna, consume both the  
plankton and the fish that  
they are eating. Carnivorous fish  
therefore likely to contain higher  
concentrations of toxins than plankton-  
eating fish.



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## Harmful substances in Foods

### \* Natural toxins: Heavy metals

#### \* methyl mercury

- \* mercury from environment
- \* water soluble
- \* transformation by bacteria->methyl mercury (a more toxic form)
- \* Fish absorb methyl mercury from water passing their gills and by eating.



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## Harmful substances in Foods

### \* Toxins: Heavy metals

#### \* Lead

- \* ceramic ware, can, etc.
- \* neurological symptoms and kidney damage
- \* action level from 0.5-7.0 ppm

#### \* Cadmium

- \* rice and other foods, ceramic ware
- \* nephrotoxicant

#### \* Arsenic

- \* rodenticide or fungicide
- \* rocks or minerals --> ground water by biological or chemical processes
- \* cancer or skin lesions

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## Harmful substances in Foods

### \* Toxins: Heavy metals

#### \* Uranium

- \* The meltdown of nuclear reactor at Chernobyl (1986)  
->radioactive fallout

- \* human death and congenital defects



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## Harmful substances in Foods

### \* Chemical used in food processing environments

#### \* chemicals for;

- \* routine operation
- \* maintenance
- \* cleaning equipments
- \* other additives, lubricants, refrigerator fluids, detergents, sanitiser, and pesticides

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## Harmful substances in Foods

### \* Chemical compound formed during cooking

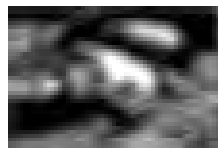
#### \* On April 24, 2002

- \* the Swedish National Food Administration —acrylamide in foods

- \* acrylamide —carcinogen in animal test

- \* food cooking at high temperature

- \* fried food
- \* roasted food
- \* baked food



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## Harmful substances in Foods

### \* Chemical used in food packaging materials

#### \* packaging materials

- \* Bisphenol A —> water and food packaged in polycarbonate plastic bottles or metal cans
- \* Styrene— food packing in foam container



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## Harmful substances in Foods

### \* Physical contaminants

- \* food preparation and food processing
- \* glass, metal, other objects



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## Harmful substances in Foods

### \* Other food contaminants

- \* food allergens (Food allergy & anaphylaxis)
- \* milk, eggs, peanut, tree nuts (cashew, walnuts), fish, shellfish, soy, wheat, etc.



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## Harmful substances in Foods

### \* Other food contaminants

- \* food allergens (Food allergy & anaphylaxis)
  - \* A variety of reaction in an allergic person;
    - \* gastrointestinal problems
    - \* skin irritation
    - \* breathing difficulty
    - \* shock
    - \* death

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## Harmful substances in Foods

### \* Key concepts:

- \* Chemical contaminants in foods include pesticides, natural toxins, and contamination related to pollution.
- \* Although organic foods are grown without synthetic pesticides or fertilisers, they still can contain chemical contaminants.
- \* Other potential food hazards are allergens and nonfood contaminants.

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## Keeping Food Safe

### \* Dietary Guideline for Americans (2000)

#### \* "Keep food safe to eat"

##### \* Example:

- \* you are enjoying a piece of broiled chicken.
- \* you cooked it by yourself.
- \* Think for food safety!

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## Keeping Food Safe

### \* Example:

#### \* harmful contamination have occurred at

- \* farm!
- \* processing plant!
- \* during transportation to supermarket!
- \* at supermarket:
  - \* under-refrigeration or keep it too long before sold!
- \* after buying:
  - \* you leave it i a warm car or keep it in a refrigerator -not cold enough!

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## Keeping Food Safe

### \* Parties responsible for keeping foods free from contamination

- \* government officials at the national and local levels
- \* producer
- \* manufacturer
- \* consumer

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## Keeping Food Safe

### \* Hazard Analysis Critical Control Point (HACCP)

- \* food industry program
- \* contamination prevention by identification areas in food production and retail -where contamination could occur???
- \* To analyse CCP - points at which hazards could occur
  - \* anywhere in a food's production -from its raw state through processing and shipping to purchase by the consumer.
- \* To determine measures -they can institute at those points to prevent, control, or eliminate the hazards

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**Table 3. HACCP: Hazard Analysis and Critical Control Point Systems**

Step 1: Analyse hazards.	Identify the potential hazard associated with a food. The hazard could be biological (e.g. a microbe), chemical (e.g. mercury), or physical (e.g. ground glass or metal).
Step 2: Identify critical control points (CCPs)	Identify points in a food's production path—from its raw state through processing and shipping to consumption—where a potential hazard can be controlled or eliminated. Examples of CCPs are cooking, chilling, handling, cleaning and storage.
Step 3: Establish preventive measures with critical limits for each control point.	An example is setting the minimum cooking temperature and time to ensure safety for a particular food (the temperature and time are critical limits).
Step 4: Establish procedures to monitor the control points.	Such procedures might include determining how and by whom cooking time and temperature should be monitored.

**Table 3. HACCP: Hazard Analysis and Critical Control Point Systems**

Step 5: Establish corrective action to be taken when a critical limit has not been met.	For example, reprocessing or disposing of food if the minimum cooking temperature is not met.
Step 6: Establish procedures to verify that the system is working properly.	For example, testing time-recording and temperature-recording devices to verify that a cooking unit is working properly.
Step 7: Establish effective record keeping to document the HACCP system.	For example, recording hazards and their control methods, the monitoring of safety requirements, and action taken to correct potential problems.



**Temple of food safety**

## Keeping Food Safe

### \* Hazard Analysis Critical Control Point (HACCP)

\* Preventive measures include proper cooking, chilling, and sanitising, as well as preventing cross-contamination and improving employee hygiene.

### \* Key concepts:

\* Food safety is the responsibility of many agencies at the federal and local levels. The use of the HACCP system allows government and industry to identify possible sites of food contamination and correct problem before they occur.

## The Consumer's Role in Food Safety

- ☞ Food safety advice to consumers used to consist of a simple message; "Keep hot foods hot and cold foods cold"
- ☞ Food safety experts urge consumers to follow the following four rules
  - ☞ Clean. Wash hands and surfaces often.
  - ☞ Separate. Don't cross-contamination.
  - ☞ Cook. Cook to proper temperature.
  - ☞ Chill. Refrigerate promptly.



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## Safe Food Practices

### ☞ Buying food

- ☞ Buy from reputable dealer and grocer who keep their selling areas and facilities clean and sanitary and maintain food at the appropriate temperature
- ☞ holding dairy foods, eggs, meats, seafood, and certain produce such as cut melons and raw sprout at refrigerator temperatures
- ☞ Don't buy canned goods with dents or bulges. Avoid torn, crushed, or open food packages.

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## Safe Food Practices

### ☞ Storing food

- ☞ Refrigerate perishable items as quickly as possible after purchase.
- ☞ Refrigerator temperature should be 40°F (4°C) or colder.
- ☞ Keep eggs in their original carton and store them in the refrigerator itself, not the door, where the temperature is warmer.
- ☞ If raw meat, poultry products, or fresh seafood will be used within two days, store them in the coldest part of the refrigerator, unusually under the freezer compartment.

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## Safe Food Practices

### ☞ Storing food

- ☞ If raw meat, poultry products, or fresh seafood will not be used within two days, store them in the freezer.
- ☞ Read label direction for storing other foods.
- ☞ Store potatoes and onions in a cool dark place, but not under the sink. Keep them away from household cleaning products and other chemicals as well.

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## Safe Food Practices

### ☑ Preparing food

- ☑ Wash hands thoroughly with warm soapy water for at least 20 seconds before beginning food preparation and every time you handle raw foods including fresh produce.
- ☑ Defrost meat, poultry and seafood products in the refrigerator, microwave oven or in a water-tight plastic bag submerged in cold water.

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## Safe Food Practices

### ☑ Preparing food

- ☑ Before opening canned foods, wash the top of the can to prevent dirt from coming in contact with the food.
- ☑ Always use clean cutting board. Wash cutting board with hot water, soap, and a scrub brush.

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## Safe Food Practices

### ☑ Cooking food

- ☑ Cook foods to the appropriate minimum internal temperature
  - ☐ Seafood → 145°F (63°C)
  - ☐ Beef, lamb, and pork → 160°F (71°C)
  - ☐ Ground chicken and turkey → 165°F (74°C)
  - ☐ Poultry breasts → 170°F (77°C)
  - ☐ Whole poultry and thighs → 180°F (82°C)

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## Safe Food Practices

### ☑ Serving food

- ☑ Keep hot foods at 140°F (60°C) or higher and cold foods at 40°F (4°C) or lower.
- ☑ Do not keep leftovers at room temperature for more than two hours. Refrigerate as quickly as possible.
- ☑ Date leftovers so that they can be used within a safe time—generally, three to five days in the refrigerator.

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## Who's at increased risk for food borne illness?

- ✧ People who are at risk include individuals with these conditions:
  - ✧ immune disorders, such as HIV infection
  - ✧ cancer
  - ✧ diabetes
  - ✧ long-term steroid use, such as for asthma or arthritis
  - ✧ liver disease
  - ✧ hemochromatosis, an iron storage disorder that affect the liver
  - ✧ stomach problems, including previous stomach surgery and low stomach acid (for example, from chronic antacid use)

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## A Final World on Food Safety

- ✧ total risk-free system of food production —> unreasonable and unattainable
- ✧ We expect our food to be clean, fresh, and not contaminated with debris, chemicals, or organisms that cause sickness or discomfort.
- ✧ Food supplies are the safest in the world.

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*The End.*

### \* Key concepts:

- Consumers play a huge role in food safety.
- They can avoid food born illness by following a few simple food-handling and preparation rules:
  - ✧ keep hands and food-preparation areas clean
  - ✧ avoid cross-contamination of foods
  - ✧ cook foods adequately
  - ✧ refrigerate foods promptly
- People who have weak or less-developed immune systems are at higher risk for foodborne illnesses.

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## Aflatoxin



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### Lesson 3 : Food Materials from Natural Resources

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- Lack of food in some area but plenty in some area due to the supporting of ecology and environmental of that area.
- There area more enough food that can produce on the earth as Thailand.
- For the poor people, The basic need of food is quantity than quality except some area as Thailand.
- For the Hi-so class can order the best quality of food as the first class of rice as Jasmine rice.

3

#### 2.2 Food Management of Human Being

- Human being is not strong as the wild animal but they have a best good brain, then for their survival, they should have to stay together as the group to defend the wild animal.
- since we can be created thinking for producing new manmade from the natural resources, the first thinking for their living on the earth is how to grow the edible foods for supporting their need.
- The original agricultural machine were made in Europe for increasing the enough of food as the population increase.

### Lesson 3 : Food Materials from Natural Resources

#### 1. Introduction

- 4 basic need of human factors : Foods , Clothes , Home and Medicine.
- Food is the first Priority.
- Food Need increasing with population and never decreasing.
- Food production can be produced in all countries.

2

#### 2. Sources of Natural Food Materials.

##### 2.1 Natural Sources.

- Since we have the human being, they need the food from the natural up to present and continue to the future forever.
- In the former time, the main original of food source is from the natural sources only because the human being do not know how to grow the food plant. (Ex. From the forest, grassland ,fresh and sea water. )
- The both quantity and quality are different each area. ( topography , climate, soil , water etc.)



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- We could control the wild animal and use them as the domestic animals for their food and the other purposes.
- We can use the brain to create the new appropriated technology as the time change. More new environment.
- We can be integrated and developed several manmades which related to both food productions and others.

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-Developed all military weapons and sent the troop to occupied the countries for several years until the end of second world war by settled the United Nations.

- New methods from the developed countries tried to develop pass thru the new high technology with all right reserved or using the GIS as ISO.9000 or ISO14000 etc.



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### 3. Food materials and Natural Resources and Environment

#### 3.1 Definition

1.) Natural Resources = both non-living and living things created by natural and useful for human being.

2.) Environment = Every things that created by both nature and man-made as the physical and abstract which can be founded surrounding us.

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3.) Conservation = the natural resources utilization serving basic needs of the people with minimize waste but sustainable uses.

4.) Sustainability = the ability of the system that can be maintain standard or accepted status under the several pressure of the factors at present and in the future that related to food production and utilization.

5.) Eco-development = the good activity of natural resources utilization under the principles of natural resources conservation for Improvement of basic needs with acceptable of the ecological balance.

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#### 6.) Ecological Balance

- The structures and functions of the ecosystem.

-The pinpoints = change of species diversity , quantity , proportion and distribution of natural resources

- The importance key words = self-regulation, self-maintenance, carrying capacity, limiting factors and compensation factors)

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### 3.2 Type of Natural Resources

#### 3.2.1 Inexhausting N.R. :-

- atmosphere
- hydrologic cycle or water cycle
- solar energy

- \* This NR type is the important supporting factors for producing the food material of the human being.

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#### 3.2.2 Exhausting NR.

- - can not renewable Ex.
- - minerals
- - petroleum
- - natural gas
- - natural wilderness



#### 3.2.3 Renewable NR = can renewable

- - water in place
- - soil
- - forest
- - Including raw food materials
- wildlife
- range
- human



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### 3.3 NR and Management

NR. Type	Example	NR management method
1. In-exhausting NR.	Air, water	Carrying capacity mgt.
2. Exhausting NR.	minerals / petroleum	Reduce Reuse Recycle-Efficiency mgt.)
3. Renewable NR.	Living things	Increment mgt

\*\*\* Food material = Renewable NR.

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3) Relative waste = loss NR with a few return.

Ex. = use the teak as the fuel wood or charcoal.

= drive the heavy trucks to work at the office

= always change or follow the new fashion styles  
or technology

4) Organized waste = loss by intend to do these  
activities.

Ex. = to maintain the price of agricultural product

= to damage the illegal goods.

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### 3.4 Waste

- Waste = Loss of NR. Without the adequate utilization  
methods. .... 4 types.

1) Absolute waste = loss without any return.

Ex. Forget turn off the light or tap water at home while  
we are working at the office.

2) Plus waste = loss this NR + another NR.

Ex. Forest fire = loss forest area including wildlife.

\*\*\* Good example for food materials :

For the cycle of growing rice and utilization :=

Rice production : seedling preparation, loss by  
bird eating.

Loss by harvesting and rice mills, loss by  
stocking and transportation.

Loss by cooking and eating etc.



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### 3.5 Type of Environment

ENV. Type	Kinds	Example
1.) NR.	(1) Living (2) Non-living	Man/animal/plant Air / soil / water
2.) Manmade	(1) Physicals (2) Social or	- can be test by our senses Law / regulation/ religion custom / culture



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### 3.6 The importance of NR conservation on Food materials

- NR = the part of ENV and can be interaction each others

- NR = the sources 4 basic need factors that including food  
materials.

- No appropriated utilization of NR under the principles of  
conservation create several chain environmental problems ex.  
loss NR in the future consumptive uses (limited of NR.) , ENV  
problems , the unsustainable of environment and ecosystem etc.



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### 3.7 Problems on NR conservation.

1. Each NR need the different ecological system.
2. All NR should be related each other.
3. Increasing population need more NR utilization
4. Lack of awareness of NR conservation :-
  - sense of belonging or people participation
5. Some NR will be used as the social or political issues
6. Lack of the certainly government policy of NR.

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#### 2.) Ecology

- Eugene P. Odum (1962) In. Japanese Journal of Ecology

"Ecology is the study of structures and functions of nature."

(2.1) Structures .... 3 parts

- (1) Living things = Species, quantity, live history , proportion and distribution in the earth space .
- (2) Quantity of nonliving things and distribution ie soil nutrients, soil, water etc.
- (3) Range or change tendency with time ie. Air temperature, day light hour, relative humidity, wind velocity etc.

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3.) Ecosystems = the unit area that have several matters stay together including both non and living things which has related each other with the same activity and symbols.

- Type of Ecology ..... 2 main systems.

(1.) Terrestrial Ecosystem = Land ecosystem

(2.) Aquatic Ecosystem = Water Ecosystem

- Ecosystem can be called by the name of each symbols. Ex, Forest ecosystem, Grassland ecosystem, Kwan Phayao ecosystem, Faculty of Agriculture ecosystem.

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### 4. Ecosystem and Food Materials

#### 4.1 Ecosystem

1.) What is the system = as the group of matters that stay in their same boundary which have their own activities and symbols together.

1.1 Closed system = without mass transfer except the energy ie. Earth.

1.2 Open system = with mass transfer except the energy ie. Your home , resort , village etc.

1.3 Isolated system = no both materials and energy transfer.

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(2.2) functions) ..... 3 parts

(1) Rate of biological energy flow in the ecosystem ie photosynthesis, respiration of the living population.

(2) rate of matters and nutrients circulation in the ecosystem ie biogeochemical cycles.

(3) The biological regulation and ecosystem ie. Their environment control the living things ie photoperiodism, sleeping, working day time etc. and the living things can control the environment ie nitrogen fixation of the Leguminisae plant or dam or reservoir or tunnel construction for changing the river flow.

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4.) Ecodevelopment = The best procednres under the principle of Natural Resources Conservation for serving basic needs of human being which still maintain the ecological balance.

- They are both Government and Private Projects ie the construction of road, railway, airport, dam, hotel, resort etc.

- The IEE or EIA reports should be approved by the Senior Committee of The Office of the Natural Resources and Environmental Policy and Planning, Ministry of NR and ENV.

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## 4.2 Ecosystem Structures..... 2 parts

### 4.2.1 Abiotic component :-

- (1) Inorganic substances =  $H_2O$   $CO_2$  nutrients
- (2) Non living organic substances
- (3) Topographic conditions = altitude, slope, aspect
- (4) Climatic conditions = air temperature, relative humidity, rain, sun light, sunshine duration etc.

\*\*\* These are the supporters of the living things in the ecological cycle as the nutrient cycling and energy flow.

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3.) Decomposers = the micro-organism to decompose both other raw materials and themselves when they die to release the nutrients to the soil for restart the growing of the producers.

\*\*\* We use the decomposers as the raw material for the fermentation to produce the several foods and other purposes including the process of waste treatment such as waste water and garbage to be a fertilizers.



### 4.2.2 Biotic components = plant, animal, human being

(1) Producers = autotrophs that can photosynthesis and change solar energy to biochemical energy

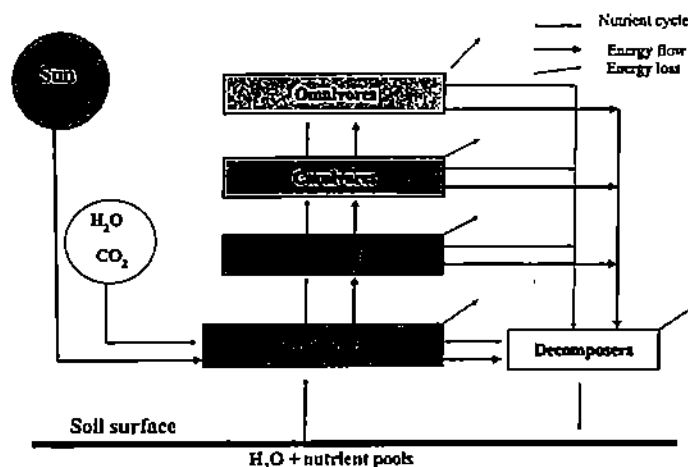
(2) Consumers = animals and human beings comprise of 3 groups as herbivores, carnivores and omnivores.

- The energy loss 10 and 20 % by transferring from plant to animal or human being and from animal to animal or human being respectively.

- More long food chain, they will lose more solar energy.

- Hence, the main source of energy for human being transferred from the solar energy of the sun light pass thru the energy in both plants and animal.

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## 4.3 Energy Flow and Nutrient Cycling of the Ecosystem.

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## 4.4 Food Materials

1.) Plants = edible plants that can be produced as the food and other purposes.

2.) Animal = both wildlife and domestic animals. For the wildlife consumption should be considered by following the reserved and protected wildlife Act. 2535. But the farmers can be made the wildlife farm under the regulation of this Act. The administration the exotic wild animals is more easy than the local wild animals.

3.) Micro-organism = For the processing of food materials.

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## 5. Food Production Factors

- The factors to produce both food quantity and quality.

### 5.1 Abiotic factors

1.) Topographic factors = landform, altitude, slope, aspect, river etc.

2.) Climatic factors = sun light energy, light intensity, light duration, precipitation, air temperature, relative humidity, wind, air mass, air pollution etc

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Limestone mountain at Nakorn Swan Province.

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### 3.) Edaphic factors

- (1) soil type = parent materials .... Igneous rock is the best to produce the good physical soil with adequate nutrients for planting agriculture crops and including the ground water management but difficult in both limestone and sandstone.
- (2) Soil fertility and soil productivity
- (3) Land capability and land suitability



Soil erosion of mixed deciduous forest along the roadside<sub>33</sub>

### 4.) Forest fire ..... 3 types

- Ground fire , Crown fire and subsurface fire



- Not only in the forest but including the site preparation of agricultural crop and garbage burning in the town.

-Damage the forest area, wildlife and micro-organism.

- Create the environmental problems on smoke, visibility and breath health.

5. Time .. Related to growth and life cycle of the evolution -

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## 5.2 Biotic factors

### 5.2.1. Vegetative factors

1.) Natural selection ... The characteristics of living thing including plant species

2.) Plant species improvement

### 5.2.2.Human factors

- Several countries try to develop the agro-industry as the main national income.

1.) New research and technology for crop production and other purposes.

2.) Production target for agro-industry.

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### 6. Food source diversity

#### 6.1 Lithosphere-Hydrosphere-Atmosphere

- Old concept = the amount of rain depend upon the water resource in the local area.

- At the present = We have to use the interdisciplinary study for integration each other as the regional area or the world. Ex.

. (1) Typhoon in the south China sea and Cyclone in the Indian ocean.

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(2) El Nino is called as the year that the Peru fisherman can get a lot of Fishes.

(3) New technology utilization for water improvement ie Cloud radar , Evaporated the radioactive of isotope water for precipitation distribution or stream flow discharge in the regional level or the world level.

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## 6.2 Source of Raw Food Material



### 6.2.1 Forest Source. .... Forest type in Thailand :- 2 tipes.

(1) Evergreen forest ... High bio-diversity with the good deep soil, high precipitation or water ..... With 7 kinds ex.

Hill evergreen forest .... Head water supply in the N

Moist evergreen forest ..... S and E / along the riverside

Dry evergreen forest ..... Hillslope

Pine forest ..... N and NE

Beach forest ..... Along the seacoast

Fresh water forest (wetland) ..... at the national reservoir

Mangrove forest ..... Along the river mouth



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Moist Evergreen Forest

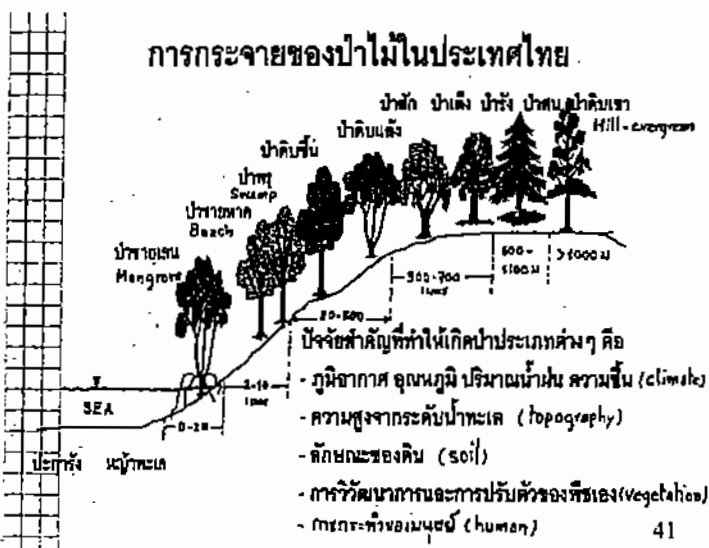
39



Mangrove Forest

40

### การกระจายของป่าไม้ในประเทศไทย



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Eucalyptus Plantation age – years.

42

(2) Deciduous forest ..... Dry and forest fire with a shallow low soil but plenty of rock outcrop.

- Low bio-diversity found in the N and NE ....2 kinds

1.) Dry dipterocarp forest) ... Shallow and less nutrient soil. Very dry soil that not suitable for planting agriculture crop.

2.) Mixed deciduous forest ..... Rather deep soil enough for planting agriculture crop. Found various bamboo species in the forest.

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**Dry Dipterocarp Forest**

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**Pine Forest with 2 species in Thailand**

(2 and 3 leaves species)



**Grassland**

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## 6.2.2 Reservoir Sources

(1) Fresh Water Sources ..... Natural or Manmade Reservoir  
From Natural Reservoirs ..... N = Kwan Phayao, Phayao Province, NE = Nongharn, Sakon Nakorn Province, C = Bueng Boraped, Nakorn Swan province S = Talenoi, Pattalung province

(2) Sal Water Sources ..... Sea and Ocean including from the Aquacultures.

**6.2.3 Agricultural Sources... Look from the other professor**

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## 6.3 World Agricultural Group

1.) Cereals and plants mainly producing carbohydrates ... rice, corn, potato, cassava, sugar can etc.

2.) Proteins ..... Several Bean

3.) Oil ..... Oil palm, Soy bean, Coconut, Sun flower

4.) Spices ..... Lemon grass, chili, peper,

5.) Beverage and confectionery crops ....., Coffee, Tea, Coco

6.) Edible fruits and nuts ..... Cashew nut, Pistachio,

7.) Vegetables

..... Not found only food in agricultural area but we can found the from the natural area as forest, grassland and reservoir.

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**7.1 Food Sources ....** \*\*\* Insect is the protien source for human being in the future.

**7.1 Agricultural area .....** Manmade

**Rice field ....** Both for rainfed and irrigation rice field.

**Horticulture .....** Fresh vegetables

**Fruit tree Plantation .....** Durian , Guava , Logan ,  
Mango , Rambutan , orange , Banana etc.

\*\*\* And including the food source from the nature.

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**7.2 Animal Husbandry .....** Manmade

**7.2.1 Grassing animal.....** Rangeland and Pasture land

**7.2.2 In Farm Site .....** Chikchen , Duck , Pig ,  
Crocodile etc.

..... The wild animal from the forest , grassland ,  
wetland, or other reservoirs.

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**7.3 Fishery ...** Some from natural sources

**7.3.1 Aquaculture Farm**

**7.3.2 Local Aquaculture Farm ....** Each home.

**7.3.3 Natural source ....** Both in fresh and salt water sources.

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**7.4 Forest .....** Natural source ... Plant and animal

- The main food source is forest and it is still more important source for the local people.

- Leaf eating ..... PakWan , PakRiang, PakNam, BiManpu.

-Fruit eating ..... LookWa , LookWai , Look Makook , LookMadoe, LookMakamPom

-Shoot eating ..... Bamboo, NorWan

- Seed eating ..... Sator, Riang , Kor , Kabok, Cashew, Pistachio

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## **8. Food impact to environment**

### **8.1 Production and Logistic.**

**8.1.1 Production technology =** Soil and water conservation , rice straw burning , Chemical applied , More annual crop , Use the groundwater for agricultural crop etc.

**8.1.2 Waste Management =** Waste water , Smell and Noise Pollution

### **8.2 For Food Consumption**

**8.2.1 During Cooking**

**8.2.2 Clenning**

53

### **8.3 Waste from Animal and Human Being**

**8.3.1 Toilet of Animal Farm**

**8.3.2 Toilet of Human being**

### **8.4 Mitigation for Environmental Impacts**

Concept of Waste Treatment = self natural recovery with self purification before applied the new and high technonogy and energy for saving the money.

Examples :-

- Terracing with planting , natural fertilizers

- Organic pesticides . No applied chemical , BioGas ,

- Waste threatment by food chian concept of the

ecosystem or use micro-organism.

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## **9. Food Material Potentials in Thailand**

**9.1 Have both side of mountainous ranges to protect the Typhoon and Cyclone.**

**9.2 Have a big and good flood plain for Agricultural crop production.**

**9.3 The low increasing population rate.**

**9.4 Have a good potentials of plenty agricultural crop for supporting the food production need of the world.**

**The End**