Fruits and vegetables are a very important part of a healthy diet.

Fruits and vegetables can be a source of foodborne illness.

Common sources of foodborne pathogens (microorganisms that cause illness) in produce include:

- Water
- Animals: wild and domestic
- Soil amendments (especially animal-based)
- People

Preventing contamination is key.

Evaluate and mitigate risks from pre-plant to harvest of the edible landscape.
Your Personal Farmer’s Market

- What are your expectations when you purchase food from the market?
  - Food is fresh and safe
  - Grown in a wholesome environment
  - Produced using safe practices
  - Harvested hygienically
  - Stored under sanitary conditions

Plan the edible landscape with these ideals in mind.
Reported outbreaks of foodborne illness linked to FDA-regulated foods by vehicle 1996-2009 (N=532 outbreaks)

- Egg: 39%
- Seafood: 26%
- Produce: 16%
- Processed foods: 8.1%
- Sprouts: 5.8%

Source: FDA/CFSAN 2011
Types of produce associated with outbreaks of foodborne illness 1996-2009 (N=87)

- Leafy greens: 32%
- Melons: 16%
- Tomatoes: 17%
- Unknown: 3.4%
- Others: 10%
- Green onions: 3.4%
- Herbs: 6.9%
- Berries: 10%

Bacteria and viruses associated:
- E. coli O157:H7
- Salmonella
- Listeria
- Hepatitis virus
Good Agricultural Practices

- Focus is on RISK REDUCTION
  - Prevent contamination where possible

- 4 main sources of foodborne pathogens
  - Water
  - Wildlife or domestic animals
  - Soil amendments
    - especially those derived from animals
  - People
Additional Considerations in the Edible Landscape

- Who maintains the edible landscape?
- Who and what have access?
- What is the harvesting protocol (how is it communicated)?
- How is the produce stored?
- Who is consuming the produce?
Microbiological Safety of the Edible Landscape

Planning
- Site Selection
- Water Source
- Facilities: toilets and handwashing

Growth (PreHarvest)
- Water
- Soil Amendments and Supplements
- Animal access

Harvest
- Personal Hygiene and Handwashing
- Cleaning and Sanitation

Post Harvest
- Washing Produce
- Food Storage and Preservation
Site Selection  
(community gardens)

- Know the history of the land
  - Risk assessment of prior use

- Consider the neighbors
  - Zoning in surrounding areas
  - Present/Future use

- Existing structures/equipment
  - Septic tanks
  - Plumbing
  - Toilets
Water Distribution

- Pipes
- Hoses
- Containers
Water Source and Quality

- Municipal Water
- Well Water
- Surface Water
- Rainwater
- Greywater
Method of Water Application

- Foliar application (spray)
  - Water in contact with edible parts
  - Use water from a safe source

- Soil application (trickle, drip)
  - May lower risk if properly maintained

Water used to mix solutions or chemicals that contact the edible plant must be potable!
Soil Amendments

- Compost
  - Animal sources (manure)
    - Potential source of high levels of pathogens
    - Properly composted or heat treated
    - **Manure from pigs, dogs, and cats must not be used**
      - Parasites may remain viable after composing
  - Vegetative matter (no manure)

- Green manures
  - Plant matter grown and chopped and incorporated into soil
Fresh Manure

- Manure
  - Solids, slurries, teas

- Potential source of human pathogens

- Keep away from edible crops
  - Evaluate risk of transfer to edible crops when applied to non-edible landscape
Un-composted Manure

- **Routes of infection**
  - **Hand to mouth contamination**
  - **Consumption of produce**
2011 Strawberry Outbreak

Mathieu Tourdjman/Oregon Public Health.

Oregon Health & Human Services Department, Environmental Health Division
Animals

- **Wildlife**
  - Deer, wild birds, rodents, rabbits, etc.

- **Pets/Farm Animals**
  - cats, dogs, ducks, chickens, turtles, cattle, goats, sheep etc.
  - waste runoff

Wild and domestic animals can be carriers of pathogens
Integrative Approach

- Exclusion
- Minimize harborage
- Eliminate food sources
- Keep a clean garden and workspace
Who has access to the garden?
How much control do you have?
Personal Hygiene

- Educate
- Toilet and handwashing facilities
  - Well maintained & stocked
    - soap, toilet paper, hand drying device or disposable towels
- First aid kit (cover wounds)
- Exclude symptomatic individuals (e.g., gastroenteritis) from area

Difficult Situation?
At minimum provide a handwashing station/sanitizer and trash can.
Make it easy for those involved in the garden to practice good hygiene.
Equipment and Personal Protective Items

- Gardening/Harvesting equipment
  - Food appropriate
    - knives, clippers, buckets

- Personal Protection
  - Gloves and other clothing
Equipment and Personal Protective Items

- Check that all are clean and well maintained
- Consider designating tools/gear for certain tasks
  - Chemical use/Compost
  - Harvesting
- Wash and sanitize harvest tools (e.g., clippers, knives) and gloves
  - As you would kitchen utensils
- Keep workspace clean
Food Safety and Pesticide Residues
Backyard Gardens

- Trending Now
  - Composting baby diapers
  - Composting pet waste
  - Backyard chickens or other animal operations
- Human urine
Washing and Preparation
Surface Characteristics
Post Harvest Handling

- Washing influences
  - Safety
  - Quality
  - Shelf life
Post Harvest Handling

- Removal of microorganisms is difficult because produce surfaces are complex.

What we see.

What *E. coli* sees.
When to wash?
Just before preparing or consuming
Sanitizing Work Surfaces and Tools

- **Wash first**
  - Wash tools or surfaces in dishwasher or clean with soap and water.

- **Then sanitize**
  - Sanitize with a bleach solution of 1 tablespoon per gallon of water for 1 min
Wash hands, sanitize brushes, work surfaces, cutting boards and knives.

Scrub or rub fruits and vegetables with a brush or hands under running water.

Dry produce with paper towels before storage.

Transfer to a sanitary container.
Food Storage and Preservation
Whole Fruits and Vegetables

- Short term storage
  - Room temperature vs. Refrigeration
- Long term storage
- Refer to chart for specifics
Food Storage and Preservation
Cut Fruits and Vegetables

- Cut produce should be consumed immediately or refrigerated within 2 hours
  - 1 hour if ambient temperatures are >90°F
Long-Term Storage

Several methods of home preservation
- Freezing
- Drying
- Fermentation
- Pickling
- Canning
- Jams and Jellies

UC Home Preservation and Storage Publications
- www.ucfoodssafety.ucdavis.edu
Canning and *C. botulinum*

- Canning of non-acidic produce
  - Most vegetables
  - Need to be canned in a **pressure canner**

- Examples of borderline acid produce
  - Tomatoes, pears, apple pears, figs
  - Should add acid in order to use a **water bath canner**
Summary

- Food safety should be integral to everything you do in the edible landscape from pre-planting to harvest and beyond

- Understand sources of contamination
  - then use common sense and practical solutions to reduce risks
Summary of important points

- Fresh fruits and vegetables are a very important part of a healthy diet

- Fresh fruits and vegetables have been associated with significant foodborne illness
  - Illness to Total Servings per Year ratio is exceptionally small

- Pathogens associated with fruits and vegetables are associated with human or animal feces

- Mitigate risk by integrating food safety into the planning, growing, harvest phases of your edible landscape
Backyard Farming

Edible Gardening

- The California Backyard Orchard (UC Master Gardener Program)

Food Safety in Community Gardens

- Food Safety in the Community Garden (North Carolina State University)
- Growing Safer Gardens - Materials developed by Dr. Ben Chapman and his research group at North Carolina State University have been combined with other useful information in one place. From the site:
  - A Handbook for Beginning and Veteran Garden Organizers: How to Reduce Food Safety Risks (PDF 1,833 KB)
  - Food Safety Culture Team - Food Safety for School and Community Gardens
Thank you!

Any Questions?

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