Animal Husbandry in Urban Agriculture

Food Safety Basics for Urban Farmers

2017 UC ANR Urban Agriculture Workshop Series

June 8, 2017

Alda Pires, DVM, MPVM, PhD, Dipl. ACVPM

Assistant Specialist in CE for Urban Agriculture & Food Safety

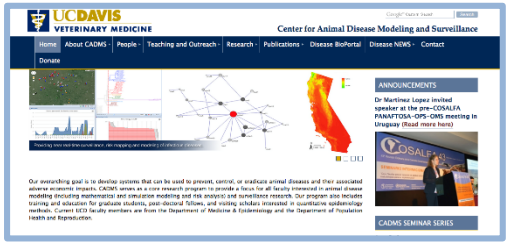
School of Veterinary Medicine, UC Davis

UCDAVIS VETERINARY MEDICINE

University of California
Agriculture and Natural Resources

Background

Food Animal Clinician (small - large - scale farms) and Lecturer, Portugal & UC Davis



Veterinary Epidemiologist (Food Safety & Epidemiology of Infectious Diseases), MSU & UC Davis

Urban Agriculture & Food Safety, Extension Specialist, School of Veterinary Medicine, UC Davis

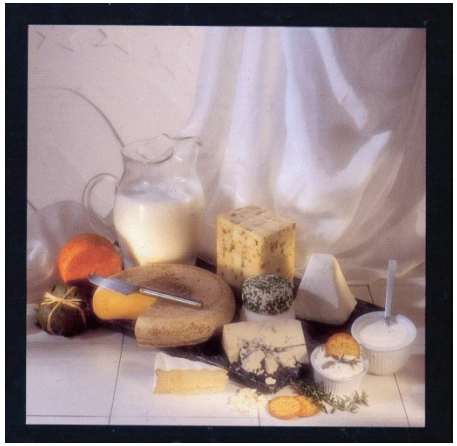
Goat Herd Characteristics

- **Dairy, Meat, Fiber, Brush clearance, Packing, Biomedical use, Companion**

Commercial producer
Seedstock breeder
Family/small herd
Youth 4H/FFA project
Individual pets

Slide courtesy of Dr. Rowe

What is the desired product?

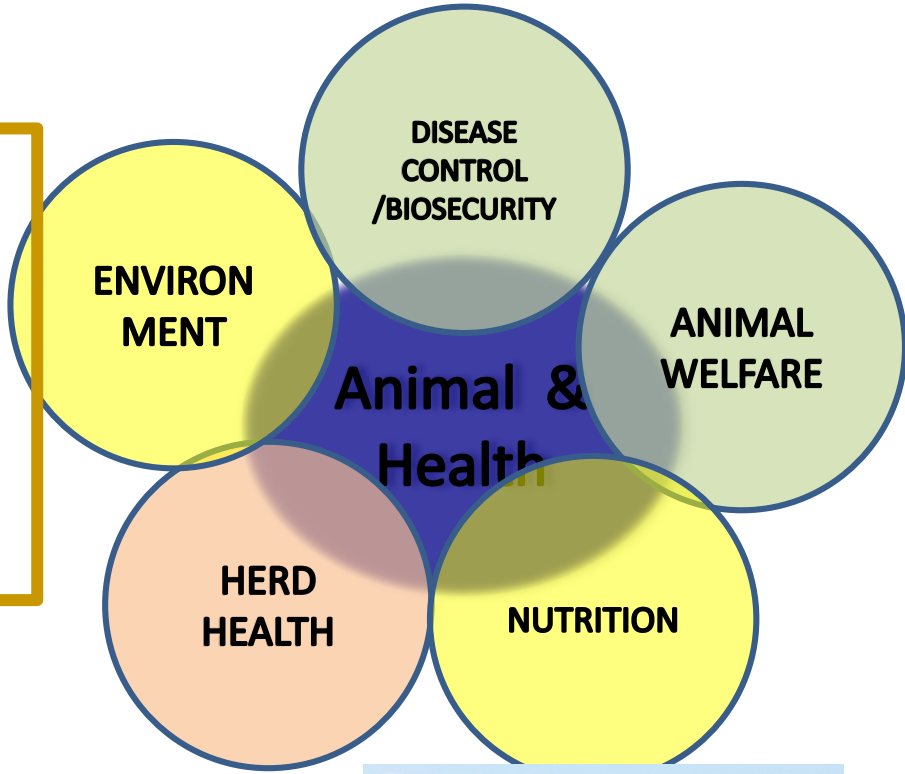


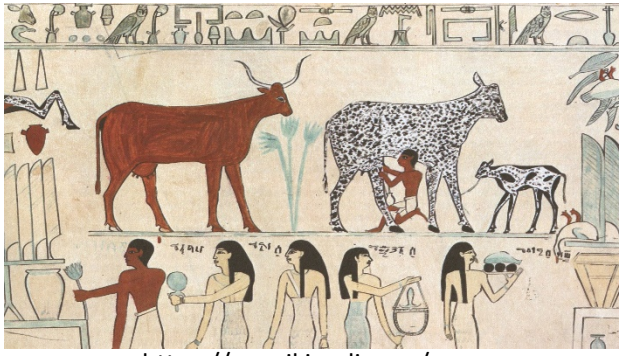
Milk, Cheese, Market Kids, Fiber, Ability to Browse/Travel, Companionship

Slide courtesy of Dr. Rowe

Animal & Herd Health

- **Animal Husbandry:** 'a branch from agriculture concerned with the production and care of domestic animals'
- **Good Husbandry Practices**



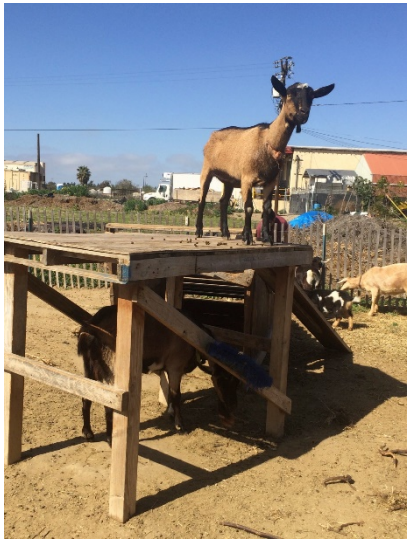


https://en.wikipedia.org/

Animal & Herd Health

Housing

- **Space available**
  - Barn/Coop
  - Pasture
- **Appropriate shelter**
- **Ventilation** (respiratory diseases)
- **Feeding Facilities**
- **Watering facilities**
- **Separation of animals by age groups**
- **Protection from predators/wildlife** (fencing)
- **Cleaning and sanitation** of the barn and equipment



Animal & Herd Health

Predator Prevention

Fencing
Housing
Guardian Animals
Pets as predators

Mortality- adult & kid
Pregnancy loss
Welfare

Slide courtesy of Dr. Rowe

Animal & Herd Health

Disease Control

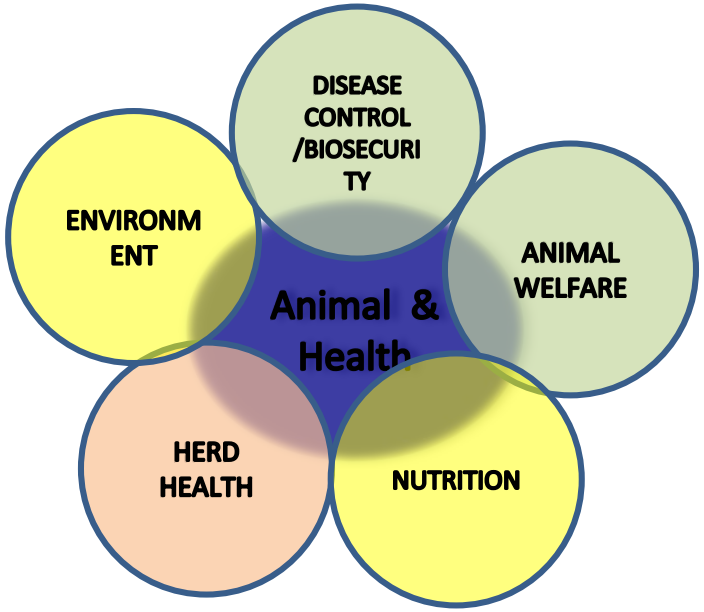
Management measures taken **to prevent disease agents** from being introduced and spreading to and/or from animal populations or their proximity (**biosecurity**)

- **ISOLATION/ ADDITIONS:** confinement of animals away from other animals

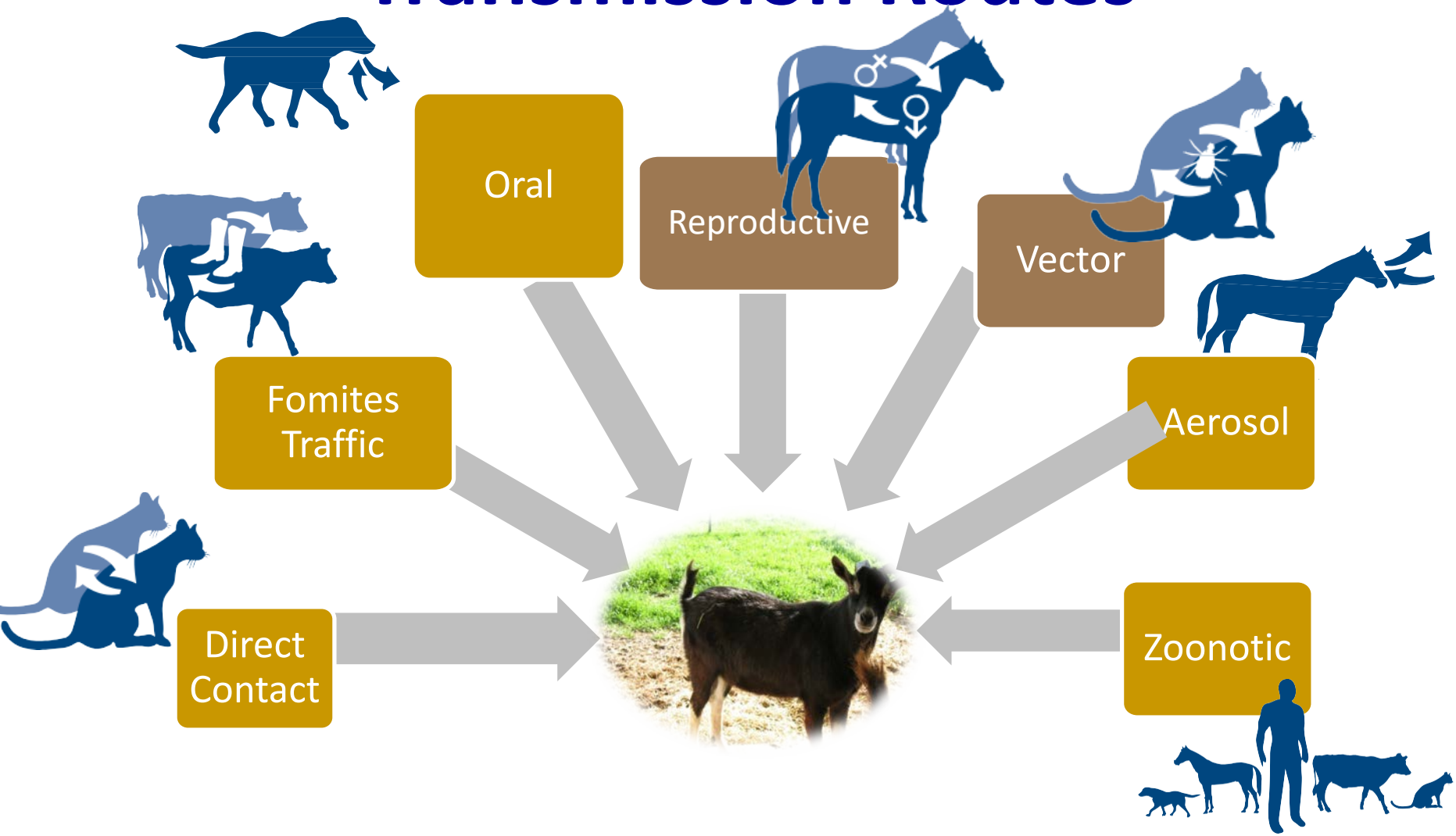
- **TRAFIC CONTROL:** movement of people, animals, and equipment

- **SANITATION/HUSBANDRY:** cleanliness and care of animals and their environment

- **PEST CONTROL:** Rodents



Transmission Routes



Introduction of Diseases and Transmission

There are multiple hosts and multiple routes of Transmission

(Adapted from www.cfsph.iastate.edu/BRM)

Disease Control
Animal Additions

- **Health status** of the **source flock/herd(s)**
  - Commercial Herd/Flock
  - Hatcheries
  - Breeder
  - Neighbor
  - Feed Stores

Photos courtesy of Dr. Rowe

- Number of animal sources should be minimized

- **High Health Herd:** Regularly monitors for diseases in the herd and keeps records

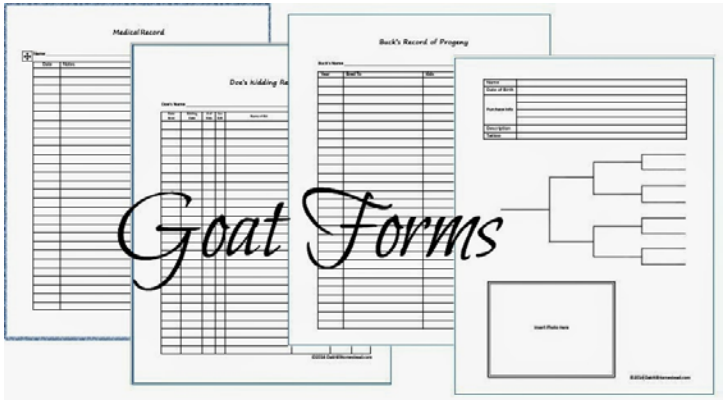
Disease Control
Animal Additions

- **Quarantine**
  - Isolate new animals **for 30 days (**at least **15 days)**
  - Isolation areas
- Time for:
  - **Observation of the animals:** signs of disease
  - **Testing for diseases** of concern
  - **Preventive Health**
    - Vaccination
    - Deworming
- **Uniform age groups**

Photo courtesy of Myrna Cadena

Disease Control
Record Keeping

- New Additions
- Individual/Group Disease Events
- Feed changes
- Reproductive Records (breeding, kidding)
- Production records
- Body Condition Scores
- Disease Test Results
  - Fecal tests
  - Diagnostic lab reports



Adapted from http://www.oakhillhomestead.com

Disease Control

Traffic Control

Movement of people, animals and equipment

- People & Equipment can carry pathogens
- Avoid exposure of the owner/employees to other flocks or other livestock

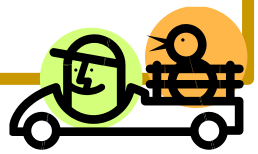
- *Q Fever, CAE, CL, Orf, Toxoplasma*, foodborne pathogens

Disease Control
Traffic Control & Sanitation

- **Visitors**
  - Restrict access visitors (e.g., barns, pastures, kidding areas)
  - Strict sanitation standards

Vehicles

- Clean and disinfect your vehicle after returning from events (fairs/shows)



Disease Control
Traffic Control & Sanitation

- Wear **personal protective equipment (PPE)** when handling animals
  - Gloves
  - Dedicated clothing (coveralls) & boots
  - Footbath (?) or bucket w scrub brush
- Different PPE to handle animals and vegetable garden
- **Wash hands after removing outwear, gloves, boots**

Disease Control
Traffic Control & Sanitation

- **Q Fever** (Coxiella burnetii) Ubiquitous & persistence in the environment

Volunteers will be used to cuddle, feed goats at Virginia farm

Published January 13, 2016 · Associated Press

A 2-year-old girl walks with goats at the Los Angeles County Fair in Pomona. (Reuters)

An Albemarle County farm is using volunteers to snuggle their baby goats.

Media outlets report that Caromont Farm in Esmontexpects 90 baby goats, c kids, will be born by mid-February.

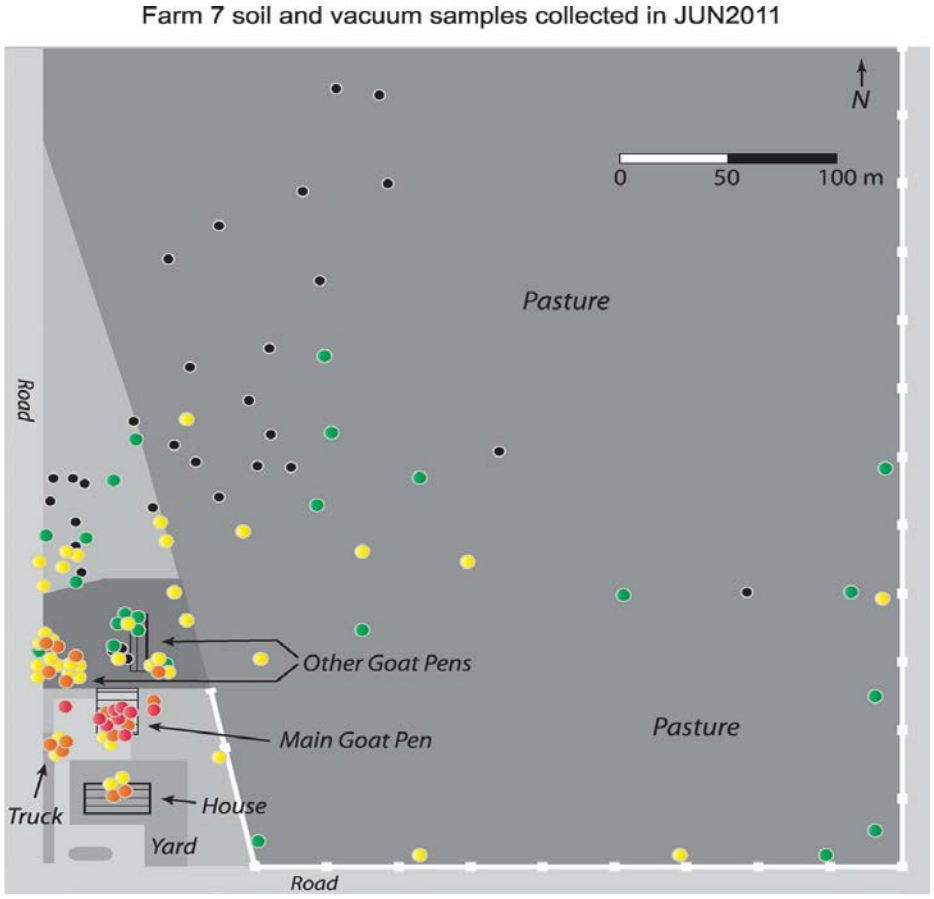
The farmers make goat cheeses, so 24-hours after the kids are born the farm starts bottle-feeding the babies and milking the mothers. The kids have to be bottle-fed four times per day.

Farm Seeks Volunteers To Cuddle Goats, And The Internet Comes To The Rescue

Dream job.

Carla Herreria
Associate Editor, HuffPost Hawaii

Who wouldn't want to cuddle this kid?



Kersh et al., 2013

Disease Control

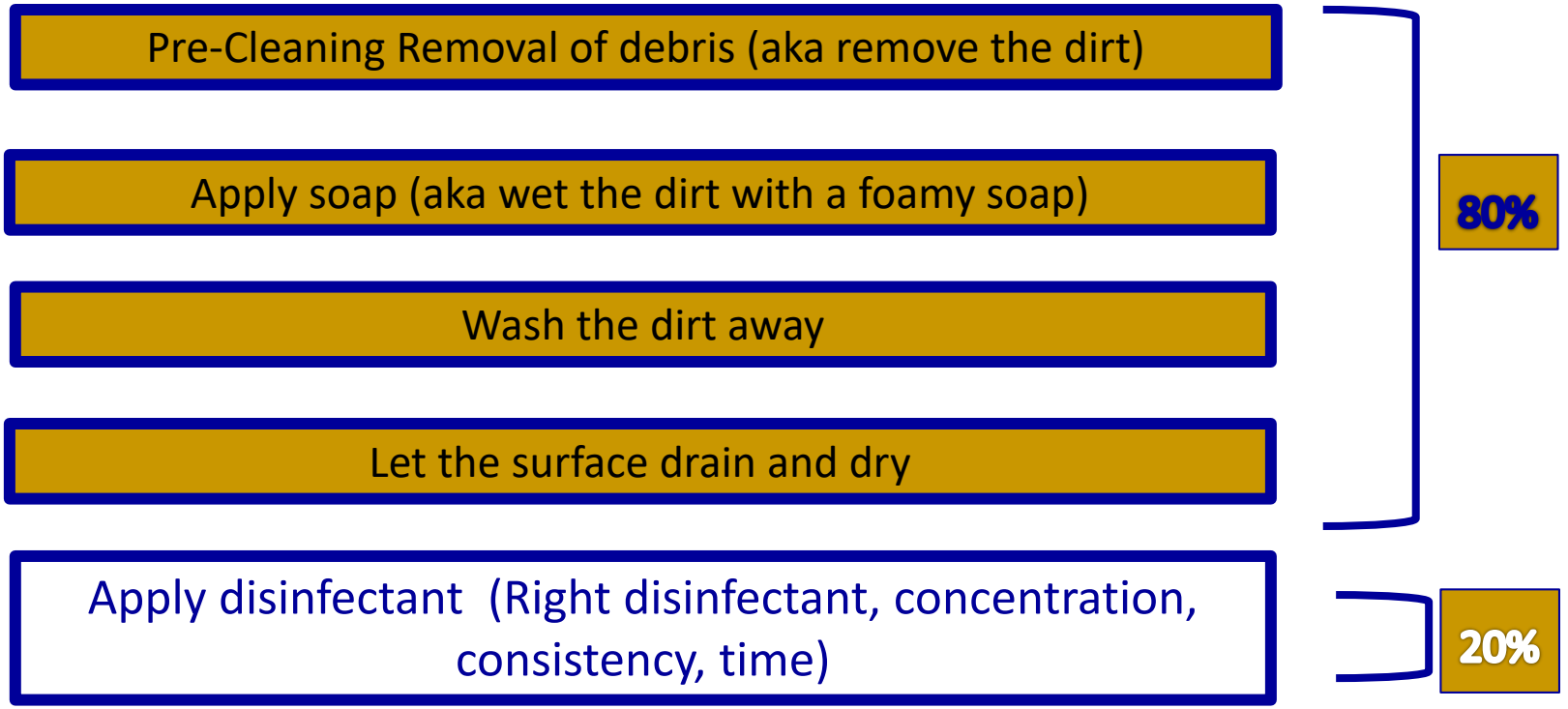
Sanitation

Equipment & Facilities

- Sources of infection
- Clean and disinfect equipment and avoid sharing equipment & feed from neighbor/healthy & sick Animals

Disease Control

Sanitation: Cleaning & Disinfection



(Slide courtesy of Dr. Maurice Pitesky)

Disease Control

Sanitation: Cleaning & Disinfection

- Dilute chlorine bleach most common agent
  - Between 65 and 200 ppm
    - 1 tablespoon bleach per gallon water = 200 ppm (max for sanitizing food contact surfaces)

Table 1 – Amount of chlorine bleach per gallon of water for a given chlorine concentration[1]

Amount of chlorine bleach per gallon of water	*Approximate concentration of total chlorine[2] (ppm)[3]*
1 teaspoon	**65**
1 tablespoon	**200**
1 fluid ounce	**400**
1/4 cup	**800**
1/2 cup	**1600**
2/3 cup	**2200**
3/4 cup	**2400**
1 cup	**3200**

1. *Assuming 5.25% sodium hypochlorite in chlorine bleach.*
2. *Typically present as both hypochlorous acid and hypochlorite ion.*
3. *ppm = parts per million.*

(McGlynn, FAPC-116))

Characteristics of Selected Disinfectants

For More Information, see the 'Disinfection 101' document at www.cfsph.iastate.edu

Disinfectant Category	Alcohols	Aldehydes	Biguanides	Halogens: Hypochlorites	Halogens: Iodine Compounds	Oxidizing Agents	Phenols	Quaternary Ammonium Compounds (QAC)
Sample Trade Names	Ethyl alcohol Isopropyl alcohol	Formaldehyde Glutaraldehyde	Chlorhexidine Nolvasan® Virosan®	Bleach	Betadyne® Providone®	Hydrogen peroxide Peracetic acid Virkon S® Oxy-Sept 333®	One-Stroke Environ® Pheno-Tek II® Tek-Trol®	Roccal® DiQuat® D-256®
Mechanism of Action	•Precipitates proteins •Denatures lipids	•Denatures proteins •Alkylates nucleic acids	•Alters membrane permeability	•Denatures proteins	•Denatures proteins	•Denature proteins and lipids	• Denatures proteins • Alters cell wall permeability	• Denatures proteins • Binds phospholipids of cell membrane
Advantages	•Fast acting •Leaves no residue	•Broad spectrum	•Broad spectrum	•Broad spectrum •Short contact time •Inexpensive	•Stable in storage •Relatively safe	•Broad spectrum	• Good efficacy with organic material • Non-corrosive • Stable in storage	• Stable in storage • Non-irritating to skin • Effective at high temperatures and high pH (9-10)
Disadvantages	•Rapid evaporation •Flammable	•Carcinogenic •Mucous membranes and tissue irritation •Only use in well ventilated areas	•Only functions in limited pH range (5–7) •Toxic to fish (environmental concern)	•Inactivated by sunlight •Requires frequent application •Corrodes metals •Mucous membrane and tissue irritation	•Inactivated by QACs •Requires frequent application •Corrosive •Stains clothes and treated surfaces	•Damaging to some metals	• Can cause skin and eye irritation	
Precautions	Flammable	Carcinogenic		Never mix with acids; toxic chlorine gas will be released			May be toxic to animals, especially cats and pigs	
Vegetative Bacteria	Effective	Effective	Effective	Effective	Effective	Effective	Effective	YES—Gram Positive Limited—Gram Negative
Mycobacteria	Effective	Effective	Variable	Effective	Limited	Effective	Variable	Variable
Enveloped Viruses	Effective	Effective	Limited	Effective	Effective	Effective	Effective	Variable
Non-enveloped Viruses	Variable	Effective	Limited	Effective	Limited	Effective	Variable	Not Effective
Spores	Not Effective	Effective	Not Effective	Variable	Limited	Variable	Not Effective	Not Effective
Fungi	Effective	Effective	Limited	Effective	Effective	Variable	Variable	Variable
Efficacy with Organic Matter	Reduced	Reduced	?	Rapidly reduced	Rapidly reduced	Variable	Effective	Inactivated
Efficacy with Hard Water	?	Reduced	?	Effective	?	?	Effective	Inactivated
Efficacy with Soap/ Detergents	?	Reduced	Inactivated	Inactivated	Effective	?	Effective	Inactivated

? Information not found

Disclaimer: The use of trade names does not in any way signify endorsement of a particular product. For additional product names, please consult the most recent Compendium of Veterinary Products.

References: Linton AH, Hugo WB, Russel AD. Disinfection in Veterinary and Farm Practice. 1987. Blackwell Scientific Publications; Oxford, England; Quinn PJ, Markey BK. Disinfection and Disease Prevention in Veterinary Medicine, In: Block SS, ed., Disinfection, Sterilization and Preservation. 5th edition. 2001. Lippincott, Williams and Wilkins: Philadelphia.

the Center for Food Security & Public Health
Iowa State University®

Disease Control
Pests Control: Rodents

Roof Rat

http://ipm.ucanr.edu/

- **Rats and Mice** carry diseases that can affect livestock, poultry, pets and humans (*Salmonella*, *Leptospira*, rat bite fever, etc.)

- **Mice and rats** have different behaviors

- Rats (Norway Rat & Roof Rats, different habitats) are more cautious, more opportunistic and have a larger geographical range of land
- **Spilled feed** will attract rats, mice, insects and birds

- **Management of Rats & Mice**: Sanitation, Building Construction and Population Control

Disease Control

Pests Control: Rodents

- **To get rid of rats/mice, remove food, water, and s and seal entryways**
  - Feed pets only the amount of food they will ea single feeding or bring food inside at night.
  - Keep garbage, trash, and garden debris in receptacles with tight-fitting lids.
  - **Habitat Control**: Thin dense vegetation (shrubs, climbing hedges, tree limbs)
  - Seal all cracks and openings (house, barns, coops, etc.)
  - Put **traps or bait stations** every **25 to 50 feet** around the perimeter of the house
  - Put traps along **beams, walls** and **ceiling routes** and at each **door**

Disease Control

Pests Control: Rodents

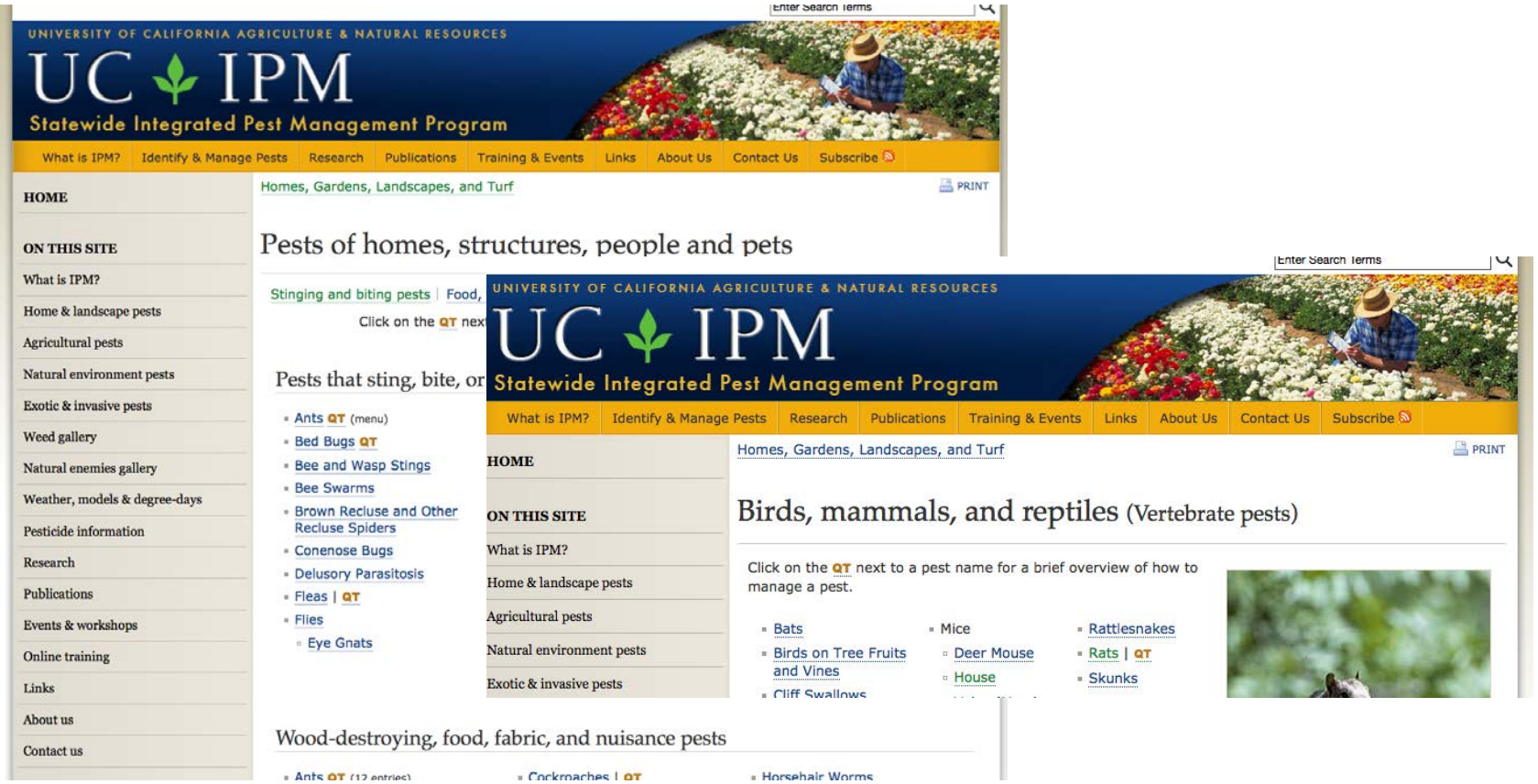
- **Ground Squirrels** cause damage by:
  - Eating food-bearing & ornamental plans
  - gnawing on plastic sprinklers and irrigation lines
  - burrowing (trip hazards and damages landscapes & structures)
- Carry diseases that can affect livestock, poultry, pets and humans (*Salmonella*, *Leptospira*, rat bite fever, plague etc.)

Disease Control
Pests Control: Rodents

- **Management of Ground Squirrels**: Traps, Fumigation and Toxic baits (depending of level of infestation, season and resources available)

- More info: UC ground Squirrel best management practices http://www.groundsquirrelbmp.com/?redirect=SB

Disease Control
Pests Control



- **UC IPM: http://ipm.ucanr.edu/PMG/menu.house.html#STING**
-

Goat Herd Health

- Ration formulation
- Feeds available
- Body condition assessment
- Feedbunk&Water management

- Mycoplasma
- CAEV
- CLA
- Johnes
- (Scrapie)
- Abortion agents

- Space
- Shelter
- Ventilation
- Fencing
- Sanitation

Prevention

Veterinary-Client – Patient Relationship (VCPR)

Protocols

- Vaccination
- Deworming
- Kidding /Doe
- Milk Quality
- Culling
- Disease Diagnosis &Treatment

Photos courtesy of Dr. Rowe

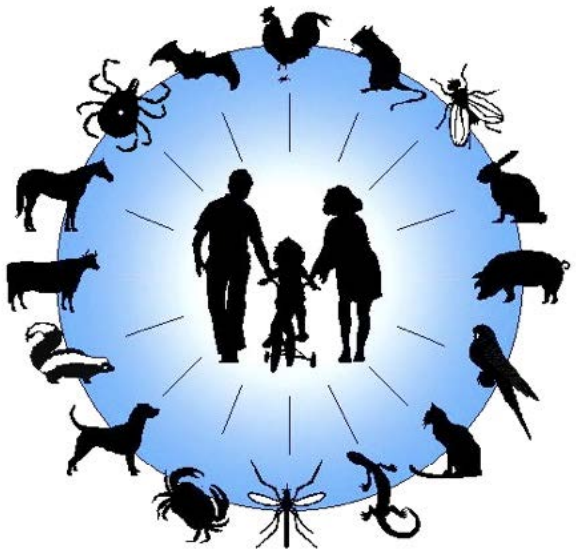
Goat Herd Health Veterinary-Client-Patient-Relationship (VCPR)

- Essentially means that the veterinarian is familiar with the client and his livestock
- Allows the veterinarian to write a prescription for medications, without actually examining every sick animal
- Keeping medications on hand allows prompt treatment of sick animals

Slide Courtesy of Dr. Bauman

Zoonotic Diseases

- Zoonoses:
  - are **diseases or infections** naturally transmissible **directly** or **indirectly between animals and humans**
- 70% of human infections diseases are zoonotic



Adapted from: http://n2gf.com/

Foodborne Diseases
Some definitions

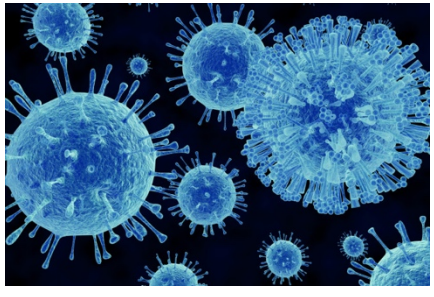
- **Foodborne Pathogens:** a biological infectious agent (bacteria, virus, parasites) that causes foodborne illness to host (food poisoning)
- **Food poisoning** is any illness resulting from consumption of contaminated food

Bacteria:

- *Campylobacter*
- *Salmonella*
- *E. coli* O157:H7
- *E. coli* non –O157 STEC
- *Listeria monocytogens*
- *Shigella*
- Staphylococcus

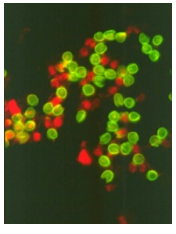
Virus:

- Noravirus
- Rotavirus
- Hepatitis virus



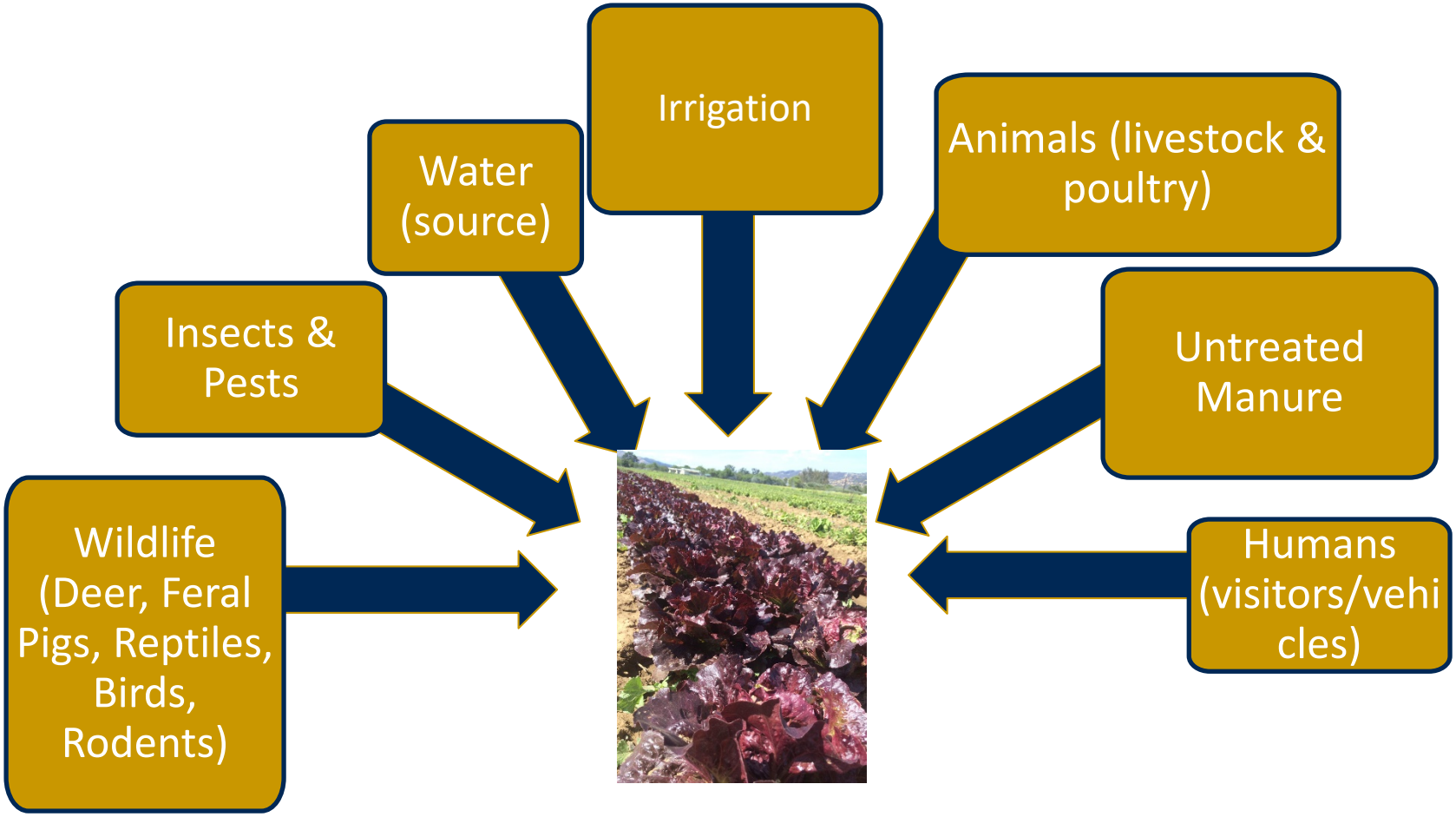
Parasites:

- Cryptosporidium
- Cyclospora
- Toxoplasma
- Trichinella



Adapted from CDC,NARMS

Foodborne Diseases



Introduction of Foodborne Pathogens in produce crops

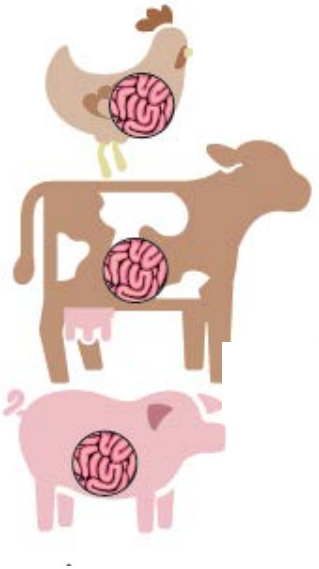
Foodborne Diseases
Animals on Diversified Farms

- Certain **animals** are **reservoirs** for certain pathogens
- What can **affect animals shedding** in their feces
  - Age (e.g. young animals)
  - Husbandry practices (e.g. stocking density)
  - Diet (e.g. distillers grain)
  - Season (summer)
  - Environmental conditions
- **Good Husbandry Practices** (prevention)

Salmonella
Campylobacter

E. coli O157:H57
Salmonella
Campylobacter

Salmonella
Campylobacter



Adapted from CDC,NARMS

Foodborne Diseases
Animals on Diversified Farms

- All manures can carry pathogens (causing human illness)
- There is an increased **risk of pathogen spread** via food products (e.g., vegetables, fruits and nuts) when **manure is applied to crop fields**

Foodborne Diseases
Manure & Risk Reduction

Soil

- Enteric Pathogens can persist for long periods in the soil:
  - ***Salmonella*** can persist in the litter applied to fields almost **4 months,** can survive up to **2 years**
  - ***Campylobacter*** can persist for about **25 days**

- Factors affecting the survival in the soil : livestock species, pathogen, manure type, composition (e.g., humidity, dry matter), soil type, environmental conditions (e.g. season, ambient temperature, rainfall, sunlight, etc.)

Foodborne Diseases

Wildlife Intrusions

- Wildlife animals can carry pathogens in their feces:
  - Rodents (gopher, ground squirrels, mice, rats)
  - Birds (wild turkeys)
  - Deer (ex: strawberry outbreak in Oregon)
  - Feral pigs (Salinas spinach outbreak 2006)
- Contamination car occur directly or indirectly (water & soil)

Zoonoses and Public Health

ORIGINAL ARTICLE

Salmonella Oranienburg Isolated from Horses, Wild Turkeys and An Edible Home Garden Fertilized with Raw Horse Manure

M. T. Jay-Russell*, J. E. Madigan, Y. Bengson, S. Madigan, A. F. Hake, J. E. Foley and B. A. Byrne

School of Veterinary Medicine, University of California, Davis, CA, USA

Impacts

- Routine faecal screening for *Salmonella* as part of the v
  hospital's infection control protocol facilitated identifi
  salmonellosis infections on a ranch in coastal Northern
- The *S.* Oranienburg clinical strain was found in multip
  including faeces from symptomatic and asymptomatic
  healthy pet dog, wild turkeys, stored manure, water tr
  the family's edible home garden.
- Viable *S.* Oranienburg persisted an estimated 210 days
  ized with raw horse manure.

Food Safety News

Breaking news for everyone's consumption

Home | Foodborne Illness Outbreaks | Food Recalls | Food Politics | Events | Subscribe | Abou

Did Deer Cause Oregon's Strawberry Outbreak?

BY GRETCHEN GOETZ | AUGUST 9, 2011

Strawberries sold at roadside and farmer's markets last month in Oregon have been implicated in an outbreak of E. coli O157:H7 infection that has caused one death and sickened as many as 15 others, the Oregon Department of Public Health announced Monday.

The outbreak sent four people to the hospital and two suffered hemolytic uremic syndrome. One, an elderly woman from Washington County, died from kidney failure caused by the disease.

So far, health investigators think deer may be to blame for the E. coli contamination. Deer tracks and deer feces were observed in several strawberry fields at the suspect farm, according to health investigators.

Tracing the berries to that farm was no easy task. Between July 10 and 29, at least 10 and as many as 16 people fell ill in Oregon with E. coli O157:H7 infections. It was not until last week – when genetic

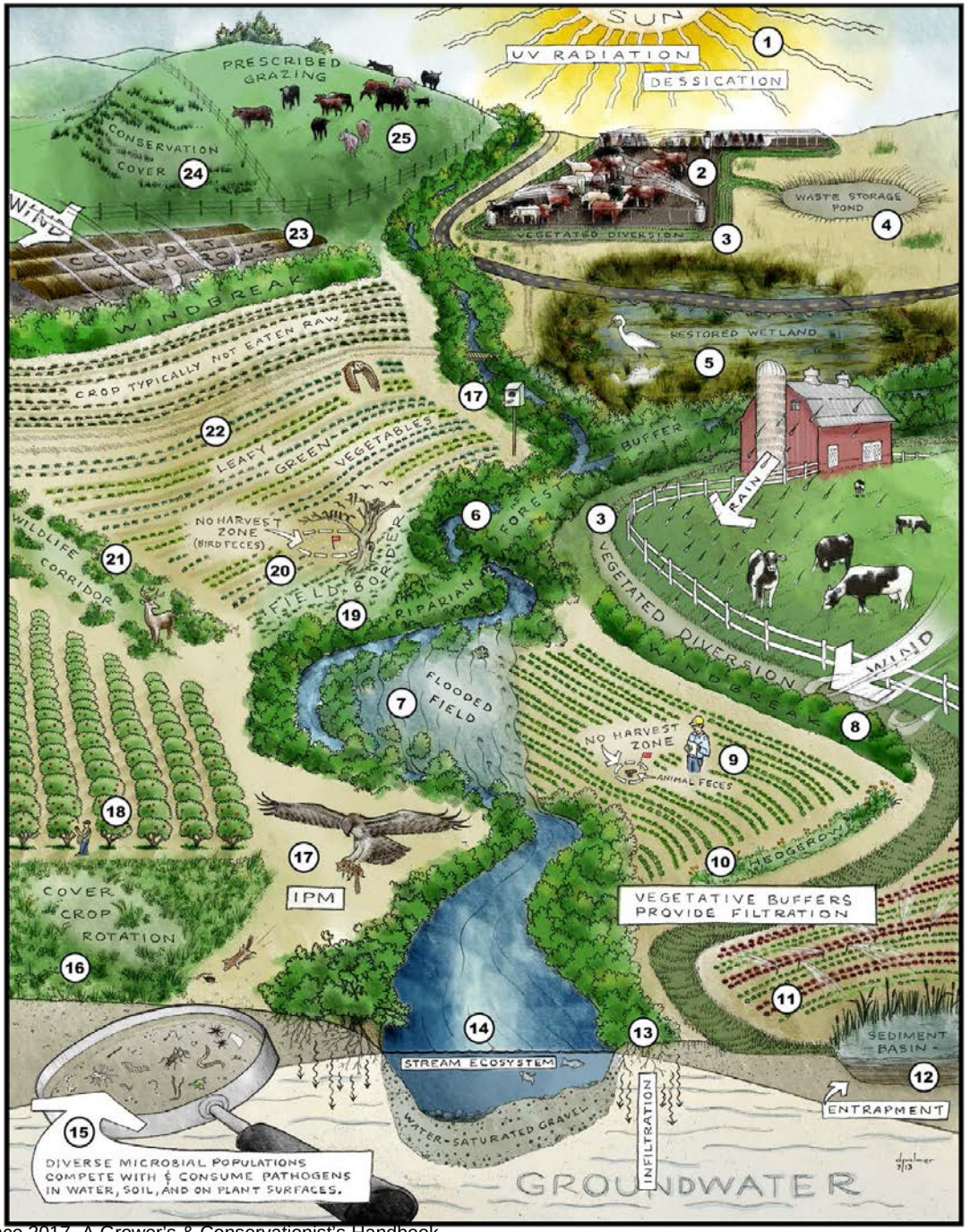
Foodborne Diseases
Wildlife Intrusions

- **Prevention of Contamination**
  - Integrated Pest Management (IPM)
  - Fencing of the vegetable garden (wildlife & pets)
  - Composting bins (avoid meat/fatty products)
  - Animals, manure and vegetable crops well separated
  - Co-management


Photo courtesy of Myrna Cadena


Photo courtesy of Myrna Cadena

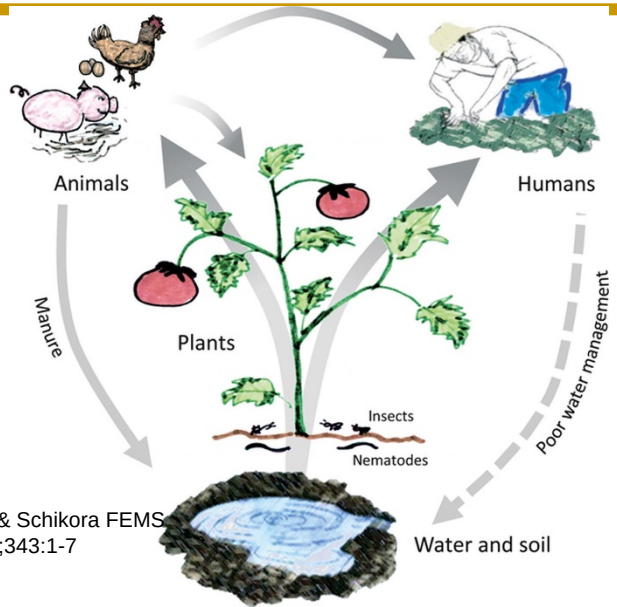
- Co-management
- encourage the application of practices that can enhance food safety and that are also consistent with sustainable conservation



Adapted from Wild Farm Alliance 2017, A Grower's & Conservationist's Handbook

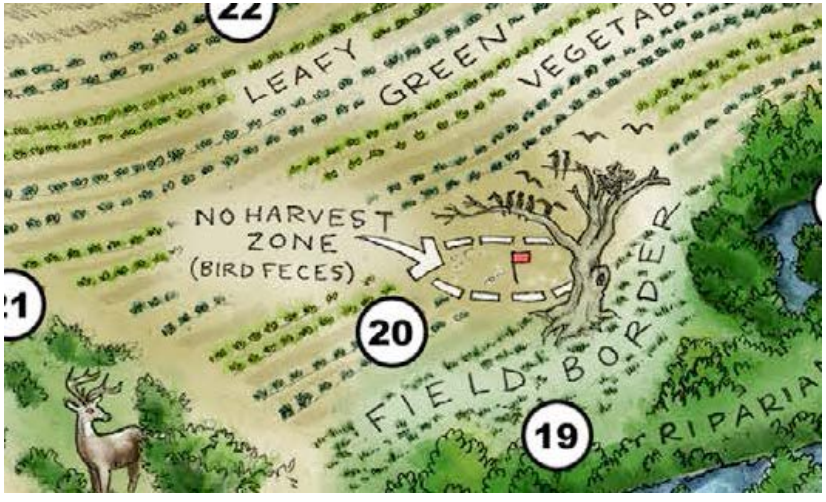
- Contaminated Crops
- What to do?

- **Grazing animals, Working Animals and Animal Intrusion**
- Evidence of potential contamination of produce (during growing)?
- Yes (observation of animals, animal excreta or crop destruction)
  - Can be harvested or not based on measures taken during the growing and assessment of the risks/contamination at the harvesting (FSMA § 112.83)



Hernández-Reyes & Schikora FEMS Microbiol Lett 2013;343:1-7

- Contaminated Crops
- Buffer zones
- No harvest



Adapted from Wild Farm Alliance 2017, A Grower's & Conservationist's Handbook

References

- Small Farms & Urban Animal Agriculture
  http://ucanr.edu/sites/Small_Farms_/

- Pests Control
  - http://ipm.ucanr.edu/PMG/menu.vertebrate.html
  - http://www.groundsquirrelbmp.com/management-cgs.html
  - http://ipm.ucanr.edu/PMG/menu.house.html#STING

- Animal Husbandry
  - https://store.extension.iastate.edu/Product/An-Introduction-to-Animal-Husbandry-and-Nutrition

- Zoonoses & Disinfection
- http://www.cfsph.iastate.edu/Zoonoses/index.php
- http://www.cfsph.iastate.edu/Disinfection/index.php
- http://ucfoodsafety.ucdavis.edu/files/26437.pdf
- Co-management
  - http://ucfoodsafety.ucdavis.edu/Preharvest/Co-Management_of_Food_Safety_and_Sustainability/
  - http://www.wildfarmalliance.org/food_safety_and_conservation_resources

Thank you for your attention!

Alda Pires, DVM, MPVM, PhD, Dipl. ACVPM

Urban Agriculture & Food Safety, ANR UC CE Specialist

School of Veterinary Medicine

apires@ucdavis.edu; 530 754 9855

http://ucanr.edu/sites/Small_Farms_/

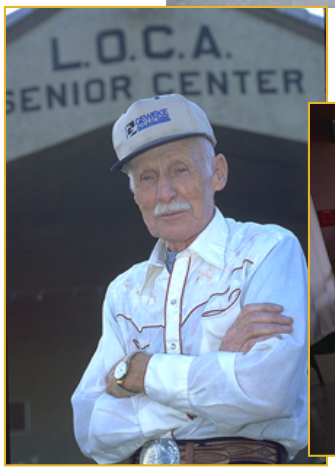
UCDAVIS VETERINARY MEDICINE

University of California
Agriculture and Natural Resources

Populations at higher risk

- Children (< 5 years)
- Older persons
- Weaken immune system (immunocompromised, chemotherapy)
- Pregnant women

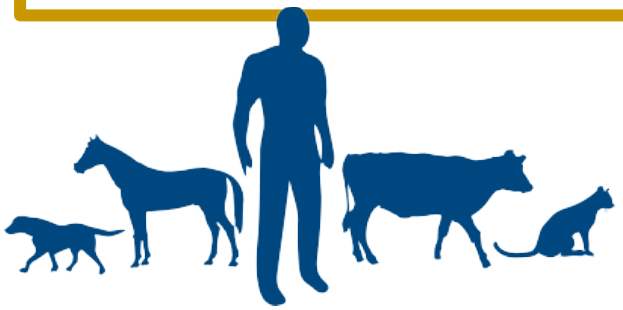
- People without previous livestock exposure more at risk (may not have immunity)

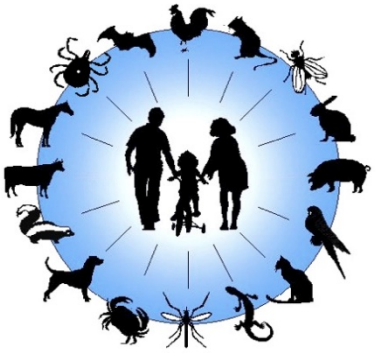


(Adapted from www.cfsph.iastate.edu/BRM)

Human-Animal Interaction

- **Animal may not show obvious signs of illness**
- **Disease risk cannot be totally eliminated**
  - Animals & its environment
  - Decrease exposure
  - Infectious agent interactions
  - Many routes of transmission
- **Identify risk areas** or **risky behaviors**
- **Minimize the threat** to animals and huma





Adapted from: http://n2gf.com/