Poisonous plants on rangelands

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UC CE

Outline

- Why plants produce toxins?
- Can animals avoid eating poisonous plants? How?
- Exceptions to the rule
- Types of secondary compounds and toxins
- Examples of toxic plants

Why plants produce toxins?

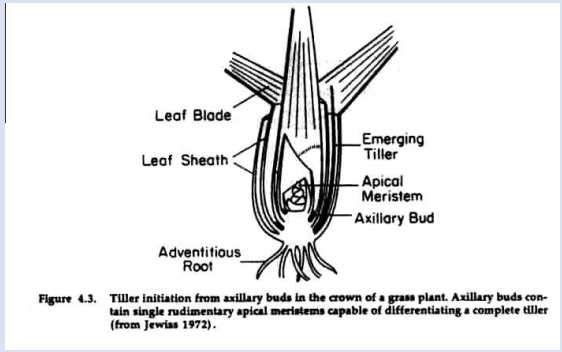


Figure 4.3. Tiller initiation from axillary buds in the crown of a grass plant. Axillary buds contain single rudimentary apical meristems capable of differentiating a complete tiller (from Jewiss 1972).

Grazing Resistance

Avoidance

Reduces probability of grazing

- Hairs, thorns and **SECONDARY COMPOUNDS**

Tolerance

Recovery and growth after grazing

Architectural

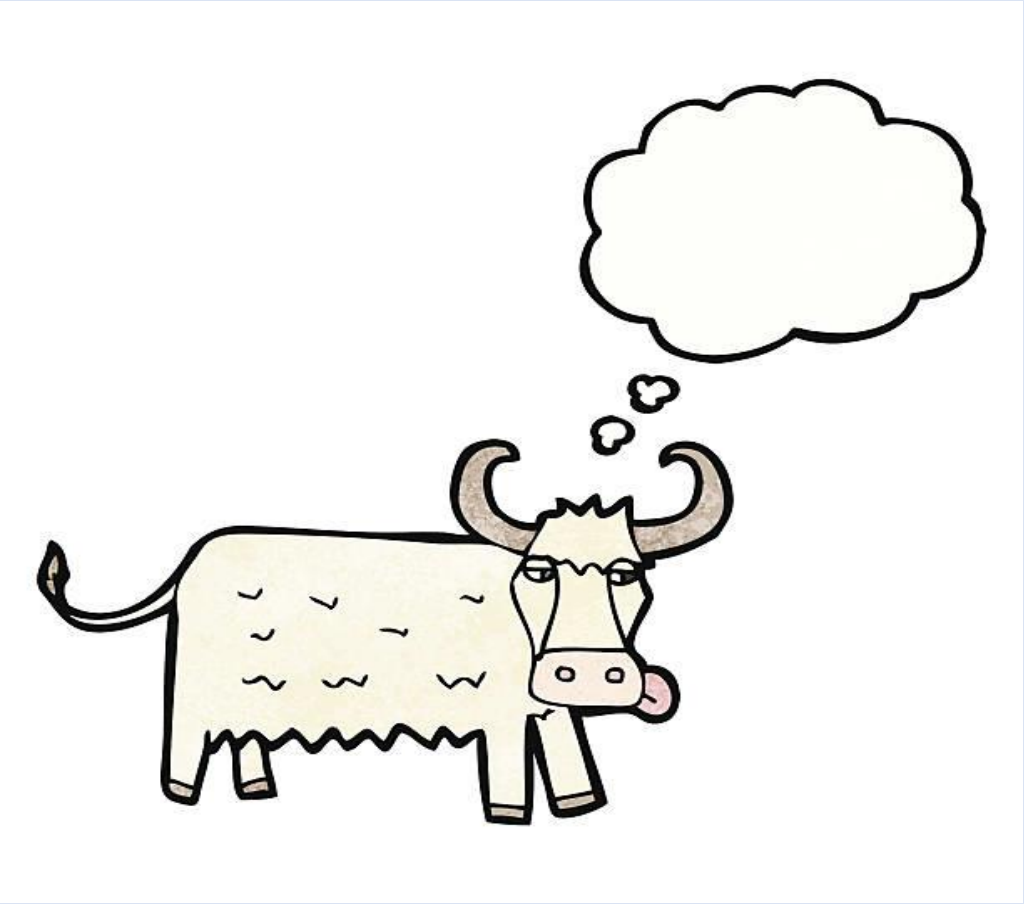
- Number and location of residual meristems

Physiological

- Apical meristems activated after growth
- Efficient use of resources to tillers vs roots

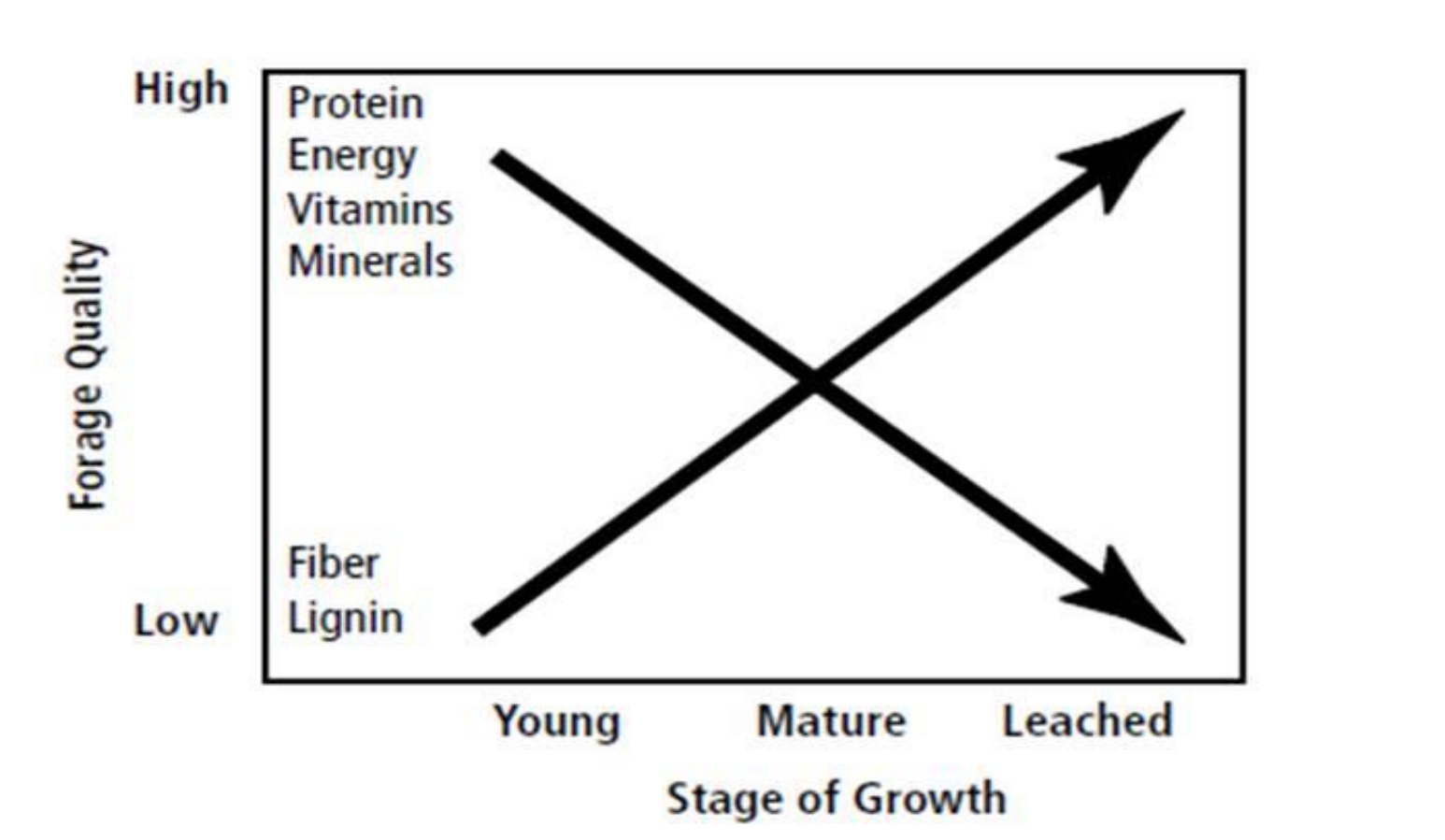
Challenges

How animals decipher palatability of individual species to avoid poisoning

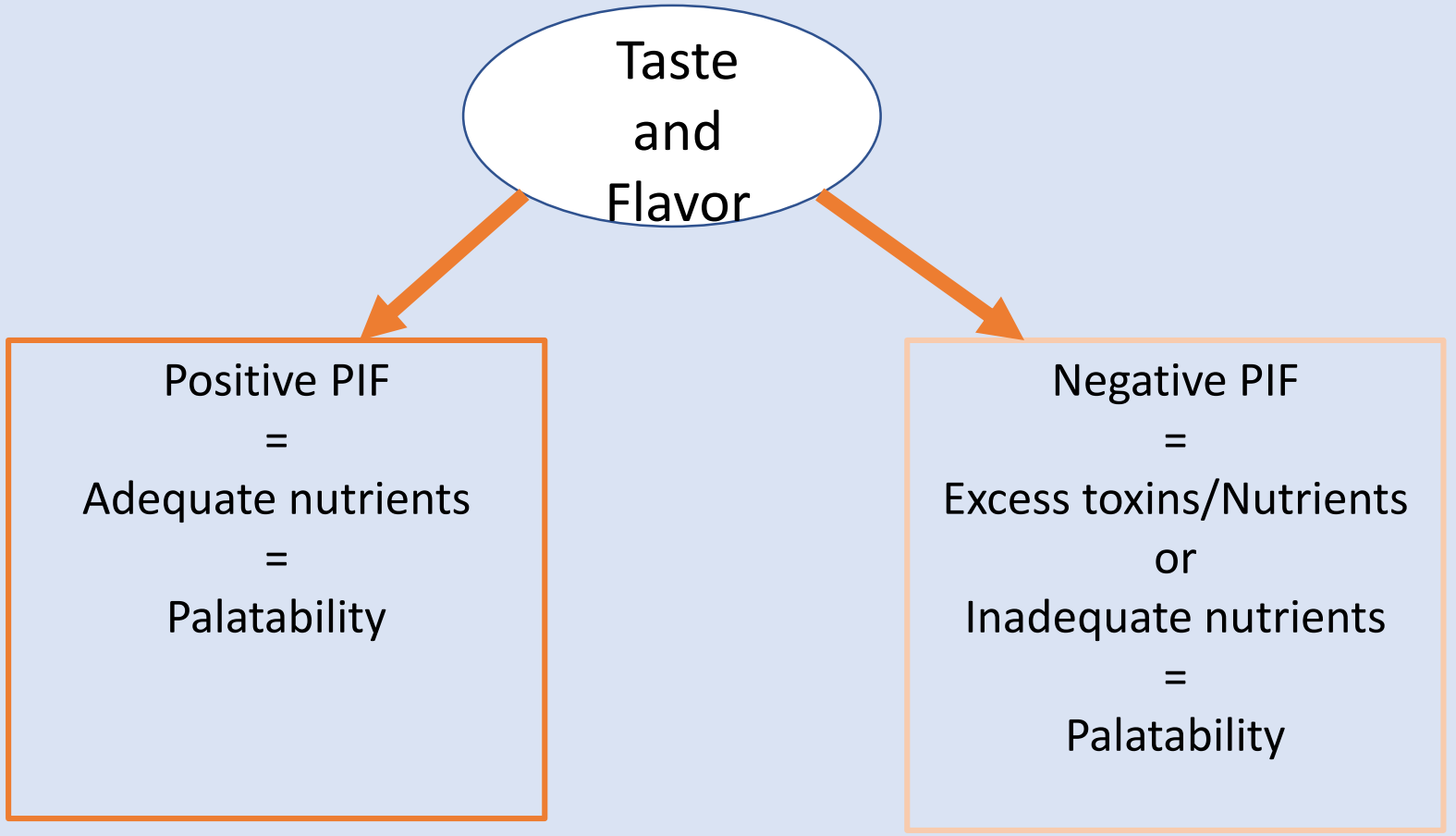


The satisfaction an animal gets from eating a particular plant → varies with succulence, fiber content, nutrient and chemical content and morphological features such as spines, thorns, awns (Frost and Ruyle, 1993)

Changing nutrition quality and toxins across landscapes and seasons



How animals determine if forage is palatable



Palatability - relationship between food's flavor and its Post Ingestive Feedback (PIF) from the nutrients and toxins (Fred Provenza)

Why animals may over ingest nutrients and/or toxins

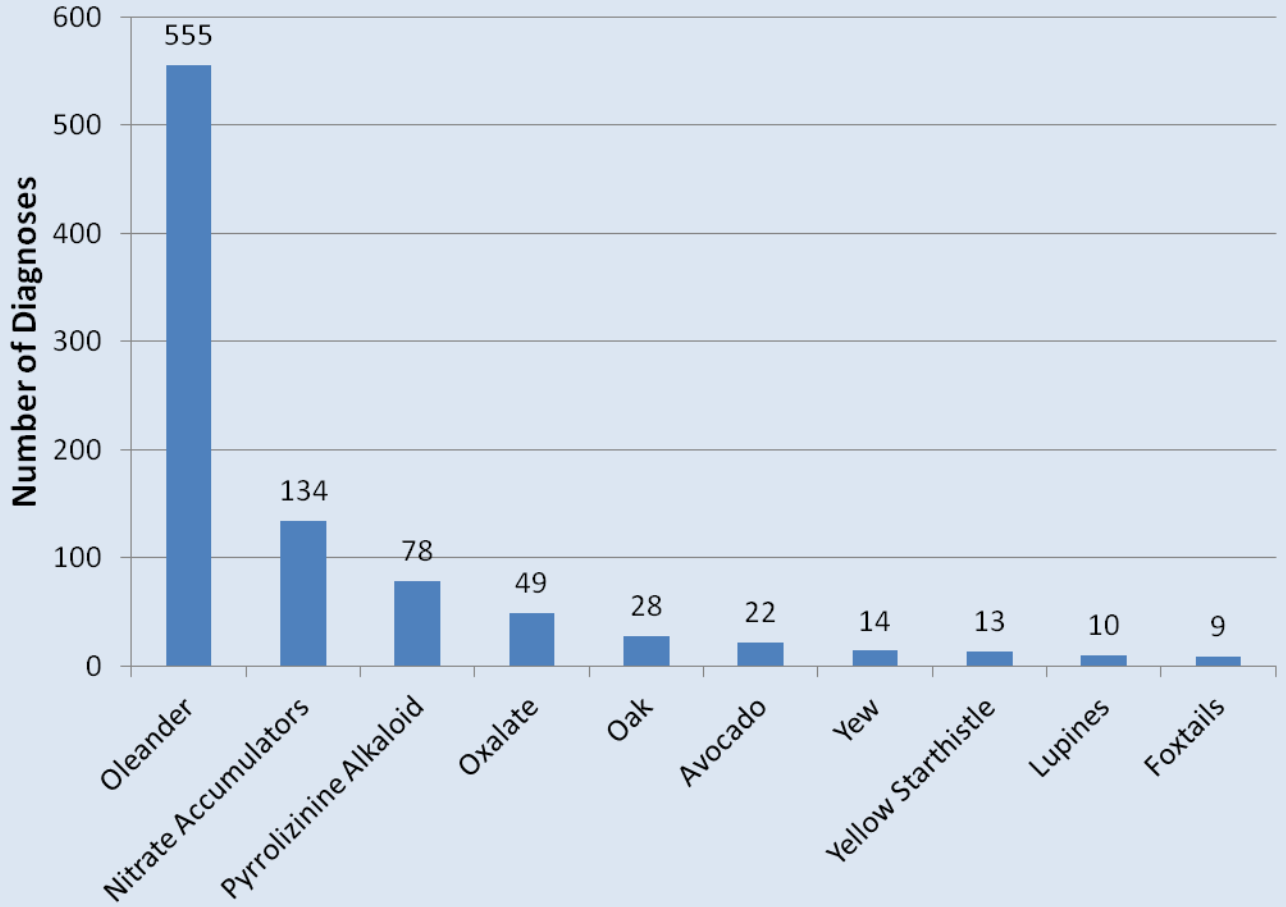
- Unfamiliar environments - difficulty to differentiate nutritious from toxic plants
- Changes in environmental conditions that alter plant physiology
  - Eg toxicity in Johnson grass after frost
  - Grass tetany – high glucose, low magnesium
- Subtle molecular changes increase plant toxicity
- Social facilitation
- Toxins in more than one plant

Types of secondary compounds and toxins

a. Classified based on chemical structure or reaction

- Phenolics: tannins, lignin, salicylic acid
- Terpenoids: aromatic oils, resins, waxes, carotenoids
- Alkaloids - often toxic, ex. nicotine, caffeine, capsaicin
- Glycosides – sugar like compounds
- Oxalates – complex salts
- Saponins – soap like compounds

Recorded Livestock Poisonings (17+ years)
Vet School Lab Data



Alkaloids

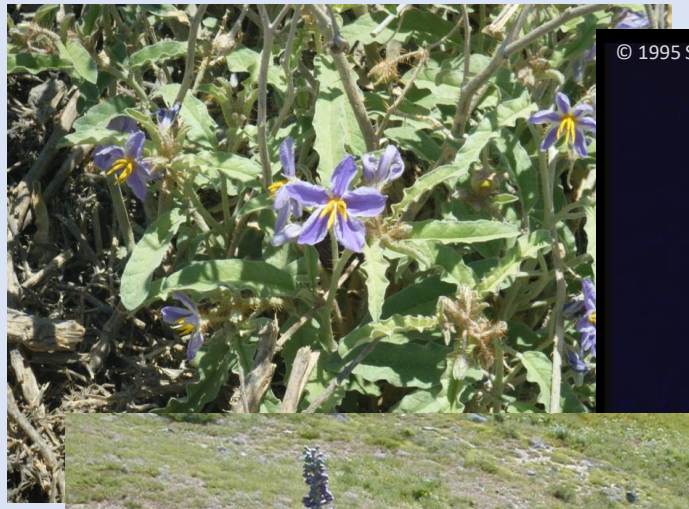
- Organic substances with a bitter taste
- Irritate the intestines
- Affects the Central Nervous System

Symptoms:

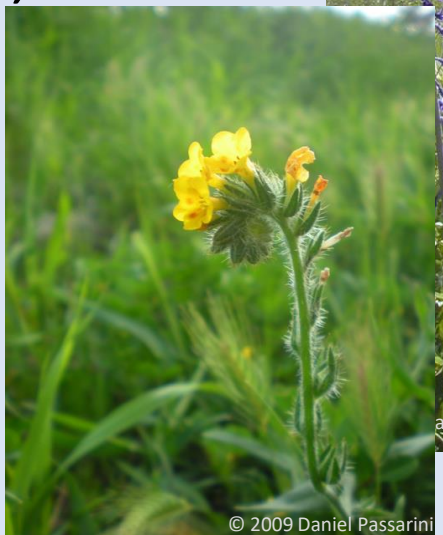
- **Nausea, colic, diarrhea**
- Central nervous system → **blindness, muscular weakness, convulsions** and **death**.

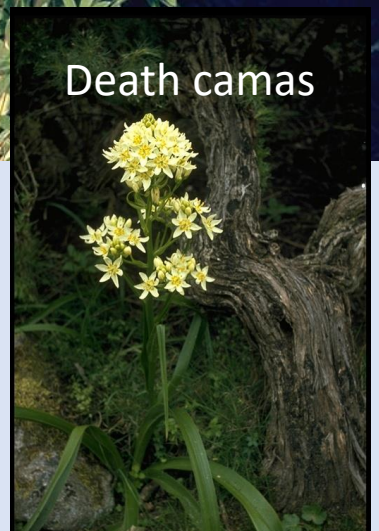
Plants:

- death camas, lupines, buttercups, larkspur, nightshades



Larkspur





Glycosides

- Interfere with the oxygen exchange in lungs or
- Cause severe gastroenteritis
- Glycoside content decrease with growth stages, change with climatic conditions, increases with factors that slow plant growth and development e.g. wilting, frost or physical damage.

Symptoms:

- **muscle tremors, difficult, rapid breaths** and **convulsions, vomiting, diarrhea, paralysis and f**ast **death,**

Plants:

sorghums, sudan grass, johnson’s grass, oleander, wild cherries cocklebur and pokeweed.

Nitrate (Nitrite) poisoning

- When animals consume forage high in nitrates
- Occurs when nitrate are reduced to nitrite.
- Product is incapable of releasing oxygen. Sheep are more resistant to this form of poisoning.

Symptoms:

- **Trembling, staggering, rapid breathing, sudden death**.
- Chronic poisoning causes **poor growth, production** and **abortions**.
- Reduced vitamin A storage cattle.

Common species associated with nitrate poisoning

Weeds	Crops
prostrate pigweed	oats
tumbling pigweed	rye
rough pigweed	wheat
lamb's quarters	barley
Canada thistle	corn
Russian thistle	sorghum
milk thistle	sudan grass
annual sow thistle	sugar beets
perennial sow thistle	mangels
poison hemlock	turnip
wild morning glory	rutabaga
spotted spurge	rape
prickly lettuce	kale
witch grass	broccoli, cucumbers, squash, celery

Mycotoxins e.g. egort

- Caused by fungi that infect grasses, corn and cereals.
- Hard, dark-colored masses in flowering grass heads
- Can occur on standing or harvested plants

Symptoms:

- **Irregular heat**, abortion in pregnant animals and death, lower fertility reproductive rates, deformed reproductive organs, low **libido in males**.

Other Types of Poisoning

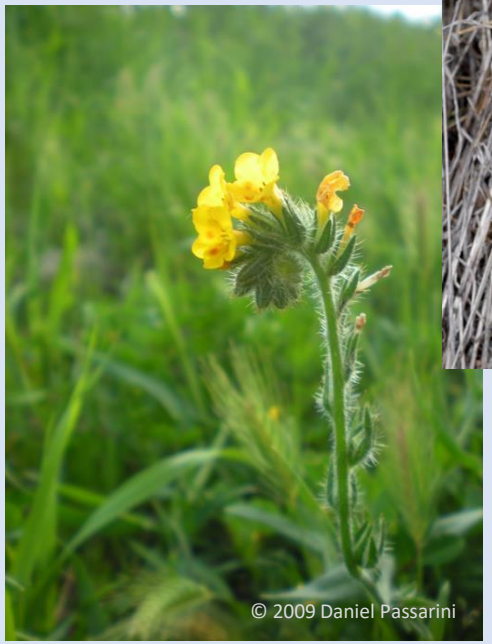
Photosensitization

- Sensitivity to sunlight
- Primary and hepatogenic (liver) photosensitivity
- Saint John's-wort, spring parsley and buckwheat cause primary photosensitization.
- Blue-green algae causes hepatogenic cases.

Symptoms:

- Sunburning,
- swelling sensitive areas,
- ulcers

Fiddleneck (*Amsinckia* spp.)



- Toxin –Alkaloids
- Species affected – Cattle, sheep, horses and goats
- Symptoms
  - Weight loss
  - Loss of appetite
- “Nutlet” seeds and dried plant material is most toxic, any fiddleneck in hay is a concern
- Sheep and goats less affected than cattle and horses

Oaks (*Quercus* spp.)

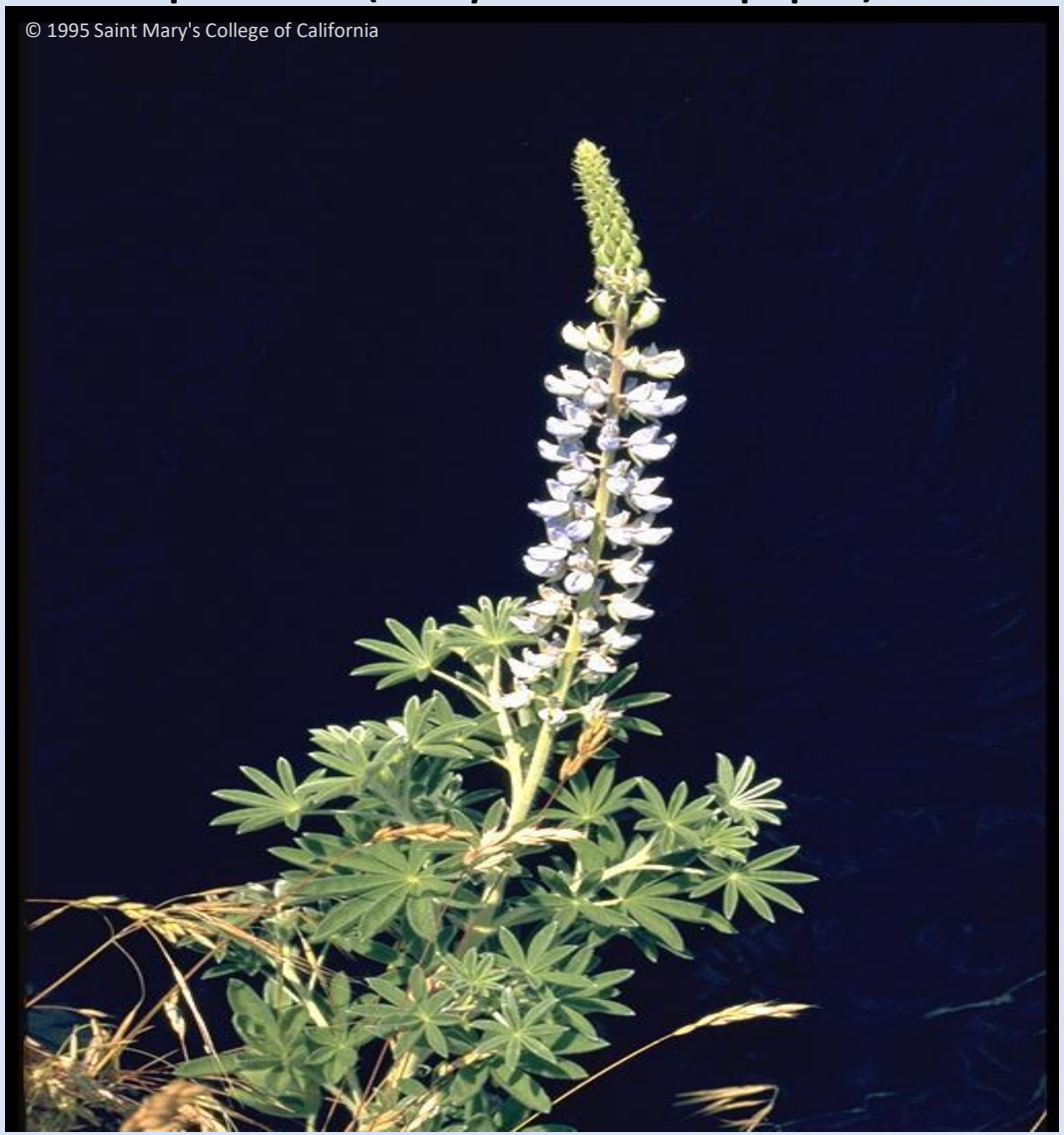
- Toxin – Tannins
- Species affected – Cattle, sheep, goats, and humans

- Symptoms
  - Sudden death
  - Bloody diarrhea
  - Kidney failure
- Goats are more tolerant → have a tannin-binding protein in saliva

Nightshades (*Solanum* spp.)

- Toxin – Alkaloids
- Species affected – Cattle, sheep, horses, goats, and humans
- Symptoms
  - Gastrointestinal upset
  - Drowsiness
  - Weakness
- Toxicity varies by species and season.
- Unripe berries more toxic than ripe berries.

Lupine (*Lupinus* spp.)



- Toxin – Alkaloids
- Species affected – Cattle, sheep, and goats most commonly
- Symptoms
  - Birth defects
  - Abortion
  - Seizures
- Toxins concentrated in seeds

Oleander (Nerium spp.)

- Toxin – Cardiac Glycosides
- Species affected – Cattle, sheep, horses, goats, and humans
- Drought and insect resistant

- Symptoms
  - Sudden death
  - Depression
  - Diarrhea
- Clippings are the primary cause of poisonings
- 5 – 10 medium sized leaves can be lethal to a horse or cow

Larkspur (*Delphinium* spp.)

- Toxins – Alkaloids
- Species affected – Cattle, sheep, and goats. Cattle are most susceptible

- Symptoms
  - Incoordination,
  - staggering
  - Bloating

- Goats affected by Tall Larkspur

Poison Hemlock (*Conium maculatum*)

- Toxin – Alkaloids
- Species affected – Cattle, sheep, horses, goats, and humans

- Symptoms
  - Birth defects
  - Nervousness
  - Weakness

- Loses toxicity when dry

Water hemlock (*Cicuta douglasii* and *maculata*)

- Toxin – Alcohols
- Species affected – All classes of livestock and humans
- Symptoms
  - Sudden death
  - Muscle spasms
  - Severe convulsions
- Among the most poisonous plants in North America
- All parts of the plant are poisonous

Ragwort and Groundsel (*Senecio* spp.)

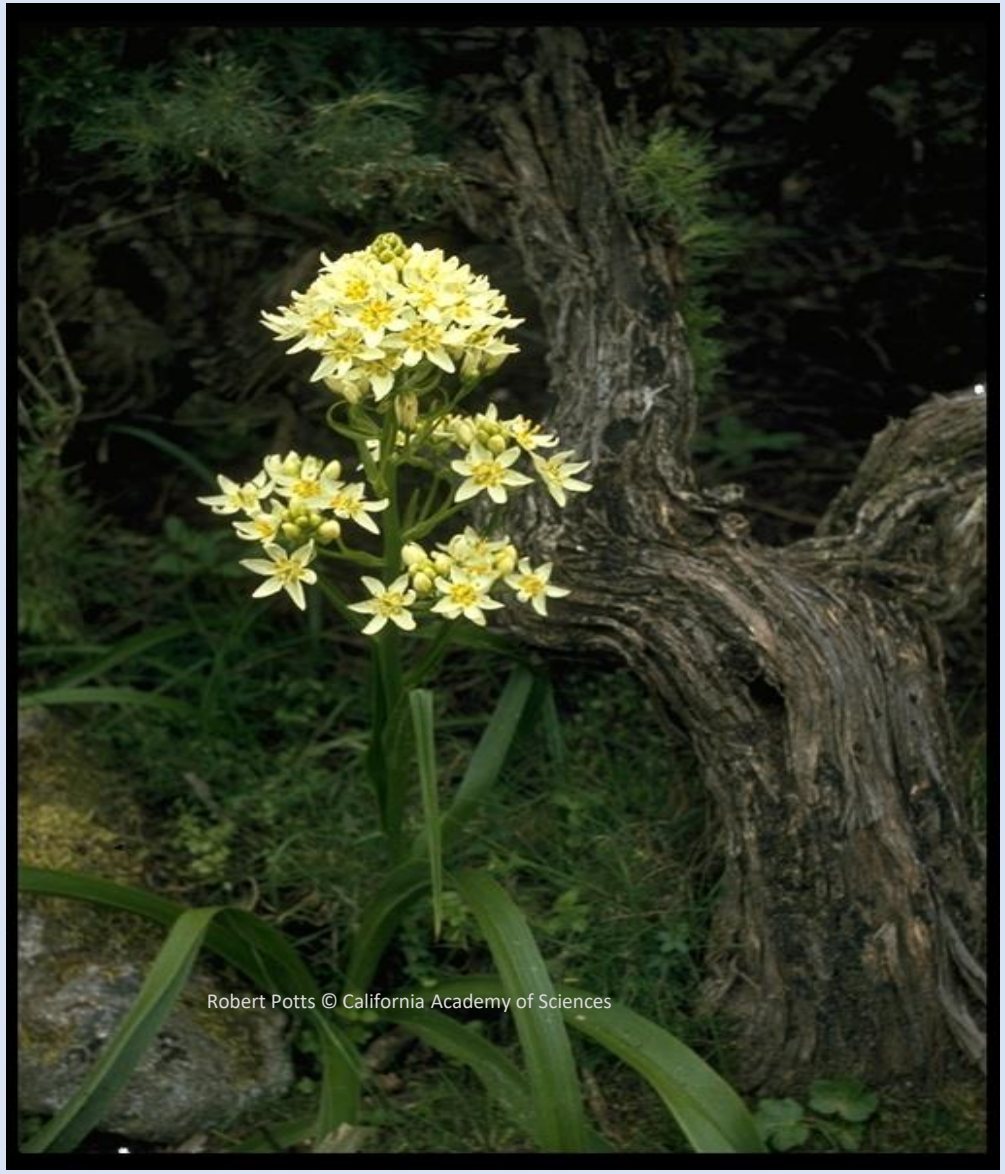
- Toxin – Alkaloids
- Species affected – Cattle, sheep, horses, goats, and humans

- Symptoms
  - Chronic appetite loss
  - Weight loss
- Sheep and goats are not as affected as cattle and horses
- Poisonous both fresh and dried

Death Camas (*Toxicoscordion* spp.)

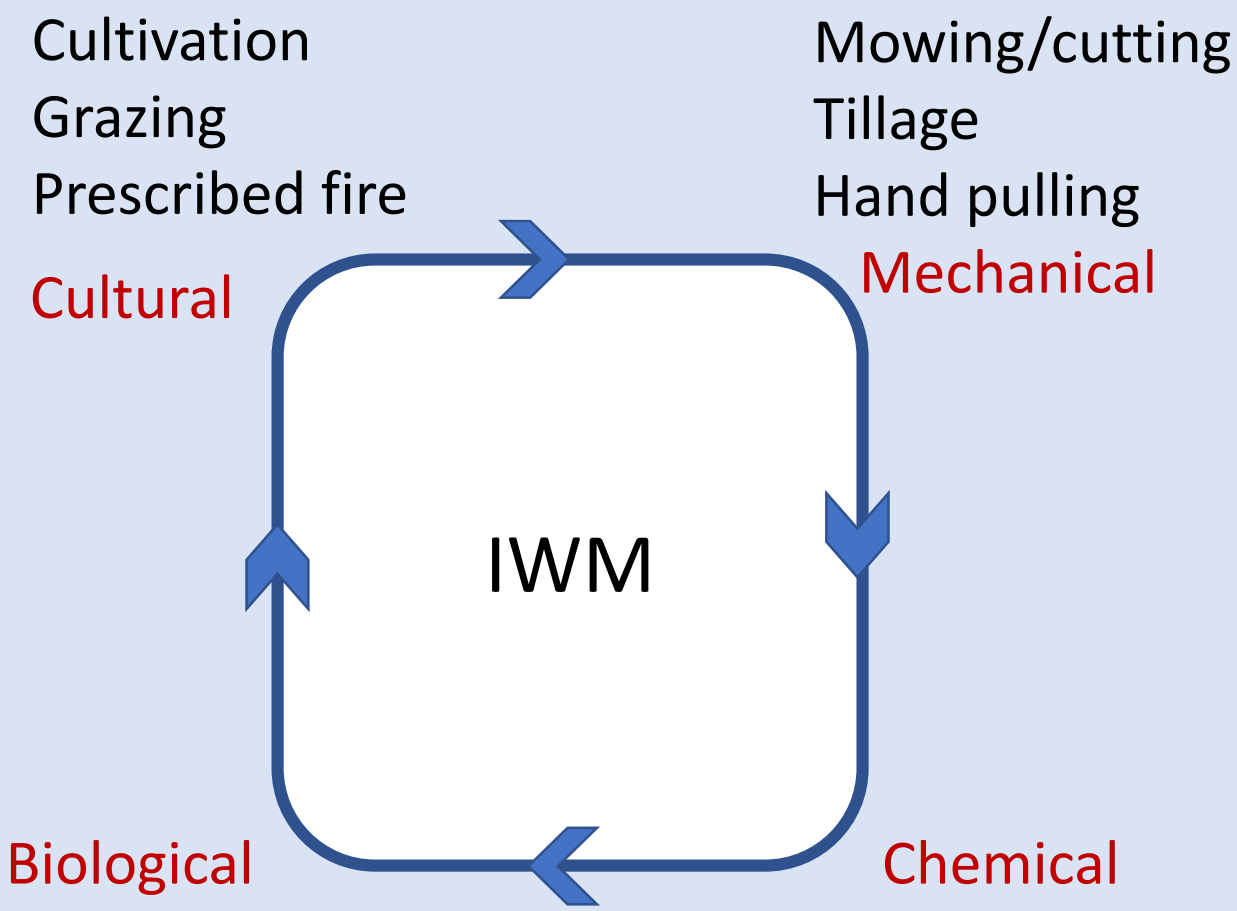
- Toxin – Alkaloids
- Species affected – Cattle, sheep, horses, goats, and humans

- Symptoms
  - Sudden death
  - Excess salivation
  - Staggering
- Toxicity varies with stage of growth
- Member of the lily family



Integrated Weed Management (IWM)

- IWM – a combination of management strategies → tends to increase effectiveness and lower costs
- Take into consideration:
  - available resources,
  - capabilities, and
  - ecological conditions
- (ADAPTIVE Management)



Resources

- https://anrcatalog.ucanr.edu/pdf/8560.pdf
- https://anrcatalog.ucanr.edu/pdf/8398.pdf
- http://wric.ucdavis.edu/
- https://wric.ucdavis.edu/PDFs/plants%20reported%20to%20be%20poisonous%20to%20animals.pdf

- Thank You

- Questions

Special thanks to Julie Finzel
UCCE livestock and Natural Resources Advisor