Wildlife Disease Surveillance and Management

6TH CYCLE TRAINING FOR THE OIE NATIONAL FOCAL POINTS FOR WILDLIFE

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Purpose

Build capacity for wildlife health in OIE member countries and territories by providing training on a range of topics relevant to the tasks of OIE National Focal Points for Wildlife

Wild Animal Surveillance

GENERAL VS TARGETED SURVEILLANCE

(6TH CYCLE MANUAL PAGES 4-11)

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Wild Animal Surveillance

Surveillance is an on-going activity - investigation and vigilance for health hazards in wildlife is most effective if it is continuous

Surveillance involves both the collection and analysis of data and information

Surveillance includes communication of the results of data collection and analysis to the full range of people, agencies and institutions that need the information

Surveillance creates information for action.

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Types of Surveillance

Surveillance may be based on many different data sources and can be classified in varying ways including:

- ✓ The *disease focus* (general versus targeted surveillance)
- The *means* by which data are collected (active versus passive surveillance)
- The *way* in which units for observation are selected (structured surveys versus non-random data sources)

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General surveillance

Scans wildlife populations to ascertain what pathogens exist in a region or country

Used to maintain national vigilance for important pathogens

Most common *means* by which general surveillance data is collected is through *passive* techniques such as the opportunistic investigation of wildlife morbidity and mortality events

Components of General Surveillance

Detection of pathogens and diseases:	Identification of pathogens	Information management	Analysis and communication
• Network of people who are likely to encounter dead or sick, wild animals	• Laboratory and personnel experienced with wildlife pathogens	• Data storage and standards	• Information relayed to those who can take action (e.g., disease management and prevention)

Targeted disease surveillance

- Searching for evidence of the presence or absence of one or more particular pathogens (viruses, bacteria, fungi, protozoa) in one or more wild animal host species
- Used to establish:
  - Freedom from disease
  - Prevalence
  - Incidence

Surveillance design considerations

- Host species
- Where to sample
- Selecting animals to sample (4th cycle Training Manual):
  - Convenience/opportunistic sampling
  - Simple random sampling
  - Stratified random sampling
  - Unequal probability sampling

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Sample type	Uses	Examples	Comments
Intact carcasses	Cause of death/ morbidity determination	Various infectious (viral, bacterial, parasitic, fungal) or noninfectious agents (toxic substances)	When carcasses are submitted in their entirety it allows testing of multiple tissues for multiple pathogens and examination of tissues for gross and microscopic lesions
Blood	Evidence of exposure or previous exposure to various pathogens (i.e., anitbodies) and contaminants (e.g., residues or altered enzyme activity) and presence of blood borne pathogens (e.g., hematozoa)	Morbilliviruses, elephant endotheoliotropic herpevirus, equine influenza Lead, insecticide poisoning, mercury, polychlorinated biphenyls Malaria, leucocytozoonosis, babesiosis	Whether antibodies indicate current infection or previous exposure is disease dependent and sometimes species dependent. Paired testing of individual can sometimes be used to establish infection status.
Swabs	Pathogen presence, shedding	Avian influenza (cloacal and oral pharyngeal/tracheal swabs), *Batrachochytrium dendrobatidis* (skin swab)	Useful for sampling large numbers of specimens for single pathogen (targeted surveillance); does not indicate whether pathogen is causing disease
Feces	Pathogen shedding, presence of parasites,	*Salmonella*, *Escherichia coli*, *Cryptosporidium* spp., Paratuberculosis *Toxoplasmosis gondii, Sarcocystis neurona*	Useful for determining presence of pathogen or parasite in population or area when animal capture not feasible. Difficult to pair results with individual animals. Does not indicate whether pathogen is causing disease in the population.

Sample collection

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Performing diagnostics on wildlife

Test validity

- Tests to directly detect pathogens (PCR) less likely to be affected by host species
- Technical disease cards on non-OIE listed diseases in wildlife provide some guidance on test selection

Sample quality

- Testing directly for pathogen less likely to be affected by sample condition

Test availability

- Consider options such as veterinary or medical laboratories

Other considerations

- Resources and legal mandates

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Managing Surveillance Information

6TH CYCLE MANUAL PAGES 36-40

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Typical data collected for General Surveillance Programs

Data about the incident (disease occurrence event):

- Location of event (GPS coordinates or as precise a description as possible)
- Land use and environmental factors (e.g., weather conditions surrounding outbreak)
- Population(s) at risk (i.e., contextual information about species present at the site)
- Estimation of morbidity/mortality onset and end date (condition of carcasses may be useful for assessing these dates)
- Species affected
- Estimated or known number of dead animals by species
- Estimated or known number of sick animals by species
- Clinical signs (for example, unusual behavior or physical appearance)
- Age of affected animals if known (e.g., juvenile/adult)
- Sex of affected animals if known
- Clinical signs and photos or videos of affected animals
- Contact: person(s) reporting the event and their contact information in case additional information is needed
- Laboratory where diagnostics were performed, and identification number of samples submitted for testing

Typical data collected for General Surveillance Programs

Data about the animals sampled from the incident (for each specimen examined or sampled):

- Collection location - Latitude and Longitude
- Species of animal – Latin name (*Genus species*)
- Species of animal – Common name
- Collection date
- Event identification number (or some other mechanism of associating with event level data)
- Preservation method (e.g., chilled, frozen, formalin)

	A	B	C
1	**Field Name**	**Data Type**	**Data Definition**
2	Event_Type	Integer	1 = Morbidity/Mortality: Sick or dead animals linked spatially and temporally. Occurr of single animals is included if there is special interest in the species, the suspected agent, the location, or the time of year (e.g., a solitary species, an endangered speci possible new pathogen, or a range or temporal expansion for an existing pathogen) 2 = Surveillance: positive detections of a pathogen during active surveillance of healt live, hunter-killed, or euthanized animals (that were not sick before euthanizing).
3	Start_Date	ISO 8601 YYYYMMDD	Beginning date for event (considering all locations).
4	End_Date	ISO 8601 YYYYMMDD	Ending date for event (considering all locations).
5	Affected	Integer	Total number of individuals affected in event. A count of sick plus dead for a morbidity/mortality event and a count of positives for a surveillance event.
6	Dianosis_id	Integer	ID for event diagnosis. Foreign key link to diagnosis look up table.
7	Species	Integer	Species ID. Foreign key link to species lookup table
8	Population	Integer	Estimate of the total population of this species at this location (population at risk). Us peak number during the course of the event.
9	Sick	Integer	Actual count of the number of sick or injured animals of this species at this location. Include euthanized animals, if any. Use 0 if known to be 0 (instead of leaving blank). blank if there is no count. Avoid re-count of animals, especially if there are repeated v to a location to assess wildlife health. Consider whether animals initially observed sic were later counted as dead; if so, only count them as dead. Numbers reported shoul reflect either a snapshot of morbidity/mortality as observed during a one-time site visi synopsis of the numbers affected over the course of an event (e.g., dead = cumulativ during multiple site visits and sick = number remaining sick or recovered from being the end of the event).
10	Dead	Integer	Actual count of the number of dead animals of this species at this location. Do NOT include euthanized animals. Use 0 if known to be 0 (instead of leaving blank). Leave if there is no count. Avoid re-count of animals, especially if there are repeated visits t location to assess wildlife health. Consider whether animals initially observed sick we later counted as dead; if so, only count them as dead. Numbers reported should refle either a snapshot of morbidity/mortality as observed during a one-time site visit, or a synopsis of the numbers affected over the course of an event (e.g., dead = cumulativ during multiple site visits and sick = number remaining sick or recovered from being the end of the event).

Data dictionary

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Disease management in wildlife

6TH CYCLE MANUAL PAGES 42-76

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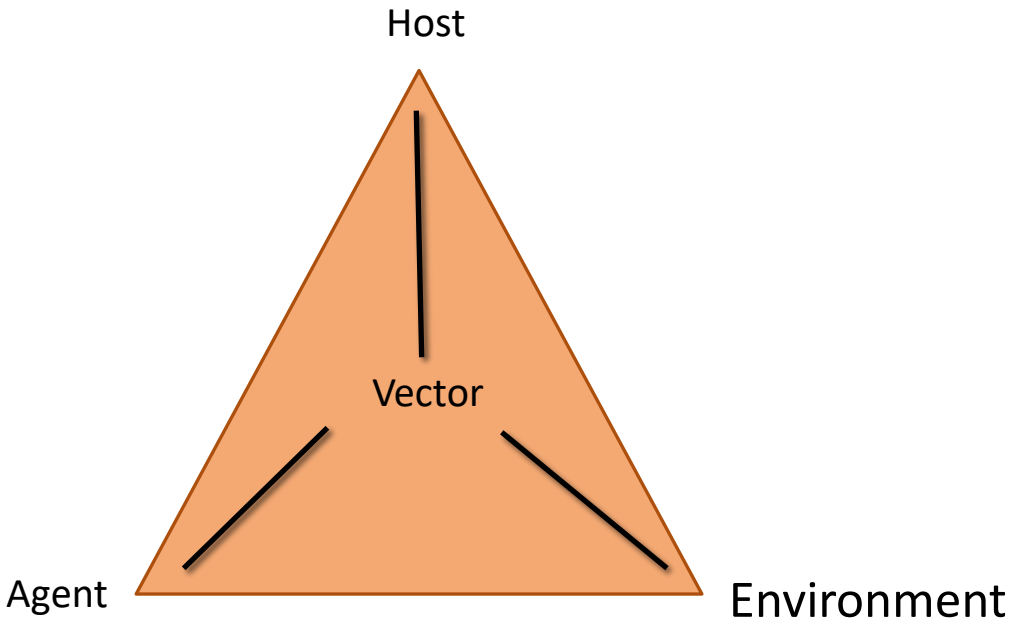


Disease management objectives

Prevention is defined as excluding or preventing the introduction of a disease into unaffected animals or a population

Control refers to activities designed to reduce the frequency of occurrence and contain the spread or effects of an existing disease within a population to a predetermined level.

Eradication is the total elimination (i.e., zero incidence) of an existing disease worldwide.

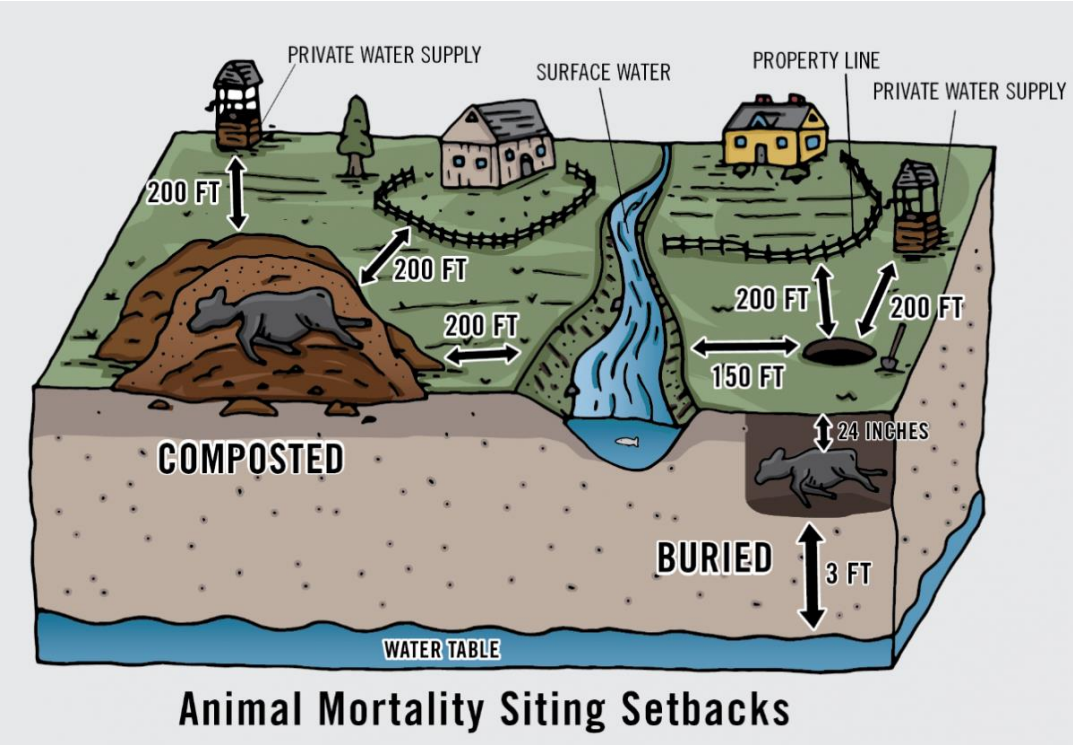
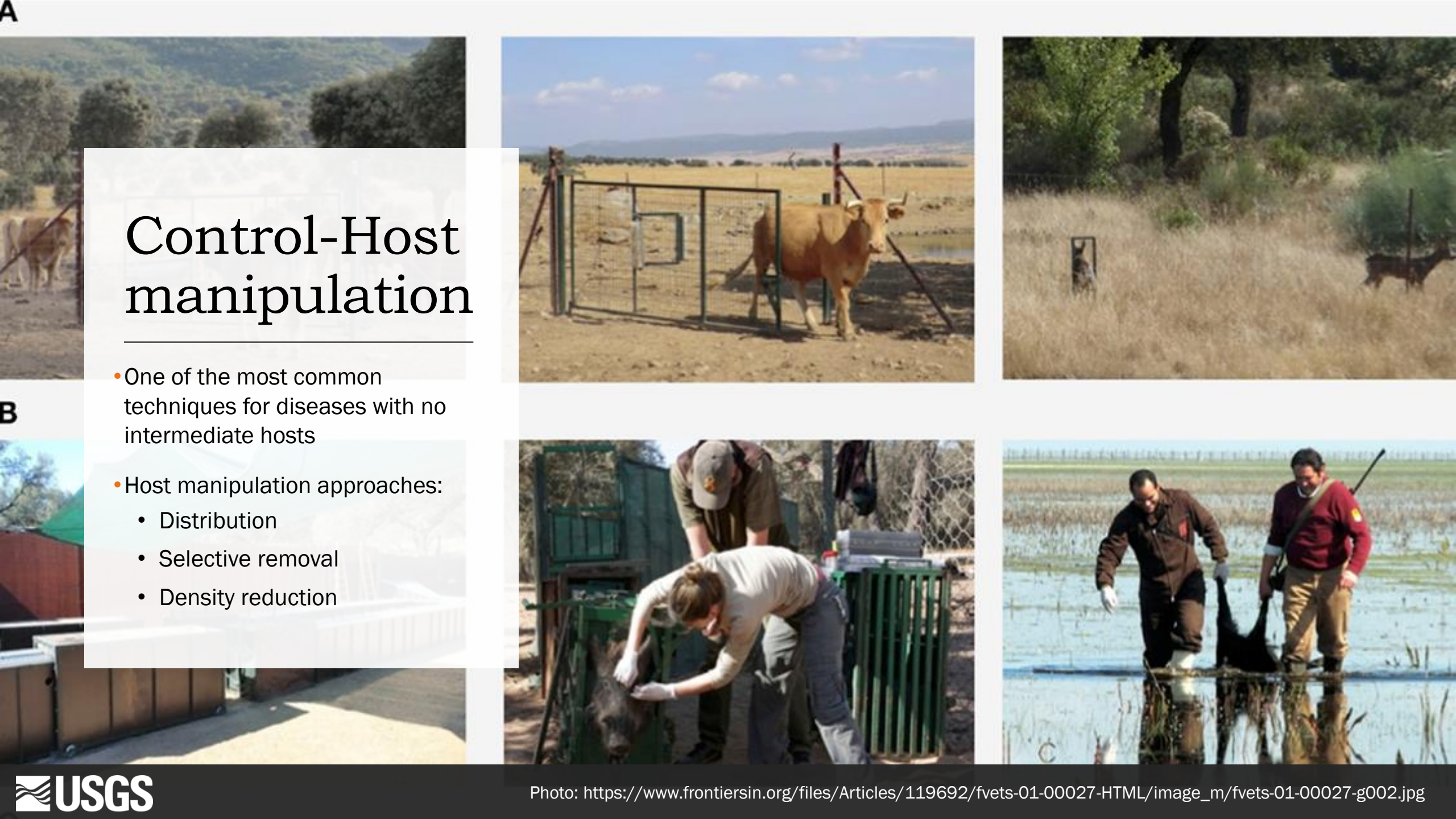


Image: https://agriculture.vermont.gov/composting-livestock-mortalities

Prevention and control- agents and vectors

- For some diseases, the most appropriate intervention is to eliminate its cause
- Typically aimed at elimination of the agent from a defined area rather than its total eradication
- Substances that have direct, acute effects and have the potential to affect human health (e.g., aquatic mercury poisoning) have had more support for control efforts than those with delayed effects that primarily affect wildlife (e.g., DDT and lead)
- If pathogens persist in environment may need to minimize contamination of the surrounding area during mortality events
- Common disposal methods for wildlife carcasses include:
  - Incineration
  - Deep burial
  - Landfill
  - Composting



Control-Host manipulation

- One of the most common techniques for diseases with no intermediate hosts
- Host manipulation approaches:
  - Distribution
  - Selective removal
  - Density reduction

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Photo: https://www.frontiersin.org/files/Articles/119692/fvets-01-00027-HTML/image_m/fvets-01-00027-g002.jpg

Host manipulation considerations

- Social acceptance
- Characteristics of etiological agent
- Attributes of host populations
- Environment
- Logistics
- Metrics of success

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Photo: https://www.nytimes.com/2019/03/09/science/culling-badgers-disease.html

Assessing use of host manipulation

Complete table on page 74 of 6th Cycle Manual

			Distribution Alteration	
Compartment	**Characteristics**	**Result**	**Dispersal**	**Fencing**
Agent	Endemic	Yes	👎	👍
		No	👍	👎
	Novel to the system	Yes	👍	👎
		No	👎	👎
	Localized	Yes	👍	👍
		No	👎	👎
	Emergence mediated by environm	Yes	👍	👍
		No	👎	👎
	Vector-transmitted	Yes	👎	👎
		No	👍	👍
	Directly transmitted	Yes	👎	👎
		No	👍	👍
	Indirectly transmitted	Yes	👍	👍
		No	👎	👎
	Human-assisted transmission/spre	Yes	👎	👎
		No	👍	👍
	Affects multiple hosts	Yes	👎	👎
		No	👍	👍
	Rate of transmission	High	👎	👎
		Low	👍	👍
	Seasonal effects	Yes	👍	👎
		No	👎	👎

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Treatment of hosts

Circumstances where treatment may be considered:

- Treatment can be efficiently done for a large proportion of the population, or an individual is of particular significance
- Treatment is conducted prior to the capture and translocation of animals
- Treatment is used to train personnel or harness public concern and gain support for disease management

Considerations:

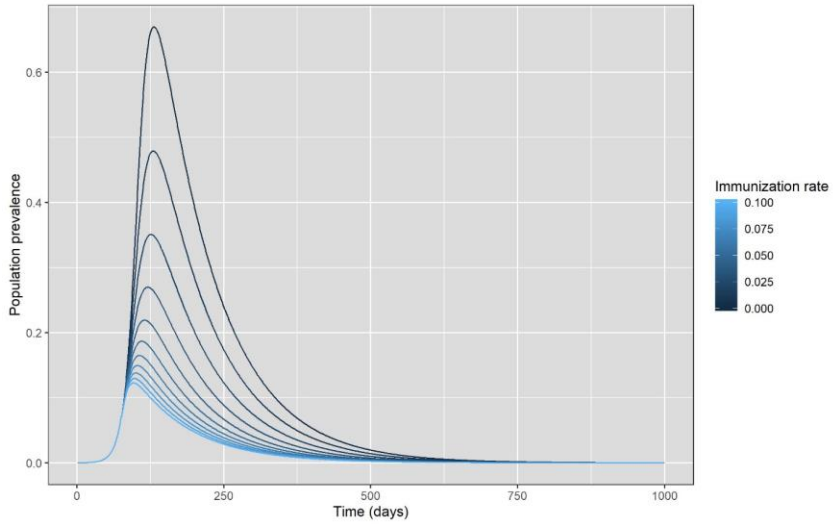
- Difficulty delivering treatments limits usefulness for managing disease in wildlife
- Ongoing treatment may be necessary
- Widespread use of chemical can exert selective pressure for resistant pathogens
- Handling and treating wildlife is stressful for them
- Few drugs are labeled for use in wildlife

Photo: https://www.news-medical.net/health/Appropriate-Use-of-Antibiotics.aspx

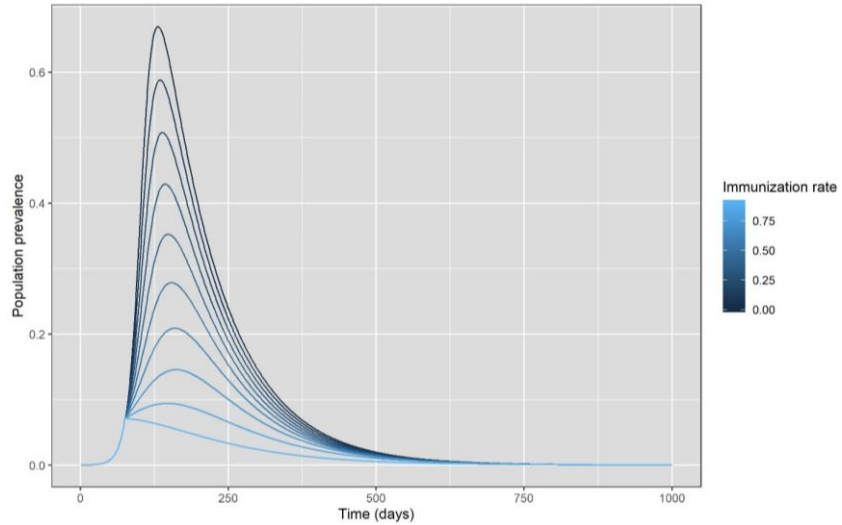
Immunization of hosts

- Used to prevent infection or development of a disease
- If population vaccinated only once, a large portion of population needs to be vaccinated
- May also consider vaccinating prior to arrival of disease or continuous vaccination
- Considerations:
  - Field conditions and administration to wild animals
  - Safe for target and non-target species

Effects of continuous immunization



Effects of one-time immunization



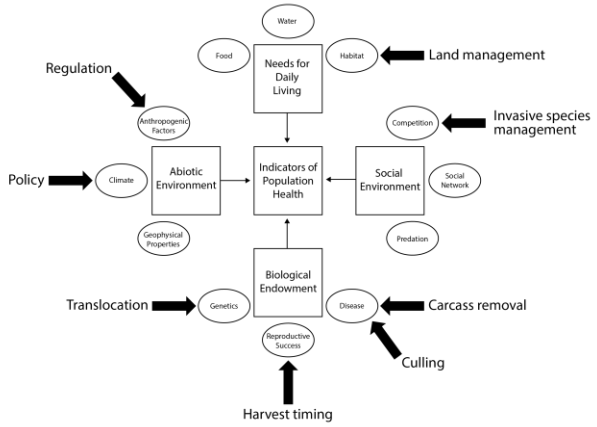
Holistic approaches to disease management

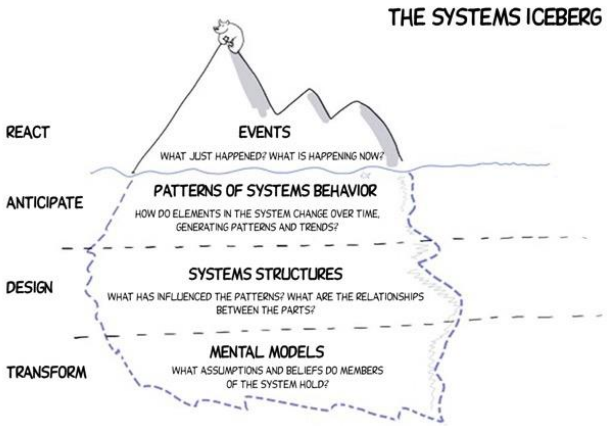
Disease is one of many components affecting the health of wildlife

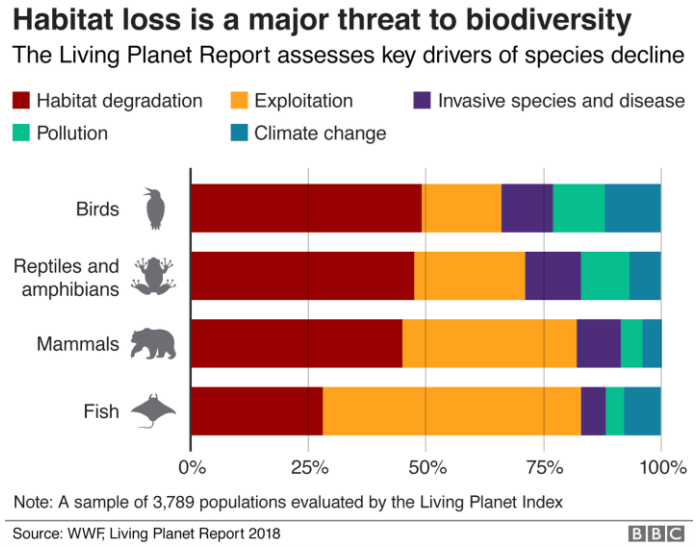
May be possible to influence disease outcomes through other types of management (e.g., forest management)

Potential to bolster wildlife health in the face of disease

Systems approaches may help us find an intervention that achieves desired impact for wildlife population AND is acceptable to stakeholders





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