World Organisation for Animal Health

Australian Government
Department of Agriculture, Fisheries and Forestry

UNIT 3:
AT RISK POPULATION

Department of Emerging diseases and Global health

Animal Health Research Centre (CISA)

Institute for Agronomic and Food Research (INIA)

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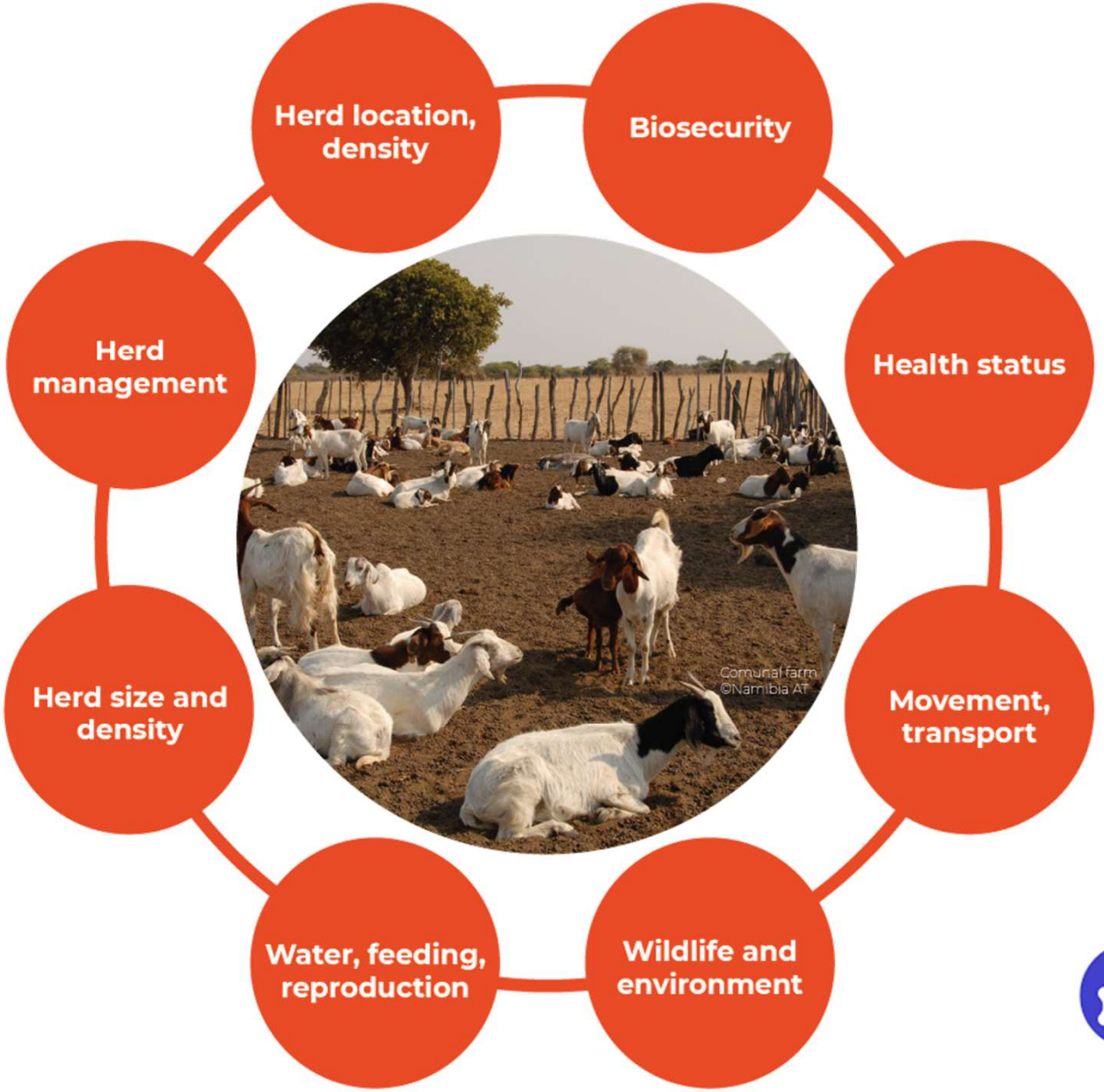
Outline

- Population at risk
- Livestock factors affecting risk:
  - Trade
  - Farming practices
  - Mapping livestock for RA; distance to risk factors
- Biosecurity

PART 1
POPULATION AT RISK



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Population at risk

The population at risk is defined by the **susceptibility to develop a disease or health condition** of interest, based on factors such as time, geographic location, species, management, environmental exposures, immune and health condition, or genetic conditions.

Population at risk

An animal is **highly susceptible** when the **likelihood** of acquiring an infection and developing adverse consequences is high.

What is interesting to classify the risk of a species is to also consider the **transmission potential** of a susceptible animal or population.

Classifying the risk of a population

Risk = Susceptibility x Transmission potential

Example:

Low-risk species	Limited susceptibility and minimal interaction with other hosts
Moderate-risk species	Susceptible but limited transmission
High-risk species	Reservoir or amplifier hosts with high interaction potential and effective shedding

Reservoirs harbour a pathogen over long periods, often without being affected by the disease, serving as a **long-term source of infection**. Example: aquatic birds and avian influenza

Amplifiers increase the quantity of a pathogen in the environment or within its population, facilitating an **increase in transmission** through high pathogen load and shedding large amounts in the environment. Example: bird-mosquito cycle in West Nile fever

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Risk management of a population

Highly susceptible animals

sentinel surveillance purposes (early detection)

Reservoirs

control purposes (extension of infection, source)

Risk management of a population: exercise

Place a S (for potential sentinel) and/or an R (for potential reservoir) under these pictures according to their susceptibility and potential to transmit highly pathogenic avian influenza virus

Mostly asymptomatic

Virus experimental excretion: 17-21 days

S or R:

Severe clinical signs and high mortality

Virus experimental excretion: 6 days

S or R:

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Population at risk

Experimental infections:

Pathogenesis, transmission routes and virulence

- How much virus
- Excretion duration
- Immunology

Field conditions:

Population susceptibility and distribution
Relevance of animal sector
Management practices
Failures in biosecurity
Prevalence/ incidence studies
Involvement of species

At risk livestock population : exercise

- List the most important at risk species for FMD in your country
- What was your criteria to consider them as “at risk” species?
- Could there be more species at risk?
- How much could you be underscoring the risk of FMD by leaving out wildlife species?
- Look up the total number of animals and animal premises for those species in your country and share your results

At risk livestock population: exercise feedback

- Generally cattle and buffalo are the species mostly considered
- Species with data on surveillance, most important for livestock revenue or to support economy, most susceptible, worst visible consequences
- Pigs are reservoirs, small ruminants have symptoms but recover quickly
- If wild life is abundant and high interaction with livestock systems through grazing or resource sharing, I would be underestimating the extension only with buffalo or cattle data
- For example, FAO Statista 2021 have figures for:
    - Cattle: 2,7 mill head
    - Buffalo: 675,260 head
    - Pigs: 2,07 mill head

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PART 2
POPULATION FACTORS AFFECTING RISK OF DISEASE

Trade, travel and movements

Trade, particularly the movement of **live animals**, **products** or **feed**, plays a significant role in influencing the occurrence, spread, and persistence of animal diseases. International travel can introduce diseases to regions where they were previously absent

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Trade, travel and movements: examples

Imported zebras with African horse sickness, Thailand, 2020

Introduction of products (meat, milk, hides…) from infected animals, in which pathogen remains infectious for prolonged times (i.e. ASF virus)

Contaminated equipment, feed, bedding, shipping containments or other vehicles, i.e. FMDv in Korea in 2002, personnel wearing contaminated clothing through several premises

Trade, travel and movements: relevant questions for RA

- How much does raising livestock contribute to the gross domestic product or the raising of which species contributes more to the livestock domestic product?
- How many heads constitute each livestock sector? How many are slaughtered in the country? What is the level of sel-sufficiency?
- What is the price for the same animal commodity across the neighbouring countries?
- Which are the main trading partners for each animal commodity? Which kind of product is mostly traded?
- What are the consumers' feeding preferences?
- What is the evolution over time of imports, exports and national preferences

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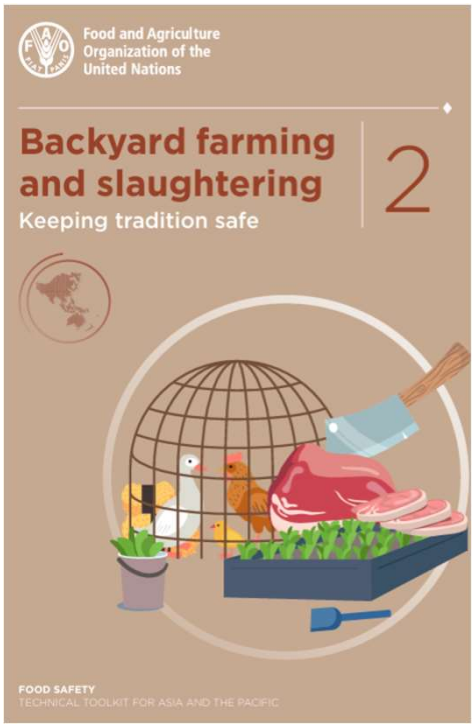
Animal management: backyard farming

Backyard farming is mainly related to subsistence farming in Southeast Asia, being very much linked to socioeconomic and cultural factors.



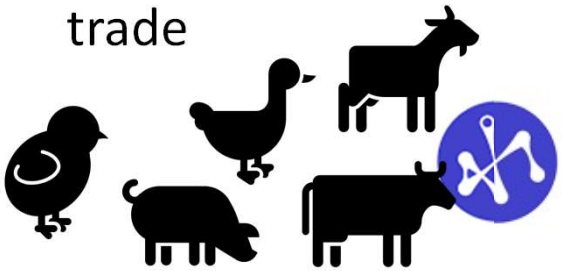
Household consumption, local trade

Close human-animal-wildlife interaction

- Limited biosecurity
- Poor housing and sanitation

- Frequent species mixing
- Unregulated trade

- Limited vet access
- Low vaccination rates



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Risks in other farming systems: exercise

- **Pick one of the following farming systems**
- **List the benefits and potential health risks**

1. Intensive commercial farming (poultry, pigs or beef feedlots)

2. Grazing animals on natural pastures (beef, water buffalo, small ruminants)

3. Dairy farming (ruminants)

Risks in other farming systems: exercise

1. Intensive commercial farming (poultry, pigs or beef feedlots)

Possible risks

- *Crowded conditions*
- *Distance to other farms*
- *Farm workers, equipment, vehicles*
- *Inadequate quarantine*
- *Manure and waste wáter management*
- *Chemical and antibiotic residues*
- *Mass culling ,export bans if outbreak*
- *Volatile production costs due to feed import*

Risks in other farming systems: exercise

Possible risks

- *Vector-borne diseases*
- *Contaminated pastures (i.e. FMD)*
- *Seasonal pasture áreas or communal grazing areas (i.e. FMD)*
- *Land use or climate changes might favor crowding (i.e. water sources)*
- *Malnutrition weakens immunity*
- *Wildlife interface*
- *Lack of biosecurity*
- *Challenging to implement control measures or vaccination*
- *Uncontrolled breeding*

2. Grazing animals on natural pastures (beef, water buffalo, small ruminants)

Risks in other farming systems: exercise

Possible risks

- *Mastitis and milk contamination*
- *Residue risks*
- *Environmental pollution*

3. Dairy farming (ruminants)

Livestock data

- Generally available from Veterinary Services.
- Other sources could be private suppliers, insurance companies, international organisation estimates
- Important to have verified, clean and well-structured data for analysis
- Essential columns might include

FARM ID	LOCATION	SPECIES	No. of animals	Type of production	Type of management	Date

- Farm ID (for counting purposes)
- Location (coordinate or smallest administrative level; village, district, province, region)
- Species,
- Number of animals (annual capacity),
- Type of production (meat, dairy, eggs, breeding…)
- Type of management (intensive, backyard, grazing, other (specify))
- Date (important to have updated information)

At risk livestock distribution mapping: exercise 1

- Open the Excel dataset and create a pivot table
- Count the number of farms (each row is a farm)
- What is the minimum farm size? And the maximum?
- Calculate mean and median farm size
- Stratify by type of production (breeding, growing)

❖ ***Add the information to a administrative level 1 map***

❖ ***Calculate the density by administrative level***

❖ ***Write a summary of pig farming by the***

At risk livestock distribution mapping: exercise 2

- Save the Excel as .csv to load it to GIS
- Add X, Y points to the map
- Colour the points according to type of production and make the size of the point according to farm size
- Add the ASF data .shp from Unit 2

❖ ***Are the units with more outbreaks also those where there is higher density? What does this mean?***

❖ ***What is the size of the farms with outbreks?***

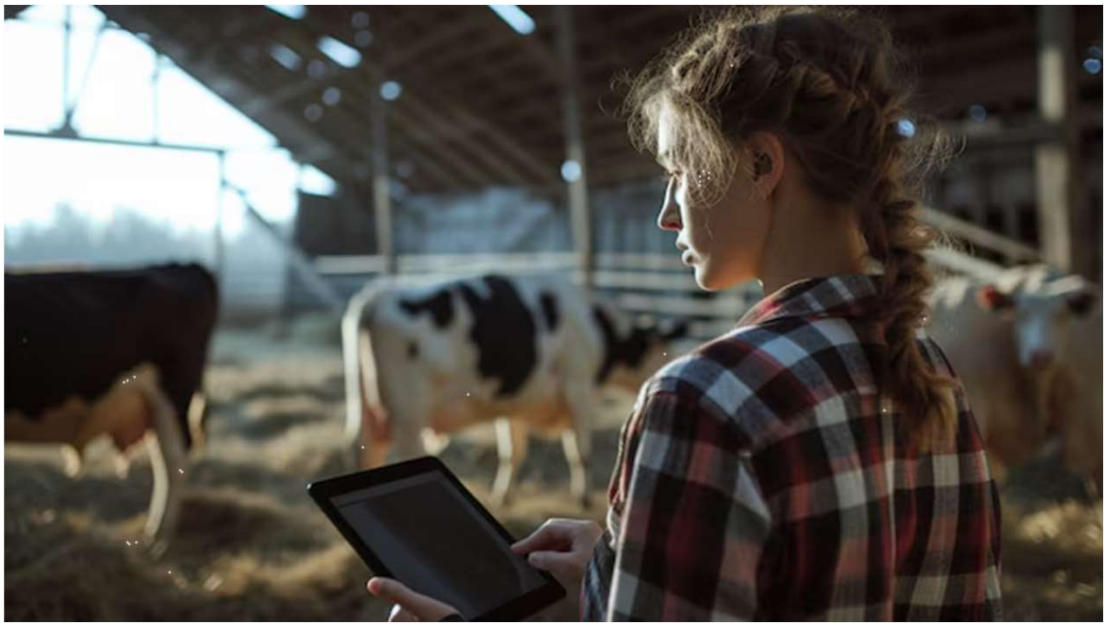
❖ ***What is the location of outbreaks and farms telling you?***

PART 3
BIOSECURITY

Biosecurity measures

Biosecurity: “means a set of management and physical measures designed *to reduce the risk of introduction, establishment and spread of animal diseases*, infections or infestations to, from and within an animal population”.

Biosecurity plan: “means a plan that *identifies potential pathways for the introduction and spread of disease* in a zone or compartment and describes the measures which are being or will be applied to mitigate the disease risks, if applicable, in accordance with the recommendations in the Terrestrial Code”.



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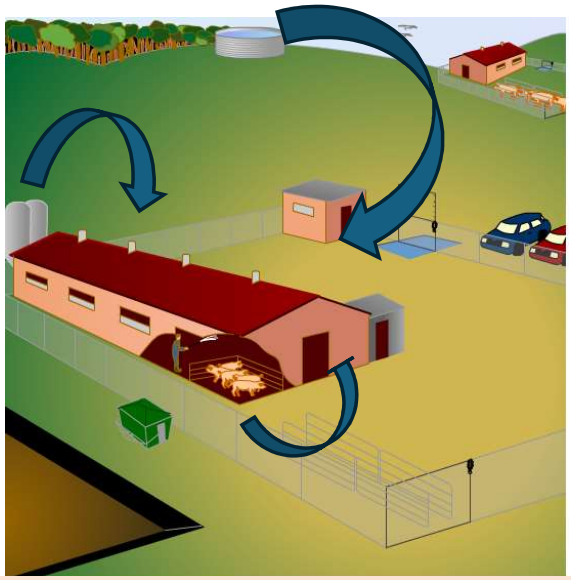
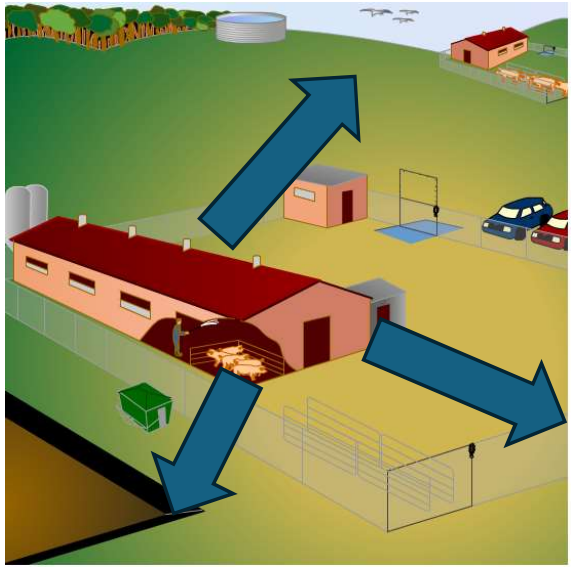
Biosecurity measures: Identification

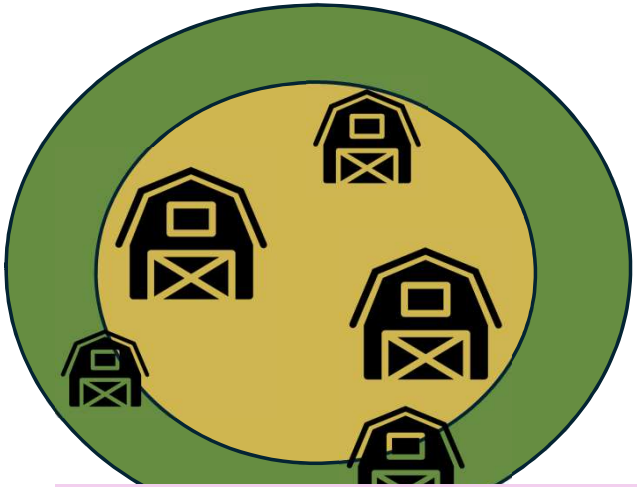
Systematic approach to identify factors that can influence the likelihood of disease introduction and transmission



Disease entry pathways
animals, humans, equipment, feed, or water, etc



Disease spread pathways
animals, humans, airborne, equipment, etc



Regional risks
- Flow of animals, people, vehicles and goods
- Environmental factors

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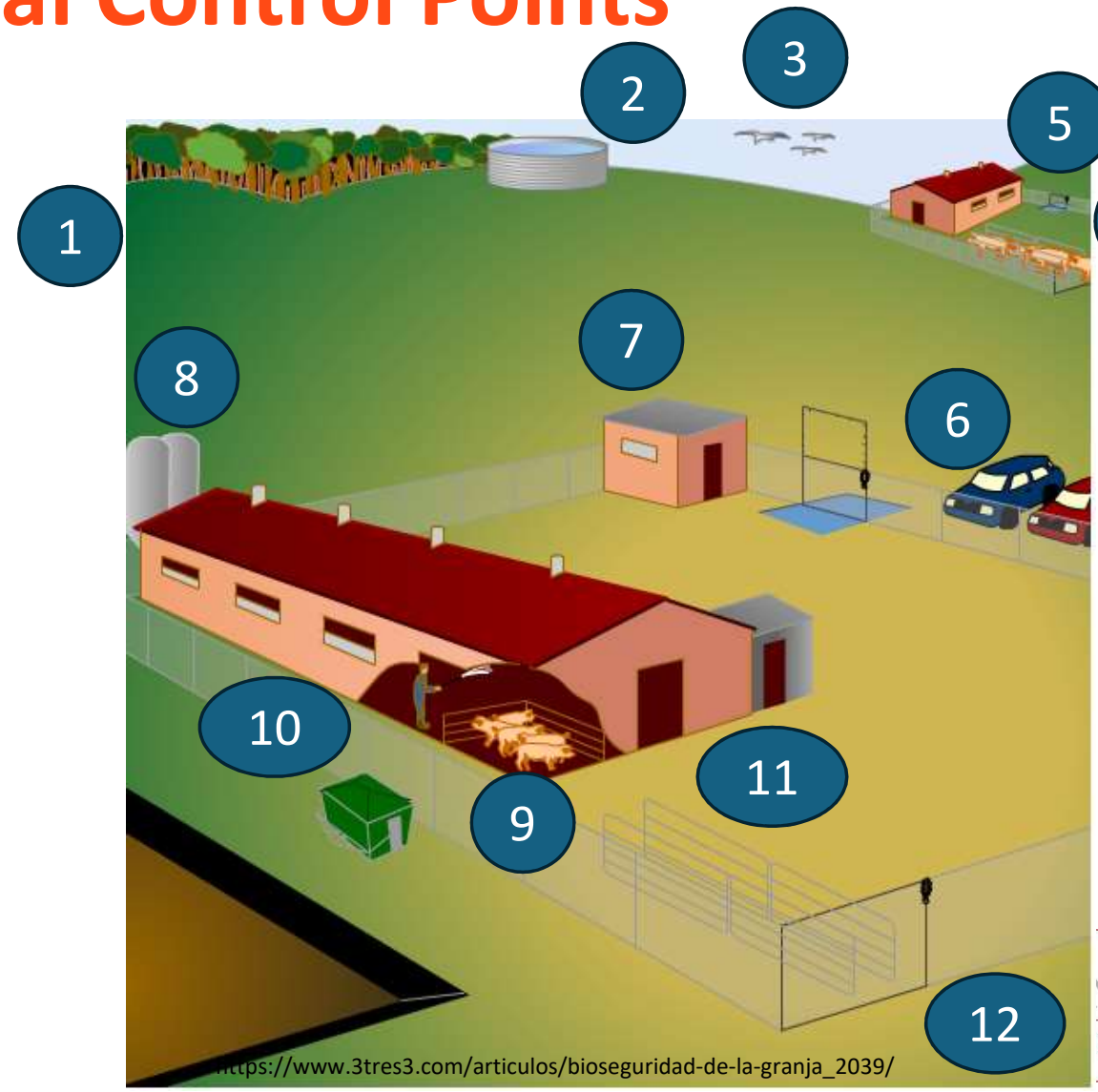
Biosecurity – Critical Control Points

1. Location (>X km)
2. Water source – Quality water
3. Control of external animals
4. Health status of incoming animals
5. Quarantine of new animals
6. Parking outside. No access to any vehicles
7. Staff and visitors' room
8. Quality feed – un-load outside
9. Density
10. Hygienic carcass disposal
11. Loading dock – exit of pigs
12. Whole premises fenced



Biosecurity – Data for analysis

Health and disease data:

- Clinical signs reports
- Diagnosis
- Laboratory test results
- Vaccination schedules

AND date, animal ID and any other relevant epi information

Movement records:

- Date
- Source or destination
- Type of commodity
- Quantity
- Route
- Control measures pre-movement

Biosecurity – Data for analysis

Environmental data:

- Water and feed sources
- Climate
- Vectors
- Land use in surroundings
- Wildlife

Visitor records:

- Providers
- Suppliers
- Other visitors or vehicles

Compliance and auditing:

- Staff hygiene
- Quarantine
- Etc

Economic/market

- Market trends
- Regional disease outbreaks

Biosecurity – Management

1) Surveillance and monitoring

2) Personal protective equipment

3) Hygiene protocols

4) Training

5) Vaccination and health protocols

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Biosecurity – Risk-based management

Identify risk factors:

- Relationship between potential risk factors and disease outcome
- Tool: statistic analysis

Assign severity scores:

- Based on likelihood of occurrence and consequence
- Tool: risk assessment

Analyze patterns:

- Identify trends, seasonal risks or recurring outbreaks
- Tool: trend analysis

Identify “hotspots”:

- Areas with high animal traffic or at risk of outbreaks (distance, vulnerability)
- Tool: Spatial analysis

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