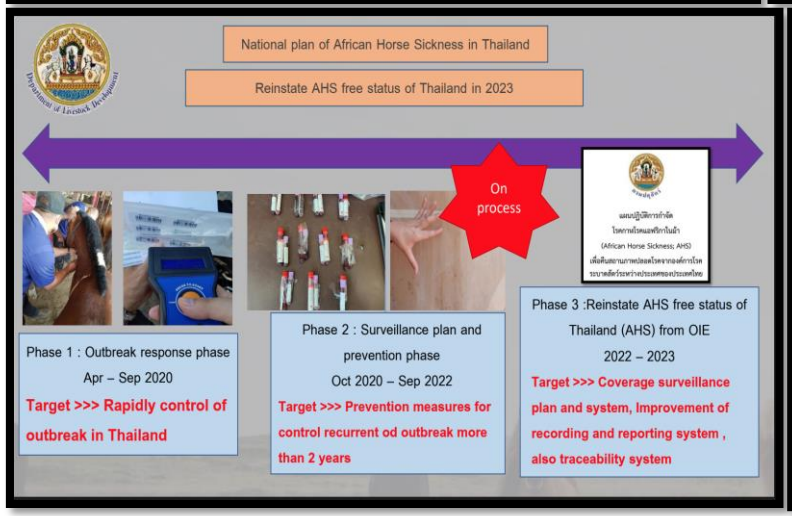
Spatial Risk Assessment of African horse sickness in Thailand



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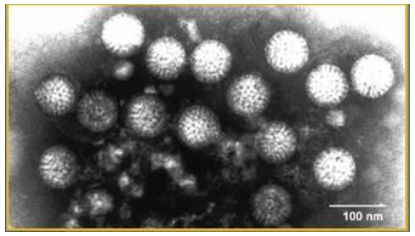
Introduction



African horse sickness virus (AHSV)

Vector-borne disease

Culicoides spp. (Culicoides imicola – principal vector/C. bolitinos/ C. Variipennis/ Other potential arthropods)

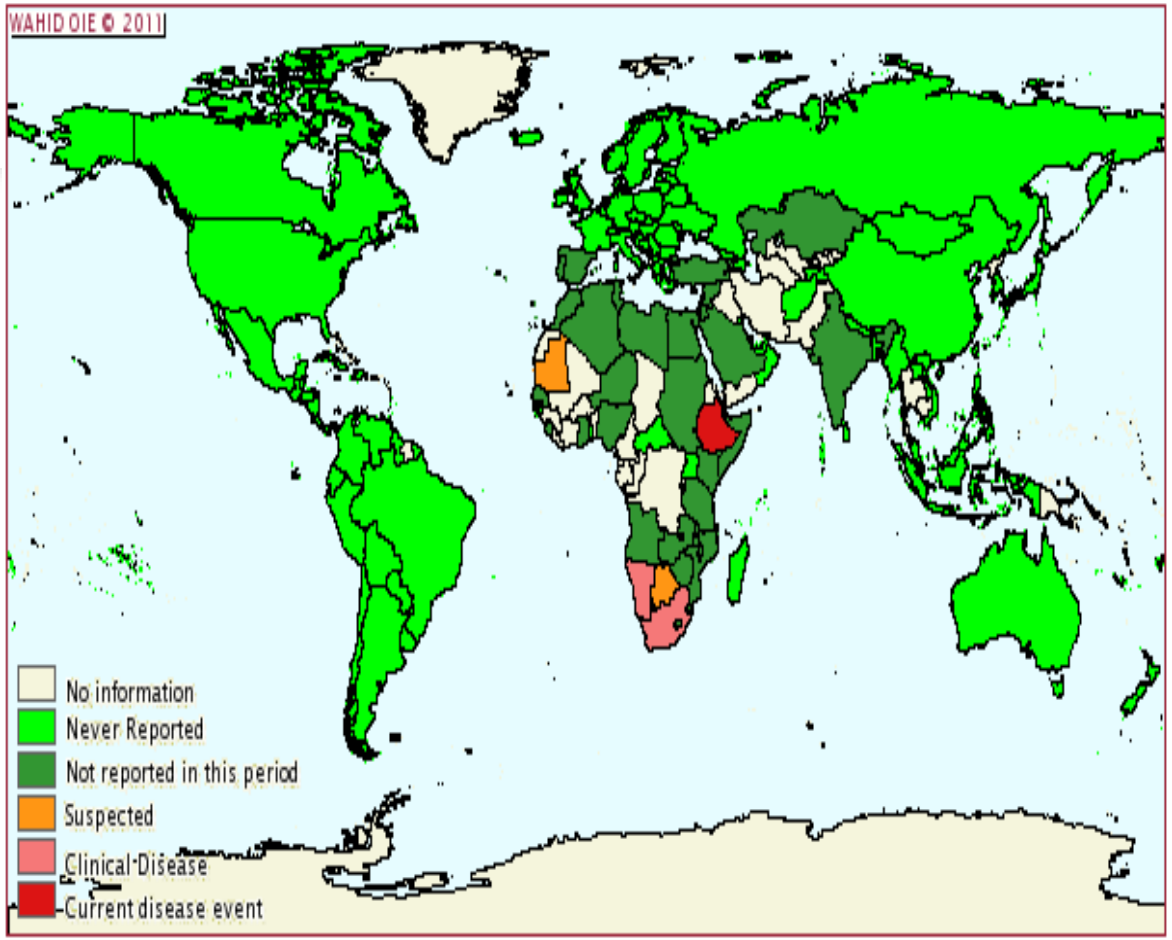
Susceptible host : Equidae

- AHS is seen during warm, rainy seasons, which favor propagation of the vectors, and disappears when cold weather stops or significantly reduces vector activity.
- The virus also has been isolated from the dog tick Rhipicephalus sanguineus sanguineus, and the camel tick Hyalomma dromedarii

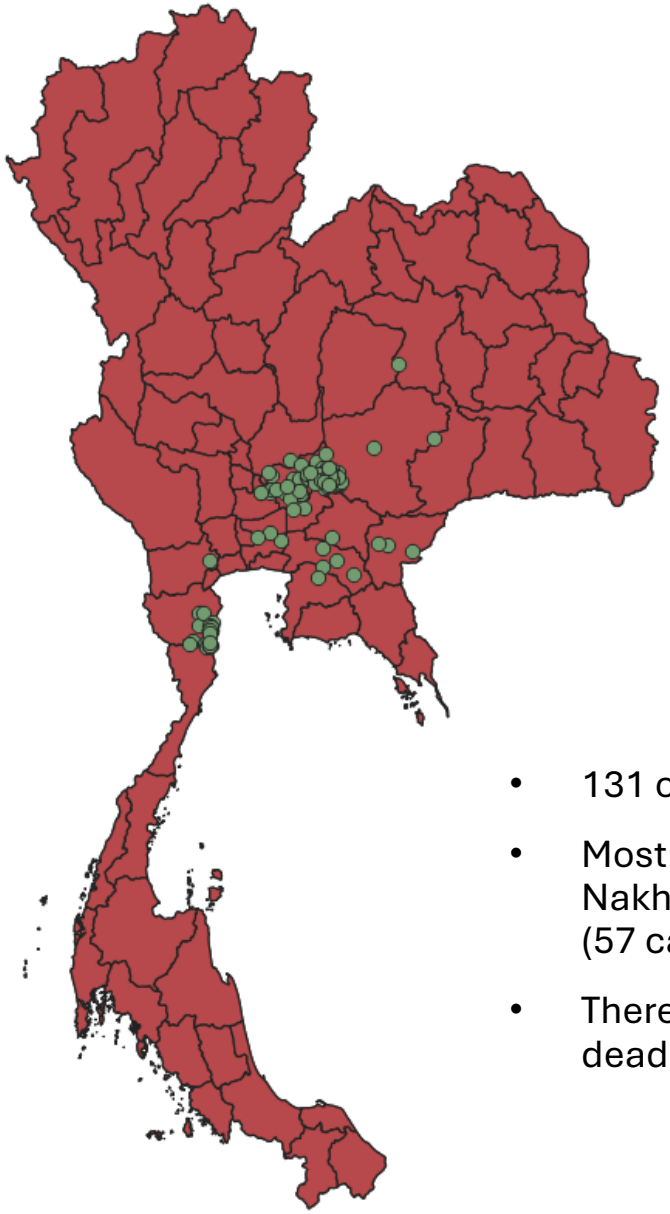
Incubation: natural infection = 3-14 days

Disease Form	Incubation Period
Peracute (pulmonary) form	3-5 days
Subacute (edematous or cardiac) form	7-14 days
Acute (mixed) form	5-7 days
Horsesickness fever	5-14 days

Disease situation



Source : OIE



Source : DLD,Thailand

- 131 outbreaks in 17 provinces
- Most of cases occur in Nakhonratchasrima province (57 cases)
- There were 610 cases and 568 dead

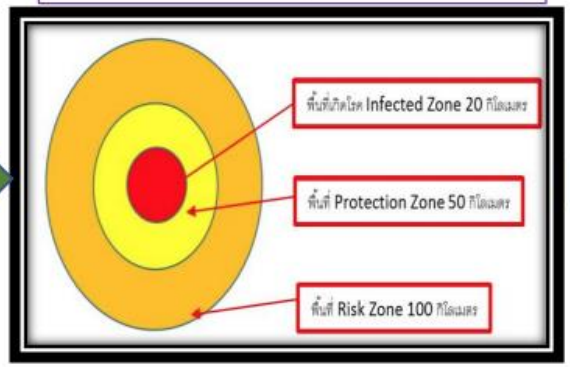
Outbreak response Phase

Case definition of AHS : Surveillance plan

Body temp > 38.5
Depressed
Sudden death
Anorexia
Conjunctival Edema

Notify DLD for further investigation and sampling collect

Outbreak response area



MOU/ Public relations

Disease surveillance
In risk animal : Zebras

Vector control/Surveillance

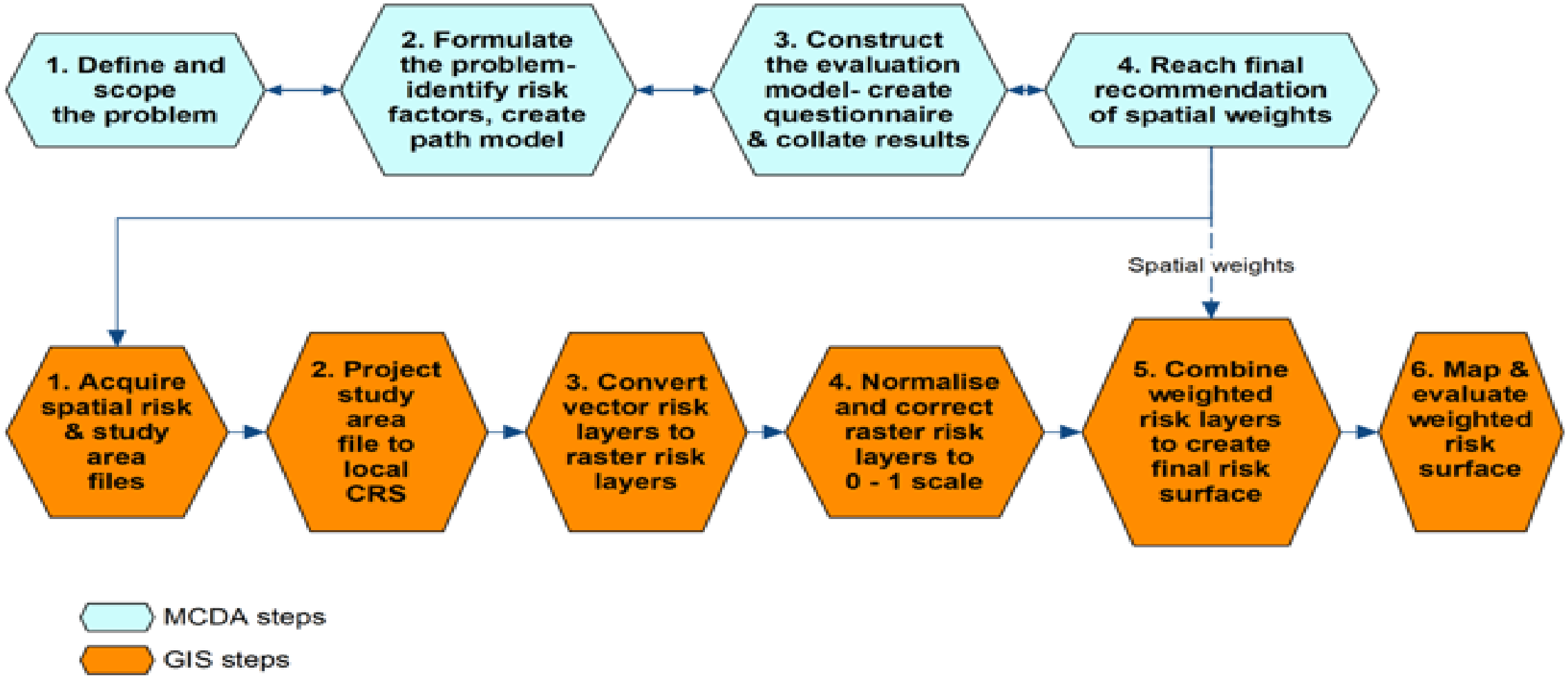
Vaccination campaign

movement control

Objective

- predict AHS spreading risk areas in Thailand

Methodology

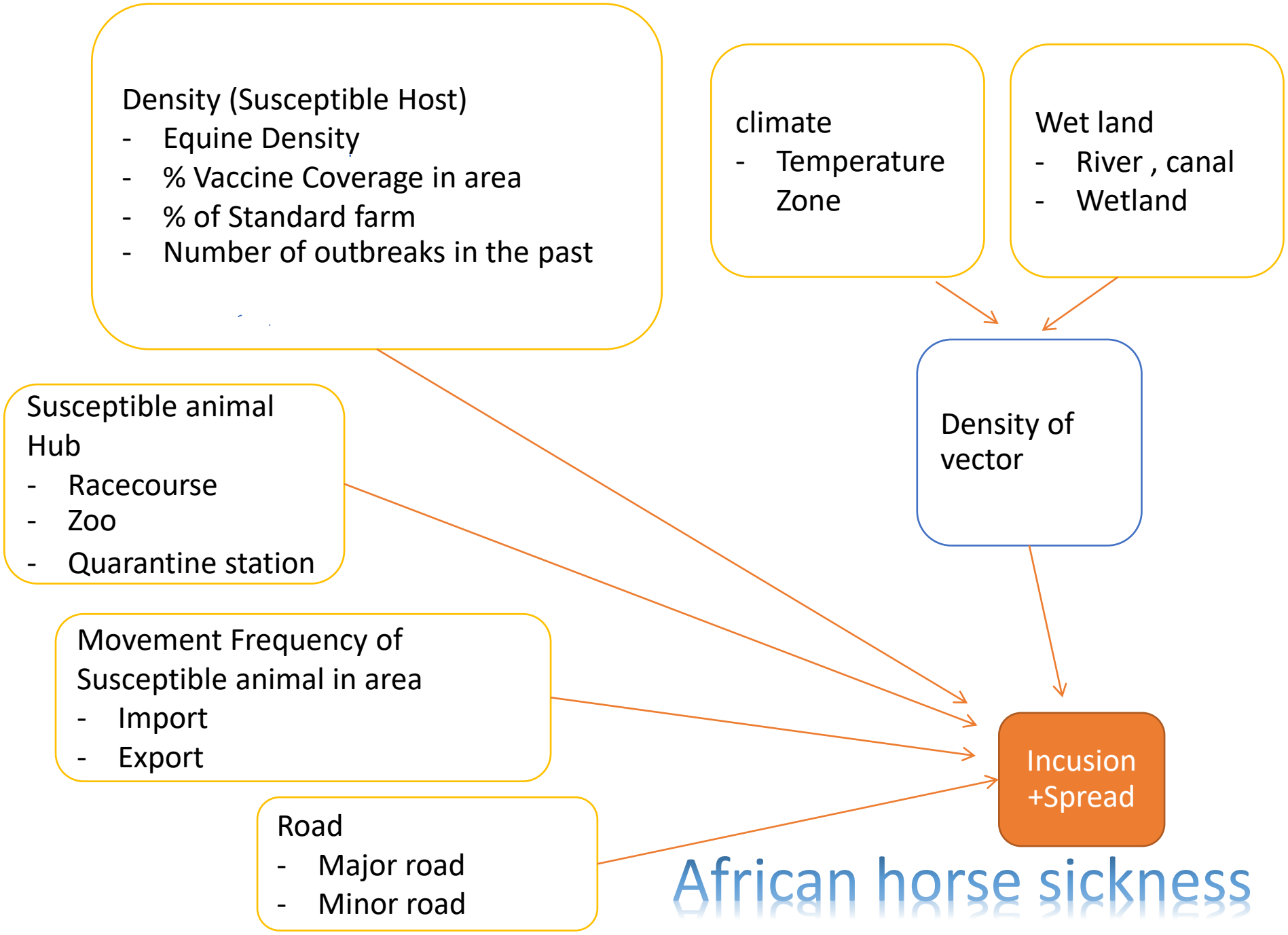


Result

Risk factors matrix

MCDA process

	With spatial data	Without spatial data
Incursion	Host Density (Susceptible Host) Wet land Road Equine hub Animal quarantine station Vector density	Biosecurity Vector control
spread	Host Density (Susceptible Host) Wet land Road Equine hub Animal quarantine station Vector density Movement Number of outbreaks in the past	biosecurity Vector control


Density (Susceptible Host)
- Equine Density
- % Vaccine Coverage in area
- % of Standard farm
- Number of outbreaks in the past
climate
- Temperature Zone
Wet land
- River , canal
- Wetland
Density of vector
Susceptible animal Hub
- Racecourse
- Zoo
- Quarantine station
Movement Frequency of Susceptible animal in area
- Import
- Export
Road
- Major road
- Minor road
Incusion +Spread
African horse sickness

Compare Factor

MCDA process

Median scores for risk factor comparisons

		Risk factor 2				
		Equine population	Movement frequency	Quarantine station	Equine hub (racecour	River and wetland
Risk factor 1	Equine population	0	-4	-3	-4	4
	Movement frequency	4	0	-1	0	4
	Quarantine station	3	1	0	-5	2
	Equine hub (racecourse an	4	0	5	0	2
	River and wetland	-4	-4	-2	-2	0

MCDA process

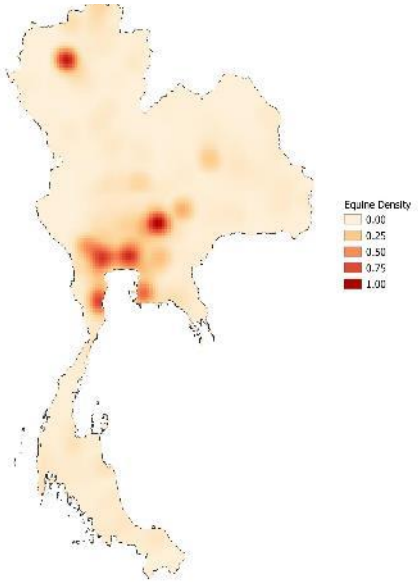
Transformed and weight

Transformed scores, geometric means & weights

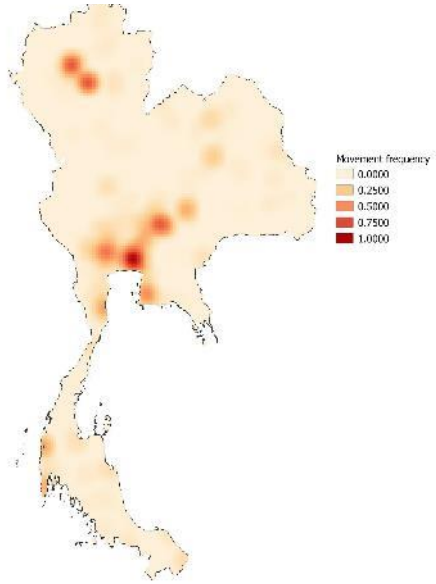
		Transformed score for each risk factor comparison						
		Risk factor 2						
		Equine population	Movement frequency	Quarantine station	Equine hub (racecourse and zebra farm)	River and wetland	Geometric row mean	Weight for spatial risk layer
Risk factor 1	Equine population	1.00	0.30	0.41	0.30	3.33	0.40	0.05
	Movement frequency	3.33	1.00	0.74	1.00	3.33	2.50	0.30
	Quarantine station	2.47	1.35	1.00	0.22	1.83	1.14	0.13
	Equine hub (racecourse an	3.33	1.00	4.50	1.00	1.83	4.21	0.50
	River and wetland	0.30	0.30	0.55	0.55	1.00	0.21	0.02
								1.00

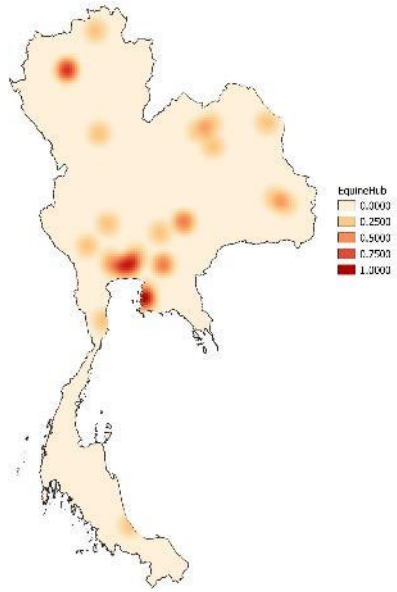
GIS process

Equine Density

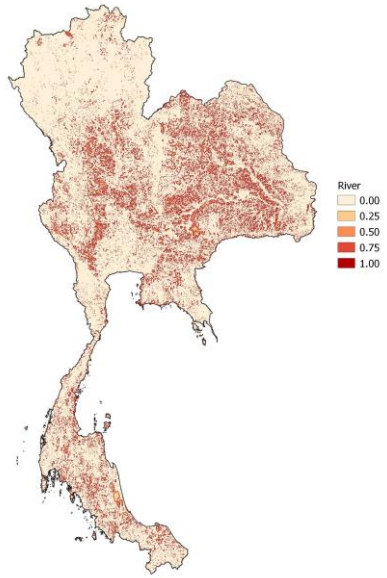


Movement frequency

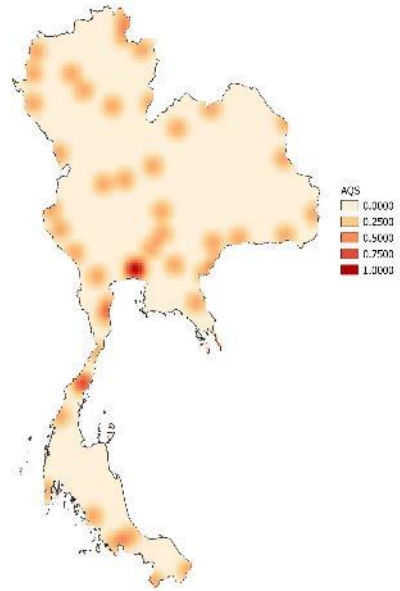




Equine Hub



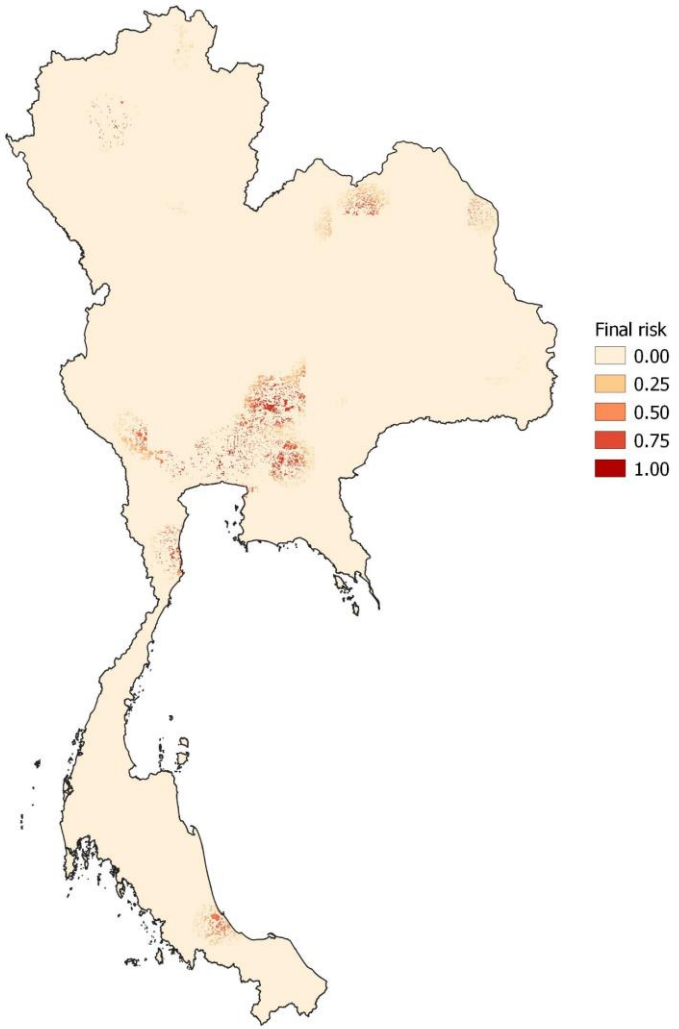
River



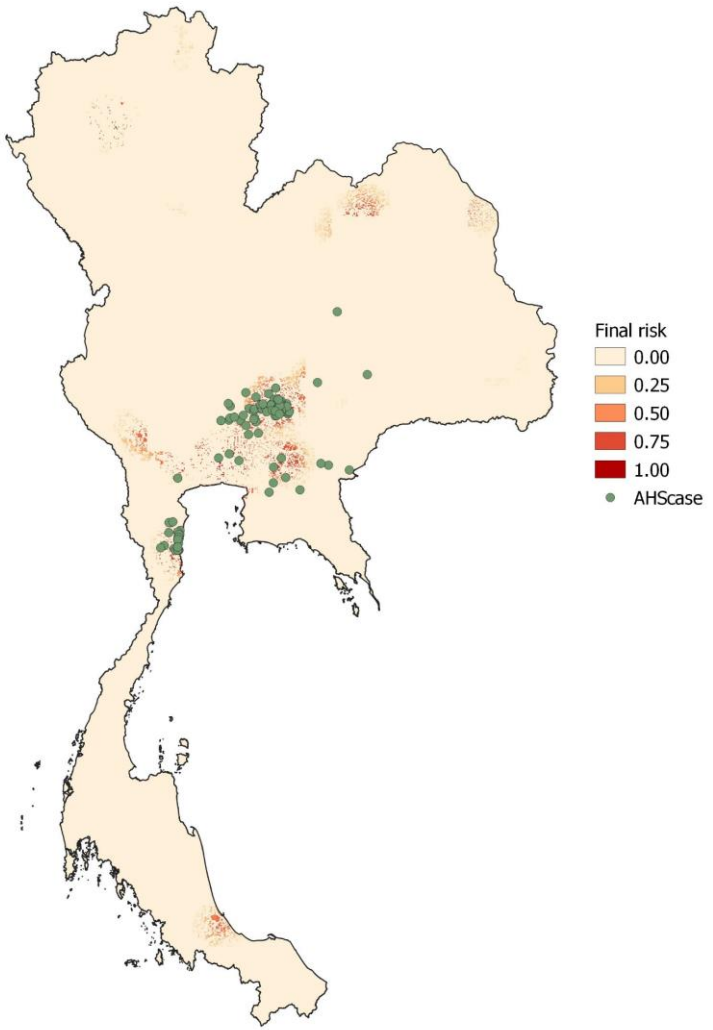
Animal Quarantine Station

GIS process

Final Thailand ASH Risk Map



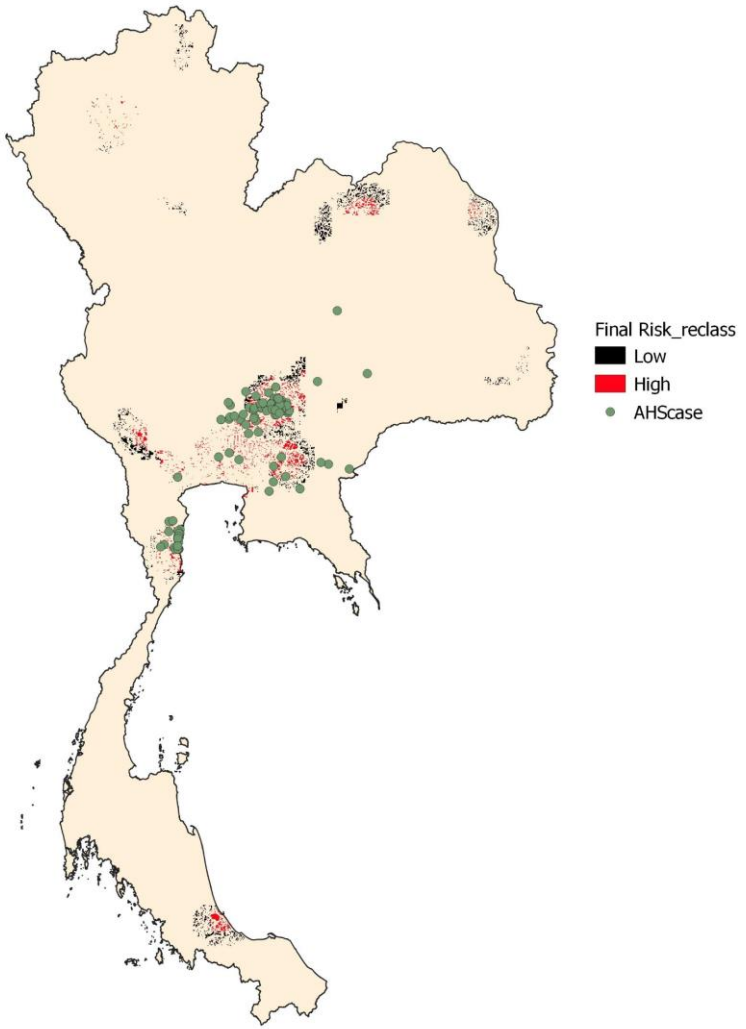
Validation : Final Thailand ASH Risk Map with cases



Validation : Reclass with sample cases

Blank Latitude = 0
Blank Longitude = 0
No. of rows = 131
No. of rows with non-missing coordinates = 131
No. of case in high area = 26
Proportion of proportion of outbreaks/cases in the high risk = 20%

GIS process



Discussion

- Equine hub and movement frequency significantly affect the model.(80% of weight sum)
  - AHS was emerging disease in Thailand. Equine hub and regulation wasn’t prepared for vector prevention.
  - Zebra was neglected animal. Before outbreak it wasn’t direct regulation.
  - While culicoides is transmit AHS in close area, Horse movement can transmit to farther area.
  - River is least significant because it may not direct risk factor for AHS.

Discussion

- Outbreaks were more frequent in Nakhon Ratchasima province which more horse density. Should increase weight of equine density.
- Some animal quarantine including airport AQS may not use for horse quarantine.

Conclusion

- ❑ We can use risk map for support consistency plan of AHS prevention and control measurement
  - can focus on target risk areas
  - reduce cost and manpower
- ❑ Can increase sensitivity of risk map if we can
  - find the appropriate factor such as density of insect because this disease transmit by insect
  - Approve the weight of each factor depend on the raw data or increase expert opinion that balance the appropriate weight factor
  - Univariable correlation and regression test between factor and outbreak may help expert to weigh and researcher to normalize