Food and Agriculture Organization of the United Nations

LSD clinical signs, epidemiology and situation in Europe

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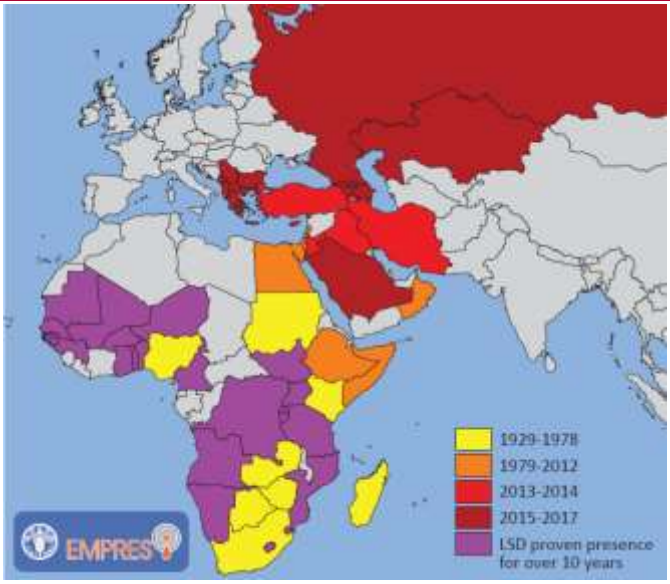
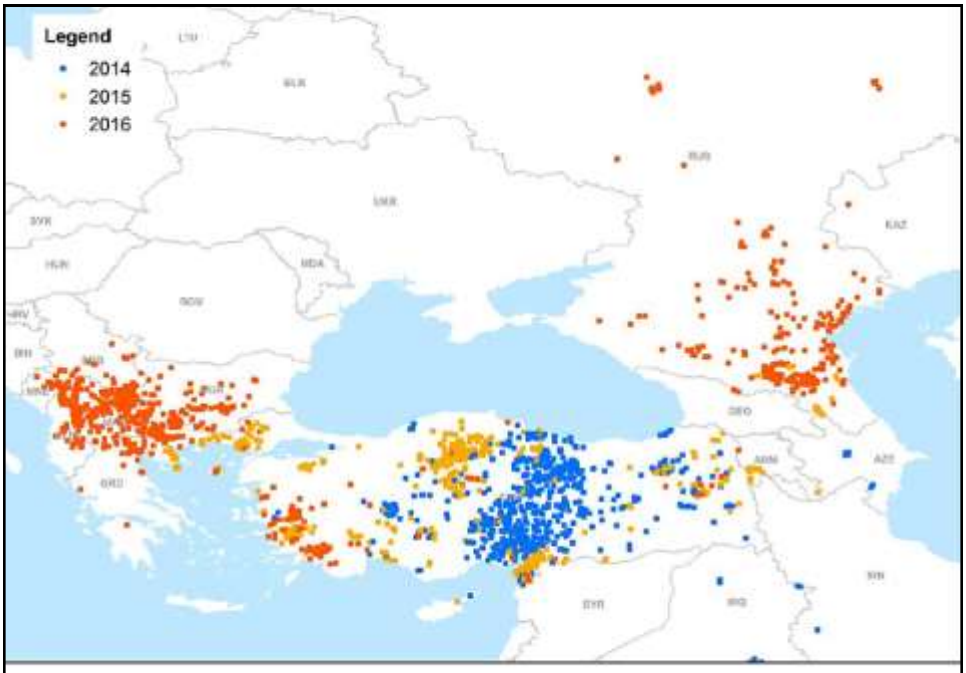
Animal Health Officer

Regional Workshop on Foot and Mouth Disease (FMD) and other Transboundary

Countries that have reported LSD



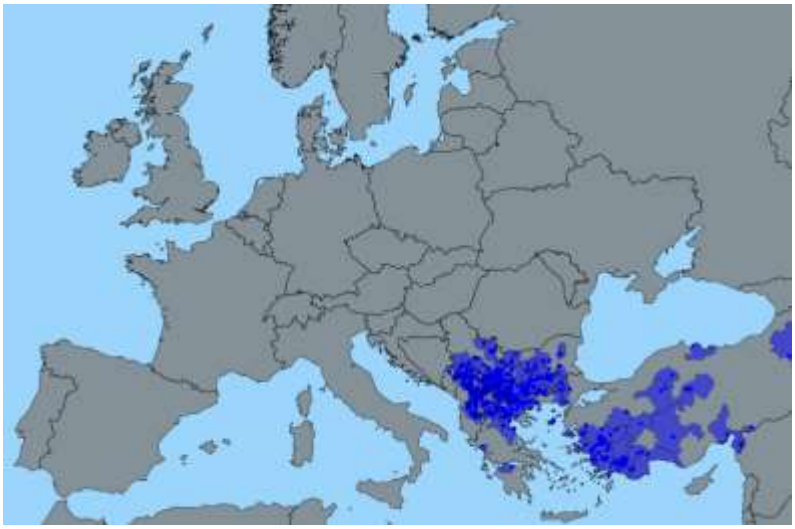


Data Source: Empres-i, Global Animal Disease Information System, FAO)

LSD outbreak in South East Europe and Northern Caucasus

- Turkey (2013), the norther part of Cyprus (2014), Greece (2015), followed by Bulgaria, Serbia, FYR of Macedonia, Montenegro, Kosovo and Albania (2016)
- Not affected: Bosnia and Herzegovina and Croatia
- Caucasus: Azerbaijan (2014), Armenia (2015) Georgia (2016)
- Kazakhstan (2016)
- In southern Russian Republics of Chechnya, Dagestan, Kalmykiyan, In the Russian Federation, LSD has spread within 16 provinces → Ukraine at high risk

LSD in the Balkans and Turkey in 2016

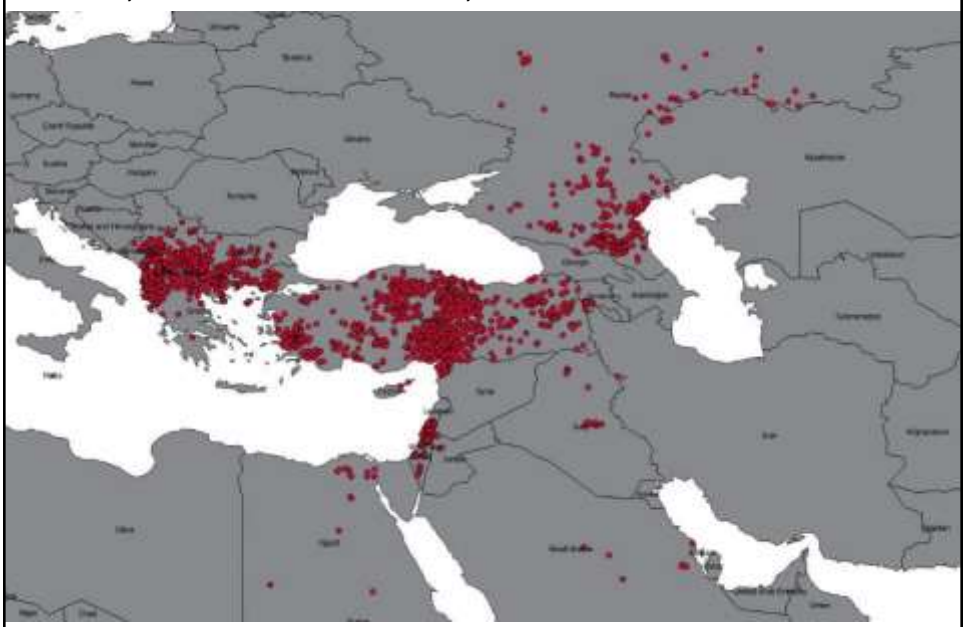


LSD has been largely controlled in Southeast Europe through a control strategy composed by a combination of **mass vaccination** and total and partial **stamping out**.

In a couple of months, a 90% vaccination coverage was achieved

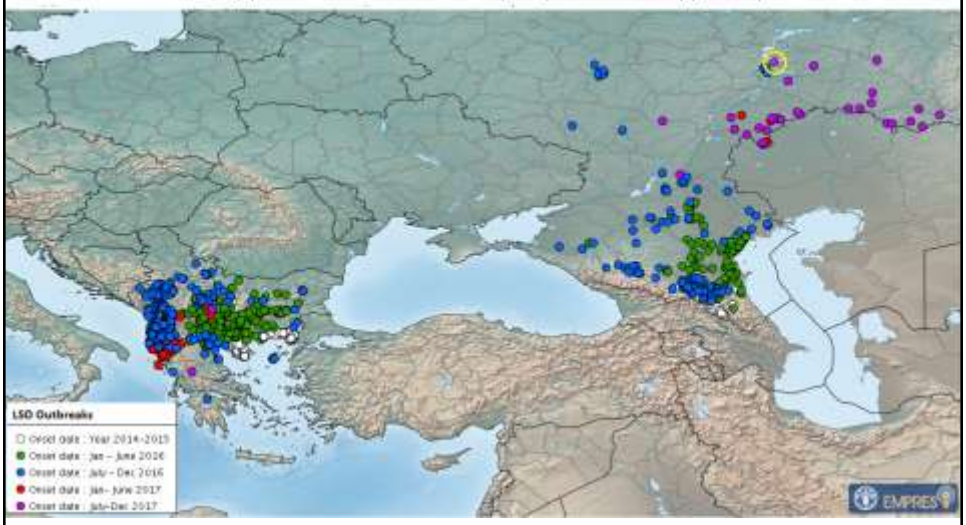
LSD in the Balkans and Turkey in 2017

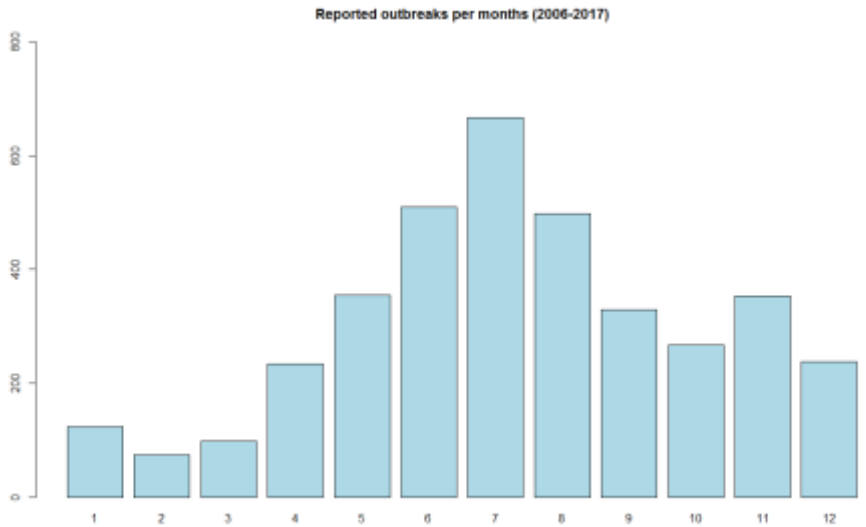
7,600 outbreaks and 12,800 animals affected



EMPRES-i (FAO) & ADNS between 2006 y 2017

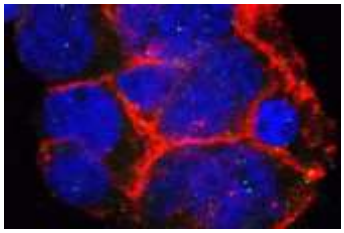
LSD outbreaks in cattle in Southern Europe, in the Russian Federation and in Central Asia, January 2014- 31 October 2017 (by onset date)





Agent

- *LSD virus* belongs to the ***Capripoxvirus*-genus** within the ***Poxviridae*-family**)
- Most **disinfectants** are effective
- **Stable** virus, survives well when protected from sunlight, e.g.
  - in scabs, for up to 6 months,
  - in dried hides for up to 18 days
  - in animal secretions (e.g. ocular, nasal discharge) up to at least 15 days P.I.



Capripoxvirus genus

- Lumpy skin disease (LSD)
- Sheeppox (SPP)
- Goatpox (GTP)

Species affected

Cattle and Asian water buffalo (*Bubalus bubalis*)

- although morbidity rate is significantly lower in buffalo (1.6% *vs.* 30.8%)

Transmission

- All infected animals can transmit the virus
- Transmission mostly through (mechanical) vectors
- High virus concentration in scabs, saliva, ocular and nasal secretions, faeces, semen and urine
- However, direct contact transmission is consider inefficient - **More research needed**



Element for transmission of virus of LSD

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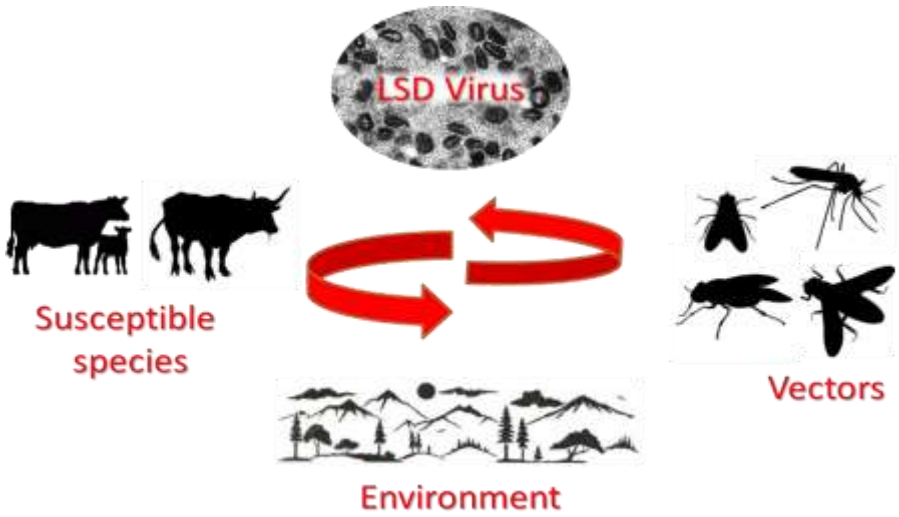

Transmission through mechanical vectors

Aedes mosquitoes

Aedes aegypti; © James Gathanhi (Sanofi Pasteur)

Stable fly *(Stomoxys calcitrans)*

© Stephen Ausmus (USDA)

Tick species *(Rhipicephalus o Amblyomma spp)*

Amblyomma hebraeum. © Bernard Dupont

In Bulgaria, LSDV has been found in:

1. Tabanids (*Tabanus spodopterus*)

Ticks:

2. *Hyalomma marginatum*

3. *Rhipicephalus bursa*

Affected herd in Bulgaria, June 2016

Vector transmission

- Vectors vary between affected regions
- Climate, season, environmental temperature, humidity and vegetation
- Vector must bite/feed frequently and change the host between feedings
- Finding PCR positive vectors indicates they have been feeding on infected animal – but transmission should be demonstrated experimentally
- Difference between mechanical and biological transmissions
- **Further research is required to investigate the role of European insect species (fleas, lice, horn flies, horse flies, midges etc.)**

Other ways of transmission

Iatrogenic

Other ways of transmission

From males to females - Seminal transmission via natural mating or artificial insemination

Other ways of transmission

Mothers to calves: trans-placental transmission and sucking calves may get infected via milk or from skin lesions in the teats

Contents lists available at ScienceDirect

The Veterinary Journal

journal homepage: www.elsevier.com/locate/tvjl

Short Communication

Evidence of intrauterine transmission of lumpy skin disease virus

Sherin Rouby [a,*], Emad Aboulsoud [b]

Other ways of transmission

Some LSD strains replicate in sheep & goats, but no evidence that they can transmit the virus

Reported cases in several wild ruminant species: impala (*Aepyceros melampus*) and giraffe (*Giraffa camelopardalis*), Arabian oryx (*Oryx leucoryx*), springbok (*Antidorcas marsupialis*), but their role in transmission is unknown

Studies in Bulgaria found no evidence that European fauna can get affected

Safety of commodities

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- LSD is not zoonotic
- No reports on the transmission of LSDV via meat products, hides and skins
- Presence of the virus in milk
- Human consumption is not a problem
  - Milk from severely affected animals is not likely to end up for consumption and milk is pasteurized
- Heat treatment of milk and meat products – 2 hours at 56°C or 30 minutes at 64°C inactivates the virus

LSD spread

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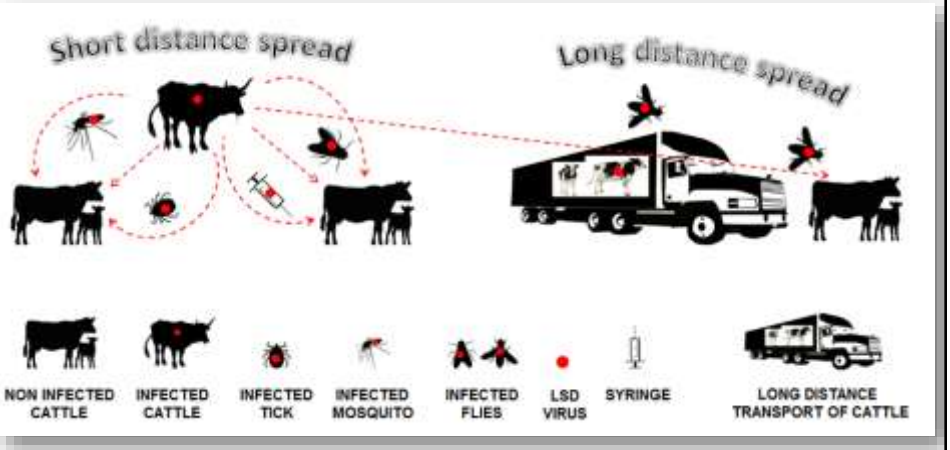

Clinical sings

- I**ncubation period** in experimentally infected animals is 4-7 days, but in naturally infected animals it may be up to 5 weeks
- Clinical signs include:
  - **Lachrymation and nasal discharge** – usually observed first.
  - Subscapular and prefemoral **lymph nodes become enlarged** and are easily palpable.
  - **High fever** (>40.50C) may persist for approximately a week.
  - Sharp **drop in milk** yield.
- **Skin lesions** start to develop following days - often in many animals at the same time
- Most animals develop at least **short-lasting viraemia**
- Morbidity rate varies between 5 to 45% and mortality rate usually remains below 10%

Nodular skin lesions (2-5 cm diameter)

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Predilection sites are the skin of the head, neck, perineum, genitalia, udder and limbs.

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- Deep nodules involve all layers of the skin, subcutaneous tissue and sometimes even the underlying muscles.
- The centre of the lesion ulcerates and a scab forms on top

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Skin nodules may persist for several months

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Evaluating the age of the skin lesions

7 dpi

1 to 2 weeks

2 weeks

2 to 3 weeks

3 weeks

© Eeva Tuppurainen

Evaluating the age of the skin lesions

3 weeks

3 to 4 weeks

5 weeks

Eye lesion

© Eeva Tuppurainen

Necrotic plaques in the mucous membranes of the oral and nasal cavities cause purulent or mucopurulent nasal discharge and excessive salivation

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Sometimes, painful ulcerative lesions develop in the cornea of one or both eyes, leading to blindness in worst cases

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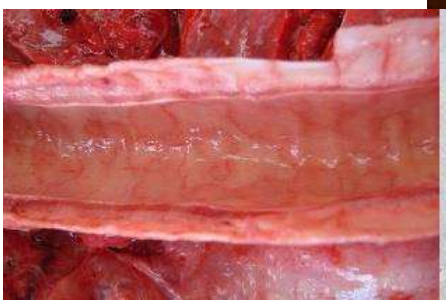
- During postmortem, pox lesions can be found throughout the entire digestive and respiratory tracts and on the surface of almost any internal organ

© Kris de Clercq & © JCA Steyl



Clinical sings

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- When an animal with multiple skin lesions is sent to a slaughterhouse, subcutaneous lesions are clearly visible after the animal is skinned.

Additional complications

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- Skin lesions in the legs and on top of the joints may lead to deep subcutaneous infections complicated by **secondary bacterial infections and lameness**.
- **Pneumonia** caused by the virus itself or secondary bacterial infections, and **mastitis** are common complications.
- **Subclinical infections** are common in the field.

LSD or not?

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LSD or not?

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Differential diagnosis

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- **Pseudo lumpy skin disease**; BHV-2 (Bovine herpes virus) - more superficial lesions and shorter course of the disease
- **Parapox** lesions (bovine papular stomatitis) in the mucous membranes of the mouth
- **Insect bites and allergic reactions** (urticaria)
- Early **ringworm** lesions – often ringworm gets worse during LSD infection
- **Demodicosis**
- **Besnoitiosis** (widely distributed in Africa, recently also in central and western Europe)
- **Onchocerciasis**
- **Hypoderma**

Critical to confirm diagnosis in the lab

Early detection?

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- **Severe** cases are highly characteristic and **easy to recognize**

  → But by the time severe cases are detected in the free-ranging herds, the virus has already been circulating for weeks
- **Early** stages and **mild** cases **difficult to recognize** even for the most experienced vets
- In dairy cattle *vs.* free-ranging beef cattle
- Difficult to detect without palpating the skin in cattle with long hair, e.g. long winter coat

Importance

Due to economic losses:

- Losses in milk production
- Losses in weight gain
- Damage to hides
- Abortions
- Infertility in males
- Mortality
- Complications:
  - Mastitis
  - Pneumonia
  - Lameness

And trade restrictions!

Identified risk factors

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- Animal movements, particularly movement of unvaccinated cattle
- Nomadic and seasonal farming practises
- Slaughterhouses, cattle market places,
- Asymptomatic viraemic animals – risk of presence subclinical

Challenges preventive approach

- Cattle transport vehicles
- Vectors - responsible for local dissemination of the virus
- Presence of suitable breeding sites for insects – standing water and dung piles
- Veterinary equipment and dirty needles

Control and eradication

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- Feasibility and effectiveness of disease control/eradication strategies vary by country and geographic region
- Essential to have a **contingency plan** in place well in advance which is updated and practised
- **Early detection** of clinical cases – major issue - varies between countries and farming practises
- **Awareness campaigns** targeted to farmers, animal care staff, artificial inseminators, animal traders, vehicle drivers, field and meat inspectors
- Active and passive **clinical** surveillance
- **Diagnostic capacity** in place allowing swift laboratory confirmation of a tentative field diagnosis

Control and eradication

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- **Vector control**
- **Large-scale vaccination campaign** around infected farms, slaughter houses, animal market and resting places
  - Regional vaccination preferred to ring vaccinations
  - Protection and surveillance zones with radius (50 km of diameter) appropriate for a vector-borne disease (3 km and 10 km)
- Strict **movement restrictions** or total standstill within the affected zone/country
- **Disinfection** of premises, equipment, vehicles
- Strategy based on a **cost-benefit analysis**
- Some sort of **stamping out** strategy
- **Compensation** in place

EFSA STATEMENT ON LSD 31 JULY 2016 (vaccination effectiveness 75%)

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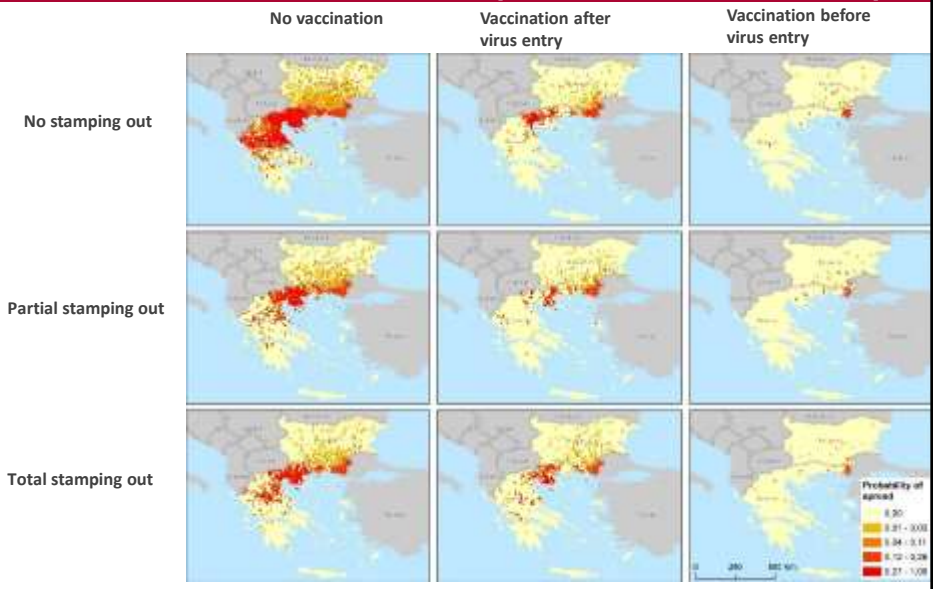

Vaccine

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- LSDV containing vaccines:
  - LSDV Neethling strain by Onderstepoort Biological Products (OBP)
  - Attenuated LSDV field strain Lumpyvac by MSD Animal Health
- Sheeppox virus (SPPV) vaccines against LSDV:
  - Yugoslavian RM65 SPPV vaccine (at a 10 times stronger dose than used for sheep) is commonly used for cattle in the Middle East
  - Romanian SPPV vaccine for cattle in Egypt
  - Bakirköy SPPV (3 times sheep dose) used in cattle in Turkey
- Gorgan goatpox vaccine (Lumpyshield, Jovac, Jordan) has been demonstrated to provide good protection against LSDV
- Confusing exception: Kenyan SGPV O-240 and 180 strains are used for cattle in some African countries - despite the name these strains are LSDV

Vaccine

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- **No DIVA** vaccines available (Differentiating Infected from Vaccinated Animals)
- **Regional vaccination** preferred over ring-vaccination (radius > 50 km diameter)
- **Annual vaccinations** with **>80% vaccination coverage** (all animals)
  - All animals are vaccinated, including pregnant females and young calves
- **Local reaction** at the vaccination site should be accepted
- Attenuated LSDV vaccines cause a general reaction in a minority of vaccinated animals ??? (**Neethling disease**)
- Attenuated SPPV and GTPV vaccines only rarely cause adverse reactions

Post vaccination clinical sings - why?

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- Herd was already incubating the disease when vaccinated
- Development of protection takes ~ three weeks during which time animals still may get infected by the field virus
- Insufficient vaccination coverage –pockets with unvaccinated animals left within vaccinated zones
- "Missing" some animals during mass vaccination, particularly with free-ranging beef cattle
- Failure of the vaccine virus to protect or over-attenuated vaccine:
  - Inappropriate storage / Failure of the cold-chain
  - Exposure to direct sunlight
- Poorly administrated vaccine or incorrect dosage
- Interfering maternal antibodies in calves less than three to four months of age
- Needles not changed between animals - contaminated needles or diluents

Knowledge gaps

- Transmission of LSDV
  - biological LSDV transmission by vectors ?
  - role of different European arthropod species ?
  - importance of direct contact between animals ?
  - ingestion of contaminated milk, water or feed ?
- Potential transmission routes for live virus from animal products to live naïve hosts?
- Immune response of cattle to LSDV infection?
- Which are the best vaccines on the market?
- How long is the immunity after vaccination?

Acknowledgements:

-Tsviatko Alexandrov, Bulgarian Food Safety Agency (BFSA)

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Thanks for your attention