Swiss Re

Closing the insurance gap for livestock

Too many farms are not protected enough against catastrophic losses like an outbreak of an epidemic disease.

If underwriters can close this gap with commercially viable solutions, livestock insurance will have a bright future.

Abbreviations

AI	Avian influenza
ASF	African swine fever
BI	Business interruption
CSF	Classical swine fever
FAO	Food and Agriculture Organisation of the United Nations
FMD	Foot-and-mouth disease
HPAI	Highly pathogenic avian influenza
LPAI	Low pathogenic avian influenza
MPL	Maximum possible loss
OIE	Office international des épizooties (World Organisation for Animal Health)
PRRS	Porcine reproductive and respiratory syndrome

Introduction

Every few years, epidemic disease outbreaks cause death and destruction to millions of cows, pigs or other livestock. Besides harming animals, such outbreaks are also a financial disaster for the farmers – unless these have adequate insurance to help them recover and stay in business.

What makes epidemics a particularly pressing issue is that there is still a large protection gap, with too many farms ill-prepared to withstand losses in case of an outbreak.

That is true for many smallholders around the globe for whom the loss of one animal is catastrophic. It is also the case for large intensive farms that face financial difficulties after an epidemic outbreak, whether due to the need to restock or to bridge business interruption losses until the outbreak is controlled and the standstill is lifted (see page 4).

In today's intensive, specialised and ever-larger commercial livestock production, farmers are less concerned about losing individual animals than about protecting the capital invested and the farm income. Both are jeopardised mainly by the residual risk of epidemic outbreaks, with its huge loss potential despite up-to-date risk prevention. A mitigating factor is risk prevention on-farm, including biosecurity, a prerequisite for livestock business interruption (BI) covers.

Even when a fund or the government pays for the direct loss of animals, there is a growing need to cover the consequential losses of an epidemic outbreak until a farm is fully restocked. When insuring epidemics, therefore, underwriters need a solid understanding of governments' disaster response, which in turn must be transparent and consistent to allow for the calculation of an adequate exposure scenario and ultimately a fair premium rate.

Government subsidies can be an important driver to improve insurance uptake, especially if they stimulate the private insurance sector to bridge the true gap between government compensation (if any) and actual losses.

Livestock programmes available today are often rather limited in scope. Yet livestock insurance is sure to have a bright future if underwriters can craft commercially viable solutions to meet farmers' needs, chief among which is protection against the catastrophic risk from epidemic diseases and their consequences.

This brochure discusses livestock mortality insurance with a special emphasis on losses due to epidemics, and includes an analysis of four selected markets.

Recent outbreaks of livestock epidemics

Avian influenza in the US, 2015

Avian influenza (AI) is an infectious viral disease that can affect both wild birds and domestic poultry. **Highly pathogenic avian influenza (HPAI)** causes high mortality. A vaccine is available but used only for eradicating an outbreak. With some types of AI, transmission to humans is possible but highly unlikely except in close contact with infected animals.

During the outbreak

48 million

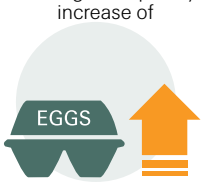
chicken, turkeys and other birds were culled, including 10% of all layer hens

with total costs of

USD 3.3bn

incl USD 1.6bn in lost birds

causing a temporary increase of



+80%

in egg prices

and a temporary drop of

–14%

in exports

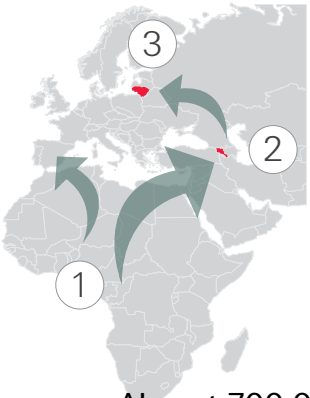
caused by

40

countries placing total bans on US poultry imports

African swine fever in Eastern Europe since 2007

Classical and African swine fever (CSF, ASF) are highly contagious viral diseases with high mortality in young pigs. They also have the greatest economic impact of all pig diseases. European wild boars are identified as carriers in Europe, where outbreaks occurred recently. A vaccine is available against CSF, but not against ASF.



1. ASF exists in most Sub-Saharan African countries, including Madagascar. In 1957 it spread to Portugal and Spain, where it was eradicated in the early 1990s, but persists in Sardinia's wild boar population.
2. Outside Africa, ASF resurfaced in Georgia in 2007.
3. ASF spread rapidly throughout the Caucasus, devastating many pig farms, and soon reached the EU borders. The first and to-date only outbreak within the EU occurred in 2014 in Lithuania. Today, ASF is considered a significant threat to the swine industry across Europe and beyond.

Almost 700 000 pigs lost to ASF in Russia and Ukraine from 2008 to 2015

Food-and-mouth disease in Europe, 2001

Foot-and-mouth disease (FMD) is a highly contagious viral disease affecting hoofed animals (including cattle, swine, sheep, deer, camel), and elephants. Mortality is generally low, but a permanent reduction in output (milk, meat, etc) causes high losses. A vaccine is available for controlling/eradicating an outbreak.

The outbreak started in spring 2001 and spread over large parts of the UK

12 million

cattle, calves, sheep and lambs were culled

With costs of over

USD 5 billion

each to the agricultural and the non-agricultural sector

It then spread to a few areas in Ireland, the Netherlands and France, where

400 000

cattle and sheep were culled

With FMD last seen 34 years prior in the UK and farming there experiencing financial hardship, only some

10%

of farmers were insured against business interruption

Livestock market

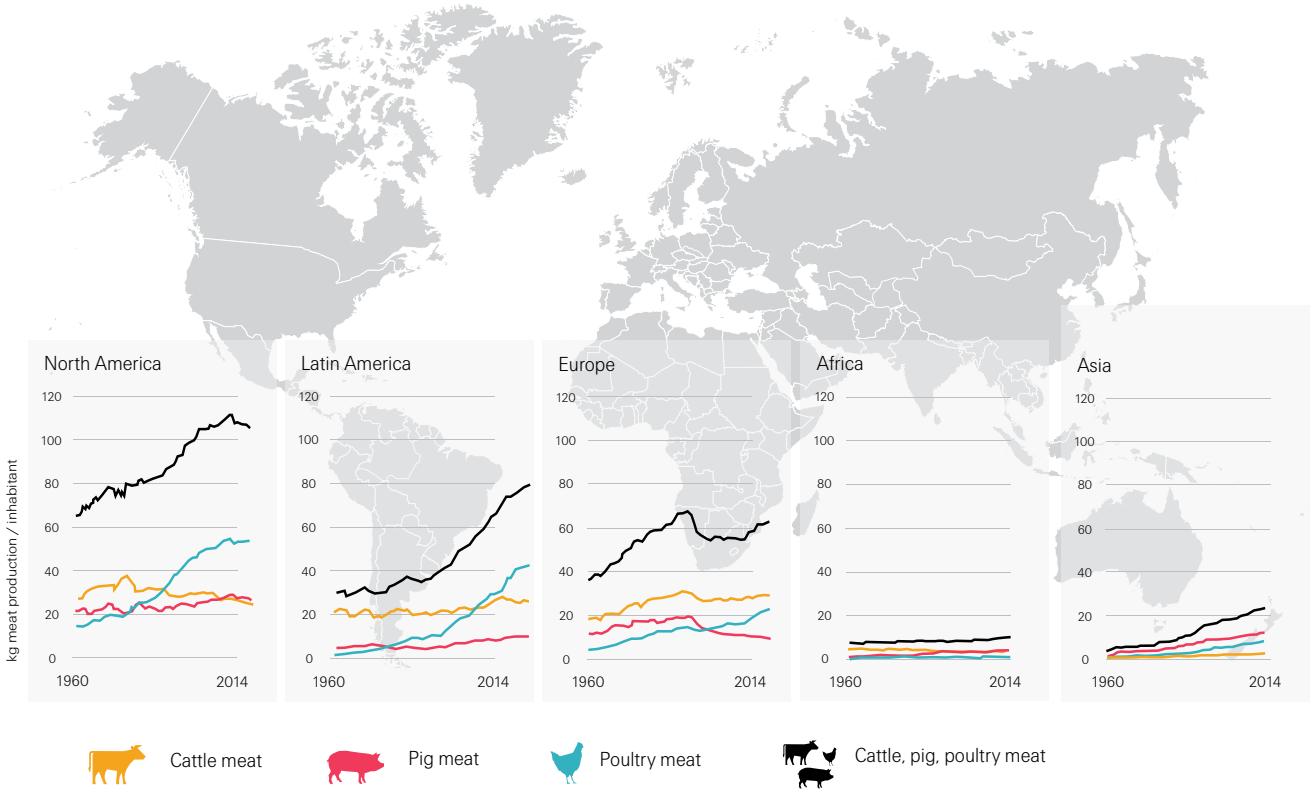
While crops remain the most important food source for human consumption, the world food economy is increasingly driven by the shift of diets towards animal-based products such as meat, milk, dairy and eggs. As a result, livestock production worldwide is growing at a significant pace.

The largest increases have been in emerging economies, where consumption levels per capita are still relatively low. With increasing wealth and purchasing power, consumers give meat a more prominent role in their diet. In Asia, total meat production increased almost twelvefold within the last 50 years, and per-capita consumption rose by a factor of close to five. In mature markets, meanwhile, consumption per capita was up only marginally and often shifted towards poultry and pork.

Globally, livestock is the largest user of agricultural land, using vast tracts of grazing land but also one-third of total arable land. Therefore, livestock production also has a significant impact on the environment and may compete with food crop production in some areas.

Livestock farming today contributes 40% of the global value of agricultural output. The dominant livestock types are cattle (meat and milk), pig (meat) and poultry (meat and eggs).

Meat production per capita



Source: FAO.org/faostat

Overview and trends

The surging demand for animal-based foods has been met mainly through commercial livestock production and associated food chains, supported by major technological innovations and structural changes in the sector.

Although subsistence livestock farming still predominates in much of the world, trends favour larger, specialised and more intensive operations with a high need for investment capital. The larger the farms, the fewer but larger and less diversified their production units. They no longer produce their own feed and so depend on bought-in forage and concentrated feed.

Commercial farms become more and more part of a production chain where each operation is integrated in a timed and predefined production phase between parent stock and the final product, be it meat or eggs.

While farms that grow their own feed may keep a few thousand heads, some production units today have hundreds of thousands of pigs or hens. At the same time, the livestock sector is highly regulated through legislation on environmental protection, animal welfare and biosafety to protect public health and prevent epidemic outbreaks. Further challenges include increasing retail business requirements and changing consumer behaviour (requiring certification by specific animal welfare labels, for example).

All these requirements add to costs, offsetting some of the economies of scale and forcing farmers to give yet more priority to productivity improvements and expansion projects. Even so, they find themselves squeezed between high input costs and eroding selling prices, also due to the increasing market power of ever larger and fewer wholesale buyers. The resulting shrinking margins reduce the affordability of insurance.

Risk landscape of livestock farmers

Mortality due to accident and non-contagious diseases remains a constant threat to livestock farming, especially to smallholdings, where the loss of even a single animal means a significant loss of income. Larger farms can absorb single animal losses but fear large losses from accidents like stable fires or failure of ventilation (leading to suffocation) and the consequential BI. Farms with high-bred animals fear the reduction of income due to loss of certification, eg as a specific-pathogen-free (SPF) pig breeder, and the cost of sanitising the herd and regaining the label.

By far the largest exposure of farmers, however, is their vulnerability to outbreaks of epidemic diseases (which have to be notified to the veterinary authorities). The worst kind, FMD, CSF and AI, can devastate livestock production in whole regions and are extremely expensive to eradicate.

In regions where contagious diseases are common (endemic) and control is limited, they can spread rapidly and inflict enormous losses, in terms of fatalities and worse in terms of reduced productivity of weakened livestock. For example, the chance of a cow contracting FMD is about 2.4% in India, with a 95% chance of survival, whereby the loss of milk makes up for half of the economic loss, followed by weight loss, treatment costs and loss of work power. Ultimately, cattle loses 20–90% of its value following an FMD infection (International Federation for Animal Health (IFAH) report Oxford Analytica, 2012).

Due to a set of interrelated factors – ever-expanding production; more movement of animals, feed and animal products; longer production chains and the growing mobility of people – an epizootic disease outbreak is more likely to spread today, either by direct contact between animals or through carriers (vectors) like contaminated food, birds, rodents or insects. Climate change also brings diseases to areas where they never survived before. Bluetongue, for example, gained a foothold in Central Europe when winters there became mild enough for the insect carrying the disease.

On a positive note, the trend for larger farms with better biosecurity is mitigating the risk of an epidemic spreading. Faster diagnostics, better traceability of animal transports and veterinary authorities with improved contingency plans reduce the risk further.

Given the massive costs of an epidemic outbreak – recent conservative estimates put global FMD costs in the region of USD 5 billion annually in production losses and vaccination spending alone – scientists see tremendous incentives for countries to initiate control programmes. This is particularly the case where there is the potential to export livestock and where livestock is held in easily managed, intensive production systems (IFAH, 2012).

Livestock insurance

While long established, classic livestock mortality insurance has a rather low penetration rate overall and remains untapped altogether in many parts of the world (see map below). However, there are trends that suggest this is changing. Much like with with crop cover, countries are starting to promote livestock insurance by subsidising premium. Here, China is at the forefront.

Livestock insurance, mainly in the form of BI, is also gaining favour the more specialised farmers come to depend on borrowed capital that requires collateralisation. Losses due to epidemic diseases, while the biggest threat, are often the least insured.

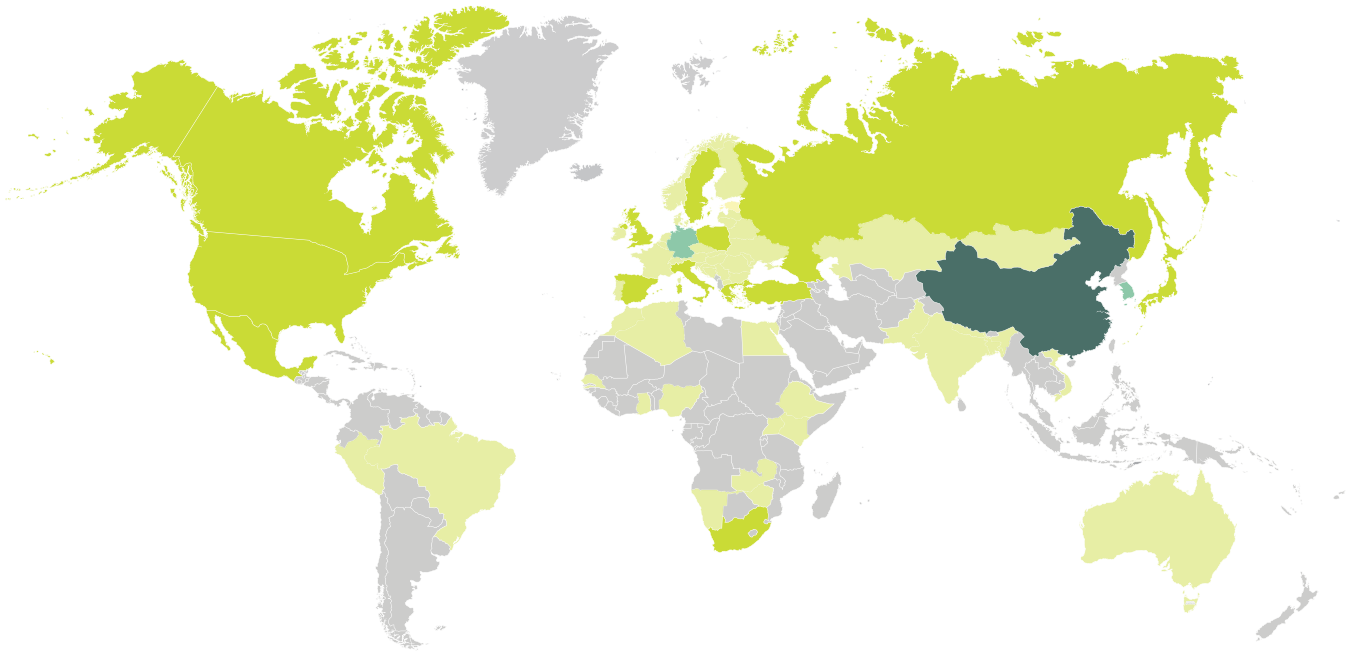
In more mature markets, typically, farmers with animals lost or culled by government order are indemnified for as much as the market value of the animals. Payment may come from a compulsory livestock epidemic fund financed with insurance levies from livestock holders and/or government contributions, or directly from the government budget. Under this model, farmers affected by stamping-out orders (mandatory slaughtering of animals) can turn to private insurers to cover the difference (if any) between the government payout and the market value and/or BI costs.

In an epidemic outbreak, the vast majority of farmers sustain significant losses due to standstill, without any animal culled. Prohibited from having any transport to and from the farm until the veterinary authorities lift the ban, they cannot market milk, eggs or livestock, while their feeding costs remain the same and their animals end up overage and unmarketable. The need for such BI cover is proven by the stunningly high insurance penetration rate of 30–40% in Germany. In short, a large protection gap remains where livestock BI risk is concerned.

It is true that insurance uptake spikes after large events, only to drop again after a certain time (or, as an underwriter said, "the return period is longer than farmers' memory").

Farmers also have to contend with market risk, where feed costs more when in short supply, perhaps due to a drought, and/or livestock fetches less due to oversupply.

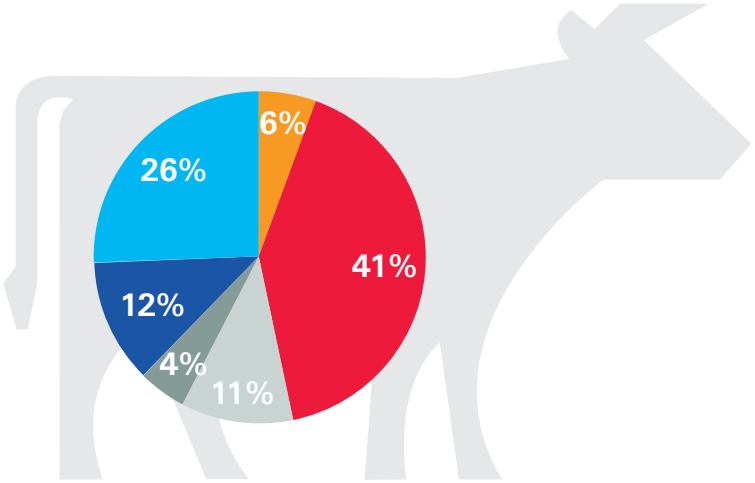
Livestock insurance premium worldwide, 2015



Source: Swiss Re estimates

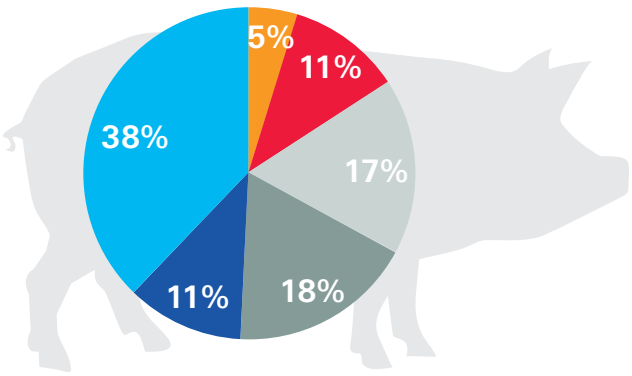
Loss causes of livestock insurance in Germany

Share of payout 1993 to 2015 by a leading livestock insurance company



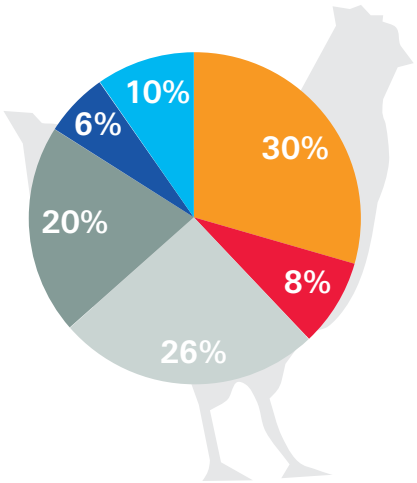
Cattle

- Accidents
- Notifiable diseases
- Respiration
- Digestion
- Other
- Mastitis



Swine

- Accidents
- Notifiable diseases
- Respiration
- Digestion
- Other
- Porcine reproductive and respiratory syndrome (PRRS)



Poultry

- Accidents
- Notifiable diseases
- Respiration
- Digestion
- Other
- Blackhead

Source: Vereinigte Tierversicherungsgesellschaft

Insuring livestock

Type of coverage

As the loss of even one animal is financially painful for them, smallholders typically look for polices covering single animals, with a deductible per animal. By contrast, larger farmers are more interested in herd insurance, which only indemnifies them for losses involving a sizeable number of animals on their premises and helps them protect their farm income.

Further covers are available for mortality during transport, auctions and expositions, mortality of zoo animals, and mortality and medical expenses for pets.

Perils covered

Traditional livestock insurance covers mortality due to accident and non-contagious diseases. Generally, this includes fatalities from stable fires, suffocation, natural perils such as flood, and wounded animals that have to be euthanised for humane reasons. Always excluded are natural mortality and animals put down for economic reasons.

Broader policies also cover mortality due to epidemic diseases, when animals are culled on the orders of the veterinary authorities ("stamping-out"), whereupon the owner is indemnified for their value and/or the BI costs.

New innovative policies cover shortage of fodder, typically based on an index on drought or on vegetation greenness measured by satellites.

Pure livestock price covers available in some countries guarantee a minimal price or gross margin. The downside of such covers is the unpredictability of livestock markets in the event of an epidemic outbreak and the immediate export/import bans, especially if authorities overreact and protect their national farmers by banning imports, asserting sanitary reasons.

This brochure focuses on mortality risk, where insurance for accidents, diseases and epidemics can help greatly improve the resilience of livestock farms.

Risk categories

Risk category	Risks
Mortality	■ Accidents and diseases ■ Epidemic diseases ■ Natural mortality, loss of productivity
Weather	■ Shortage of fodder
Markets	■ Livestock prices ■ Input costs
In addition to the risk categories, insurers need to consider	
Country	Local regulatory frameworks on ■ Animal health (disease control) ■ Animal welfare ■ Transport ■ Environmental protection, eg carcass disposal

Direct loss, valuation and indemnity

Livestock policies covering direct losses typically insure the market value of the animal, according to species, type of production and age. However, the sum insured can also be agreed below market value, particularly if no deductible is applied. Direct-loss policies indemnify for the sum insured, net of salvage value and net of any payment from epidemic funds or government in case of epidemic diseases.

The cover may also include follow-up costs, such as costs for carcass removal and cleaning and disinfection of premises, usually with a sublimit.

Business interruption (BI)

Livestock BI insurance protects the farmer from consequential losses due to a large accident or a "stamping-out" period ordered by the veterinary authorities on premises with an epidemic disease outbreak. Besides follow-up costs, livestock BI covers the loss of income or profit, either as verified in the farm's accounting (eg German market) or at agreed fixed amounts per day and by type of production (Italy, Spain), typically representing the fixed costs per stable place or production costs of milk, eggs or meat. (For example, 20% of milk market price × kg milk/cow × number of cows during the insured period.)

Farms falling within a "standstill" zone surrounding infected premises (without a stamping-out) also experience significant economic losses. In German regions with medium-sized farms, farmers are some 70 times more likely to be ordered a standstill than a stamping-out, at about twice the loss amount as animals still have to be fed without the prospect of a product sale.

Such BI due to a standstill can be insured, provided the legal framework and actions taken by the veterinary authorities in an epidemic are transparent and predictable. With few insurers offering livestock BI cover today (eg in Germany, Spain, Italy), it is still a largely untapped market.

Contingent business interruption (CBI)

In areas with an epidemic outbreak, not only livestock farmers but all types of industries can be affected by the movement restrictions and the measures taken. They may sustain CBI losses due to prevention/denial of access, increasingly so if they depend on regular transport (just-in-time production). Farmer suppliers (feed producers) or customers (dairy industry) lose their sale or supply. Egg producers, too, may sustain CBI when the chicken supply from the hatchery is halted.

All those CBI covers are conditional to an official order of movement restrictions from the veterinary authorities. The loss frequency can be assumed to be the same as for an epidemic outbreak.

Rate, deductible and waiting period

Traditional coverage for single-animal mortality due to accident and disease, with a per-animal deductible of 0–20%, typically costs 3–10% of the sum insured. Herd insurance for mortality due to accident or disease, including epidemic diseases, typically has a premium rate ranging from 0.8–5%, depending on risk quality, type of animals, coverage, and deductible (ideally 10–30% of sum insured per site or per total production, with sum insured at market price). Pigs and poultry tend to have higher premium rates than cattle, as their loss incidence is usually higher.

When insuring infectious diseases, it is recommended to stipulate a waiting period, usually 30 to 90 days from inception, to prevent paying losses on already infected herds before these show clinical signs, such as during the incubation period.

Subsidies

As an incentive to farmers to protect themselves from insolvency, and to reduce governmental ad-hoc spending on indemnifying farmers for epidemic outbreaks, some countries include livestock insurance in the premium subsidy scheme they have in place for crop insurance.

Risk management and biosecurity

The success of livestock insurance depends in large part on risk quality, so insurance should be granted only to farmers with sound management standards and on condition that they mitigate the risks as best as can reasonably be expected. Especially on larger farms, solid expertise of farmer and staff is key, as are well-maintained premises with adequate feed, water and waste management. An animal identification system should be in place and records kept on all animals, their health care (vaccinations, veterinarian treatments etc) and movements to and within the farm.

When insuring for infectious diseases, especially in large production units, special attention should be paid to biosecurity – all measures, that is, to keep a herd free of diseases. Key factor and disease vector number one are humans. Therefore, cleanliness and good hygiene are of utmost importance, with strict control and disinfection of all incoming personnel, goods, feed and animals, as well as regular cleaning and sanitation of all premises, including control of vectors like rodents. Still, despite all the in-plant measures, significant residual risks remain – and that is where insurance and reinsurance comes in.

Managing and insuring epidemic diseases

Epidemics – that is, outbreaks of infectious diseases – certainly have the potential to threaten farmers' very livelihoods. But epidemics also cause enormous losses to entire economies and pose an ever-greater risk as livestock production continues expanding, intensive farming gains further ground and transport of animals and animal products spans the globe. Therefore, containing and eradicating epidemics is moving up on governments' agendas – and so is insurance. By its very nature, insuring contagious diseases needs special attention and depends very much on the disease situation in a given area or country.

Animal health frameworks

Best practices to contain and eradicate livestock diseases, including the ones transmissible to humans (zoonoses, eg tuberculosis), are laid out in the OIE's international standards, the Animal Health Codes. These standards also cover international trade, surveillance, vaccination, diagnostic methods, as well as guidelines on animal welfare and on food safety at the level of animal production.

The OIE standards are binding relative to international animal trade (WTO) and provide guidance for national regulations on animal health and procedures to follow in case of epidemic outbreaks across the world. The OIE official disease status is a fairly good indicator of the national state of animal health.

As an example, the European Union's Animal Health Law (2016), explicitly in line with the OIE, is binding for its member countries, which have to transpose it into their national law. It gives detailed guidance on how to proceed in the event of an epidemic outbreak to recover the status of "disease-free without vaccination".

World Organisation for Animal Health (OIE) and epidemics

The OIE (Office International des Epizooties, www.oie.int), headquartered in Paris, is an intergovernmental organisation of 180 member countries. Part of its mission is to guarantee the transparency of animal disease statuses worldwide, and to ensure the sanitary safety of world trade by developing sanitary rules for international trade in animals and animal products. OIE standards are recognised by the WTO as reference international sanitary rules, and are typically adopted by national veterinary laws.

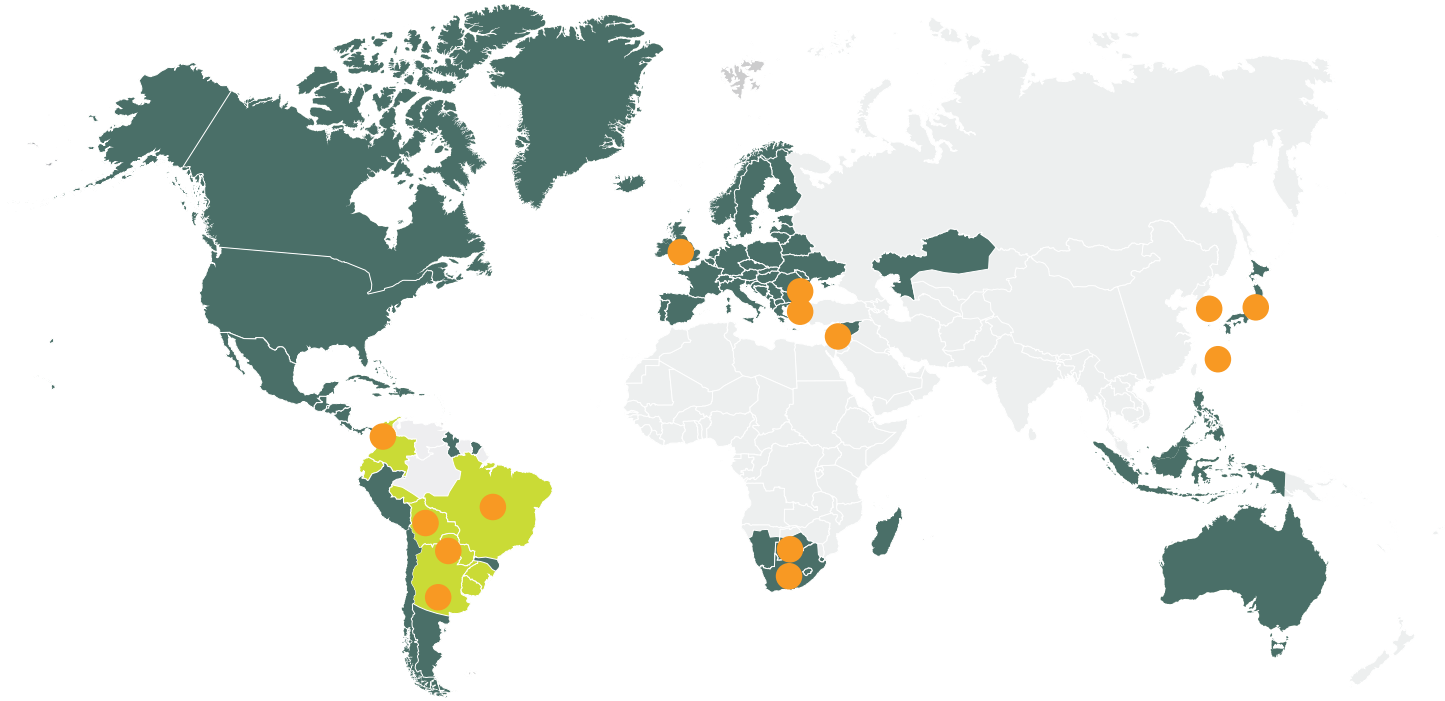
While OIE and WTO today use a single list of diseases, national veterinary regulations typically still discern two types of "notifiable diseases" (the OIE classification until 2004):

- Highly transmissible diseases with a very serious and rapid spread, wide-ranging socio-economic or public health consequences and a major impact on international trade in animals and animal products. Typically 15 diseases, eg FMD, CSF and AI.
- Transmissible diseases considered to be of socio-economic and/or public health importance within countries and significant in the international trade of animals and animal products. Classification ranges from cattle to aquatic diseases.

The OIE recognises the following official statuses for countries or zones within a country (so far defined for FMD and six other diseases):

- Disease-free without vaccination (FMD: 65 countries and 10 countries with "free zones" in 2016)
- Disease-free with vaccination (FMD: 1 country and 4 countries with "free zones" in 2016)
- Without an OIE official status: disease either endemic (with limited or no control) or absent (but with no effective monitoring); countries did not request to have their status verified.

OIE official FMD status and outbreaks in FMD-free countries and zones



Member countries/zones recognised as free from FMD without vaccination

Member countries/zones recognised as free from FMD with vaccination

Countries/zones without an OIE official status for FMD

Countries with outbreaks in FMD-free zones Jan. 2005 - Jan. 2016

Source: Map with FMD status (May 2015) from www.OIE.int, adapted by Knight-Jones 2016.

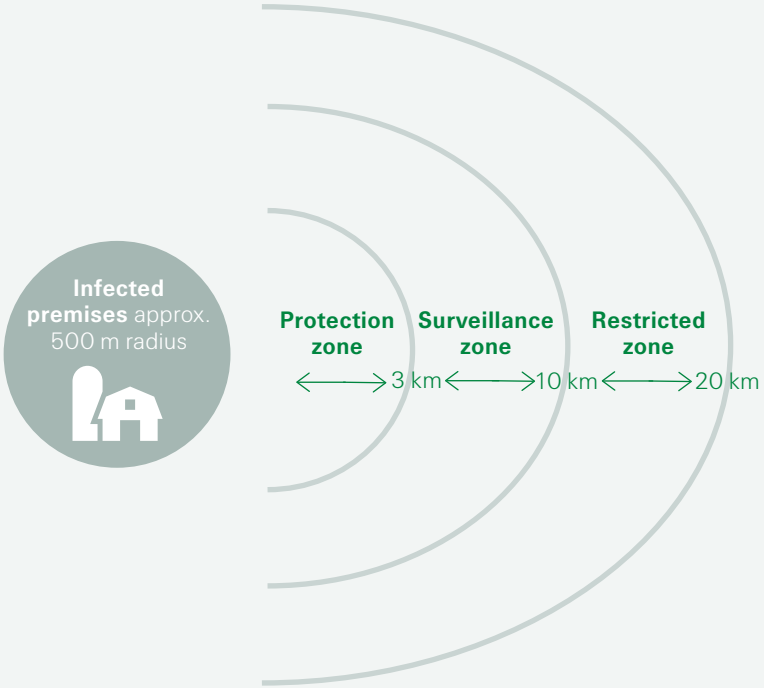
Measurements in quarantine areas around an epidemic outbreak

Infected zone (approx. 500m radius) with infected premises ("outbreak") and epidemiologically linked production units: "stamping-out", all stock destroyed (culled, slaughtered) as quickly as possible and premises disinfected.

Protection/buffer/containment zone (approx. 3-km outer radius): "standstill". No movement of animals. Cull or emergency vaccination on suspicious premises. Veterinary checks. Movement restrictions on population.

Surveillance zone (approx. 10-km radius): movement of animals within the surveillance zone permitted only under licence and directly to slaughter at an approved slaughterhouse within the surveillance zone. Movement restrictions on population.

Restricted zone (approx. 20-km radius): used in European Union when several outbreaks occur within the same area. Animal movements out of infected area allowed only under licence.



Adapted from: OIE Terrestrial Animal Health Code 2016, EU Animal Health Law (2016), and US Department of Agriculture Animal Health Emergency Management; terminology for the various quarantine or control zones may vary.

Three disease situations

Essentially three disease situations can be differentiated, in line with the OIE official statuses (see page 15), whereby evolvement and consequences vary depending on the disease situation in a given zone or country.

Disease-free without vaccination

A livestock population completely "disease-free without vaccination" is usually achieved through intensive eradication programmes involving mass vaccination, as carried out in Western Europe from 1950 to 1992 to eradicate FMD. In such zones or countries, any highly contagious disease resurging sporadically will spread very rapidly and inflict serious losses, as the animals have no immunity at all.

Accordingly, swift and decisive action by the veterinary authorities will be needed to contain and eradicate such a disease again, usually involving forced slaughtering of all diseased and potentially infected animals, a so-called "stamping-out", and so recover the disease-free status (see Measurements in quarantine areas around an epidemic outbreak, page 16). Permanent preparedness and measures for early detection and control are further musts.

Such events are typically low-frequency but high-impact, with steep economic losses in the short term due to eradication work, culling of animals, BI, decline in sales due to international trade bans or consumer concerns over food safety, and possible effects on public health.

This strong public involvement in the livestock sector is mainly the strategy of wealthier countries (such as OECD member states), where the veterinary authorities bear the cost for depopulation, carcass disposal, cleaning, disinfection and diagnostics. Farmers tend to be indemnified for the value of animals lost through government action, either from the government budget or funds financed by the government and/or a levy on all farmers' livestock.

In this type of framework, private insurers offer mainly BI cover for consequential losses of a "stamping-out" and a "standstill". Clear rules under the national animal health framework and transparent procedures on the part of the veterinary authorities are a precondition and essential for a sound underwriting assessment, especially with regard to the likely severity of loss scenarios.

In endemic zones, by contrast, the infectious disease is present in the livestock population, either in visible or subclinical form, and the risk and size of an outbreak depends on whether there is a systematic containment strategy ("disease-free with vaccination") or not (endemic).

Disease-free with vaccination

In such areas, systematic vaccination programmes immunise the livestock and prevent further outbreaks. Yet circulation of the pathogen cannot be excluded altogether. As mass vaccination is costly and also implies certain trade restrictions, the target is to thin out the pathogen, over decades, until extinction is achieved and with it, the status of "disease-free without vaccination". As long as the pathogen subsists, however, flaws in the vaccination programme may lead to a reappearance and another outbreak – either because the vaccine is not applied consistently and frequently enough or is already inactive, or because a new strain or serotype emerges and renders the vaccine ineffective.

Under such circumstances, disease outbreaks may be quite frequent, but tend to be less severe and spread over a limited area.

Endemic

In many areas, livestock coexists with endemic epizootics, there being only limited surveillance and control activities in place, with merely sporadic containment measures like vaccination and movement restrictions in case of an outbreak. In such endemic regions, periodic losses of animals and animals with reduced productivity, post-disease, inflict permanent and significant losses in income and productivity. This is a situation often encountered in poorer countries, where the lack of a clear control framework means that losses due to an epidemic outbreak are a challenge to insure.

Insurance calculations in zones "disease-free without vaccination"

Exposure-based pricing

As mentioned, outbreaks in "disease-free zones without vaccination" sporadically cause very serious losses. Insurers therefore should pay special attention to such events and consider them for so-called exposure-based pricing, which is a best estimate of the frequency and severity of worst-case scenarios. The annualised costs of a worst case are then added to the experienced loss history, with due consideration given to whether the insured book sustained such a large loss previously – which should rarely be the case, as the return periods of epidemics are rather long compared to the generally recent history of livestock insurance.

When insuring epidemic diseases, enough data are usually available at a farm level and also scientific data on the diseases themselves. Yet regional and national historic outbreak data are often rather scarce or very generic, and expert opinions and scientific research on frequency and epidemiology of the disease in a specific area tend to be limited or disparate. In addition, models for the spread of epidemics rely on many factors and are more complex than other natural catastrophe models, including those for storm and flood.

However, there are some basic criteria for a pragmatic approach to assessing a maximum possible loss (MPL) and its frequency:

- Countries "free of disease without vaccination" typically have a clear regulatory framework, with contingency plans, and veterinary authorities with enough operative infrastructure on hand – all of which are prerequisites for insuring epidemics.

When appraising historical outbreaks, a number of improving factors should also be considered:

- As farms have become fewer and larger, with fewer backyard holders, the overview has become easier.
- With tighter requirements to tag cattle and register animals and transports, tracing-back is much quicker in case of an outbreak.
- Diagnostics, too, have improved, allowing for quicker proof of pathogens and more preventive screening.
- The level of preparedness of veterinary authorities has improved, especially in countries with recent large events (eg in Western Europe), with contingency plans and stand-by equipment for culling and rendering carcasses.

Nevertheless, it is important to consider that outbreaks can develop very differently. Variables include the clarity of the symptoms (clear FMD symptoms in pigs versus almost none in sheep), the time lag between primary infection and discovery (a crucial factor being non-retaliation against farmers reporting a discovery), farm sizes and density, number of transports, and the veterinary authorities' decisiveness and preparedness for action.

Severity

When assessing the severity of a worst-case outbreak, an MPL, the first step is to define the area and amount of the largest exposure of the insured book, usually where livestock density is highest in the area covered. Second, an assumption needs to be made about the share of farms possibly affected by stamp-outs and standstills in that peak area. The third step is to assume the average payout per policy as a percentage of the maximum payout (say, a policy covers BI for nine months but assumptions are that farms are restocked after only five months).

The severity of an occurrence is certainly high in cases of catastrophic epidemics with extensive measures needed (protection and surveillance zones) due to:

- high virulence (eg FMD, which affects multiple species and is airborne),
- high mortality (eg AI),
- low biosecurity standards (eg many backyard and smallholdings), or
- delayed restocking (chicken may be restocked after three weeks, but a shortage of pullet may mean a loss period of several months).

As a cost-saving measure, ring vaccination – which involves creating a buffer zone with immune animals around an outbreak to keep a disease from spreading – may be an option if the livestock is then approved for slaughter.

Then again, severity is fairly low in single events not escalating into major epidemics if the veterinary authorities take resolute, quick and efficient action. An example of this is the immediate extinction of small CSF and LPAI or HPAI (low or highly pathogenic AI) outbreaks in Germany, which are relatively frequent due to the dense population of wild boars and birds as carriers (see page 20).

Smaller outbreaks are such which can be extinguished at their earliest stage locally by stamping out a few interconnected farms, without any need for major zoning (protection and surveillance zones). Affecting mainly mid-sized farms, such outbreaks typically incur total costs up to single-digit millions of US dollars.

Large outbreaks at MPL level, in disease-free areas without vaccination for major epidemics, are defined as such which spread out and are conveyed to other zones, states or even countries, with much stamping-out of livestock and extensive standstill zoning before the authorities are able to extinguish the disease. Just to mention an order of magnitude, such outbreaks may incur total costs in the hundreds of millions or even billions of US dollars.

Frequency of a large event

In a next step, the frequency of such an MPL has to be assessed.

Frequency will certainly be rather high if the pathogen is already present in the area's wild population, like CSF in Central Europe's wild boars or AI in wild birds in Europe and North America. Conversely, it will be fairly low if the pathogen has to be "imported" first, as is the case with FMD in Europe, North America and Australia, or if the pathogen is "before the gates", such as ASF whose advance was successfully halted at the EU border. Furthermore, an outbreak in a large country is more likely than in a small and isolated one or even on a single farm.

For Western Europe, with veterinary services at the ready and contingency plans in place, large outbreaks at MPL level can be assumed to have return periods (=1/frequency) in the order of 40 to 50 years. Smaller outbreaks, with just a few farms infected, are assumed in current scenarios to have return periods in the order of 20 years for diseases "to be imported", like FMD and ASF, and just two to ten years for diseases present in wild animals, like AI and CSF. However, these are merely rules of thumb for countries whose recognised status is "disease-free without vaccination", and actual return periods may vary substantially for other areas with different livestock size, density and health status.

In a last step, the severity is multiplied by the frequency to give us the annualised loss burden to be expected from an MPL loss per the assumptions above.

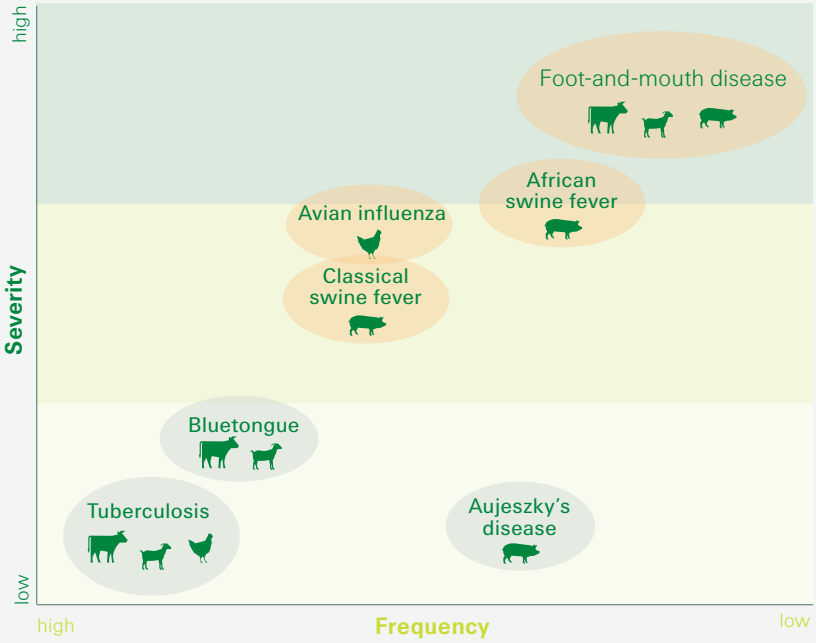
Insurance of epidemic diseases in other zones

For countries whose OIE status is other than "disease-free without vaccination", the situation has to be analysed case-by-case before contagious disease risks can be underwritten.

In addition to the countries and zones with OIE status recognition as "disease-free with vaccination", there are others that use mass vaccination systematically against certain diseases, such as China.

In other areas only selected livestock populations are vaccinated, generally high-yield breeds on large farms. If vaccination is handled professionally and accurately, then the epidemics they are meant to prevent can be insured against. In fact, the insurance will cover the risk of an inaccurate vaccination or a breakthrough infection, that is, if there is a new disease strain and the current vaccine is no longer effective, both of which are manageable risks if duly monitored by the veterinary authorities.

Relevance of some epidemics



Relevance of some epidemics for countries "disease-free without vaccination"

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A. Ziegler, Vereinigte Tierversicherungs-gesellschaft

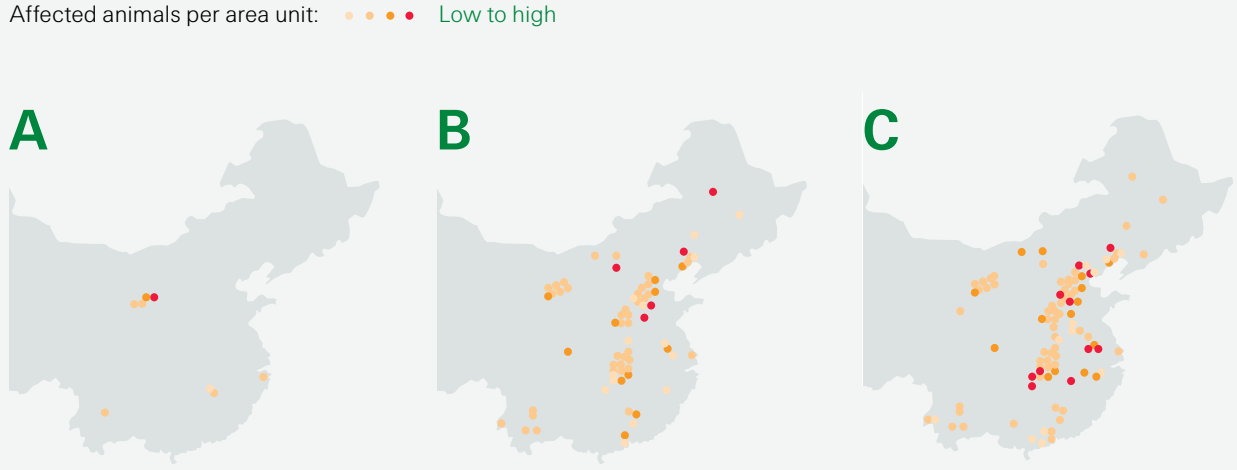
Modelling epidemic disease outbreaks in livestock

Modelling infectious diseases helps to understand and predict the dynamics of a disease by developing scenarios in a current or future setting. It facilitates decisions about managing a disease before, during, and after an outbreak. Depending on the requirements for the model and the available knowledge about the disease, several criteria are adapted and integrated:

- Information about the disease: type of pathogen (bacteria, virus, parasite), mode of transmission (airborne, vector-borne, seasonal etc) as well as transmission and recovery rate. The latter for example is influenced by the availability of antibiotics, vaccines etc.
- Information about the affected population: disease, age structure of the population, mortality and morbidity in response to the disease as well as changes in behaviour in response to the disease. Interspecies dynamics if the disease affects more than one species.
- Changes in behaviour over time and space: seasonal changes, migration and livestock transport form an evolving network of transmission routes. Especially during an outbreak, this network is expected to change due to actions like a stamping-out, standstill, or emergency vaccination.

Therefore, modelling epidemics in livestock is complex and simplifications need to be made whenever possible. Additionally, the influence of decisions by people make the nature of a disease model fundamentally different from a purely physical model, like a hurricane model.

Modelled scenario of an avian influenza outbreak in China
Evolution over one year



Source: Spatiotemporal epidemiological modeller (STEM) tool.

Underwriting considerations for insuring livestock

Insurance

For livestock insurers, the following technical considerations are essential when insuring for epidemic diseases:

- Risk quality: the first steps in any risk management scenario are risk avoidance, prevention and reduction. Therefore, sound husbandry practice is key, with adequate stabling, an animal identification and tracking system, good veterinary health care (eg vaccination) and qualified personnel. Special attention should be paid to robust biosecurity. It is sound practice to check risk quality with specific questionnaires and, on larger farms, with a risk report prior to insurance. Promising candidates for a positive risk assessment will be isolated farms, with experienced, longstanding staff, state-of-the-art infrastructure, an animal register and good health indicators for herds.

- Legal framework and veterinary system: the measures taken by the authorities need to be transparent, consistent and familiar to the underwriter. Ideally, the country's official OIE status will be "disease-free". If not, the government should have a clear plan and target for reaching disease-free status, typically through zoning (disease free vs not yet free) and systematic vaccination. To guarantee an efficient control of outbreaks, the national regulator should define clear procedures and roles. The veterinary authorities should be empowered to take action and be adequately staffed and trained, with emergency/contingency plans at hand and sufficient capacity to test and destroy infected animals and to disinfect premises. Farmers reporting an outbreak should receive a payout for animals lost rather than a penalty. See for example the OIE's Performance of Veterinary Services (PVS) counselling, or the FAO's Good Emergency Management Practice.

- Exposure: the critical diseases in epidemic covers are FMD for pigs, cattle, sheep and goats; CSF and ASF for pigs; and AI for poultry. Other diseases tend to be of minor importance at this time.

- Accumulation: areas with high livestock density require special attention. These areas may cause considerable accumulation problems for insurers and reinsurers alike. Exposure tracking with geo-referenced farms would be ideal.

- Pricing: the main criteria for this type of catastrophe insurance are accumulation considerations and long-term aspects like severity and frequency of events. Due to sometimes long return periods, rates tend to come under pressure after a series of loss-free years, improving only following a major event.

- Risk of change: a change in the animal health status of the country or a change in the containment policy should be assessed on its improving or impairing effect.

- Diversification: epidemic covers diversify the agriculture insurance portfolio, as there is no correlation between the main epidemics and perils covered by crop insurance (eg hail, drought).

Reinsurance

For reinsurance, the following underwriting provisions are important, among others, to facilitate the calculation of an adequate exposure scenario:

- The actions of the veterinary authorities in case of an outbreak should be transparent and consistent to facilitate the calculation of an adequate exposure scenario.
- The geographical spread of the portfolio is known and communicated to the reinsurer.
- A risk accumulation monitoring system is in place and ensures a sound accumulation check.
- Limits of sums insured or MPL per defined area are established.
- The "event" in an excess of loss (XoL) cover has to be clearly defined. As outbreaks may last longer than three months (the standard definition), alternatives may be considered, such as introducing an annual aggregate limit (AAL), or defining the entire official outbreak duration as the event.

United States

Livestock gross production value in USD billions*

106

1%

Insurance penetration (Swiss Re estimate)

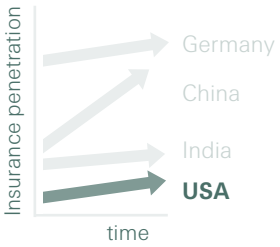
Cattle and buffaloes

Sheep and goats

Pigs

Poultry

Market outlook



1 symbol = USD 10 billion*

1 symbol = 10 million animals*

1 symbol = 100 million poultry*

Insured (Swiss Re estimates)

* FAO 2013/2014

Livestock and market

The livestock sector in the US represents roughly half of the total value of national farming output, or about 1% of GDP. The sector is highly vertically integrated, especially in the poultry meat industry and in pig farming. This means that large integrators own the livestock, while farmers are responsible only for the investment in the barn and then raising, feeding and delivering marketable animals. In recent years, about 70% of pigs, 95% of broilers and 5% of layer hens have been raised under such production contracts.

Control framework for epidemic livestock diseases

There are many government programmes whose aim is to detect, control and eradicate animal diseases. The mission of Veterinary Services is to keep the country free of epidemics, and thus free of export trade restrictions by the WTO, including by ordering depopulation. Costs related to stamping-out are paid by the government. So, too, is compensation to the owners of livestock destroyed, although it covers lost cost only and so is less, generally, than the lost animal market value, and does not include any BI costs.

Large losses – past events

The last FMD outbreak in the US occurred nearly 90 years ago. In hog production, classical swine fever was eliminated almost 40 years ago, after a 16-year eradication programme. Recently, the porcine epidemic diarrhoea (PED) virus swept across the US, wiping out the production of several thousand farms. Eradicating the most recent AI outbreak in 2015 required destroying 48 million birds (see page 4).

Available livestock insurance solutions

Federal livestock insurance programmes entitled to subsidies started in 2000, covering price and revenue losses only. The Livestock Risk Protection Programme (LRP) is designed to insure against declining market prices, whereas the Livestock Gross Margin Programme (LGM) covers any decline in the margin of livestock/milk over feed prices. Most recently, the Whole Farm Revenue Protection Plan (WFRP) was added to protect the revenue of highly diversified farms whose operations include livestock but derive no more than 35% of their expected revenue from animal products. The WFRP, then, is hardly suitable for specialised livestock farmers. Being contract farmers, moreover, the vast majority of pig and poultry meat growers are not entitled to take such covers, as current farm insurance regulations require insurance takers to have an ownership interest in the livestock. Furthermore, current law limits total livestock insurance expenses (most notably subsidies) to only USD 20 million per fiscal year. As a consequence, uptake of these subsidised insurance offerings has been low, covering only about 1% of livestock production (approx. USD 30 million in annual premium). There is no federal insurance programme to cover the loss of income following a natural catastrophe event or a disaster like an epidemic outbreak.

Private livestock insurance is mainly linked to property insurance, covering losses due to natural catastrophe events, accidents, fires or floods, sometimes with small sublimits for losses caused by disease outbreaks. However, private, non-subsidised specific livestock insurance which covers losses due to epidemic diseases too is offered by only a handful of insurers, with a premium volume presumably in the order of a few million US dollars. The fixed operating cost insurance is triggered by a government order to depopulate and covers costs such as mortgage and labour until the farm is restocked, and is also available to contract farmers. Still a largely untapped potential are contingency policies, which cover a drop in gross margin due to direct losses (in excess of government compensation) and BI following an epidemic outbreak, which are serious issues for individual farmers and integrators alike.

In fact, insurance is far less significant in the US today than the Disaster Assistance Programmes permitting farmers to apply for ad-hoc, non-repayable financial support in case of losses from natural disasters like drought and other "calamities". Additionally, in a county declared a disaster area, producers may become eligible for low-interest emergency disaster loans.

Germany

Livestock gross production value in USD billions*

37

40%

Insurance penetration (Swiss Re estimate)

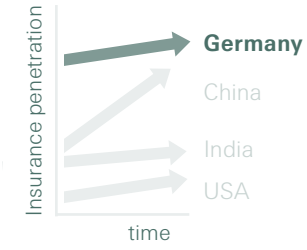
Cattle and buffaloes

Sheep and goats

Pigs

Poultry

Market outlook



Livestock and market

Germany is Europe's leading livestock producer and also the leader in livestock insurance penetration, a ranking achieved without subsidies. Today, some 40% of the livestock value is insured privately for loss of income due to large accidents and epidemic outbreaks. Like all of Western Europe, Germany has OIE/WTO official status recognition as "disease-free without vaccination" for most serious livestock epidemics. Vertical integration with contract production of poultry and pork is on the rise. In this system, which often includes pre-financing, integrators and farmers enter into contracts for supply and delivery, but the farmers own the animals and carry the production risk.

Control framework for epidemic livestock diseases

Germany's regulations follow the binding rules set out by the EU Animal Health Law (2016). Highly transmissible diseases are immediately stamped out. Livestock tagging and movement protocols for single animals and poultry flocks are mandatory for farmers. Livestock destroyed during a stamping-out is compensated for at fair market value from dedicated funds. These funds are run by the country's state governments and financed in equal parts by these and through levies on livestock holders. Interestingly, in Northwest Germany, the region with the highest livestock density, farmers' associations and animal funds formed an entity with the logistics and trained personnel needed to handle the swift and proper destruction of diseased livestock in emergencies.

Large losses – past events

Germany experienced the most recent large-scale epidemics from 1993 to 1995, with 269 outbreaks of CSF causing losses of over EUR 1 billion. Recent outbreaks of minor diseases incurred total costs estimated at less than EUR 100 million per event, among them the bluetongue outbreak in 2008, the Schmallenberg virus in 2011 and the reappearance of bovine tuberculosis in 2013.

Available livestock insurance solutions

Since the mid-1990s, single-animal livestock insurance has been almost completely replaced by loss of income insurance. Available to cattle, pig and poultry farmers, loss of income insurance covers direct losses (mortality of animals) and BI arising from catastrophic events, accidents or diseases, including all highly contagious diseases. This commercial insurance solution covers the drop in gross margins if production is interrupted or products (meat, milk) are not accepted. If a herd has to be destroyed, the insurance will cover any shortfall in paying for cleansing and disinfection and excess costs in rebuilding livestock, less any compensation from a compulsory livestock fund for the destroyed animals. The loss of gross margin is also covered in case of a standstill due to any epidemic outbreak nearby. The indemnity period is up to two years. Premiums are flat amounts, corresponding to about 0.2% of market value for cattle and 1–5% for pigs; for poultry it is in the order of 0.5% of annual turnover.

Compensation can be either the quantified actual loss of profit per animal or a predefined amount per day. While the former is assessed by loss adjusters based on a farm's accounting records, the latter generally amounts to a lump sum paid out immediately upon culling and an additional, predefined percentage for each week the farm stays shut.

Despite the absence of a public subsidy, market penetration is about 70% for broilers and 50% for dairy cows, which proves that the insurance product is effective in meeting farmers' needs. Total livestock premium volume was EUR 147 million in 2015.

India

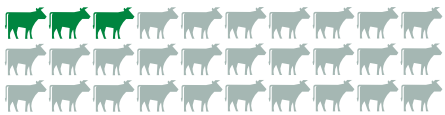
Livestock gross production value in USD billions*

53

8%

Insurance penetration (Swiss Re estimate)

Cattle and buffaloes

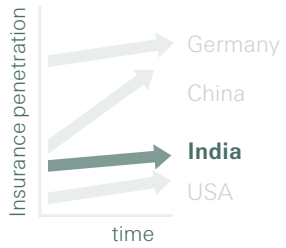


Sheep and goats

Pigs

Poultry

Market outlook



 1 symbol = USD 10 billion*

 1 symbol = 10 million animals*

 1 symbol = 100 million poultry*

 Insured (Swiss Re estimates)

* FAO 2013/2014

Livestock and market

India has the second-largest livestock herd in the world. Roughly 500 million heads of large livestock plus 750 million heads of poultry generate 3.9% of the country's GDP. The bulk is kept by smallholders, with 70 million households owning livestock. As most epidemic diseases are still common and endemic in India, farmers' biggest risks are losses due to diseases, whether in terms of lower productivity or even death of animals. If there is only one animal on a farm, as is often the case in India, the loss is devastating. And yet, just 6% of animals (excluding poultry) were insured in 2011, representing about 8% of total livestock value.

Challenges posed by diseases are often aggravated by the lack of proper nutrition due to scarce grazing lands and highly fluctuating availability of cattle fodder.

Control framework for epidemic livestock diseases

The national government runs various schemes for improvements in the animal husbandry and dairy sector, including assistance to states for control of animal diseases. The aim of the National Disease Control Programme involves the vaccination of all susceptible livestock against major infectious diseases. Due to logistical and financial constraints, however, this remains a promise and infectious diseases are still present, that is, endemic.

Large losses – past events

In a country with many endemic diseases but limited means to control them, it is not the single outbreak which counts but the overall economic loss caused, in terms of dead animals to some extent but mostly as measured in reduced productivity. Studies indicate that the worst economic losses are inflicted by FMD (74%), followed by haemorrhagic septicaemia in cattle and buffaloes (19%). Sporadic outbreaks, too, of PPR (peste des petits ruminants, a highly contagious disease) lead to very significant losses.

Available livestock insurance solutions

Livestock insurance started in the late 1960s but began gaining traction only after the insurance industry was nationalised in 1972. By 2004, a mere 3% of cattle were insured. Deregulation of the private cattle insurance market in 2003 spurred further growth.

Only cattle is insured in significant numbers (9% of cattle). Policies are also available for many other species, including sheep, goats, camels, pigs, working elephants, honeybees and silkworms, but with a very low uptake to date.

The total annual livestock premium of about USD 33 million is mainly generated by public sector insurers, with just 17% written by private insurers. Most livestock insurance is government-sponsored, with subsidies covering about 50% of the premium. The main distribution channels are dairies, banks and microfinance institutions, and subscription is mostly linked to loans.

Given the farming-sector structure in India, policies are mostly for single-animal insurance, with correspondingly small sums insured and high distribution and claims processing costs. Challenges remain with regard to improving some key aspects of livestock insurance, among them the establishment of a safe and standard animal identification system, a solid valuation system to consistently estimate an animal's fair value, and the introduction of consistently risk-adequate premiums to make livestock insurance more attractive to farmers and insurers.

China

Livestock gross production value in USD billions*

412

14%

Insurance penetration (Swiss Re estimate)

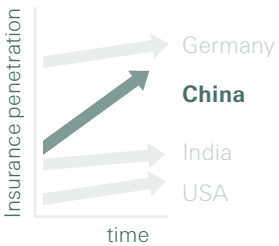
Cattle and buffaloes

Sheep and goats

Pigs

Poultry

Market outlook



Livestock and market

China has the largest livestock herds worldwide, with roughly one billion heads of large livestock and an additional 5.5 billion heads of poultry. It is also home to about half the world's pig population. Accordingly, the challenges regarding animal health and outbreaks of endemic diseases are considerable. However, government efforts have increased, improving animal health through intensified vaccination programmes and protecting farmers from economic hardship by incentivising livestock insurance through premium subsidies.

Control framework for epidemic livestock diseases

The Animal Epidemic Prevention Law was amended in 2015. It enhances animal disease prevention and control programmes that are funded by central and local authorities. The programmes include compulsory mass vaccination free of charge for highly transmissible diseases and compensation for destroyed animals exposed to those diseases. Disposal of diseased carcasses is now strictly regulated and controlled. More professional livestock production with better biosecurity should also be achieved through the current land reform, which favours large-scale cooperative farming and should lead to fewer individual smallholdings.

Large losses – past events

In 2004, an AI epidemic killed some 130 000 heads of poultry, and a further nine million were destroyed to control a total of 49 outbreaks. It was the first epidemic officially reported to the OIE. In 2005, an FMD outbreak spread from west to east in widely dispersed locations, including Hong Kong and suburban Beijing, with fewer than 5 000 animals reported destroyed and emergency vaccination of animals in at-risk areas. Subsequent events, including one in 2013 with 11 000 animals culled, confirmed the importance of the national plan on compulsory vaccination, surveillance and epidemiological investigation. In 2006 and 2007, "blue ear" disease, a new highly virulent strain of PRRS, plagued swine producers, who lost several million pigs, according to industry reports. The subsequent lack of piglets and other factors decimated the pig population by an estimated 9%.

Available livestock insurance solutions

Livestock insurance started in China in 2007 with subsidised insurance of breeding sows and today is also available for fattening pigs, dairy cows, yak and Tibetan sheep. Pilot insurance programmes include insurance for poultry and price covers for pigs. Subsidised policies cover mortality due to accident by natural perils and diseases. On animals destroyed by forced slaughter, the policies pay the difference, if any, between the sum insured and governmental indemnification (usually just 60–80% of market value). On subsidised policies, a typical insurance rate is 5–6% for cattle or pigs, with no deductible but a sum insured well below the market value of the animals.

Premiums are subsidised by 70–80%, with central government contributing 50% to middle and western areas in China and 40% to eastern, financially stronger areas. Provincial and local governments pay the balance.

Many other livestock species, including silkworms, can be insured with non-subsidised, commercial insurance policies. However, even including insurance of large poultry farms, commercial insurance premium volume is marginal compared to subsidised policies.

In 2015, swine made up 60% and dairy cows 23% of aggregate livestock insurance premium. By 2016, insurance premium volume had reached about USD 1.3 billion, with over 150 million heads of larger livestock (excluding poultry) insured, representing some 14% of total livestock value.

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