# A qualitative assessment of the risk of introducing foot and mouth disease into Russia and Europe from Georgia, Armenia and Azerbaijan

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**Summary**
A qualitative risk assessment was performed to evaluate the risk of introducing foot and mouth disease (FMD) virus into Russia and the rest of Europe from the countries of Transcaucasia (Armenia, Azerbaijan and Georgia). The assessment was based on data collected during a three-week mission to these countries by the Food and Agriculture Organization, the European Union and the Office International des Epizooties in March 1999. Due to the strong involvement of the local veterinary services, much information was obtained. Although the data were not sufficient to allow a quantitative risk assessment to be performed, the investigation served as a useful initial approach, prior to undertaking a quantitative risk assessment.
The risk of FMD virus infection is a function of two elements, namely: the probability of the hazard (virus infection) occurring, and the magnitude of the consequences. The probability of the hazard occurring is the product of the probability of entry of the virus and the probability of exposure to the virus. These elements were assessed using the following parameters: prevalence of infection; volume of trade; capacity of the virus to survive; and potential for infection. The magnitude of the consequences is derived from the probability of transmission and spread. Combining these parameters, the probability of occurrence of the hazard was rated as 'moderate'. Economic consequences of potential transmission and spread of FMD, in the local context, were rated as 'negligible'. As a result, the overall risk of introducing FMD virus into Russia and the rest of Europe from Trancaucasia was rated as 'low' at the time of evaluation. The method and results are presented to serve as a basis for further discussion.

**Keywords**
Armenia – Azerbaijan – Foot and mouth disease – Georgia – Qualitative risk analysis – Risk assessment – Transcaucasia.

# Introduction

Foot and mouth disease (FMD) remains a significant health problem in domestic herds of cloven-hoofed animals in many countries. Eradication of the disease in most countries of Europe and the absence of the disease in North and Central America, as well as in certain important territories in the rest of the world, make FMD an undesirable factor for world trade of animals and animal products (2, 5).

In accordance with Council Directive 90/423/EEC, the Members of the European Community ceased routine vaccination of susceptible livestock against FMD in 1991, and such vaccination, as well as imports of vaccinated animals from third countries, have been forbidden since 1 January 1992. Consequently, many other countries of Europe also stopped vaccination against FMD at this time.

The break-up of the Union of Soviet Socialist Republics in 1991 and thereafter, led to the creation of fifteen new countries (twelve of which form the Commonwealth of the Independent States), some of them on the borders of Europe (7). Given the political and economic instability of these countries, special attention and assistance was required from the international community, and in particular from the European Union (EU). The Office International des Epizooties (OIE), and the Food and Agriculture Organization (FAO) have helped several of these countries to develop and reorganise national Veterinary Services.

The 115 outbreaks of FMD reported in the countries of Transcaucasia (Georgia, Armenia and Azerbaijan) since 1992 have caused concern to the immediate neighbours of these countries in Europe, particularly Russia. The decision was thus taken to perform an assessment of the risk of introducing FMD from Transcaucasia to Russia and the rest of Europe. For this purpose, a joint FAO/EU/OIE mission, composed of four experts, visited the countries concerned in March 1999. The mission was very well received by the local Veterinary Authorities, and was hence able to gather first-hand information which was indispensable to the analysis. However, the information gathered was insufficient to produce a quantitative risk assessment. The authors therefore present a qualitative assessment of the risk of introducing FMD from Georgia, Armenia and Azerbaijan into Russia and the rest of Europe, based on the data available in 1999.

# Methods

The method used to conduct this qualitative risk assessment is based on the work of Zepeda Sein (11). The theoretical bases for any risk assessment, whether qualitative or quantitative, are the same. Once the hazard has been identified, in this case infection with FMD virus, the risk to be assessed is a function of the probability that infection will occur and of the magnitudes of the consequences of such an occurence. The probability of the occurrence of the infection is, in turn, the product of the probability of the entry of the virus and the probability of exposure to the virus. The appraisal of the magnitude of the consequences must take into account both the probability of the dissemination of the pathogen (transmission plus spread) and the economic impact of the disease.

For a qualitative assessment, Zepeda Sein proposes that each of these events be characterised by a number of parameters and

that each parameter be analysed on the basis of all available information (11). In addition, the probability of occurrence of each event is assessed for classification by means of the following descriptive scale:

– negligible, when the probability of occurrence of the event is sufficiently low to be ignored, or if the event is possible only in exceptional circumstances

– low, when the occurrence of an event is a possibility in some cases

– moderate, when the occurrence of the event is a possibility

– high, when the occurrence of the event is clearly a possibility.

Table I contains a matrix showing probabilities of occurrence when two parameters are combined.

**Table I**
**Combination of occurrence probabilities of the parameters considered in the qualitative risk assessment** (11)

| Result of the assessment of parameter 2 | Result of the assessment of parameter 1 | | | |
|---|---|---|---|---|
| | **Negligible** | **Low** | **Moderate** | **High** |
| Negligible | Negligible | Low | Low | Moderate |
| Low | Low | Low | Moderate | Moderate |
| Moderate | Low | Moderate | Moderate | High |
| High | Moderate | Moderate | High | High |

In this study, the probability of occurrence of a hazard (FMD virus infection and the consequences of an epizootic) is equal to the probability of entry (from Transcaucasia to Russia and the rest of Europe) combined with the probability of the exposure of animals susceptible to the pathogen. As FMD virus cannot be transmitted to humans, the consequences of an epizootic will be purely economic.

The three countries will not be presented in detail here, but Tables II to IV present data relevant to the present assessment.

**Table II**
**Number of outbreaks of foot and mouth disease reported in Transcaucasia, Turkey and Iran from 1992 to 1998**

| Countries | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|
| Georgia | 1 | 4 | 0 | 1 | 21 | 36 | 5 |
| Armenia | 5 | 7 | 0 | 0 | 15 | 13 | 1 |
| Azerbaijan | 0 | 0 | 2 | 0 | 4 | 0 | 0 |
| Turkey | – | – | 153 | 108 | 133 | 54 | 74 |
| Iran | – | – | 221 | 270 | 651 | 345 | 342 |

*Sources*: Office International des Epizooties, Anon. (1)

*Rev. sci. tech. Off. int. Epiz.,* **20** (3)

725

**Table III**
**Herds of domestic cloven-hoofed animals in Transcaucasia**

| Countries | Bovines | Buffalo | Sheep | Goats | Camels | Swine |
|-----------|---------|---------|-------|-------|--------|-------|
| Georgia | 1,230,000 | 20,000 | 1,300,000 | 40,000 | | 640,000 |
| Armenia | 450,000 | | 450,000 | 10,000 | | 80,000 |
| Azerbaijan | 1,400,000 | 300,000 | 5,300,000 | 30,000 | 20,000 | 20,000 |

*Sources:* Food and Agriculture Organization, Anon. (1)

**Table IV**
**Animals present in the border provinces of the Greater Caucasus, and percentages of the national herds (in brackets) (1)**

| Type of animal | Countries | |
|----------------|-----------|---|
| | Georgia | Azerbaijan |
| Bovines (including buffalo) | 513,327 (41) | 332,931 (19.6) |
| Sheep and goats | 650,433 (48.5) | 764,977 (14.4) |
| Swine | 331,325 (51.8) | – |

# Results

## Probability of entry

The three parameters examined in order to determine the probability of entry of the virus into Russia and the rest of Europe from the countries of Transcaucasia were as follows:

– the prevalence of infection in the three countries (Georgia, Armenia, Azerbaijan)

– the volume of trade in animals and animal products

– the survival capacity of the virus in the environment.

### Prevalence of the infection

The prevalence of FMD virus infection in the three countries is a determinant of the probability of occurrence of the hazard. Table II presents the number of cases of FMD declared by the three countries between 1992 and 1998. The number of outbreaks may vary according to whether an outbreak is defined as an animal, a herd, or a village. The most realistic epidemiological unit is probably the village, since the herds of different farmers in a given village are generally kept together and share pastures in the summer (e.g. Armenia has no border with Russia, but herds from Armenia mingle with those from Georgia on a regular basis). However, this information is not always specified in official declarations.

Annual declarations of outbreaks show that the virus is present on a regular basis in Turkey and Iran, which border the south of Transcaucasia. Thus, the probability that the virus crosses these borders is high. The genetic characteristics of isolates from Transcaucasia appear to support this hypothesis.

Hence, the risk of FMD is greater along the southern border than along the northern border of Transcaucasia, which is the region covered by the present survey (Fig. 1).



**Fig. 1**
**Map of the Caucasus, showing the location of the three countries**

It is important to bear in mind that the declared prevalence does not always reflect actual prevalence. Some outbreaks are undetected or undeclared. Declared rates of prevalence should therefore be modulated on the basis of the quality of the local epidemiological surveillance systems (4, 9, 10, 11). The quality of these systems is dependant on two factors, namely: the infrastructure of the veterinary services and the diagnostic capability of the country.

The official veterinary network in all three countries is well structured and covers the whole of the territory concerned. State veterinarians have first-hand clinical and field experience of FMD. However, diagnostic capability is limited, and communication between field veterinarians and regional or national laboratories is complicated. In recent outbreaks, although diagnostic capability was acceptable once the disease had been suspected clinically, the number of samples sent for genetic characterisation to the OIE-Regional FMD Reference Laboratory in Vladimir, Russia, was insufficient and epidemiological investigations were incomplete.

Given the various uncertainties regarding actual incidence, and the fact that outbreaks have been declared every year since 1992, the authors consider the probability of FMD infection in the three countries to be 'high'.

726

*Rev. sci. tech. Off. int. Epiz.,* **20** (3)

## Volume of trade

Since the three countries concerned are not yet self-sufficient in food, particularly in meat, the countries attempt to import rather than to export. More importantly, the EU and most of the eastern neighbours of Transcaucasia do not allow imports of live animals and animal products derived from susceptible animals from countries of Transcaucasia or from Russia. Current national herd sizes are relatively low (Table III), and in some cases are even declining. Thus, no direct exports are made to Russia or the rest of Europe.

However, during the summer months, contact between herds in Russia and those in Georgia (including Abkhazia and South Ossetia) and Azerbaijan is possible in the pastures of the Greater Caucasus (along the northern borders). Table IV presents figures for herds in the border provinces. Herds are relatively small, although in Georgia, six out of twelve provinces are concerned. No data are available for South Ossetia. Data pertaining to the Autonomous Republic of Abkhazia were obtained from the mission report by Garland (3). In Azerbaijan, eight *rayonul* (regions) out of 65 are concerned. However, given the current structural and economic conditions in the region, more extensive animal movement is improbable. Based on the above considerations, the probability of entry as determined by trade volume is rated 'low'.

## Survival of the pathogen

The capacity of the virus to survive in the environment is principally dependant on ambient humidity, as the virus is sensitive to dryness. However, a more serious problem is that in the three countries concerned, diseased and contaminated animals are not slaughtered. Such animals are isolated for twenty-one days, after which the measure is lifted. Thus, the danger of clinically asymptomatic carriers being present is realistic, and the probability of survival of the agent is rated 'high'.

## Assessment

Using the matrix (Table I) proposed by Zepeda Sein (11), the authors conclude that the probability of entry is a function of the combination of risks relating to prevalence (high), contact due to cross-border movement and trade (low), and survival (high); thus, the probability of entry is rated 'high' (Fig. 2).

## Probability of exposure

The parameters considered in determining the probability of exposure were as follows:

– the potential for transmission to susceptible animals in the importing country

– the probability of spread within the country

– factors influencing the survival of the virus
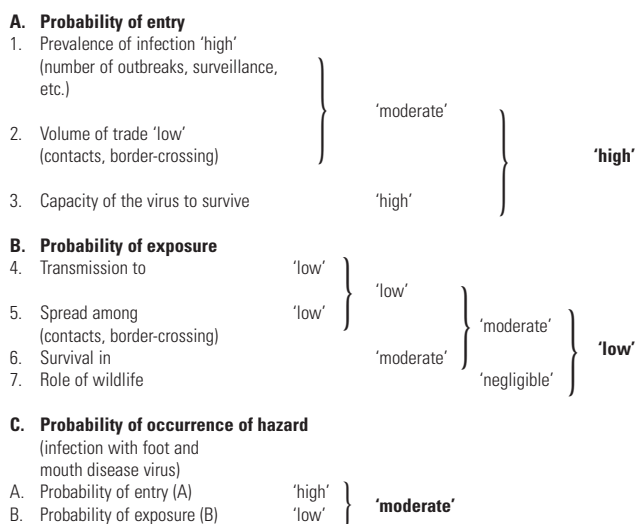
– the role of wild animals as potential vectors.

**A. Probability of entry**
1. Prevalence of infection 'high' (number of outbreaks, surveillance, etc.)
2. Volume of trade 'low' (contacts, border-crossing) } 'moderate'
3. Capacity of the virus to survive — 'high' } **'high'**

**B. Probability of exposure**
4. Transmission to — 'low'
5. Spread among — 'low' (contacts, border-crossing) } 'low'
6. Survival in — 'moderate' } 'moderate'
7. Role of wildlife — 'negligible' } **'low'**

**C. Probability of occurrence of hazard** (infection with foot and mouth disease virus)
A. Probability of entry (A) — 'high'
B. Probability of exposure (B) — 'low' } **'moderate'**

**Fig. 2**
**Probability of occurrence of various risk factors using descriptive scale and classification matrix (considering two factors at a time) defined by Zepeda Sein** (11)

## Potential for transmission to animals in Russia

The common pasturelands of the Greater Caucasus represent a risk for transmission. Animal movement is probably limited in Transcaucasia, but may be more extensive over the border, in Russia, if animals are sold at a distance from these pastures. Nonetheless, this is improbable given current economic and political conditions which dictate that the owners generally keep the few animals they have. Thus, the risk for transmission to animals in Russia can be considered to be 'low'.

## Probability of spread among animals in Russia

The probability of spread among animals in Russia is conditioned by the small number of animals vaccinated over recent years; Veterinary Services can no longer afford to buy vaccines (marketed by one or two institutes in Russia) for annual vaccine campaigns. According to reports, animals are only vaccinated in the immediate periphery of declared outbreaks. However, fifteen million doses of bivalent (A-O) FMD vaccine might have been used annually in North Caucasus. Given the limited movement of animals, and because animal products are consumed locally (due to the current economic situation), the risk of spread can be classified as 'low'.

## Survival of the virus in Russia

The factors affecting the survival of the virus are climatic and environmental. Low temperature and high humidity are favourable to the survival of the virus. In the present analysis, the principal concern was the fact that diseased and contaminated animals are not slaughtered, and that the probability of clinically asymptomatic carriers is high, both in Russia and Transcaucasia. Nonetheless, the probability of survival in the more northern regions, beyond the Greater

Caucasus, is limited as far as can be determined on the basis of information concerning animal movements in these areas. The risk is thus considered to be 'moderate'.

### The role of wildlife

The probability of transmission by contaminated wild animals (wild boar, cervids, ibexes, chamois and wild sheep) appears to be low, given the small numbers of such animals present, due in turn to the absence of hunting regulations following the independence of the countries of Transcaucasia. The estimated populations of chamois (15,000) and of the two species of ibex (37,000) present in the Greater Caucasus are not high (8). Further north, in Kalmykian Autonomous Region, the population of saiga antelope (*Saiga tatarica*) could contribute to transmission and spread, should the virus cross the Caucasus range. However, the recent figures for the saiga population showed a sharp decline in the 1990s (6). Hence, the probability of spread among and transmission from wildlife is rated as 'negligible'.

### Assessment

The probability of exposure resulting from a combination of the four parameters, namely: potential for transmission (low), probability of spread (low), survival (moderate) and the role of wildlife (negligible), is considered to be 'low'.

## Magnitude of the consequences

The consequences of an outbreak of FMD in Russia are solely economic, since the virus cannot be transmitted to humans and the public health consequences are zero (i.e. negligible on the scale used in this case). In border areas, the economic impact primarily concerns local cattle breeds, which are subject to little genetic selection and produce modest amounts of milk and meat. In this context, the impact is considered negligible.

Regarding sheep, direct losses (mortality in the young) may occur if the virus infects a flock during the lambing season, but this is unlikely in mountain pastures. Indirect consequences and the risk of spread are more likely to be linked to the geographic location of an outbreak, and the ability of local authorities to rapidly control the situation. Once again, available information on the local economic situation led to a classification of the risk as 'negligible'.

The rest of Europe (the EU, countries of the European Free Trade Area [EFTA] or Central and Eastern Europe) could, in addition to the existing bans on imports of live animals or products from susceptible animals, impose embargoes of varying length and geographical coverage on Russia. The fact that the FAO, the EU and the OIE are currently committed to providing financial and/or technical assistance to the OIE Regional FMD Reference Laboratory in Vladimir, Russia, is a positive development. This will enhance risk management and help to produce vaccines for use in Transcaucasia, co-ordinate surveillance in the region and thereby to maintain the only centre of FMD expertise in the Commonwealth of Independent States, and ensure a minimum of disease reporting. The magnitude of the consequences is, on the whole, rated as 'negligible'.

# Assessment

The probability of occurrence of the hazard (FMD virus infection) results from the combination of a risk considered as 'high' and one considered as 'low', and is thus 'moderate' (Fig. 2 and Table V).

The assessed risk is a combination of the probability of occurrence (moderate) and of the consequences of occurrence

**Table V**
**Summary table for the assessment of the risk of FMD infection in Russia and Europe via introduction from the three countries of Transcaucasia in 1999**

| Parameters | Events | Elements | Overall rating |
|---|---|---|---|
| Prevalence of infection = **h** | Probability of entry = **h** | Probability of occurrence of hazard = **m** | Assessed risk = **l** |
| Trade and cross-border contact = **l** | Probability of entry = **h** | Probability of occurrence of hazard = **m** | Assessed risk = **l** |
| Survival of virus = **h** | Probability of entry = **h** | Probability of occurrence of hazard = **m** | Assessed risk = **l** |
| Transmission to = **l** | Probability of exposure = **l** | Probability of occurrence of hazard = **m** | Assessed risk = **l** |
| Spread among = **l** | Probability of exposure = **l** | Probability of occurrence of hazard = **m** | Assessed risk = **l** |
| Survival in country = **m** | Probability of exposure = **l** | Probability of occurrence of hazard = **m** | Assessed risk = **l** |
| Role of wildlife = **n** | Probability of exposure = **l** | Probability of occurrence of hazard = **m** | Assessed risk = **l** |
| Zoonosis = **n** | Public health consequences = **n** | Magnitude of consequences = **n** | Assessed risk = **l** |
| Dissemination = **n** | Economic consequences = **n** | Magnitude of consequences = **n** | Assessed risk = **l** |
| Economic impact = **n** | Economic consequences = **n** | Magnitude of consequences = **n** | Assessed risk = **l** |

**n** = negligible
**l** = low
**m** = moderate
**h** = high

728

*Rev. sci. tech. Off. int. Epiz.,* **20** (3)

(negligible), and is thus rated 'low'. The following interpretation of the scale is provided by Zepeda Sein (11):

– negligible = authorise import without restrictions

– low = authorise import with certain risk reduction measures, as appropriate

– moderate = before authorising import, carefully assess risk reduction measures, including efficacy, feasibility of implementation and verification mechanisms

– high = do not authorise import unless risk reduction measures are proven effective and adequate verification procedures are available to ensure safe implementation.

Thus, imports of cattle and cattle products from Transcaucasia could be tolerated, provided that certain measures are implemented. This already appears to be the case to a certain extent, since some problems encountered in the field were, or will be, rapidly mastered or attenuated, and this is illustrated by the fact that a vaccination campaign was initiated soon after the mission.

## Discussion

The method used to analyse the FMD risk has clear limitations, especially regarding the choice of categories for the different parameters chosen. For instance, the evaluation of economic consequences could be 'low' instead of 'negligible'. However, the overall result would not be altered significantly. The data currently available are insufficient for a quantitative assessment, and although the performance of a risk analysis concerning the introduction of FMD into Russia and the rest of Europe was requested of the mission, this was not possible within the time allowed; however, this assessment remains valid. The method followed in this project thus represents a first approach to a more comprehensive process which will undoubtedly require considerable time and resources.

Risk management measures include the use of vaccination, and eventually, the strengthening of Veterinary Services. Clearly, from the perspective of countries in Europe, control of the FMD situation in the Caucasus is of great importance. The tripartite FAO/EU/OIE group on FMD (recommended by the OIE Regional Commission for Europe in September 1998 and established at the 62nd Session of the Executive Commission of the European Commission for the Control of Foot and Mouth Disease, held in Lysebu, Norway, 26-27 November 1998), is already working along these lines with the countries of the region.

## Acknowledgements

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# Une évaluation qualitative du risque d'introduction de la fièvre aphteuse en Russie et en Europe à partir de la Géorgie, de l'Arménie et de l'Azerbaïdjan

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**Résumé**
Une analyse qualitative a été effectuée pour évaluer le risque d'introduction du virus de la fièvre aphteuse en Russie et dans le reste de l'Europe à partir des pays de la Transcaucasie (Arménie, Azerbaïdjan et Géorgie). L'analyse utilise les informations recueillies lors d'une mission de trois semaines dans ces pays, effectuée en mars 1999 par des représentants de l'Organisation des Nations Unies pour l'alimentation et l'agriculture, de l'Union européenne et de l'Office international des épizooties. Grâce à la participation active des Services vétérinaires locaux, beaucoup d'informations ont été obtenues, insuffisantes toutefois pour réaliser une évaluation quantitative du risque. Les enquêtes effectuées ont néanmoins servi profitablement de première approche préalable à une telle évaluation.

Le risque d'infection par le virus de la fièvre aphteuse est une fonction exprimant, d'une part, la probabilité que l'événement (l'infection par le virus) se produise effectivement et, d'autre part, l'ampleur des conséquences d'un tel événement. La probabilité que l'événement se produise est à son tour le produit de la probabilité d'introduction du virus et de la probabilité d'exposition au virus. Ces éléments ont été évalués à l'aide des paramètres suivants : prévalence de l'infection, volume des échanges, capacité de survie du virus et potentiel d'infection. Quant à l'ampleur des conséquences, elle découle de la probabilité de transmission et de propagation du virus. Compte tenu de tous ces paramètres, la probabilité que l'infection survienne a été qualifiée de « faible ». Les conséquences économiques de la transmission et de la propagation potentielles de la fièvre aphteuse, dans le contexte local, ont été considérées comme « négligeables ». En conséquence, le risque global d'introduction du virus de la fièvre aphteuse en Russie et dans le reste de l'Europe à partir de la Transcaucasie a été jugé « modéré » à la date de l'évaluation. Les auteurs présentent la méthode utilisée et les résultats obtenus comme point de départ pour des travaux ultérieurs.

**Mots-clés**

Analyse qualitative du risque − Arménie − Azerbaïdjan − Évaluation du risque − Fièvre aphteuse − Géorgie − Transcaucasie.

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# Evaluación cualitativa del riesgo de penetración de fiebre aftosa en Rusia y Europa desde Georgia, Armenia y Azerbaiyán

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**Resumen**

Los autores describen un proceso de evaluación cualitativa del riesgo de que el virus de la fiebre aftosa penetre en Rusia y el resto de Europa desde los países transcaucásicos (Armenia, Azerbaiyán y Georgia). Para ello se utilizaron los datos recogidos en esos países en marzo de 1999, durante un viaje de estudio de tres semanas de duración auspiciado por la Organización de las Naciones Unidas para la Agricultura y la Alimentación, la Unión Europea y la Oficina Internacional de Epizootias. Gracias a la activa colaboración de los servicios veterinarios locales pudo obtenerse una gran cantidad de información, que resultó insuficiente para realizar una evaluación de riesgos cuantitativa pero de gran utilidad como primera aproximación antes de acometer tamaña empresa.

El riesgo de infección por el virus de la fiebre aftosa viene determinado por dos factores, a saber, la probabilidad de que la infección se produzca y la magnitud de sus consecuencias. La probabilidad de infección vírica corresponde al producto de la probabilidad de penetración del virus y la probabilidad de exposición a él. Para evaluar estos elementos se utilizaron los siguientes parámetros: prevalencia de la infección; volumen de intercambios comerciales; y capacidad de supervivencia y potencial de infección del virus. La magnitud de las

730

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consecuencias se calcula a partir de la probabilidad de transmisión y propagación. Tras el estudio combinado de todos esos factores, se calificó de "baja" la probabilidad de que se produjera la infección. Las posibles repercusiones económicas de una eventual transmisión y propagación de fiebre aftosa se consideraron, en el contexto local, "insignificantes". En conclusión, el riesgo global de que la fiebre aftosa penetrara en Rusia y el resto de Europa desde la zona transcaucásica se juzgó de "moderado" en el momento del estudio. Los autores presentan el método de análisis y los resultados obtenidos para que sirvan de punto de partida de ulteriores estudios.

**Palabras clave**
Análisis cualitativo de riesgos – Armenia – Azerbaiyán – Evaluación de riesgos – Fiebre aftosa – Georgia – Transcaucasia.

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# References

1. Anon. (1999). – Report of the OIE/EUFMD/EC missions to Georgia, Armenia, Azerbaijan and to the all-Russian Research Institute for Animal Health, Vladimir, Russian Federation. Food and Agriculture Organization, Rome, 88 pp.

2. Donaldson A. & Doel T.R. (1992). – Foot and mouth disease: the threat for Great Britain after 1992. *Vet. Rec.*, **131**, 114-120.

3. Garland A.J.M. (1998). – Assessment mission to Abkhazia region Georgia, 16 February-4 March. TEMP/INT/859/MSC. Report on the livestock/veterinary sectors. Food and Agriculture Organization, Rome, 38 pp.

4. Morley R.S. (1993). – A model for the assessment of the animal disease risks associated with the importation of animals and animal products. *In* Risk analysis, animal health and trade (R.S. Morley, ed.). *Rev. sci. tech. Off. int. Epiz.*, **12** (4), 1055-1092.

5. Moutou F. (1993). – La fièvre aphteuse : passé, présent et avenir. *Point Vét.*, **25** (155), 477-484.

6. Nowak R.M. (ed.) (1999). – Walker's mammals of the world, 6th Ed. Johns Hopkins University Press, Baltimore, 1,732 pp.

7. Observatoire des États post-soviétiques (1997). – De l'URSS à la CEI. 12 États en quête d'identité. Ellipses, Paris, 208 pp.

8. Shackleton D.M. (1997). – Wild sheep and goats and their relatives. International Union for the Conservation of Nature, Gland, 390 pp.

9. Toma B., Sanaa M. & Dufour B. (1996). – Proposition de modification méthodologique de l'analyse du risque de maladies animales associé à l'importation d'animaux ou de produits d'origine animale. *Épidémiol. Santé anim.*, **30**, 45-59.

10. Toma B., Dufour B., Bonjour P., Sanaa M. & Angot J.-L. (1998). – A method for incorporating the evaluation of veterinary services and surveillance programmes in animal health risk assessments. *In* Proc. Annual Meeting of the Society for Risk Analysis-Europe. Risk analysis: opening the process (P. Hubert, ed.), 11-14 October, Paris. Institut de Protection et de Sûreté Nucléaire, Fontenay-aux-Roses, France, 1157-1167.

11. Zepeda Sein C. (1998). – Méthodes d'évaluation des risques zoosanitaires lors des échanges internationaux. *In* Séminaire sur la sécurité zoosanitaire des échanges dans les Caraïbes, 9-11 December 1997, Port of Spain (Trinidad and Tobago). Office International des Epizooties, Paris, 2-17.