



HELLENIC REPUBLIC
MINISTRY OF AGRICULTURE
DIR.GENERAL OF VETERINARY SERVICES
ANIMAL HEALTH DIRECTORATE

Address : 2 Acharon Str.
101 76 Athens, Greece
Telephone : 0030-1-88 35 440/88 36 030
Fax : 0030-1-82 29 188
Telex : 22 17 38 YDAG.GR
E-mail : vetserv@ath.forthnet.gr

VI/6490/74
April 1997

FINAL REPORT

on the eradication of Foot-and-Mouth disease in Greece

Presented at the EU Standing Veterinary Committee on 08-09 April 1997
with a view to repealing Commission Decision 96/S26/EC.

1. INTRODUCTION

Between 7 July and 30 September 1996 thirty nine (39) outbreaks of Foot-and-mouth disease (FMD) were reported in the Prefecture of Evros, North-Eastern Greece, leading to the adoption of Commission Decision 96/440/EC concerning certain protection measures with regard to FMD in the entire territory of Greece.

However, intensive nation wide clinical, epidemiological and - in the Pref. of Rodopi, west of Evros - serological surveillance never raised any suspicions in other parts of Greece and the disease was effectively contained in Evros throughout the epidemic. This fact was acknowledged by the community which adopted Commission Decision 96/526/EC repealing Decision 96/440/EC and regionalising Evros. Decision 96/526/EC is still in force.

Six months after the last outbreak the Greek Authorities are confident that FMD has been eradicated from Evros and, thus, reclaim «FMD free status without vaccination» for the whole of Greece and request the repealing of Decision 96/526/EC.

The present report provides supporting evidence to justify this claim and request. The report is divided into three parts, as follows :

1. The first part reconstructs the history of the epidemic and discusses its main clinical, epidemiological and laboratory features.
2. The second part provides recent serological, clinical and epidemiological evidence attesting to the eradication of FMD.
3. The third part presents briefly the position of the Greek Authorities with regard to appropriate future actions intended to prevent re-incursion of FMD in Evros.

2. ANALYSIS OF THE EPIDEMIC

2.1 Epidemiological profile

In Evros, outbreaks of FMD were clustered in three distinct groups, the distinction justified on temporal, geographical and epidemiological grounds, namely the South-Western, the South-Eastern and the Northern Clusters.

The distinction will become apparent in the course of this report and will be used in all epidemiological considerations.

2.1.1 Flow chart of the epidemic

The overall flow chart of the epidemic is presented in Diagram 1.

Out of a multitude of possible contacts and epidemiological relations the flow chart indicates only definitive contacts which have most likely passed on the infection.

The flow chart is laid out in chronological order with a vertical direction based on the date of confirmation of each outbreak and adjusted, where appropriate, to epidemiological intelligence and age of lesions.

Outbreaks are numbered in accordance with the date of confirmation, which was invariably based on clinical signs of FMD with laboratory confirmation following 5-10 days later.

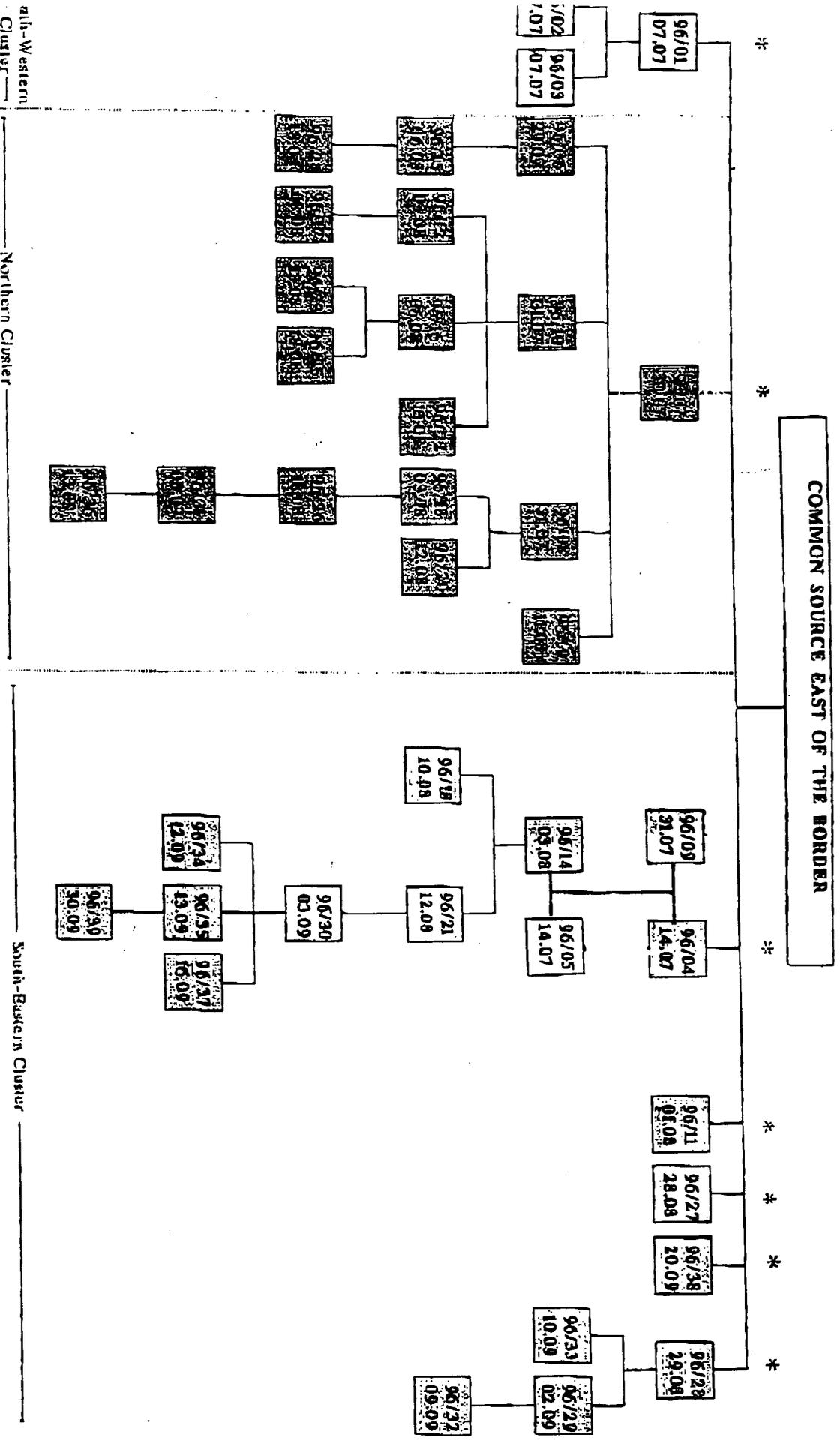
From Diagram 1, it is noted that :

- The South-Western cluster comprised one (1) primary and two (2) secondary outbreaks.
- The South-Eastern cluster comprised five (5) primary and thirteen (13) secondary outbreaks.
- The Northern cluster comprised one (1) primary and seventeen (17) secondary outbreaks.
- At no point was there a contact or epidemiological link between outbreaks belonging to different clusters.

This characterisation and classification of outbreaks is consistent with the qualified opinion of an EU mission which visited Greece from 2 to 13 September (Doc. VI/5885/96).

The flow chart is augmented by information contained in Table 1 concerning the source, date and means of infection of each outbreak and the correlation among outbreaks in the same cluster.

DIAGRAM 1: Flow chart of the epidemic



(*) Primary out breaks

Table 1 : Source and means of infection of outbreaks.

Cluster	Nr. of outbreak	Type of outbreak	Date of report	Source of infection	Means of infection
South-Western	96/01	primary	07.07.1996	European Turkey	Human contact (the farmer visited relatives in Turkey in mid June)
	96/02	secondary	07.07.1996	Outbreak 96/01	Human contact (the owner is also a butcher in the area)
	96/03	secondary	07.07.1996	Outbreak 96/01	Direct contact (common grazing)
South-Eastern	96/04	primary	14.07.1996	European Turkey	Indirect contact (Wild animals and/or illegal immigrants)
	96/05	secondary	14.07.1996	Outbreak 96/04	Direct contact (common grazing)
	96/09	secondary	31.07.1996	Outbreak 96/04-05	Human contact (the farmer owned a field in Evros delta)
	96/11	primary	01.08.1996	European Turkey	Human contact (illegal immigrants)
	96/14	secondary	03.08.1996	Outbreak 96/04-05	Human contact (the farmer owned a field in Evros delta)
	96/18	secondary	10.08.1996	Outbreak 96/14	Direct contact (common grazing)
	96/21	secondary	12.08.1996	Outbreak 96/14	Indirect contact (vehicle visited both herds on 01.08.1996)
	96/27	primary	28.08.1996	European Turkey	Human contact (illegal immigrants)
	96/28	primary	29.08.1996	European Turkey	Indirect contact (air borne spread)
	96/29	secondary	02.09.1996	Outbreak 96/28	Direct contact (contiguous herds)
	96/30	secondary	02.09.1996	Outbreak 96/21	Direct contact (contiguous herds)
	96/32	secondary	09.09.1996	Outbreak 96/29	Direct contact (contiguous herds)
	96/33	secondary	10.09.1996	Outbreak 96/28	Direct contact (common grazing)
	96/34	secondary	12.09.1996	Outbreak 96/30	Direct contact (common grazing)
	96/35	secondary	13.09.1996	Outbreak 96/30	Direct contact (common grazing)
	96/37	secondary	16.09.1996	Outbreak 96/30	Human contact (the two herds shared the same employee)
96/38	primary	20.09.1996	European Turkey	Human contact (illegal immigrants)	
96/39	secondary	30.09.1996	Outbreak 96/35	Direct contact (common grazing)	

Table 1 : Continued

Cluster	Nr. of outbreak	Type of outbreak	Date of report	Source of infection	Means of infection
Northern	96/06	secondary	29.07.1996	Outbreak 96/07	Direct contact (common grazing)
	96/07	primary	30.07.1996	European Turkey	Human contact (illegal immigrants)
	96/08	secondary	31.07.1996	Outbreak 96/07	Direct contact (common grazing and watering)
	96/10	secondary	31.07.1996	Outbreak 96/07	Human contact (the owner helped 96/07 with difficult lambing)
	96/12	secondary	03.08.1996	Outbreak 96/10	Human contact (social relations between farmers)
	96/13	secondary	03.08.1996	Outbreak 96/08	Direct contact (contiguous herds)
	96/15	secondary	06.08.1996	Outbreak 96/06	Direct contact (contiguous herds)
	96/16	secondary	06.08.1996	Outbreak 96/10	Direct contact (common grazing)
	96/17	secondary	08.08.1996	Outbreak 96/12	Human contact (owner visited 96/12 prior to detection)
	96/19	secondary	11.08.1996	Outbreak 96/07	Direct contact (common watering)
	96/20	secondary	12.08.1996	Outbreak 96/07	Direct contact (common watering)
	96/22	secondary	13.08.1996	Outbreak 96/10	Indirect contact (animals moving along common path)
	96/23	secondary	13.08.1996	Outbreak 96/16	Direct contact (common grazing)
	96/24	secondary	18.08.1996	Outbreak 96/15	Direct contact (contiguous herds)
	96/25	secondary	18.08.1996	Outbreak 96/16	Direct contact (common grazing)
	96/26	secondary	18.08.1996	Outbreak 96/13	Direct contact (contiguous herds)
	96/31	secondary	03.09.1996	Outbreak 96/26	Indirect contact (air borne spread)
	96/36	secondary	13.09.1996	Outbreak 96/31	Direct contact (common grazing)

From Table 1, it is noted that :

- All seven (7) primary outbreaks are linked with European Turkey, either via human contact with illegal immigrants acting as mechanical carriers of FMDV, or by air borne spreading. The implication of immigrants is entirely plausible and justified considering that more than 40.000 are apprehended annually in Evros, while there is no estimate of how many manage to elude detection.

Besides, their travelling pattern favors spreading of disease because they often spend a few days working in herds east of Evros before they are guided across the borders. Once inside Greek territory, again they seek refuge in animal sheds at the bank of Evros river before they get their bearings and organise their journey inland. Finally, signs of recent human presence were found inside the premises of most primary outbreaks.

Air borne transmission, on the other hand, is considered to be the mode of infection of outbreak 96/28. Indeed, the infected premises were situated approximately 500 m from the actual border line and at the estimated period of infection the prevailing wind was blowing from the east at a speed of 10 km/h.

- Secondary outbreaks are most often attributed either to direct contacts in common grazing areas and/or watering points or to indirect contacts through personnel and vehicle movements.

The *former case* applies, in particular, to areas near the bank of Evros river which are intensively cultivated and provide prime grazing land, especially after harvest in summer. In this way, local animal husbandry conditions favor a multitude of contacts and epidemiological relations which make the whole village a single epidemiological unit in so far as sheep and goats are concerned.

This was the case of the Northern cluster of outbreaks which is further illustrated in Figure 1.

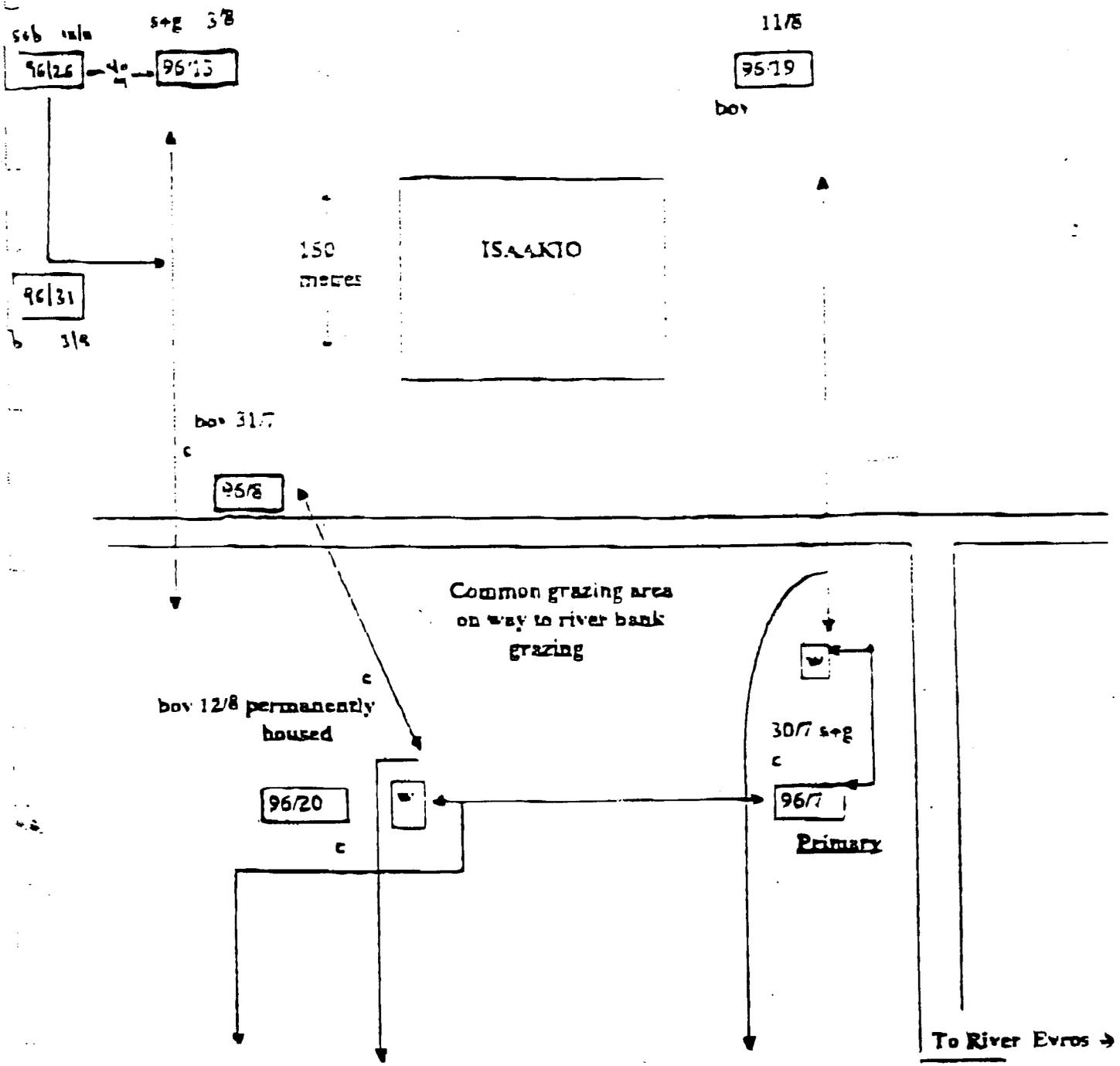
The *latter case* applies, in particular, to the South-Eastern cluster of outbreaks and is largely due to various activities carried out in the delta of Evros river. Inside the delta a large number of free-grazing cattle were kept making it almost impossible to distinguish between infected and «clean» areas. On the other hand, the Evros delta is not only intensively cultivated but is a favorite hunting and fishing area attracting many people from surrounding villages. Consequently, despite limited access and application of disinfection means and procedures at the entry / exit points, the multitude of human activities was bound to transmit the disease outside the delta area.

Figure 1, shows all identified epidemiological links in and around the village of Isaakio at the Northern cluster of outbreaks.

Although not to scale, it conveys the idea of close contiguity of herds, sharing of common water troughs and grazing in the same communal pastures along the bank of Evros river.

The information concerning the two milk tankers shared by outbreaks 96/07-13 and 96/08-19-20 respectively has been included for reasons of completeness but this is not considered to be the most likely means of infection.

Outbreak 96/31 was probably infected by air borne transmission from outbreak 96/26 which passed just outside the stable on its way to and from grazing.



All flocks are grazing at Evros river bank area

Not to scale

- w = common water troughs
- s = sheep
- g = goats
- bov = bovines
- c = Route to grazing directly contiguous.

Outbreaks No. 96/7 and 96/13 share the same milk tanker as do outbreaks No. 96/8, 96/19 and 96/20. Outbreak 96/10 Didimoticho helped 96/7 with a difficult lambing just prior to discovery of disease at 96/7.

2.1.2 Temporal and spacial distribution of outbreaks

The geographic location of each cluster appears in Map 1 while an overview of the temporal and spacial distribution of outbreaks is summarised in Table 2.

Cluster	Village	Distance from Evros river	Outbreaks		Date of confirmation
			Type	Number	
South-Western	Dikella	40.0 km	Primary	1	07.07.96
	Makri	38.0 km	Second.	2	07.07.96
South-Eastern	Evros Delta	0.5 km	Primary	1	14.07.96
	Evros Delta	0.5 km	Second.	1	14.07.96
	Alexandroupolis	10.0 km	Second.	1	31.07.96
	Peplos	1.0 km	Primary	1	01.08.96
	Peplos	1.0 km	Second.	1	30.09.96
	Ferres	1.0 km	Second.	1	03.08.96
	Pilea	2.5 km	Second.	1	10.08.96
	Ardanio	1.0 km	Second	3	12.08.96-02/16.09.96
	Thymaria	1.0 km	Primary	1	28.08.96
	Kipi	0.5 km	Primary	1	29.08.96
	Kipi	0.5 km	Second.	1	10.09.96
	Gemisti	2.0 km	Second.	2	02.09.96-09.09.96
	Poros	0.7 km	Second.	1	12.09.96
Vrysoula	3.0 km	Second.	1	13.09.96	
Loutros	8.0 km	Primary	1	20.09.96	
Northern	Thyrea	3.0 km	Second.	3	29.07.96-06/18.08.96
	Isaakio	1.5 km	Primary	1	30.07.96
	Isaakio	1.5 km	Second.	6	31.07-3/11/12/18.08-03.09.96
	Didimoticho	2.5 km	Second.	7	31.07.96-03/06.08.96 13/13/18.08.96 13.09.96
	Karoti	3.5 km	Second.	1	08.08.96

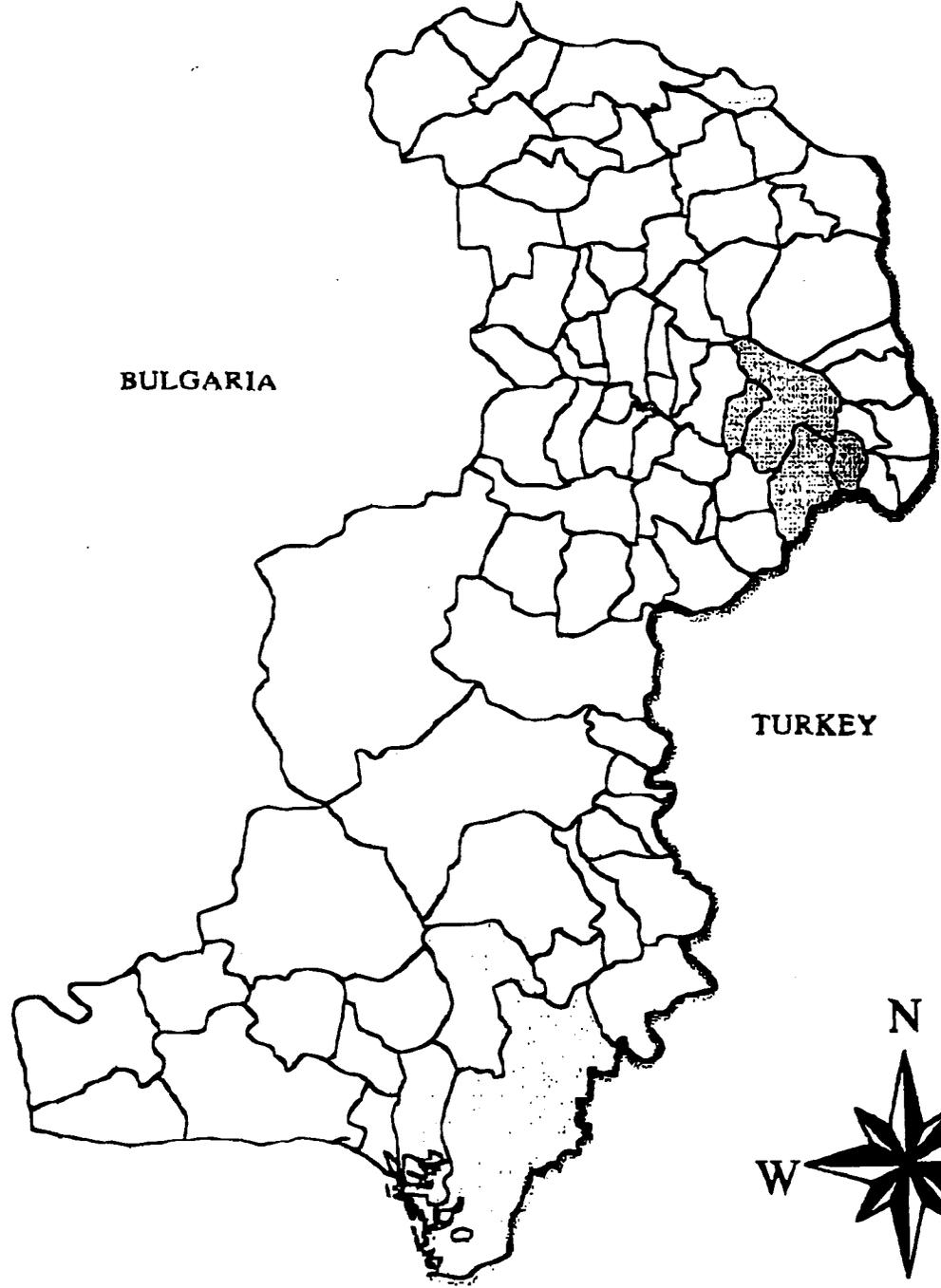
Table 2 : Temporal and spacial distribution of outbreaks per cluster.

From Table 2, it is noted that :

- The South-Western cluster comprises one (1) primary and two (2) secondary outbreaks reported on 7 July at a distance of 38-40 km from Evros river.
- The South-Eastern cluster comprises five (5) primaries and thirteen (13) secondary outbreaks, the former reported between 14 July-20 September at a distance of 0.5-10 km from Evros river, and the latter reported from 14 July-13 September at a distance of 0.5-30 km from Evros river.
- The Northern cluster comprises one (1) primary and seventeen (17) secondary outbreaks, the former reported on 30 July at a distance of 1.5 km from Evros, and the latter reported between 29 July-13 September at a distance of 1.5-3.5 km from Evros river.

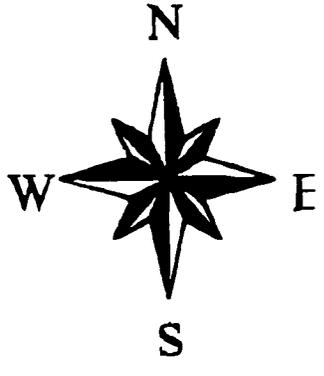
Map 1. Prefecture of Evros

-  South-Western cluster
-  South-Eastern cluster
-  Northern cluster
-  Evros river



BULGARIA

TURKEY



With regard to temporal distribution of outbreaks, in particular Diagram 2 presents the generic curve of the epidemic and the cluster-specific epidemic curves, while in Diagram 3 an overview of the epidemic is presented and primary outbreaks are marked so that the magnitude of their effects can be assessed.

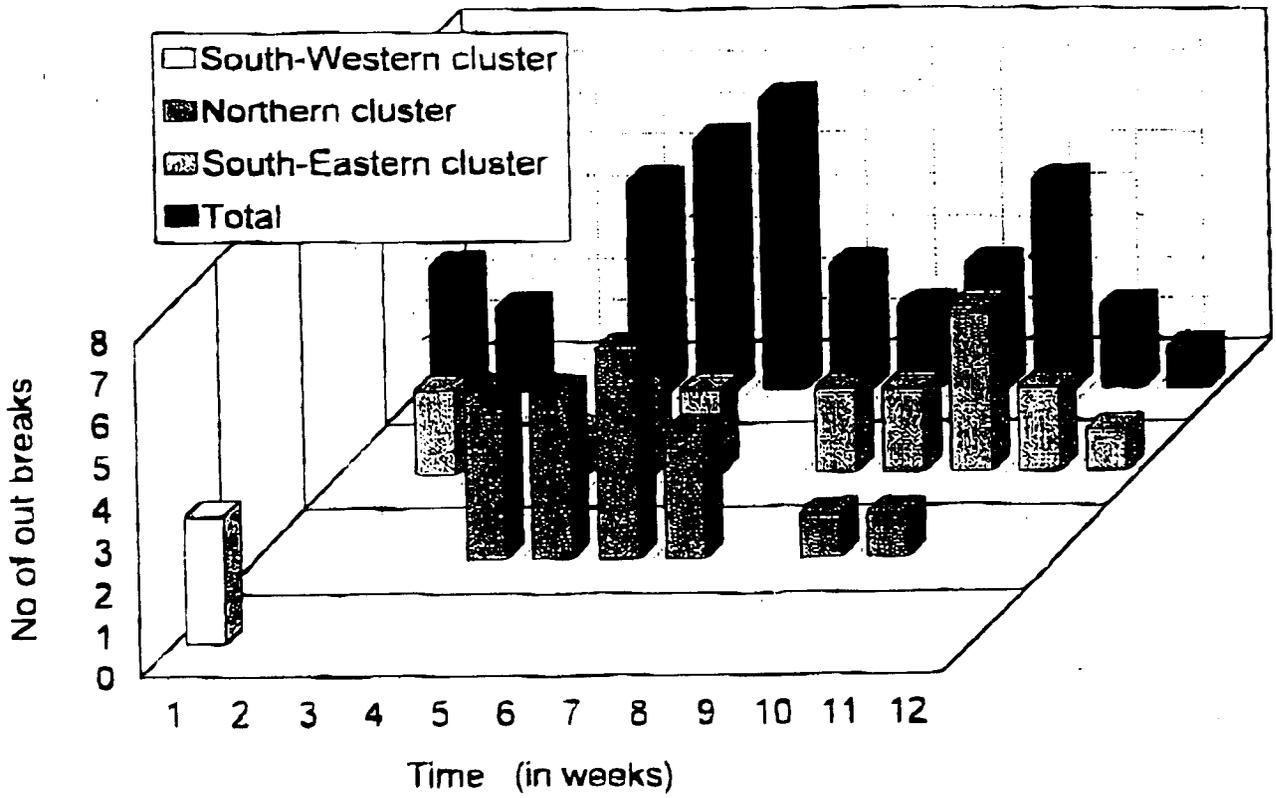


Diagram 2 : Generic and cluster-specific epidemic curves.

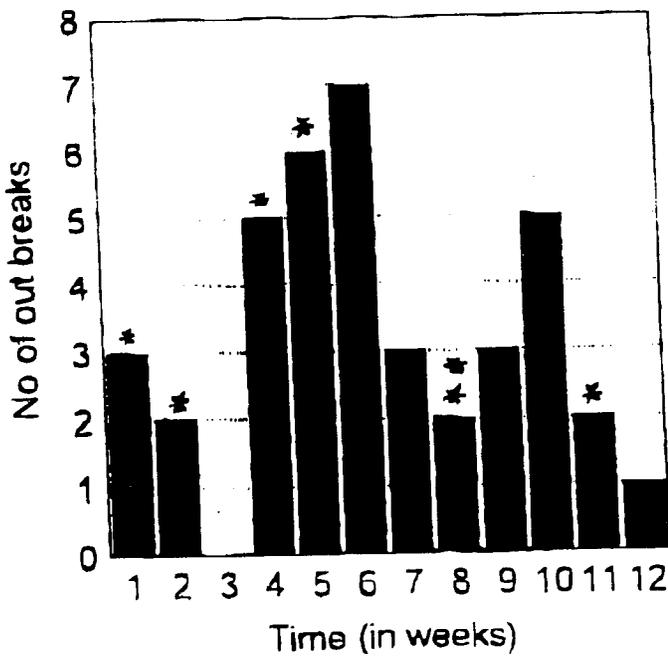


Diagram 3 : Overall epidemic curve with indication of primary outbreaks

In Diagrams 2 and 3, the overall generic curve suggests a propagated epidemic which was prolonged for three months.

This is true only as far as the effects of the epidemic on the agricultural community and the related industry of Evros are concerned, but not in terms of efficiency of the disease control and safeguard measures implemented by the local and national authorities.

From the cluster-specific epidemic curves in Diagram 3, however, it is noted that :

- The **South-Western** cluster is a typical point epidemic with a limited number of outbreaks detected and reported within a very short period of time (2 days).
The small number of outbreaks and the short duration of the sub-epidemic provide a good measure of the efficacy of disease control and safeguard measures and are due to prompt identification of disease, precise and complete epidemiological data and preventive stamping out of possible in-contact herds.
Occurrence of a single primary outbreak was due to the distance from the border meaning that normal conditions for primary outbreaks were not met.
Prevention of secondary outbreaks was further enhanced by the absence of a common grazing area.
- The **South-Eastern** cluster can be mistakenly considered as propagated epidemic progressing in waves over an 11-week period.
However, the increased number of and the intervals between primary outbreaks not only justify the form and the length of the epidemic curve, but also break it down essentially to five sub-epidemics independent to each other.
The increased number of primary outbreaks is attributed to the high relative risk of exposure to FMDV due to close proximity with the border through mechanisms already explained.
The epidemic curve supports clinical and epidemiological evidence suggesting that the incubation period was 5-7 days and, also, that the virus might survive in the environment for as many days.
The latter statement is supported by the intervals between primary and secondary outbreaks due to indirect contacts via personnel or vehicle movements.
- The **Northern** cluster is a typical propagated epidemic with a single primary and a fair number of secondary outbreaks following over a 7-week period.
In this case the form and the length of the epidemic curve can only be explained, if not justified, by the animal husbandry conditions practiced in the area as has already been demonstrated.
The complexity of epidemiological relations combined with the high density of livestock population in the area confused the epidemiological picture, caused grave financial and social concerns in the local agricultural community and resulted in a reluctance to apply large-scale preventive stamping out.
Now it is known that this policy failed to save too many animals, prolonged the circulation of active virus in the area and thus presented a risk to huge numbers of animals, both inside and outside Greece, for an unnecessarily long period.

With regard to **spacial distribution** of outbreaks, the following considerations are relevant :

- a) The causative relation, if any, between the location of *primary* outbreaks and the Evros river along the eastern border.
- b) The geographic dispersion of secondary outbreaks from respective primary ones.

On these questions, from Table 2 it is noted that :

- There appears to be a causative relation between the location of five (5) out of seven (7) primary outbreaks and the Evros river along the border. This finding is consistent with accumulated epidemiological evidence placing the source of infection east of Evros river, indicates a high relative risk of exposure to FMDV over an extended period of time (probably with seasonal fluctuations), identifies areas most likely at risk and is of the utmost importance in designing effective surveillance, prevention and control programmes in future.

With regard to the two (2) primary outbreaks located away from the border (96/01 and 96/38), there is irrefutable epidemiological evidence linking them directly with the same common source of infection.

- On the second question, geographic dispersion of secondary outbreaks depends on awareness for and early diagnosis of disease, good epidemiology, prompt and stringent enforcement of control measures and certain inherent properties of the specific virus strain, like virulence, sensitivity and viability.

Table 2 hints on the efficacy of the control and safeguard measures applied in the infected areas and reflects the fact that in most cases the disease was contained within normal boundaries of originally infected epidemiological units, i.e villages.

In the rare occasions where secondary outbreaks occurred in neighboring villages, this was due to overlapping boundaries and contacts either at the fringes of these boundaries or in common grazing areas.

The latter was observed, in particular, at the Northern cluster of outbreaks.

2.1.3 *The epidemic in numbers*

The logistics of the epidemic in relation to the number of present, sick and destroyed animals in the outbreaks or in contact herds (as appropriate) are presented in Tables 3 and 4 respectively.

4. PRIORITIES FOR FUTURE ACTIONS

Twice in as many years Greece succeeded to control and eradicate Foot-and-Mouth disease without jeopardising the livestock of its trading partners both inside and out of the European Union.

Furthermore, in 1996 it was able to demonstrate a significant improvement in terms of procedures, infrastructure and overall efficacy in combatting the disease and is determined to continue the efforts aiming to prevent reincursion of FMD into the Union.

However, the Greek Authorities are not able to guarantee that such reincursion will not occur in the not too distant future because effective protection against FMD calls for specific measures and consistent actions at both sides of the border. To this end the European Commission must urgently support or initiate definitive actions along the following lines :

- At the Turkish side of the border, the Commission acting in cooperation with the Turkish Authorities and competent international agencies must pursue the implementation of control and safeguard measures, including vaccination, in order to reduce the level of infection in European Turkey.
The modalities, conditions and funds of this operation have not been determined yet thus exposing Evros, Greece and the Union to an incredibly high risk of reincursion.
- At the Greek side of the border, the Greek Authorities in cooperation with the Commission will set up an enhanced and on-going epidemio-surveillance network to provide early warning and prompt control of primary outbreaks. For this purpose the Greek Authorities are currently preparing a comprehensive plan to be submitted to the Standing Veterinary Committee for consideration and approval, both at technical and financial level.

The realisation of both actions referred to above as a matter of urgency is the best, and probably the only, way to protect the external borders of the European Union from future incursions of FMD and permit economic prosperity and social calm in the agricultural community of Evros.
