Miscellaneous Report FF-Y-4

WILDLAND FIRE CONTROL OPERATIONS IN FRANCE

by

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ACKNOWLEDGEMENTS

Without exception, I received a warm and cordial welcome throughout the ranks of the Sécurité Civile. Everyone with whom I spoke was more than willing to discuss the French fire control operations, answer endless questions and, perhaps most importantly, exhibited considerable patience with the author's fractured French. The author would like to take this opportunity to express his sincere gratitude to everyone whom he met during his brief visit. In particular, a special note of thanks is due to Capitaine Maret of the Centre D'essais de Valabre and Charlie Massey of Canadair Limited, both of whose hospitality and generous assistance helped to make the visit more than worthwhile.

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INTRODUCTION

This report summarizes observations made by the author concerning wildland fire control operations in France. The observations were made during a one week visit from September 15 through September 19, 1975. The focus of this visit centered around the use of airtankers for fire control. While a one-week visit can hardly be considered sufficient to comprehend the workings of a complex system, it was sufficient to acquire a general overview.

This report is not taken directly from the randomly gathered notes, but rather has been edited and reorganized by the author to form a somewhat more coherent picture. No doubt, the discussion contains a few errors; there were cases where something was lost in the author's French-English translation, as well as cases where two different interviews yielded different information. Hopefully, misrepresentations are few and of little consequence.

1. THE WILDFIRE PROBLEM

GENERAL STATISTICS

In France, 50% of all forest fires occur in the southern zone which comprises only 10% of the total land area of the country. All of the information in this report pertains to the southern zone. As shown in Fig. 1, the southern zone extends from Spain to Italy and from the Mediterranean to the Alps. The zone is about 500 km long and the primary wildfire area extends about 100 km from the Mediterranean. The Island of Corsica adds another 10,000 km² to the total land area. In this 60,000 km² region, (New Brunswick is about 70,000 km²), there were 4,500 fires as of September 1 of this year. Of this number about 2,000 are classed as forest fires. That is, they occurred in a natural area, at least 1 ha in size and burned at least 0.1 ha. The total area burned amounted to 18,500 ha, with an average fire size of just under 10 ha (forest fires only). Average occurrence density is thus about 33 fires per 1000 km² per year. For comparison, the average occurrence density in Canada is 2 to 4 fires per 1,000 km², with an extreme of 25. New Brunswick with about 500 fires per year loses about 6,000 ha and has an average fire size of 12 ha. Thus, despite an average occurrence density which exceeds the Canadian extreme, the fire loss statistics are comparable to those for New Brunswick, which has one of the lowest average fire sizes in Canada. Thus, it

has to be concluded that the French fire control operations are very effective.

CLIMATE

The primary fire season is comparable to that found throughout much of Canada, lasting about three months, from June through August. There is a smaller spring peak in March and April. Total annual rainfall averages 600 mm (24 in.), falling mostly in the spring and fall with smaller amounts in winter and virtually none in summer. There are two types of significant winds. The first is a southeast wind blowing across the Mediterranean. Although it is often fast, it tends to be humid and have associated precipitation. The more important is the Mistral -- a northeast wind originating in high pressure zones in Central France. Since the Mistral crosses the Alps, it tends to be very dry by the time it reaches southern France. Speeds of 30-35 knots are not uncommon, with acceleration by as much as a factor of 2 in the Rhone valley. There are also variable but often strong valley winds in the mountains.

FUELS AND TOPOGRAPHY

Anyone familiar with southern California fuels and topography would feel very much at home in southern France. The fuel complex has a strikingly similar overall appearance -- grass, brush, scattered trees and forested areas. Additionally, many of the same species (Chamise, Live Oak) are present. As in California, the brush types constitute the primary fire hazard. This was strongly emphasized by a wind tunnel demonstration, in which very impressive intensities and spread rates were generated. The topography ranges from flat through rolling to mountainous, with peaks in excess of 2,500 metres (8,000 ft.). The Island of Corsica is particularly rugged with very limited access.

FIRE OCCURRENCE

Man causes almost all wildfires. It is estimated that about 10 million people pass through the Cote d'Azur region during the three month fire season. Needless to say, this region experiences an above average fire occurrence problem. Even more troublesome, however, is the Island of Corsica. Even though it is only one of 13 departments in the southern zone, half of all the fires occur there. Incendiarism appears to be a primary factor. Despite a normal frequency of thunderstorms, lightning fires appear to be a rarity. Finally, as in Canada, there is a decided diurnal fire occurrence cycle. The peak is around 1400 hrs., with 66% of all fires occurring between 1100 and 1600 hrs.

2. THE FIRE CONTROL SYSTEM

UNDERSTANDING THE STRUCTURE

Acquiring information on system organization proved to be the most vexing part of the visit. By North American standards, some aspects of the organizational structure appear to be awkward. In some instances, the author is not sure who reports what to whom! Considering the previous statistics, however, it has to be concluded that the system works efficiently, though how it does so is occasionally not clear. In all fairness, however, part of the difficulty lies with the shortness of the visit. No doubt a longer visit would have enabled the author to better sort out the many details of the organizational structure.

DEPARTMENTAL ORGANIZATION

Fire control involves at least three government departments. The Sécurité Civile (responsible for rural and urban firefighting) is part of the Ministry of the Interior. The Forest Service (responsible, among other things, for prevention, presuppression and detection) comes under the Department of Agriculture. Finally, the Metêo (weather office -- responsible for weather and fire danger information) is part of the Ministry of Transport.

In addition to firefighting, (employing about 214,000 firemen) the Sécurité Civile performs several other functions: air-sea rescue, police, ambulance, highway patrol, etc., which together employ an additional 150,000 security personnel (see Fig. 2). For the most part, these services are independent but because they are part of the same department, personnel transfers are fairly common. In addition, there are at least two independent groups responsible for different aspects of fire control within the Sécurité Civile, both of which report to Paris -- the Sapeurs-pompiers (firemen) and the Groupment Airien (airtankers) even though the latter are stationed entirely within the southern zone.

FIRE CONTROL ORGANIZATION

France is divided into 95 departments, 13 of which are in the southern zone. The departments, comparable in size to North American counties, appear to have a significant role in the administration of local affairs. In all cases, however, major decisions and final approval for significant innovations must come from Paris. Each department contains, on the average, 30 Centres de Secours (village fire and emergency stations), which are responsible for all fires in their districts. Each Centre de Secour is comprised of one or more four-wheel drive fire trucks or pumpers, each of which has two or three associated firemen. In addition,

there are small trucks and jeeps with one or two men used for extensive patrol work as well as initial attack. Together, the ground units form the backbone of the fire control system. There is a readily definable chain of command with respect to this aspect of the control system. One chief for the southern zone, one in each department, and a fire chief responsible for each fire station. Sometimes the positions are held by military personnel serving in command positions for the purpose of promotion.

OPERATIONS

There are a number of detection sources -- lookout towers, under the jurisdiction of the Forest Service; ground patrols, under the command of the departmental chiefs; aircraft, under the zonal commander; and the general public. All information converges at the departmental centre. The closest station is assigned the initial attack responsibility. The first chief to arrive becomes the Director de Secours (fire boss), with complete authority for the control operation on the particular fire. Requests for additional assistance are passed to the departmental and if necessary the zonal centres.

FIRE REPORTS

The French are very conscious of the need for and use of fire statistics. For the past three years reports have been completed on each fire and the information entered in a computer data file. A two-page computer printout is available for each fire. A typical example can be seen in Fig. 3. The report contains about 100 bits of information, laid out in a systematic well-organized format. The fire report is comparable to the best in Canada. Interestingly, French statisticians face problems similar to those encountered in Canada, with regards to variability in the quality of information reported from the field. A set of statistics familiar to many Canadians (man-hours, aircraft-hours, fire fighting time, accessibility, distributions of area burned, rates of growth, etc.,) has been completed for each department. A few examples can be seen in Figs. 4 to 6.

MEASURING SYSTEM EFFICIENCY

An attempt has been made to rate the relative efficiency of each department (an undertaking dutifully avoided by the Forest Fire Research Institute for obvious reasons, but which would no doubt be of value to individual agencies). In particular, two interesting measures of efficiency have been developed.

$$K_1 = \frac{\text{area burned}}{\text{area threatened}}; \quad \bar{K}_1 = .25$$

$$K_2 = \frac{\text{area burned before suppression}}{\text{area burned during suppression}}; \quad \bar{K}_2 = 2.3$$

It appears that wildland fires generally threaten only clearly definable, limited areas. In other words fires tend to stop naturally or be easily controllable at rock outcrops, discontinuities in the fuel complex or watershed boundaries. Thus, by rating the area burned as a function of the area threatened (K_1) an excellent measure of overall system performance can be derived. The only problem is that some aspects of system performance are not under the direct control of the individual department. K_2 measures the relative efficiency of detection and dispatch versus suppression. As detection and dispatch become relatively more efficient, the numerator decreases and so also does K_2. As suppression becomes relatively more efficient, K_2 increases. Relative values and some uses of K_1 and K_2 are shown in Figs. 7 to 10. While the specific variables K_1 and K_2 as defined above may or may not be directly applicable to Canadian fire control agencies, the concepts are most interesting and warrant serious consideration.

3. AIRTANKER OPERATIONS

LOCATION

Since the primary purpose of the visit was to observe airtanker operations, a major portion of the time available was spent at the Marignane airbase about 25 km north east of Marseilles. While there are extensive pine forests in southeastern France, the terrain tends to be relatively flat, the soil sandy and plenty of water is available. Since ground forces are easily able to handle fire suppression operations in the southeastern zone, all CL-215's have been stationed in the southern zone.

NUMBERS

A total of 14 CL-215's have been purchased to replace older Cansos, with three more slated for acquisition over the next two to three years. Three have crashed (all due to pilot error) leaving a total of 11 operating aircraft. Eight are stationed at the Marignane airbase and three on Corsica. When the additional aircraft become available, two satellite bases (currently under construction) with two to three aircraft each, will be established.

AIRTANKER USE STATISTICS

Year	No. of fires	Flying hours	Number of Drops Water	Retardants	Tons of Water
1973	450	2,400	6,350	?	42,000
1974	402	2,400	7,300	1,300	47,000
1975	356	2,020	5,300	?	36,000

The preceeding data are self-explanatory. A few additional points are worth noting. Half of the fires attacked from the air are on Corsica (210 in 1974). The above represents about 10% of all fires (compared to an average of 15% in Canada). Some feel that about 7% of all fires definitely require airtankers, while the other 3% are marginal. The use statistics represent an average of 35 fires and 200 flying hours per aircraft, the latter of which is almost three times the average seasonal utilization (70 hours) in Canada.

THE AIR BASE

While the airtankers are part of the Sécurité Civile, the base at Marignane is attached to the Paris headquarters. The three principal individuals at the base are: the base commander -- responsible for administration; the chief pilot -- responsible for scheduling and training crews; and the chief mechanic -- responsible for keeping the fleet operational. Only the chief pilot (and the crews under him) are directly concerned with actual fire fighting. All three individuals report directly to Paris. Collectively, the base is simply responsible for having the aircraft available at all times when they are needed. At this mission they are more than successful in that monthly availability ranges from 92% to 98%. A primary factor in this success rate is the fact that all maintenance is done at night.

CREWS

The aircraft are flown with two-man crews -- a pilot and a flight mechanic. There are two sets of crews per aircraft. Thus, there are 22 pilots and 22 flight mechanics stationed at the base. Each crew is allowed a maximum of eight hours per day or 60 drops, with a maximum unbroken flying time of four hours.

COSTS

The CL-215's are expensive to own and operate. The primary factor is the annual maintenance schedule which is extensive and hence expensive. The total hourly cost is 6,400 francs ($1,470). In addition, amortizement and depreciation total 5,600 francs ($1,290) per hour. Interestingly, this is

almost double a previously estimated Canadian cost. All costs are borne by the Paris headquarters. The airtankers constitute a service provided by the national government and neither the pilots nor the departmental chiefs have to concern themselves with aircraft costs. Needless to say, this form of cost accounting is not conducive to maximizing system efficiency.

DISPATCH

The process of requesting and dispatching an aircraft appears to be somewhat cumbersome. In general, the fire boss radios his departmental chief who, in turn, radios zonal headquarters. The latter may call the air base directly and order a dispatch or send a helicopter for an on-site report and then call the base. Some efforts to streamline the dispatch procedure are currently underway. Once dispatched it takes 20 minutes for the first airtanker to be airborne. In addition, because Marignane is an international airport, the airtankers must wait their turn for permission to take off. It was observed that this could add as much as 10 minutes to the take-off time. This compares unfavourably with Canadian operational standards of 5 to 15 minutes for take off, depending on the agency.

COORDINATION

If the aircraft arrive first, the pilot selects the mission, whereas if ground forces are on the fire first, the pilot is under the command of the fire boss. Coordination appears to be no problem -- decisions tend to be made by mutual agreement whenever possible. Sometimes a helicopter (under the control of the zonal chief) is used as an air attack coordinator. Helicopters are felt to be more desirable than fixed-wing aircraft, in that they can also perform other tasks. To date, however, helicopters have not been used operationally as airtankers.

SIZE OF ATTACK FORCE

The number of aircraft dispatched is primarily a function of the fire to water distance. The objective is to achieve a 4-minute interval between drops, if possible. Up to 8 aircraft have been dispatched to one fire. When the fire to water distance is long, longer intervals become necessary -- but never in excess of fifteen minutes (their estimated maximum effectiveness time of water). When water is close, ten to fifteen drops per hour are possible. One problem has been encountered with respect to endurance. On the average, the aircraft have about 3 hours of operational flying time before they must refuel. The practice has been for all aircraft to return to the base at the same time (since they all run out of fuel at about the same time) often leaving an interval of an hour or more between drops, during which time some fires

have been lost. The problem is recognized, but attempts to stagger the returns thereby maintaining a reduced but continuous attack do not appear to have been particularly successful to date.

TACTICS

Drop height is normally about 30 metres. They feel the effective drop pattern to be about 30 x 75 metres. The airtankers always hit the head first if possible. If not, they attack either the hottest flank or that flank which is least accessible to ground forces. Airtankers are recognized as being poorly suited to two objectives: mop-up operations and very large fires.

SUCCESS

From Fig. 11, it can be seen that the success ratio for airtanker operations averages about 80%. As would be expected, most of the failures are in the largest fire class (fire front over 1,000 metres long). This is very comparable to a reported success ratio of 82% for a sample of Canadian operations.

OTHER COUNTRIES

Currently, the use of airtankers for fire control throughout the remainder of Europe is very limited. Spain has acquired a number of CL-215's primarily for search and rescue. Six are also used as airtankers, however, with two being assigned to each of three bases. Retardants are used in Barcelona. France has loaned its CL-215's to Italy on two occasions, both of which were successful missions. Italy currently employs one helicopter with a sling bucket for fire control work. Greece has acquired two CL-215's primarily for troop transport. The extent, if any, to which they will be used as airtankers is unknown. Finally, France loaned three aircraft to Germany for four days this summer during their disastrous fire situation. They flew 152 hours and made about 100 drops. Unfortunately, by the time they arrived the fires were beyond the point where effective control was possible. In spite of this, the Germans apparently were very impressed with the effectiveness of the CL-215's.

4. FIRE DANGER RATING

ORGANIZATION

The Centre Meteorologique Regional de Marignane (regional weather office) is in direct contact with the zone headquarters at Valabre. They are responsible for gathering meteorological data, calculating fire danger indicies and disseminating the information to the appropriate offices of

the Sécurité Civile. The organizational boundaries of the weather office do not appear to coincide with those of the Sécurité Civile. Thus, the office at Marignane handles what is called the southeast region which does not include the four departments west of the Rhone or the two northernmost departments which are in the Alps. Presumably, these are handled by another weather office. As is commonly done elsewhere, the southeast region is divided into smaller zones of similar climatic and ignition potential. As shown in Fig. 12, the seven departments are divided into 29 climatic zones. Weather and fire danger information (danger class and soil moisture reserve) is provided for each climatic zone.

METEOROLOGICAL NETWORK

There are several weather stations in each zone. The two departments which were sampled -- Gard (30) and Var (83) have about 20 stations each, averaging about 20 km apart. Overall the network averages around 14 stations per department, separated by an average distance of 30 km. Most Canadian fire weather offices are forced to work with networks considerably sparser than this. Additionally, there are roving meteorological vans which sample weather as well as fuel and soil moisture throughout the region -- concentrating in the drier and hence most critical areas. Interestingly, the weather office is currently developing a network of automatic remote stations which, when employed, will decrease the average interstation distance to 10-20 km.

FIRE DANGER RATING

The French fire danger rating system is somewhat simpler than the FWI. There are four danger classes which are a function of wind and a soil moisture reserve (see Fig. 13). Essentially, the latter, with a capacity of 150 mm of water (about 6 in.), is comparable to our Drought Index. It is calculated twice per week. Rain adds water and evapotranspiration removes it. The latter is a function of measured evaportranspiration, temperature and day length. Solar radiation is also observed but its use is not clear. The 1973 soil moisture reserve to mid-June for the Cote d'Azur is shown in Fig. 14, along with the 10-year average. This simple index works well because the primary fuel is brush and the moisture content of the foliage plays a major role in determining fire behaviour. Ground fuels are of little importance during the primary fire season. Wind is obviously highly significant with regard to spread. They also found a very high correlation between wind speed and fire occurrence -- a relationship not commonly acknowledged in Canada.

5. RESEARCH AND DEVELOPMENT

VALABRE TEST CENTRE

A test centre at Valabre has been studying various aspects of forest fire control for about 12 years. The test centre is currently operating under the direction of Capitaine Maret, who took over from Capitaine De Blaise about two years ago. The visitor cannot help but be impressed with the quantity and quality of research currently underway at Valabre. Two of the main projects involve vehicle research and development, (including a vehicle test area) and a partially completed hydraulics laboratory.

WIND TUNNEL

There is also a wind tunnel for fire behaviour studies. The wind tunnel is interesting in that rather than using model fuels, full scale brush fuels are employed. The species to be tested is cut and "planted" in 3' x 3' x 6' deep soil boxes at normal densities found in the field. These are lined up to form a 30 foot long fuel bed which is loaded into the tunnel by a track system. The fan is turned on to the desired speed, the fuel bed lit, and a series of measurements are automatically taken and recorded. The wind tunnel is located outside and therefore subject to the vagaries of the weather (which caused the demonstration to be delayed for a couple of days). All in all, however, with ingenuity a relatively inexpensive system has been developed which yields reliable full scale fire behaviour information, which avoids the scaling and modeling problems associated with most laboratory fire behaviour studies.

RESEARCH PROJECTS

There are several research projects currently underway at Valabre. One involves processing information from individual fire reports to produce some of the statistics mentioned earlier. Another involves the development of a mobile command centre as well as improving on the current command and organizational structure. The latter was presented to a working group meeting involving departmental chiefs at Valabre. It should be noted that because both the research facilities and the zone chief are located at Valabre, there is excellent opportunity for communication between field personnel and research. It should also be noted, however, that field people appear to have much the same attitude towards researchers as is found throughout North America. In general, though, the research establishment appears to be closely tuned-in to the operational needs of the organization.

AIRTANKER DISPATCH MODEL

There are number of develcpments specifically related to airtankers. Perhaps the most well known is the use of a computer model as an aid in making airtanker dispatch decisions. The current model is recognized as being fairly simplistic. It calculates rate of spread as a function of the moisture deficit, temperature, solar radiation and wind. Then, by applying Newburger's triangular fire growth model and inputting fire size at detection, the expected fire perimeter at any time is calculated. Finally, by adding the fire to base and water distances, the circuit time is calculated. From these, the cost and final size of the fire for various dispatch strategies is calculated. The relative results are then used as a dispatch guide. A more sophisticated dispatch and allocation model is currently under development.

AIRTANKER RESEARCH AND DEVELOPMENT

There are a number of airtanker related developments as well. In the coming year, extensive tests on the new scoop developed by Field Aviation will be undertaken. No work on the Fire-Trac or on-board Tenogum mixing systems will be undertaken as these are not felt to be sufficiently developed to warrant field trials. There has also been considerable work involving the use of helicopters. A sling bucket and dropping system for the SA 330 PUMA has been designed and extensively drop tested. Additional work with helicopter transport and initial attack crews and equipment has also been undertaken. Operational guidelines have been developed. It is presumed by the author that helicopters will have an operational attack role (in addition to their current intelligence and logistics role) in the not too distant future.

5. SUMMARY

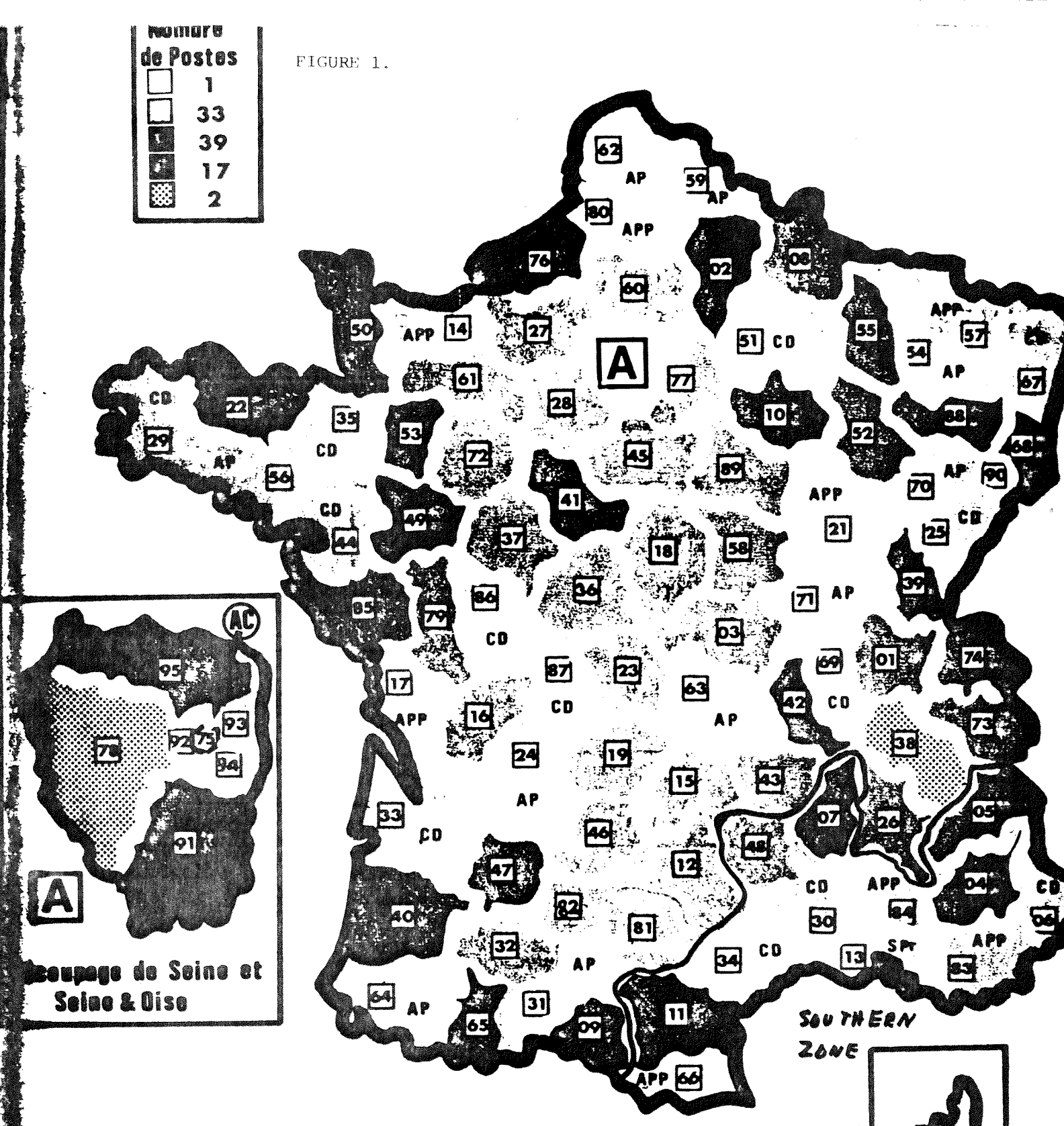
The wildfire problem in southern France is considerably more significant than most North Americans would suspect. While the structure of the various organizations responsible for fire control is different from that typically found in North America, the statistics suggest that the organization is very effective in accomplishing their mission. The basic building block of the suppression organization is the four-wheel drive ground tanker with a two to three man crew. On about 10% of all fires, the ground crews are supported by a fleet of 11 CL-215 airtankers. Both water and retardants are used, though the former is by far the most predominant. The French have developed their own fire danger rating system, which is used to govern much of the day-to-day activities of the organization. Finally, they are conducting a considerable amount of applied research, much of which would be of interest to Canadian fire control agencies.

All in all, the visit was most successful. Hopefully, it will prove to be only one of many mutually beneficial exchanges between researchers and operational personnel of French and Canadian Fire management agencies.

LIST OF ILLUSTRATIONS

Figure

FIGURE 1.



DIRECTIONS DEPARTEMENTALES DE LA PROTECTION CIVILE :

- Poste tenu par un Adminstrateur Civil ..... AC
- Poste tenu par un Chef de Division ..... CD
- Poste tenu par un Attaché Principal de Préfecture ..... APP
- Poste tenu par un Attaché de Préfecture ..... AP
- Poste tenu par un Officier G.M.S. .....
- Poste tenu par un Inspecteur S.I.S. .....
- Poste tenu par un Contractuel .....

JUILLET 197

FIGURE 2.

ORGANISATION DE LA PROTECTION CIVILE, PENDANT LE TEMPS DE PAIX

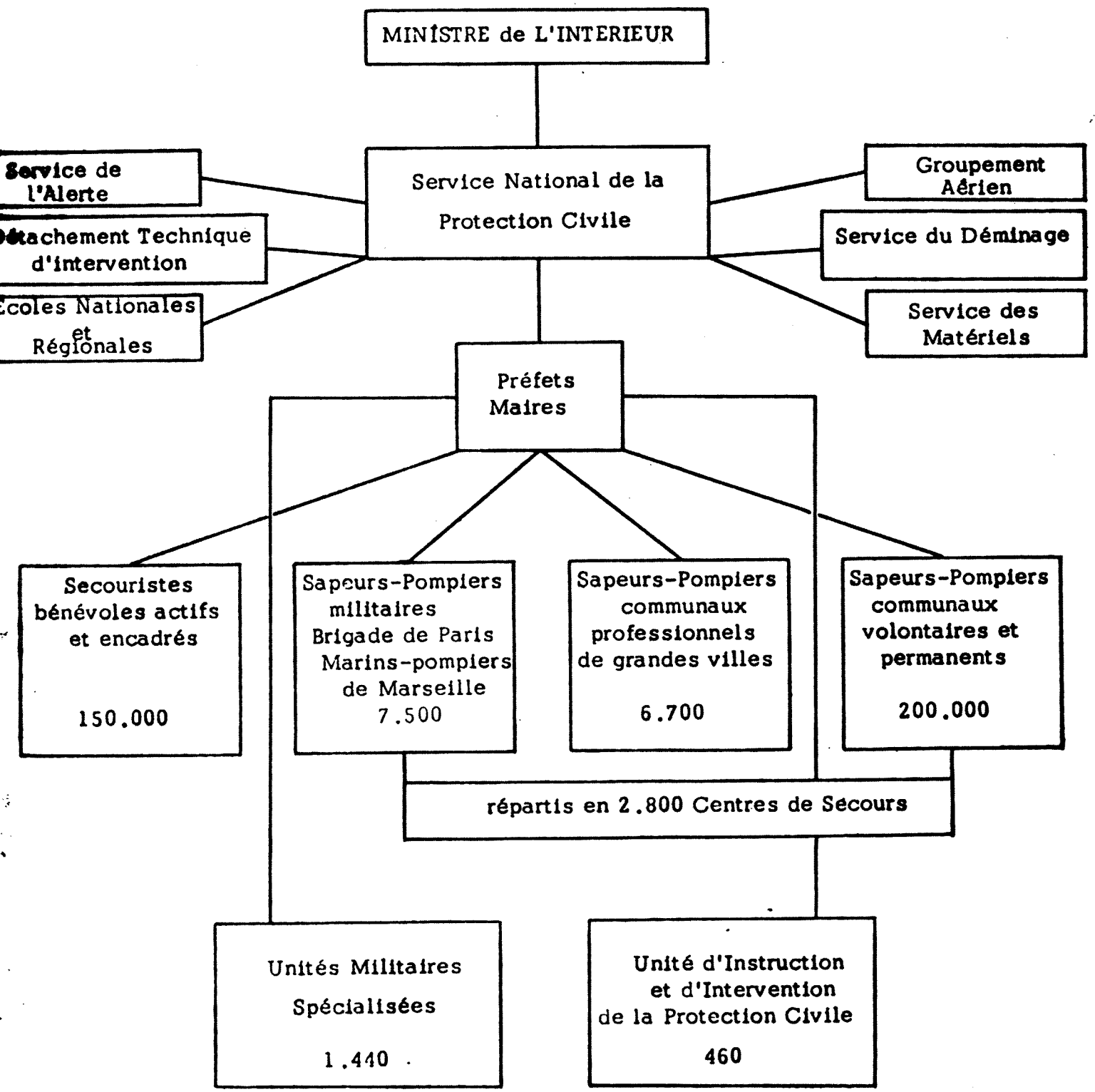


FIGURE 3a.

FEUX DE FORÊ

IDENTIFICATION DU FEU

DÉPARTEMENT: BOUCHES DU RHONE

LIEU DE NAISSANCE DU FEU: COM

N°s D'INTERVENTION: 130004

DATE DU FEU: 09 07

AUTRES COMMUNES SINISTRÉES:

SUPERFICIE TOTALE BRÛLÉE: 20,0 HA

RISQUE ENCOURU PAR (OU SURFACE MAX

DONNÉES MÉTÉOROLOGIQUES ANTÉRIEURES AU FEU

RISQUE MÉTÉO DE PROPAGATION SECTEUR	ALERTE	SÉCHERESSE DU SOL (EN MM)	P POUR J – 1
5	NUL	095	034

CONDITIONS DU DÉPART DU FEU (ÉCLOSION & PROLONGATION LIBRE)

LOCALISATION: DE 0 A 15 M VOIE CARROSSABLE

CAUSE: 1

DONNÉES MÉTÉO — TEMPÉRATURE: 32

HYGROMÉTRIE AIR: 31 %

VE

ÉTAT DES LIEUX — RELIEF: VALLONE

PROPAGATION SUR UN PLAN: EN MONTAN

CARACTÉRISTIQUES DE PROPAGATION LIBRE — DURÉE: 00H05

VITESSE (EN M/HEURE)

UTILISATION DE L'ÉQUIPEMENT DU TERRAIN

POINTS D'EAU INÉPUISABLES: BOUCHE INCENDIE A 01 KMS

RIVIÈRE A 01 KMS

POINTS D'EAU ÉPUISABLES: 010

AUTRES AMÉNAGEMENTS UTILISÉS

DÉROULEMENT DES OPÉRATIONS

- ALERTE — HEURE DU PREMIER APPEL: 16H25

ORIG

- PREMIERS SECOURS — ÉLÉMENT D'INTERVENTION ARRIVÉ EN PREMIER SUR LES LIEUX

PREMIER CENTRE DE SECOURS INTERVENU: AUBAGNE

DÉ

DISTANCE DU C.S. AU FEU: 04 KMS

CIRCULATION: NORMALE

- DÉBUT DE L'ATTAQUE A 16H35 — ÉTAT DU FEU = 1 SURFACE BRÛLÉE
- FEU CIRCONSCRIT LE 09 07 A 16H40
- FEU ÉTEINT LE 09 07 A 19H00
- REPRISE DU FEU LE A

CONDITIONS MÉTÉO 1ER JOUR	TEMPÉRATURE MAX.	VENT MOYEN VITESSE (EN M/SEC)	DIRECTION
	32	07	120-140D

MOYENS UTILISÉS POUR L'EXTINCTION

- HOMMES (EN N°s D'HEURES HOMMES) — SAPEURS-POMPIERS: 231 — HARKIS: 176 — ARM

- MATÉRIEL (EN N°s DE VÉHICULES)

ENGINS DE COMMANDEMENT VL RADIO ou PC MOBILE	ENGINS D'ATTAQUE		
	CCF LÉGERS	CCF MOYENS	CCF LOURDS

DANIEL 145 002

RÊTS FIGURE 3b. **ÉTAT RÉCAPITULATIF PAR FEU**

CARTE 023 ZONE 024

COMMUNE DE AUBAGNE COORDONNÉES

7 72 ET HEURE DE DÉPART 16H30

AVEC

PAR LE MASSIF FORESTIER
X DIRECTEMENT MENACÉE) 500HA = 1000 HA ENQUÊTE GENDARMERIE

POUVOIR ÉVAPORANT DE L'AIR		PRÉCIPITATIONS RÉCENTES		
POUR J-1 A J	POUR J	DU	QUANTITÉ (MM)	DURÉE (1/4 H)
006	050	05 07 72	001	XXX

)

VÉGÉTATION FUTAIES PIN D ALEP

VENT MOYEN 07 M/SEC. MAX. XX M/SEC. DE 120-140D

ANT EXPOSITION DU VERSANT NORD

4800 VITESSE (EN HA/HEURE) 3,6

10 M³ A 01 KMS M³ A KMS M³ A KMS TOTAL 10 M³

M³ A KMS M³ A KMS DISTANCE MOYENNE 1 KMS

ORIGINE POPULATION

JEEP RADIO

DÉLAI DE DÉPART	HEURE DE DÉPART	DÉLAI D'INTERVENTION	HEURE D'ARRIVÉE
0H02	16H27	0H03	16H30

ACCESSIBILITÉ MAUVAISE VITESSE D'INTERVENTION 60 KM/H

0,3 HA 2 DISTANCE PARCOURUE PAR LE FEU DANS SA PLUS GRANDE LONGUEUR 400 M

● SURFACE BRULÉE A L'EXTINCTION 20,0 HA X FEU MIS EN SURVEILLANCE

● PAR REPRISE

VENT MAX. (EN M/SEC)	PRÉCIPITATIONS QUANTITÉ	PRÉCIPITATIONS DURÉE
XX	000 MM	00 1/4 H

ARMÉE	SAUVETEURS COM. ou REQUIS	D.F.F. BRIGNOLES	TOTAL	N^bre D'HOMMES AU FEU EN MOY.
			407	168

	ENGINS D'ALIMENTATION MOBILE			COMMANDOS HÉLIPORTÉS	
OS AUTRES	CC de 3-10 M³	CC > 10 M³	C. SOUPLE de 6 à 20 M³	H. 34	HÉLICOS LÉGERS

DOMMAGES CAUSÉS AUX PEUPLEMENTS FORESTIERS

● PAR NATURE DE PEUPLEMENT (SURFACES INCENDIÉES EN HA ET DIZAINES D'ARES)

FIGURE 3c.

LANDES, GARRIGUES ET MAQUIS IMPRODUCTIFS	LANDES, GARRIGUES ET MAQUIS EN SEMIS	TAILLIS SIMPLES	TAILLIS SOUS FU
		11,0	
FUTAIES DE PINS D'ALEP	FUTAIES DE PINS MARITIMES	FUTAIES DE PINS SYLVESTRES	FUTAIES DE PINS NOIRS D'AUT
1,0			
CHATAIGNERAIES EN TAILLIS	SUVERAIES	JEUNES BOIS ET REBOISEMENTS EN RÉGÉNÉRATION NATURELL FEUILLUS	RÉSINEUX
			3,0

● ESTIMATION EN VALEUR (A TITRE D'INFORMATION ET SANS ENGAGEMENT DE L'ADMINISTRATION)

VALEUR TOTALE DES BOIS 2300 F VALEUR DES PRO

● ESTIMATION EN QUALITÉ

PROTECTION 20,0 HA RÉCRÉATION ET LOISIRS

● PAR NATURE JURIDIQUE

FORÊTS DOMANIALES HA FORÊTS COMMUNALES ET SOUMIS

AUTRES DOMMAGES

VÉHICULES INUTILISABLES DE COMBAT	VÉHICULES INUTILISABLES AUTRES	IMMEUBLES DÉTRUITS OU ENDO
7		

GRANDS FEUX (POUR LESQUELS LA LUTTE A DURÉ PLUS DE 24 HEURES)

● SURFACES BRÛLÉES A 17 H CHAQUE JOUR (EN HA)

● CONDITIONS MÉTÉO CORRESPONDANTES

	J 1	N 1/2	J 2	N 2/3
TEMPÉRATURE MAX.	33			
TEMPÉRATURE MIN.	07			
VENT MOYEN VITESSE	07			
VENT MOYEN DIRECTION	10			
VENT MAX. VITESSE	000			
PRÉCIPITATIONS (M M)	00			
PRÉCIPITATIONS (1/4 H)				

CANADAIRS

● DEMANDE DE L'I.D.S.I.S. AU P.C. VALABRE LE A

● NOMBRE D'APPAREILS DEMANDÉS PAR L'I.D.S.I.S. PAR P.C. 02

● 1ÈRE MISSION - DATE 09 07 72 LIEU AUBAGNE

DÉLAI DE DPE 0H00 DE DÉCOLLAGE 0H15 DE TRANSPORT 0H07

MISSION N°	MISSION DATE	NOMBRE D'AVIONS	TEMPS DE VOL	ÉTAT DU FEU S BRÛLÉE	ÉTAT DU FEU VITESSE DE PROPAGATION EN HA/H	ÉTAT DU FEU V P	ÉTAT DU FEU TAILLE D
01	09 07 72	10	16,25	001			580M

FIGURE 3d.

IS SOUS FUTAIES	FUTAIES DE CHÊNES VERTS	FUTAIES DE CHÊNES PUBESCENTS	AUTRES FEUILLUS	AUTRES FEUILLUS
FUTAIES DE NOIRS D'AUTRICHE	FUTAIES DE SAPINS - ÉPICÉAS	AUTRES RÉSINEUX	AUTRES RÉSINEUX	CHATAIGNERAIES EN VERGERS
ÉNÉRATION NATURELLE RÉSINEUX	JEUNES BOIS ET REBOISEMENTS EN PLANTATIONS ET SEMIS ARTIFICIELS FEUILLUS	RÉSINEUX	AUTRES	
3,0				

:UR DES PRODUITS DIVERS 100 F TOTAL 2400 F

;IRS HA

S ET SOUMISES HA FORÊTS PRIVÉES 20AA

IMMEUBLES :UITS OU ENDOMMAGÉS	AUX PERSONNES BRÛLÉS ET BLESSÉS SAUVETEURS	AUTRES	MORTS SAUVETEURS	AUTRES

EURES)

N 2/3	J 3	N 3/4	J 4	J 5	J 6	J 7	J 8	J 10

A INTERVENTION DES CANADAIRS

FOURNIS EN 1ÈRE MISSION 10

TYPE DE MISSION ORDONNEE

ANSPORT 107 DÉLAI TOTAL D'INTERVENTION 0H22 DISTANCE EN KMS 027

U	TAILLE DU FRONT DE FEU	CONDITIONS DE COMBAT	CADENCE DE LARGAGE	TEMPS DE COMBAT	ÉTAT DU FEU EN FIN DE MISSION
	500M -1000M	MOYENNE	1,1	1,13	MAITRISE
			0,0	0,00	
			0,0	0,00	
			0,0	0,00	
			0,0	0,00	
			0,0	0,00	

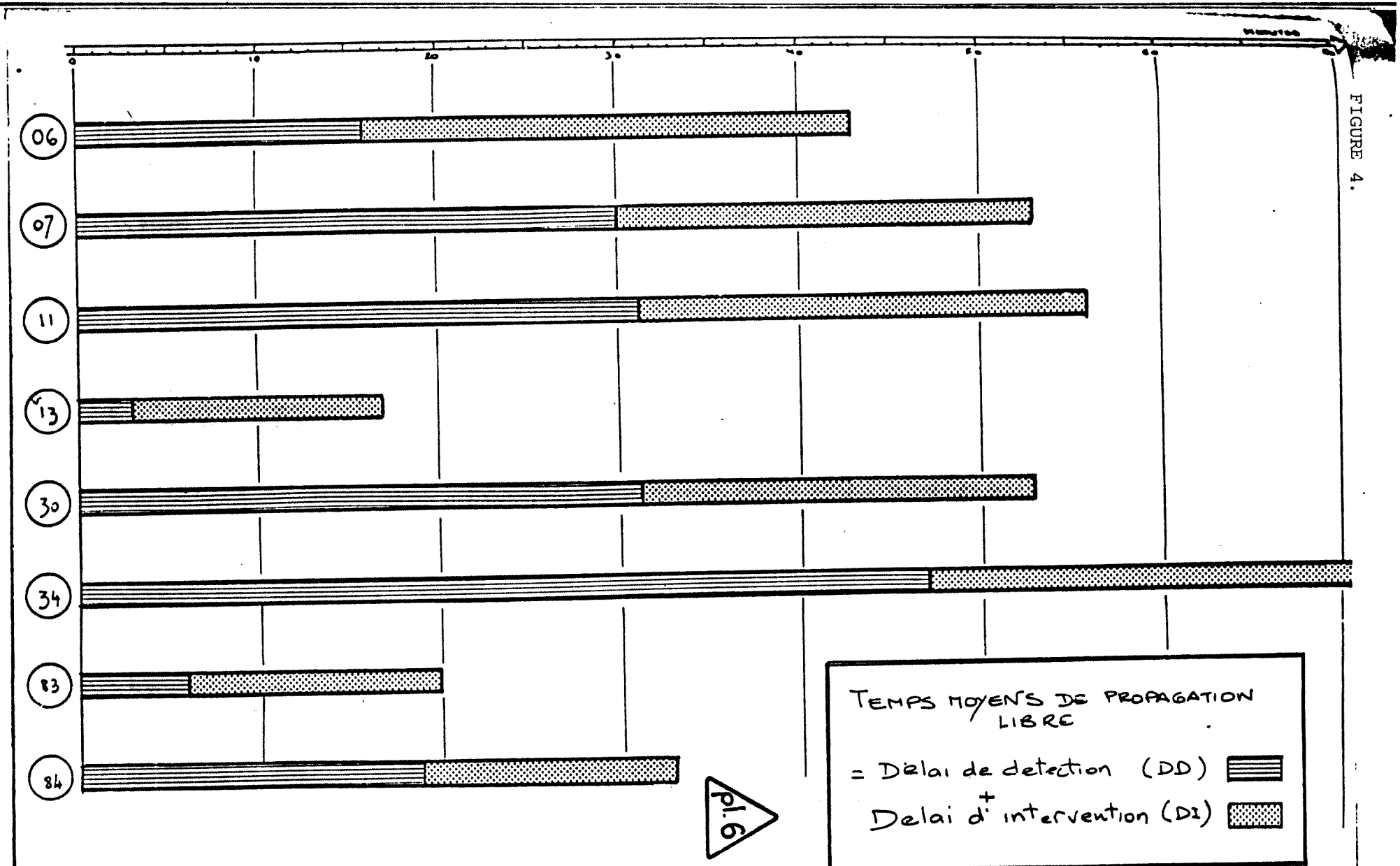

0
10
20
30
40
50
60
06
07
11
13
30
34
83
84
TEMPS MOYENS DE PROPAGATION LIBRE
= Délai de détection (DD)
+ Délai d'intervention (DI)
pl.6

FIGURE 4.

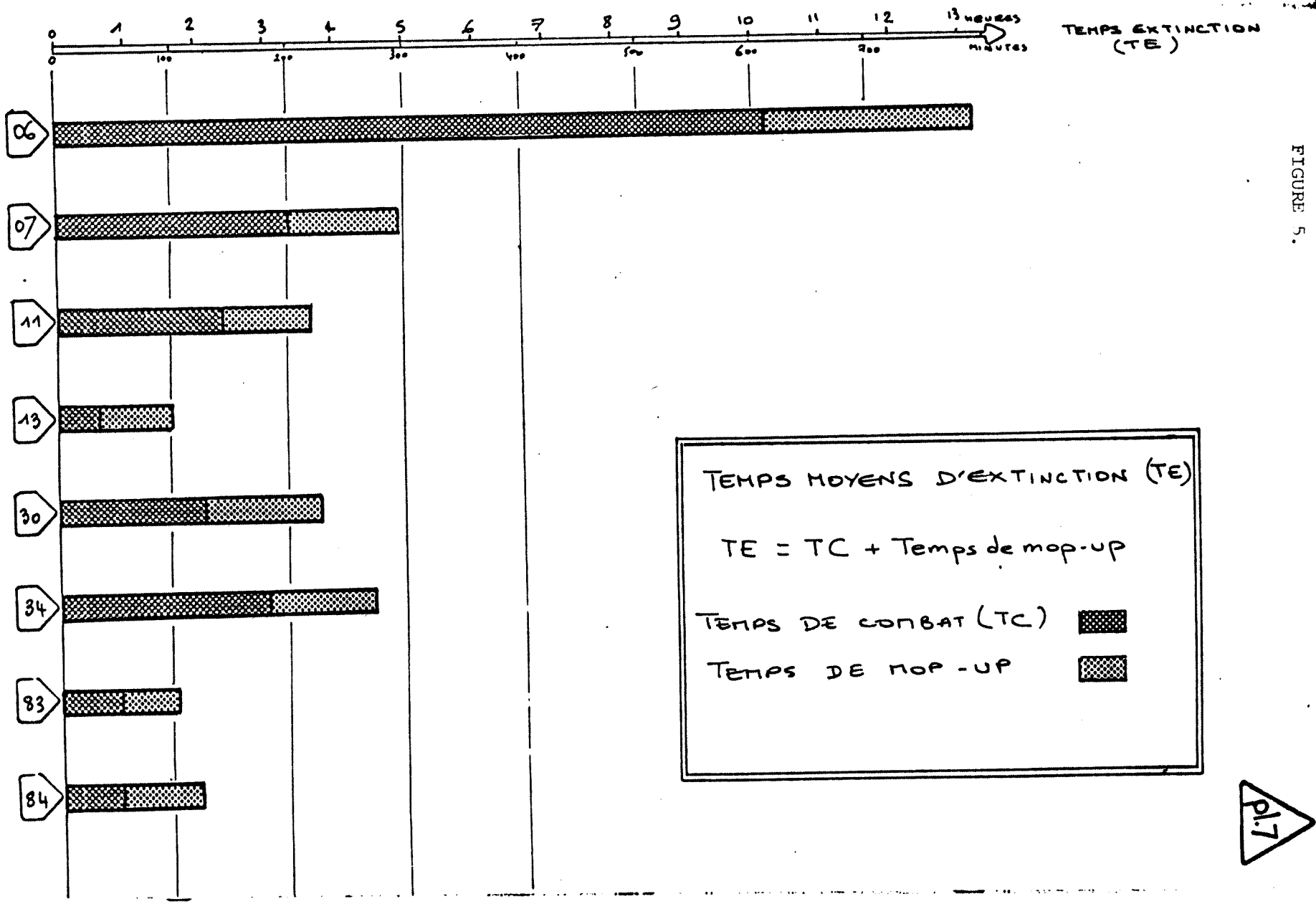
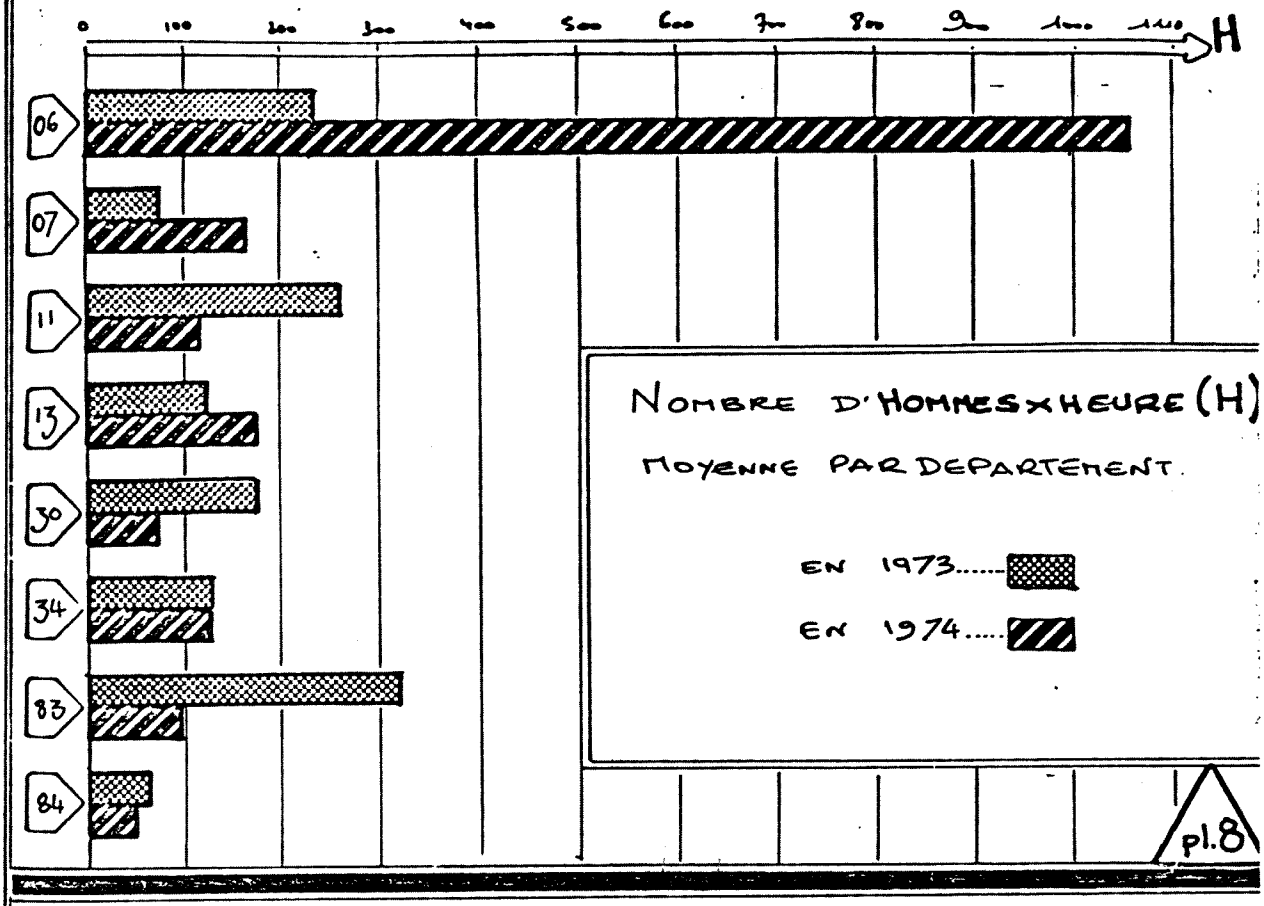
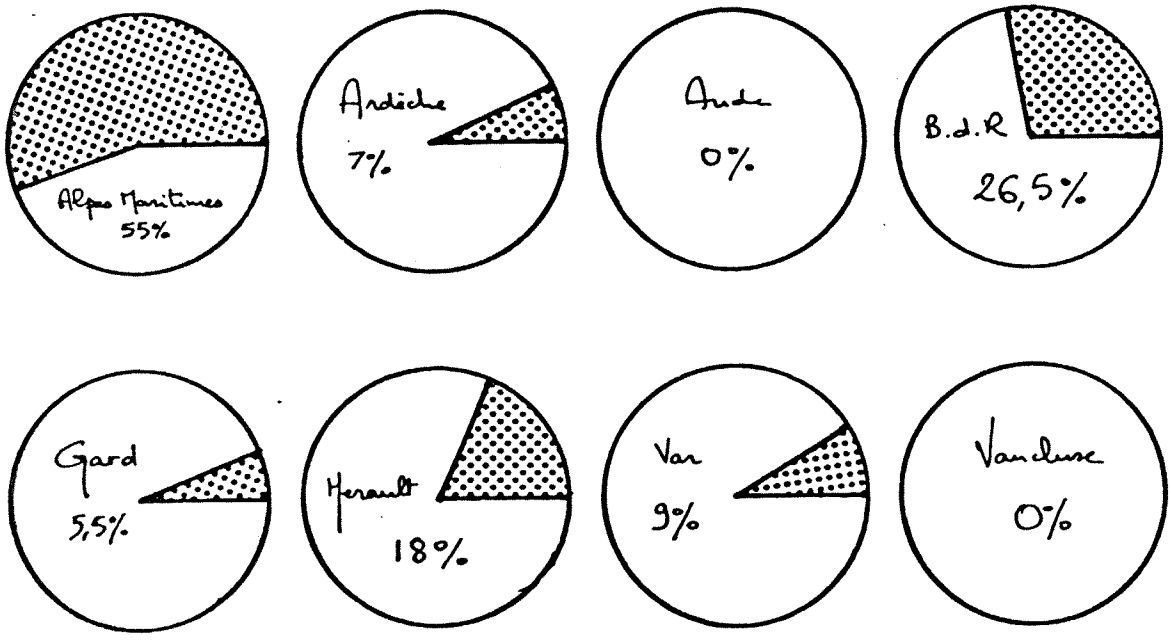

0 1 2 3 4 5 6 7 8 9 10 11 12 13 heures
0 100 200 300 400 500 600 700 minutes
TEMPS EXTINCTION (TE)
06
07
11
13
30
34
83
84
TEMPS MOYENS D'EXTINCTION (TE)
TE = TC + Temps de mop-up
TEMPS DE COMBAT (TC)
TEMPS DE MOP-UP
pl.7

FIGURE 5.

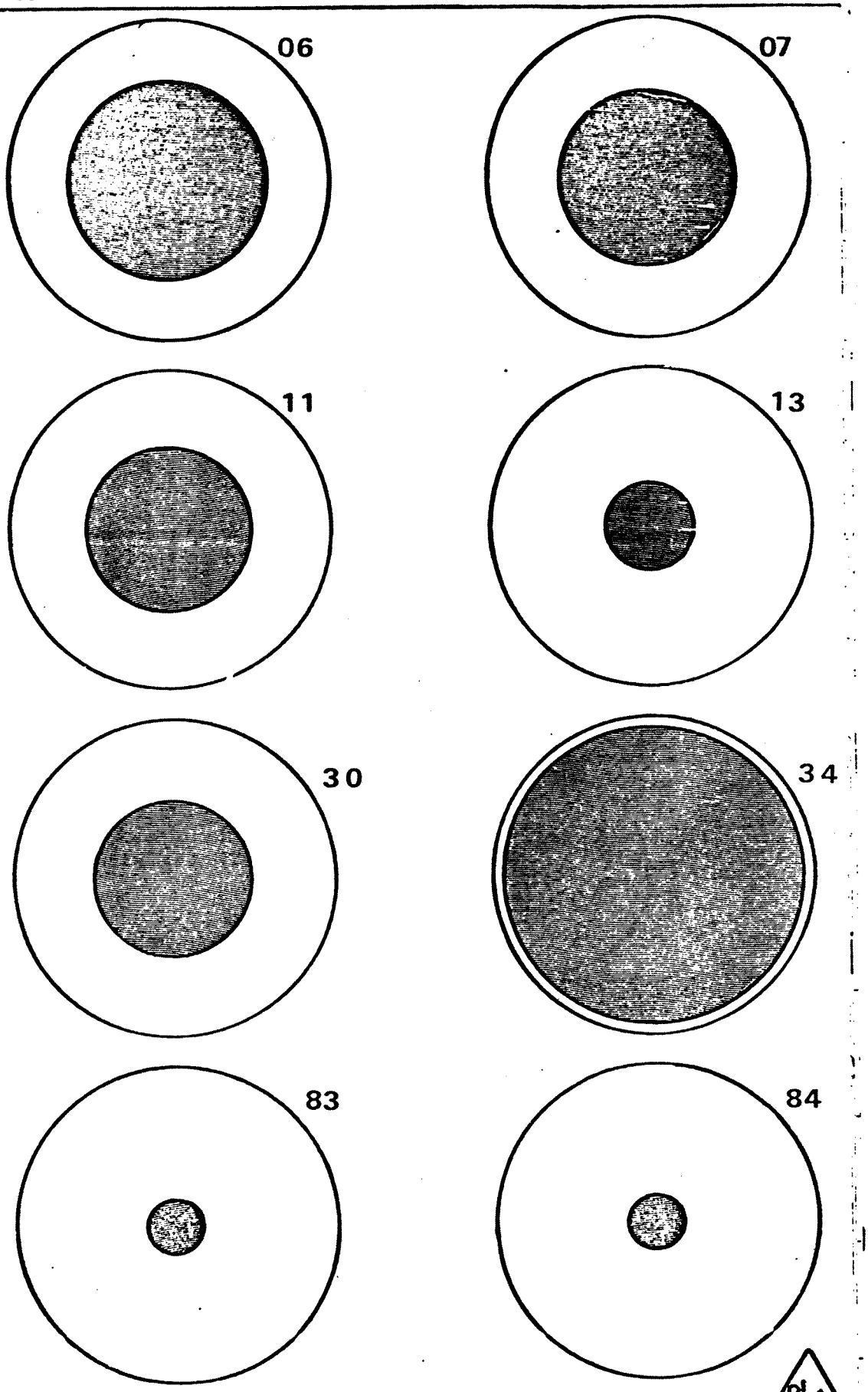
FIGURE 3.





TAUX D'UTILISATION DES CANADAIRS (PAR RAPPORT AU NOMBRE TOTAL DE FEUX PAR DEPARTEMENT)

FIGURE 7.

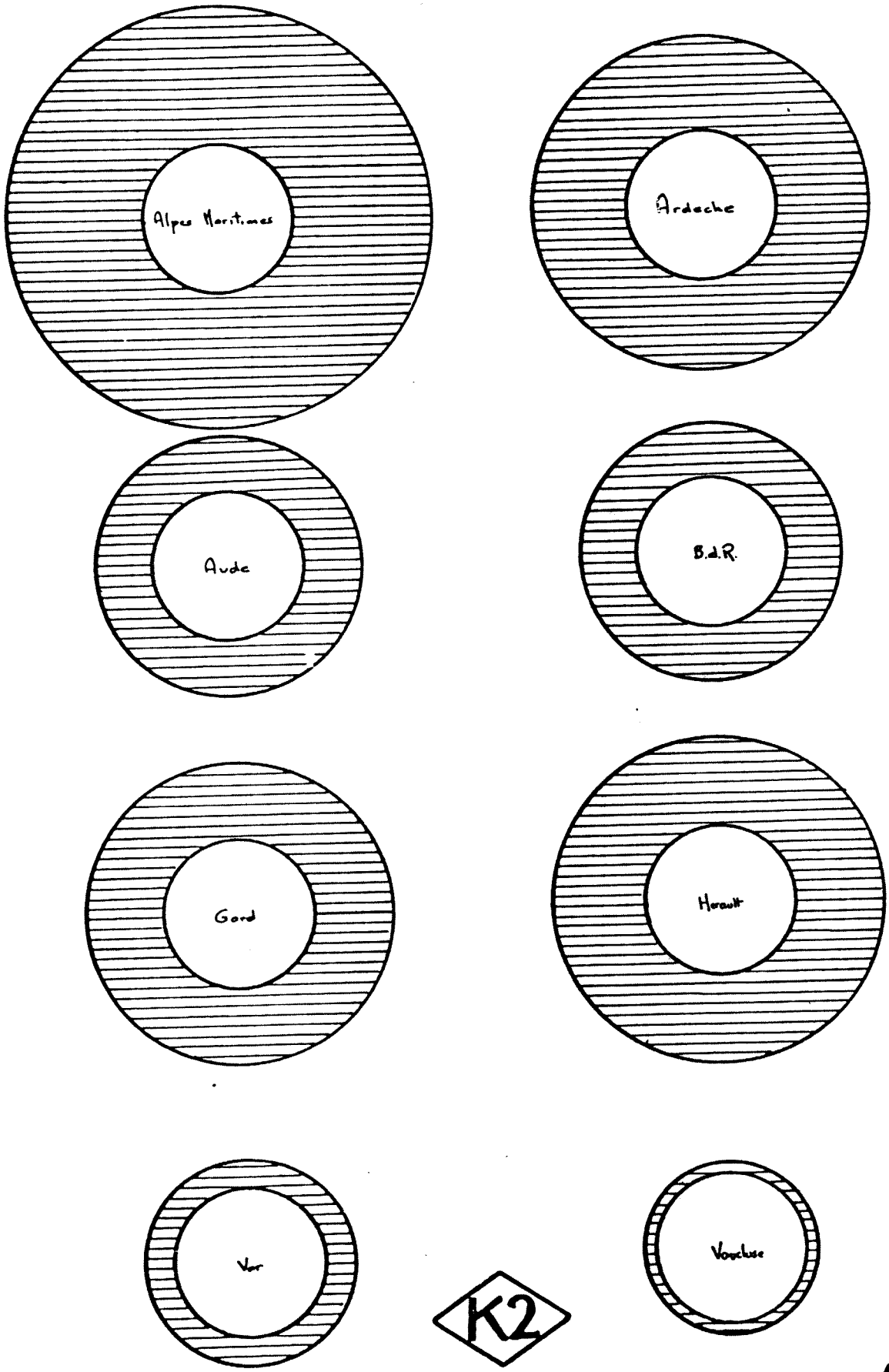


REPRESENTATION DE K1.

le cercle interieur represente la surface detruite, le cercle exterieur represente la surface menacée.

Pl.1

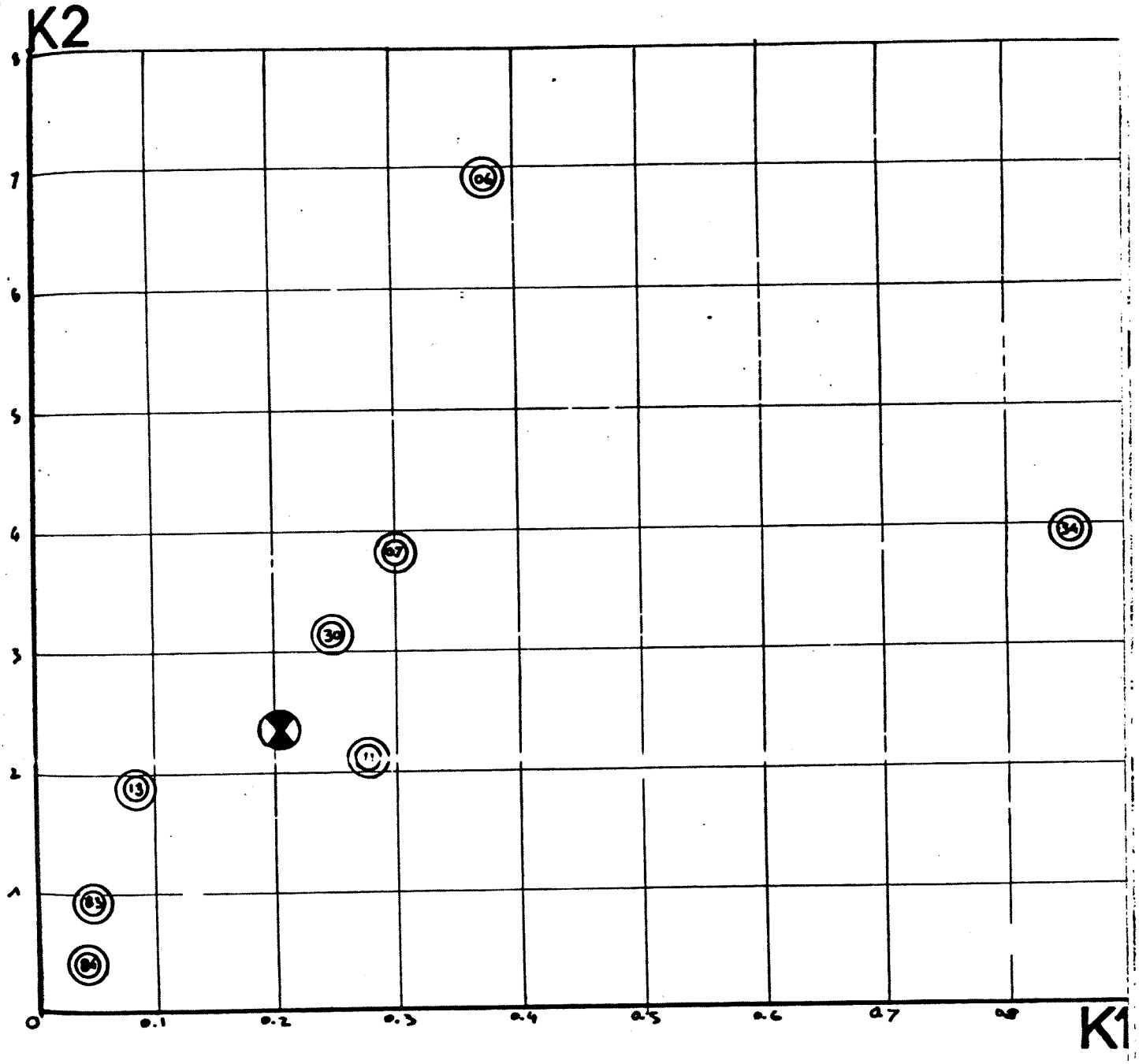
FIGURE 8.



Representation de la surface detruite (cercle exterieur) pour une surface à l'arrivee des secours identique (cercle interieur)

pl. 2.

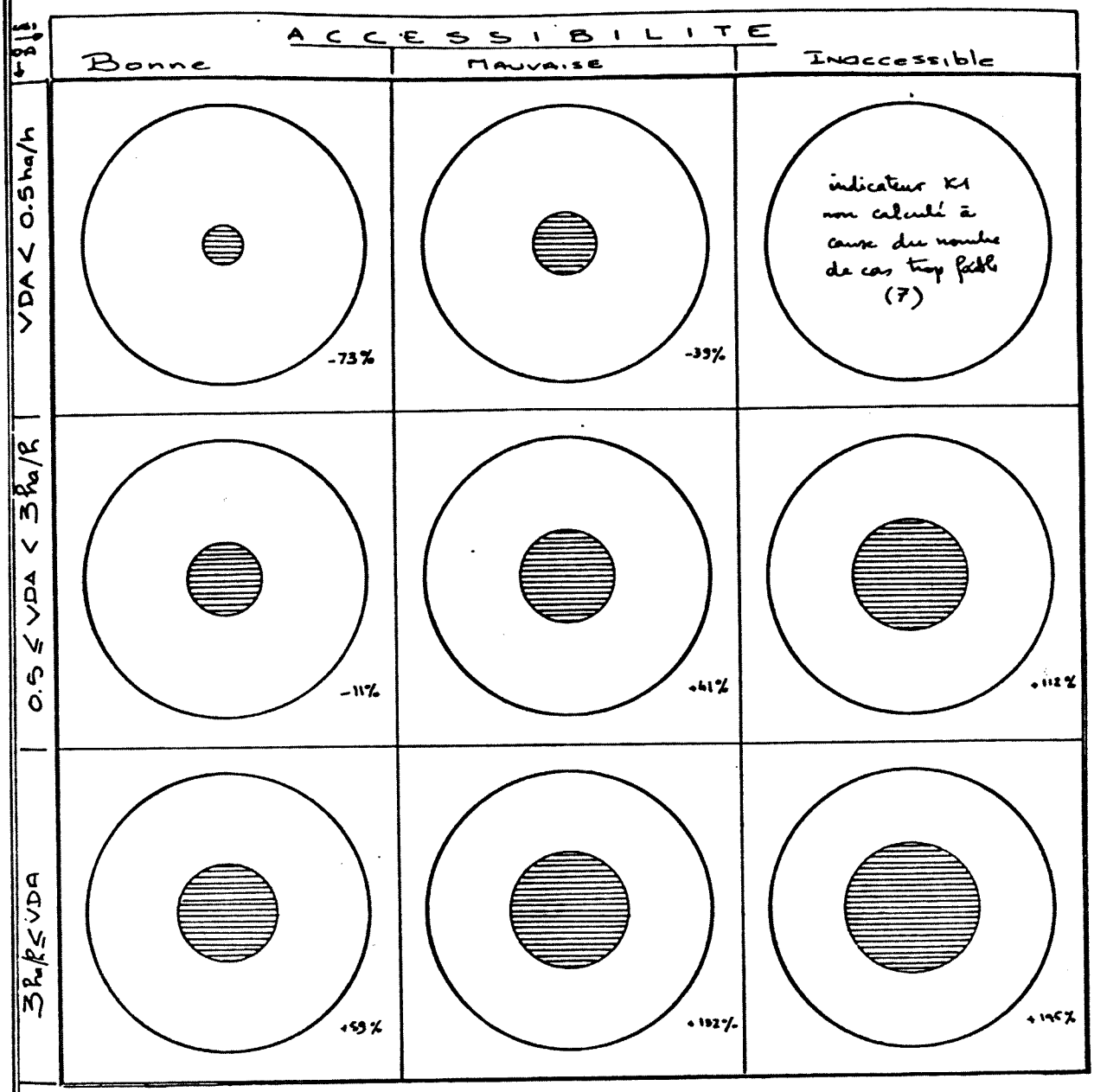
FIGURE 9.



Representation de l'efficacité dans un diagramme (K1, K2)
(⊗ = moyenne de la région)

pl.3

FIGURE 10.



Variation de l'indicateur d'efficacité K1 (moyenne pour les 8 departements) en fonction :

- de l'accessibilite
- de la VDA (vitesse destruction avant attaque)

(Cercle exterieur = Surface menacee
Cercle interieur = Surface detruite)

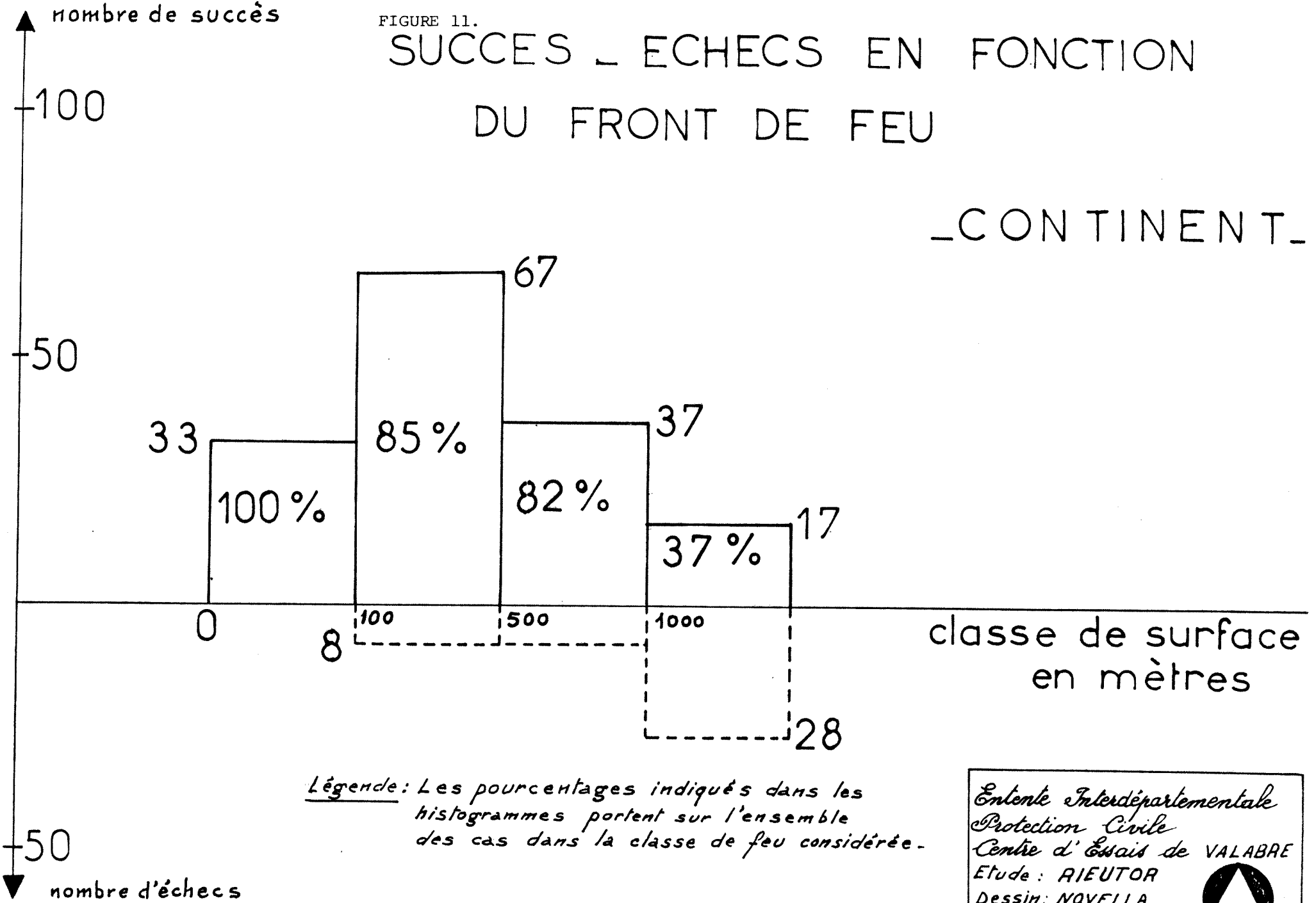
pl.10

les pourcentages figurant en bas et à droite de chaque figure représentent les variations de K1 par rapport à la moyenne.

FIGURE 11.

SUCCES _ ECHECS EN FONCTION DU FRONT DE FEU

CONTINENT



Légende : Les pourcentages indiqués dans les histogrammes portent sur l'ensemble des cas dans la classe de feu considérée.

Entente Interdépartementale
Protection Civile
Centre d'Essais de VALABRE
Etude : AIEUTOR
Dessin : NOVELLA
Vérifié : Cne MAARET

FIGURE 12.

INCENDIES DE FORETS

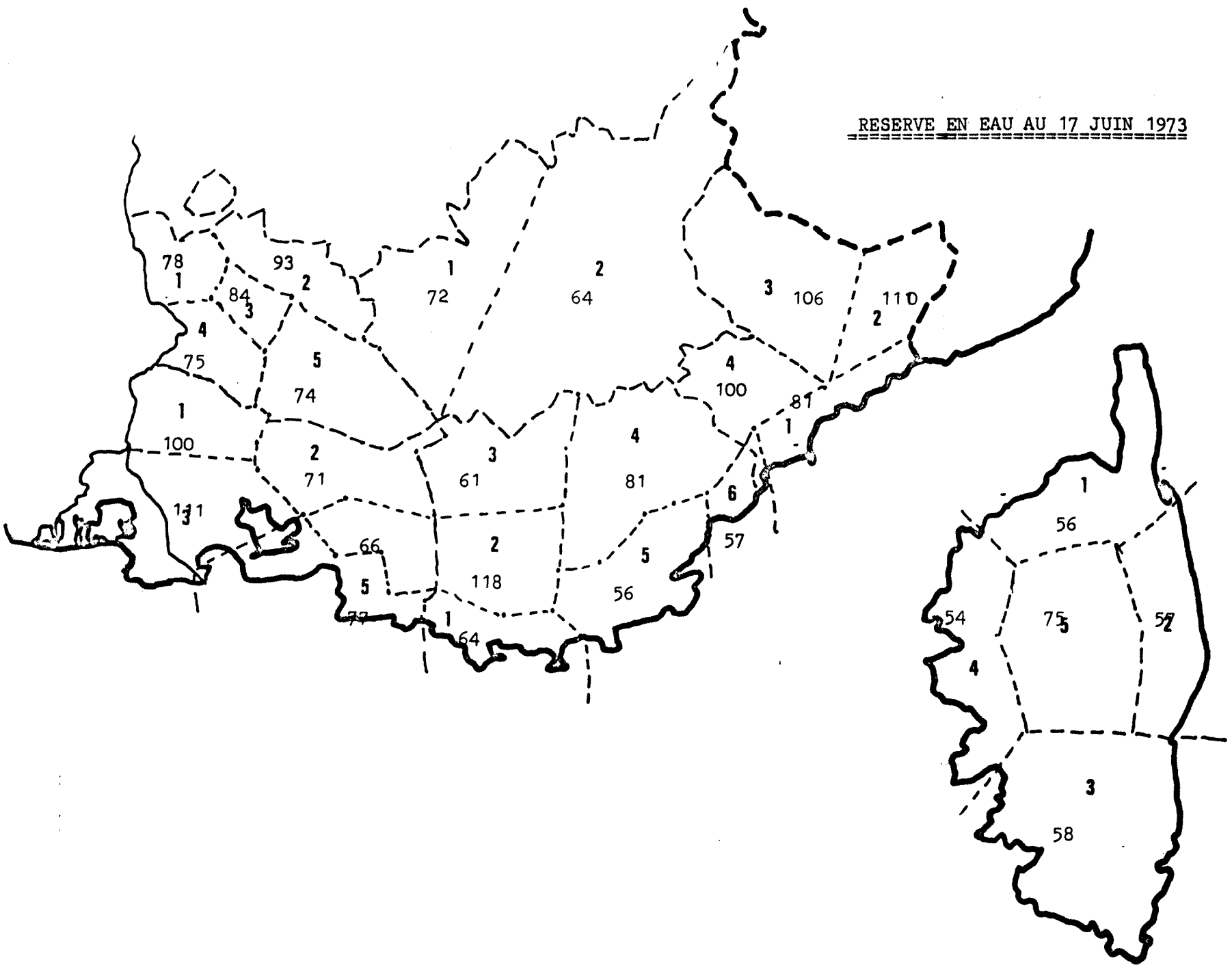


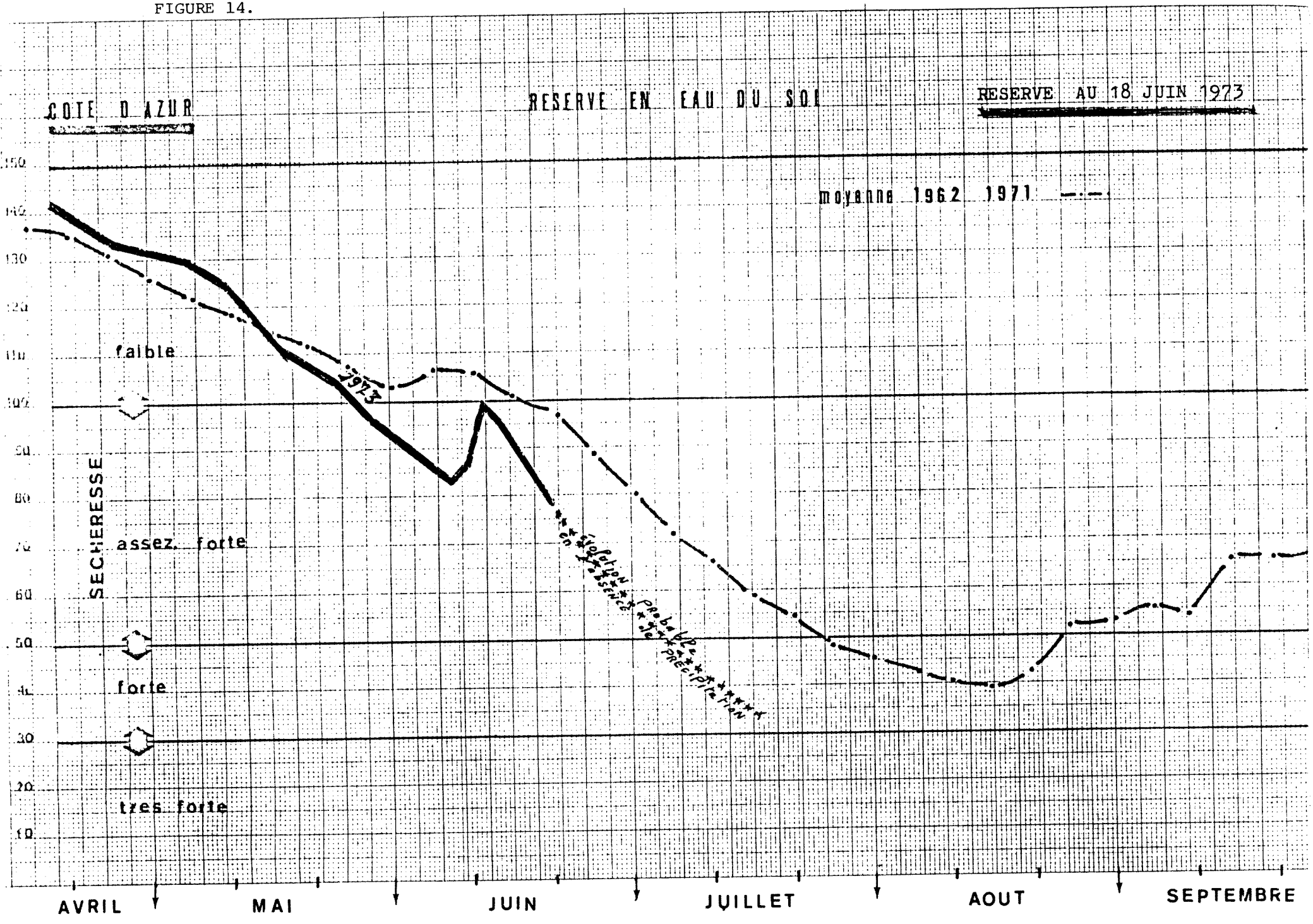
FIGURE 13.

RISQUES FEUX

Vent Km/h / Réserve en eau en mm	> 20	20 à 40	> 40
de 100 à 150	0	0	0
de 50 à 100	1	1	2
de 30 à 50	1	2	3
moins de 50	1	2	3

0	Risques faibles	Pas d'alerte
1	Risques habituels	Alerte
2	Risques sévères	Alerte grave
3	Risques très sévères	Alerte très grave

FIGURE 14.


COTE D AZUR
RESERVE EN EAU DU SOL
RESERVE AU 18 JUIN 1973
moyenne 1962 1971
1973
faible
assez forte
forte
très forte
SECHERESSE
AVRIL
MAI
JUIN
JUILLET
AOUT
SEPTEMBRE