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MONITORING THE EXTENT AND OCCURRENCE OF FIRE IN THE DIFFERENT
VELD TYPES OF SOUTH AFRICA WITH PARTICULAR REFERENCE TO ITS
ECOLOGICAL ROLE AND ROLE IN RANGE MANAGEMENT

BY

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PRETORIA 0001
SOUTH AFRICA

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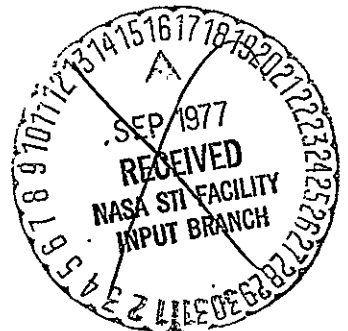
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MONITORING THE EXTENT AND OCCURRENCE OF FIRE IN THE DIFFERENT VELD
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BY

DENZIL EDWARDS

1. INTRODUCTION

Literature and experimental work on the occurrence and rôle of fire in vegetation and in range management for Southern Africa has been comprehensively reviewed by West (1965). Fires may be caused naturally, such as by lightning, but man is certainly the main agent. Early inhabitants of the subcontinent such as the Bushmen and Hottentot tribes are known to have used fire in hunting and to stimulate grazing, but the earliest reference to fire is in the account by Periplus of the voyage by Hanno the Carthaginian along the west coast in 600 B.C. Since then, historical references abound in the writings of the early Portuguese explorers of the 15th century and of subsequent explorers, naturalists and missionaries (see West, 1965). It is generally agreed by ecologists that fire has played a major rôle in the historical development of the present vegetation over much of South Africa.

Experimental work on the effects of burning of vegetation in South Africa began as early as 1916 (West, 1965). Most of this work has been on grassland, where the chief interest has centered on the reaction of grassland to burning at different seasons and frequencies, and on protection from burning and grazing. Some work has also been done on the fynbos (winter rainfall macchia or chaparral type vegetation - see Fig. 15), and on the use of burning to control the spread of undesirable trees and shrubs. Experimental work on fire in savanna and woodland has been mainly in countries to the north of South Africa where there is a preponderance of this kind of vegetation. Much of the various experimental work has been done with the ultimate objectives of establishing the rôle of fire in range management. One feature, however, of all the work on fire is the apparent absence of any systematically carried out precise estimates on a national or semi-national scale of the extent and time of burning, and of its extent in the different kinds of vegetation. The

absence of such data can be readily understood in view of the practical problems involved in obtaining such information over a wide area.

With the advent of the first American earth resources technology satellite, Landsat-1, in 1972, new possibilities emerged for the assessment of natural resources such as vegetation and range land. What was to some extent an unforeseen by-product of the plant ecological component of the Landsat-1 multi-disciplinary project submitted by South Africa to assess the value of satellite imagery in resource evaluation on a national scale (Edwards in Malan, 1973), was the possibility of monitoring veld burning on a national scale. An investigation by Jarman (in Malan, 1973) of six images covering approximately 5 700 250 ha of the province of Natal was accordingly carried out to include a comparison of the amount of burning in different veld types. This study showed the usefulness of the satellite imagery in establishing the location, extent and time of burning. She concluded that for "monitoring fire and establishing the ecological and possible socio-economic relationships of fire the ERTS imagery proved outstandingly useful if consecutive imagery is available because burnt areas are clearly identifiable. The monitoring of fire on a national scale would be impossible by conventional means in view of the cost of acquiring the data base and the manpower involved in interpretation" (see Malan, 1973).

Accordingly, when research participation was invited for the Landsat-2 satellite project, a proposal was submitted for monitoring the extent and occurrence of fires in the different veld types of South Africa. Specific objectives of the investigation were:

- (i) To establish within each veld type the extent and location of the particular areas being burnt
- (ii) To record the time of burning, which could be used to determine if areas are being burnt during recommended periods
- (iii) To provide an analysis of the extent, frequency, location and time of burning in relation to ecological type and socio-agricultural communities. The effects upon

vegetation type, the adequacy of legislation and control could then be derived to provide more effective management of range lands.

It was thus anticipated that if the necessary consecutive imagery could be provided, fires could be recorded monthly (every 36 days) to provide a seasonal fire development pattern for veld type and region.

2. DATA COVERAGE

The number of images and the various scenes of the Landsat-1 and Landsat-2 imagery used are shown in Fig. 1. Expressed in terms of quarter degree (15 minute) squares of latitude and longitude that were completely or partially covered by the imagery, the coverage is shown separately for Landsat-1 and Landsat-2 by Figs. 2 and 3, and on a monthly basis by Figs. 4-14. Altogether, 92 images covering 39 scenes of Landsat-1 and Landsat-2 were analysed for the occurrence of fire. These totals consisted of 75 images for 33 different scenes of Landsat-2, and 17 scenes and images of Landsat-1.

From Fig. 1 it will be seen that there are three main gaps in the Landsat-2 coverage. The first is for the province of Natal, where the absence of the three scenes W.R.S. 180-79 to 180-81 precluded 1975 analyses for one of the main veld burning areas of the country, and especially of comparing it with the Transvaal high density burning areas during the same year. Previous imagery from Landsat-1 was, therefore, used to provide an indication of veld burning in this region, bearing in mind the variations in veld burning pattern that may occur in different years.

The second main gap in Landsat-2 coverage is for the images 183-78 to 183-82, an orbital path that, broadly speaking, marks the vegetation transition from the moister grassland to the drier dwarf shrubland of the Karoo. Here it is singularly unfortunate that, in a year of good rains leading to an unusually good grass development, the absence of imagery coincided with the area where the expected veld fires did in fact

occur. As noted in the Annual Report of the Department of Agricultural Technical Services of 1975/76, at least 30 000 ha of veld were burnt. Some of this burning is probably represented in image 184-83 (Figs. 2 & 8), but most is known to coincide with the image gap represented by degree square 3125.

The third gap in Landsat-2 coverage is for scenes 181-83 and 192-83, an area of montane forest, grassland and savanna where veld burning also occurs with some regularity because of the moist climatic conditions and good grass cover. It is also unfortunate here that a seldom recorded large forest fire that occurred on the Amatola Mountains at Stutterheim fell just outside image 181-83, as did also the grass fires on these mountains.

From the aspect of monitoring the monthly and seasonal development of fire patterns for various scenes, the chronological sequences of available Landsat-2 coverage are shown in Table 2. Figs. 4-12 show the geographical cover for the different months. The 18 day consecutive pairs show excellent coverage in scenes 181-78 to 181-80 and 182-76 to 182-82 of the bushveld savanna of the Transvaal and the eastern half of the Highveld grassland (see Fig. 15). The September repetition of three of these scenes is also valuable, though it should be noted that the September image 181-80 centred on the northern high Drakensberg mountains of Natal unfortunately has a high cloud cover that obscures the increase in fires that is apparent in parts of the image. The 36 day coverage provided by the August to September images 184-77 to 184-79 of the western Highveld grassland to the marginal Kalahari shrublands and savannas is also valuable for monitoring fire development. Although valuable for specific scenes, extrapolation of results over the wider area from the more scattered and irregular monthly coverage of other scenes is difficult and unreliable.

3. TECHNIQUES.

The interpretation and cartographic techniques used were simple unsophisticated ones capable of being applied under supervision by

personnel with little academic training. The basic procedure was to identify burnt areas on the satellite imagery and then to transfer the outlines of the burns onto a suitable base map. Once the burnt areas have been plotted onto a map, ecological and other relationships may be determined. Also, certain features of the burns, such as their time of occurrence, number, size and distribution, can be assessed for any specific kind of patterning and relationships. Satellite imagery with its synoptic and repetitive coverage is uniquely suited to supplying such information.

Both positives and negatives of the MSS red and infra bands 5 and 7 of Landsat-2 were available. Identification of burnt areas was done by direct visual interpretation of the optically enlarged Landsat-2 infra red image in a Bausch & Lomb Model ZT-4 Zoom Transfer Scope.

Simultaneously, the image was checked and compared with the 1:1 000 000 scale image on an international Imaging Systems Mini-Addcol Colour Additive Viewer Model 6020. This was possible because the negative 70 mm image was usually found more convenient to use on the Zoom Transfer Scope than the usually darker toned infra red positive which was then available for use on the colour viewer. For the Landsat-1 images, interpretation of burns was made from 1:500 000 scale False Colour Photo-litho prints that were available.

The outlines of the burnt areas were transferred directly from the 70mm MSS images onto overlays of the standard 1:250 000 SA Topo Series, or when not available, the standard 1:250 000 SA Topocadastral Series maps. The Zoom Transfer Scope that was used for this purpose saved considerable time and cost in not requiring enlargement of the 70 mm imagery. A minor modification facilitating the transfer work was achieved by fitting an easily removable microscope sub-stage so that systematic scanning in X and Y directions was possible. For the Landsat-1 images, burn information was plotted onto transparent overlays at 1:500 000 scale, this being the original image scale that could be superimposed on the standard 1:500 000 SA Topo Series maps.

The areas of each individual burn were measured from the overlays, using

a dot grid which trials showed to be faster and more consistent than available planimeters, though somewhat less accurate and underestimating small areas. The number of burns in area classes was then also determined for image and vegetation type.

To determine the relationship of the burnt areas to vegetation, the national 1:1 500 000 Veld Types of South Africa by Acocks (1975) was enlarged to the 1:250 000 and 1:500 000 standard base maps, thereby allowing direct comparison of the overlays with veld type. Although enlargement of the small scale 1:1 500 000 veld types map to the larger scale is not a desirable practice, the original map is remarkable for the accuracy of its vegetational information and, in any case, no satisfactory reasonable alternatives appeared to exist. Any obvious errors could easily be corrected. The area of each veld type for each image was determined as before by dot grid.

Although tedious, the method as a whole proved satisfactory. The chief problems encountered were in consistent interpretation of small burns and in a few areas for larger burns where these were possibly old burns or were associated with a dark soil and rock. As a whole, the present study is a conservative estimate of the amount of veld burning, mainly due to an underestimate of the amount of small burns. There are several reasons for this in addition to the tendency for the dot grid method used to underestimate small areas as previously mentioned.

It will be apparent that interpretation depends on the skill of the interpreter and there is no doubt that the tedium involved in examining large amounts of imagery may affect accuracy. In the present investigation it has been observed that the interpreter has a marked tendency towards underestimating burns smaller than 1000 ha in size as well as old burns. Interpretation of old burns is also affected by image contrast.

The problem of distinguishing burns from cultivated lands with dark coloured soils, especially when freshly ploughed, did not arise in the original test study done on the Landsat-1 imagery for Natal where such

soils are of comparatively limited extent (see Jarman in Malan, 1973). Interpretation is particularly difficult in intensively cultivated areas, such as in the Themeda Veld veld type of the Highveld and in parts of the Turf-Thornveld veld types of the Transvaal bushveld savanna. Small patchworks of cultivation are difficult to distinguish from burns on the basis of shape, texture and tone. Shape is often similar for small burns and cultivated fields since the boundaries of such burns usually coincide with paddock or farm boundaries. Texture and tone differences are also difficult to appreciate in small image areas.

As a whole, accurate identification of small areas such as of small burns is not to be expected in small scale imagery. Furthermore, from a practical viewpoint, for intensively cultivated areas, burning of veld is of less interest from a range management viewpoint. Although a limited amount of ground checking was undertaken, a more systematic approach was unfortunately prevented owing to the time interval between burning and the actual date of receiving the imagery. June and July images were thus received at the end of September, the end of the dry season and of extensive burning and when in certain areas rapid vegetative growth is occurring.

4. ACCOMPLISHMENTS

The incidence of veld burning has been recorded from Landsat-2 imagery covering approximately 64 million ha of the eastern portion of South Africa for the period from the end of June 1975 to the end of January 1976. In addition, a certain amount of September 1972 to January 1973 Landsat-1 imagery for a further 11,5 million ha was examined to compare with and to complement the Landsat-2 images. Altogether, approximately 75 million ha or 62% of the surface area of South Africa was examined from the satellite imagery. The total amount of image area examined over the 8 month period amounted to that covering nearly 300 million ha of ground area. Data on burning are given for 67 of the 70 veld types of South Africa and are summarized for 9 of the 11 biomes recognized for South Africa.

The basic data derived from the satellite images records the location of veld burns, the areas of burns and the number of burns for different months of the June to January period. These data are available in tabular format for each image and veld type and on 1:250 000 overlays for Landsat-2 images, and on 1:500 000 overlays for the Landsat-1 images. There are 184 map overlays for the Landsat-2 images and 17 overlays for the Landsat-1 images. These map overlays have not been included in this report.

The veld burning data are presented in two ways: on a geographical basis to show the geographical distribution of veld burning, and on a vegetation basis for 67 of the 70 different veld types of South Africa to show the incidence and character of burning for the different kinds of vegetation.

(a) Geographical distribution of veld burning

For the area covered by the satellite imagery, the geographical distribution of veld burning is summarized on small scale maps for each 15 minute square of latitude and longitude for the eight month period as a whole, and for seven individual months where each 15 minute square records within classes the area of burnt vegetation (Figs. 2-14).

As shown by the general fire distribution maps (Figs. 2, 3 & 15), veld burning is not randomly distributed but is almost continuous in a broad belt that extends from the north, where it is widest in the Transvaal, narrowing southwards into the eastern Orange Free State and into Natal, Republic of the Transkei and into the higher lying areas of the eastern Cape Province. The gaps in fire occurrence near the Natal, eastern and southern Cape Province coastline are not real and are due either to gaps in imagery, cloud cover, or the conservative interpretation of burns, especially small burns.

There are few isolated single 15 minute squares, which show a definite tendency towards grouping. This suggests deliberate firing rather than accidental fires. Such scattered groups extend west of the main distribution into the northern Cape Province via the Transvaal-Cape Province border, as well as from the eastern Orange Free State into the

marginal Karoo.

Approximately 23% of the 15 minute squares covered by the satellite imagery shows evidence of fire. Since the interpretation of veld burns is known to be very conservative, the occurrence of burning is certainly well over 23% of the 15 minute areas covered by the satellite imagery.

The clustering of quarter degree squares classed according to area burnt is also evident in the monthly fire distribution maps (Figs 4-14). Clusters of 15 minute squares with more than 4000 ha (6,4%) of their area burnt, and of lower amounts, are thus found. The clusters of areas showing a higher incidence of burning tend to be associated with the western, central and eastern Transvaal and Natal areas.

(b) Annual variation and seasonal fire development

The September Landsat-1 map (Fig. 7) shows a high incidence, 71%, of quarter degree squares with more than 1000 ha (1,6) of burnt area. The Landsat-1 images in general show a high percentage of burnt area, for instance exceeding 200 000 ha in three instances out of 17 images compared with none for the 75 Landsat-2 images (Table 1). Corresponding Landsat-1 & 2 images for the Kruger Park and Barberton areas of the eastern Transvaal and of Thabazimbi in the western Transvaal also show more burnt area for 1972 than for 1975 (scenes 180-77, 180-78 and 183-77 in Table 1). Apart from regional differences, the year 1972 apparently had a higher fire incidence than 1975. The difference in burnt area between 1972 and 1975 may be as much as 246 700 ha for a single scene covering approximately 3,2 million ha.

The 18 day and monthly fire development pattern is shown for corresponding images of particular scenes in Table 2 and by comparing the monthly fire maps in Figs. 4-14.

By July there is widespread burning, as shown by Fig. 4, and by the occurrence of 20 Landsat-2 images with burning and only 7 without burning (Table 1). Table 2 shows the rapid increase in the amount of burning over an 18 day period during July for 8 paired images. The increase in area burnt over an 18 day period may be as much as 45 500 ha.

The rates of increase in monthly burning show considerable variation in different parts of the country. Some, such as for the Smithfield Orange Free State scene 182-82, remaining the same from the end of July to the end of September, or they may have a large rate of increase such as for the western Transvaal Thabazimbi scene 183-77, which changed from 4300 ha of burnt area at the end of June to 128 900 ha at the end of October 1975.

It is significant that, possibly apart from Natal where available data are inconclusive, over almost the whole area showing veld burning the overall pattern is clearly marked out as early as July and August. Subsequent development is merely an intensification of this pattern. While much of the midwinter burning could be ascribed to accidental fires, it would appear that most burning is deliberate practice, otherwise adequate fire protection measures would be adopted. Bearing in mind that on Fig. 4 the estimate of 48% of the quarter degree squares that show at least 1000 ha of burnt area each in July is almost certainly a conservative estimate, the amount of July burns implies that much of this burning probably occurred before July. Although there is lack of agreement as to the amount of harm that mid-winter burning in itself can cause to the veld, it is nevertheless true that such veld is unproductive for several months. Furthermore, if grazing is practised on such early burnt veld to any extent the veld is harmed, especially if the onset of the spring rains is delayed. From the available Landsat-2 image cover for July 1975, the amount of burnt veld is conservatively estimated at 293 000 ha.

(c) Fires in relation to vegetation type

Data in Tables 3 and 4 for 67 of the 70 veld types of South Africa show the area burnt of each veld type for the months of July to September, these months showing nearly always the highest amounts of burnt area. Table 5 records the number of burns found in each veld type for three classes of burn size. The extent of burning in relation to broad vegetation classes - biomes - is summarized in Table 7, and the distribution of burning as related to the biomes in Fig. 15. The biomes are based on a grouping of the veld types.

Considerable caution must be used in comparing the amount of burning from month to month and between veld types because of the variation in the amount of image cover. It should be noted that in Tables 3 & 4 the image area values refer that examined. The percentage of the total veld type recorded is accordingly based on the total image area examined in relation to the total area of the veld type, accounting for values over 100%. The burning data are thus on the one hand overestimates in failing to take into account overlaps and orbital ships, and on the other hand underestimates in terms of interpretation of burning. These compensate each other to an unknown degree. Apart from the complexity involved in accounting for much of the overlap areas where different sets of images are continuously being compared, subtraction of the overlap areas would also have lost much of the scanty burning information available on a great deal of the imagery.

Veld types represented on the earlier 1972 Landsat-1 imagery show the highest areas of burning commensurate with higher degree of burning in that year as previously discussed. The following veld types thus showed from 102 600 ha to 235 600 ha of burnt area:

- 10. Lowveld
- 19. Sourish Mixed Bushveld.
- 20. Highland Sourveld
- 57. Northeastern Sandy Highveld.
- 61. Bankenveld

From both the Landsats-1 & 2 imagery, the following veld types showed between 10 000 ha and 100 000 ha of burnt area:

- 5. Ngongoni Veld
- 9. Lowveld Sourveld Bushveld
- 11. Arid Lowveld
- 12. Springbok Flats Turf Thornveld
- 13. Other Turf Thornveld
- 15. Mopani Veld
- 18. Mixed Bushveld
- 19. Sourish Mixed Bushveld
- 44. Highland Sourveld

- 45. Ngongoni Veld of Natal Mistbelt
- 48. Cymbopogon-Themeda Veld
- 56. Highland Sourveld to Cymbopogon-Themeda Veld Transition
- 58. Themeda-Festuca Alpine Veld
- 61. Bankenveld
- 63. Piet Retief Sourveld
- 64. Northern Tall Grassveld
- 65. Southern Tall Grassveld
- 66. Natal Sour Sandveld

These 22 veld types are thus those showing the greatest amount of burning. These veld types are those contributing to the Savanna Biome, which shows the largest amount of burning; the South African Grassland Biome which shows the next greatest amount of burning; followed by the Dry Woodland and Montane Forest Biomes (see Table 7).

It will be evident that certain veld types and biomes are not adequately covered by imagery to be representative. These are, as will be seen in Figs. 1, 2 & 15, the Fynbos and Karoo and Desert Biomes and veld types of the western parts of the country outside the area covered by the satellite imagery.

Tables 5 and 6 show that although there is a general relationship as expected between the number of burns recorded and the area burnt, veld types with the largest areas burnt do not necessarily have the greatest number of burns, that is, large fires often account for the amount of burnt area. The largest number of burns on both Landsat-1 & 2 imagery is shown by the veld types:

- 18. Mixed Bushveld
- 19. Sourish Mixed Bushveld
- 44. Highland Sourveld
- 61. Bankenveld

A larger number of burns was recorded for the same veld types in the 1972 Landsat-1 imagery than on the 1975 Landsat-2 imagery, indicating once again the greater degree of veld burning during the earlier year.

5. SIGNIFICANT RESULTS

Veld burning has been recorded from Landsat imagery covering approximately 75 million ha or 62% of the surface of the eastern part of South Africa. The total amount of image area examined over the 8 month period June to January amounted to that covering nearly 300 million ha of ground area. All the basic data on the location, areas and numbers of burns for 10 biomes composed of 67 veld types are available on 1:250 000 and 1:500 000 map overlays, and are summarized on small scale maps showing fire distribution and amount burned in classes per 15 minute square of latitude and longitude. Fire occurrence is also summarized on a small scale map in relation to the biomes of South Africa.

Approximately 23% of the quarter degree squares of latitude and longitude covered by the satellite imagery show evidence of veld burning. This is known to be a very conservative estimate of fire distribution.

Veld burning is not randomly distributed, but is almost continuous over a broad belt, widest in the north and narrowing southeastwards and then southwestwards between the eastern escarpment and the sea. It is shown that over almost the whole area the overall pattern of veld burning is clearly marked out as early as July in mid-winter, subsequent development being merely an intensification of the pattern. The implication is that, highly conservatively estimated, at least some 293 000 ha are burnt during and before July, and that the amount of such unproductive burnt veld, which is liable to harm during the dry winter season, increases progressively until the onset of the spring rains. The increase in burnt area over an 18 day period during July was found to be as much as 45 000 ha for a single scene covering some 3,2 million ha.

By comparing Landsat-1 with Landsat-2 imagery, it was found that 1975 had an appreciably lower amount of veld burning than 1972. For one scene covering approximately 3,2 million ha, there was a difference of 246 000 ha burnt area between 1972 and 1975.

From the Landsat-1 imagery five veld types showed the highest amount of burning with between 100 000 and 250 000 ha of burnt land while 22

veld types showed at least 10 000 ha of burnt area each. These veld types are those belonging to the Savanna Biome, which shows the largest amount of burning, the South African Grassland Biome showing the next greatest amount of burning, followed by the Dry Woodland and Montane Forest Biomes.

As a result of the investigation the overall pattern, time and extent of veld burning is established, and those areas and veld types subject to the highest intensities of burning are known. It should now be possible to channel with some confidence research and agricultural extension service effort into the appropriate areas.

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TABLE 1 . ANALYSIS OF ALL IMAGES GIVING AREAS BURNT IN HA
AND PERCENT OF IMAGE AREA

LANDSAT-1 IMAGES

W.R.S. NO.	DATE	USUABLE IMAGE HA	BURNT AREA HA	BURNT X 100 USABLE
179-79	27 Jul 23 Jan	1 455 300 1 524 000	0 0	0 0
179-80	23 Jan	1 721 860	0	0
180-76 ⁺	8 Sept ⁺	556 600 ⁺	64 300 ⁺	11,6 ⁺
180-77	20 Sept ⁺ 8 Sept ⁺	1 476 500 2 038 900	121 800 204 700	8,2 10,0
180-78 + + +	20 Sept 13 Nov 8 Sept ⁺	1 476 300 1 403 900 1 432 200 ⁺	8 000 24 300 72 500 ⁺	0,5 1,8 5,1 ⁺
180-79 ⁺	8 Sept ⁺	2 741 500 ⁺	143 200 ⁺	5,2 ⁺
180-80 ⁺	8 Sept ⁺	2 658 900 ⁺	159 100 ⁺	6,0 ⁺
180-81 ⁺	8 Sept ⁺	1 914 400 ⁺	133 500 ⁺	7,0 ⁺
180-82	15 Aug	1 103 400	15 100	1,4
181-76 + +	7 Jan 8 Dec ⁺	2 968 900 3 072 200 ⁺	2 300 87 400 ⁺	0,1 2,8 ⁺
181-77	11 Jul	2 851 400	3 700	0,1
181-78 + +	11 Jul 29 Jul 9 Sept ⁺	3 233 100 3 168 900 2 600 500 ⁺	15 200 60 700 108 900 ⁺	0,5 1,9 4,2 ⁺

W.R.S. NO.	DATE	USUABLE IMAGE HA	BURNT AREA HA	BURNT X 100 USABLE
181-79	11 Jul 29 Jul	3 289 300 2 850 000	6 100 22 200	0,2 0,8
181-80	11 Jul 29 Jul 21 Sept + 15 Oct ⁺	2 176 400 2 238 500 2 528 200 2 370 000 ⁺	7 900 18 000 7 200 114 192 ⁺	0,1 0,8 0,3 4,8 ⁺
181-81	11 Jul + 15 Oct ⁺	2 118 600 2 081 400 ⁺	15 000 47 700 ⁺	0,7 2,3 ⁺
181-82	11 Jul	3 064 000	12 600	0,4
182-76	12 Jul 30 Jul + 10 Sept ⁺	2 792 900 3 193 000 3 164 000 ⁺	300 7 600 67 100 ⁺	0,01 0,2 2,1 ⁺
182-77	12 Jul 30 Jul + 10 Sept ⁺	3 258 700 3 279 100 3 213 600 ⁺	8 300 21 400 226 500 ⁺	0,3 0,7 7,1
182-78	12 Jul 30 Jul 3 Dec + 16 Oct ⁺	3 283 100 3 280 900 3 279 500 3 366 200 ⁺	56 900 94 000 0 46 200 ⁺	1,7 2,9 0 1,4 ⁺
182-79	12 Jul 3 Dec + 10 Sept ⁺	3 290 700 3 289 300 3 290 700 ⁺	9 600 0 19 000 ⁺	0,3 0 0,6 ⁺

W.R.S. NO.	DATE	USUABLE IMAGE HA	BURNT AREA HA	BURNT X 100 USAELE
182-80	12 Jul 30 Jul 22 Sept 3 Dec 8 Jan	2 192 700 2 063 800 2 378 500 2 106 000 2 271 000	0 4 200 11 600 0 0	0 0,2 0,5 0 0
182-81	12 Jul 30 Jul 22 Sept 28 Oct 3 Dec 8 Jan	2 129 100 1 998 200 1 812 700 1 989 200 2 117 900 2 147 200	0 0 0 0 0 0	0 0 0 0 0 0
182-82	12 Jul 30 Jul 22 Sept	3 300 600 3 300 600 3 264 100	7 700 22 400 21 400	0,2 0,7 0,7
183-77 +	25 Jun 29 Oct 11 Sept ⁺	3 268 600 3 175 800 3 212 700 ⁺	4 300 129 000 259 600 ⁺	0,1 4,1 8,1 ⁺
183-83 183-84 ⁺	18 Aug 15 Jan ⁺	2 775 100 1 021 500 ⁺	0 16 800 ⁺	0 1,7 ⁺
184-77	1 Aug 19 Aug 6 Sept	2 049 400 2 072 500 2 023 100	37 100 49 100 56 200	1,8 2,4 2,8

W.R.S. NO.	DATE	USUABLE IMAGE HA	BURNT AREA HA	BURNT X 100 USABLE
184-78	1 Aug	2 786 800	14 700	0,5
	6 Sept	2 745 600	66 100	2,4
	23 Dec	2 634 800	1 500	0,1
184-79	1 Aug	3 310 200	9 700	0,3
	6 Sept	3 318 000	18 700	0,6
	23 Dec	3 347 700	0	0
184-80	1 Aug	3 149 100	3 800	0,1
	17 Nov	3 164 000	0	0
184-81	1 Aug	2 496 200	0	0
184-82	17 Nov	3 336 600	0	0
184-83	17 Nov	3 222 600	1 200	0,03
	10 Jan	3 314 100	0	0
185-78	18 Nov	2 204 600	0	0
	6 Dec	2 280 400	0	0
185-79	15 Jul	3 301 800	2 300	0,1
	18 Nov	3 320 900	0	0
	6 Dec	3 252 300	0	0
185-80	15 Jul	3 303 200	0	0
	18 Nov	3 357 400	0	0
	6 Dec	3 272 800	0	0

W.R.S. NO.	DATE	USUABLE IMAGE HA	BURNT AREA HA	BURNT X 100 USABLE
185-81	15 Jul	3 248 900	0	0
	18 Nov	3 244 700	0	0
	6 Dec	3 309 800	0	0
	29 Jan	3 332 000	0	0
185-82	15 Jul	3 279 500	0	0
	6 Dec	3 353 100	0	0
	11 Jan	3 354 600	0	0
	29 Jan	3 329 700	0	0
187-84 ⁺	19 Jan ⁺	1 322 900 ⁺	14 400 ⁺	1,1% ⁺

TABLE 2 18-DAY AND MONTHLY FIRE DEVELOPMENT PATTERN IN HA AS SHOWN BY LANDSAT-2 IMAGERY

WRS NO.	JUNE 15-30	JULY 1-15 16-31		AUGUST 1-15 16-31		SEPTEMBER 1-14 15-30		OCTOBER 1-15 16-31		NOVEMBER 1-14 15-30		DECEMBER 1-15 16-31		JAN 1-15
180-78							8 000			24 500				
181-78		15 200	60 700											
181-79		6 100	22 200											
181-80		7 900	18 000				7 200 ⁺							
182-76		300	7 600											
182-77		8 300	21 400											
182-78		56 900	94 000									0		
182-79		9 600										0		
182-80		0	4 200				11 600					0		0
182-82		7 700	22 400				21 400							
183-77	4 300								128 900					
184-77				37 100	49 100	56 200								

WRS NO.	JUNE 15-30	JULY 1-15 16-31	AUGUST 1-15 16-31	SEPTEMBER 1-14 15-30	OCTOBER 1-15 16-31	NOVEMBER 1-14 15-30	DECEMBER 1-15 16-31	JAN 1-15
184-78			14 700	66 100			1 500	
184-79			9 700	18 700			0	
184-80			3 800					
184-83						1 200		0
185-79		2 300				0	0	

⁺30% Cloud cover probably accounting for decline over previous image

TABLE 3 AREA BURNT PER VELD TYPE FOR MONTHS JULY TO SEPTEMBER, 1975 FROM LANDSAT-2
IMAGERY (SEE ALSO TEXT)

VELD TYPE		JULY	AUGUST	SEPTEMBER
1. Coastal Forest and Thornveld	% of total veld type	38,2%	12,9%	-
	Image area of veld type	766 900	259 800	-
	Burnt area of veld type	0	2 000	-
	% burnt	0%	0,8%	-
2. Alexandria Forest	% of total veld type	-	6,8%	-
	Image area of veld type	-	13 800	-
	Burnt area of veld type	-	0	-
	% burnt	-	0%	-
3. Pondoland Coastal Plateau Sourveld	% of total veld type	-	104,8%	-
	Image area of veld type	-	76 500	-
	Burnt area of veld type	-	300	-
	% burnt	-	0,4%	-

5. Ngongoni Veld	% of total veld type	15,9%	25,9%	-
	Image area of veld type	177 500	288 300	-
	Burnt area of veld type	900	4 200	-
	% burnt	0,5%	1,5%	-
6. Zululand Thornveld	% of total veld type	37,8%	-	3,4%
	Image area of veld type	127 800	-	11 600
	Burnt area of veld type	0	-	0
	% burnt	0%	-	0%
7. Eastern Province Thornveld	% of total veld type	27,5%	23,9%	-
	Image area of veld type	17 200	149 400	-
	Burnt area of veld type	1 800	900	-
	% burnt	1,1%	0,6%	-
8. Northeaster Mountain Sourveld	% of total veld type	91,6%	-	10,1%
	Image area of veld type	874 000	-	96 100
	Burnt area of veld type	500	-	0
	% burnt	0,06%	-	0%

VELD TYPE		JULY	AUGUST	SEPTEMBER
9. Lowveld Sour Bushveld	% of total veld type	65,5%	-	30,0%
	Image Area of veld type	728 100	-	333 900
	Burnt Area of veld type	5 000	-	100
	% burnt	0,7%	-	0,03%
10. Lowveld	% of total veld type	50,4%	-	92%
	Image area of veld type	942 000	-	1 718 100
	Burnt area of veld type	900	-	60 000
	% burnt	0,1%	-	3,5%
11. Arid Lowveld	% of total veld type	27,1%	-	45,3%
	Image area of veld type	479 900	-	803 700
	Burnt area of veld type	0	-	57 900
	% burnt	0%	-	7,2%

VELD TYPE		JULY	AUGUST	SEPTEMBER
12. Springbok Flats Turf Thornveld	% of total veld type	6,7%	5,3%	12,1%
	Image Area of veld type	22 800	18 000	41 300
	Burnt Area of veld type	4 500	0	5 800
	% burnt	19,7%	0%	14,0%
13. Other Turf Thornveld	% of total veld type	4,8%	82,7%	88,5%
	Image area of veld type	38 400	659 100	705 500
	Burnt area of veld type	4 100	43 500	42 300
	% burnt	10,7%	6,6%	6,0%
14. Arid Sweet Bushveld	% of total veld type	4,5%	16,6%	15,3%
	Image area of veld type	85 500	314 400	289 300
	Burnt area of veld type	2 000	500	200
	% burnt	2,3%	0,2%	0,1%

VELD TYPE		JULY	AUGUST	SEPTEMBER
15. Mopani Veld	% of total veld type	31,4%	-	9,3%
	Image Area of veld type	650 900	-	192 300
	Burnt Area of veld type	900	-	25 500
	% burnt	0,1%	-	13,3%
16. Kalahari Thornveld and shrub bushveld	% of total veld type	28,7%	22,4%	15,4%
	Image area of veld type	4 008 000	3 124 700	2 146 900
	Burnt area of veld type	2 300	13 800	9 000
	% burnt	0,1%	0,4%	0,4%
17. Kalahari Thornveld invaded by Karoo	% of total veld type	104%	27,0%	-
	Image area of veld type	1 549 800	407 100	-
	Burnt area of veld type	0	0	-
	% burnt	0%	0%	-

VELD TYPE		JULY	AUGUST	SEPTEMBER
18. Mixed Bushveld	% of total veld type	76,0%	7,7%	7,9%
	Image Area of veld type	3 278 500	330 400	342 600
	Burnt Area of veld type	28 600	6 400	14 900
	% burnt	0,9%	1,9%	4,4%
19. Sourish Mixed Bushveld	% of total veld type	58,6%	33,1%	33,8%
	Image area of veld type	1 951 900	1 104 900	1 128 000
	Burnt area of veld type	39 200	15 000	29 000
	% burnt	2,0%	1,4%	2,6%
20. Sour Bushveld	% of total veld type	33,0%	2,5%	1,2%
	Image area of veld type	603 700	46 300	22 300
	Burnt area of veld type	4 700	400	2 200
	% burnt	0,8%	0,9%	9,9%

VELD TYPE		JULY	AUGUST	SEPTEMBER
21. False Thornveld of Eastern Province	% of total veld type	-	57,4%	-
	Image Area of veld type	-	137 000	-
	Burnt Area of veld type	-	0	-
	% burnt	-	0%	-
22. Invasion of Grassveld by <u>Acacia Karroo</u>	% of total veld type	152%	-	129%
	Image area of veld type	768 500	-	652 500
	Burnt area of veld type	700	-	700
	% burnt	0,1%	-	0,1%
23. Valley Bushveld	% of total veld type	37,1%	29,4%	15,6%
	Image area of veld type	901 300	714 100	378 400
	Burnt area of veld type	900	900	0
	% burnt	0,1%	0,1%	0%

VELD TYPE		JULY	AUGUST	SEPTEMBER
24. Noorsveld	% of total veld type	-	61,1%	-
	Image Area of veld type	-	167 900	-
	Burnt Area of veld type	-	0	-
	% burnt	-	0%	-
25. Succulent Mountain Scrub (Spekboomveld)	% of total veld type	-	22,5%	-
	Image area of veld type	-	197 400	-
	Burnt area of veld type	-	0	-
	% burnt	-	0%	-
26 Karroid Broken Veld	% of total veld type	14,8%	4,7%	-
	Image area of veld type	501 600	160 400	-
	Burnt area of veld type	0	0	-
	% burnt	0%	0%	-

VELD TYPE		JULY	AUGUST	SEPTEMBER
27. Central Upper Karoo	% of total veld type	88,7%	5,3%	-
	Image Area of veld type	1 783 200	105 800	-
	Burnt Area of veld type	0	0	-
	% burnt	0%	0%	-
28. Western Mountain Karoo	% of total veld type	0,09%	-	-
	Image area of veld type	1 800	-	-
	Burnt area of veld type	0	-	-
	% burnt	0%	-	-
29. Arid Karoo and Desert False Grassveld	% of total veld type	10,7%	-	-
	Image area of veld type	733 800	-	-
	Burnt area of veld type	0	-	-
	% burnt	0%	-	-

VELD TYPE		JULY	AUGUST	SEPTEMBER
30. Central Lower Karoo	% of total veld type	32,5%	13,1%	-
	Image Area of veld type	320 600	129 200	-
	Burnt Area of veld type	0	0	-
	% burnt	0%	0%	-
31. Succulent Karoo	% of total veld type	-	-	0,6%
	Image area of veld type	-	-	20 100
	Burnt area of veld type	-	-	0
	% burnt	-	-	0%
32. Orange River Broken Veld	% of total veld type	32,7%	-	-
	Image area of veld type	1.089 500	-	-
	Burnt area of veld type	0	-	-
	% burnt	0%	-	-

VELD TYPE		JULY	AUGUST	SEPTEMBER
35. False Arid Karoo	% of total veld type	158%	29,3%	-
	Image Area of veld type	1 996 900	370 100	-
	Burnt Area of veld type	0	0	-
	% burnt	0%	0	-
36. False Upper Karoo	% of total veld type	10,9%	47,2%	5,6%
	Image area of veld type	718 400	3 106 100	366 200
	Burnt area of veld type	0	600	0
	% burnt	0%	0,02%	0%
37. False Karroid Broken Veld	% of total veld type	10,4%	53,8%	7,0%
	Image area of veld type	97 600	505 600	66 000
	Burnt area of veld type	0	0	0
	% burnt	0%	0%	0%

VELD TYPE		JULY	AUGUST	SEPTEMBER
38. False Central Lower Karoo	% of total veld type	-	106,5%	-
	Image Area of veld type	-	143 500	-
	Burnt Area of veld type	-	0	-
	% burnt	-	0%	-
40. False Orange River Broken Veld	% of total veld type	58,5%	38,8%	-
	Image area of veld type	330 100	218 900	-
	Burnt area of veld type	0	0	-
	% burnt	0%	0%	-
41. Pan-Turf Veld invaded by Karoo	% of total veld type	-	101%	-
	Image area of veld type	-	116 300	-
	Burnt area of veld type	-	0	-
	% burnt	-	0%	-

VELD TYPE		JULY	AUGUST	SEPTEMBER
42. Danthonia Mountain Veld replaced by Karoo	% of total veld type	48,3%	18,1%	-
	Image Area of veld type	97 700	36 600	-
	Burnt Area of veld type	0	0	-
	% burnt	0%	0%	-
43. Mountain Renosterbos veld	% of total veld type	5,7%	-	-
	Image area of veld type	63 300	-	-
	Burnt area of veld type	0	-	-
	% burnt	0%	-	-
44. Highland Sourveld and Dohne Sourveld	% of total veld type	128%	6,4%	43,3%
	Image area of veld type	5 061 800	254 500	1 712 100
	Burnt area of veld type	54 100	6 500	9 200
	% burnt	1,1%	2,6%	0,5%

VELD TYPE		JULY	AUGUST	SEPTEMBER
45. Ngongoni Veld of Natal Mist-belt	% of total veld type	5,4%	-	2,5%
	Image Area of veld type	19 900	-	9 200
	Burnt Area of veld type	0	-	0
	% burnt	0%	-	0%
48. <u>Cymbopogon-Themeda</u> Veld (sandy)	% of total veld type	82,3%	44,0%	97,2%
	Image area of veld type	3 322 200	1 777 200	3 924 600
	Burnt area of veld type	10 300	0	10 500
	% burnt	0,31%	-	0,27%
49. Transitional <u>Cymbopogon-Themeda</u> Veld	% of total veld type	76,1%	-	49,2%
	Image area of veld type	1 071 300	-	692 000
	Burnt area of veld type	3 400	-	2 000
	% burnt	0,3%	-	0,3%

VELD TYPE		JULY	AUGUST	SEPTEMBER
50. Dry <u>Cymbopogon</u> - <u>Themeda</u> Veld	% of total veld type	19,8%	92,6%	52,3%
	Image Area of veld type	859 000	4 016 800	2 266 800
	Burnt Area of veld type	0	3 000	7 000
	% burnt	0%	0,1%	0,3%
51. Pan-Turf Veld of Western Free State	% of total veld type	-	84,5%	0,3%
	Image area of veld type	-	219 400	700
	Burnt area of veld type	-	0	0
	% burnt	-	0%	0%
52. <u>Themeda</u> Veld (Turf Highveld)	% of total veld type	148%	-	-
	Image area of veld type	1 615 200	-	-
	Burnt area of veld type	8 000	-	-
	% burnt	0,50%	-	-

VELD. TYPE		JULY	AUGUST	SEPTEMBER
53. <u>Themeda Veld to Cymbopogon-Themeda Veld Transition</u>	% of total veld type	119%	-	0,6%
	Image Area of veld type	1 393 000	-	6 600
	Burnt Area of veld type	2 000	-	1 100
	% burnt	0,1%	-	16,7%
54. <u>Themeda Veld to Highland Sourveld Transition</u>	% of total veld type	75,5%	-	-
	Image area of veld type	207 600	-	-
	Burnt area of veld type	200	-	-
	% burnt	0,10%	-	-
55. <u>Themeda Veld to Bankenveld Transition</u>	% of total veld type	105,3%	-	-
	Image area of veld type	71 800	-	-
	Burnt area of veld type	500	-	-
	% burnt	0,70%	-	-

VELD TYPE		JULY	AUGUST	SEPTEMBER
56. Highland Sourveld to <u>Cymbopogon-Themeda</u> Veld Transition	% of total veld type	133,8%	-	93,0%
	Image Area of veld type	1 317 700	-	916 200
	Burnt Area of veld type	600	-	11 200
	% burnt	0,05%	-	1,2%
57. Northeastern Sandy Highveld	% of total veld type	111,1%	-	6,1%
	Image area of veld type	1 630 400	-	88 800
	Burnt area of veld type	27 600	-	700
	% burnt	1,7%	-	0,8%
58. <u>Themeda-Festuca</u> Alphine Veld	% of total veld type	144,4%	-	90,6%
	Image area of veld type	1 187 000	-	744 600
	Burnt area of veld type	300	-	1 110
	% burnt	0,03%	-	1,5%

VELD TYPE		JULY	AUGUST	SEPTEMBER
59 Stormberg Plateau Sweet Veld	% of total veld type	101,2%	-	100,1%
	Image Area of veld type	248 600	-	245 900
	Burnt Area of veld type	0	-	700
	% burnt	0%	-	0,28%
60 Karroid <u>Danthonia</u> Mountain Veld	% of total veld type	23,5%	21,2%	19,5%
	Image area of veld type	335 200	302 300	277 500
	Burnt area of veld type	0	0	0
	% burnt	0%	0%	0%
61 Bankenveld	% of total veld type	94,6%	8,1%	8,7%
	Image area of veld type	2 230 100	190 900	204 000
	Burnt area of veld type	40 000	1 400	11 200
	% burnt	1,8%	0,7%	5,5%

VELD. TYPE		JULY	AUGUST	SEPTEMBER
62. Bankenveld to Sour Sandveld Transition	% of total veld type	162,8%	-	-
	Image Area of veld type	187 900	-	-
	Burnt Area of veld type	900	-	-
	% burnt	0,5%	-	-
63. Piet Retief Sourveld	% of total veld type	84,7%	-	20,4%
	Image area of veld type	643 400	-	154 700
	Burnt area of veld type	15 200	-	2 000
	% burnt	2,4%	-	1,3%
64. Northern Tall Grassveld (Transition between 63 & 68)	% of total veld type	9,8%	-	-
	Image area of veld type	43 800	-	-
	Burnt area of veld type	0	-	-
	% burnt	0%	-	-

VELD TYPE		JULY	AUGUST	SEPTEMBER
65. Southern Tall Grassveld	% of total veld type	86,1%	2,1%	52,8%
	Image Area of veld type	1 226 700	28 900	751 700
	Burnt Area of veld type	13 400	400	0
	% burnt	1,1%	1,4%	0%
66. Natal Sour Sandveld	% of total veld type	66,8%	-	22,8%
	Image area of veld type	364 800	-	124 600
	Burnt area of veld type	6 600	-	0
	% burnt	0,02%	-	0%
67. Pietersburg Plateau Grassveld	% of total veld type	144,8%	-	-
	Image area of veld type	349 500	-	-
	Burnt area of veld type	3 100	-	-
	% burnt	0,89%	-	-

REPRODUCIBILITY OF THE
ORIGINAL PAGE IS POOR

VELD TYPE		JULY	AUGUST	SEPTEMBER
68. Eastern Province Grassveld	% of total veld type	-	50,8%	-
	Image Area of veld type	-	30 500	-
	Burnt Area of veld type	-	0	-
	% burnt	-	0%	-
70. False Macchia	% of total veld type	-	15,2%	-
	Image area of veld type	-	272 000	-
	Burnt area of veld type	-	0	-
	% burnt	-	0%	-
	% of total veld type			
	Image area of veld type			
	Burnt area of veld type			
	% burnt			

TABLE 4 : AREA BURNT PER VELD TYPE FOR SEPTEMBER 1972 FROM LANDSAT-1 IMAGERY
(SEE ALSO TEXT).

VELD TYPE	SEPTEMBER	
1. Coastal Forest and Thornveld	% of total veld type	23,0%
	Image area of veld type	463 600
	Burnt area of veld type	1 200
	% burnt	0,30%
3. Pondoland Coastal Plateau Sourveld	% of total veld type	16,0%
	Image area of veld type	11 900
	Burnt area of veld type	0
	% burnt	0%
5. Ngongoni Veld	% of total veld type	66,0%
	Image area of veld type	731 000
	Burnt area of veld type	11 900
	% burnt	1,6%

6. Zululand Thornveld	% of total veld type	12,0%
	Image Area of veld type	39 300
	Burnt Area of veld type	0
	% burnt	0%
8. Northeastern Mountain Sourveld	% of total veld type	46,0%
	Image area of veld type	442 000
	Burnt area of veld type	9 300
	% burnt	2,1%
9. Lowveld Sour Bushveld	% of total veld type	46,0%
	Image area of veld type	517 000
	Burnt area of veld type	36 200
	% burnt	7,00%
10. Lowveld	% of total veld type	102,1%
	Image area of veld type	1 908 400
	Burnt area of veld type	143 600
	% burnt	7,5%

VELD TYPE

SEPTEMBER

11. Arid Lowveld	% of total veld type	7,6%
	Image Area of veld type	134 800
	Burnt Area of veld type	96 400
	% burnt	71,5%
12. Springbok Flats Turf Thornveld	% of total veld type	166,6%
	Image area of veld type	567 800
	Burnt area of veld type	12 500
	% burnt	2,20%
13. Other Turf Thornveld	% of total veld type	52,8%
	Image area of veld type	420 900
	Burnt area of veld type	60 800
	% burnt	14,5%
14. Arid Sweet Bushveld	% of total veld type	65,6%
	Image area of veld type	1 243 000
	Burnt area of veld type	4 100
	% burnt	46 0,3%

VELD TYPE

SEPTEMBER

15. Mopani Veld	% of total veld type	6,1%
	Image Area of veld type	126 000
	Burnt Area of veld type	85 500
	% burnt	67,9%
16. Kalahari Thornveld and Shrub Bushveld	% of total veld type	0,4%
	Image area of veld type	58 000
	Burnt area of veld type	6 600
	% burnt	11,4%
18. Mixed Bushveld	% of total veld type	80,2%
	Image area of veld type	3 460 700
	Burnt area of veld type	202 800
	% burnt	5,9%
19. Sourish Mixed Bushveld	% of total veld type	37,2%
	Image area of veld type	1 241 800
	Burnt area of veld type	102 600
	% burnt	47 8,3%

VELD TYPE

SEPTEMBER

20. Sour Bushveld	% of total veld type	81,1%
	Image Area of veld type	1 483 900
	Burnt Area of veld type	152 300
	% burnt	10,3%
23. Valley Bushveld	% of total veld type	32,8%
	Image area of veld type	795 900
	Burnt area of veld type	9 400
	% burnt	1,2%
44. Highland Sourveld and Dohne Sourveld	% of total veld type	33,8%
	Image area of veld type	1 334 400
	Burnt area of veld type	235 600
	% burnt	17,7%
45. Ngongoni Veld of Natal Mist-belt	% of total veld type	105,9%
	Image area of veld type	391 200
	Burnt area of veld type	10 600
	% burnt	48/ 2,7%

VELD TYPE

SEPTEMBER

48. <u>Cymbopogon- Themeda</u> Veld (Sandy)	% of total veld type	28,0%
	Image Area of veld type	1 130 100
	Burnt Area of veld type	7 500
	% burnt	0,67%
49. Transitional <u>Cymbopogon- Themeda</u> Veld	% of total veld type	35,2%
	Image area of veld type	495 100
	Burnt area of veld type	1 600
	% burnt	0,32%
50. Dry <u>Cymbopogon-Themeda</u> Veld	% of total veld type	6,2%
	Image area of veld type	269 300
	Burnt area of veld type	2 800
	% burnt	1,04%
52. <u>Themeda</u> Veld (Turf Highveld	% of total veld type	51,8%
	Image area of veld type	565 700
	Burnt area of veld type	600
	% burnt	49 0,11%

VELD TYPE

SEPTEMBER

53. <u>Themeda Veld to Cymbopogon-Themeda Veld Transition</u>	% of total veld type	75,4%
	Image Area of veld type	882 000
	Burnt Area of veld type	4 100
	% burnt	0,46%
55. <u>Themeda Veld to Bankenveld Transition</u>	% of total veld type	5,4%
	Image area of veld type	3 700
	Burnt area of veld type	0
	% burnt	0%
56. <u>Highveld Sourveld to Cymbopogon-Themeda Veld Transition</u>	% of total veld type	24,8%
	Image area of veld type	244 300
	Burnt area of veld type	3 100
	% burnt	2,2%
57. <u>Northeastern Sandy Highveld</u>	% of total veld type	93,5%
	Image area of veld type	1 372 900
	Burnt area of veld type	105 500
	% burnt	50 7,7%

61. Bankenveld	% of total veld type	37,7%
	Image Area of veld type	888 000
	Burnt Area of veld type	18 700
	% burnt	2,1%
62. Bankenveld to Sour Sandveld Transition	% of total veld type	178,2%
	Image area of veld type	205 700
	Burnt area of veld type	6 600
	% burnt	3,2%
63. Piet Retief Sourveld	% of total veld type	111,4%
	Image area of veld type	845 700
	Burnt area of veld type	23 700
	% burnt	2,80%
64. Northern Tall Grassveld (Transition between 63 & 68)	% of total veld type	127,3%
	Image area of veld type	569 700
	Burnt area of veld type	10 900
	% burnt	51 1,90%

65. Southern Tall Grassveld	% of total veld type	71,0%
	Image Area of veld type	1 012 100
	Burnt Area of veld type	54 600
	% burnt	5,4%
66. Natal Sour Sandveld	% of total veld type	111,4%
	Image area of veld type	608 700
	Burnt area of veld type	17 200
	% burnt	2,8%
67. Pietersburg Plateau Grassveld	% of total veld type	153,9%
	Image area of veld type	371 300
	Burnt area of veld type	9 400
	% burnt	2,5%
	% of total veld type	
	Image area of veld type	
	Burnt area of veld type	
	% burnt	52

TABLE 5 NUMBER OF BURNS PER VELD TYPE RANKED FROM HIGHEST TO LOWEST ACCORDING TO
MAXIMUM NUMBER OF BURNS RECORDED FOR JULY TO SEPTEMBER:

LANDSAT-2 IMAGERY:

(FOR VELD TYPE NAME SEE TABLE 3)

*FIRE SIZE CLASSES: Class 1: 0 - 1000 ha. Class 2: 1000 - 4000 ha. Class 3: > 4000 ha.

VELD TYPE	*NUMBER OF FIRES PER MONTHS FOR RESPECTIVE FIRE-SIZE CLASSES											
	JULY				AUGUST				SEPTEMBER			
	*1	2	3	Total	1	2	3	Total	1	2	3	Total
61	59	6	2	67	1	1	0	2	3	3	1	7
13	6	1	0	7	23	4	3	30	36	8	2	46
19	35	7	2	44	25	4	0	29	29	13	2	44
44	27	10	2	39	4	3	0	7	9	3	0	12
65	36	3	0	39	2	0	0	2	0	0	0	0
18	31	6	1	38	9	2	0	11	17	5	0	22
10	2	0	0	2	-	-	-	-	20	12	4	36
56	0	0	0	0	-	-	-	-	32	1	0	33
57	25	5	1	31	-	-	-	-	7	0	0	7
16	9	1	0	10	26	4	0	30	3	1	1	5
48	16	3	0	19	0	0	0	0	24	2	0	26
66	23	1	0	24	-	-	-	-	0	0	0	0
52	18	2	0	20	-	-	-	-	-	-	-	-
63	18	0	2	20	-	-	-	-	6	0	0	6
12	16	0	0	16	0	0	0	0	1	0	1	2
11	0	0	0	0	-	-	-	-	3	7	3	13
53	10	0	0	10	-	-	-	-	0	1	0	1
50	0	0	0	0	8	0	0	8	7	2	0	9
9	7	1	0	8	-	-	-	-	1	0	0	1
5	3	0	0	3	5	2	0	7	-	-	-	-
49	6	1	0	7	-	-	-	-	4	0	0	4
58	2	0	0	2	-	-	-	-	3	2	1	6
67	5	1	0	6	-	-	-	-	-	-	-	-
23	5	0	0	5	4	0	0	4	0	0	0	0
62	5	0	0	5	-	-	-	-	-	-	-	-
1	0	0	0	0	3	1	0	4	-	-	-	-
20	3	1	0	4	1	0	0	1	1	1	0	2
22	1	0	0	1	-	-	-	-	3	0	0	3
36	0	0	0	0	3	0	0	3	0	0	0	0
3	-	-	-	-	2	0	0	2	-	-	-	53

TABLE 6: NUMBER OF BURNS PER VELD TYPE RANKED FROM HIGHEST TO LOWEST:

LANDSAT - 1 IMAGES FOR SEPTEMBER: (FOR VELD TYPE NAME SEE TABLE 3)

VELD TYPE	SEPTEMBER			
	+ NUMBER OF FIRES PER MONTH FOR RESPECTIVE FIRE-SIZE CLASSES			
	1	2	3	Total
18	63	27	15	105
44	45	16	11	72
19	52	14	5	71
57	41	12	5	58
10	14	12	9	35
20	11	7	17	35
63	18	9	1	28
66	21	4	0	25
5	22	2	0	24
9	15	5	3	23
61	16	4	0	20
13	6	9	4	19
11	7	6	4	17
15	4	8	5	17
45	12	3	0	15
64	13	2	0	15
8	10	3	1	14
23	13	1	0	14
48	13	1	0	14
67	12	0	1	13
62	12	0	0	12
12	6	5	0	11
53	8	0	0	8
14	6	0	0	6
56	5	1	0	6
16	2	3	0	5
49	4	0	0	4
50	2	1	0	3
1	2	0	0	2
52	1	0	0	1

+ No burns recorded for following veld types: 3; 6; 55.

+ FIRE-SIZE CLASSES

Class 1: 0 - 1000 ha

Class 2: 1000 - 4000 ha

Class 3: 4000 - 10000 ha

54

TABLE 7: SUMMARY OF AREA BURNT DURING MONTHS JULY TO SEPTEMBER:
LANDSAT - 2 IMAGERY.

BIOME	IMAGE- BURNT HA	% BURNT	IMAGE AREA HA	% TOTAL OF BIOME
1 Fynbos	0	0	272 000	4,6%
2 Subtropical Coast Forest	2 000	0,7%	273 600	16,7%
3 Tropical Louland Coast Forest	0	0%	547 734	171,2%
4 Montane Forest	59 100	0,9%	6 320 500	92,4%
5 Afro-Alpine Grass-Heath	11 100	1,5%	744 600	90,6%
6 South African Grass land	147 200	0,5%	27 215 600	121,1%
7 Moist Woodland	6 800	0,7%	1 027 900	49,5%
8 Dry Woodland	87 500	4,0%	2 170 200	89,9%
9 Savanna	260 200	1,6%	16 140 500	45,8%
10 Karroo	600	0,01%	11 007 500	28,9%
11 Namib Desert	0	0	0	0

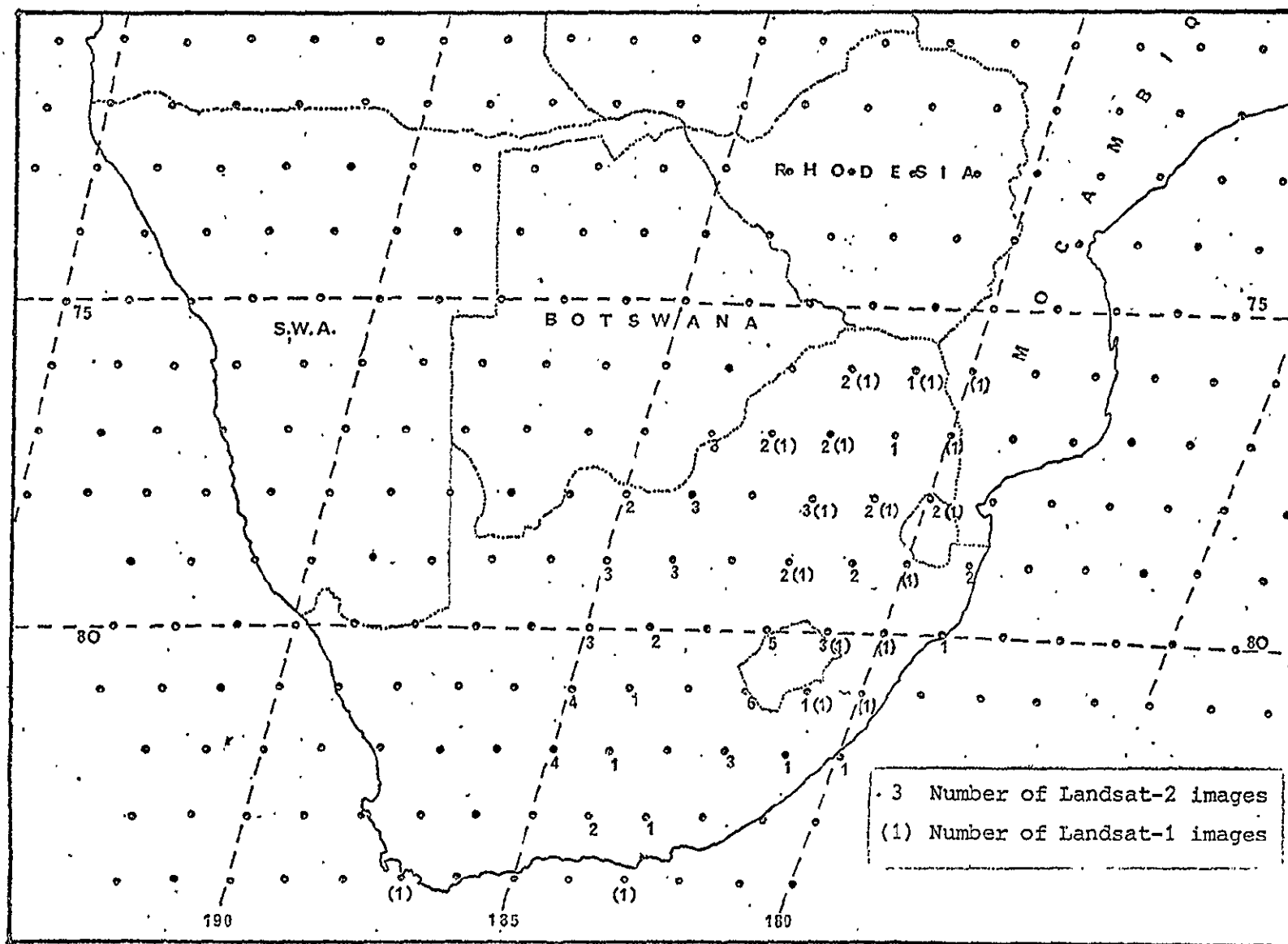
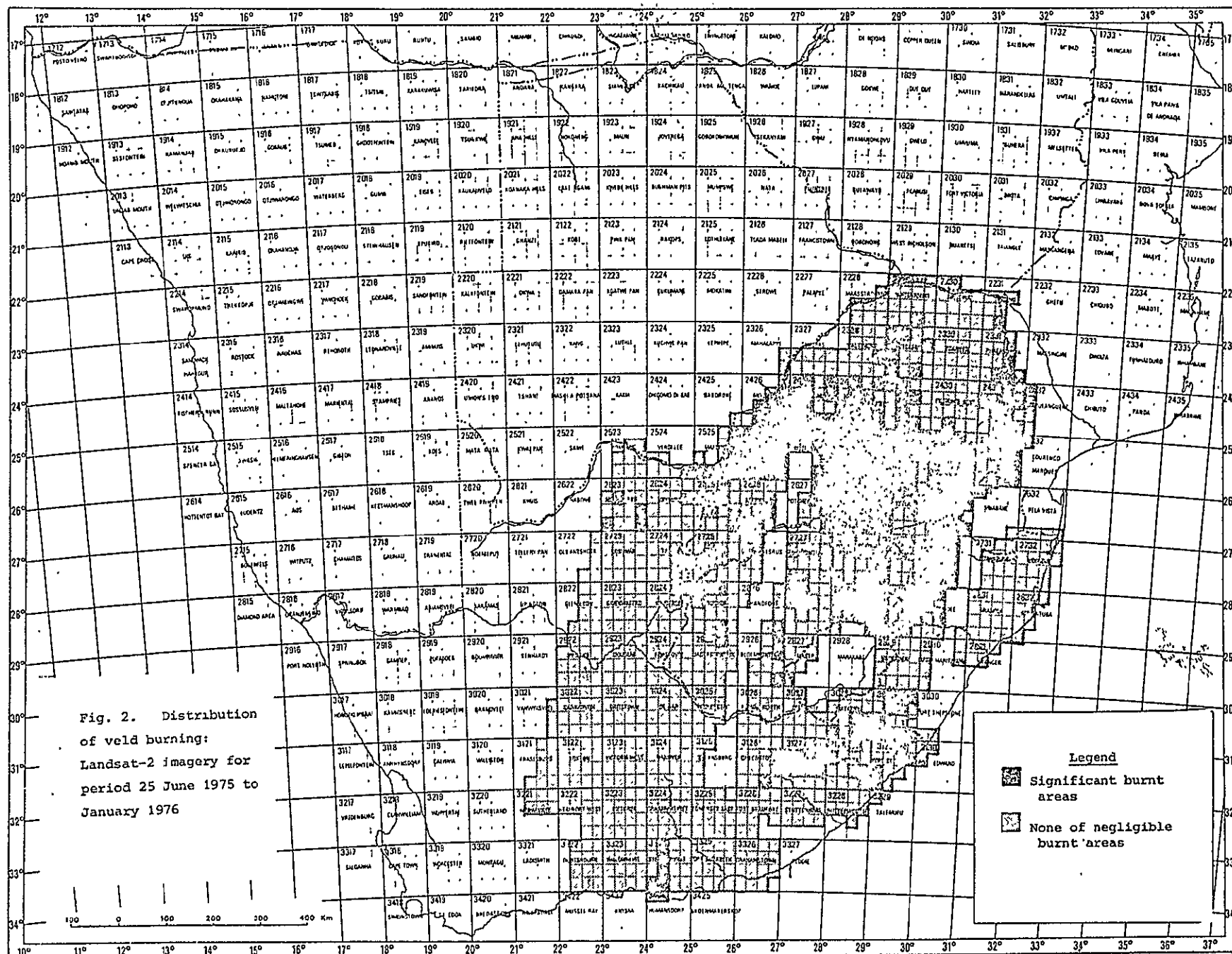
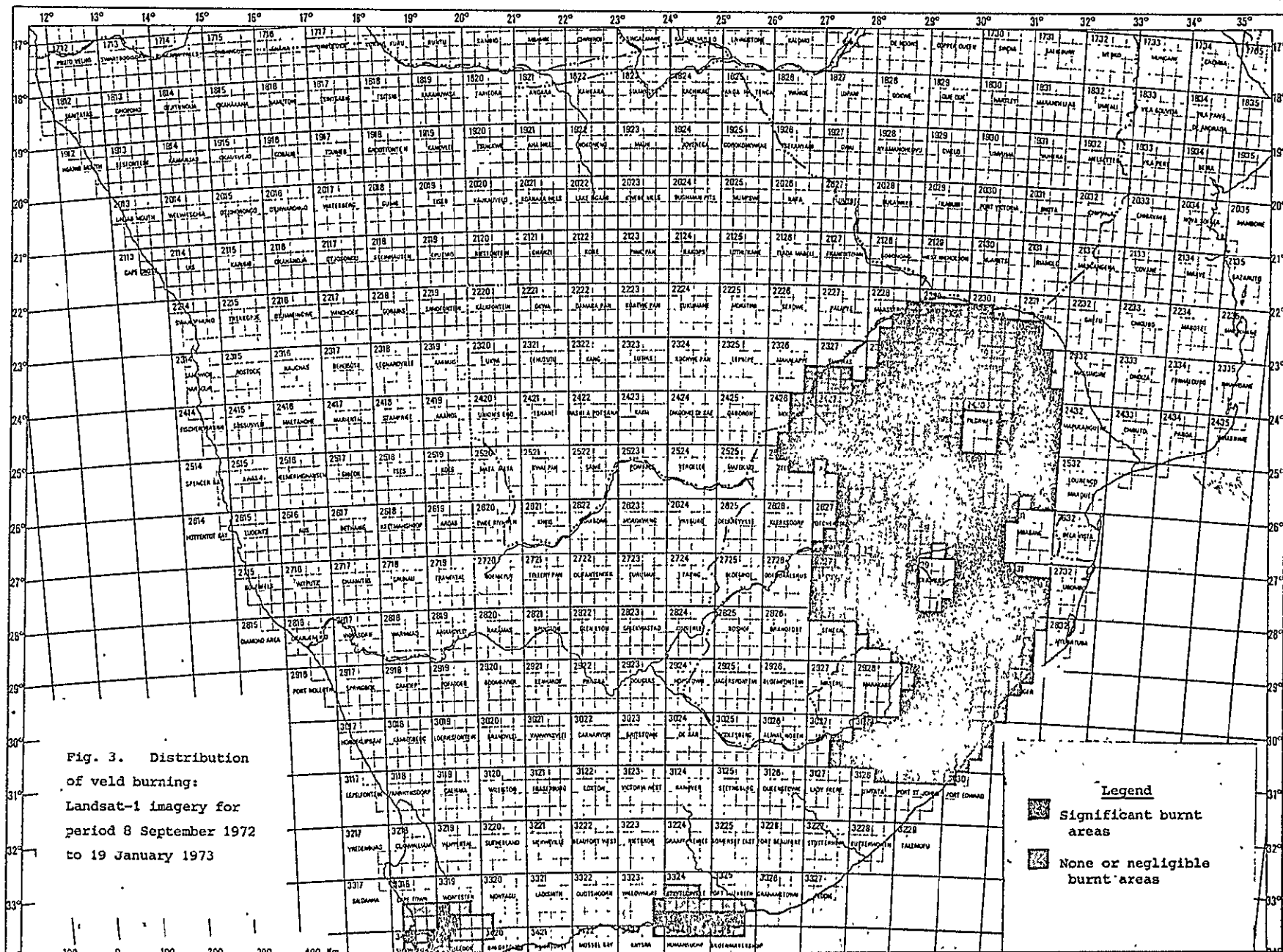
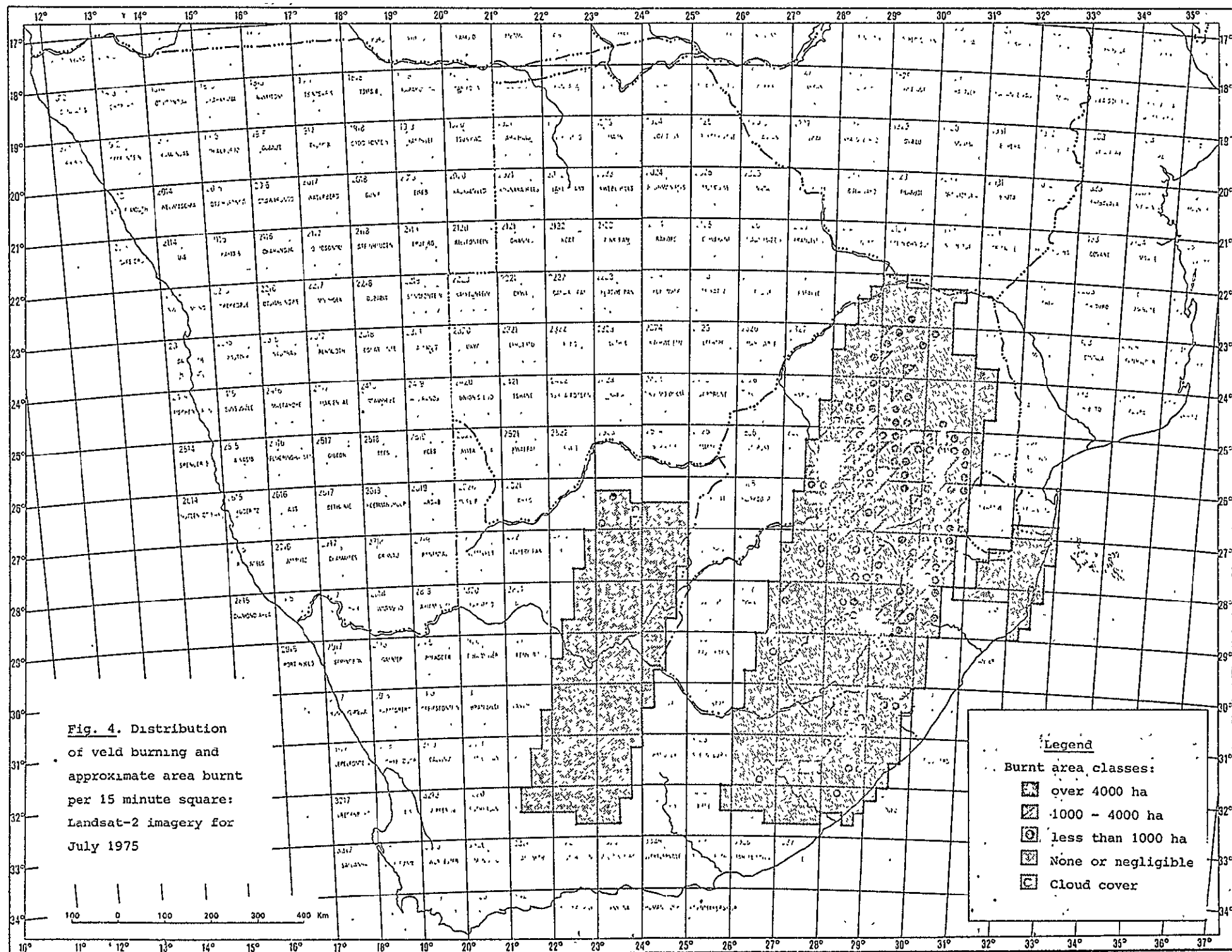
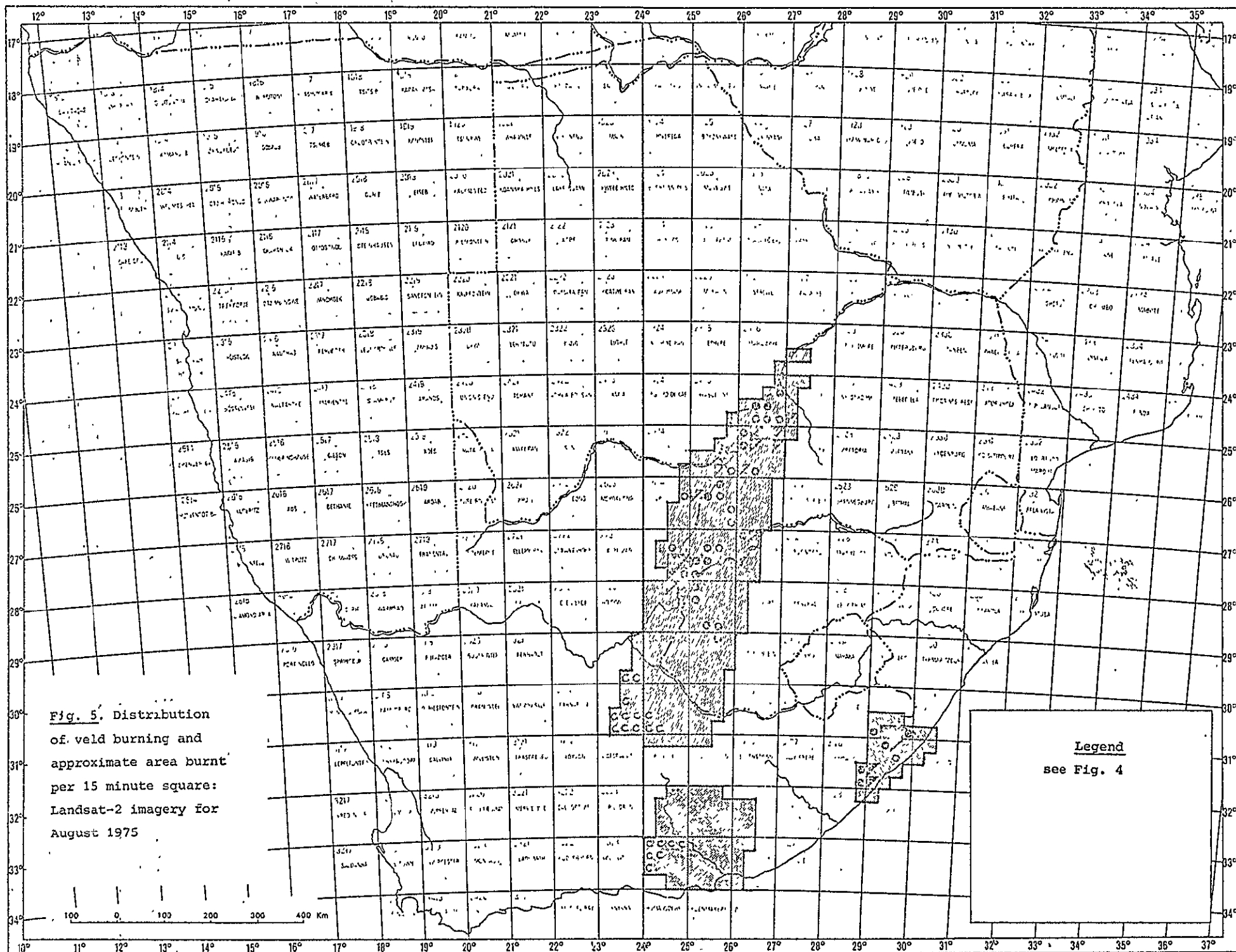


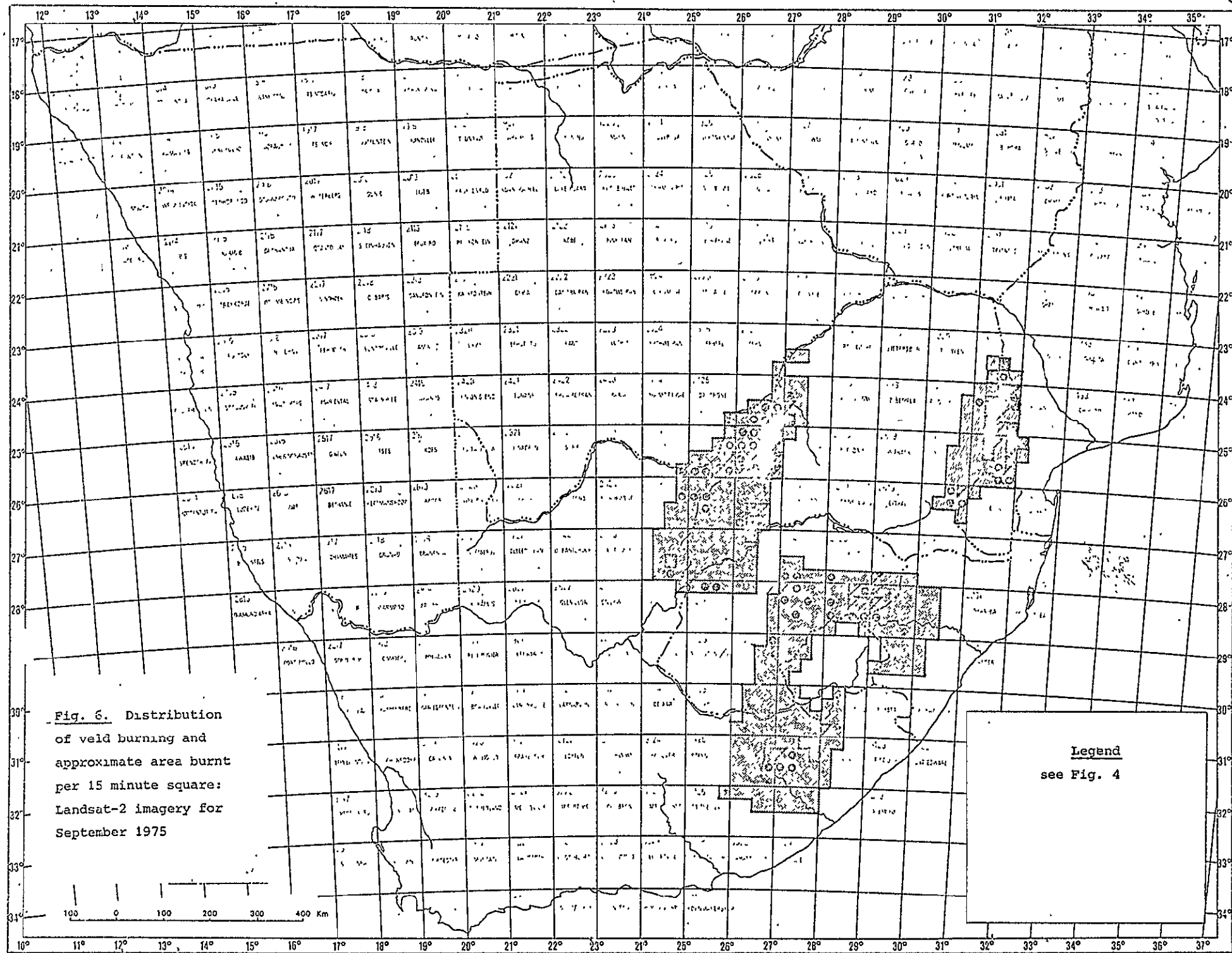
Fig. 1. Landsat-2 coverage with Landsat-1 complementary cover used in brackets

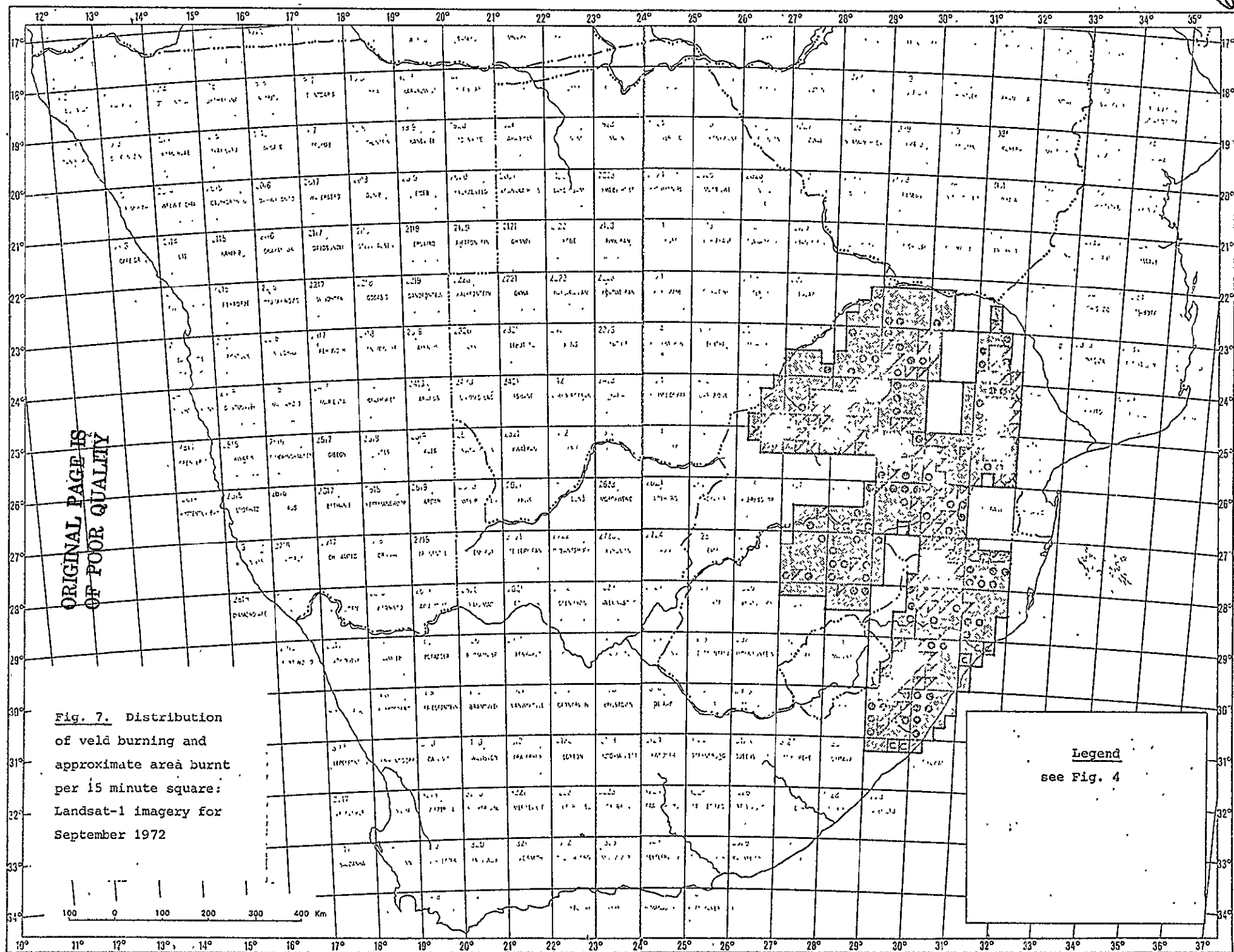


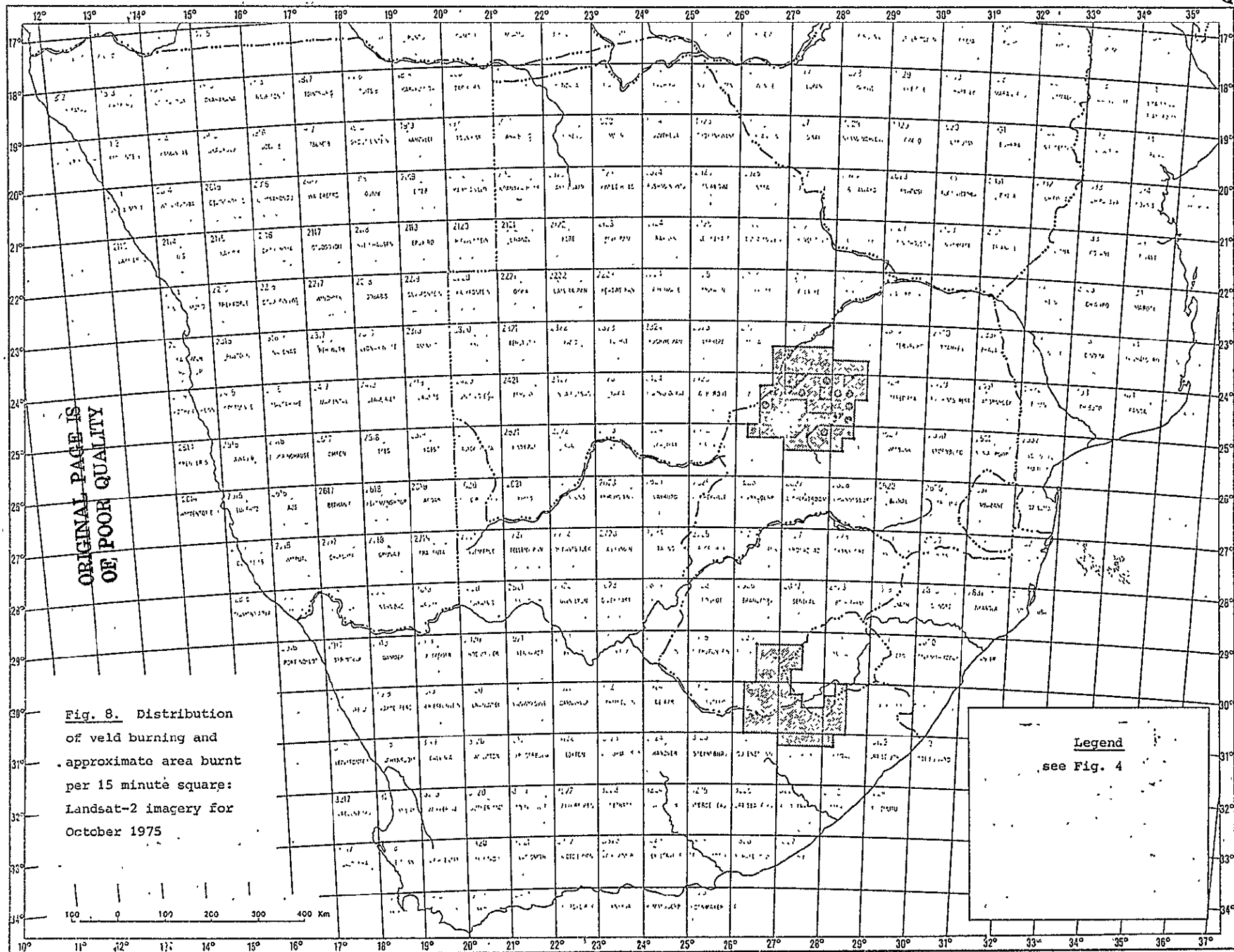


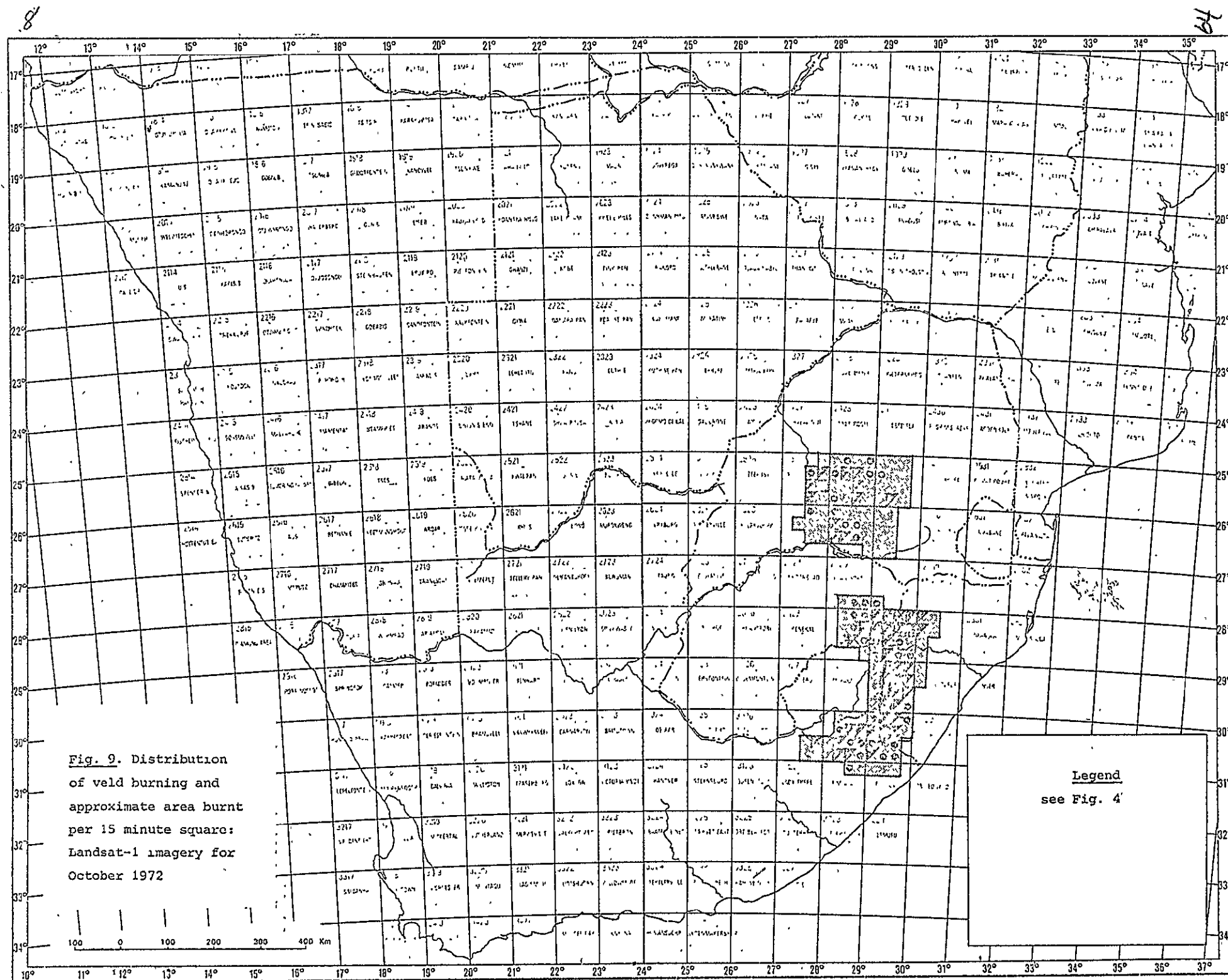












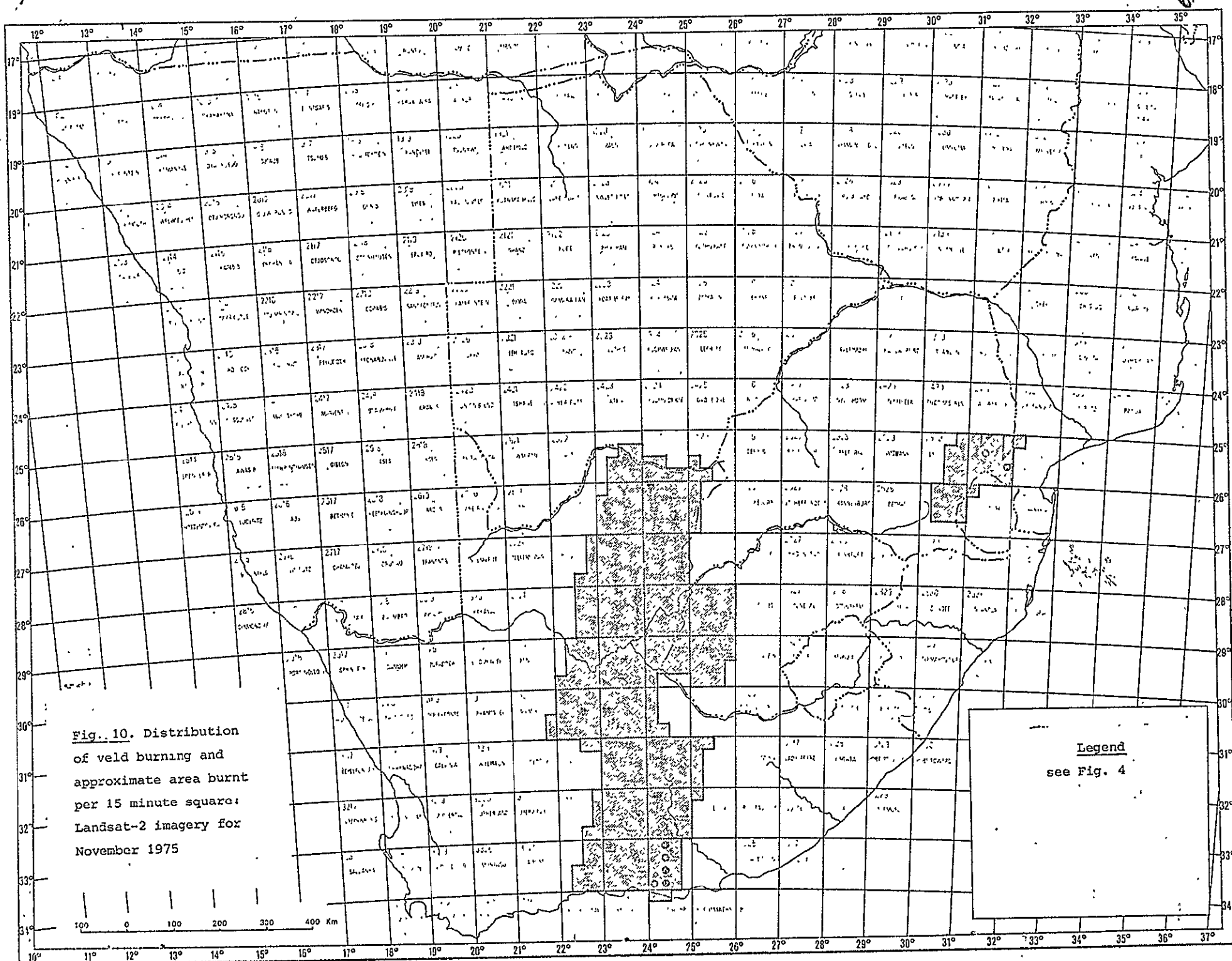


Fig. 10. Distribution of veld burning and approximate area burnt per 15 minute square: Landsat-2 imagery for November 1975

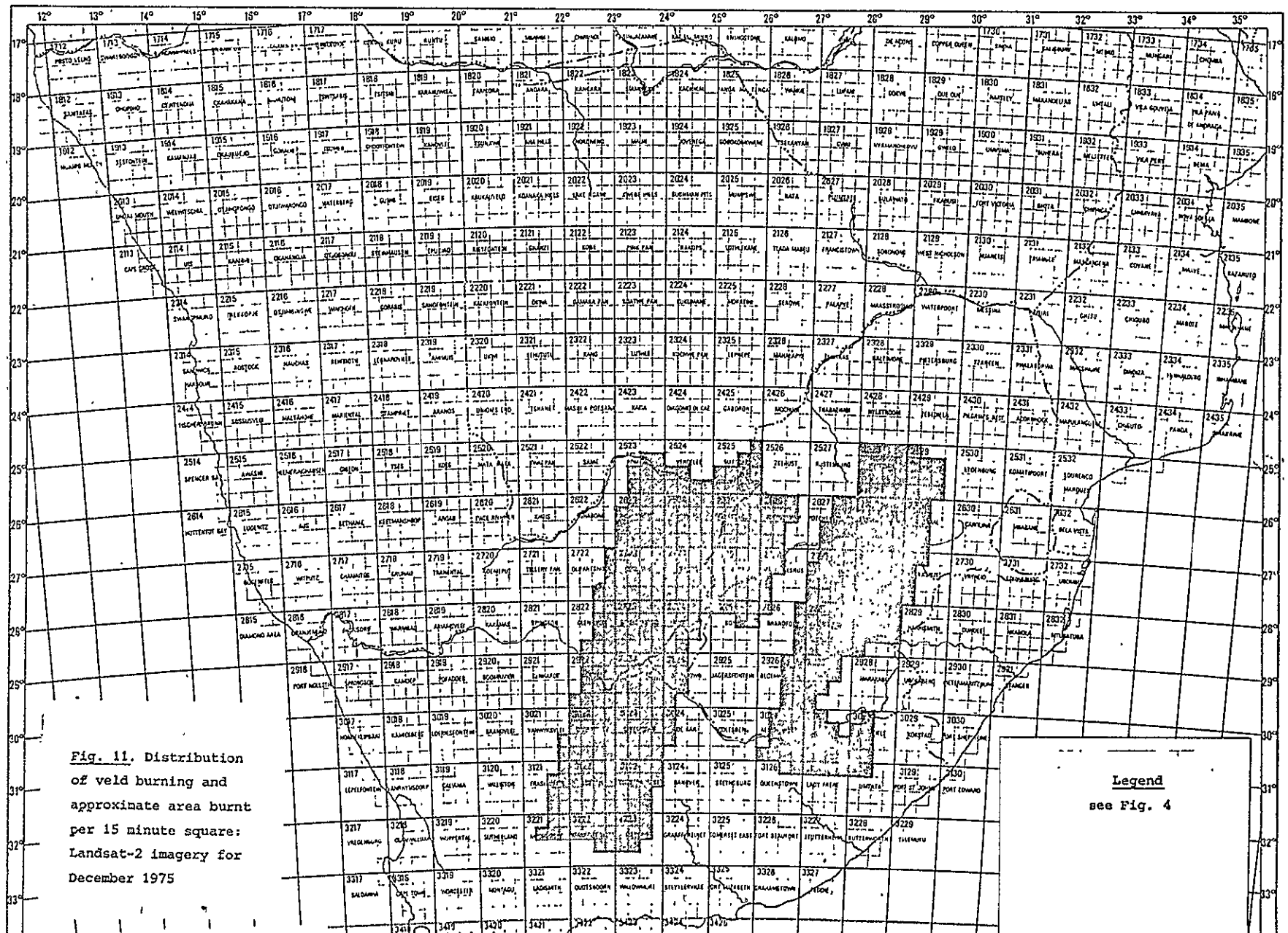
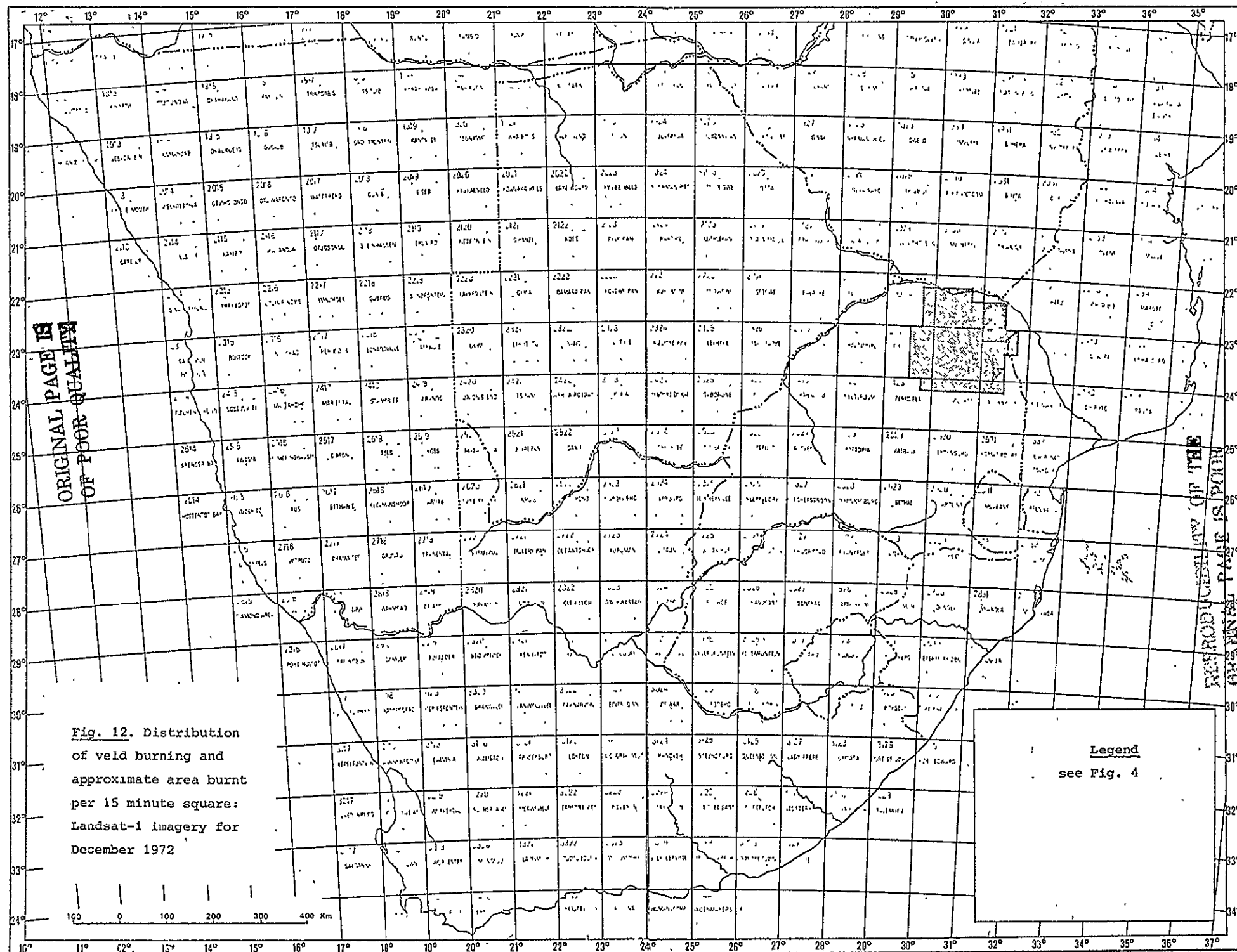
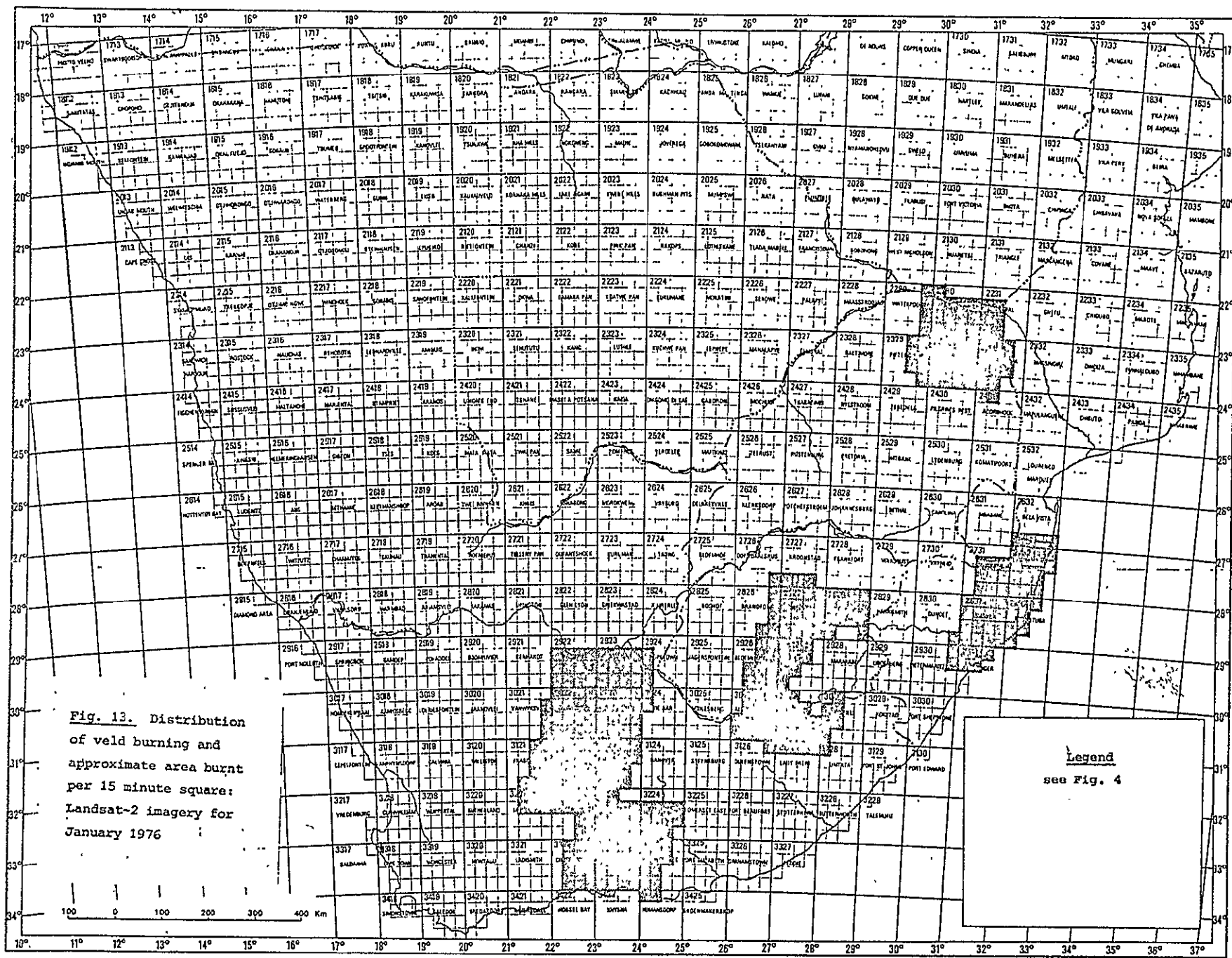
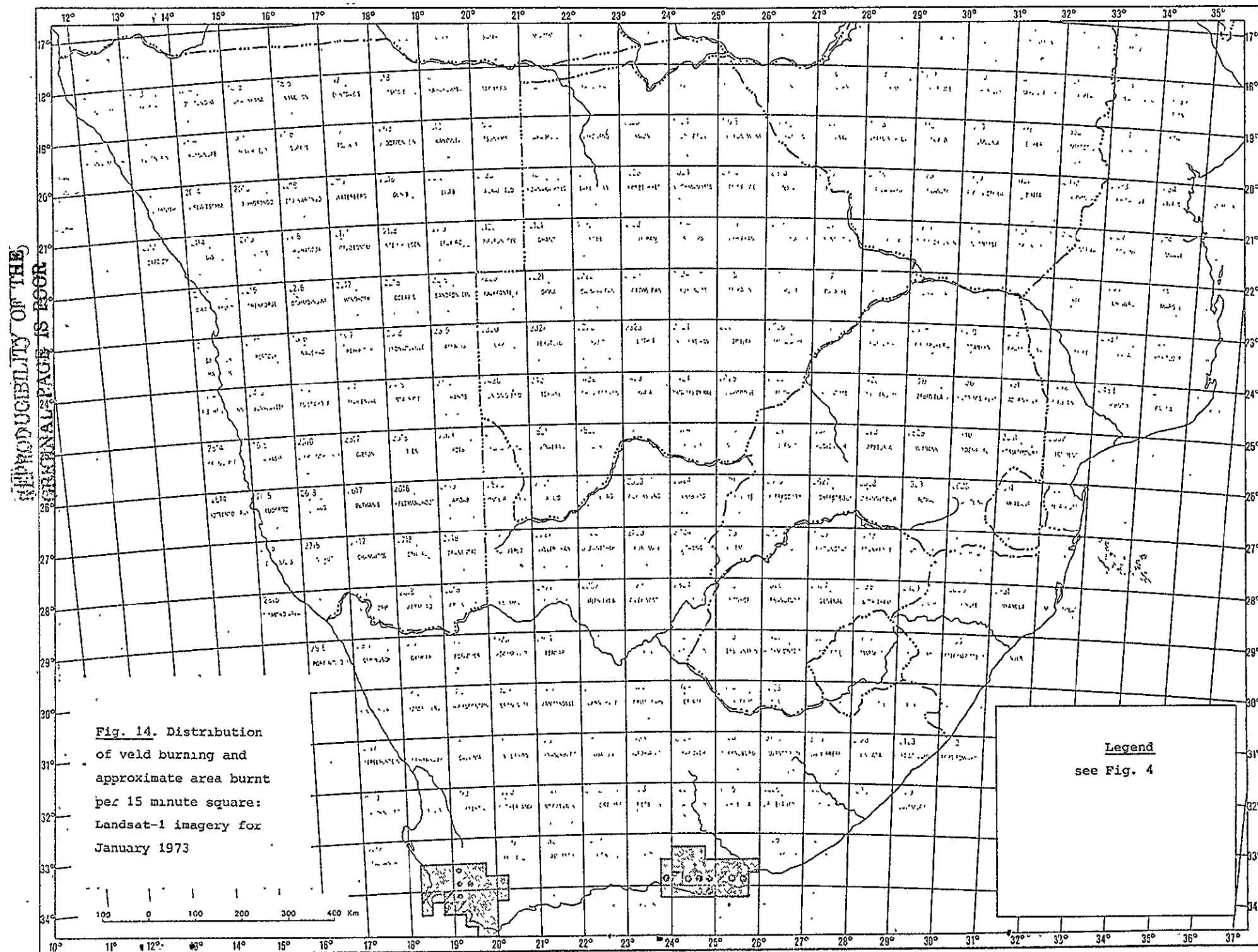


Fig. 11. Distribution of veld burning and approximate area burnt per 15 minute square: Landsat-2 imagery for December 1975

Legend
see Fig. 4







BIOMES of SOUTH AFRICA

SHOWING ALSO THE DISTRIBUTION OF
VELD BURNING FROM LANDSAT-2 AND
LANDSAT-1 IMAGERY

FYNBOS BIOME

SUBTROPICAL COAST FOREST BIOME

TROPICAL LOWLAND (COAST) FOREST BIOME

MONTANE FOREST BIOME

AFRO-ALPINE GRASS-HEATH BIOME

GRASSLAND BIOME

MOIST WOODLAND BIOME

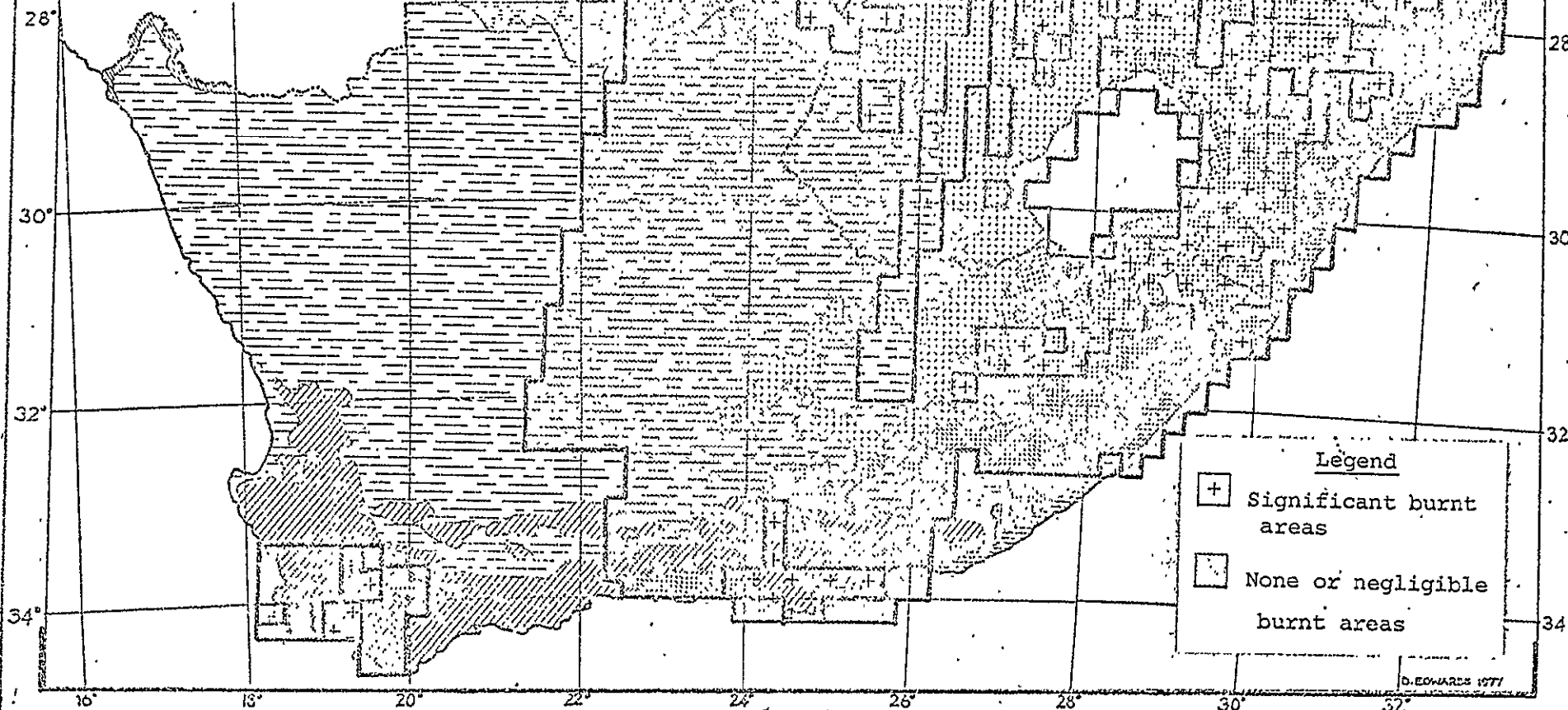
DRY WOODLAND BIOME

SAVANNA BIOME

KAROO BIOME

NAMIB DESERT BIOME

km 50 0 50 100 km



Legend

+ Significant burnt areas

None or negligible burnt areas