NATURAL PLANT COVER IN THE DESERT FRINGE WEST OF NILE DELTA

BY

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Introduction

The area west of Rosetta Branch of the Nile gives an ample of a desert fringe where xeric and mesic habitats me.in contact at a margin line. In such an area reciprocal fluences and interactions of factors occur. This paper is vocated to a study of natural plant cover in the area. ttern and features of plant communities in this area were nvestigated.

The scope of survey covers a traingular area, the head f the traingle is SW of Cairo and its base represents a line assing from Khatatba on Rosetta branch to k. 106 on Cairo-lexandria desert road. The study was made along four trans-cts traversing longitudinal and horizontal planes of the surveyed area.

The effect of wind ercsion and deposition in auch an area is quite pronounced. Sand is drifted from the desert uplands and deposited on the lower contours to the east and threatens the fertile land. Wind-transported sand exerts clear effects on soil and vegetation.

Geology

The general geological characteristics of the norther part of the western desert of Egypt has been reported on b some authors e.g. Shatta (1955). Recent series include th Nile silt and alluvium occuring in the limited area border the Nile Delta. Its thickness averages from 20m. to the s of Cairo to 40m. to the north, Attia, (1954). Pleistocene deposits as sands and gravels of assorted sizes border the cultivated areas west of the Nile Delta forming a series terraces of various heights. Pliocene rocks exist in the [illegible]t. Outcrops of porcelaneous limestone and black s alternating with argillaceous sandstone are distinguished. Miocene deposits composed essentially of limestone changin partly into a fluviatile series and exposed Eocene sedimen occur at Abu Rawash area and the Pyramids plateau.

The general axial trend of the surface anticlines is NE-SW.

Topography

The area under investigation (see Fig. 1) shows in ge a characteristic uneven relief, of an undulated landscape SW-NE sloping trends and an eastward depressed area which provides the fertile land bordering Rosetta branch of the N (contour about 12-15m.). A prominently broad sand bar -4

t Katta- is developed west of and parallel to Rosetta channel xtending northward to a long distance from Katta to Wardan. Behira channel has its way along sandy area (contour about 0m.) in the south. To the west, the land rises steeply to ontour 50m. or more forming the terrace side seen westward of bu Rawash-Birkash and further to the north along Imbaba - hatatba desert road. From this side some runnels slope down ith a prevailing SW-NE direction. There exist also few wide nd sloping dry streams of which may be mentioned Wadi Farah ith a west-eastward course joining the eastward depressed ea opposite to k.30 on Imbaba-Khatatba desert road. Westwards the undulated gravel desert prevails; Cairo-Alexandria esert road traverses it SE-NW and Khatatba-Tahrir province esert road E-W.

Especially to the south exist calcareous prominent uplifts .g. G. Abu Rawash (174 m.), G. Mansuria (182m) and Garet Hadadin (233 m.).

Climate

The following table, (Table 1) shows monthly variations f the climatic factors in Giza (G), at the south of the studied area, and Badr Centre in Tahrir province (T), at the orth. The data given represents mean values of 1966 and 1967.

Transects

Vegetation study was made along four transects as follo

Transect 1: (SE-NW) Imbaba-Khatatba eastern road (ea of Behira channel).

Transect 2: (SE-NW) Desert border from Abu Rawash t Birkash-Nikla-Khatatba desert road.

Transect 3: (SE-NW) Cairo-Alexandria desert road til k. 106.

Transect 4: (E-W) Khatatba-k. 82 Cairo-Alexandria de road.

Vegetation

The main types of plant communities and habitats along the studied transects are given in the following:

Transect 1:

The prominent effects pertaining on vegetation are cas by Nile water (Behira channel) and by drifted sand. Alhagi maurorum or Phragmites australis occasionally appear formin pure or mixed stands indicating near water table. A communit type (stand 2, Table 2, Fig. 2) is remarkable on elevated areas.

Table 2: Floristic composition of Alhagi maurorum community type.

	Stand 1	Stand 2
Alhagi maurorum	(pure stand)	d.
Phragmites australis	.	cod.
Imperata cylindrica	.	c.
Cynodon dactylon	.	c.
Panicum turgidum	.	c.
Launaea nudicaulis	.	r.

		J	F	M	A	M	J	J	A	S	O	N	D
Air temperature:													
mean for day (C)	G:	11.8	11.6	15.6	21.0	23.5	27.1	27.2	27.9	26.0	23.1	19.4	14.2
	T:	11.6	13.5	15.2	20.1	23.0	26.0	26.5	27.9	25.0	22.7	19.0	14.3
highest mx. °(C)	G:	26.6	22.1	33.5	40.1	42.8	44.0	38.2	38.8	39.4	34.9	34.9	28.5
	T:	29.2	22.9	34.8	41.0	40.3	46.0	38.8	38.8	38.5	35.3	33.1	28.1
lowest min. °(C)	G:	1.1	3.3	2.2	6.7	11.9	16.6	18.3	19.5	16.1	13.1	4.2	3.0
	T:	1.1	3.6	2.6	7.5	11.0	15.8	17.4	19.5	14.7	13.1	5.6	4.2
Relative humidity:													
mean for day (%)	G:	70	67	46	51	54	51	61	63	63	67	70	65
	T:	66	62	50	57	61	60	70	63	65	71	78	72
Wind speed:													
mean for day (m/sec.)	G:	1.7	2.2	2.5	2.6	2.8	2.7	2.7	2.2	2.2	2.2	2.8	2.8
	T:	2.6	2.6	3.1	2.7	2.6	2.9	2.9	2.3	2.3	2.1	2.1	2.3
highest gust (knots)	G:	30	29	37	30	32	29	25	28	24	26	26	27
	T:	39	38	50	42	34	30	27	28	27	26	34	42
Rain fall (mm.)	G:	4.4	1.4	2.8	0.7	3.7	0	0	0	0	0	8.9	0.8
	T:	3.0	4.1	12.8	tr.	23.3	0	0	0	0	0	7.4	8.2

On moist areas of low contours C.6., south of Abu Galeb evelops an aquatic community type composed of Panicum epens on water, the cattail Typha domingensis and bordered y the reed-grass Phragmites australis and the sedge Cyperus lternifolius. The series of flat sand dunes west of Rosetta ranch hold a dune plant community (Table 3) dominated Aristida coparia in the top stands: (Fig 3) and by Polycarpea repens n the foot stands.

Table 3: Floristic Composition of Aristida scoparia Plant community type.

	Stand 1 Katta: foot of dune	Stand 2 Katta: top of dune	Stand 3 T3 k.55	Stand 4 T3 k.56
Aristida scoparia	Cod.	d.	d.	d.
Polycarpea repens	d.	.	r.	.
Pennisetum divisum	a.	.	.	.
Panicum turgidum	.	.	cod.	c.
Heliotropium luteum	O.	.	.	.
Moltkea Calosa	O.	O	r.	.
Hammada elegans	.	.	r.	r.
Monsonia nevea	O.	.	O.	.
Bassia muricata	r.	.	.	.

The windward side- height may reach 4 mts.-is dev id of plant cover which is only restricted to its base.

Transect 2:

The terrace side to the west is almost devoid of vegetation except scarcely on the eastward inclining slopes.

The sand flats by the terrace base on the border of fertils land sustain Moltkea callosa community; type, Table 4 and Figs. 4,5). Of the characteristic species may be mentioned Heliotropium luteum and Panicum turgidum.

Table 4: Floristic composition of Moltkea calosa Plant community type.

	Stand 1 T2	Stand 2 T2	Stand 3 T2	Stand 4 T3 K41
Maltkea callosa	d.	d.	d.	d.
Heliotropium luteum	cod.	c.	c.	.
Panicum turgidum	a.	O.	a.	.
Pennisetum divisum	O.	r.	.	.
Aristida plumosa	C.	cod.	.	.
Pulicaria crispa	O.	C.	.	.
Erenobium lineare	O.	.	.	.
Launaea nudicaulis	O.	.	.	.

Passing northward, the transect traverses the gravely desert and on drifted sand, distinct stands of Aristida scopar appear. Blown sand fall along the slopes, and despite windbreaks the effect of blown sand is clear e.g. at fences (Fig.6 Panicum turgidum scatterly appears and dominates on sand sheet along Wadi Farah runnel (opposite k. 30 Imbaba-Khatatba desert road) and especially at its mouth.

Opposite to Khatatba appears Artemisia monosperma and comes codominant with Panicum turgidum.

A soil profile in a cultivated area just at the desert rder SW or Birkash-near the southern end of the transect-is presented (Fig. 7), Table 5). The upper soil is formed of layer of light sand, one meter thick, below which exists a ver of heavier silty sand '20 cm).

This sublayer has been formed by earlier silting from le flood irrigation water where as the upper layer is built by wind drifted sand.

able 5: Granulometric analysis of the soil Profile at the desert limit (SW. Birkash)

Particle size	50 cm	125 cm
00 - 0.20 mm.	75.7%	27.5%
20 - 0.15 mm.	8.5	11.0
15 - 0.07 mm.	15.2	21.4
0.07 mm.	0.6	10.1

Transect 3:

At the foot of Abu Rawash uplift a community of Alhagi rorum is located (Fig. 8). A community dominated by gophyllum coccineum (e.g. at K. 24) inhabits the shallow il at the foot of the limestone elevations. Plant cover

is scanty on the gravel desert (e.g. k. 34-53), however, a community type dominated by Hammada elegans occasionally appears (e.g. K. 32) on depressed areas. From k. 53-64 the landscape changes to a desert grassland. By k.55-57 Aristi stoparia community type is remarkable on loose drifted sand on the eastwardly directed runnels (Table 3. Fig. 9). Stan of Moltkea callosa are located on drifted sand at the borde (e.g. k. 41, Fig. 10, and k. 67). A second grassland commu type dominated by Panicum turgidam inhabits wide and conti

Table 6: The floristic Composition of Panicum turgidum Plant community type.

T3:	Stand 1 k.54	Stand 2 k.58	Stand 3 k.70	Stand k.72
Panicum turgidum	d.	d.	d.	d.
Piptanthe[illegible] torbuosus	O.	h.	c.	c.
Aristida stoparia	O.	.	O.	O.
Hammada elegans	O.	.	O.	O.
Moltkea callosa	c.	c.	O.	O.
Fagonia cretica	O.	O.	r.	r.
Polycarpea repens	c.	c.	c.	c.
Ifloga spicata	O.	O.	O.	O.
Dawthonia forskalei	O.	.	.	.
Neurada procumbens	r.	.	r.	.
Convolvulus lanatus	r.	.	r.	.
Cotula cinerea	o.	.	.	.

Table 7: Floristic composition of Pituranthos tortuosus plant community type.

T3:	Stand 1 k.72	Stand 2 k.83	Stand 3 k.87	Stand 4 k.89	Stand 5 k.95	Stand 6 k.105
Pituranthos tortuosus	d.	d.	d.	d.	d.	d.
Panicum turgidum	c.	c.	c.	r.	.	.
Zilla spinosa	.	r.	r.	r.	o.	o.
Farsetia aegyptisca	.	.	.	r.	.	r.
Schismus barabatus	o.	c.	o.	o.	c.	o.
Moltkea callosa	o.	c.	.	o.	.	.
Zygophyllum album	.	o.	o.	o.	c.	r.
Fagonia glutinosa	.	r.	o.	o.	r.	c.
Artemisia monosperma	c.	cod.	o.	c.	r.	a.
Crotalaria aegyptiaca	.	.	o.	o.	.	.
Stipa lagasca	.	.	o.	o.	o.	.
Hoplophyllum tuberculatum	.	.	r.	.	c.	.
Atractylis flava	.	r.	.	.	o.	.
Hyoscyamus muticus	.	.	.	r.	c.	.
Neurada procumbens	.	r.	o.	.	.	.
Helianthemum lippii	.	.	.	.	o.	.
Convolvulus lanatus	.	.	o.	o.	.	.
Lamarkia sp.	.	r.	r.	.	.	.
Launaea nudicaulis	.	.	.	.	r.	.

Table 8: Floristic composition of Zilla spinosa Plant Community type.

T:3	Stand 1 k.96	Stand 2 k.97	Stan k.9
Zilla spinosa	d.	d.	d.
Pituranthos tortuosus	c.	a.	c.
Farsetia aegyptiaca	o.	o.	o.
Panicum turgidum	.	.	c.
Hammada elegans	.	c.	.
Zygophyllum coccineum	.	o.	.
Z. album	o.	o.	o.
Z. simplex	r.	.	.
Fagonia arabcea	.	o.	.
Artemisia monosperma	o.	cod.	.
Atractylis flava	o.	.	.
Hyoscyamus muticus	r.	o.	.
Senecio coronopifolius	r.	o.	.
Cotula cinerea	o.	o.	.
Launaea nudicaulis	o.	o.	.
Pteranthus dichotomus	o.	o.	.
Helianthemum lippii	c.	r.	.

Table 9: Floristic composition of Artemisia monosperma plant community type

	Stand 1 T4 k.16	Stand 2 T4 k.24	Stand 3 T4 k.28	Stand 4 T3 k.100	Stand 5 T5 k. 104
Artemisia monosperma	d.	d.	d.	d.	d.
Pituranthos tortuosus	a.	c.	o.	c.	c.
Panicum turgidum	c.	o.	o.	c.	c.
Zilla spinosa	c.	c.	o.	c.	c.
Farsetia aegyptiaca	r.	.	.	.	.
Hyoscyamus muticus	o.	o.	.	c.	.
Hammada elegans	o.	.	r.	r.	r.
Fagonia glutinosa	o.	.	o.	o.	c.
Salsola kali	r.	.	o.	.	.
Trigonella stellata	c.	.	o.	.	.
Polycarpea repens	o.	.	.	o.	.
Pancratium sickenbergi	r.	.	.	.	r.
Helianthemum lippii	r.	.	r.	.	.
Medicago hispida	c.	.	.	.	.
Filago spathiolata	o.	.	r.	r.	.
Ifloga spicata	o.	r.	r.	r.	.

sheets of sand, (Fig. 1). Table 6 shows the [illegible] position of four stands of this community type. Fur[illegible] the north, Pituranthos tortuosus dominates a characteristic community type of sandy furrows: (Fig. 12). The floristic composition is shown in Table 7. In some runnels, pure stands of Pituranthos tortuosus, the suffrutescent perennial, are seen. Roots of Pityranthus tortuosus are known to be deep penetrating, the plant shows good growth in its sandy habitat. By k.96-98, Zilla spinosa community type prevails, (Table 8). Artemisia monosperma begins to appear near k. 77, but further [illegible] appears frequently and dominates a plant community type (e.g. stands k. 100 and 104). Artemisia monosperma is commonly codominated by Pituranthus tortuosus, and occasionally by Zygophyllum album in some stands, (e.g. k. 100). [illegible] pure stand of Zygophyllum album may exist, (e.g. k. [illegible]).

Transect 4:

The desert west of Khaiseria is gravelly [illegible] poor vegetation on the drifted sand, but further west Artemisia monosperma plant community type richly colonized the area, (Fig. 13, Table 9) till the reaches of the end of the transect. The S-N runnels are densely grass oriented by September due to the new growth of Artemisia monosperma; the green runnels alternate with barren slightly elevated gravelly areas. In some localities Pituranthos tortuosus, or Zilla spinosa, codominates with Artemisia monosperma, whereas in several other

localities Artemisia monosperma forms almost pure stands. Artemisia monosperma actually characterizes the open desert scrub landscape of nearly the whole length of Transect 4. For few kilometers at both ends of the transect - higher elevations-, the vegetation is very scarce.

Discussion

It is evident that the features of the plant cover in the studied area are greatly regulated by the complex of the climatic, especially rainfall and wind, (Table 1), and physiographic factors especially topography (Fig. 1), and soil characteristics.

The natural plant cover in the area under investigation is oriented in six distinct plant community types, as follows:

1- Aristida scoparia community type.
2- Moltkea callosa " "
3- Panicum turgidum " "
4- Pituranthos tortuosus " "
5- Zilla spinosa " "
6- Artemisia monosperma " "

and three subcommunity types, namely:

7- Zygophyllum coccineum subcommunity type
8- Hammada elegans " "
9- Zygophyllum album " "

A quatic and moist soil communities are also represented.

- 4.4 -

Each of the above mentioned community types is characterized by the dominant species which give it a homogeneity of plant growth. The phytoceonsis varies from an open desert grassland in Aristida scoparia and Panicum turgidum community types to an open desert sub Serub as Artemisia monosperma community type.

The pattern of the different plant community types is regulated by the interacting complex of factors of the environment . Tolerance limits of the different species to various factors determine the floristic composition of the different localities of the above mentioned vegetation units; some are transitional types. While few Zygophyllum coccineum subcom. appears on shallow soil on limestone at the southern sector of the area, Zygophyllum coccineum forms a rich community type representing stages in the development of wadi, Kassas (1952) and Kassaa and Imam (1954). Hammada elegans appears commonly on gravel desert.

Panicum turgidum grassland represents a stage in the general building up of sand soil. The last two examples may thus represent stages in allogenic retrogressive and progressive successional changes, respectively.

Pityranthos tortuosus community type is sand preferable and merges to Panicum turgidum type to one side and to Artemisia monosperma community type to the other side. Orientation of Zilla spinosa and Artemisia monosperma community

types appears to be greatly governed by factors such as soil depth, runoff, and moisture regime.

Moltkea callosa community type is a transitional one. Moltkea callosa is a pioneer plant on newly drifted sand and develops on sand flats and dune bases. Aristida scoparia too, a pioneer sand binder is higly wind tolerant and inhabits tops of dunes. Both species are endowed with the ability of colonizing moving sand.

The six plant community types above mentioned are dominated mostly by sand loving plants. They represent stages of plant succession on sand exhibiting a form of communities of a psamosere. However, some of these community types could reach a relatively stable subclimax state.

It may be stated here that the community types here represented exhibit some relationship with community types distinguished by Kassas and Abid (1962) for the Eastern desert.

The role of wind, through erosion and deposition is quite evident in the area. Sand creeps gradually from the north-west to the low cultivated land in the east. Movement of soil is controlled by grain size and wind velocity. Thus according to Stockes law, a grain of sand 0.125 mm. in diamter could be moved by a threshold wind velocity of 4, 5-6.7 m./sec. (about 16.0-24.0 km./h). Soil may be moved by saltation,

supension or surface creep, Stallings, (1959). While saltation is responsible of moving grains ranging in diameter from 0.1- 0.2 mm., particles less than 0.1 mm. are carried in suspension. Grains of about 0.5 - 1.0 mm. in diameter derive their kinetic energy by the impact of grains moving in saltation to form surface creep. Deposition occurs as wind carrying soil material either in suspension or saltation subsides so it deposits its soil load, (see Fig. 6). Exceptional wind storms and gusts of increasing frequency and severity occur in the desert, (Table 1). They are responsible of building up of surface sand soil, (Fig. 7), the observed movement of sand and sometimes its oncroschment on fertile land. Worthwhile to emphathize here the advantageous role of wind breaks and tree and shrub plantation.

Summary

A vegetation study of the desert fringe area west of the Nile Delta was made. The following vegetation units were distinguished: Aristida scoparia, Moltkea callosa, Panicum turgidum Pituranthos tortuosus, Zilla spinosa, Artemisia monosperma, Zygophyllum coccineum, Hammada elegane, and Zygophyllum album.

An aquatic and moist soil comm. type appears at water habitats.

The features and characteristics of these vegetation units were shown. The community types distinguished are dominated by sand loving plants and they represent stages of plant succession on sand.

The role of wind erosion and deposition is disscussed.

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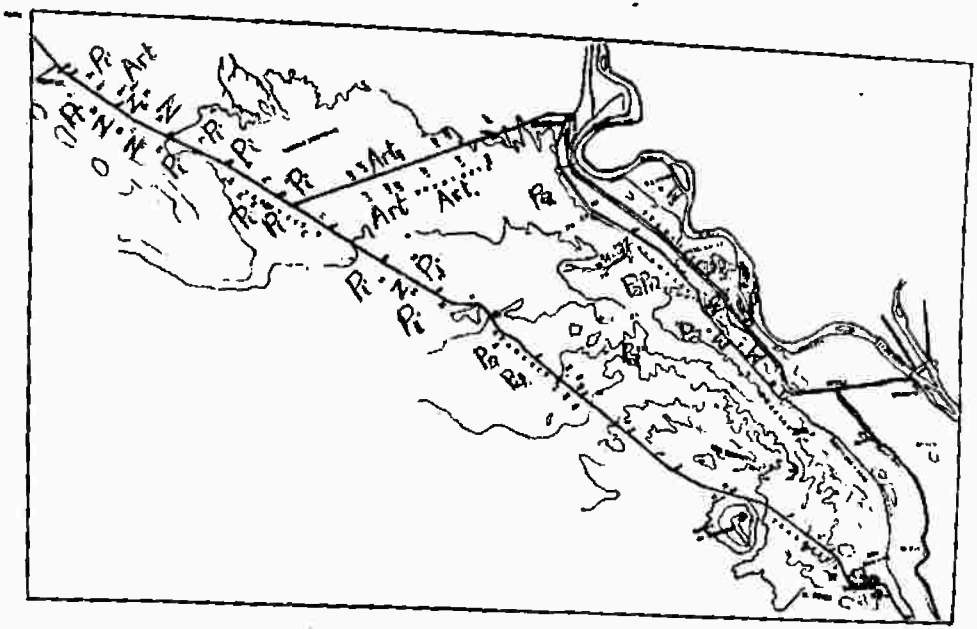

Fig. 1: Map of the studied area west of the Nile Delta showing orientation pattern of vegetation.

Fig. 2: (Tr 1) A stand of Alhagi maurorum; Phragmites australis is invading the area.

Fig. 3: (Tr 1, near Katta) Aristida scoparia on sand dunes.

Fig. 4: (Tr 2) Moltkea callosa plant community type, in neighbourhood of cultivation.

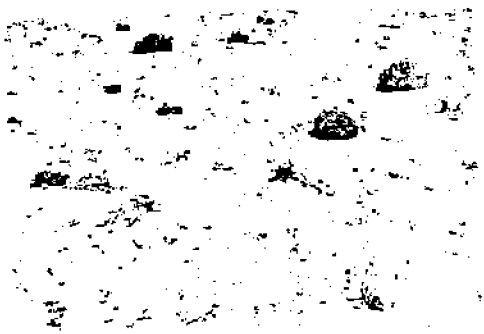

Fig. 5: (Tr 2) Moltkea callosa plant community type.

Fig. 6: (Tr 2) A semi natural stand with plantations of Opuntia. Note deposited sand beyond the fence.

Fig. 7: (Tr 2) A soil profile near Birkash. Note the silty layer below the layers of deposited sand.

Fig. 8: (Tr 3) Alhagi maurorum stand at the foot of G. Abu Rawash.

Fig. 9: (Tr 3, k.57) Aristida scoparia plant community type.

Fig. 10: (Tr 3, k. 41) Meltkea callosa plant community type.

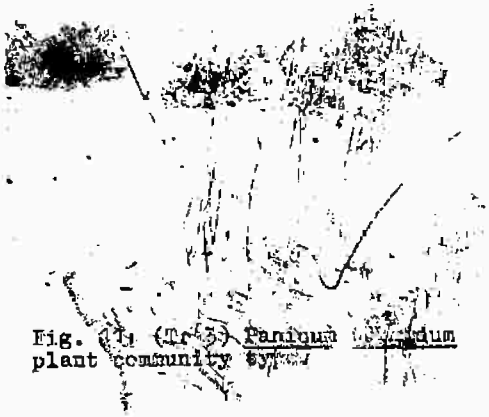

Fig. 11 (Tr 3) Panicum [illegible]dum plant community type.

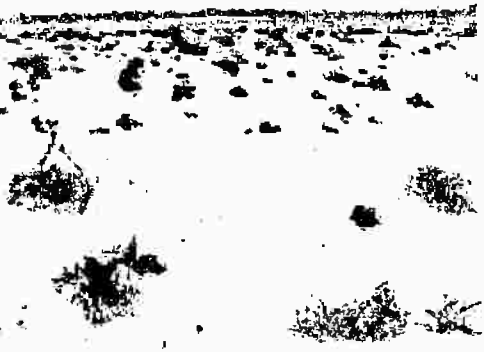

Fig. 12: (Tr 3, k. 97) Pituranthos tortuosus plant community type.

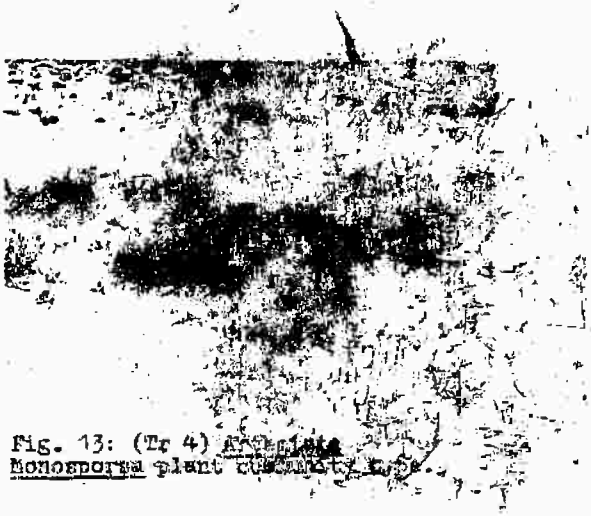

Fig. 13: (Tr 4) [illegible] monosperma plant community type.