

## Old Field Plant Succession in the Subtropical Arid Highland of Sana'a, Republic of Yemen

H.A. Abulfatih

Department of Botany, Faculty of Science, University of Qatar,  
P.O. Box 120148, Doha, Qatar

**ABSTRACT.** The 1-year old field is characterized by having 6 species, which belong to two life forms including therophytes and hemicryptophytes, low plant cover (15%), sandy soil with less humus and lower field capacity (20.2%).

The 4-year old field is characterized by having 32 species of a more diverse life forms, including therophytes, hemicryptophytes, chamaephytes and phanerophytes; moderate plant cover (55%); sandy-loam soil with more humus and higher field capacity (33.3%).

In both fields most plants started growing in late April, after the beginning of the winter rainfall. Importance value index, measured in late July 1997, at the time of maximum productivity, showed that *Cornulaca* sp., *Lamarkia aurea*, *Bromus arvensis*, *Fagonia indica*, *Zygophyllum simplex* were the most prominent species in the 1-year old field. On the other hand, *Bromus arvensis*, *Cornulaca* sp., *Francoeria crispa*, *Plantago afra*, *Osteospermum vaillantii* were the most prominent species in the 4-year old field. Yet, more perennial species were found in the 4-year old field.

For six months, during the relatively dry period of the year, between September and February, not a single plant was seen over the ground surface in the 1-year old field. On the contrary, during the same dry period, in the 4-year old field, many perennial plants were found carrying little leaves. These plants included the ones that behaved as hemicryptophytes, chamaephytes and phanerophytes. They are *Francoeria crispa*, *Ochradenus baccatus*, *Osteospermum vaillantii*, *Pulicaria* sp., *Solanum nigrum*, *Solanum schimperii*, *Solanum sepicula*, *Solanum villosum*, and *Ziziphus spina-christi*.

In the semitropical arid areas as in Sana'a plant species are able to use various tactics to cope with the droughtiness. From the life form viewpoint, plants during the prolonged drought period either die (Therophytes), save water by losing their leaves while keeping their roots and renewal buds (Hemicryptophytes), or extending their roots to the subsoil moisture as in the cases of the dwarf perennial shrubs (Chamaephytes) and the trees (Phanerophytes).

The subtropical arid highland north of Sana'a is characterized by low rainfall and sporadic plants, composed of small annuals and dwarf shrubs, with a few trees. Agriculture in the area is dependent mainly on well water. The chewing relaxant plant Qat (*Catha edulis*), grapes, barley, corn, and alfalfa are the major cash crops in the area. Vast areas on flat lands and hillsides are barren.

A number of publications concerning the vegetation and flora were of great assistance in understanding the plant communities and species composition. Among such publications: Lavranos (1975), Hepper (1977), Chaudhary and Revri (1983), Al-Hubaishi and Müller-Hohenstein (1984), Al-Khuleidi *et al.* (1990), Abulfatih (1984, 1987, 1991a, 1991b, 1992, 1997a, 1997b), Scholte *et al.* (1991), Gabali (1993).

Plant succession in the desert or semi-desert areas received less attention by researchers compared to areas of high rainfall. In desert or semi-desert areas the shortage of rainfall and its unpredictability usually leads to the formation of a climax vegetation of short lived annuals and/or the formation of sporadic, dwarf shrubs, with very few trees.

In the present study the attempt was made to understand the community structure, life forms and dynamics in two successional fields, a one-year old and a four-year old, at a flat land, in the cool semi-desert area at Arhab, at 2300 m above sea level, 35 km north of the capital Sana'a.

### Materials and Methods

In an area which never been cultivated before, two successional areas were chosen at the College of Education at Arhab, 2300 m above sea level, 35 km north of the capital Sana'a, Republic of Yemen, to conduct this project. The first area was plowed and abandoned for one year, and the second plowed and abandoned for four years.

Ten quadrates of one square meter each were chosen at random at each successional area. Plant life forms, flowering and fruiting times were observed over a period of one year, between July 1996 and July 1997. Quantitative data including species density, frequency, and dominance were collected when most species were blooming, in late July 1997.

The following modified formulas were applied on the vegetation to determine relative density, relative frequency, relative dominance, and importance value index (IVI), (Curtis and McIntosh 1950).

$$\text{Relative Density} = \frac{\text{Number of individuals of species x in 10 quadrates}}{\text{Total number of all species in 10 quadrates}} \times 100$$

$$\text{Relative Frequency} = \frac{\text{Frequency of species x in 10 quadrates}}{\text{Sum frequency of all species in 10 quadrates}} \times 100$$

$$\text{Relative Dominance} = \frac{\text{Crown cover of species x in 10 quadrates}}{\text{Total crown cover of all species in 10 quadrates}} \times 100$$

$$\text{IVI} = \text{Relative Density} + \text{Relative Frequency} + \text{Relative Dominance}$$

Classification of plant life forms was based upon the method proposed by Raunkiaer (1937) and revised by Ellenberg and Mueller-Dombois (1967). The definitions of these life forms are as follows:

*Phanerophytes*: Woody plants or herbaceous evergreen perennials that grow taller than 50 cm, or whose shoots do not die back periodically to that height limit.

*Chamaephytes*: Woody plants or herbaceous evergreen perennials whose mature branch or shoot system remains perennially within 50 cm above ground surface, or plants that grow taller than 50 cm, but whose shoots die back periodically to that height limit. Renewal buds are positioned within 50 cm above ground surface.

*Hemicryptophytes*: Perennial (including biennials) herbaceous plants with periodic shoot reduction to a remnant shoot system that lies relatively flat on the ground surface.

*Geophytes (Cryptophytes)*: Perennial (including biennial) herbaceous plants with periodic reduction of the complete shoot system to the storage organs that are

embedded in the soil.

*Therophytes:* Annual plants whose shoot and root system die after seed production and which complete their life cycle within one year.

Plant height was represented by the mean of 10 individuals found in the area, in July, the time of maximum plant growth. Plant identification was based on the publications by Abulfatih (1984), Migahid (1978), Collenette (1985), Chaudhary and Revri (1983), Al-Hubaishi and Müller-Hohenstein (1984).

Soil water holding capacity (field capacity) was determined by watering the soil to the saturation level. Then left to drain on filter paper until leaching ceased. Drained soil then was weighted. Soil oven dried at 100 °C, over night and weighted. The difference between the drained soil and the oven-dried soil represented field capacity. Soil physical analysis was tested by the hydrometer method. Ten replicates were tested in each field.

### Climate

The climatic conditions recorded at the nearest meteorological station at the capital Sana'a (2360 m above sea level), which is located 35 km south of the study site is characterized by the prevailing south-westerly wind and two major rainy periods (Statistical Year Book 1975-1987). The first prominent rainy season is in spring (March-April), and the second minor rainy season is in summer (July-August). Average annual rainfall is about 200 mm. Mean monthly temperature is 22 °C during the warmest month (July) and 14 °C during the coldest months (January-December). Most of the seed germination is taking place in March. The relatively lower quantity of rainfall and higher temperature of the summer season showed an immense reduction of seed germination and plant productivity.

### Results

After the onset of the relatively high rainfall in March-April, the period of maximum rainfall, seedlings, off shoots, and the new leaves of various plants started to come out. Six plant species were found in the 1-year old field. They showed very distinctive growth plasticity. They grew as therophytes and hemicryptophytes (Table 1). On the other hand, in the 4-year old field thirty-two species were found. They grew as therophytes, hemicryptophytes, chamaephytes, and one grew as a phanerophyte (Table 1). In the surrounding areas, out side the study plots, 69 of

common species were encountered (Table 2).

Quantitative analysis was conducted at the period of maximum vegetative growth, in late July 1997. Importance value index showed that *Cornulaca* sp., *Lamarkia aurea*, *Bromus arvensis*, *Fagonia indica*, and *Zygophyllum simplex* were the most prominent species in the 1-year old field. On the other hand, *Bromus arvensis*, *Cornulaca* sp., *Francoeria crispa*, *Plantago afra*, and *Osteospermum vaillantii* were the most prominent species in the 4-year old field (Table 1).

Quantitative analysis could lead to a different set of results, if conducted during the dry period of the year, when all therophytes and hemicryptophytes are absent. For six months, during the relatively dry period of the year, between September and February, not a single plant was seen over the ground surface in the 1-year old field. On the other hand, in the 4-year old field, many species were found carrying little green material during that period. These species included the ones that behaved as chamaephytes and phanerophytes. They are: *Francoeria crispa*, *Ochradenus baccatus*, *Osteospermum vaillantii*, *Peganum harmala*, *Pulicaria crispa*, *Solanum nigrum*, *Solanum schimperi*, *Solanum sepicula*, *Solanum villosum*, *Trichodesma ehrenbergii* and *Ziziphus spina-christi* (Table 1).

Maximum plant height, 20 cm, was recorded by *Cornulaca* sp. in a 1-year old field, and 100 cm was recorded by *Ziziphus spina-christi* in a 4-year old field. No significant height differences were recorded between plants of the same species that were found in both successional fields.

In the 1-year old field a low plant cover was recorded (15%) by the plants that lived for short time during the year. On the contrary, plants of the 4-year old field formed moderate cover (55%) which were made of mostly perennials that lived longer during the year. Soil excavation indicated that the latter group was building more subterraneous reserved materials than the first group.

Soil in the upper 15 cm was sandy in a 1-year old field and sandy-loam in a 4-year old field. Soil in the 1 and 4-year old fields recorded subsequently 20.2% and 33.3% field capacity. More fine soil particles, higher humus and root content were the reason behind higher soil water holding capacity in the 4-year old field. Such higher soil moisture content in the 4-year old field was very helpful in supporting more perennial plants throughout the prolonged drought period between September and February.

### Conclusions

Plants living in such subtropical arid highland to cope with droughtiness expressed various tactics of life forms. The species found in the 1-year old field were behaving as short living plants (therophytes or losing their crowns while keeping their roots and renewal buds (hemicryptophytes) during the drought periods. The species found in the 4-year old field, were behaving either as short living plants (therophytes), or losing their crowns while keeping their roots and renewal buds (hemicryptophytes), or extending their roots deep in the soil as in the cases of the dwarf perennial shrubs (chamaephytes) and the trees (phanerophytes).

Generally, in arid and semi-arid regions abandoned plowed fields could harbor plant communities made of limited number of species of low stature. The climax stage of the vegetation can be also reached soon. Studies showed, on the contrary, that in temperate and tropical regions abandoned plowed fields could develop into forests of large number of species in few years (Bazzaz 1969, Bazzaz and Pickett 1980, Drury and Tisbet 1973, Pickett 1976). However, reaching the climax stage of the vegetation might take longer time.

**Table 1.** Quantitative analysis of the vegetation, in one and four-year old fields. Life forms include: Therophytes (T), Hemicryptophytes (H), Chamaephytes (C), Phanerophytes (P). Importance Value Index (IVI), Species Absent (-). Data were taken from 10 x 1 m<sup>2</sup> quadrates, from each field.

Ecological parameters	Relative density		Relative frequency		Relative dominance		IVI		Life form		Av. plant height (cm)	
	1	4	1	4	1	4	1	4	1	4	1	4
Field age (years)	1	4	1	4	1	4	1	4	1	4	1	4
<b>Dicot plants:</b>												
<i>Brassica tournefortii</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	H	-	40
<i>Caylusea hexagyna</i>	-	0.82	-	3.22	-	1.02	-	5.06	-	T H	-	40
<i>Centaurea scoparia</i>	-	0.82	-	3.22	-	1.02	-	5.06	-	H	-	25
<i>Cornulaca</i> sp.	35.8	18.6	34.5	9.3	54.4	30.0	124	57.9	T H	T H	20	20
<i>Echinops</i> sp.	-	0.41	-	1.61	-	0.51	-	2.53	-	H	-	50
<i>Echium longifolium</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	T	-	25
<i>Euphorbia granulata</i>	0.62	0.82	3.44	3.22	0.14	0.51	4.20	4.55	T	T	1	1
<i>Fagonia indica</i>	1.73	0.82	10.3	1.61	0.39	1.02	12.4	3.45	T H	T H	10	10
<i>Francoeria crispa</i>	-	9.58	-	9.2	-	15.2	-	33.9	-	H C	-	40
<i>Launaea capitata</i>	-	0.41	-	1.61	-	0.25	-	2.53	-	T	-	12
<i>Leucas inflata</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	T H	-	30
<i>Ochradenus baccatus</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	C	-	90
<i>Osteospermum vaillantii</i>	-	2.91	-	5.44	-	3.03	-	11.3	-	H C	-	40
<i>Peganum harmala</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	H C	-	30
<i>Plantago afra</i>	-	12.1	-	6.06	-	1.02	-	19.2	-	T	-	10
<i>Pulicaria arabica</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	T H	-	20

Table 1. (Continued)

Ecological parameters	Relative density		Relative frequency		Relative dominance		IVI		Life form		Av. plant height (cm)	
	1	4	1	4	1	4	1	4	1	4	1	4
Field age (years)	1	4	1	4	1	4	1	4	1	4	1	4
<i>Pulicaria</i> sp.	-	0.41	-	1.61	-	0.51	-	2.53	-	C	-	25
<i>Rumex vesicarius</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	T	-	20
<i>Senecio schimperi</i>	-	2.08	-	2.22	-	0.5	-	4.8	-	T	-	25
<i>Solanum nigrum</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	H C	-	25
<i>Solanum schimperi</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	H C	-	25
<i>Solanum sepicula</i>	-	0.82	-	3.22	-	1.53	-	5.57	-	H C	-	30
<i>Solanum villosum</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	H C	-	30
<i>Tribulus terrestris</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	T	-	2
<i>Trichodesma ehrenbergii</i>	-	0.41	-	1.61	-	0.51	-	2.53	-	H C	-	35
<i>Xanthium spinosum</i>	-	1.66	-	2.22	-	0.76	-	4.64	-	T H	-	30
<i>Ziziphus spina-christi</i>	-	0.41	-	1.61	-	2.54	-	4.56	-	P	-	100
<i>Zygophyllum simplex</i>	1.15	-	3.44	-	0.57	-	5.16	-	T	-	5	-
<b>Monocot Plants:</b>												
<i>Bromus arvensis</i>	22.6	37.9	20.9	13.4	20.1	27.9	63.6	79.2	T H	T H	10	10
<i>Cenchrus ciliaris</i>	-	1.66	-	3.22	-	0.75	-	5.63	-	H	-	15
<i>Cynodon dactylon</i>	-	1.20	-	3.25	-	2.54	-	6.99	-	H	-	10
<i>Hyparrhenia hirta</i>	-	0.82	-	2.22	-	2.00	-	5.04	-	H	-	60
<i>Lamarkia aurea</i>	38.1	0.83	27.6	3.22	24.4	1.27	90.1	5.32	T H	T H	8	8

Table 2. Plant species found in the fields of one-year old, four-year old, and outside the study plots, in the surrounding areas. Present (+), Absent (-).

Species	Family	1-Year Old	4-Year Old	surrounding Areas
<b>Dicot Plants:</b>				
<i>Acacia iraquensis</i>	Leguminosae	-	-	+
<i>Aerva javanica</i>	Amaranthaceae	-	-	+
<i>Aizoon canariense</i>	Aizoaceae	-	-	+
<i>Altenanthera pungens</i>	Amaranthaceae	-	-	+
<i>Amaranthus</i> sp.	Amaranthaceae	-	-	+
<i>Argemone mexicana</i>	Papaveraceae	-	-	+
<i>Atriplex dimorphostegia</i>	Chenopodiaceae	-	-	+
<i>Blumea gariepina</i>	Compositae	-	-	+
<i>Brassica tournefortii</i>	Cruciferae	-	+	+
<i>Calotropis procera</i>	Asclepiadaceae	-	-	+
<i>Capparis spinosa</i>	Capparaceae	-	-	+
<i>Caylusea hexagyna</i>	Resedaceae	-	+	+
<i>Centaurea pseudosinaica</i>	Compositae	-	-	+
<i>Centaurea scoparia</i>	Compositae	-	+	+
<i>Chenopodium schaderiana</i>	Chenopodiaceae	-	-	+
<i>Citrullus colocynthis</i>	Cucurbitaceae	-	-	+
<i>Commicarpus grandiflorus</i>	Nyctaginaceae	-	-	+
<i>Cornulaca</i> sp.	Chenopodiaceae	+	+	+
<i>Datura innoxia</i>	Solanaceae	-	-	+
<i>Echinops</i> sp.	Compositae	-	+	+
<i>Echium longifolium</i>	Boraginaceae	-	+	+
<i>Euphorbia granulata</i>	Euphorbiaceae	+	+	+
<i>Euphorbia schimperiana</i>	Euphorbiaceae	-	-	+
<i>Fagonia indica</i>	Zygophyllaceae	+	+	+
<i>Flaveria trinervia</i>	Compositae	-	-	+
<i>Forskoalea tenacissima</i>	Urticaceae	-	-	+
<i>Francoeria crista</i>	Compositae	-	+	+
<i>Heliotropium ramosissimum</i>	Boraginaceae	-	-	+
<i>Indigofera arabica</i>	Leguminosae	-	-	+
<i>Launea capitata</i>	Compositae	-	+	+
<i>Leucas inflata</i>	Labiatae	-	+	+
<i>Lycium shawi</i>	Solanaceae	-	-	+
<i>Malva parviflora</i>	Malvaceae	-	-	+
<i>Ochradenus baccatus</i>	Resedaceae	-	+	+

Table 2. (Continued)

Species	Family	1-Year Old	4-Year Old	surrounding Areas
<i>Onopordon heterocarthurum</i>	Compositae	-	-	+
<i>Osteospermum vaillantii</i>	Compositae	-	+	+
<i>Peganum harmala</i>	Zygophyllaceae	-	+	+
<i>Plantago afra</i>	Plantaginaceae	-	+	+
<i>Plantago ovata</i>	Plantaginaceae	-	-	+
<i>Pulicaria arabica</i>	Compositae	-	+	+
<i>Pulicaria crispa</i>	Compositae	-	+	+
<i>Pulicaria glutinosa</i>	Compositae	-	-	+
<i>Ricinus communis</i>	Euphorbiaceae	-	-	+
<i>Rumex vesicarius</i>	Polygonaceae	-	+	+
<i>Salsola inermis</i>	Chenopdiaceae	-	-	+
<i>Senecio schimperi</i>	Compositae	-	+	+
<i>Sisymbrium irio</i>	Cruciferae	-	-	+
<i>Solanum incanum</i>	Solanaceae	-	-	+
<i>Solanum nigrum</i>	Solanaceae	-	+	+
<i>Solanum schimperi</i>	Solanaceae	-	+	+
<i>Solanum sepicula</i>	Solanaceae	-	+	+
<i>Solanum villosum</i>	Solanaceae	-	+	+
<i>Tagetes minuta</i>	Compositae	-	-	+
<i>Tamarix</i> sp.	Tamaricaceae	-	-	+
<i>Tribulus terrestris</i>	Zygophyllaceae	-	+	+
<i>Trichodesma ehrenbergii</i>	Boragenaceae	-	+	+
<i>Withania somnifera</i>	Solanaceae	-	-	+
<i>Xanthium spinosa</i>	Compositae	-	+	+
<i>Ziziphus spina-christi</i>	Rhamnaceae	-	+	+
<i>Zygophyllum simplex</i>	Zygophyllaceae	+	-	+
<b>Monocot Plants:</b>				
<i>Andropogon distachos</i>	Graminae	-	-	+
<i>Bromus arvensis</i>	Graminae	+	+	+
<i>Cenchrus ciliaris</i>	Graminae	-	+	+
<i>Cynodon dactylon</i>	Graminae	-	+	+
<i>Dichanthium annulatum</i>	Graminae	-	-	+
<i>Hyparrhenia hirta</i>	Graminae	-	+	+
<i>Lamarkia aurea</i>	Graminae	+	+	+
<i>Pennisetum setaceum</i>	Graminae	-	-	+
<i>Themeda triandra</i>	Graminae	-	-	+

### References

- Abulfatih, H.A.** (1984) *Wild plants of Abha and the surrounding areas*. Saudi Publishing and Distributing House, Jeddah, Saudi Arabia.
- Abulfatih, H.A.** (1987) Medicinal plants in south-western Saudi Arabia. *Economic Botany*, **41**(3): 354-360.
- Abulfatih, H.A.** (1991a) *Ecology*. A textbook in Arabic. King Saud University Press, Riyadh, Saudi Arabia.
- Abulfatih, H.A.** (1991b) Quantitative assessment of wild trees in south-western Saudi Arabia. *Proc. Saudi Biol. Soc. Biol. Sci.*, **1**: 117-127.
- Abulfatih, H.A.** (1992) Vegetation zonation along an altitudinal gradient between sea level and 3000 meters in south-western Saudi Arabia. *J. King Saud University, Science*, **4**(1): 57-97.
- Abulfatih, H.A.** (1997a) *Arabian desert ecology*. In Arabic. Dar Al-Shurook, Amman, Jordan.
- Abulfatih, H.A.** (1997b) Vegetation cover of Republic of Yemen, natural and cultivated. Univ. of Aden Journal of Natural and Applied Science. Accepted.
- Bazzaz, F.A.** (1969) Succession and species distribution in relation to erosion in southern Illinois. Illinois State Academy of Science. **62**(4): 430-435.
- Bazzaz, F.A.** and **Pickett, S.T.A.** (1980) Physiological ecology of tropical succession: A comparative review. *Ann. Rev. Ecol. Syst.* **11**: 287-310.
- Drury, W.H.** and **Tisbet, C.T.** (1973) Succession. *Journal of the Arnold Arboretum*. **54**(3): 331-368.
- Al-Hubaishi, A.** and **Müller-Hohenstein, K.** (1984) An introduction to the vegetation of Yemen. Eschborn, Federal Republic of Germany.
- Al-Khuleidi, A.W., Kessler, J.J., Scholte, P.T.** and **De Kruyff, K.** (1990) Vegetation Map of Yemen Republic, Western Part. Environmental Protection Council and the Agricultural Research Authority, with the assistance of Netherlands Ministry of Development Cooperation. Distribution by EPC, Sana'a, The Republic of Yemen, and DHV Consultants, Amerstfoot, The Netherlands.
- Chaudhary, S.A.** and **Revri, R.** (1983) Weeds of North Yemen. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), GmbH, Eschborn, Federal Republic of Germany.
- Collenette, S.** (1985) *An illustrated guide to the flowers of Saudi Arabia*. NEPA Kingdom of Saudi Arabia - Flora Publication, No. 1. Scorpion Publishing Ltd., London.
- Curtis, J.T.** and **McIntosh, R.P.** (1950) The inter-relations of certain analytic and synthetic phytosociological characters. *Ecology*, **31**: 434-455.
- Ellenberg, H.** and **Müeller-Dombois, D.** (1967) A key to Raunkiaer plant life forms with revised subdivisions. Ber. Geobot. Inst. ETH. *Stiftg. Rubel, Zurich*, **37**: 56-73.
- Gabali, S.A.** (1993) *Trees of Yemen*. In arabic. Aden University Publications, Aden, Republic of Yemen.
- Hepper, F.N.** (1977) Outline of the vegetation of Yemen Arab Republic. Publ., Cairo Univ., No. **7-8**: 307-322.
- Lavranos, J.J.** (1975) Note on the northern temperate elements in the flora of the Ethio-Arabian region. *Bioss*, **24**: 67-69.

- Migahid, A.M.** (1978) *Flora of Saudi Arabia*, 2nd Ed., Vol. I & II. Riyadh University Publications, Riyadh, Saudi Arabia.
- Pickett, S.T.A.** (1976) Succession: An evolutionary interpretation. *Amer. Natur.* **110**: 107-119.
- Raunkiaer, C.** (1937) *Plant life forms*. Clarendon, Oxford.
- Scholte, P., Al-Khuleidi, A.W. and Kessler, J.J.** (1991) The vegetation of the Republic of Yemen. Environmental protection Council and the Agricultural Research Authority. Range and livestock improvement project, Dhamar, Republic of Yemen, with the assistance of Netherlands Ministry of Development Cooperation. DHV Consultants, B.V. 56 pp.
- Statistical Year Book** (1975-1987) Publications of the Republic of Yemen, Ministry of Planning and Development, Central Statistical Organization.

(Received 29/09/1997;  
in revised form 22/03/1998)

## التعاقب النباتي في الحقول القديمة ، فوق الهضبة الجافة شبه الاستوائية ، لصنعاء ، في الجمهورية اليمنية

حسين على أبو الفتح

قسم النبات - كلية العلوم - جامعة قطر  
ص.ب. (١٢٠١٤٨) - الدوحة - قطر

تتميز الحقول المحروثة والمتروكة لمدة سنة واحدة بإحتوائها على ست أنواع من النباتات البرية تابعة إلى نمطين من أنماط النمو هما الحوليات وفاقدات الجزء الظاهري . وهذه النباتات تغطي ١٥٪ من مساحة الأرض . التربة رملية ، قليلة المادة العضوية ، ذات سعة حقلية مقدارها ٢ , ٢٠٪ .

تتميز الحقول المحروثة والمتروكة لمدة أربعة سنوات بإحتوائها على ٣٢ نوعاً من النباتات البرية تابعة إلى أربعة أنماط نمو هي الحولية ، وفاقدة الجزء الظاهري ، والشجيرات والأشجار . وتغطي هذه النباتات ٥٥٪ من مساحة الأرض . التربة رملية طفلية ، ذات نسبة عالية من المادة العضوية ، ذات سعة حقلية مقدارها ٣ , ٣٣٪ .

تبدأ النباتات بالنمو في كلا الحقلين في أواخر أبريل بعد سقوط الأمطار الشتوية . ومقياس الأهمية الذي تم حسابه في أواخر يوليو حين كانت النباتات في أوج إنتاجها من المادة الخضراء ، أظهر تفوق النباتات التالية في الحقل الذي عمره سنة واحدة ، وبالتسلسل من اليسار إلى اليمين :

*Cornulaca sp., Lamarkia aurea, Bromus arvensis, Fagonia indica, and Zygophyllum simplex*

وفي الحقل الذي عمره أربعة سنوات تفوقت النباتات التالية :

*Bromus arvensis*, *Cornulaca* sp., *Francoeria crispa*, *Plantago afra*, and *Osteospermum vaillantii*

خلال ستة شهور من الجفاف بين سبتمبر وفبراير اختفت جميع النباتات من على سطح الأرض في الحقل الذي عمره سنة واحدة . وفي الحقل الذي عمره أربع سنوات استمر النمو البطيء للعديد من النباتات المعمرة . وهذه النباتات اشتملت أنماط فاقدرات الجزء الظاهري ، والشجيرات ، والأشجار . وهذه النباتات هي كما يلي :

*Francoeria crispa*, *Ochradenus baccatus*, *Osteospermum vaillantii*, *Pulicaria* sp., *Solanum nigrum*, *Solanum schimperi*, *Solanum sepicula*, *Solanum villosum*, *Ziziphus spina-christi*

تميزت نباتات هذه المنطقة ، شبه الصحراوية ، المعتدلة الحرارة ، بتكتيكات معينة مكنتها من العيش تحت ظروف الجفاف الطويلة . ففي فترات الجفاف ، يموت النباتات كلياً كما هي الحال في النباتات الحولية (Therophytes) ، أو يموت الجزء الظاهري وتبقى الجذور حية تحت سطح الأرض ، كما في فاقدرات الجزء الظاهري (Hemicryptophytes) ، أو تمد النباتات جذورها عميقاً في الأرض للحصول على الماء كما في الشجيرات (Chamaephytes) ، والأشجار (Phanerophytes) .