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Relationship between Vegetation and Soil Seed Bank at Protected Versus Unprotected Sites at Coastal Habitats in Libya

Elsayed Nafea
Aquatic Environment Department, Faculty of Fish Resources, Suez University, Egypt

ABSTRACT
The present study conducted to assess the relationship between vegetation and soil seed bank at protected versus unprotected sites at coastal habitats in Libya, where two sites (protected and non-protected) were selected and soil seeds estimated manually by sieving and flotation method. The results revealed that 190 species recorded in the protected site for both vegetation and soil seed bank, among them 87 perennials, 2 biennials and 101 annual and included 126 genera belonging to 34 families. While the non-protected site vegetation attained 104 species, among them 51 perennials, 2 biennials and 51 annuals and 82 species in soil seed bank, from which 12 species were found only as seeds and 77 species were found as seeds and as vegetation, but 22 species were found only as vegetative forms. The life form spectrum was dominated by therophytes which represented by 106 species, (55.78%) of the total number of recorded species, hemicryptophytes 32 species, (16.84%), cryptophytes 23 species, (12.1%), Chamaephytes 16 species, (8.4%) and phanerophytes 12 species, (6.3%). Soil seed bank increased with the increases of soil salinity, soil organic matter content, calcium carbonates and sandy textured soil. The higher similarity index between the vegetation and soil seed bank recorded in the protected site (100 %), while the lower one detected in non-protected site (75.26%**).** Vegetation protection may lead to formation of a huge storage of seeds in soil more than in the non-protected vegetation. Accordingly, soil seed banks can provide a clear picture about the present , as well as the past vegetation and could be play a vital role in conservation and restoration of rare and endangered species after the disturbance processes in the coastal habitats
Keywords: Conservation status, edaphic characteristics, Libya, Mediterranean coastal habitats, restoration, soil seed bank

INTRODUCTION

Soil seed bank can be defined as the viable seeds in soil which have accumulated over many years (El-Sayed, 1996). Soil seeds are considered as a memory for the old past vegetation as they often dominate the unfavourable conditions than their above ground vegetation where they can escaped from the unsuitable conditions such as disturbance, diseases and predators (Bekker *et al.*, 2000). The most abundance of the above ground vegetation leads to increasing of soil seed bank, as well as the annuals produces and accumulates more seeds than the perennials (Chang *et al.*, 2001).

Also soil seed bank can be considered as good indicators for plant population that grow under certain environmental conditions and can be also used as sources of vegetation, as well as a tool for restoration of the vegetation in an area while soil becomes a big store for seeds (Brown, 1998). Soil seed bank is often plays a role in the conservation of rare and threatened species, as well as in the selection of some species (Baskin and Baskin 1998; Wisheu and Keddy 1991).

The annual plants produce large numbers of small and long age seeds leading to an increase in the degree of similarity between the above ground vegetation and soil seed bank (Chambers, 1993; Hutchings and Russell 1989), while the disturbed vegetation produces a small soil seed bank**.**

Also, soil seed bank is affected greatly by salinity which restricts the germination of some plant species persist in soil (Nafea, 2005). Soil pH also plays a role in the development and structure of some wetlands, as well as the natural conservation and restoration of vegetation (Grime, 1981; Roberts, 1981).

The relationship between soil seed bank and the above ground vegetation is very important in the conservation and restoration of the natural vegetation if the management procedures are the same in each year, where areas with a stand of annual species will have similar vegetation in the next year potentially (Bakker *et al.*, 1996).

On the other hand, one of the less expensive and easy way to establish native vegetation in an area where it has previously not existed is to use donor soil from a nearly site with the appropriate vegetation (Bakker *et al.*, 1996).

Soil seed bank can plays an important role in the conservation and restoration in the coastal habitats especially after disturbance by fire, overgrazing, drought, cutting and over collection as many coastal plants are routinely managed by lowering their water levels to recruit species from their soil seed bank (Van der valk, 1981).

Soil seed bank is a function of seed production by the recent and old vegetation as well as the long age of seeds under local environmental conditions which helps the establishment of vegetation in disturbed sites, both in wet lands and terrestrial habitats (Bekker, *et al.* 2000).

The soil seed bank is also considered as one of the

* *Corresponding author: drsayednafea2005@yahoo.com*

most important structural components of wetland ecosystems as it present in nearly all ecosystems and is a critical component in the establishment, as well as development of vegetation in wetlands (Baker, 1989; EL-Barasi *et al.*, 2011).

The present study was conducted to evaluate the relationships between vegetation and soil seed bank in protected versus unprotected sites in the coastal habitats at Libya, and the role of soil seed bank in the conservation and restoration of the natural vegetation in the selected locations.

MATERIALS AND METHODS

The study area

The study area is located at Surt region in Libya between the 31.0 North and 31.3 South and the 16.30 West and 17 East above sea level by nearly 100 meter. It is considered as a part of the middle section of the Mediterranean coastal strip of Libya .It is also considered as semi-arid lands which include some wadies. It is characterized by different coastal habitat types including salt marshes, sand dunes and non-cultivated sandy lands (EL-Deftar and Issawi, 1977) as shown in Figure (1). The soil of the study area is deep, sandy and loamy sandy in texture with low maximum water- holding capacity. It contains high concentrations of nutrients.

On the other hand, the hydrogen ion concentration (pH) is highly alkaline and ranged from 10 to 13, (Alaib and Ihseen, 2008). Two sites (protected and non-protected localities) selected and studied by application of two transects each with about 1000 meter length and 100 meter width, where 10 squares quadrates (10 x 10 m) 100 sq m. taken and five surface soil samples (5 cm. and 10 cm. deep) collected from each quadrate and mixed to form a composite soil sample for studying the soil seed banks and edaphic characteristics**.**

Figure (1): Location map showing the study area

Soil seed bank and edaphic characteristics

The estimation of seeds in soil carried out manually by using sieves and by floatation methods (Henderson *et al.*, 1988) as quoted by El-Sayed, 1996 and Price *et al.*, 2010, where 100gm soil taken and sieved to separate the large size seeds, then identified, and then wet the soil sample within surfactant solution to facilitate digestion of any aggregates in the sample. Then wash over 0.1 mm. sieve to eliminate fine materials. The washed sample was mixed with 500 ml of saturated sucrose solution, agitated and allowed to stand for 15 minutes. The organic materials floated to the surface was collected by decanting through 0.1 mm mesh screen, followed by several rapid washing and decanting of the remaining sample with water. The accumulated organic materials rinsed with water, deposited on filter paper, and air dried. Sorting and counting of the seeds conducting under magnification and identification following a reference collection gathered from the plants growing in the study area and the surrounding areas according to Alexander and Williams 1968, manual for seed identification. 100 gm. Of soil sample were taken and analyzed for $CaCO_3$, O.C., pH, E.C and soil texture classes, where calcium carbonate was determined by titration against 1N HCl (Allen *et al.*, 1974). Oxidizable organic carbon (as indication of organic matter) was determined by using Walkley and Black rapid titration method (Jackson, 1967), by using air dried soil. On the other hand, pH and electrical conductivity (E.C.) were determined in 1: 5 soil extract according to (Piper, 1947). The soil texture was determined by using the hydrometer method for determination of soil texture classes.

Similarity index calculation

The similarity index was calculated as statistical parameter. According to the (Sorensen, 1948), equation of similarity was calculated to assess the degree of similarity between above ground vegetation and the soil seed bank as follow:

Similarity index= (2cx100/a+b)

c= number of species common in both (above ground vegetation and soil seeds); **a**= number of species recorded in the above ground vegetation; **b**= number of species recorded in the soil as seeds.

Vegetation study

The vegetation was studied by determining the presence absence percentages as a measure for the vegetation dominance in the study area. Life forms, nomenclature and identification followed by Boulos (1999, 2000, 2002, 2005 and 2009) and Ellenberg and Mueller-Dombois (1974). Species were sorted according to their families, life forms, life span and presence absence percentages (P %).

RESULTS

The obtained data showed that 190 species were recorded in the protected site as active vegetation and as seeds in soil seed bank plants which represented by 126 genera and belonging to 34 family. These species were classified in to 87 perennials, 2 biennials and 101 annuals. While in non- protected site, 104 species were recorded as active vegetation, which classified into 51 perennials, 2 biennials and 51 annuals, whereas 82 species were recorded in soil seed bank plants among which 12 species were found only in soil seed bank and 77 species were found in both soil seed bank and as active vegetation. It was also observed that 22 species were recorded only as above ground vegetation in the non-protected site as shown in Tables (1and 2).

Table (1): Number of species, genera and families recorded as active vegetation and as seed in soil seed bank in the studied sites.

Parameters	Protected site	Non-Protected site
Number of species recorded as active vegetation and seeds	190	77
Number of species recorded as active vegetation only	-	22
Number of species recorded as seeds only	-	82
Number of Perennial species	87	51
Number of Annual species	101	51
Number of Biennial species	2	2
Number of families	34	34
Number of genera	126	92
Similarity Index	100%	75.26%

Table (2): The Presence absence estimates (P %) of the active vegetation and the mean value of seed density /100g. soil in the studied sites.

Family	Species	Life form	Life span	protected site		Non- protected site	
				P%	seeds /100gsoil	P %	seeds /100g soil
Aizoaceae	*Mesembryanthemum crystallinum* L.	Th	Ann	75	200	15	150
	Mesembryanthemum nodiflorum L.	Th	Ann	75	155	20	145
	Mesembryanthemum forsskalei Hochst. & Bioss.	Th	Ann	70	170	20	142
Alliaceae	*Aptenia cordifolia* L.	Th	Ann	40	56	10	20
	Allium roseum L.	Th	Cr	50	5	40	10
	Asphodelus tenuifolius Cav.	Th	Ann	30	15	-	10
Amaranthaceae	*Amaranthus graecizans* L.	Th	Ann	70	35	10	15
	Amaranthus hybridus L.	Th	Ann	60	20	30	10
	Amaranthus lividus L.	Th	Ann	60	55	10	5
Amaryllidaceae	*Pancratium maritimum* L.	Cr	Per	80	5	10	7
	Pancratium sickenbergri Asch.&Schweinf.	Cr	Per	70	12	-	5
	Narcissus elegans (Haworth) Spach.	Cr	Per	50	5	20	5
Asclepiadaceae	*Calotropis procera (*Aiton) W. T.)	Ph	Per	30	5	-	-
	Cynanchum acutum L.	H	Per	20	6	-	-
Boraginaceae	*Heliotropium curassavicum* L.	Ch	Per	50	15	20	5
	Anchusa humilis (Desf.).I.M.Johnst.	Th	Ann	40	32	20	10
	Moltkiopsis ciliata(Forssk).I.M.Johnst	Ch	Per	70	55	40	25
	Gastrocotyle hispida Foesk.	Ch	Per	70	15	20	5
	Echium anguistifolium Mill.sub sp *sericeum.*(Vabl) Klotz.	Ch	Per	50	7	20	2
Caryophyllaceae	*Paronychia arabica* (L.) Dc.	Th	Ann	*20*	56	10	21
	Silene arabica Bioss.	H	Per	70	64	30	27
	Silene rubella L.	Th	Ann	30	38	10	23
	Silene villosa Forssk.	Th	Ann	*40*	33	30	26
	*Silene succulent*a Forssk.	H	Per	40	28	40	33
	Polycarpon teteraphyllum L.	Th	Ann	20	22	20	12
	Vacoria diandra L.	Th	Ann	10	2	-	1
Chenopodiaceae	*Atriplex halimus* L.	Ph	Per	60	34	-	-
	Atriplex semibaccata R.Br.	H	Per	20	12	-	-
	Atriplex portulacoides L.	Ch	Per	70	24	10	20
	Atriplex glauca L.	Ph	Per	40	21	20	12
	Atriplex leucoclada Bioss.	Ph	Per	20	2	-	-
	Atriplex nummularia Lndl.	Ph	Per	20	4	-	-
	*Bassia indica (*Weight) A.J.Scott.	Th	Ann	80	80	-	20
	Bassia muricata (L) Asch.	Th	Ann	70	12	--	-
	Arthrocnemum macrostachyum (Moric.) Koch.	Ch	Per	80	65	60	35
	*Halocnemum strobilaceum (*Pall.) M. Bieb.	Ch	Per	80	45	60	20
	Suaeda vera Forssk. J.F.Gmel	Ch	Per	80	25	40	22
	Suaeda pruinosa Lang	Ch	Per	70	45	50	24
	*Suaeda maritima (*L.) Dumort.	Th	Ann	70	21	60	12
	Chenopodium album L.	Th	Ann	80	23	50	3
	Chenopodium murale L.	Th	Ann	70	87	30	75
	Chenopodium ambrosoides L.	Th	Bie	55	45	10	12
	Beta vulgaris L.	Th	Ann	30	25	-	-
	Cornulaca monacantha Delile	Ch	Per	40	7	20	5
	Salsola kali L.	Th	Ann	50	3	30	-
Asteraceae	*Arnebia tinctoria* Forssk.	Th	Ann	40	3	30	-
	*Symphyotrichum squamatum (*Spreng.)Nesom	H	Per	10	4	40	-

	Artemisia scoparia Valdst.&Kit.	H	Per	20	2	-	-
	Asteriscus hierochuntica (Michon)Wiklund.	Th	Ann	30	4	20	-
	Urospermum pecroides (L.) F.W. Schmidt	Th	Ann	50	54	40	3
	Senecio vulgaris L.	Th	Ann	70	25	50	3
	Senecio gluacus L.	Th	Ann	50	5	20	-
	Sonchus oleraceus L.	Th	Ann	30	6	-	-
	Echinops spinosus Turra.	H	Per	40	6	30	1
	Echinops galalensis Schwein. f..	H	Per	40	3	30	2
	*Reichardia tingitana (*L) Roth.	Th	Ann	30	5	20	6
	Launaea mucronata (Forssk.) Muchl..	H	Per	60	3	50	4
	*Conyza aegyptiaca (*L.) Dyand	Th	Ann	40	3	40	5
	Carthamus glaucus M.Bieb.	Th	Ann	10	4	20	2
	Ifloga spicata (Forssk.).Sch. Bip.	Th	Ann	10	5	-	-
	Centaurea dimorpha Viv..	H	Per	20	3	10	3
	Carduus pycnocephalus L.	Th	Ann	10	4	10	-
	*Launaea capitata (*Spreng.) Dandy	Th	Ann	30	6	20	-
	Lactuca serriola L.	Th	Ann	20	3	20	-
	Pluchea dioscoridis (L.)DC.	Ph	Per	80	6	-	-
	Convolvulus arvensis L.	H	Per	30	2	-	-
Convolvulaceae	*Convolvulus lanatus* Vahl.	H	Per	20	3	-	-
	Cressa cretica L.	H	Per	40	12	-	-
	Brassica tournefortii Gouam	Th	Ann	20	45	-	-
	Brassica rapa L.	Th	Ann	20	35	-	-
	Cakile maritime Scop.*sub sp . egyptiaca* (Willd) Nyman	Th	Ann	40	55	20	20
	Sisymbrium irio L.	Th	Ann	20	85	20	75
	Lobularia arabica (Bioss.) Muschl.	Th	Ann	20	65	20	45
Brassicaceae	*Lobularia libyca (*Viv.) C.F. Meissn	Th	Ann	10	25	10	34
	Lepidium sativum L.	Th	Ann	20	25	20	25
	*Capsella bursa-pastoris (*L.) Medik	Th	Ann	20	75	20	75
	Farsetia aegyptia Turra	Ch	Per	20	55	20	45
	*Diplotaxis harra (*Forssk.) Boiss.	H	Per	40	76	40	25
	Sinapis arvensis L.	Th	Ann	30	20	10	12
	Matthiola fruitculosa (L.) Maire	H	Per	20	15	-	-
	*Malcolmia pygmaea (*DC.) Boiss	Th	Ann	10	4	-	-
	Cronopus didymus (L.) Sm.	Th	Ann	10	7	10	-
Cynomoriaceae	*Cynomorium coccineum* L.	Cr	Per	10	2	-	-
	Cyperus capitatus Vand.	Cr	Per	30	2	20	3
Cyperaceae	*Cyperus conglomerates* Rottb.	Cr	Per	20	5	85	8
	Cyperus laevigatus L.	Cr	Per	30	6	-	8
	Cyperus rotundus L.	Cr	Per	10	7	10	8
	Euphorbia peplus L.	Th	Ann	10	3	-	3
Euphorbiaceae	*Euphorbia prostrata* Aiton.	Th	Ann	10	5	-	-
	Euphorbia retusa Forssk.	Th	Ann	10	3	-	4
	Euphorbia terracina L.	H	Per	10	3	-	4
Frankeniaceae	*Frankenia arabica* L.	Th	Per	5	4	-	-
	*Erodium laciniatum (*Cav.) Wild.	Th	Ann	10	4	10	-
Geraniaceae	*Erodium glaucophyllum* L. Her.	H	Per	10	6	10	7
	Erodium bryomifolium L.	Th	Ann	10	5	10	5
	*Monsonia nivea (*Decne.)Webb	H	Per	10	5	10	6
	Aeluropus lagopoides (L.)Trin ex Thwaites	H	Per	10	3	-	-
	Avena fatua L.	Th	Ann	10	2	-	-
	Avena barbata Pott ex Link	Th	Ann	30	2	-	-
	Cutandia dichotoma (Forssk.) Batt ex Trab.	Th	Ann	10	9	-	-
	Cutandia memphetica (Sperng.).Benth.	Th	Ann	20	8	-	-
	Cynodon dactylon (L.) Pers	Cr	Per	10	5	-	-
	*Echinochloa colona (*L.) Link	Th	Ann	10	5	-	-
	*Denibera retroflexa (*Vahl) Panz..	Th	Ann	10	7	-	-
	*Phragmites australis (*Cav.).Trin. Steud.	Cr	Per	10	5	-	-
	Schismus barbatus (L..) Thell.	Th	Ann	10	9	-	-
Poaceae	*Leptochloa fusca* (L.) Kunth.	Cr	Per	20	5	-	-
	Lolium perenne L.	H	Per	20	3	-	6
	Lolium multiflorum lam.	Th	Ann	20	3	-	5
	Phalaris minor Retz.	Th	Ann	10	6	-	-
	*Setaria verticillata (*L) P. Beauv.	Th	Ann	20	3	-	-
	Imperata cylindrica L.	Cr	Per	20	9	10	-
	Stipagrostis ciliate (Desf.).De Winter	Cr	Per	10	8	-	-
	Hordeum vulgare L.	Th	Ann	30	9	-	-
	Hordeum marianum L.	Th	Ann	10	8	-	-
	Setaria viridis (L.) Beauv.	Th	Ann	10	7	-	-
	*Aegilops bicornis (*Forssk.) Jaub ex Spach	Th	Ann	30	5	-	-
	Arundo donax L.	Cr	Per	30	4	-	-
	Bromus scoparius L.	Th	Ann	20	8	-	-

Poaceae	*Elymus farctus* (Viv.) Runem.ex Meld.	G	Per	20	34	-	-
	Sphenopus divaricatus (Gouan) Rchb.	Th	Ann	10	9	-	-
Juncaceae	*Juncus rigidus* Desf.	Cr	Per.	70	45	20	15
	Juncus acutus L.	Cr	per	60	56	30	20
	Salvia lanigera Poir.	H	Per	30	14	10	7
	Ajuga iva (L.) Schreb.	H	Per	10	3	-	-
Lamiaceae	*Salvia spinosa* L.	H	Per	50	3	10	-
	Salvia aegyptiaca L.	Ch	Per	40	4	10	-
	Teucrium oliverianum L.	H	Per	20	2	-	-
	Teucrium polium L.	H	Per	30	5	-	-
	Alhagi graecorum Bioss.	H	Per	80	3	25	-
	Lotus arabicus L.	Th	Ann	60	25	10	-
	Lotus halophilus Bioss.	Th	Ann	20	35	10	-
	Lotus glaber Mill.	H	Per	30	35	10	-
	Astragalus bombycinus Boiss.	Th	Ann	30	45	·	-
	Astragalus boeticus L.	Th	Ann	10	23	-	-
	Astragalus caprinus L.	H	Per	10	23	-	-
	Astragalus spinosus (Forssk.) Muschl.	H	Per	10	23	-	-
	Astragalus peregrinus Vahl.	Th	Ann	10	3	-	5
Fabaceae	*Medicago polymorpha* L.	Th	Ann	20	3	-	2
	Medicago hispida L.	Th	Ann	20	12	-	-
	Medicago laciniata (L.) Mill.	Th	Ann	10	5	-	-
	Medicago sativa L.	H	Per	10	3	-	-
	Medicago littoralis Rohde ex Loisel.	Th	Ann	30	4	-	-
	Trigonella stellata Forssk.	Th	Ann	10	6	-	-
	Trigonella maritima Poir	Th	Ann	10	4	-	-
	Ononis serrata Forssk.	Th	Ann	10	3	-	-
	Retama raetam (Forssk.)Web ex Berthel.	Th	Per	20	7	10	-
	Vicia sativa L.	Th	Ann	20	5	20	-
	Melilotus indicus L.	Th	Ann	20	15	10	12
Scrophulariaceae	*Linaria lenius* L.	Th	Ann	10	4	10	-
Liliaceae	*Asparagus stipularis* Forssk.	Cr	Per	60	2	20	-
	*Urginea undulata (*Desf.) Steinh.	Cr	Per	20	3	20	-
	Malva parviflora L.	Th	Ann	30	15	-	-
Malvaceae	*Malva sylvestris* L.	Th	Ann	20	2	-	-
	Sida alba L.	Th	Bie	10	8	10	-
Neuradaceae	*Neurada procumbens* L.	Th	Ann	10	2	10	3
	Cistanche phelypaea (L) Cout..	Cr	Per	20	5	10	-
Orbanchaceae	*Orobanche arabica* L.	Cr	Per	20	5	10	-
	Orobanche cernua Loeft	Cr	Per	10	3	-	-
	Plantago lanceolata L.	H	Per	30	23	10	5
Plantaginaceae	*Plantago major* L.	H	Per	30	21	-	-
	Plantago notata Lag.	Th	Ann	20	25	20	33
	Plantago squarrosa Murray	Th	Ann	10	15	10	8
	Plantago ovata Forssk..	Th	Ann	10	11	-	-
	Emex spinosa (L.) Campd.	Th	Ann	30	20	10	-
	Polygonum aviculare L.	Th	Ann	20	6	10	-
	Polygonum macrocarpa L.	Th	Ann	10	8	10	-
Polygonaceae	*Rumex vesicarius* L.	Th	Ann	20	7	-	-
	Rumex dentatus L.	Th	Ann	40	6	-	-
	Polygonum equisetiforme Sm.	Cr	Per	20	9	-	-
	Rumex pictus Forssk.	Th	Ann	30	3	10	-
	Calligonum polygonoides L.	Ph	Per	30	3	20	-
	Prolongoa macrocarpa L.	Ph	Per	10	6	10	-
Portulacaceae	*Portulaca oleracea* L.	Th	Ann	20	77	-	-
Solanaceae	*Solanum nigrum* L.	Th	Ann	20	5	-	-
	Lycium schweinfurthii Dammer	Ph	Per	50	2	10	-
	Hyoscyamus muticus L.	Ch	Per	20	3	10	5
Tamaricaceae	*Tamarix nilotica (*Ehrenb.) Bunge	Ph	Per	30	5	20	-
	Tamarix aphylla (L.) H.Karst.	Ph	per	20	4	-	-
Thymeleaceae	*Thymeleae hirsuta* (L.) Endl.	Ph	Per	40	3	20	4
	Daucus syrticus Murb.	Th	Ann	30	21	-	-
Apiaceae	*Ammi visnaga* (L.) lam.	Th	Ann	30	12	-	-
	Daucus capillinus L.	Th	Ann	20	3	-	-
	*Deverra tortuosa (*Desf.) DC.	Ch	Per	10	2	-	-
	Anethum graveolens L.	Th	Ann	20	4	-	-
Urticaceae	*Uritca urens* L.	Th	Ann	30	6	10	-
	Zygophyllum album L.f.	Ch	Per	40	5	10	7
Zygophyllaceae	*Zygophyllum coccineum* L.	Ch	Per	20	7	10	2
	Peganum harmala L.	Ch	Per	20	4	20	2
	Tribulus terrestris L.	Th	Ann	30	5	20	2
Total	**190 species**	**190**	**190**	**190**	**190**	**104**	**82**

Life forms: Th=Therophytes, Ch=Chamaephytes, Ph=Phanerophytes, H= Hemicryptophytes, Cr= Cryptophytes, Life span: Ann= Annual, Per =Perennial and Bie = Biennial.

Therophytes were the dominated life form in both protected and non-protected sites, with values of 55.78% and 53.84 %, respectively, followed by hemicryptophytes 16.84 % and 12.5%, while cryptophytes were higher in protected site than the phanerophytes and chamaephytes by 12.1%, while in non-protected site the chamaephytes were the dominant type (15.4%) as shown in table (3) and figure (2).

Table (3): Life forms spectrum in the protected and non- protected sites

Site / Life form	Protected site		Non- protected site	
	Number of species	Percentage %	Number of species	Percentage %
Therophytes	106	55.78	56	53.84
Hemicryptophytes	32	16.84	13	12.5
Cryptophytes	23	12.1	13	12.5
Chamaephytes	16	8.4	16	15.4
Phanerophytes	12	6.3	6	5.8
Geophytes	1	0.53	0	0

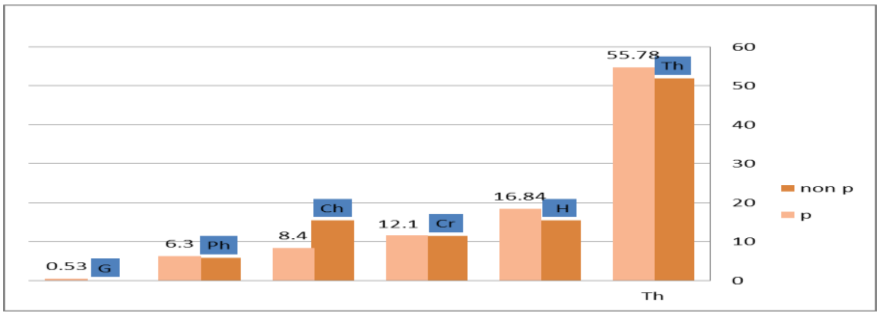

Figure (2): Relationship between life forms percentages in protected and non-protected sites.

It was observed that the highest mean seed density /100gm of soil was recorded in the protected site (264 seed/100gm of soil) in stand number 5, while the lowest mean seed density/ 100gm of soil was recorded in non-protected site with value of 76 seeds/100gm of soil (Table4).

Table (4): The mean value of seed density/100g.soil in protected and non- protected sites

Stand No.	Mean seed density /100g. soil in protected site	Mean seed density /100g. soil in non- protected site
1	150	78
2	172	84
3	215	89
4	234	91
5	264	94
6	162	87
7	153	76
8	151	86
9	167	98
10	176	97

The similarity between soil seed bank and active vegetation showed that the highest similarity index was recorded in the protected site (100 %) and the lowest similarity was recorded in the non-protected site (75.26%). All the above ground vegetation were represented by seeds in the soil (Table 1**)** The relationship between soil seed banks and edaphic characteristics as in Tables (5 &6), show that the soil seed banks increased with the salinity increasing, while organic carbon , calcium carbonate and hydrogen ion concentration(pH) showed positive correlation with soil seed banks in both sites. The soil texture classes affect soil seed banks, where sandy soil keeps and preserve seeds more than clay and salty soils.

The relationships between the soil seed banks and organic carbon percentage were positive, where the high percentages of organic matter in soil attained high stores of seeds in both of protected and non-protected sites.

Table (5): The mean seed density/100gm of soil and soil characteristics in protected site.

Stand No.	Seed density /100g. soil	O.C. %	E.C. %	CaCo3 %	pH	Sand %	Silt %	Clay %	Soil texture class
1	150	0.5	9.5	19.6	10.2	46	40	14	loamy
2	172	0.4	9.4	19.9	10.3	51	39	10	sandy
3	215	1.2	9.1	20.3	10.5	60	34	6	sandy
4	234	1.4	8.7	22.1	11.3	55	28	17	sandy
5	264	2.1	8.2	23.4	11.7	55	37	8	sandy
6	162	1.9	7.1	23.5	9.5	55	38	7	sandy
7	153	1.7	6.8	22.7	10.8	41	41	18	loamy
8	151	2.3	6.5	21.6	11.0	35	45	20	silt
9	167	2.5	5.7	22.4	10.6	43	42	15	loamy
10	176	2.7	5.4	22.3	10.5	46	41	13	sandy

Table (6): The mean seed density/100gm of soil and soil characteristics in non-protected site.

Stand No.	Seed density /100g. soil	O.C. %	E.C.%	CaCo3	pH	Sand %	Silt %	Clay %	Soil texture class
1	78	0.5	9.5	19.6	10.2	46	40	14	loamy
2	84	0.4	9.4	19.9	10.3	51	39	10	sandy
3	89	1.2	9.1	20.3	10.5	60	34	6	sandy
4	91	1.4	8.7	22.1	11.3	55	28	17	sandy
5	94	2.1	8.2	23.4	11.7	55	37	8	sandy
6	87	1.9	7.1	23.5	9.5	55	38	7	sandy
7	76	1.7	6.8	22.7	10.8	41	41	18	loamy
8	86	2.3	6.5	21.6	11.0	35	45	20	silt
9	98	2.5	5.7	22.4	10.6	43	42	15	loamy
10	97	2.7	5.4	22.3	10.5	46	41	13	sandy

DISCCUSION

The high number of plant species (190 species), as well as seed density /100gm of soil was detected in the protected site which may be due to that most of the recorded species in the non-protected site are perennials which producing low number with large sized and short aged seeds. This agrees more or less with the finding of Chang *et al.*, (2001) reported that the increased vegetation in an area may lead to increase soil seed bank, while the annuals usually produce and store large soil seed banks more than the perennials.

On the other hand, the relatively high number of species recorded in soil seed banks in the protected site transect (190 species) may be attributed to the protection of the above ground vegetation from grazing and cutting, as well as the majority of vegetation types are annuals which produce a huge seed number with long age.

In general, the amount of seeds present in the soil is determined by the amount of seeds produced by plants, where the annuals and biennials produce great number of seeds than the perennials, and so the seed density in the protected site was higher than in the non-protected site.

On the other hand, the amount of seeds in soil could be used as a marker for the presence or absence of the above ground vegetation giving a clear picture about the vegetation in the present and past vegetation. This agrees with the finding of Brown (1998) stated that soil seed banks can be used as a tool for identification of vegetation grows under certain environmental variables.

Also, soil seed bank could be used as a way for restoration, conservation of rare and threatened plant species in the disturbed areas; this agrees with Zaghloul (2008) found that soil seed bank could be used as a good tools in the conservation and restoration programs in arid and semi-arid regions, while soils are a huge reservoir for seeds and a new source of species. Major and Payott (1966) reported that soil seed bank is a part of vegetation. The study of the impact of soil seed bank on the conservation and restoration of vegetation by Nasr (2012) stated that the density and composition of soil seed bank can give a clear image about the past and present vegetation. Seed bank could detect the future image of the vegetation structure of the studied areas, where Wisheu and Keddy (1991) stated that soil seed banks storage can play a role in the preservation of the rare species and in selection of some species**.**

Mubarak (2008) studied the impact of protection on soil seed banks in arid land at Saudi Arabia, and he reported that the vegetation protection increases soil seed bank density and diversity.

The life forms spectrum was dominated by therophytes and represented by 106 species, (55.78%) of the total recorded species, hemicryptophytes 32 species, (16.84%), cryptophytes 23 species, (12.1%), chamaephytes 16 species, (8.4%) and phanerophytes 12 species, (6.3%), which may lead to increase the soil seed banks and assured that the coastal land of Libya is mainly related to the Mediterranean flora.

The high concentrations of soil organic carbon, calcium carbonate, as well as high pH lead to high store of seeds in soil, and also the sandy soil accumulates and stores high seeds than the loamy soil. In the present study, the results of soil analysis showed that the relationship between soil seed bank and organic carbon content was positive in both protected and non-protected sites.

Also, there were positive correlations between seed density and soil characteristics e.g. pH, EC, OC, $CaCO_3$ % and soil texture, where the sandy soil accumulates and stores seed bank more than the loamy soil in both studied sites. Seed frequently persist in soil as a memory of former vegetation (Bekker *et al*, 2000), as they often more tolerant to adverse conditions than their adult counterparts, and once buried in soil they may escape from agents of disturbance, disease and predation.

The similarity index between the above ground vegetation and soil seed bank along gradients of soil organic carbon content in different locations of a transect at the protected site, indicates that an increase in species composition and diversity in both active vegetation and soil seed bank with the increased organic carbon contents. This finding agrees with Wisheu and Keddy (1991) found a decrease in species richness with the decrease of organic carbon content in the soil.

Keddy (1985) found that species richness of the protected site vegetation reach maximum at high organic carbon content in the soil. El-Sayed (1996) reported that the soil seed bank is affected greatly by the soil salinity which restricts germination of some species persist in the soil where soil seed bank generally increase with the increase in soil salinity.

On the other hand, soil pH can also play a good role in the development and structure of some habitats. Also, the vegetation can be established by using donor seed banks through using a donor soil from a nearby sites with the appropriate vegetation, this may help establishment of the vegetation in non-vegetated sites, either in wetland or terrestrial habitats (Bekker *et al.*, 2000).

The degree of similarity between the above ground vegetation and soil seed bank may be increased due to the high relative abundance of annuals in the vegetation types which produce large numbers, small sized and long lived seeds, also the protection of the above ground vegetation from the disturbance (Chambers, 1993), While the low similarity index is related to the disturbance in the vegetation may be due to grazing or cutting processes and also most of the recorded species are perennials which produce small number of short lived seeds (Bakker *et al*., 1996).

In general, the soil seed bank in coastal habitats at Surt region (Libya) can reflect the picture of the current vegetation and give a historical background about the past vegetation, and it can be also play an important role in the conservation and restoration of the natural vegetation in the coastal habitats, especially after the disturbance by cutting, burning, overgrazing, drought, this agrees more or less with the finding of Van der Valk (1981).

The content of soil seed bank is a function of the composition of the seed production of the present, past vegetation and the longevity of seeds under local condition, this agrees with the findings of EL-Halawany and Nafea (2003).

The compositions of soil seed bank can be also reflect the standing vegetation both as seedling in the field, as well as mature vegetation. On the other hand, the soil seed bank reveals clues to past vegetation, this agrees with the finding of Leck and Simpson (1987), where the donor seed banks are potentially an economically and ecologically sound way to establish vegetation on mine sites, where the adequate supply of donor exists.

On the other hand, soil seed bank can be reflect the picture of the past and current vegetation in the study area, and it could be used as a vital tool for conservation, restoration and establishment of the vegetation in the study area, as well as it can reflects the role of protection on the soil seed bank and vegetation composition in the coastal habitats of the world.

CONCLUSION

The soils seed bank can be reflect the picture of the present vegetation and give a historical background about the past vegetation in study area. It can be also play an important role in the conservation of rare and threatened plant species, restoration of the natural vegetation after disturbance processes, and it could be taken as a good tool for conservation programs in disturbed areas. According to the protection of vegetation which leads to formation of high storage of soil seed banks than in the non-protected vegetation , So it could be recommended that the protection of the rare and endangered species is urgent for conservation, rehabilitation and restoration of the disturbed areas to keep the natural genetic resources.

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العلاقة بين الكساء النباتي ومخزون التربة من البذور في مناطق محمية وآخري غير محمية في البيئات الساحلية لليبيا

السيد محمد علي نافع
قسم البيئة المائية- كلية الثروة السمكية- جامعة السويس- السويس -مصر

الملخص العربي

لقد صممت هذه الدراسة لتوضيح العلاقة بين الكساء النباتي ومخزون التربة من البذور في مناطق محمية وأخري غير محمية في البيئات الساحلية لليبيا وكذلك معرفة تأثير الحماية علي تركيب الكساء النباتي ووفرته في تلك المناطق .وقد تمت الدراسة عن طريق اختيار قطاعين في منطقة محمية وأخري غير محمية معرضة للرعي وقطع النباتات ، حيث أن طول القطاع حوالي ألف متر طول ومائة متر عرض وقد تم تحديد عشرة مربعات مساحة كل منها ١٠٠ متر مربع لدراسة الكساء النباتي به وكذلك جمع عينات من التربة عند عمق ٥ سم و ١٠سم لمعرفة مخزون التربة من البذور بطريقة النخل وطريقة التعويم وكذلك تحليل خواص التربة الكيميائية والفيزيائية .أوضحت نتائج الدراسة أن هناك ١٩٠ نوعاً نباتياً سجلت في المنطقة المحمية ككساء نباتي حي وكبذور بالتربة منها : ٨٨ نوعا معمراً و ١٠٠ نوعا حولياً ٢ نوعين ثنائي الحول متتبع ١٢٦ جنساً وتنتمي إلي ٣٤ عائلة نباتية ولكن في المناطق غير المحمية تم تسجيل ١٠٤ نوعاً منها ٥٢ نوعاً معمراً و ٥٠ نوعاً حولياً و نوعين ثنائي الحول ، وقد لوحظ في المناطق غير المحمية أن ٨٢ نوعا سجلت كبذور في التربة منهم ١٢ نوعاً لم يسجل ككساء نباتي حي فوق سطح التربة وأيضاً ٢٢ نوعاً مسجل فقط ككساء نباتي حي ولم يسجل كبذور في التربة .أوضحت أيضا نتائج دراسة الطرز الحياتية أن طراز النباتات الحولية (Therophytes)هو الطراز السائد في كلا المنطقتين بنسبة ٥٥.٧٨% و٥٣.٨٤% في المناطق المحمية وغير المحمية علي التوالي ، يليه طراز شبه المختفيات(Hemicryptophytes) بنسبة ١٦.٨٤% و ١٢.٥% لكلا المنطقتين ثم طراز المختفيات (Cryptophytes) في المناطق المحمية ١٢.١% ولكن في المناطق الغير محمية كان طراز النباتات الظاهرية (Chamaephytes)هو السائد ١٥.٤% و يليه طراز النباتات الشجرية (Phanerophytes). أظهرت دراسة معامل التشابه بين مخزون التربة من البذور والكساء النباتي الحي أن نسبة التشابه ١٠٠% في المناطق المحمية و ٧٥% في المناطق غير المحمية كذلك أوضحت هذه الدراسة أن ملوحة التربة كان لها تأثير إيجابي علي حفظ البذور في كلا المنطقتين المحمية وغير المحمية . وقد خلصت هذه الدراسة إلي أن مخزون التربة من البذور يزيد بصورة ملحوظة وكذلك الكساء النباتي الحي في المناطق المحمية عنها في المناطق غير المحمية وكذلك يمكن لمخزون التربة من البذور أن يلعب دوراً هاماً وأساسياً في إعطاء صورة واضحة عن الكساء النباتي الحالي للمنطقة وأيضاً الماضي لتلك المنطقة وأيضاً في عملية صون وتأهيل الكساء النباتي لأى منطقة من المناطق التي تتعرض للدمار والتخريب وبخاصة للأنواع النادرة والمهددة بخطر الإنقراض للحفاظ علي الأصول الوراثية الطبيعية.