

# Floristic diversity and vegetation analysis of Siwa Oasis: An ancient agro-ecosystem in Egypt's Western Desert



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**KEYWORDS** 

Oasis:

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Desert reclamation; Environmental change: Abstract The rapid development and expansion of modern irrigation schemes across arid environments have radically transformed both natural environments and existing agricultural systems over the past century. The consequences for natural and cultural values are often severe, but remain poorly documented for many regions. The present study describes the floristic diversity of an Oasis agro-ecosystem located in Egypt's hyper-arid Western Desert. A total of 132 sites were chosen to represent the flora of Siwa Oasis agro-ecosystem and 154 species were recorded of which 52 were cultivated. Non-cultivated taxa consisted predominately of therophytes whereby the flora of Siwa is represented by monoregional, biregional and pluriregional elements as well as some cosmopolitan species. During field survey, 55 species were recorded for the first time suggesting the recent introduction of new weeds. Based on previous studies, 36 wetland and orchard species may have become locally extinct due to loss of habitat and extensive transformation of the Oasis agro-ecosystem. Although Siwa does not support any endemic species, this study documents a unique and complex agro-ecosystem shaped by natural and human agents over millennia. Descriptive floristic studies such as presented here are important records during a time of continuing and increasing change throughout arid regions of the world.

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## Introduction

\* Corresponding author. Tcl.: + 20 1012890605. E-mail address: Baraa elsaied@yahoo.com (A.-B. El-Saied). The development of modern irrigation schemes across arid regions of the globe has radically transformed both natural environments and existing regions for agricultural production (Worster, 1985; Powell, 2012; Heathcote, 1965). The

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replacement of traditional agro-ecosystems with modern, intensified and productivity-orientated agriculture, which has increased over the past century, has presented significant environmental and social challenges including declining biodiversity, increased greenhouse gas emissions and the loss of both cultural and ecosystem values (Chapin et al., 2000; Tilman et al., 2001; Robinson and Sutherland, 2002; Benton et al., 2003; Altieri and Koohafkan, 2004; Tscharntke et al., 2005).

The Western Desert of Egypt encompasses several extensive depressions overlying the Nubian Sandstone Aquifer System (NSAS) which forms isolated oases within a region of intense aridity. The oases have a long history and have supported human populations, trade routes and agriculture for millennia (Fakhry, 1973, 1974). Prior to the development of modern rock boring equipment, agriculture was entirely dependent on the exploitation of springs and ancient artesian wells (Beadnell, 1909; Stanley, 1912; Fakhry, 1973; Schacht, 2003) but in recent decades, the oases have been extensively modified through the implementation of ambitious desert reclamation schemes (Lamoreaux et al., 1985). Their social and economic isolation has also been radically diminished through improved trade, transport and communication networks as well as attempts to bring them under the centralized administration of the Egyptian state.

Siwa Oasis, the most westerly and remote of Egypt's major inhabited oases, is a microcosm of recent economic, social and environmental changes. New and improved irrigation facilities have conquered vast swathes of desert, but profligate groundwater use has resulted in the expansion of naturally occurring salt lakes as well as the loss of arable land through waterlogging and land salinization (Misak et al., 1997; Masoud and Koike, 2006). Many springs were modified and developed since ancient times and the practice of excavating and lining springs and canals has been shown to obliterate or alter the surrounding wetland habitat (El-Saied, 2012). Recent attempts to enhance spring flows have meant virtually all of Siwa's springs have been controlled and enclosed with concrete. Due to its relative isolation, plant diversity probably remained stable over much of Siwa's history leading to the development of a unique agro-biodiversity (Nabhan, 2007). Following the completion of paved roads in 1986, enhanced connectivity with both other oases and the Nile Delta has resulted in the introduction of new cultivars and, almost certainly, new weeds.

Several studies provide insights into the ecology, and plant distributions of the Western Desert (Zahran, 1972; Abd El-Ghani, 1992; Abd El-Ghani and Fawzy, 2006; El-Saied, 2012); however, despite the significant changes which have occurred in Siwa, there have been few attempts to comprehensively analyze and describe its floristic diversity. This work aimed to provide a complete analysis of the Siwan flora including a breakdown of its different life forms and chorology of the recorded species. In doing so, this paper provides the most up-to-date and comprehensive vegetation study for Siwa, with insights into its ecology within the context of recent transformations to agro-ecosystems in the Western Desert.

#### The study area

#### Geology and geomorphology

Siwa Oasis is the farthest Oasis depression from the Nile Valley to the west and located approximately 300 km south

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of the Mediterranean coast (from 29°10' to 29°16'N Latitude and 25°27' to 25°35'E Longitude) (Fig. 1). The depression is approximately 50 km in length, varying from 2 to 20 km in width and encompasses about 1000 km<sup>2</sup>. Siwa Oasis extends between 0 and 18 m below sea level (Misak et al., 1997) and displays numerous land forms including salt lakes, salt marshes (Sabkhas) as well as cultivated lands and orchards (Madani, 2005; Abd El-Ghani and Fawzy, 2006). The region is hyper-arid receiving 10 mm or less average annual precipitation and evaporation rates are in the vicinity of 3000 mm per annum (Shahin, 2007). The depression is flanked by high Miocene escarpments along the northern face and extensive sand dunes along its southern flank. Siwa is also surrounded by several smaller oases which were inhabited in ancient times but are no longer occupied. The soil of Siwa consists primarily of particles of limestone and sandstone derived from the walls and the floor of the Siwan depression or carried by the winds. It contains small amounts of clay (about 6.9%), larger proportions of sand (59%) and large amounts of soluble matter. The amount of sodium chloride found in Oasis soils ranges from about 0.12% to 59.12% (Zahran, 1972).

#### Hydrogeology and water resources

Siwa is entirely dependent on groundwater derived from the NSAS, an extensive artesian system which consists of a sandstone deposit spanning early Paleozoic to Cretaceous age with depths ranging from 2500 to 3000 m (Aql, 1992). The NSAS in Siwa lies beneath fractured Miocene–Eocene sequences which receive recharge from the NSAS complexes below. Salinity varies within the carbonate rocks and ranges between above 1500 ppm in the upper Miocene layers to as low as 200 ppm in the Eocene–Cretaceous beds (Shata, 1982). Holocene–Pleistocene sediments which make up the depression floor are separated from the artesian system by low permeability aquitards of shale and clay which varies in thickness between 60 m in the west and 250 m in the east (El Hossary, 2013).

# Materials and methods

Survey of Siwa Oasis was conducted between October 2013 and June 2015 to represent the flora of the Oasis agroecosystems during both winter and summer seasons. A total of 132 locations were selected which were distributed across all of the major cultivated zones of the Oasis. A GPS position for each stand was recorded. All plant species existing in each stand were listed after complete identification according to Täckholm (1974) and Boulos (1999–2009). Voucher herbarium specimens were incorporated in the herbarium of the Department of Botany, Faculty of Science, Al-Azhar University. Life form categories were identified after Raunkiaer (1934). Variation in the life form in the field was not considered. Phytogeographical affinity, after the system of Eig (1931), of each species was obtained from Abd El-Ghani (1981,1985).

## Results

A total of 154 species were recorded in Siwa Oasis of which approximately one-third were cultivated (Tables 1 and 2). 55 species were documented for the first time while, based on pre-



Fig. 1 Siwa Oasis showing various landforms and outer uninhabited oases. The inset depicts the major Oasis depressions of the Egyptian Western Desert (Image: Landsat 2013).

vious studies, 76 species were absent. Non-cultivated or wild taxa were represented by 34 families and 90 genera (Table 1). The most common families were Asteraceae (16 species), Poaceae (14 species) and Fabaceae (14 species). The majority of wild species were annuals (58) and only one biennial species was recorded (*Silybum marianum*).

According to the life forms classification of Raunkiaer (1934), seven categories were recorded (Fig. 2). Therophytes were the most abundant life form and constituted half of the recorded non-cultivated species followed by hemicryptophytes which were represented by 19 species. Helophytes were represented by three species (*Najas pectinata, Typha domingensis* and *Ruppia cirrhosa*) and parasitic plants were represented by two species (*Cuscuta campestris* and *Cistanche phelypaea*) (Table 1 and Fig. 2).

Non-cultivated taxa predominately consisted of monoregional (28), bioregional (27) and pluriregional (20) species (Fig. 4) with regional affinities spanning North Africa, the Mediterranean and central Asia. Additional phytogeographical categories included paleotropical (14 species), cosmopolitan (9 species) and pantropical (4 species) taxa (Table 1 and Figs. 3 and 4). Relations between phytogeographical affinities and life forms are summarized in Table 3.

#### Discussion

The flora of Siwa Oasis reflects an ecosystem shaped by intense aridity, saline groundwater conditions and human disturbance. The high proportion of therophytes, and to a lesser extent hemicryptophytes (Fig. 2), demonstrates the opportunistic life strategies required to survive in this extreme environment. This is similarly reflected by the high ratio of often salt tolerant, winter annuals which take advantage of cooler desert conditions, and sometimes limited rainfall, to regenerate. Comparable life form compositions have been recorded in previous studies of Egyptian oases (Abd El-Ghani and Fawzy, 2006; El-Saied, 2012) as well as in the wider Middle East region (Osman et al., 2014).

Spring-fed desert environments can be characterized by high levels of endemism and plant rarity as a result of their isolation and unique hydro-chemical conditions (Shepard, 1993; Harvey et al., 2007; Fensham et al., 2011). In the case of Siwa, however, plant diversity is comparably limited and represented by several broad phytogeographical categories. Ubiquitous taxa in Siwa such as, Imperata cylindrica, Alhagi graecorum, and Tamarix nilotica feature across the other Oasis agroecosystems of the Western Desert which shares a similar climate and history of anthropogenic disturbance. Some such as Cynodon dactylon and Phragmites australis are also widespread in springs in other continents (Fensham and Fairfax, 2003). The ancient caravan routes similarly would have been responsible for the adoption of common cultivars as well as introduction of weeds and plants across the African and Eurasian continents. A classic example of this is Euphrates Popular (Populus euphratica) which is present in the western part of Siwa. Zahran (1972) suggested this plant was introduced during the Greek Period after the conquest of Egypt by Alexander the Great in 332 B.C., though a more likely scenario is that it came from Libya via the ancient caravan route and where there are local populations.

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**Table 1** List of the non-cultivated species recorded in the agro-ecosystem of Siwa Oasis during spring and summer season of 2013–2015. The species were referred to their families, and vegetation type; Annual = Ann, Biennial = Bie, Perennial = Per. according to Boulos (1999–2009), life forms according to (Raunkiaer, 1934); Therophyte = Th, Hemicryptophyte = Hem, Chamaephyte = Cha, Phanerophyte = Ph, Parasite = Par, Geophyte = Geo, Helophyte = Hel. Phyto-geographical affinities according to the system of Eig (1931); COSM = Cosmopolitan, ER-SR = Euro-Siberian, IR-TR = Irano-Turanian, ME = Mediterranean, PAL = Paleotropical, PAN = Pantropical, SA-SI = Saharo-Sindian, S-Z = Sudano-Zambesian. Families are arranged alphabetically; genera and species are in alphabetical order within their respective families.

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Apine notifioram (L) Lag.         Apiaccac         Hem.         PAL         Per.           Torits arvensa (Hods.) Link.         Apiaccac         Th.         ME + IR-TR + ER-SR         Ann.           Consendum acutom L.         Asteraceac         Th.         ME + IR-TR         Per.           Calendud officindis L         Asteraceac         Th.         ME + IR-TR         Ann.           Convac boundnesis (L) Cronquist         Asteraceac         Th.         ME + RS.R         Ann.           Convac boundnesis (L) Cronquist         Asteraceac         Th.         ME         Ann.           Convac boundnesis (L) Cronquist         Asteraceac         Th.         ME         Ann.           Convac boundnesis (L) Cronquist         Asteraceac         Th.         ME         Ann.           Convac boundnesis (L) Hilard & BL Burtt         Asteraceac         Th.         ME + IR-TR + ER-SR         Ann.           Lactera scribba         Asteraceac         Th.         ME + IR-TR + ER-SR         Ann.           Socia s alguess L         Asteraceac         Th.         ME + IR-TR + ER-SR         Ann.           Socia saluess L         Asteraceac         Th.         ME + IR-TR + ER-SR         Ann.           Socia saluess L         Asteracea         Th.         ME	Mesembryanthemum nodiflorum L.	Aizoaceae	Th.	ME + SA-SI + ER-SR	Ann.
Fenda mamminica Asch. & Taub. ex Asch. & Schweinf.     Apiaccae     Hem.     ME     Per.       Contracting and the state of t	Apium nodiflorum (L.) Lag.	Apiaceae	Hem.	PAL	Per.
Torilis orvensis (Huds.) Link.         Apjaccae         Th.         ME + IR-TR         Ann.           Contendum outum L.         Asteraceae         Th.         ME + IR-TR         Per.           Calendud officinatis L.         Asteraceae         Th.         ME + IR-TR         Per.           Convac ounderinga L.         Asteraceae         Th.         ME         Ann.           Convac oundering Conguist         Asteraceae         Th.         ME         Ann.           Convac oundering Delite         Asteraceae         Th.         SA-SI         Ann.           India critering Delite         Asteraceae         Th.         ME + IR-TR + ER-SR         Ann.           India critering Delite         Asteraceae         Th.         ME + IR-TR + ER-SR         Ann.           India critering Delite         Asteraceae         Th.         ME + IR-TR + ER-SR         Ann.           Condering Origita L         Asteraceae         Th.         ME + IR-TR + ER-SR         Ann.           Senecis algenes L         Asteraceae         Th.         ME + IR-TR + ER-SR         Ann.           Senecis algenes L         Asteraceae         Th.         ME + IR-TR         Bie.           Sonchin marinimus L         Asteraceae         Th.         ME + IR-TR         An	Ferula marmarica Asch. & Taub. ex Asch. & Schweinf.	Apiaceae	Hem.	ME	Per.
Cynanchiar L.       Ascipiadacae       Ph.       ME + IR-TR       Per.         Centanda officinato L.       Asteraceae       Ch.       ME + IR-TR       Ann.         Convac admirtarga L.       Asteraceae       Ch.       ME + ER-SR       Ann.         Convac admirtarga L.       Asteraceae       Th.       ME       Ann.         Convac acmedmass (L.) Conquist       Asteraceae       Th.       SA-SI       Ann.         Convac admired L.       Asteraceae       Th.       SA-SI       Ann.         Init orithmolds L.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Lanaca seriola L.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Lanaca multicuits (L.) Hook /       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Senecio glacuits L.       Asteraceae       Th.       ME + IR-TR + SA-SI + IR-TR       Ann.         Senecio glacuits L.       Asteraceae       Th.       ME + IR-TR + SA-SI + IR-TR       Ann.         Sonchan adritions L.       Asteraceae       Th.       ME + IR-TR + SA-SI + Ann.       Ann.         Symmetrianing L.       Asteraceae       Th.       ME + IR-TR + SA-SI + Ann.       Ann.         Sonecha agreguits L.       Sastarceaee	Torilis arvensis (Huds.) Link.	Apiaceae	Th.	ME + IR-TR + ER-SR	Ann.
Calendada officinalis L.       Asteraceae       Th.       ME + IR-TR       Ann.         Convare conductarga L.       Asteraceae       Th.       ME       Ann.         Convare conductors (L.) Cronquist       Asteraceae       Th.       SA-SI       Ann.         Could authemolde L.       Asteraceae       Th.       SA-SI       Ann.         Could authemolde L.       Asteraceae       Cha.       ME       Ann.         Indire crithmolde L.       Asteraceae       Th.       SA-SI       Ann.         Lanceae autocautis (L.) Hock f.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Lanceae autocautis (L.) Hock f.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Senecio algunas L.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Senecio algunas L.       Asteraceae       Th.       ME + IR-TR       Bie.         Sonchae maritimus L.       Asteraceae       Th.       ME + IR-TR       Bie.         Sonchae maritimus L.       Asteraceae       Th.       ME + IR-TR       Bie.         Sonchae maritimus L.       Asteraceae       Th.       ME + IR-TR       Ann.         Colde automodifolim Forsk.       Brassicaceae       Th. <td< td=""><td>Cynanchum acutum L.</td><td>Asclepiadaceae</td><td>Ph.</td><td>ME + IR-TR</td><td>Per.</td></td<>	Cynanchum acutum L.	Asclepiadaceae	Ph.	ME + IR-TR	Per.
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Conva canadensis (L.) Cronquist       Asteraceae       Th.       ME       Ann.         Convla atheraceae       Th.       SA-SI       Ann.         Convla atheraceae       Th.       SA-SI       Ann.         Convla atheraceae       Th.       SA-SI       Ann.         India crithmoide L.       Asteraceae       Th.       ME       IR.         Lanace seriola L.       Asteraceae       Th.       ME       IR.       TR.       Ann.         Lanace and multiculuit (L.)       Hillard & B.L. Burut.       Asteraceae       Th.       ME + IR.TR + ER-SR       Ann.         Senecio valgaris L.       Asteraceae       Th.       ME + IR.TR + ER-SR       Ann.         Senecio valgaris L.       Asteraceae       Th.       ME + IR.TR + SA-SI       Ann.         Senecio valgaris L.       Asteraceae       Th.       ME + IR.TR + SA-SI       Ann.         Senecio valgaris L.       Asteraceae       Th.       ME + IR.TR + SA-SI       Ann.         Senecio valgaris L.       Asteraceae       Th.       ME + RTR + SA-SI       Ann.         Senecio valgaris L.       Asteraceae       Th.       ME + RTR + SA-SI       Ann.         Senecio valgaris L.       Asteraceae       Th.       ME + RTR + SA-SI       <	Conyza bonariensis (L.) Cronquist	Asteraceae	Th.	МЕ	Ann.
Condu anthemoider L.       Asteraceae       Th.       SA-SI       Ann.         Inula crithmoides L.       Asteraceae       Th.       SA-SI       Ann.         Inula crithmoides L.       Asteraceae       Th.       ME       ME       Ann.         Lackca vertiola L.       Asteraceae       Th.       ME       HR-TR       FR.       Ann.         Lancaca mideauli (L.) Hook. J.       Asteraceae       Th.       ME       HS.       R.       Th.       RE       SA-SI       Ann.         Senecio glancus L.       Asteraceae       Th.       ME       HS.       SA.       SA.       Ann.         Senecio vaggrifus L.       Asteraceae       Th.       ME       HR-TR       SA.SI       Ann.         Senecio vaggrifus L.       Asteraceae       Th.       ME       HR.       TR.       SA.SI       Ann.         Silybam mariaman (L.) Gactin.       Asteraceae       Th.       ME       TR.       COSM       Ann.         Sonchus obrecasu L.       Asteraceae       Th.       COSM       Ann.       ME       Man.         Heithorephan vallokum Forsk.       Borapinaceae       Th.       ME       SA.SI       Ann.         Sonowia thebaica Webb.       Brassicaceae	Convza canadensis (L.) Cronquist	Asteraceae	Th.	ME	Ann.
Caula cimera Delile.       Asteraceae       Th.       SA-SI       Ann.         Lacheeu serriola L.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Lachaeu serriola L.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Lannaeu mulciculis (L.) Hook, f.       Asteraceae       Th.       ME + SA-SI + IR-TR       Ann.         Senecio ganceus L.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Senecio ganceus L.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Senecio aggorins L.       Asteraceae       Th.       ME + IR-TR       Bie.         Somchan aggorins L.       Asteraceae       Th.       ME + IR-TR       Bie.         Somchan maritimus L.       Asteraceae       Hem.       ME + IR-TR       Bie.         Somchan oraceareas L.       Asteraceae       Th.       ME + IR-TR       Ann.         Eachermonium Scop.       Brassicaceae       Th.       ME + ER-SR       Ann.         Eacher warding Scop.       Brassicaceae       Th.       ME + SA-SI       Ann.         Stowath theolace Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Stowath theolace Webb.       Brassicaceae       Th.<	Cotula anthemoides L.	Asteraceae	Th.	SA-SI	Ann.
India cristmonides L.         Asteraceae         Cha         ME         IR-TR         Ann.           Lacturea serriofa L.         Asteraceae         Th.         ME + IR-TR + ER-SR         Ann.           Pseudopnohalium lute-allow (L.) Hilliard & B.L. Burt         Asteraceae         Th.         ME + IR-TR + ER-SR         Ann.           Senecio vigencia L.         Asteraceae         Th.         ME + IR-TR + SA-SI         Ann.           Senecio vigencia L.         Asteraceae         Th.         ME + IR-TR + SA-SI         Ann.           Senecio vigencia L.         Asteraceae         Th.         ME + IR-TR + SA-SI         Ann.           Silyhum mariamum (L.) Gaerth.         Asteraceae         Th.         ME + IR-TR         Bic.           Sonchus oleraceu         L.         Asteraceae         Th.         ME + IR-TR         Bic.           Sonchus oleraceu         L.         Asteraceae         Th.         ME + IR-TR         Ann.           Calde maritimas L.         Brassicaceae         Th.         ME + SR-SI         Ann.           Sondwia thebaica Webb.         Brassicaceae         Th.         ME + SA-SI         Ann.           Symbrian iro L         Caryophylacea         Th.         ME + SA-SI         Ann.           Sonowia thebaica Webb. </td <td>Cotula cinerea Delile.</td> <td>Asteraceae</td> <td>Th.</td> <td>SA-SI</td> <td>Ann.</td>	Cotula cinerea Delile.	Asteraceae	Th.	SA-SI	Ann.
Lactures vertified L.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Lannaea mudicaulis (L.) Hook, f.       Asteraceae       Th.       ME + SA-SI + IR-TR       Per.         Peudopandonism huber-dilum (L.) Hilliard & B.L. Burtt.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Senecio guacus L.       Asteraceae       Th.       ME + IR-TR + SA-SI       Ann.         Senecio guacus L.       Asteraceae       Th.       IR-TR + SA-SI       Ann.         Soncham maritimus L.       Asteraceae       Th.       IR-TR + SA-SI       Ann.         Soncham maritimus L.       Asteraceae       Th.       COSM       Ann.         Eductoropian ovalifoliam Forssk.       Boraginaceae       Th.       ME + IR-TR       Per.         Soncham oleraceus L.       Asteraceae       Th.       ME + IR-TR       Ann.         Cakle maritima Scop.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowia thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowia thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Cleame analycoarpa Barrate & Murb.       Caryophylaceae       Th.       SA-SI       Ann.         Cleame	Inula crithmoides L.	Asteraceae	Cha.	ME	Ann.
Lanaca madicaula (L.) Hook f.         Asteraceae         Hem.         IT-TR         Per.           Pseudognochalium hateo-album (L.) Hilliard & B.L. Burt.         Asteraceae         Th.         ME + IR-TR + SA-SI + IR-TR         Ann.           Senecio algancia L.         Asteraceae         Th.         ME + IR-TR + SA-SI + Ann.         Ann.           Senecio agginita L.         Asteraceae         Th.         ME + IR-TR + SA-SI + Ann.         Ann.           Silybur marianum (L.) Gaertin.         Asteraceae         Th.         ME + IR-TR + SA-SI + Rest.         Ann.           Sonchus adrenacea         L.         Asteraceae + Hem.         ME + IR-TR + SA-SI + Rest.         Ann.           Sonchus adrenaceas L.         Asteraceae - Hem.         ME + IR-TR + SA-SI + Ann.         COSM + Ann.           Kelthonic Information Scop.         Brassicaceae - Th.         ME + ER-SR + Ann.         Earthocarpus strangulatus Bois.         Brassicaceae - Th.         ME + IR-TR + Ann.           Schauvia thebatea Webb.         Brassicaceae - Th.         ME + SA-SI + Ann.         Ann.           Schauvia thebatea Webb.         Brassicaceae - Th.         ME + SA-SI + Ann.         Ann.           Polycarpon accelentum (Delile) J. Gay.         Caryophyllaceae - Th. SA-SI + Ann.         Ann.           Polycarpona accelentum (Delile) J. Gay.         Caryophyllaceae - Th. SA-S	Lactuca serriola L.	Asteraceae	Th.	ME + IR-TR + ER-SR	Ann.
Preudograohalum Juteo-album (L.) Hilliard & B.L. Burtt.       Asteraceae       Th.       ME + JR-TR + ER-SR       Ann.         Senecio gancus L.       Asteraceae       Th.       ME + JR-TR + ER-SR       Ann.         Senecio gancus L.       Asteraceae       Th.       ME + JR-TR + SA-SI       Ann.         Senecio gancus L.       Asteraceae       Th.       ME + JR-TR       Bie.         Sonchus maritomus L.       Asteraceae       Hen.       ME + JR-TR       Per.         Sonchus maritomus L.       Asteraceae       Hen.       ME + JR-TR       Per.         Sonchus maritomus C.Gaetta.       Asteraceae       Th.       ME + JR-TR       Ann.         Cokie maritima Scop.       Brassicaceae       Th.       ME + SA-SI       Ann.         Cokie maritima Scop.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowist thebraica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowist thebraica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowist thebraica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowist thebraica Webb.       Caryophylaceae       Th.       SA-SI       Ann.         Schowist thebraica Webb.	Launaea nudicaulis (L.) Hook. f.	Asteraceae	Hem.	IT-TR	Per.
Senecio vulgaris L.       Asteraceae       Th.       ME + IR-TR + ER-SR       Ann.         Senecio agginita L.       Asteraceae       Th.       ME + IR-TR + SA-SI       Ann.         Silybum marianum (L.) Gaetth.       Asteraceae       Th.       ME + IR-TR       Bie.         Sonches marinum (L.)       Gasth.       Asteraceae       Th.       ME + IR-TR       Bie.         Sonchus navitomus L.       Asteraceae       Th.       ME + IR-TR       Bie.         Sonchus oleraceus L.       Asteraceae       Th.       COSM       Ann.         Heliotrophum ovalfolum Forsk.       Boraginaceae       Th.       ME + IR-TR       Ann.         Cakle maritima Scop.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowid thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowid thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Cleome amblyocarpa Barratte & Murb.       Caryophyllaceae       Th.       SA-SI       Ann.         Polycarpa succulatiut (Delile) J. Gay.       Caryophyllaceae       Th.       SA-SI       Ann.         Polycarpa succulatiut (Delile) J. Gay.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.	Pseudognaohalium luteo-album (L.) Hilliard & B.L. Burtt.	Asteraceae	Th.	ME + SA-SI + IR-TR	Ann.
Senecio glancus L.       Asteraceae       Th.       ME + IR-TR + SA-SI       Ann.         Senecio aggprius L.       Asteraceae       Th.       IR-TR + SA-SI       Ann.         Sonchas maritomus L.       Asteraceae       Th.       ME + IR-TR       Bie.         Sonchas maritomus L.       Asteraceae       Hen.       ME + IR-TR       Per.         Sonchas maritomus L.       Asteraceae       Th.       COSM       Ann.         Brassicaceae       Th.       ME + R-TR       Per.       Ann.         Cakle maritima Scop.       Brassicaceae       Th.       ME       Ann.         Cakle maritima Scop.       Brassicaceae       Th.       ME       Ann.         Schowita thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowita thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Cleome amblyocupa Batratte & Murb.       Caryophyllaceae       Th.       SA-SI       Ann.         Polycarpear repen (Forsk).       Schuwit thebaica       Caryophyllaceae       Th.       SA-SI       Ann.         Polycarpear repen (Forsk).       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.         Selaria palida (Dumort) Murb.       Caryophyllaceae	Senecio vulgaris L.	Asteraceae	Th.	ME + IR-TR + ER-SR	Ann
Senecio aegyptius L.       Asteraceae       Th.       IR-TR + SA-SI       Ann.         Stlyhum marianum (L.) Gaertin.       Asteraceae       Th.       ME + IR-TR       Bie.         Sonchus narritims L.       Asteraceae       Hem.       ME + IR-TR       Per.         Sonchus oleraceus L.       Asteraceae       Th.       COSM       Ann.         Cakle maritima Scop.       Brassicaceae       Th.       ME + ER-SR       Ann.         Cakle maritima Scop.       Brassicaceae       Th.       ME + ER-SR       Ann.         Schowia thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schowia thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Cleome amblyocarpa Barratte & Murb.       Caryophyllaceae       Th.       SA-SI       Ann.         Polycarpa sacculentum (Delile) J. Gay.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.         Polycarpa sacculentum (Delile) J. Gay.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.         Polycarpa sacculentum (Delile) J. Gay.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.         Polycarpa sacculentum (Moric.) K Koch.       Chenopodiaeeae       Th.       ME + IR-TR + ER-SR <t< td=""><td>Senecio glaucus L.</td><td>Asteraceae</td><td>Th.</td><td>ME + IR-TR + SA-SI</td><td>Ann.</td></t<>	Senecio glaucus L.	Asteraceae	Th.	ME + IR-TR + SA-SI	Ann.
Silyburn marianum (L.) Gaertin.       Asteraceae       Th.       ME + IR-TR       Bic.         Sonchus mariimus L.       Asteraceae       Hem.       ME + IR-TR       Per.         Sonchus mariimus L.       Asteraceae       Hem.       ME + IR-TR       Per.         Sonchus obraceas L.       Asteraceae       Th.       COSM       Ann.         Heitoropian ovalifolium Forsk.       Boraginaceae       Th.       ME + IR-TR       Par.         Cakle maritima Scop.       Brassicaceae       Th.       ME + ER-SR       Ann.         Enarthrocurpus strangulatus Boiss.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schwait thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schwait thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schwait thebaica Webb.       Capparaceae       Th.       SA-SI       Ann.         Schwait thebaica Webb.       Capparaceae       Th.       SA-SI       Ann.         Steparapia stratte & Murb.       Capparaceae       Th.       SA-SI       Ann.         Polycarpeae repers (Forski As Ash. & Schweinf.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.         Stellaria pallida (Dumort.) Murb.	Senecio aegyptius L.	Asteraceae	Th	IR-TR + SA-SI	Ann
Sonchus maritimus L.       Asteraceae       Hem.       ME + IR-TR       Per.         Sonchus oleraceus L.       Asteraceae       Th.       COSM       Ann.         Elciotropiano valifoliam Forssk.       Boraginacee       Th.       PAL       Ann.         Cakle maritima Scop.       Brassicaceae       Th.       ME + ER-SR       Ann.         Enarthrocarpus strangulatus Boiss.       Brassicaceae       Th.       ME       Ann.         Schouwia thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schouwia thebaica Webb.       Brassicaceae       Th.       ME + IR-TR       Ann.         Cleome amblyocarpa Barratte & Murb.       Capparaceae       Th.       SA-SI       Ann.         Polycarpon succulentum (Delile) J. Gay.       Caryophyllaceae       Th.       SA-SI       Ann.         Polycarpon succulentum (Delile) J. Gay.       Caryophyllaceae       Hem.       PAL       Ann.         Spergularia marina (L.) Griseb.       Caryophyllaceae       Hem.       ME + IR-TR + ER-SR       Ann.         Scelaria puraiidata Medik.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.         Vaccaria puraiidata Medik.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.	Silvbum marianum (L.) Gaertn.	Asteraceae	Th.	ME + IR-TR	Bie
Sonchus oleraceus L.       Asteraceae       Th.       COSM       Ann.         Heliotropium ovalifolium Forsk.       Boraginaceae       Th.       MAL       Ann.         Cakle maritima Scop.       Brassicaceae       Th.       ME + ER-SR       Ann.         Enarthrocarpus strangulatus Boiss.       Brassicaceae       Th.       ME + ER-SR       Ann.         Matthiola livida (Deblic) DC.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schouwia thebatea Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Cleome ambyocarpa Barraite & Murb.       Capyophyllaceae       Th.       SA-SI       Ann.         Polycarpa succulentum (Delile) J. Gay.       Caryophyllaceae       Th.       ME + TR-TR + ER-SR       Ann.         Polycarpa areans (Forsk) Asch. & Schweinf.       Caryophyllaceae       Hem.       PAL       Ann.         Spergularia marina (L.)       Griscb.       Caryophyllaceae       Th.       ME + TR-TR + ER-SR       Ann.         Vaccaria pyramidata Medik.       Caryophyllaceae       Th.       ME + TR-TR + ER-SR       Ann.         Vaccaria pyramidata Medik.       Caryophyllaceae       Th.       ME + SA-SI       Per.         Chenopodiaceae       Th.       Chenopodiaceae       Th.	Sonchus maritimus L.	Asteraceae	Hem.	ME + IR-TR	Per.
Heliotropium ovalifolium Forssk.       Boraginaceae       Th.       PAL       Ann.         Cakie maritima Scop.       Brassicaceae       Th.       ME + ER-SR       Ann.         Mathiola livida (Delike) DC.       Brassicaceae       Th.       ME       Ann.         Schouvia thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Schouvia thebaica Webb.       Brassicaceae       Th.       ME + SA-SI       Ann.         Symbrium iro L.       Brassicaceae       Th.       ME + SA-SI       Ann.         Cleome amblyocarpa Barratte & Murb.       Caryophyllaceae       Th.       SA-SI       Ann.         Polycarpon succulentum (Delile) J. Gay.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.         Polycarpo are repens (Forssk.) Asch. & Schweinf.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.         Stellaria pallida (Dumort.) Murb.       Caryophyllaceae       Th.       ME + IR-TR + ER-SR       Ann.         Arthrooremum macrostackyloym (Moric.) K. Koch.       Chenopodiaceae       Th.       ME + IR-TR       Per.         Chenopodiaceae       Th.       CossM       Ann.       Corrido and macanth L.       Chenopodiaceae       Th.       CossM       Ann.         Convolvula	Sonchus oleraceus L.	Asteraceae	Th.	COSM	Ann.
Cakile maritima Scop.BrassicaceaeTh.ME + ER-SRAnn.Enarthrocarpus strangulatus Boiss.BrassicaceaeTh.MEAnn.Mathiola livida (Delile) DC.BrassicaceaeTh.MEAnn.Schouwia thebaica Webb.BrassicaceaeTh.ME + SA-SIAnn.Stynbrium irio L.BrassicaceaeTh.ME + SA-SIAnn.Cleone anblycoarpa Barratte & Murb.CapparaceaeTh.SA-SIAnn.Herniaria hirsuta L.CaryophyllaceaeTh.SA-SIAnn.Polycarpae repens (Porsk) Asch. & Schweinf.CaryophyllaceaeHen.PALAnn.Spergularia marina (L) Griseb.CaryophyllaceaeHen.ME + IR-TR + ER-SRAnn.Stellaria pallida (Dumort.) Murb.CaryophyllaceaeTh.ME + IR-TR + ER-SRAnn.Arthronennum macrostachyum (Moric.) K. Koch.ChenopodiaceaeCha.ME + SA-SIPer.Chenopodiam album L.ChenopodiaceaeTh.COSMAnn.Convolvuluscae Erist M.ChenopodiaceaeTh.COSMAnn.Convolvuluscae Erist A.ConvolvuluscaeeConvolvuluscaePer.Coresa creite LConvolvuluscae Geo.PALPer.ConvolvuluscaePer.Coresa creite LPer.ConvolvuluscaeGeo.PALPer.ConvolvuluscaePer.Coresa creite LPer.ConvolvuluscaeGeo.PALPer.ConvolvuluscaePer.Coresa creite LPer.ConvolvuluscaeGeo.PAL <td>Heliotropium ovalifolium Forssk</td> <td>Boraginaceae</td> <td>Th</td> <td>PAL</td> <td>Ann</td>	Heliotropium ovalifolium Forssk	Boraginaceae	Th	PAL	Ann
Enarthrocempus strangulatus Boits.       Brassicaccae       Th.       ME       Ann.         Mathiola livida (Delile) DC.       Brassicaccae       Th.       ME       Ann.         Schouwia thebaica Webb.       Brassicaccae       Th.       ME + SA-SI       Ann.         Schouwia thebaica Webb.       Brassicaccae       Th.       ME + SA-SI       Ann.         Schouwia thebaica Webb.       Brassicaccae       Th.       ME + SA-SI       Ann.         Cleome amblyocarpa Batratte & Murb.       Capparaccae       Th.       SA-SI       Ann.         Polycarpon succulentum (Delile) J. Gay.       Caryophyllaccae       Th.       SA-SI       Ann.         Polycarpon succulentum (Delile) J. Gay.       Caryophyllaccae       Hem.       ME + IR-TR + ER-SR       Ann.         Stellaria pailida (Dumort.) Murb.       Caryophyllaccae       Th.       ME + ER-SR       Ann.         Stellaria pailida (Dumort.) Murb.       Caryophyllaccae       Th.       ME + ER-SR       Ann.         Chenopodiacea macrostachyum (Moric.) K. Koch.       Chenopodiaccae       Th.       ME + SA-SI       Per.         Cornulaca monacantha Delile       Chenopodiaccae       Th.       ME + SA-SI       Ann.         Convolvulaccae       Geo.       PA1.       Per.       Convolvul	Cakile maritima Scop	Brassicaceae	Th	ME + ER-SR	Ann
Mathiola finida (Delile) DC.BrassicaceaeTh.MEAnn.Schouwia thebaica Webb.BrassicaceaeTh.ME + SA-SIAnn.Schouwia thebaica Webb.BrassicaceaeTh.ME + SA-SIAnn.Cleome amblyocarpa Barratte & Murb.CapparaceaeTh.ME + SA-SIAnn.Cleome amblyocarpa Barratte & Murb.CaryophyllaceaeTh.SA-SIAnn.Herniaria thirsuta L.CaryophyllaceaeTh.SA-SIAnn.Polycarpon accudentum (Delile) J. Gay.CaryophyllaceaeHem.PALAnn.Spergularia marina (L.) Griscb.CaryophyllaceaeHem.ME + IR-TR + ER-SRAnn.Stellaria pallida (Dumort.) Murb.CaryophyllaceaeTh.ME + IR-TR + ER-SRAnn.Vaccaria pyramidata Medik.CaryophyllaceaeTh.ME + SA-SIPer.Chenopodium murale L.ChenopodiaceaeTh.COSMAnn.Chenopodium murale L.ChenopodiaceaeTh.RE + TR-TR + ER-SRAnn.Convolutaca monacantha DelileChenopodiaceaeTh.RT + RPer.Convolvulacea monacantha DelileChenopodiaceaeTh.RT + RPer.Sueada aegyptiaca (Hasselq.) Zohary.ChenopodiaceaeTh.RT + RPer.Convolvulacea aronsts L.ConvolvulaceaeGoo.PALPer.Cressa creita L.ConvolvulaceaeGoo.PALPer.Cyperas totundu L.CyperaceaeGeo.COSMPer.Cyperas totundus L.CyperaceaeGeo.<	Enarthrocarnus strangulatus Boiss	Brassicaceae	Th	ME	Ann
Schowin inkolica Webb.BrassicacceeTh.ME + SA-SIAnn.Skymbrium trio L.BrassicacceeTh.ME + SA-SIAnn.Cleome amblyocurpa Barratte & Murb.CapparaceaeTh.SA-SIAnn.Cleome amblyocurpa Barratte & Murb.CaryophyllaccaeTh.ER-SRAnn.Polycarpon succulentum (Delile) J. Gay.CaryophyllaccaeTh.SA-SIAnn.Polycarpaea repens (Forssk.) Asch. & Schweinf.CaryophyllaceaeHem.PALAnn.Spergularia marina (L.) Griscb.CaryophyllaceaeHem.ME + IR-TR + ER-SRAnn.Stellaria pallida (Dumort.) Murb.CaryophyllaceaeTh.ME + SA-SIPer.Chenopodiane macrostachyan (Moric.) K. Koch.ChenopodiaceaeTh.ME + SA-SIPer.Chenopodiaum nurale L.ChenopodiaceaeTh.COSMAnn.Cornulaca maccantha DelileChenopodiaceaeTh.R-TRPer.Convolvulacea repens (Hasselq.) Zohary.ChenopodiaceaeTh.R-TRPer.Convolvulacea strensis L.ConvolvulaceaeHem.SA-SI + S-ZAnn.Suada aegyptiaca (Hasselq.) Zohary.ChenopodiaceaeHem.SA-SI + S-ZAnn.Suada aegyptiaca (Lam.) S.G. Smith.Cyperacea	Matthiola livida (Delile) DC	Brassicaceae	Th	ME	Ann
Stymbrium irio L.BrassicaceaeTh.ME + IR-TRAnn.Cleome amblyocarpa Bartatte & Murb.CapparaceaeTh.SA-SIAnn.Herniaria hirsuta L.CaryophyllaceaeTh.SA-SIAnn.Polycarpaea repens (Forssk.) Asch. & Schweinf.CaryophyllaceaeHem.PALAnn.Polycarpaea repens (Forssk.) Asch. & Schweinf.CaryophyllaceaeHem.PALAnn.Spergularia marina (L.) Griscb.CaryophyllaceaeHem.ME + IR-TR + ER-SRAnn.Vaccaria pyramidata Medik.CaryophyllaceaeTh.ME + ER-SRAnn.Vaccaria pyramidata Medik.CaryophyllaceaeTh.ME + ER-SRAnn.Vaccaria pyramidata Medik.CaryophyllaceaeTh.ME + ER-SRAnn.ChenopodiaceaeChenopodiaceaeTh.COSMAnn.Chenopodiam album L.ChenopodiaceaeTh.RC + SA-SIPer.Conudaca monacantha DelileChenopodiaceaeCha.IR + TRPer.Kochia indica Wight.ChenopodiaceaeCha.IR + SA-SIPer.Convolvulacea monacantha DelileConvolvulaceaeHem.SA-SI + S-ZAnn.Convolvulacea indica Wight.ConvolvulaceaeGeo.PALPer.Cusuta campestris Vunck.ConvolvulaceaeGeo.PALPer.CyperaceaeGeo.COSMPer.CyperaceaeGeo.COSMCyperus laevigatus L.CyperaceaeGeo.COSMPer.Cyperus laevigatus L.CyperaceaeGeo.<	Schouwig thebaicg Webb	Brassicaceae	Th	ME + SA-SI	Ann
Cleame amblyocarpa Barratte & Murb.Capparaceae CaryophyllaceaeTh.SA-SIAnn.Herniaria hirsuta L.CaryophyllaceaeTh.SA-SIAnn.Polycarpae repens (Forssk.) Asch. & Schweinf.CaryophyllaceaeHem.PALAnn.Spergularia marina (L.) Griseb.CaryophyllaceaeHem.ME + IR-TR + ER-SRAnn.Stellaria pallida (Dumort.) Murb.CaryophyllaceaeHem.ME + IR-TR + ER-SRAnn.Vaccaria pyramidata Medik.CaryophyllaceaeTh.ME + IR-TR + ER-SRAnn.Arihrocnemum macrostachyum (Moric.) K. Koch.ChenopodiaceaeCha.ME + SA-SIPer.Chenopodiam murale L.ChenopodiaceaeTh.COSMAnn.Conudaca monacantha DelileChenopodiaceaeTh.IR-TRPer.Convolvulacea monacantha DelileChenopodiaceaeTh.IR-TRPer.Convolvulacea reprise (Hasselq.) Zohary.ChenopodiaceaeTh.IR-TRAnn.Suaeda aegyptiaca (Hasselq.) Zohary.ChenopodiaceaeGo.PALPer.Cressa cretica L.ConvolvulaceaeGeo.PALPer.Cuscuta campestris Yunck.ConvolvulaceaeGeo.PANAnn.Boloschoemis glaucus (Lam.) S.G. Smith.CyperaceaeGeo.PANPer.CyperascaeGeo.PANPer.CyperaceaeGeo.PANPer.CyperascaeGeo.PANPer.Per.Per.Per.Per.Per.Cuscuta campestris Yunck.Copreaceae	Sisymbrium irio 1.	Brassicaceae	Th	ME + IR-TR	Ann
Herniaria Airsuta L.CaryophyllaccaeTh.ER-SRAnn.Polycarpon succulentum (Delile) J. Gay.CaryophyllaccaeTh.SA-SIAnn.Polycarpon succulentum (Delile) J. Gay.CaryophyllaccaeTh.SA-SIAnn.Polycarpaea repens (Forssk.) Asch. & Schweinf.CaryophyllaccaeHem.PALAnn.Spergularia marina (L.) Griscb.CaryophyllaccaeHem.ME + IR-TR + ER-SRAnn.Stellaria pallida (Dumort.) Murb.CaryophyllaccaeTh.ME + IR-TR + ER-SRAnn.Vaccaria pyramidata Medik.CaryophyllaccaeTh.ME + SA-SIPer.Chenopodium murale L.ChenopodiaccaeTh.COSMAnn.Chenopodium aluma L.ChenopodiaccaeTh.COSMAnn.Conulaca monacantha DelileChenopodiaccaeTh.RTRPer.Social a agyptiaca (Hasselq.) Zohary.ChenopodiaceaeTh.RTRAnn.Suaeda agyptiaca (Hasselq.) Zohary.ChenopodiaceaeTh.RTRPer.Cressa cretica L.ConvolvulaccaeGeo.PALPer.Cuscuta campestris Yunck.ConvolvulaccaeGeo.COSMPer.Diboschoenus glaucus (Lam.) S.G. Smith.CyperaccaeGeo.COSMPer.Cyperus laevigatus L.CyperaccaeGeo.PANPer.Cyperas cardidana Savi.FabaccaePh.SA-SIPer.Acacia nilotica (L.) Delile.FabaccaePh.SA-SIPer.Acacia nilotica (L.) Delile.FabaccaePh	Cleame amblyocarna Barratte & Murb	Capparaceae	Th	SA-SI	Ann
Arring in sum is in an interview of the int	Herniaria hirsuta I	Carvonhyllaceae	Th	FR-SR	Ann
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Astragalus corrugatus Bertol.     Fabaceae     Fn.     ME     Per.       Astragalus corrugatus Bertol.     Fabaceae     Th.     IR-TR     Ann.       Hippocrepis multisiliquosa L.     Fabaceae     Th.     IR-TR + SA-SI     Ann.	Chaushing alabar I	Fabaceae	Dh		Fer.
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	rupporepis mutustiquosu L.	1 avacede	11.	IIX-I X T 5/4-51	Ann.

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Species	Family	Life form	Floristic categories	Vegetation type
Lotus glaber Mill.	Fabaceae	Hem.	ME + IR-TR + ER-SR	Per.
Melilotus indicus (L.) All.	Fabaceae	Th.	PAL	Ann.
Prosopis farcta (Banks & Sol.) Macbr.	Fabaceae	Cha.	IR-TR + SA-SI	Per.
Scorpiurus muricatus L.	Fabaceae	Th.	ME	Ann.
Vicia sativa L.	Fabaceae	Th.	ME	Ann.
Frankenia hirsuta L.	Frankeniaceae	Cha.	ME + IR-TR	Per.
Monsonia nivea (Decne.) Webb.	Geraniaceae	Th.	SA-SI	Per.
Juncus rigidus Desf.	Juncaceae	Hem.	ME + IR-TR + SA-SI	Per.
Mentha longifolia (L.) Huds.	Lamiaceae	Hem.	ME + IR-TR + ER-SR	Per.
Ziziphora sp.	Lamiaceae	Th.	IR-TR	Ann.
Emex spinosa (L.) Campd.	Loranthaceae	Th.	ME	Ann.
Polygonum equisetiforme Sm.	Loranthaceae	Hem.	ME + IR-TR	Per.
Rumex vesicarius L.	Loranthaceae	Th.	ME + IR-TR + S-Z	Ann.
Malva parviflora L.	Malvaceae	Th.	ME + IR-TR	Ann.
Najas pectinata (Parl.) Magn.	Najadaceae	Hel.	PAL	Ann.
Cistanche phelypaea (L.) Cout.	Orobanchaceae	Par.	IR-TR + SA-SI	Per.
Portulaca oleracea L.	Portulacaceae	Th.	PAL	Ann.
Anagallis arvensis L.	Primulaceae	Th.	ME + IR-TR + ER-SR	Ann.
Samolus valerandi L.	Primulaceae	Hem.	PAL	Per.
Avena fatua L.	Poaceae	Th.	COSM	Ann.
Bromus diandrus Roth.	Poaceae	Th.	ME + IR-TR + S-Z	Ann.
Cynodon dactylon (L.) Pers.	Poaceae	Geo.	PAN	Per.
Echinochloa crusgalli (L.) P. Beauv.	Poaceae	Th.	ME + IR-TR	Ann.
Dactyloctenium aegyptium (L.) Willd.	Poaceae	Th.	PAL	Ann.
Imperata cylindrica (L) Raeusch.	Poaceae	Hem.	ME + S-Z	Per.
Lolium perenne L.	Poaceae	Hem.	ME + IR-TR + ER-SR	Per.
Phragmites australis (Cav.) Trin. ex Steud.	Poaceae	Geo.	PAL	Per.
Poa annua L.	Poaceae	Th.	ME + IR-TR + ER-SR	Ann.
Polypogon monspeliensis (L.) Desf.	Poaceae	Th.	COSM	Ann.
Setaria verticillata (L.) P. Beauy.	Poaceae	Th.	COSM	Ann.
Setaria viridis (L.) P. Beauv.	Poaceae	Th.	ME + IR-TR + SA-SI	Ann.
Sorehum halepense (L.) Pers.	Poaceae	Cha.	PAL	Per.
Stipagrostis plumosa (L.) Munro ex T. Anderson.	Poaceae	Geo.	IR-TR	Per.
Reseda lutea L	Resedaceae	Th.	ME + IR-TR	Ann.
Haplophyllum tuberculatum (Forssk.) Juss.	Rutaceae	Cha.	IR-TR + SA-SI	Per.
Populus euphratica Oliv.	Salicaceae	Ph.	IR-TR + SA-SI	Per
Bacona monnieri (L.) Pennell	Scrophulariaceae	Hem.	ME	Per.
Solanum nigrum L	Solanaceae	Hem.	ME + IR-TR + ER-SR	Ann
Tamarix nilotica (Ehrenh) Bunge	Tamaricaceae	Ph.	SA-SI + S-Z	Per
Remmuria hirtella Jaub & Spach.	Tamaricaceae	Cha	IR-TR	Per
Typha domingensis (Pers.) Poir, ex Steud.	Typhaceae	Hel.	PAN	Per
Urtica urens L	Urticaceae	Th	ME + ER-SR	Ann
Runnia cirrhosa (Petagna) Grand	Zannichelliaceae	Hel	ME + IR-TR + FR-SR	Per
Farania cretica L	Zygophyllaceae	Cha	SA-SI	Per
Zveanhvllum alhum L f	Zygophyllaceae	Cha.	ME + IR-TR + SA-SI + S-7	Per
Zvpophyllum coccinerum L.	Zygophyllaceae	Cha	SA-SI + S-Z	Per.
Zveophyllum simplex L	Zygophyllaceae	Th.	SA-SI + S-Z	Ann
-1PAL. Jume and the A	-JBopuJudelle	****	Min Ma 1 1 2 2	

While the introduction of new species probably occurred sporadically over millennia, comparison between the present study and the previous floristic and ecological studies on Siwa Oasis reveals significant differences in the numbers of spontaneous and cultivated species (Table 4). This study recorded 55 'new' species out of a combination of 102 spontaneous and 52 cultivated taxa but much fewer numbers, 64 spp., were reported by Abd EL-Ghani (1994), El-Khouly and Khedr (2000), 41 spp. and Hassan (2005), 94 spp. of which 26 are cultivated.

While this disparity might be partially explained by greater search effort conducted in this study, the increase in the recorded number of spontaneous and cultivated species in Siwa Oasis is probably related to trends of agricultural intensification (Fig. 5) and enhanced connectivity with the other oases and Nile Delta over the last three decades. *Prosopis farcta* was recorded in just one study site in Siwa and is an invasive species native to Asia that has moved from India to the Middle East and along the North African coast to Algeria (Pasiecznik et al., 2004). El-Saied (2012) reported the presence of this species in an isolated portion of Farafra Oasis, over 300 km south east of Siwa, but no record of *P. farcta* has been made elsewhere in the present study of Siwa Oasis or in Bahariya and Farafra Oases (El-Saied, 2012). The invasive nature of the species means that it would have been likely to have been recorded in more locations and its limited distribution suggests

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 Table 2
 List of the cultivated species recorded from Siwa
 Oasis and their families.

Species	Family
Spinacia oleracea L.	Amaranthaceae
Allium cepa L.	Amaryllidaceae
Allium ampleloprasum var.porrum (L.) J. Gay.	Amaryllidaceae
Helianthus annuus L.	Asteraceae
Lactuca sativa L.	Asteraceae
Petroselinum crispum (Mill.) Fuss.	Apiaceae
Anethum graveolens L.	Apiaceae
Coriandrum sativum L.	Apiaceae
Daucus carota L.	Apiaceae
Phoenix dactylifera L.	Arecaceae
Brassica rapa L.	Brassicaceae
Eruca sativa Mill.	Brassicaceae
Opuntia ficus-indica (L.) Mill.	Cactaceae
Casuarina equisitifolia L.	Casuarinaceae
Beta vulgaris L.	Chenopodiaceae
Cucumis melo L. var. cantalupensis	Cucurbitaceae
Cucumis sativus L.	Cucurbitaceae
Citrullus langtus (Thunh ) Matsum & Nakai	Cucurbitaceae
Medicago sativa I	Fabaceae
Pierm sativum I	Fabaceae
Phaseoble wilderie I	Fabaceae
Caratonia silima I	Fabaceae
Sashania sashan (1.) Marr	Fabaceae
Ocimum bariliana I	Lamincaco
Demine assessment	Lannaceae
Funica granatum L.	Lythraceae
Lawsonia inermis L.	Lyunaceae
Constant olitorius I	Malvaccae
Corchorus outorius L.	Marvaceae
Picus carica L.	Moraceae
Ficus sycomorus L.	Moraceae
Morus alba L.	Moraceae
Moringa oleifera Lam.	Moringaceae
Musa acuminate Colla.	Musaccae
Psidium guajava L.	Myrtaceae
Eucalyptus camaldulensis Dehn.	Myrtaceae
Olea europaea L.	Olcaceae
Hordeum murinum L.	Poaceae
Saccharum officinarum L.	Poaceae
Sorghum bicolor (L.) Moench.	Poaceae
Triticum vulgare L.	Poaceae
Zea mays L.	Poaceae
Citrus limon (L.) Burm.f.	Rutaceae
Citrus sinensis (L.) Osbeck.	Rutaceae
Citrus tangerina Tanaka.	Rutaceae
Malus domestica Borkh.	Rosaceae
Pyrus communis L.	Rosaceae
Ziziphus spina-christi (L.) Desf.	Rhamnaceae
Capsicum frutescens L.	Solanaceae
Solanum lycopersicum L.	Solanaceae
Lantana camara L.	Verbenaceae
Vitis vinifera L.	Vitaceae
Aloe vera (L.) Burm.f.	Xanthorrhoeaceae

that it is a recent introduction to the Western Desert. It is plausible that seeds or even rhizomes of *P. farcta* were introduced with seeds of different crops to these isolated parts of Siwa and Farafra Oases and isolation has prevented its further spread:

The absence of 76 species can be explained by both differences in site selection and the likelihood that numerous species have gone locally extinct in Siwa. Several species are thought

Table 3	Number of	species be	elonging t	o the mai	n floristic
categories	and their	percenta	ges (%).	Phytogeo	ographical
affinities	according	to the	system	of Eig	(1931);
COSM =	Cosmopolit	an, ER-SI	₹ = Euro-	Siberian,	IR-TR =
Irano-Tur	anian, ME	= Mediter	ranean, PA	AL = Pale	otropical,
PAN = Pan	antropical,	SA-SI	= Saharo-	Sindian,	S-Z =
Sudano-Za	ambesian. 👘				12 建星

Phytochoria	Number of species	Percentage (%)
PAL	14	13.7
COSM	9	8.8
PAN	4	3.9
Monoregional		
ME	11	10.7
SA-SI	7	6.8
IR-TR	7	6.8
ER-SR	2	1.9
S-Z		0.9
Total	28	27.4
Biregionals		
ME + IR-TR	10	9.8
IR-TR + SA-SI	6	5.8
ME + ER-SR	4	3.9
ME + SA-SI	2	1.9
SA-SI + S-Z	4	3.9
ME + S-Z		0.9
Total	27	26.4
Pleuriregionals		
ME + SA-SI + ER-SR	1	0.9
ME + IR-TR + ER-SR	12	11.7
ME + SA-SI + IR-TR	4	3.9
ME + IR-TR + SA-SI + S- Z		0.9
ME + IR-TR + S-Z	2	1.9
Total	20	19.6

to have already become extinct across the Western Desert Oases including Ranunculus rionii and a water lily (Nymphaea caerulea) while species recorded in Siwa such as Gossypium arboreum, have been referred to as 'endangered' (Abd El-Ghani and Fawzy, 2006). Abd El-Ghani (1994), focused on the weed plant communities of Siwan orchards associated with local springs, similar to this study; however, due to the ongoing enclosure of springs it is likely that 36 unique species, including Gossypium arboreum, are now locally extinct. Four wetland species documented by El-Khouly and Khedr (2000) including Aetheorhiza bulbosa, Silene gallica, Ceratophyllum demersum and Scirpus litoralis are likely to have suffered a similar fate as a result of wetland modification. Hassan (2005), recorded 35 unique species out of a total of 68 documented taxa; however, these were identified in the deserts around Siwa which were not included in this current survey.

Conservation priorities often focus on areas of perceived 'naturalness', but the dichotomy of natural versus modified unravels in places like Egypt, which has a long history of agriculture. There may be limited priorities for conserving some of Siwa's susceptible flora given their ubiquity in other parts of Egypt and Middle-East and Mediterranean region. There are, however, some exceptions. The isolated stand of Floristic Diversity and Vegetation Analysis of Siwa Oasis





Fig. 3 Floristic categories of plant species in Siwa Oasis: COSM = Cosmopolitan, ER-SR = Euro-Siberian, IR-TR = Irano-Turanian, ME = Mediterranean, PAL = Paleotropical, PAN = Pantropical, SA-SI = Saharo-Sindian, S-Z = Sudano-Zambesian.



Fig. 4 Floristic categories of plant species in Siwa Oasis.

P. euphratica occurs no-where else in Egypt and in a living relic on the ancient caravan routes or potentially the ancient Greek conquest. There are also unique cultivars in Siwa, of both Old and New World Origin, which form part of traditional Siwan agriculture and cuisine. Local varieties of olives, dates, peppers, tangerines, and onions, as a genetic resource, are at risk of being supplanted by exotic cultivars being planted in new agricultural areas and re-claimed lands (Nabhan, 2007).

#### Conclusion

Siwa Oasis is a unique agro-ecosystem that illustrates the combined effects of extreme aridity and extended history of human occupation and agricultural activity. This study identified 52 cultivated species and 102 wild species. Non-cultivated species predominately consisted of therophytes that adapt to harsh desert conditions and modified landscapes. Based on an extensive survey of cultivated areas, this study significantly increased the known number of species thought to exist in

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pecies	Abd El-Ghani (1994)	El-Khouly and Khedr (2000)	Hassan (2005)	Present study (2015)
Icacia nilatica (L) Delile*		(2000)	(2002)	+
Icacia raddiana Savi.			+	4 4 4 4
Icacia saligna (Labill.) H.L. Wendl.	1 <u>1</u>		+	+
legilops katschvi Boiss.	<u>1</u>		+	노 소 송 요
Aetheorhiza bulbosa (L.) Cass.	<b>4</b> 3.			1 4 3 것 :
Igrostis semiverticellata (Forssk.) C.Chr.	+			<u>) i i i i i i i i i i i i i i i i i i i</u>
Ilhagi graecorum Boiss.		+	4	+
Imaranthus graecizans L.	+		12.3.40	
Immi majus L.	- <b>-</b>			
nabasis articulata (Forssk.) Mog.			+	
Inagallis arvensis L.	<b>↓</b>		+	+
nagallis latifolia (L.) Arcangeh*	-		+	
nastatica hierochuntica L.*	말 같은 것 같은 것		+	1134
pium nodiflorum (L.) Lag.*				8 4 1 1 1
ristida adscensionis L.	+			1 2 1 8 1
rthrocnemum macrostachyum (Moric.) K. Koch.		+	4	2440
sphodelus temifolius Cay	i _ ič _ i		4 1 1 1	
ster squamatus (SPRENG) HIFRON *	4		6 <u>1</u> (m. 1	
Istragalus corrugatus Bertol				1 <u> </u>
Istragalus corrugalus Borton.			1	
(stragalus scort DC.	· · · ·			
triplay conjecto Formsk *				
trainles halinna I.*				김 김 것 ??
triplex nations L.				计算机的 法
triplex numinularia Eliku.				1 $1$ $1$ $1$
vena jalua L.	Т		T	т. ,
acopa monnieri (L.) Pennell.			1720	+
lumea bovel (DC.) vatke	<b>.</b>			
olboschenus maritimus (L.) Palla	<b>.</b> .			
olboschoenus glaucus (Lam.) S.G. Smith.				
rachypodium distachyon (L.) P. Beauv.	•			
rassica tournefortii Gouan.	<b>*</b> * 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3			
romus diandrus Roth.				+
Cakile maritima Scop.			T	別 才順 明 9
alendula officinalis L.			-	S+
Calligonum comosum L'Her.			+	
Capparis aegyptia Lam.			+	
Capsicum frutescens L.			+	지는 것 같은 같은
Centaurea calcitrapa L.				+
Centaurium erythraea Rafn	+			
Centaurium spicatum (L.) Fritsch	+			
Seratophyllum demersum L.		+		<b>.</b>
Thenopodium album L.				+
Chenopodium murale L.	- <b>+</b>			- <b>-</b>
hrysanthemum coronarium L.	+			그는 그는 것이다.
Cistanche phelypaea (L.) Cout.			+	+
leome africana Botsch.			+	위 (그 것 것 것 것
leome amblyocarpa Barratte & Murb.			-	+
onvolvulus arvensis L.	+		+	+
onyza bonariensis (L.) Cronquist, Bull.	1 _1			+
onyza canadensis (L.) Cronquist, Bull.				+
ornulaca monacantha Delile.		<u>_</u>	+	+
otula anthemoides L.				+
otula cinerea Delile.	3. J. N.		에 걸는 것 수가	
ressa cretica L	4 - C	4		
uscuta campestris Yunck				
vnanchum acutum I	· 梁 』 秋   秋	<b>4</b>	S <u>E</u> Stati	
vnodon dactylon (L.) Pers			<b>+</b>	
Voenis laevigatus I				
Viperus rotundus I			K E W K	
actulactanium accountinum (I ) Willd	KIRUDIAN CALL AND	IN A CONTRACTOR OF		The second

 Table 4
 Comparison between the present work and the previous studies of Abd El-Ghani (1994), El-Khouly and Khedr (2000) and Hassan (2005) showing the differences among the recorded species in each study. Asterisk denotes unique species recorded by only one study

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(1994)(2000)Echinochloa crusgalli (L.)P. BeauvEmex spinosa (L.) CampdEnarthrocarpus strangulatus BoissEphedra alata DeeneEragrostis cilianensis (All.) Janch.+Erodium laciniatum (Cav.) WilldErucalyptus camaldulensis DehnEucalyptus camaldulensis DehnEucalyptus camaldulensis DehnEugonsia arabica LFagonia arabica LFagonia cretica LFerula marmarica Asch. & Taub. ex Asch. & SchweinfFrancoeuria crispa (Forssk.) CassFrankenia hirsuta L.+Glycyrrhiza glabra L.+Gosspium arboreum L.+Haplophyllum tuberculatum (Forssk.) JussHeliotropium ovalifolium ForsskHerniaria hirsute LHaptophyllum tuberculatum (Forssk.) JussHerniaria hirsute LHaptophyllum suberculatum (Forssk.) JussHerniaria hirsute LHuriaria hirsute L.<	(2005)  - - +	(2015) + + +
Lehnnochloa crusgalli (L.)P. Beauv.       -       -         Emex spinosa (L.) Campd.       -       -         Enarthrocarpus strangulatus Boiss.       -       -         Ephedra alata Decne.       -       -         Errogrostis cilianensis (All.) Janch.       +       -         Errodium faciniatum (Cav.) Wild.       -       -         Erwearia pinnata (Viv.) Taeckh.       -       -         Eucalyptus camaldulensis Dehn.       -       -         Eughorbia pephus L.       +       -         Fagonia arabica L.       -       -         Fagonia arabica L.       -       -         Frankenia pephus L.       +       -         Frankenia irusta L.       -       -         Frankenia hirsuta L.       -       -         Frankenia pulverulenta L.       +       -         Glycyrrhiza glabra L.       +       -         Gymnocarpos decander Forssk.       -       -         Heliotropium ovalifolium Forssk.       -       -         Herniaria hirsute L.       -       -         Hyposcyamus muticus L.       -       -         Imperata cylindrica (L.) Raeusch.       +       +         Ipomoea cairica (L.) Sweet <td></td> <td></td>		
Enerthrocarpus strangulatus Boiss. Enarthrocarpus strangulatus Boiss. Engrostis cilianensis (All.) Janch. Eragrostis cilianensis (All.) Janch. Eragrostis cilianensis (All.) Janch. Eragrostis cilianensis (All.) Janch. Eradium laciniatum (Cav.) Willd. Erucaria pinnata (Viv.) Taeckh. Eucalyptus camaldulensis Dehn. Eucalyptus camaldulensis Dehn. Euchorbia peltus L. Fagonia aretica L. Fagonia cretica L. Franceuria crispa (Forssk.) Cass. Frankenia hirsuta L. Frankenia hirsuta L. Frankenia pulverulenta L. Giycsyrrhiza glabra L. Heiotropium aboreum L. Heliotropium ovalifolium Forssk. Heliotropium ovalifolium Forssk. Herniaria hirsute L. Hyoscyamus muticus L. Hyoscyamus muticus L. Hyoscyamus muticus L. Hyoscyamus muticus L. Hula crithmoides L. Imperata cylindrica (L.) Racusch. Hula crithmoides L. Jomoea eriocarpa Hulotoro Starpa H Juncus rigidus Desf. Koeleria phleoides (Vill.) Pers. Heiotropium ovalifoli. Hyoscyamus muticus V. Hulota Cull. Pers. Heiotropium ovalifolium Forssk. Hulota mitore V. Hulota cilica Wight. Hulota mitore V. Hulota mitore V. Hulota cilica Wight. Hulota phleoides (Vill.) Pers. Hulota phleoides (Vill.) Pers.		+
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Eragrostis cilianensis (All.) Janch.       +       -         Erodium laciniatum (Cav.) Willd.       -       -         Erucaria pinnata (Viv.) Taeckh.       -       -         Eucalyptus camaldulensis Dehn.       -       -         Eughorbia peplus L.       +       -         Fagonia arabica L.       -       -         Fagonia cretica L.       -       -         Ferula marmarica Asch. & Taub. ex Asch. & Schweinf.       -       -         Francoeuria crispa (Forssk.) Cass.       -       -         Frankenia hirsuta L.       +       -         Frankenia pulverulenta L.       +       -         Gycyrrhiza glabra L.       +       -         Gossypium arboreum L.       +       -         Haplophyllum tuberculatum (Forssk.) Juss.       -       -         Heliotropium ovalifolium Forssk.       -       -         Henniaria hirsute L.       -       -         Hyoscyamus muticus L.       -       -         Inperata cylindrica (L.) Racusch.       +       +         Ingonoea cairica (L.) Sweet       -       -         Ipomoea cairica (L.) Sweet       -       -         Ipomoea eriocarpa       +       +       - </td <td>a provide a subsective strategy of the subsec</td> <td></td>	a provide a subsective strategy of the subsec	
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Erucaria pinnata (Viv.) Taeckh.       -       -         Eucalyptus camaldulensis Dehn.       -       -         Euphorbia peplus L.       +       -         Fagonia arabica L.       -       -         Fagonia cretica L.       -       -         Franceuria crispa (Forssk.) Cass.       -       -         Frankenia hirsuta L.       -       -         Frankenia hirsuta L.       +       -         Glycyrrhiza glabra L.       +       -         Gossypium arboreum L.       +       -         Haplophyllum tuberculatum (Forssk.) Juss.       -       -         Heliotropium ovalifolium Forssk.       -       -         Hyoscyamus muticus L.       -       -         Imperata cylindrica (L.) Racusch.       +       +         Inlac crithmoides L.       -       -         Inponoca cairica (L.) Sweet       -       -         Juncus rigidus Desf.       +       +         Kochia indica Wight.       -       -         Koeleria phleoides (Vill.) Pers.       +       -	A 19 19 17 1	
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Fagonia arabica L.       -       -         Fagonia cretica L.       -       -         Ferula marmarica Asch. & Taub. ex Asch. & Schweinf.       -       -         Francoeuria crispa (Forssk.) Cass.       -       -         Frankenia hirsuta L.       -       -         Frankenia hirsuta L.       -       -         Frankenia pulverulenta L.       +       -         Glycyrrhiza glabra L.       +       -         Gossypium arboreum L.       +       -         Gymnocarpos decander Forssk.       -       -         Haplophyllum tuberculatum (Forssk.) Juss.       -       -         Heliotropium ovalifolium Forssk.       -       -         Herniaria hirsute L.       -       -         Hyoscyamus muticus L.       -       -         Imperata cylindrica (L.) Raeusch.       +       +         Inde critimoides L.       -       -         India critimoides L.       -       -         Ipomoea cairica (L.) Sweet       -       -         Ipomoea reiocarpa       +       +         Kochia indica Wight.       -       -         Koeleria phleoides (Vill.) Pers.       +       -		
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Francoeuria crispa (Forssk.) Cass.       -       -         Frankenia hirsuta L.       -       -         Frankenia pulverulenta L.       +       -         Glycyrrhiza glabra L.       +       -         Gossyptum arboreum L.       +       -         Gymnocarpos decander Forssk.       -       -         Haplophyllum tuberculatum (Forssk.) Juss.       -       -         Heliotropium ovalifolium Forssk.       -       -         Herniaria hirsute L.       -       -         Hyposcrapts multisiliquosa L.       -       -         Hyposcyamus muticus L.       -       -         Imperata cylindrica (L.) Racusch.       +       +         Invala crithmoides L.       -       -         Ipomoea cairica (L.) Sweet       -       -         Incus rigidus Desf.       +       +         Kochia indica Wight.       -       -         Koeleria phleoides (Vill.) Pers.       +       -	黄油 正正正法	
Frankenia pulverulenta L.       -       -         Frankenia pulverulenta L.       +       -         Glycyrrhiza glabra L.       +       -         Gossypium arboreum L.       +       -         Gossypium arboreum L.       +       -         Gymnocarpos decander Forssk.       -       -         Haplophyllum tuberculatum (Forssk.) Juss.       -       -         Heliotropium ovalifolium Forssk.       -       -         Herniaria hirsute L.       -       -         Hippocrepis multisiliquosa L.       -       -         Hyoscyamus muticus L.       -       -         Imperata cylindrica (L.) Raeusch.       +       +         Inula crithmoides L.       -       -         Ipomoea cairica (L.) Sweet       -       -         Juncus rigidus Desf.       +       +         Kochia indica Wight.       -       -         Koeleria phleoides (Vill.) Pers.       +       -	i e di serie di terre di serie	P HE HALL MADE
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nuceriu pricouci ( ( in.) i sis.		
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Mesembryanthemum crystallinum L.	+	
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Monsonia nivea (Decne.) Webb. – – – –	이 가 수 있는 것	+
Najas pectinata (Parl.) Magn. – – – – – – – – – – – – – – – – – – –	W W & + 10 w	+
Nicotiana glauca Graham –		
Nitraria refusa (Forssk.) Asch. – – – –		
Panaver rhoegs I		t he <mark>T</mark> entro de Sola
Parapholis incurva (L.) C.E. Hubb.		
Pergularia tomentosa L.		
Phragmites australis (Cav.) Trin. ex Steud. + +	+	🛉 🕂 🦉 🖉
Poa annua L.		P 🕂 alls alls a
Polycarpaea repens (Forssk.) Asch. & Schweinf. –		
Polycarpon succulentum (Delile) J. Gay. – – – – – – – – – – – – – – – – – – –		
Polygonum equivelijorme Sill.		
Polypogon monspeliensis (L.) Desf.	<ul> <li>Annumber - Annumber - Annu Annumber - Annumber - Annu</li></ul>	

J

Species	Abd El-Ghani (1994)	El-Khouly and Khedr (2000)	Hassan (2005)	Present study (2015)
Ponulus euphratica Olix			_	+
Portulaçã oleracea L.	1. <sup>1</sup> (2.1)			1
rosonis farcta (Banks & Sol.) Macbr.				<b>_</b>
seudognachalium hiteo-album (L.) Hilliard & B. L.				
hurit			都 P. 2. 名	
Pulicaria aspera Pomel			+	
andonia africana Coss			11	
Paramuria histolla Jauh & Spach			うし足…	
larada hitaa I				
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activitàs comprisantes E.				
unica vesicarius L.	T Star			- T - L - I
suppla curnosa (retagna) Orana.			17	+
amonis valeranai L.	· +		33. 12. 1	
avignya parvisiora (Delile) webb			もも言い	医发育试验
chouwia thebaica Webb.			1+2	【 土 国 未 法
cirpus litoralis Schrad.		+	1 <b></b> 3 2	
corpiurus muricatus L.	- <b>t</b>		+	* * 1 8 1
enecio aegyptius L.	-			. +
Senecio glaucus L.	+		+ / 24	+
enecio vulgaris L.				+
etaria verticillata (L.) P. Beauv.	+ _		11 <b>-</b> 11 7	+
etaria viridis (L.) P. Beauv.				+
ilybum marianum (L.) Gaertn.			1-3	4
isymbrium irio L.	8 B		+	+
ilene gallica		+		
olanum nigrum L.	+		_ L T	+
onchus maritimus I.	÷	+		<b>_</b>
onchus oloracous I	<b>.</b>			1
orghun halanense (I) Pers			教 法 超 。	
Corchum virgatum (Hack) Stanf				
reneration maring (1) Crisch				
perguaria marina (L.) Offseo.	7			T
tellaria media (L.) VIII.				
tellaria pallida (Dumort.) Murb.		- <b>.</b> .		*
tipagrostis lanata (Porssk.) de Winter	- 後に 路			1-21
tupagrostis plumosa (L.) Munro ex T. Anderson.				- 後生 4 - 5 - 5
uaeda aegyptiaca (Hasselq.) Zohaary.				( <b>+</b> )
Tamarix aphylla (L.) Karsten			+	-
Famarix nilotica (Ehrenb.) Bunge.	+	+		+
hesium humile Vahl	+			
Thymelaea hirsuta (L.) Endl.			+	
Forilis arvensis (Huds.) Link.		<u>4</u>		+
Forilis nodosa (L.) Gaertn.	+			
richodesma africana (L.) Lehm.	+			精 斗 折 轰 .
hesium humile Vahl	+			
rigonella maritima Delile ex Poir.			£	10 🙀 🕹 🖓
rigonella stellata Forssk.	그 같은 것은		+	
Synha domingensis (Pers.) Poir ex Stend			· & & III	
rtica urens L.	ti <u>t</u> a si en de la composition de la compositi			
accaria pyramidata Medik				
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icia sanva L.	tt nik sk		•	+
illa biparmata O. E. Schulz.			+	1、「気・気・狭」」
iziphora sp.				
ygophyllum album L.f.			+	+
Lygophyllum coccineum L.			+	+
Lygophyllum simplex L.				+ 10/
Jumber of unique energies	26			
runner of unique species	<b>.</b>		33	77



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Fig. 5 Agricultural intensification in Siwa 1939–2013. Note the expansion of salt lakes and green cultivated areas. (Source: Siwa 1:100,000 Topographic Map, Dept. of Mines 1939; Landsat 2013)

Siwa. Many of these 'new' species were annual weeds which are likely to have arrived as a result of agricultural intensification and the construction of roads over the last 30 years. But over this time many local species have also disappeared as a result of enclosure of artesian springs used for irrigation and modification of wetlands. Siwa Oasis does not support any endemic species *per se*; however, its floristic composition, which developed over millennia, and traditional cultivars form part of a rich cultural heritage. The conservation value of Siwa's flora emerges from its distinctive history and, until recently, isolation which has been disrupted by dramatic economic and social changes across the Western Desert of Egypt.

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