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A longer-term perspective on human exploitation and management of peat wetlands: the Hula Valley, Israel

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SUMMARY

The influence of non-recent human activities on the structure and functioning of wetlands is frequently overlooked. The Hula wetland in northern Israel was exploited for a variety of resources over thousands of years prior to near-total destruction by drainage in the 1950s. These pre-drainage human impacts created a mosaic of anthropogenic habitats which should be considered in attempting to re-create and rehabilitate the wetlands. Here we take an environmental history approach, using the documentary record to identify the numerous ways in which the ecosystem was shaped by human activity. The major traditional activities in the wetland included reed-harvesting, fishing, animal husbandry and limited arable agriculture. The corpus of material examined illustrates that drainage of the wetlands has a longer history than is frequently supposed. Activities such as papyrus harvesting, buffalo husbandry and fishing shaped the ecosystem and their replication may be desirable to re-create lost anthropogenic niches in contemporary conservation management.

KEY WORDS: drainage, Ghawarna, mire, papyrus, peatland.

INTRODUCTION

Despite evidence from around the world (e.g. Huang 2002, Christanis 1996), the role of non-recent human activity in wetland ecology is often overlooked in conservation management. Human activity can hardly be more significant anywhere than in the Middle East, a region with a long history of human civilisation and associated exploitation of sparse wetland resources. The Hula wetland (החולה in Hebrew, also variously transliterated as Hulah, Houla, Huli, Hooleh and Huleh) in the north of what is now Israel (33º04'N, 35º35'E) was one of the most extensive wetland complexes in the Middle East and one of the exceptionally few peatlands in this generally arid region. Peat started accumulating in the northern valley of the River Jordan around 20,000 BP, reaching depths of 8–9 m by the early twentieth century (Hambright & Zohary 1998). The original wetland was, by all accounts, a remarkable place; in the late 19th Century the American missionary William Thomson (1883) wrote that '*the lake is alive with fowls, the trees with birds, and the air with bees. At all times fair, but fairest of all in early spring and at eventide…such is the Huleh*'. The wetland complex consisted of a large (around 15 km^2), shallow lake (Lake Hula), an extensive area of peatland with vegetation dominated by *Cyperus papyrus* to the north of the lake, and areas of seasonally-inundated inorganic soils further north again (Figure 1). The extensive and dense papyrus marshes of the Hula were a remarkable feature of the Upper Galilee landscape until recent times. The British traveller Henry Baker Tristram (1882) wrote '*I never anywhere else have met with a swamp so vast and so utterly impenetrable'* (Figure 2).

Between 1951 and 1958 the wetland was drained to provide arable land, eliminate malaria and improve water supply. Around 120 species were thus lost from the Hula (Dimentman *et al*. 1992), including endemics such as the frog *Discoglossus nigriventer* (Mendelssohn & Steinitz 1943) and the fish *Acanthobrama hulensis* (Crivelli 2006). As the drainage programme led to extensive environmental degradation, a limited rehabilitation programme was initiated in the 1990s. The wetlands of the Hula are now a fraction of their former size, consisting of the Hula Nature Reserve, which is an area of original lake and marshes enclosed prior to drainage but now extensively modified; and Lake Agmon—a shallow lake constructed in the 1990s—with its surrounding reedbeds, canals and pools (Figure 1). Present management includes the provision of habitats for species typical of the original wetlands. However, our knowledge of the pre-drainage Hula wetlands is fragmentary. This article attempts to place the contemporary studies described elsewhere in this volume into their longer-term context.

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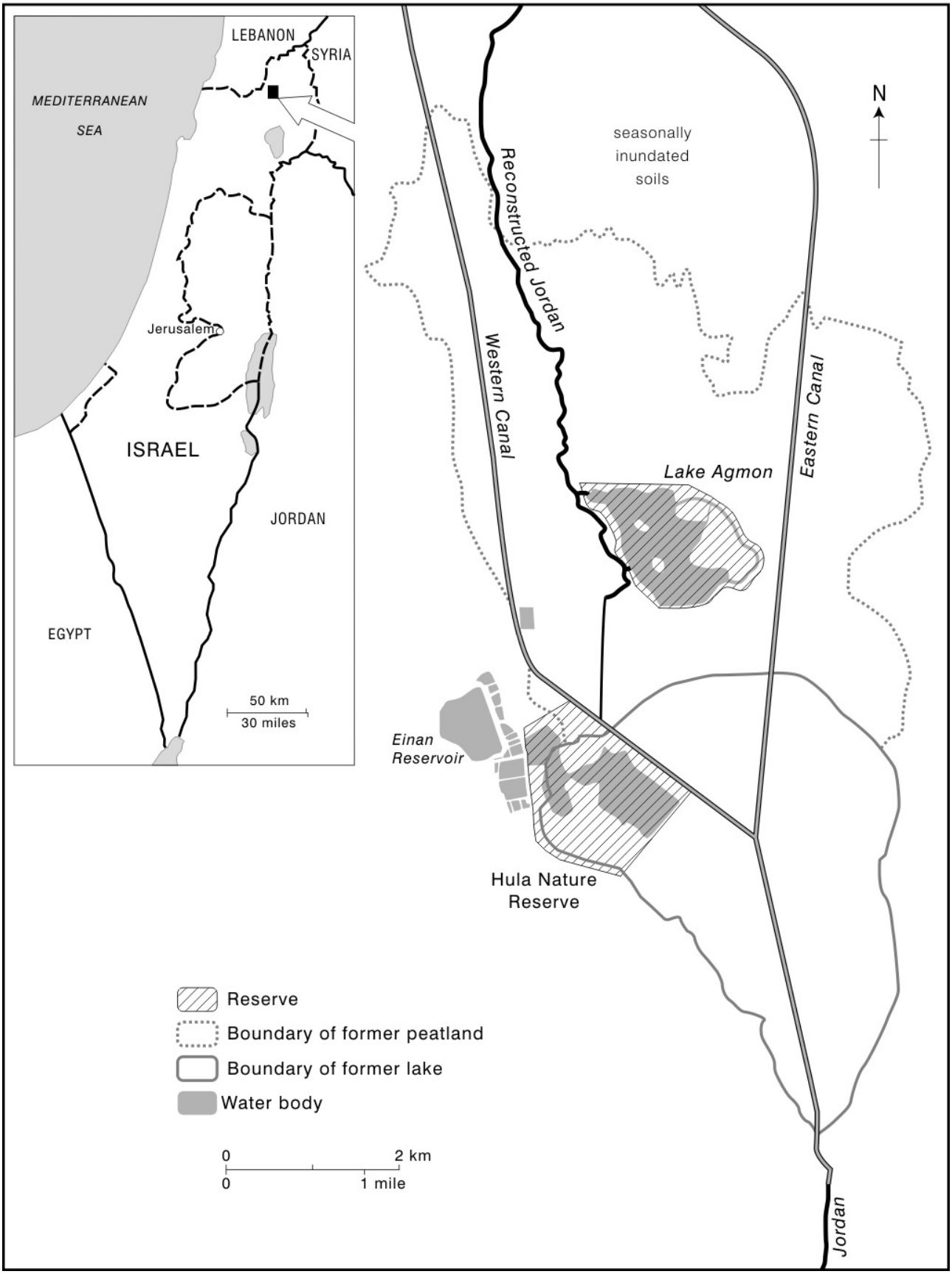

Figure 1. The Hula peatland past and present, showing the boundaries of former lake and peatland plus current water bodies, Lake Agmon and Hula Nature Reserve.

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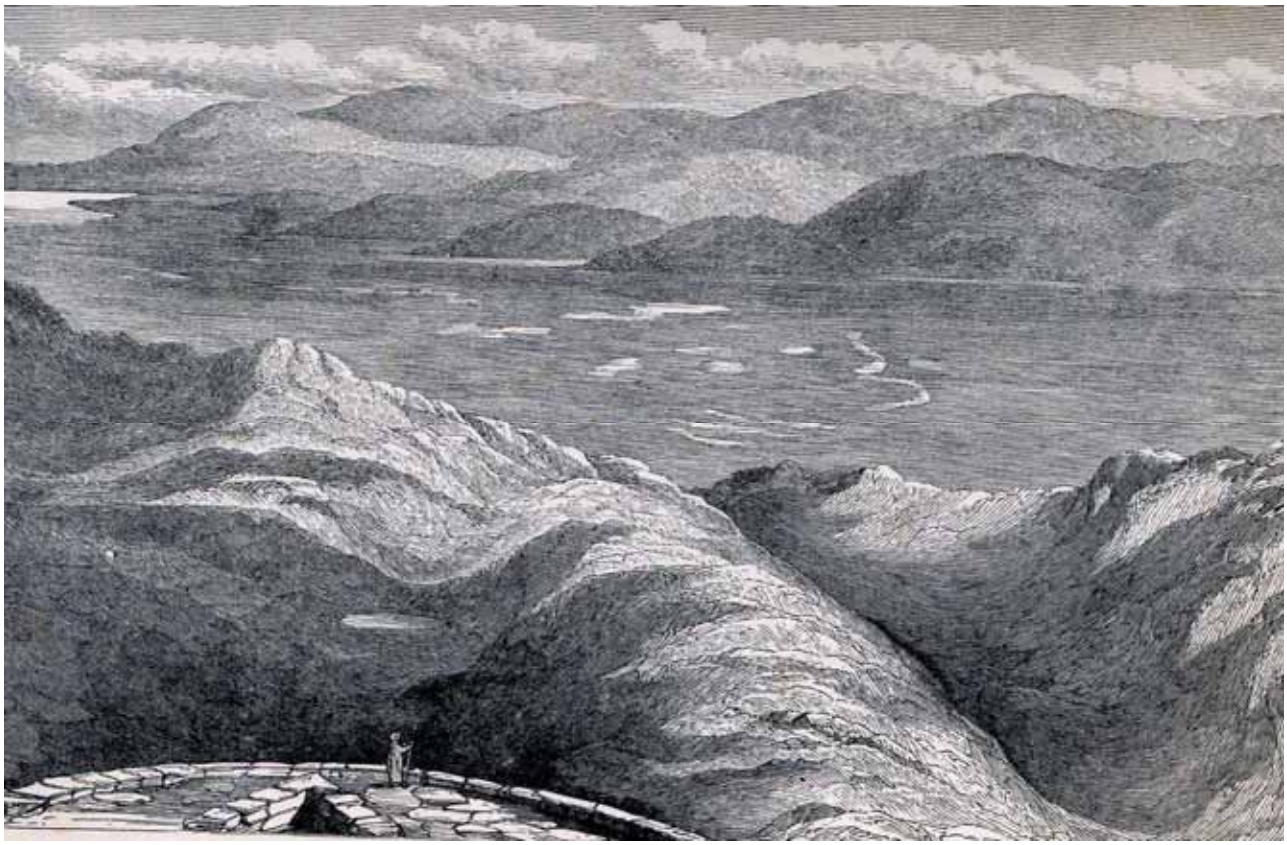

Figure 2. A mid-19th century view of the Hula peatland from the north; 'Hooleh Morass, from the Castle of Subeibeh' (now generally known as Nimrod Fortress) from MacGregor (1869).

The pre-drainage Hula wetland was a human-modified landscape. If contemporary conservation management aims to reproduce habitats which mimic those of the original wetlands to even a small extent, then historical activities should be taken into account when setting restoration targets and deriving management approaches. This article adopts an environmental history approach to investigate and reconstruct the ways by which the local people exploited and managed the wetlands prior to drainage. A large corpus of historical records from travellers to the Hula has been studied, along with the scientific literature, in order to identify mechanisms and processes of human impact.

HISTORICAL BACKGROUND

From the 16th century the Hula Valley was under the jurisdiction of the Ottoman Empire, followed by the British Mandate in Palestine after the First World War, becoming part of Israel following the 1948 war. Through this period the dominant Arab group of the wetland were the Ghawarna ('people of the plain'). The Ghawarna were a heterogeneous and low-status Sunni Muslim group whose origins are disputed, and who apparently occupied a rather marginalised position among the Palestinians of the Upper Galilee. The Ghawarna communities of the Hula had a largely subsistence lifestyle based on the resources which could be extracted from the wetland and what agriculture could be carried out in and around the wetland, in many ways similar to the better-known Ma'dan Marsh Arabs of the Tigris-Euphrates marshes in southern Iraq (Thesiger 1967). The permanent Ghawarna population was swelled at certain times of year by fellahin (agricultural communities) from areas bordering the Hula. Disease was a persistent problem for the people of the Hula, with malaria endemic throughout the region and one of the main motivators for the eventual idea of draining the swamps (Oliphant 1880, Tristram 1882, Hyamson 1928, Bentwich 1934). Estimates for the population of the Hula basin prior to 1948 range from around 12,000 to 16,000 (Khawalde & Rabinowitz 2002). Thomson (1883) notes the presence of 32 permanent encampments within the Hula (although other late 19th century authors give figures as low as three, see e.g. Twain 1869).

The Jewish population of the region increased

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over time with the first waves of zionist settlers arriving in the late 19th century first aliyah (immigration). The town of Rosh Pinna to the southeast of the Hula was established in 1882 by settlers from Romania and the first settlement in the Hula Valley, Yesud HaMa'ala, was established by Polish settlers the same year (Friedman 1986). Jewish populations expanded over the course of the late 19th and early 20th century with the Hula concession for harvesting reeds and fishing sold to Jewish organisations by its Lebanese Christian owners in 1934 and fishing rights transferred to Kibbutz Hulata in 1937. The war of 1948 essentially ended Arab occupation of the Hula, the remaining Ghawarna fled the region, mostly ending up in refugee camps in Syria, Lebanon and Jordan (Khawalde & Rabinowitz 2002).

HUMAN INFLUENCE THROUGH HISTORY

Approach

There are mentions of the Hula in texts as old as the Christian Bible, Jewish Talmud and writings of the 1st century AD historian Flavius Josephus, but few of those written before the mid-19th Century are useful for present purposes. The primary sources used here are accounts by European and American travellers to the Holy Land in the late-Ottoman and British Mandate periods (most accounts fall within the period 1850–1940). More detailed information is available from the later years of the British Mandate with the first rigorous scientific expeditions from the University of Birmingham and the Hebrew University of Jerusalem; however, by this stage the human population and the wetlands themselves were much changed.

Environmental history is inevitably limited by the quantity and quality of historical records. The temporal concentration of available accounts is generally insufficient to allow a confident reconstruction of changes in human exploitation of the Hula over time, although these are likely to have been marked. The accounts are also sometimes insufficient to allow the differentiation of human impacts in different parts of the ecosystem so that, for instance, it is difficult to determine to what extent fish were extracted from the ponds and channels within the peatland as opposed to the lake.

To understand human interactions with the Hula, a complete-as-possible census of the ways in which the ecosystem was exploited is first compiled. The compilation also attempts to provide an overview of the way of life of the Ghawarna. These records are then synthesised to identify the most important environmental interventions and their possible consequences. The human activities are grouped under five general categories below.

Arable agriculture

Arable agriculture was practised in and around the wetlands with crops including rice, wheat, barley, maize, sesame, sorghum, millet, peas, cotton and sugar cane (Robinson 1856, Kitto 1859, Twain 1869, Tweedie 1874; Thomson 1883, Tristram 1882, Stanley 1910). The most important in the Hula itself were probably rice and maize, while in the broader region olives and figs were also important (Naval Intelligence Division 1943). Most arable agriculture was carried out in the periodically-inundated mineral soil area surrounding the peatland; although at least rice, maize and millet were cultivated in areas of drained papyrus peat (Jones 1940). Ploughing was carried out using wooden ploughs drawn by buffalo, and grains were stored in reed huts. Cotton, wheat and barley were traded throughout Palestine, to Damascus and even to Europe through Jaffa (Thomson 1883, Tristram 1882, Gottheil 1986). Tristram (1882) records that large amounts of cotton were planted to meet enhanced demand during the American Civil War, showing the distance to which products from the Hula were traded. Much of the arable agriculture practised in the Hula was share-cropping, with landlords based in Lebanon and Syria (Khawalde & Rabinowitz 2002).

Animal husbandry and hunting

The people of the Hula kept many animals including cattle, buffalo, goats, sheep, donkeys, horses, camels, chickens and geese (Ritter 1866, Tristram 1882, Robinson 1856, Cox 1852). Horses and cattle were primarily grazed in the seasonally inundated plain to the north of the peatland while sheep and goats were grazed mostly on the surrounding hillsides (Robinson 1856, Ritter 1866, Cox 1852). Within the papyrus peatland itself the most important animal was the buffalo, which was kept in considerable numbers in the marshes and around the margins of the lake. Buffalo were used to draw ploughs and to produce milk and leather (Tristram 1882). Much of the milk was converted to butter by churning in leather bags (Conder 1889). Thomson (1883) comments that '*this Huleh butter is the best in the land*'. Bees were kept in mud-covered wickerwork hives with abundant forage available in the marshlands (Robinson 1856, Tweedie 1874, Thomson 1883).

Many species of wild animals were found in and around the marshes; Dimentman *et al*. (1992) list: bears, lions, panthers, leopards, wild boar, wolves, foxes, jackals, hyenas, gazelles and otters. In the

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drier parts of the marshes wild boar were hunted for food (Thomson 1883, Larsson 1936), otter were hunted in the marshes and lake (Dimentman *et al*. 1992) and it is likely that other species were also hunted in the surrounding areas. Wildfowl were abundant on the lake and were hunted (Ritter 1866, Hyamson 1928); in later years, local people acted as hunting guides for foreign travellers (Larsson 1936).

Fishing

Lake Hula and the marshlands were rich in fish and this resource was widely exploited; the species mainly extracted included *Tristramella simonis*, *Clarias gariepinus* (African sharptooth catfish), *Cyprinus carpio* (common carp) and *Sarotherodon galilaeus* (St Peter's fish) (Dimentman *et al*. 1992). Most fishing was by net, although some fishing was by poisoning and, at least in later years, line (Wilson 1847, Larsson 1936). Thomson (1883) records that '*the natives around Lake Huleh, especially at the northwest end… sometime cast into the water a fruit which so stupefies the fish that they are easily caught with the hand*'. The fruit is perhaps a *Datura* species which was used for this purpose in the Mesopotamian marshes. Three types of net were used: cast-nets, drag-nets and a compound-type net (termed *mubatten*: Larsson 1935; Naval Intelligence Division 1920). Fresh fish were exported to Safed and other regional towns and villages while preserved fish (salted or pickled) was exported as far as Lebanon, Syria and even Italy (Naval Intelligence Division 1920, Smith 1918). In 1944 the total yield of fish was 90 tons (2% of the total for Palestine), although with initial drainage works and regulation by the Hula concessionaires this would have been considerably less than in earlier periods of the Hula's history. Freshwater molluscs were present along the lake shores (Thomson 1883) and may also have been exploited; Washbourn (1935) states that '*up to a few years ago there was a local mother of pearl industry*'.

Reed harvesting

The extensive reedbeds which covered the peatland area and fringed the lake were one of the main resources of the Hula. A major industry of the Ghawarna involved the manufacture of reed mats (Figure 3), which clearly has a very long history here; there are mentions of this industry in texts from the 10th Century (Le Strange 1890). Papyrus was harvested from the peatland and split to produce either coarse mats from which huts were constructed, or finer mats used inside the huts and for bedding (Larsson 1936). The papyrus stems were cut and dried. For the warp, the dried stalks were split and twisted into rope; and for the weft, the stalks were either used whole (for the coarse mats) or split to about one-fifth of their original thickness. The stems were fixed to a loom and woven either by hand, or in the case of the coarse mats, with the aid of stones tied to the ends of the binding string (Crowfoot 1934, Larsson 1936). Huts were constructed by layering multiple coarse mats on a wooden supporting framework, sometimes as many as ten thick, and securing with ropes; giving the huts a distinctive 'cushion' shape (MacGregor 1869).

Reed mats were widely traded through the surrounding country and provided an important source of income (Wilson 1883, Larsson 1936, Karmon 1960). Ropes were also woven from the papyrus (Dimentman *et al*. 1992). Papyrus roots and rhizomes were dug up and burned as fuel for cooking (Jones 1940, Tristram 1882, Dimentman *et al*. 1992). Reed pipes were manufactured as musical instruments (Teape 1895, Twain 1869). Papyrus was also used to construct crude rafts which were used to move cut papyrus to shore and probably also as platforms for fishing (Jones 1940, MacGregor 1869, Washbourn 1935, Dimentman *et al*. 1992). The use of these rafts was possibly seasonal or intermittent, as several 19th century authors imply that they encountered no watercraft on the lake (Tristram 1882, Thomson 1883, Tweedie 1874).

Drainage

A widespread view of the history of the Hula is of a pristine ecosystem, abruptly destroyed by drainage. However, it is clear from this literature review that both smaller-scale drainage and the idea of completely draining the Hula have a longer history. From the mid-nineteenth century numerous travellers commented on the idea of drainage (Oliphant 1880, MacGregor 1869, Wilson 1847, Boggis 1939), primarily motivated by the possibility of creating good agricultural land and also controlling malaria. Prior to complete drainage, considerable peripheral drainage had been carried out. In discussing the possibility of draining the wetlands Ritter (1866) writes '*how easily the hydrographical character of a lake like this may be affected, is shown by the circumstances that, at the instigation of a number of agriculturalists, Ibrahim Pasha* [Egyptian general and conqueror of Syria] *was persuaded to allow some rocks to be blasted which stood at the outlet. The result was an immediate fall in the waters of the lake. The soil this reclaimed yielded for several years a most abundant harvest, but at length the soil deposited at the outlet raised the waters to their former elevation'*. Areas of the seasonally-inundated wetlands to the north of the peatland had been drained by ditch digging since

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Figure 3. Early 20th Century papyrus harvesting in the peatland, from Washbourn (1935). Above: 'Part of Papyrus swamp ("dry area")'; below: 'Edge of Papyrus swamp preparing the "rafts" for the use of the expedition'.

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at least the 1850s (De Saulcy 1854). The Ottoman authorities granted a drainage concession to two merchants from Beirut in 1914; this was transferred to the Syro-Ottoman Agricultural company in 1918, and thence to the (zionist) Palestine Land Development Company in 1934 (Naval Intelligence Division 1943, Anglo-American Committee of Inquiry 1946). The proposed scheme involved digging a canal and diverting the water from above the Hula. By the later years of the British Mandate it was reported that '*the northern part of the marshes has been drained*' (Washbourn 1935, Naval Intelligence Division 1943); and in the mid-1930s Reifenberg (1936) reported 13,000 acres of cultivable land in the Hula plain. As well as peripheral drainage schemes the Ghawarna cut channels through the papyrus to allow transport (Dimentman *et al*. 1992, Jones 1940, MacGregor 1869), such channels appear to have been quite substantial features (MacGregor 1869). While it is clear that the hydrology of the Hula was extensively modified during the British Mandate and earlier periods, it was not until after the 1948 war and the foundation of the state of Israel that full drainage was eventually carried out. It is interesting to note that, even before our current age of greater environmental awareness, the proposed drainage of the marshes caused considerable concern for the flora and fauna which would be lost (e.g. Meinertzhagen 1935).

ECOSYSTEM IMPACT AND IMPLICATIONS FOR CONTEMPORARY CONSERVATION MANAGEMENT

The extensive historical accounts of human exploitation and management of the Hula show the many and varied ways in which the human inhabitants interacted with the wetland ecosystem. While many of the human interventions may have been minor (and most would count as 'sustainable'), some certainly had more far-reaching impacts on the ecosystem. Zohary & Orshansky (1947) note that *'the removal of the Papyrus rhizomes for fuel, digging ditches for transport of Papyrus culms and for primitive soil reclamation, rearing of the water buffalo in the midst of the swamp and fishing on the Lake, all these have introduced many changes in the primary vegetation'*. Observations of the effects of human activities in similar contemporary papyrus-dominated systems in Africa illustrate the potential scale of impacts of such traditional exploitation (Owino & Ryan 2007, Maclean *et al*. 2006).

One of the most significant human activities within the Hula was undoubtedly the introduction of buffalo. Buffalo have been shown to be an important agent of environmental change in other wetlands (e.g. Bowman *et al*. 2010) and were both widespread and numerous in the pre-drainage Hula. Buffalo clearly had a major role in shaping the ecosystem, serving to control dense vegetation (particularly of *Tamarix jordanis*) and create meadow areas. This activity has been recognised as an important process in the Hula ecosystem, and a small buffalo herd was re-introduced to the Hula Nature Reserve in the 1960s. This herd has aided the creation of meadow areas, promoting the abundance of *Pasapalum paspalodes, Cynodon dactylon, Cyperus fuscus, Cyperus pygmaeus* and *Trifolium fragiferum* and decreasing the abundance of *Phragmites australis, Rubus sanguineus* and *Tamarix jordanis* (Kaplan & Vaadia 1993). Today buffalo graze a limited area of the Hula Nature Reserve, preserving a more open habitat within the generally dense reed-swamp. As the reed beds around constructed Lake Agmon develop, it may be desirable to introduce buffalo into some areas here also.

As the major industry of the Ghawarna, with products both used locally and exported, papyrus harvesting clearly also had a major impact on the ecosystem. Oppenheimer (1938) notes a *Lythretum* assemblage in areas cleared of papyrus. Similarly, Zohary & Orshansky (1947) recognised a *Polygonetosum* assemblage consisting of *Polygonum acuminatum* (a national Red Data Book species), *Panicum repens* and much reduced *Cyperus papyrus* as typical of areas in which papyrus rhizomes had been removed. It is difficult to estimate the extent of such disturbed areas but the number of inhabitants within the Hula (the 32 encampments mentioned by Thomson 1883) and the amount of material that would be required to construct the thickly-layered mat huts and export widely suggests that large areas must have been cleared each year.

Other substantial human impacts may relate to fishing and channel construction. Zohary & Orshansky (1947) suggest that an increase in fishing on the lake may have been the cause of apparent changes in aquatic vegetation in the period between the University of Birmingham expedition of 1936 and their visits in the early 1940s. The construction of channels through the peatland area created more open areas which were colonised by the submerged plant *Ceratophyllum demersum* and the carnivorous plant *Utricularia australis* (Dimentman *et al*. 1992). This latter species provides a good example of the importance of considering past human impacts in contemporary conservation management. While not globally rare, *U. australis* is an Israel Red Data

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Book species, believed to be nationally extinct (Sapir *et al*. 2003). If the re-colonisation of such a species is desired then re-creation of lost anthropogenic environments—in this case cut channels within the papyrus peatland—may be a necessary pre-requisite.

It is dangerous to extrapolate too far from the fragmentary records that are used here because the sources of evidence are inherently qualitative and need to be treated with a degree of caution; environmental history is best used in combination with neo- and palaeoecological studies (Bowman 2001). However, it seems clear that a number of human activities in the Hula considerably modified the ecosystem and produced habitats which would not have been present without human actions. Rather than degrading the ecosystem, these impacts may actually have enhanced α-diversity by creating a mosaic of habitats and maintaining a non-equilibrium state (*cf*. Connell 1978). If the aim of restoration is to reproduce habitats and re-introduce species which existed in the wetlands prior to drainage—as opposed to a deeper, pre-human past—then these impacts should be considered.

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