Chapter 28
The Role of Plants as a Canopy in the Inland Waters: Basic Information for Application in Iraq

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Abstract The water temperature of stream can limit the growth and endurance of aquatic biota, while covering of the plantation on the stream catchments plays a vital role in inhibiting river warming. Water temperature directly responded to air temperature and cloudiness. Removal of plantation especially those with large leaves can upsurge solar radiation in the stream catchment area as well as wind speed and disclosure to air, which can increase during air in summer, soil, and stream temperatures and decrease in relative humidity. Stream temperature upsurges and subsequent removal of plantation are not only chiefly organized by variations in separation but also governed by stream hydrology and channel shape.

Recently, eco-environment degradation processes and changes have been detected in Iraq. Examples on such great changes in the environment can be seen in the environment of Basrah City, south of Iraq. Observed changes are mainly desertification, secondary salinization, urbanization, vegetation degradation, and loss of wetlands.

Recommendations to restore the streams and their catchments were suggested in order to be followed in any developmental program that will be taken by the government.

28.1 Introduction

Water temperature in streams and springs is considered a limiting factor for a number of aquatic organisms such as fish and invertebrates (Logez and Pont 2013; Pletterbauer et al. 2014). The losses and gain in water temperature in small freshwater body depend on the quantity of stream release, topography, and atmospheric settings along the river way for example (Evans et al. 1998; Caissie 2006;

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Pletterbauer et al. 2014). Also, another set of characters may affect water temperature of streams such as upstream water temperature and discharge, bed heat conduction, and solar radiation (incident, reflected) (Caissie 2006; Logez and Pont 2013). Air temperature and short-wave radiation are deliberated as main impelling issues on water temperatures of streams (Evans et al. 1998).

The studies that have dealt with the effect of riparian vegetation on river water temperature have recognized certain parameters to measure in order to assess whether the vegetation cover is enough to keep the water temperature of stream in its normal range (Moore et al. 2005; Gomi et al. 2006; Caissie 2006; Davies-Colley et al. 2009). Among these important parameters are the buffer width, vegetation height, and its density. On the other hand, the height and density of the river bank vegetation have an equal or even greater influence on water temperature (Evans et al. 1998; Gomi et al. 2006; DeWalle 2010), and Davies-Colley et al. (2009) and DeWalle (2008) have shown that the ratio of canopy height to stream width has specific high effect on stream light disclosure and is consequently particularly applicable (Logez and Pont 2013).

Changes in water temperature of small rivers and streams are somewhat quick (Moore et al. 2005; Caissie 2006; Davies-Colley et al. 2009; DeWalle 2010), and river bank vegetation effect can be great (Poole and Berman 2001; Gomi et al. 2006). Changes in water temperature vary with the size of the river. Shading could be dissimilar for greater rivers where water temperature variations are normally lower (Poole and Berman 2001; Moore et al. 2005; DeWalle 2010).

In Iraq, deforestation is a main problem and riparian areas along the rivers, especially the small streams, are decreasing substantially (Haktanir et al. 2004). Therefore, this chapter aims to review short studies performed on the effects of river bank vegetation on river water temperature during summer and how to manage the presence of vegetation along the sides of the rivers to keep water temperatures of these water bodies in its normal range. At the end of the chapter, recommendations have been given about managing the riparian areas, and so the policy makers in Iraq can take up.

28.2 The Role of Stream Bank Plantation in Improving and Protecting Chemical Water Quality

Worldwide, protecting sources of clean water and refining the chemical value of ruined waters for both human drinking and habitat health have become vital goals (Baker et al. 2006; Arthurton et al. 2007). One approach that can attain these aims is administration of vegetation on the stream bank. It is well recognized that vegetated riparian areas can powerfully impact the chemical composition of contiguous streams, chiefly through the elimination of nutrients in runoff from agricultural uplands (Baker et al. 2006; Arthurton et al. 2007). Vegetation refurbishment and management in the zone adjacent to streams are therefore widely proposed and endorsed in agricultural zones to recover chemical water quality in rivers (NRC 2002; Baker et al. 2006).

Dosskey (2001) and Arthurton et al. (2007) have suggested that the level and time frame of water class enhancement rely on the sort of contaminant and the methods that impact it such as (1) site situations that govern how significant each procedure is and (2) the extent of dilapidation in these procedures that happened prior to refurbishment. An understanding of these fundamental processes is vital for successfully using vegetation state as a marker of water quality protection and for precisely evaluating outlooks for water quality enhancement through renovation of permanent vegetation (Dosskey 2001; NRC 2002; Baker et al. 2006; Arthurton et al. 2007).

28.3 The Date Palm: THE Main Canopy Vegetation in Stream Area in Iraq

In Iraq, date palms are usually planted near the banks of rivers and streams in large quantities. Therefore, their long leaves form an excellent canopy and create a decent shade to the rivers and streams nearby (Fig. 28.1).

The date palm (*Phoenix dactylifera* L.) is deliberated a figure of life in the Middle East, since it bears high temperatures, drought, and salinity more than many other fruit produce plant species. In the long history of the human civilization, date palm is considered as one of the oldest trees from which man has obtained benefit (Zohary and Hopf 2000). It has been suggested that the cultivation of the date palm goes as far back as 4000 B.C. in southern Iraq. Evidences on using dates as food were obtained from prehistoric Egypt (Barreveld 1993; Zohary and Hopf 2000). Relics of dates have been discovered on a number of Neolithic sites, chiefly in Syria and Egypt. This indicates that they were being consumed by man as much as 7000–8000 years ago (Lunde 1978; Barreveld 1993).

The date palm is counted a renewable natural resource because it can be substituted in a comparatively short period of time or used through upkeep attempts without running down (Lunde 1978; Barreveld 1993; University of Delaware 2004). The date palm maintains its value for growers as it gives a wide range of harvests and facilities, including many provisions of life. The date, the primary product of the palm, is rich in protein, vitamins, and mineral salts. That is why it signifies a vital constituent of food for the farmer himself and his animals. All subordinate goods of the palm result from annual clipping and have indispensable usages for the farmer (Lunde1978) (Fig. 28.2).

Fig. 28.1 Date palm trees used as canopy in Iraq. (**a**) Tall date palm trees; (**b**) other plantations are usually cultivated in the shadow of the date palm trees; (**c**) cultivation of date palm close to each other

Fig. 28.2 Pieces of mat made of dry leaves of date palm

28.4 Socioeconomic and Traditional Importance of Dates

Date palm is socioeconomically and conventionally important for native societies where the culture succeeds (Barreveld 1993; Jain et al. 2011). Formation of date palm meadows assisted nomad groups in the past to live and start societies and start agriculture. These groups became a center for marketing/trading supplies and animal and other products. Dates were and still are among the most imperative and appreciated products for trading at these societies. They are respected for their food and feed usages (Jain et al. 2011).

A completely new business has also been established in recent years around date palm and dates. For instance, workshops with more or less complicated ways of pitting, penetrating, crushing, and sieving dates provide a significant number of local jobs. Excess production not eaten fresh frequently is changed by natives into paste, spread, powder (used locally as a sugar), jam, jelly, juice, sirup, vinegar, and alcohol (Jain et al. 2011). Unacquainted dates do not go discarded. They are frequently dehydrated, crashed, and mixed with grains and straw to become an appreciated feed for domestic animals.

The date palm tree can give more than their fruit to the benefited human being. Young leaves and terminal buds are sometimes prepared as vegetables. Seeds are also often roasted and crushed (Barreveld 1993; El Hadrami et al. 2011). The stems of the date palm tree can be used for building houses and bridges over small streams. The leaves are also included in the building house sectors in southern of Iraq (Fig. 28.3) (El Hadrami et al. 2011). Date palm leaves are frequently included in making mats, screens, baskets, crates, and fans or for religious devotions (Fig. 28.4). The pulp of the date palm tree can be eaten fresh as a fruit (Fig. 28.5).

Medically, dates have been prescribed for several diseases and sicknesses. The fruit is rich in tannins, making it a good severe cure for intestinal distresses (El Hadrami et al. 2011). Preparations such as infusions, decoctions, sirups, and pastes are often administered against colds, sore throat, and bronchial cough. They are also taken to release fever, liver and abdominal aches, cystitis, gonorrhoea, and edema. The roots are used to treat toothache, and the pollen is appreciated for its estrogenic compound, estrone (El Hadrami and Al-Khayri 2012).

28.5 Degradation of Date Palm Trees in the Arab Countries: Indicators and Causes

The state of Date palms in Iraq is similar to that in the remaining Middle east countries that are facing hazard from diseases, pests, habitat variations, and socio-economic causes (FAO 1982).

Over the last decade, yield of date palms has deteriorated in the traditional farming zones that pests and diseases have induced important impacts on date production in the Arab countries for example (FAO 1982; Malumphy and Moran 2009). Unfortunately, pests and diseases spread increasingly with the development of trade and travel in the globalizing world system (UN Press Release 2004). Additionally, habitat effects, such as drought and salt and conventional cultural methods, are common difficulties in the areas and put more pressures on those already present (Oihabi 2001; Malumphy and Moran 2009).

The other cause that made a reduction in the yield volume of date palms and the dilapidation of the feature of production itself is the loss of manpower (Fig. 28.6). The workers, who used to work at the date palm fields in the countries where dates are usually produced, have left to the urban areas to increase their income (de Haas 1998; Oihabi 2001; Malumphy and Moran 2009). The needed agricultural events such as soil grounding, selection, and planting out of palm offshoots are considered hard jobs that are suitable only for young people. With the loss of the young manpower, the maintenance of date palms is generally reduced and resulted in field having densely wild grown date palms and consequently reducing harvests (de Haas 1998; Oihabi 2001).

In the last half of century, date palm trees have been uncovered to deprivation owing to widespread misuse ensuing from the upsurge in both the human society and the number of domestic animals (de Haas 1998). Hundreds of date palm fields have been converted to urban sites, where date palm trees have been cleared to prepare the

Fig. 28.3 Stems of date palm tree used for house roofing. (**a**) Date palm trunks prepared for roofing process; (**b**) date palm trunks after cutting; (**c**) completed roof

Fig. 28.4 Handmade artifacts made from dry leaves of date palm trees

Fig. 28.5 Steps to extract the pulp of the date palm trees. (**a**) Cutting the head of the date palm tree; (**b**) removing the hard layers of plant tissues, (**c**) removing the soft plant tissues, and (**d**) exposing and removing the pulp

Fig. 28.6 Neglected date palm trees showing loss of leaves

land for building houses (Fig. 28.7). Effects of war in the regions where date palms are usually grown were evident in reducing the number of these trees dramatically. 8 years spent in the first Gulf War (Iraq-Iran war) has produced hundreds of date palms that are classified as nothing but dead plant remains (Fig. 28.8).

Among the common reasons of date palm dilapidation in the Arab countries are the lack of vegetation canopy. In some regions and owing to high grazing and harvesting of wood for fuel, soil erosion is created. With the augmented wind velocity and storm frequency, an increase in the levels of hovering dust in the air will increase. The other factor is the decreased infiltration of water into soil due to the increase in runoff and floods and reduced water table levels in some areas.

28.6 Wildfire as an Ecological Factor for Streams

One of the most worst ecological factors, which are natural disturbances, is the wildfire (Agee 1998). The effect of this factor has been investigated on the vegetation, soils, water yield of diverse areas, and numerous forest kinds (Gresswell 1999; Agee 1998; Brown 2000; Arno and Allison-Bunnell 2002). The area adjoining the stream usually experienced different natural disturbances such as fire, flooding, debris flows, and landslides (Naiman et al. 1993).

Fig. 28.7 Date palm field has been prepared for house building after removal of the trees

Fig. 28.8 Effects of the Iraq-Iran war on the date palms in the southern of Iraq. Images showing burned trees and others without heads

Several aspects need to be understood in order to encompass the behavior of fire in the area adjacent to streams (Agee 1998; Brown 2000; Arno and Allison-Bunnell 2002). Among these issues are understanding the mechanism of spread of fire spread and burn patterns, fuel loads and spreading, fuel chemistry and flammability, and fuel moisture (Naiman et al. 1993; Patten 1998). It is not possible to separate human activities from the effects and properties of fire. For instance, water usage and administration and man-made disturbances (Gresswell 1999; Brown 2000; Arno and Allison-Bunnell 2002) are among the main anthropogenic factors on fire behavior. To manage such an effect, the urban-rural line needs to manage first (Agee 1998; Gresswell 1999; Kauffman 2001). Moreover, in addition, foretelling prototypes of fire performance under diverse situations of land and water usage and global climate modification need to be considered and put in contingency plans (Patten 1998; Kauffman 2001; Arno and Allison-Bunnell 2002).

28.7 Effect of Fire on the Soil of the Stream: Case of the Southern Marshes of Iraq

Soon after the genocide and the ecocide that Saddam Hussein has committed against Marsh Arabs in 1991, he committed another crime. To make sure that no one will come out of the marsh area alive, he ordered his forces to burn the reeds in the marshes. The author has witnessed this burning reed crime. Saddam Has ordered members of his popular army to be present in the marsh area and provided them with all the tools that enable them to burn completely the reed forest of the marshes. The smoke of the fire extends to over 100 Km south of the marsh area and covered the sky of Basrah city. The smoke was too thick that many people who have problem in breathing have been taken to the hospital.

The reason behind drying the marshes and burning the reeds is to deny the rebels a place to hide. The government troops found it problematic to combat in the marshes as their heavy equipment and vehicles could not move through such territory. As a result, the resolution was to strengthen and enlarge the strategies to empty the marshes completely from water. This strategy and burning the reeds were completely and quickly executed by Iraqi administration and the Marsh Arabs, and the Shi'ite troops were killed, seized, or driven out and into expatriate camps mostly inside Iran (UNEP 2003). Chemical arms, weaponry, and minefields were involved to take out the remaining marsh people. Prevalent mass killings and forced replacements meant that by the year 2000, only 20,000 marsh Arabs out of a total population of 500,000 endured in their customary regions (Carpenter and Ozernoy 2003; UN 2002).

The marshes were dry when the fire has set in the reeds, and therefore, the heat resulting from the huge fire has affected the soil of the marshes (Fig. 28.8). Fitzpatrick (2004) in his report on the changes in the soil of the marshes has shown that soil of the marshes has been completely devastated. To let the readers many aspects of this report, here I quote Fitzpatrick (2004), "The severely burned locations in the marsh area were designated by enflamed surface soils, loss of organic matter, and occasionally white to gray ash on top of the soil. The inflamed surface soil layer fluctuated in thickness from 1 to 80 cm and was caused by a darkened soil layer 1–15 cm thick. Biomass burning has had a profound effect on the functioning of these soils. Both the direct impacts of fire and also the overall variations to the habitat in a post-fire state have led to short-, medium-, and long-term deviations in the soil (Fitzpatrick (2004). These are linked to soil performance in the physical, biological, and chemical aspects and also contain variations to combined stability, pore size distribution, water repellence, and runoff response. High temperature burning (>500 degrees centigrade) of the dried marshland soils has irreversibly destroyed the original soil components (e.g., organic matter, iron pyrite, and layer silicates) and formed high concentrations of magnetic cemented/ceramic-like gravel (>60%) in the upper 1–50 cm (Fitzpatrick 2004). These fragments have significant inferences for chemical and physical procedures in these soils because they increase permeability and provide a physical restriction to the root growth of sensitive plants".

Fitzpatrick (2004) also noted that the dried reeds were up to 2–3 m high when the burning occurred. The fuel load was enormous to burn such dry reed. Therefore, the fires would cause temperatures to exceed 300 degrees centigrade (i.e., as though in a kiln or oven). Topsoil between 15 and 50 cm transformed irreversibly into ceramic bricks or hard cemented (fused) ceramic-like porous fragments (Carpenter and Ozernoy 2003).

28.8 Decreasing Plant Cover Due to the Environmental Changes: Case of Southern of Iraq

In south of Iraq, the decreasing plan cover is forming a serious problem in recent years. There is no precise indication about the area of plant concealment in Iraq (Jabbar 2001; Hadeel et al. 2010; Al-saadi 2002). The land of Iraq has experienced numerous changes over the past few years (UNEP 2001). The agricultural land in Iraq is about 12%. Most of which is in the region of the Tigris and Euphrates Rivers (Al-saadi 2002; Jabbar 2001).

In their study, Hadeel et al. (2010) have shown that voluminous changes in the land at Basrah City, south of Iraq, have been performed during the last decade. The urban area and sand land have increased, with a significant decrease in farmland (Al-saadi 2002; Hadeel et al. 2010). The reasons behind such changes could be the expansion of new network and huge development in military aspect, which transformed huge agricultural lands to build up these areas. In addition, several other factors may be considered vital for such environmental changes. Jabbar (2001) and Hadeel et al. (2010) have identified four important elements, which are as follows: (1) Basrah City has been evolving fast under the habitat of rapid growth of the southern part of Iraq. For instance, the rural development of the marshland and the rural-urban zone of Safwan-Zubair, south of the city, have increased rapidly; (2) continuous increase in number of inhabitants and housing stresses enhanced the real estate expansion on the fringes of Basrah Province, which transformed agricultural lands to housing land; (3) traffic, water, power, natural gas, and other numerous substructures are some other lashing powers of urban growth and extension (Hadeel et al. 2010).

28.9 Why Restorations are Needed

Palmer et al. (2007) and Arthurton et al. (2007) have suggested an urge for more restorations and proposed the following reasons: (1) yet where human societies are not mounting, water withdrawals and human substructure on the land endure to upsurge intensely Arthurton et al. (2007); (2) assumed upcoming weather plans, many rivers will face new flow and sediment rules (Poff et al. 2002; Palmer et al. 2007).

Palmer et al. (2007) have also suggested that renovation along with sensible administration movements may ease the predictable influences and possibly even withstand a river ecosystem's capability to react to and be tough in the meet water usage and climate modification.

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