

8. Ecology of spate irrigation

Ephemeral rivers are often unexpectedly rich depositories of vegetation. Spates collect seeds from a large part of the catchment and deposit them in the river bed and flood irrigated fields. The moist and often organic-rich layers of silt provide a favourable environment for wild trees, plants and mushrooms to germinate and develop. Logs and branches, often carried over considerable distance, may add to this. As they are lodged against trees growing in or along the river channel, they create small blockages, trapping organic material, further supporting vegetative growth (Jacobson et al. 1995).

8.1 Wild vegetation

A sample of native species occurring in the spate irrigated area of DG Khan in Pakistan is given in box 8.1. The wild species often represent a considerable value. The grasses and shrubs sustain livestock population. Trees such as tamarisk are used for fuel, utensils and tanning; acacia is used as timber and fuel wood. Harvesting is often done in bad years, helping families to survive adverse periods. The spates also carry wild vegetables and cucurbits to the fields. Often special interest are mushrooms - in the spate irrigated areas of Pakistan the harvesting of various types of mushrooms is a lucrative side activity, with truffles fetching particularly good prices. To locate these 'underground mushrooms' however is a skill that is not everyone's forte - it requires a special 'eye'.

Box 8.1: Native species in Suleiman Spate Area (Pakistan)

Botanical name	Common name	Economic uses
<i>Acacia kacquemonti</i>	Kikri	Leaves browsed
<i>Acacia nilotica</i>	Kikar	Timber, leaves browsed
<i>Aerva javanica</i>	Bui	
<i>Alhaji camelorum</i>	Jawan	Weed
<i>Aristida depressa</i>	Lumb	Grass (poor quality)
<i>Calligonum polygonoides</i>	Phog	Sand stabilizer
<i>Capparis decidua</i>	Karir	Firewood, browse
<i>Carex</i> sp.		Palatable grass
<i>Cenchrus biflorus</i>	Lidder	Weed
<i>Cenchrus ciliaris</i>	Dhaman	Palatable grass
<i>Cenchrus pennisetiformis</i>	Lidder	Low quality grass
<i>Crotalaria burhia</i>	Chag	
<i>Cymbopogon jawarancusa</i>	Khavi	Medicinal value
<i>Cymbopogon schoenanthus</i>	Khavi	Low quality grass
<i>Cynodon dactylon</i>	Khabbal	Palatable grass
<i>Desmostachya bipinnata</i>	Dab	Low quality grass
<i>Dichanthium annulatum</i>		Palatable grass
<i>Dipterogium glaucum</i>	Fehl	Palatable grass (camels)
<i>Eleusine flagellifera</i>	Chimber	Low quality grass
<i>Euphorbia</i> spp.		Browsed

<i>Haloxylon recurvum</i>	Khar	Browsed (camels)
<i>Haloxylon salicornicum</i>	Lana	Browsed (camels)
<i>Indigofera oblongifolia</i>	Jhil	
<i>Kochia indica</i>	Bui	Low quality shrub
<i>Lasiurus indicus</i>	Ghorka	Palatable grass
<i>Leptadenia pyrotechnica</i>	Khip	
<i>Panicum antidotale</i>	Murat	Palatable grass
<i>Panicum turgidum</i>	Murat	Low quality grass
<i>Peganum harmala</i>	Harmal	Medicinal value
<i>Phoenix dactylifera</i>	Khajoor	Fruit tree
<i>Poa</i> spp.		Palatable grass
<i>Prosopis cineria</i>	Jand	Timber, browse
<i>Prosopis juliflora</i>	Mesquite	Firewood, browse
<i>Rhazya stricta</i>	Senhwar	Medicinal value
<i>Saccharum munja</i>	Sarkanda	
<i>Salsola foetida</i>	Lani	Browsed (camels)
<i>Salvadora oleodis</i>	Wan	Browsed
<i>Suaeda fruticosa</i>	Lana	Browsed
<i>Tamarix aphylla</i>	Frash	Sand stabilizer, utensils
<i>Tribulis terrestris</i>	Bhakara	Weed
<i>Withania coagulans</i>	Paneer	
<i>Zizyphus mauritania</i>	Ber	Timber, browse
<i>Zizyphus nummularia</i>	Mallah	Browse
Source: PARC/UNEP/ESCAP 1994		

8.2 Vegetation and river bed stabilization

The vegetation that develops in the river beds often plays an important role in stabilizing the river bed. This is particularly true in spate rivers in soft alluvial plains, that do not have the armouring of the gravel and stone river beds and are therefore far more prone to rapid sedimentation or scour.

An example is the Yandefero River in Konso, Ethiopia. When the vegetation of the riverine forest downstream of the system of flood channels was disturbed in Yandefero, the river changed its course and dropped at a lower level at the main Sehan river. This contributed to accelerated scour of the river in the upper section, rendering the flood channels located there unserviceable. Vegetation also sometimes helps in raising the river beds. When trees such as tamarisk colonize the bed of spate rivers, flows are slowed down and bed levels increase. In the Korakan River in Balochistan, a river particularly prone to degradation, a ban on cutting vegetation in the river bed was put in place by the spate irrigation farmers.



Damage to the riverain forest at the end of the Yandafero system in Konso, Ethiopia contributed to the deepening of the river bed upstream

There is usual a gradual transition in the vegetation of spate rivers - as one travels downstream. Whereas the upper reaches of spate rivers tends to get more frequent floods, the physical disturbance that comes with has the effect of removing the vegetation will. In the lower reaches of ephemeral rivers discharges decreases as a result of upstream abstraction and infiltration. Infrequent floods result in harsh environments, where only hardy drought-resistant plants survive (Jacobson et al. 1995). Vegetation can also be used as an indicator to assess the pattern and reliability of flooding.

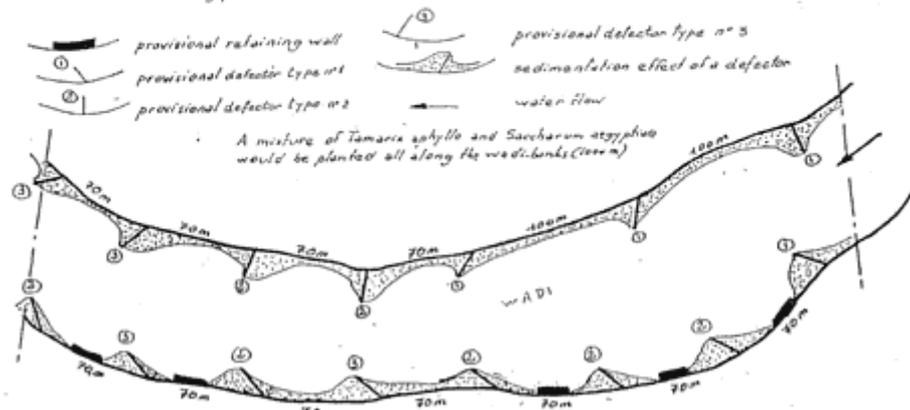
Rouchiche, quoted in Camacho (2000) has also suggested that vegetation can be used to protect the outer curves of spate streams. As the speed of water in these stretches is higher little natural vegetation take root. Rouchiche proposed to:

- armor the most exposed parts of the rviers with a tamarix cover under the protection of a retaining wall. Camacho (2000) has suggested that in the absence of tamarix lowland grawa could be used too
- undertake wadi training by establishing dense vegetative patterns in spur patternd
- protect the banks of the wadi by planting for instance tamarix and saccharum aegyptica

FLOOD PROTECTION WORKS

WADI-BANK PROTECTION

Illustration of the protection of a 500m wadi-section using provisional deflectors (3 types), retaining walls and vegetation



Proposed bank protection using retaining wall with shrubs (Rouchiche, quoted in Camacho (2000))



Eritrea - repair of flood diversion spurs with shrubs - denuding the surrounding hills

8.3 Spate irrigation and natural degradation

The construction of brushwood spurs and weirs also requires a substantial amount of trees and branches. These are usually collected in the surroundings. In Eritrea the numerous bunds (aqm's) that have developed in some parts of the country have been associated with the denudation of the hills. There are several other factors that cause upland deforestation obviously. A link exists with the development of spate irrigation and the changing hydrographs that result from deteriorating vegetation cover in the uplands - floods become more peaked and more silt laden. The phenomena

is not new. Research into pollen near the pre-Indus site of Nauwshero on the Kacchi Plains, Pakistan suggested that in 2600 BC already dramatic shift in vegetation took place. One theory is that this was caused by the development of spate irrigation and the larger population pressure on local natural resources.