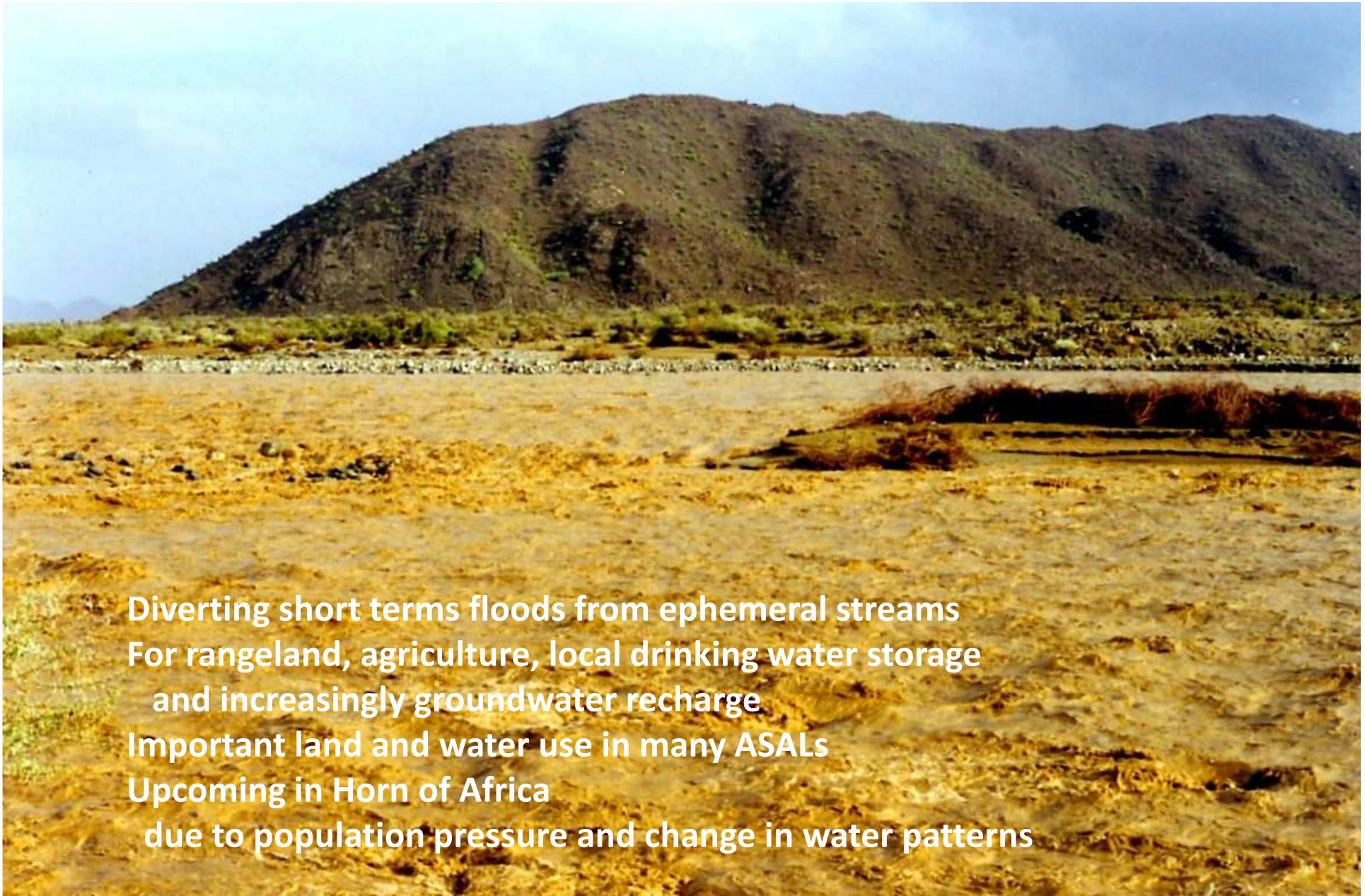


Prosopis Juliflora in Spate Irrigation Systems

Control and or use of Prosopis juliflora in Sudan, Yemen, Ethiopia, Eritrea and Pakistan





**Diverting short terms floods from ephemeral streams
For rangeland, agriculture, local drinking water storage
and increasingly groundwater recharge
Important land and water use in many ASALs
Upcoming in Horn of Africa
due to population pressure and change in water patterns**

Spate irrigation in ASAL – globally

Estimates

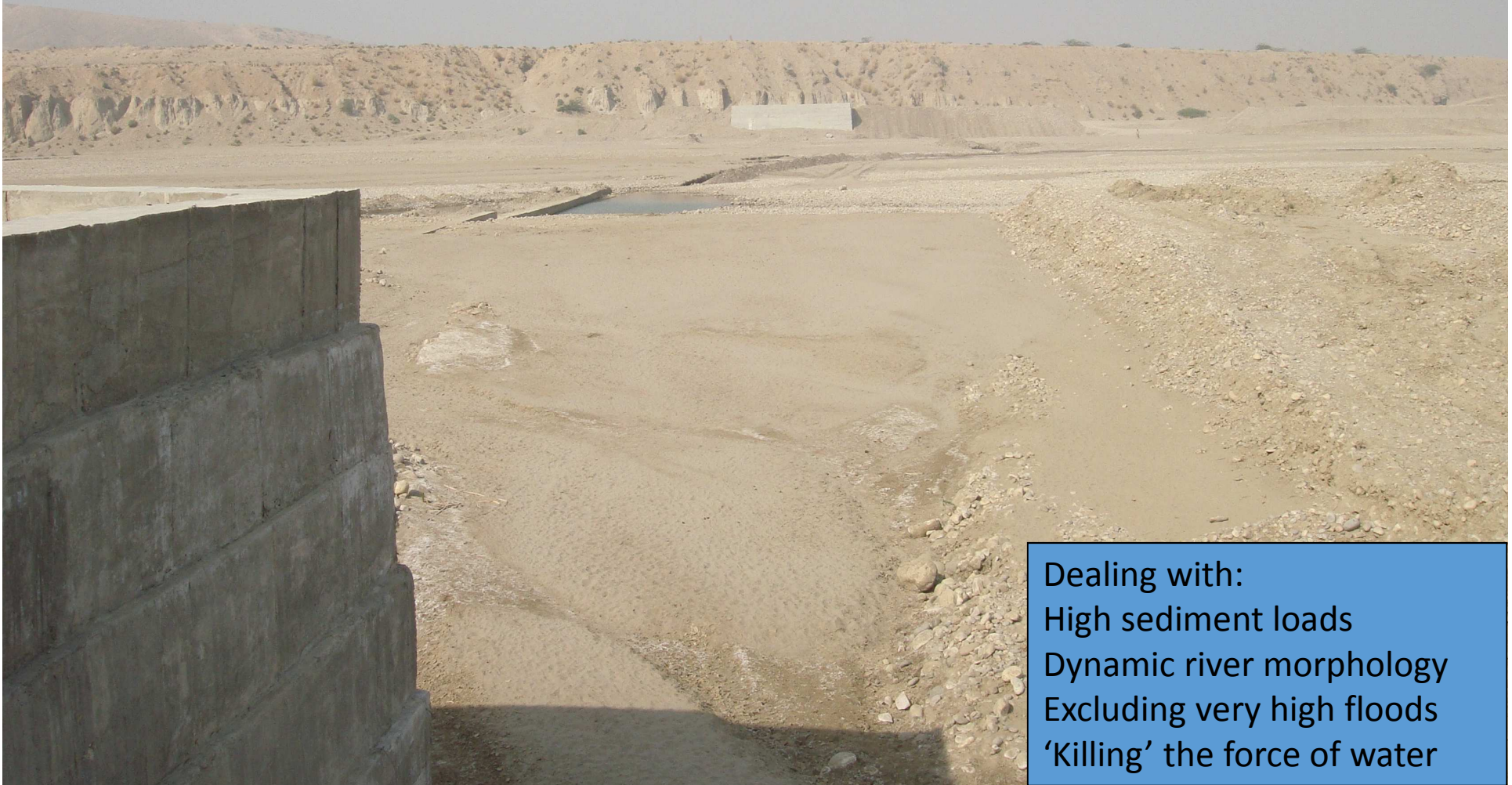
Country	Year of Irrigation	Total Irrigated Area (ha)	Spate Irrigated Area (ha)	Spate Irrigation as % of Total Irrigation
Algeria	1992	555,500	110,000	19.8
Eritrea	1993	28,124	15,630	55.6
Libya	1987/1997	470,000	53,000	11.3
Morocco	1989	1,258,200	165,000	13.1
Pakistan	1990	15,729,448	1,402,448	8.9
Somalia	1984	200,000	150,000	75.0
Sudan	1997/1987	1,946,000	280,000	14.4
Tunisia	1991	385,000	30,000	7.8
Yemen	1987/1997	485,000	193,000	39.8

Source: FAO Aquastat; Hadera 2001; Kohler 1999

In addition there is spate irrigation in Ethiopia (110,000 ha) and Kenya (20,000 ha)

Spate irrigation was practiced by Red Indians as well as Queen of Sheba – in comparison history in Horn of Africa is recent

Engineering in spate irrigation is different



Dealing with:
High sediment loads
Dynamic river morphology
Excluding very high floods
'Killing' the force of water

Constructing soil diversion and guide bunds in lowland systems





**Managing sediment as
important as managing water**



Land being built up by sediment



Recharge of wells from flood water

Moisture conservation is key:
ploughing and mulching





**Moisture conservation is key:
ploughing and mulching**

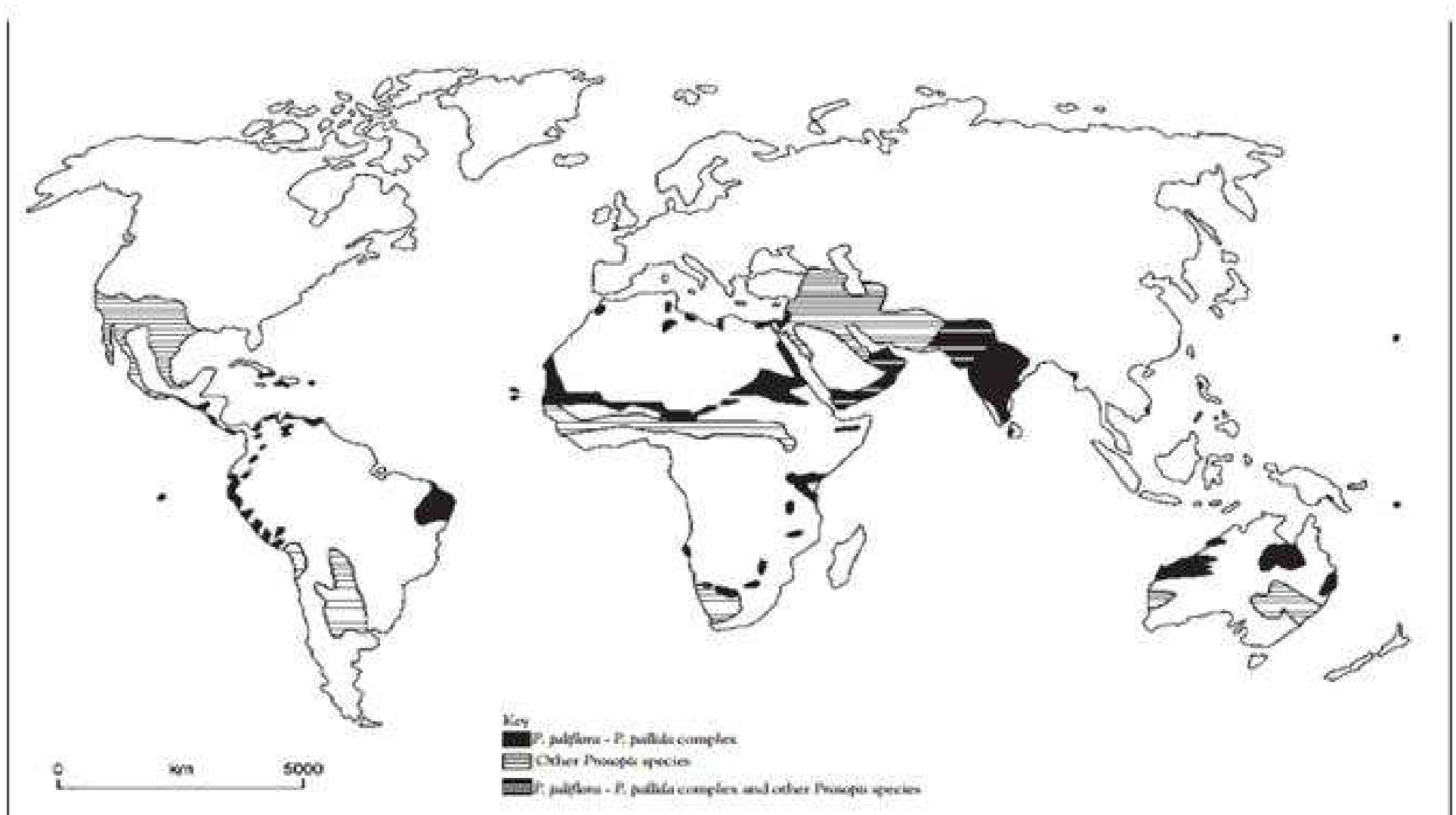


Contribute to food security and economic growth – from areas with high variability



Prosopis juliflora geographical range in the year 2000

(Source: Pasiecznik et al., 2001)



The background of the slide is a dense, close-up photograph of the Prosopis juliflora plant. The leaves are small, green, and feathery, typical of the species. The image is slightly blurred and has a semi-transparent white overlay where the text is placed. A thin green vertical line is visible on the left side of the slide.

Prosopis Juliflora in Spate Irrigation

- Increasing fast
- Clogs canals and reduces their capacity
- Blocks rivers, especially deltas – flooding becomes uncontrolled
- Invades land
- Country overview: Eritrea, Ethiopia, Pakistan, Sudan and Yemen
 - Control or Management of Prosopis juliflora
 - Making use of Prosopis juliflora
 - Conclusions: How to address the Prosopis juliflora challenge?

Eritrea

Introduction purpose	Impact	Mitigation
Early 80s Migration Livestock From Sudan	Crop cultivation more labour intensive and costly, because farmers have to remove seedlings and shrubs from the fields. Infestation still remains low. Potentially it can become a serious risk.	Attempts by local administration under food work. <i>Prosopis</i> simply re-grew. Some research Only measure in place up to this date - and this may not even contribute to the control of <i>Prosopis</i> ' spread - is the approval for the cutting of <i>Prosopis</i> wood from live trees.

Ethiopia

Introduction purpose	Impact	Mitigation
<p data-bbox="459 438 627 486">Late 70s</p> <p data-bbox="459 558 705 718">Biological soil and water agent</p>	<p data-bbox="750 438 1209 542">Afar and Somali regions most affected</p> <p data-bbox="750 614 1243 774">Displacement of natural pasture grasses as well as native tree species.</p> <p data-bbox="750 845 1288 1125">Originate from many small villages, extending along the main (water) routes; now steadily advancing into the surrounding landscape.</p>	<p data-bbox="1332 438 1937 893">Controlling <i>Prosopis juliflora</i> in the Afar region in a number of ways. Mass campaigns to clear <i>Prosopis juliflora</i> have been organised. Control through utilization such as charcoal production and pod crushing, recently bricket making</p> <p data-bbox="1332 965 1993 1356">Not much could be done to eradicate or control <i>Prosopis juliflora</i>- need integrated land use planning, community mobilization, technology transfer, private sector participation and supply of resources.</p>

Pakistan

Introduction purpose	Impact	Mitigation
<p>Second half of 19th century – but quick acceleration in recent two decades</p>	<p>Prosopis juliflora slows down the silt flow in the canals.</p> <p>Obstructs livestock from accessing drinking water.</p>	<p>Focus on productive use</p> <p>Research to cultivate Prosopis juliflora in saline areas for providing fodder, fuel wood and timber</p>
<p>Control soil erosion and desertification</p>	<p>Suppresses natural vegetation and dominating fallow lands.</p> <p>Selling Prosopis juliflora as fuelwood or as charcoal is a popular business</p> <p>Farmers use branches for fencing</p>	<p>Prosopis juliflora is used along the coast of Balochistan for sand dune control and prevention of sea incursion.</p>

Sudan

Introduction purpose	Impact	Mitigation
1917 Stabiize sand dunes	<p>Large areas invaded in drought-prone areas</p> <p>In Gash, decrease in the channel discharge capacity (25%), reduction in groundwater level, land infestation</p> <p>Source of fodder and river bank stabilization,</p> <p>Income from charcoal making and fuel wood from <i>Prosopis juliflora</i>.</p>	<p>Campaign in 1996 by the Kassala state government to eradicate <i>Prosopis juliflora</i> through community mobilization. In 2005 private companies were contracted. Mechanical, chemical and biological methods were used.</p> <p>Gash livelihood project (2004): Land was titled to farmers on the condition that it would be taken back if they could not control the shrub.</p> <p>Re-infested in the Gash delta. Lack of follow up programs, inadequate management and weak enforcement of regulations played a major role.</p>

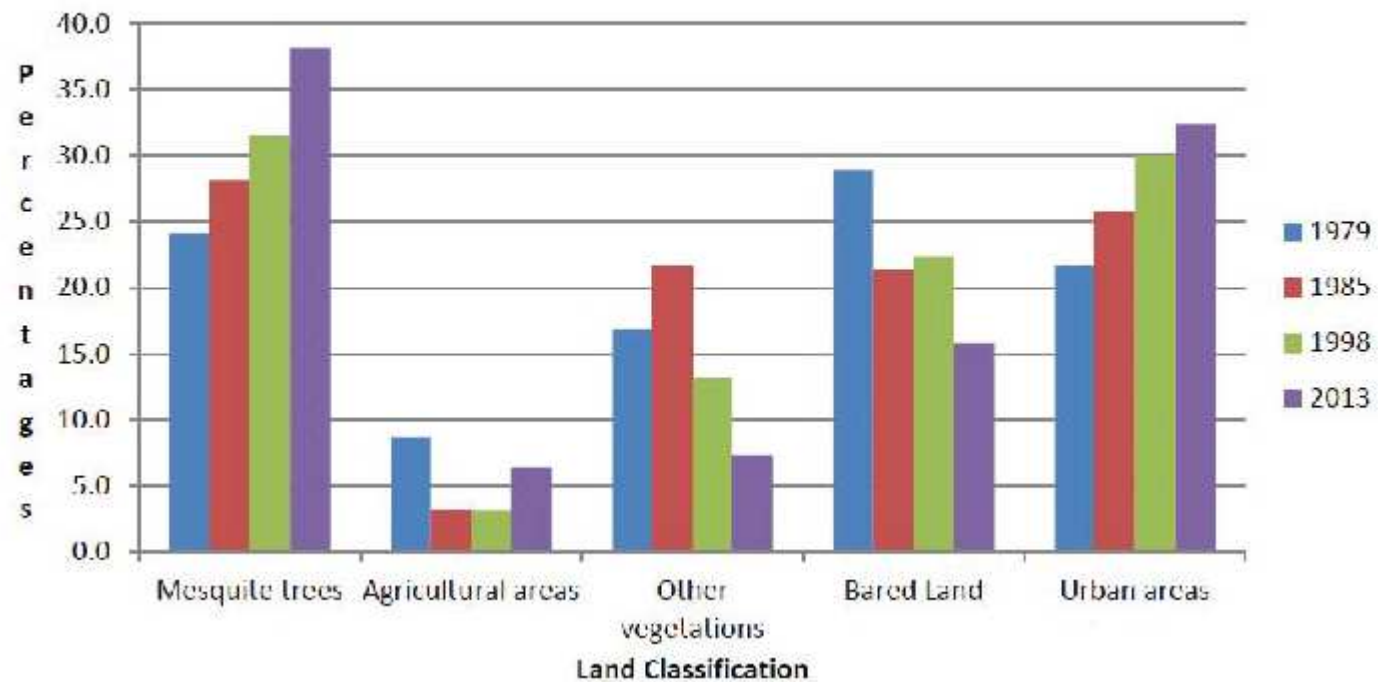
Yemen

Introduction purpose	Impact	Mitigation
<p>1974</p> <p>To combat soil erosion and dune movement</p>	<p>In wadi Hajar, causing floods by blocking watercourses and diverting floodwater into villages.</p> <p>Investation of productive land in Hodeidah governorate, Hadramout, Lahej, Abyan and Shabwa</p> <p>Drying out data palms – destabilizing coastal areas</p>	<p>FAO implemented a project to manage and control <i>Prosopis juliflora</i>. Farmers were trained in the use of <i>Prosopis juliflora</i> pods for animal feeding and the stems of the plant for firewood.</p> <p>Pods became a profitable enterprise for the farmers.</p>



Land cover change in the Gash scheme, Sudan.

Land Cover Change on GAS, Kassala state in Sudan (1979-2013)



Effect of Prosopis Juliflora infestation on canal discharge capacity in the Gash scheme.

Intake canal	Canal discharge capacity of canal design (m ³ /s)	Canal discharge capacity after infestation of mesquite trees (m ³ /s)	Crop production* year	Crop production (bags)**	
				Harvest (bags)	Expected production (bags)
Fola	10	7.5	2006	16	22
Salamaleko	30	22.5	2007	20	27
Makati	20	15	2008	24	32
Digeni	58	23.5	2009	30	41
Tendalal	20	15	2010	13	13
Matatelp	20	15	2011	10	14
Hadalia	20	15	2012	14	15
Kassala	Not measured, very small canal size		2013	Not harvested	

* Crop-Sorghum
 ** 1 bag = 100 kg

Methods of control





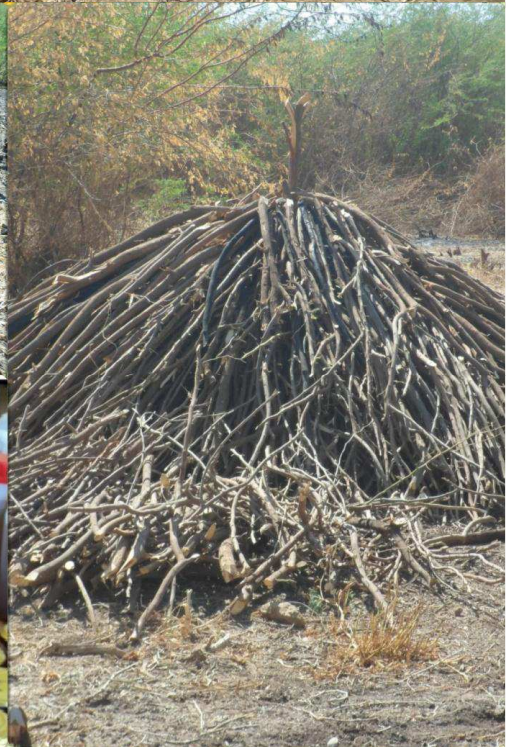
Control and Management

- **Biological:** (predators/ pathogens such as *Algarobius bottimeri*, *Algarobius prosopis*, *Prosopidopsylla flava* and *Evippe spp*)
 - Experimented in Sudan and Australia
 - Slow process
- **Burning** the stump with kerosene after it has been cut (Yemen)
 - Works when plant is dry and roots not too deep

Control and Management

- **Mechanical:** (stick racking, chain pulling, bulldozer pushing and blade ploughing)
 - Effectiveness depends on soil moisture
 - Reinfestation esp. when much young trees and seedlings
 - Maintenance and follow up care is important
- **Chemical:** (Round up, 2-4 D, Glenside, Kerosine and diesel oil)
 - Cutting and spraying/painting freshly cut stems
 - Use when plant is actively growing, but before having pods

Beneficial use



The background of the slide is a dense, close-up photograph of the foliage of Prosopis juliflora. The leaves are small, pinnate, and green, with some reddish-brown stems visible. The image is slightly blurred and has a semi-transparent white overlay where the text is placed.

Making use of prosopis juliflora

- Fuel wood, charcoal and brickets
- Biomass feed for energy plants
- Timber (if not too craggy)
- Fodder
- Land reclamation (tera preta, biochar)
- Honey, gum and sugar




No single remedy: focus on combination of control and making use of Prosopis juliflora

Positive Aspects

- Can play a role in sustaining the livelihood of poor rural households
- Source of fuel and dry season animal feed
- Wood does not spit, spark or smoke excessively (produces good charcoal)
- High quality and hard timber (can be processed into furniture or construction material)
- Good animal feed
- Can act as vegetative fencing to delimit and protect properties

Negative aspects

- Lack of traditional knowledge on how to manage and control the plants
- Obstructs paths and roads
- Hard and costly to remove
- Expands quickly even in the hardest conditions
- Thorns can injure animals and people
- Depletes the water moisture and groundwater
- Few plants are able to grow under its crown shade
- Can favor the breeding of malaria spreading mosquitoes
- Causes pastoralists communal lands to shrink.

The background of the slide is a dense, close-up photograph of Prosopis juliflora (mesquite) foliage. The leaves are small, pinnate, and green, with some brownish stems visible. The image is slightly blurred and has a soft, natural lighting. A thin green vertical line runs along the left edge of the slide, and a thin green horizontal line runs along the bottom edge.

Conclusions: How to address the Prosopis Juliflora Challenge in Spate Irrigation Systems?

- Intense land use planning and regulation – not allow cattle movement between areas
- Combine ‘combating’ and ‘utilizing’
- Focus on removal from water ways, highly productive land or land important for local food security
- Land using communities encouraged to uproot seedlings when still easy to remove
- Promote innovative uses (bio-char or energy bio-mass - bricketing)
- Alternative land uses – Acacia charcoal plantations
- Introduce broader range of eradication measures

www.spate-irrigation.org

