The 2019 annual meeting of the COST Action CONVERGES ,Pruhonice (Czech Republic), 3-4th April

Eco-Hydro-Geomorphological Assesment of River Restoration Project: Tzipori Stream as a Case Study

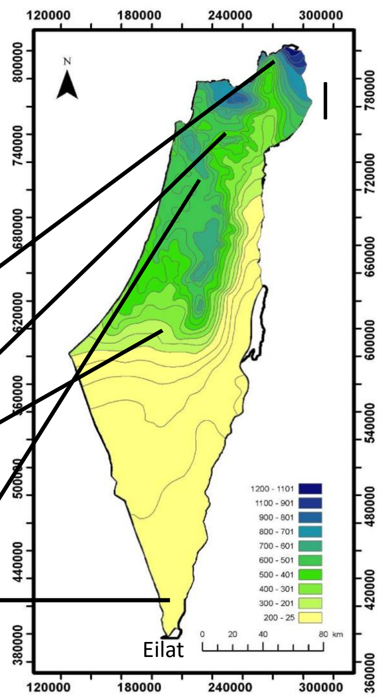
Roey Egozi
Oraha Moshe
Marcelo Sternberg
Tal Ratner

רשות ניקוז ונחלים קישון
THE SOIL EROSION RESEARCH STATION
Soil Conservation & Drainage Division
Ministry Of Agriculture
TEL AVIV UNIVERSITY אוניברסיטת תל אביב

Backgrond

Rainfall regime gradient

Riparian vegetation



Motivation

Intervention actions
Documentation ?

Establish a detailed baseline to asses Pre- & Post- intervention / restoration actions

A baseline for long-term monitoring of river processes

River assessment- methodology & context

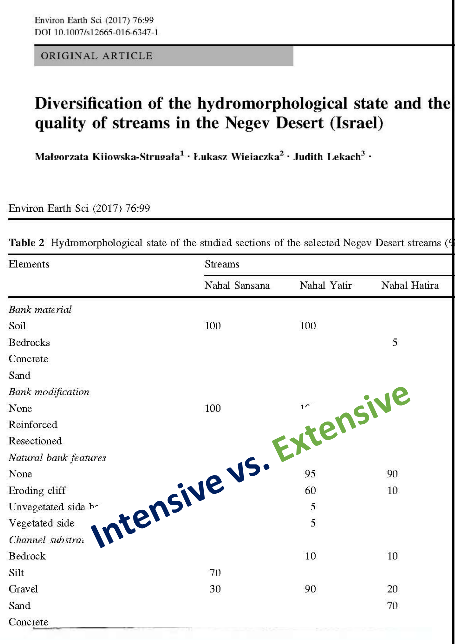
Variety of indices e.g.,
- River Habitat Survey (RHS; UK)
- National Physical Habitat Index (Denmark)…
- Rapid Assessment Protocols For Use in Streams & Wadeable Rivers (USA)

↓

- Rapid Assessment Protocol

↓

- Morphological Quality Index (MQI; Rinaldi et al, 2013)



Environ Earth Sci (2017) 76:99
DOI 10.1007/s12665-016-6347-1

ORIGINAL ARTICLE

Diversification of the hydromorphological state and the quality of streams in the Negev Desert (Israel)

Malgorzata Kijowska-Strugala[1] · Łukasz Wiejaczka[2] · Judith Lekach[3] ·

Environ Earth Sci (2017) 76:99

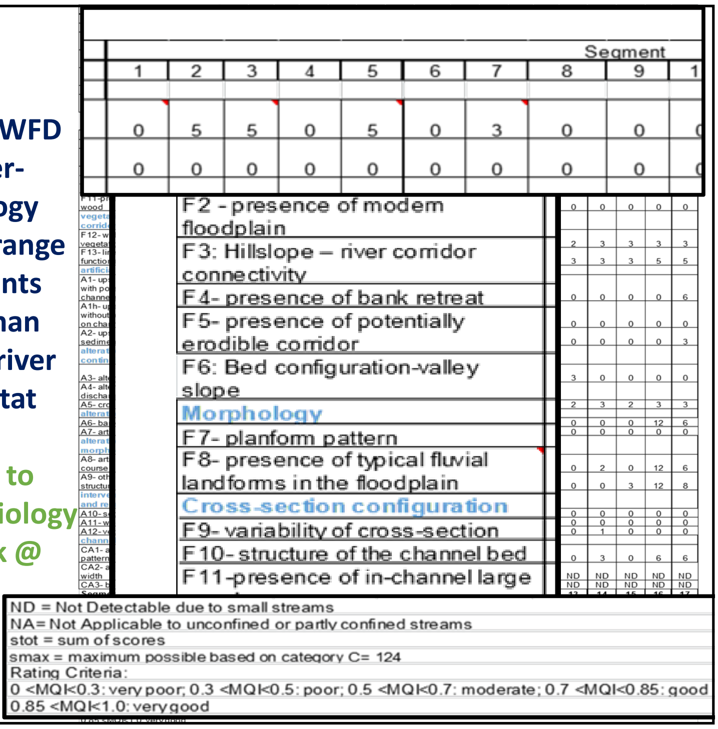
Table 2 Hydromorphological state of the studied sections of the selected Negev Desert streams (%

Elements	Streams		
	Nahal Sansana	Nahal Yatir	Nahal Hatira
Bank material			
Soil	100	100	
Bedrocks			5
Concrete			
Sand			
Bank modification			
None	100	[illegible]	
Reinforced			
Resectioned			
Natural bank features			
None		95	90
Eroding cliff		60	10
Unvegetated side [illegible]		5	
Vegetated side		5	
Channel substra[illegible]			
Bedrock		10	10
Silt	70		
Gravel	30	90	20
Sand			70
Concrete			

Inbar, 2008

MQI

- Comply with WFD
- Focus on River-Geomorphology
- Applied to a range of environments
- Consider human alteration of river
- Riparian habitat assessment
- Does not aim to cover hydrobiology
- Does not look @ water quality



MQI

- **Does it work in the case of Mediterranean Streams?**
- **Does it work in the case of long-term & intensive anthropogenic impact**

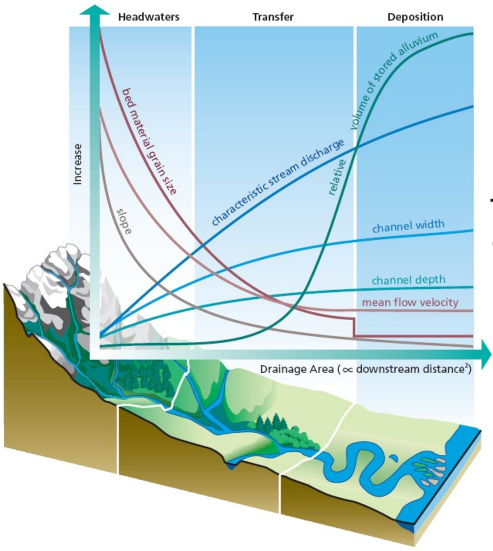
JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION
Vol. 51, No. 2 AMERICAN WATER RESOURCES ASSOCIATION April 2015

CAN RAPID ASSESSMENT PROTOCOLS BE USED TO JUDGE SEDIMENT IMPAIRMENT IN GRAVEL-BED STREAMS? A COMMENTARY[1]

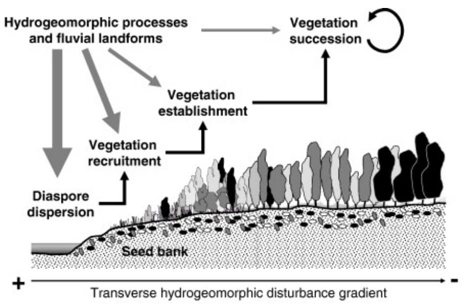
Thomas E. Lisle, John M. Buffington, Peter R. Wilcock, and Kristin Bunte[2]

Human Cause	Natural Cause	Geomorphic Response	Channel Change
Logging, roads, urban development, vegetation conversion, grazing, off-road vehicles (ORVs) dam removal, climate change	Wildfire, landslides, debris flows, large floods, channel migration	Increased total sediment input Increased fine sediment input	Finer surface grain size
Water diversion, climate change	Forest growth, stream capture	Decreased flow	
Grazing, ORV traffic	Meander migration	Channel widening	
Gravel mining, ORV traffic, suction dredging, grazing	Intensive salmon spawning	Armor layer disturbance	
Impoundments, grade control structures	Log jams, tributary deltas, landslide deposits	Deposition from backwater effects	
Habitat structures, logging slash	Woody debris	Increased form roughness	
Dams, watershed rehabilitation, gravel mining	Watershed recovery, debris flows, log jams	Decreased sediment input	Coarser surface grain size
Gravel injections, hillslope disturbance	Debris flows, landslides, tributary inputs	Inputs of coarse sediment	
Transbasin diversion, flow releases	Large runoff events	Increased flow	
Stream cleaning, channelization	Scour by large floods	Decreased form roughness	
Causes for increased sediment input (see above)	Causes for increased sediment input (see above)	Increased sediment input	Channel widening
Grazing, dewatering of riparian vegetation	Succession from sod to forest, increased meandering	Weakening banks	
Logging, development, roads, channelization, climate change	Wildfire, large floods, change in flow regime	Increased peak flow	
Causes for decreased sediment input (see above), stream cleaning	Causes for decreased sediment input (see above), scour of wood	Channel incision from decreased sediment input or roughness	Channel narrowing
Disturbance of fine-grained soils and bedrock	Volcanic ash eruptions	Increased suspended sediment to build banks	
Peak flow reduction below dams, fine-sediment inputs (see cause above)	Fine-sediment inputs (see cause above), reduced peak flows	Riparian encroachment	
Grazing, impacts leading to increased runoff, removal of large wood from channels	Steep landscapes with fine-grained, cohesive sediments	Gullying	
Channelization, stream cleaning	Debris flows and floods	Loss of scour elements	Decreased pool frequency and/or volume
Causes for increased sediment input (see above)	Causes for increased sediment input (see above)	Increased sediment input	
Grazing, removal of woody riparian vegetation, desiccation of riparian vegetation by water withdrawals	Bank erosion by floods, natural loss of riparian vegetation	Channel widening	
Habitat structures, logging debris, blowdown of riparian buffers	Wood inputs, debris flows and landslides	Gain in scour elements	Increased pool frequency and/or volume
Causes for decreased sediment input (see above)	Causes for decreased sediment input (see above)	Decreased sediment input	
Suction dredging		Direct effects	

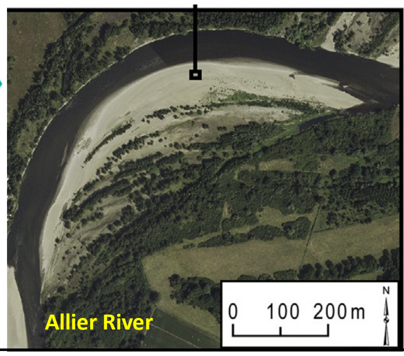
Contextual Approach



Church, 1992 in Robert, 2003



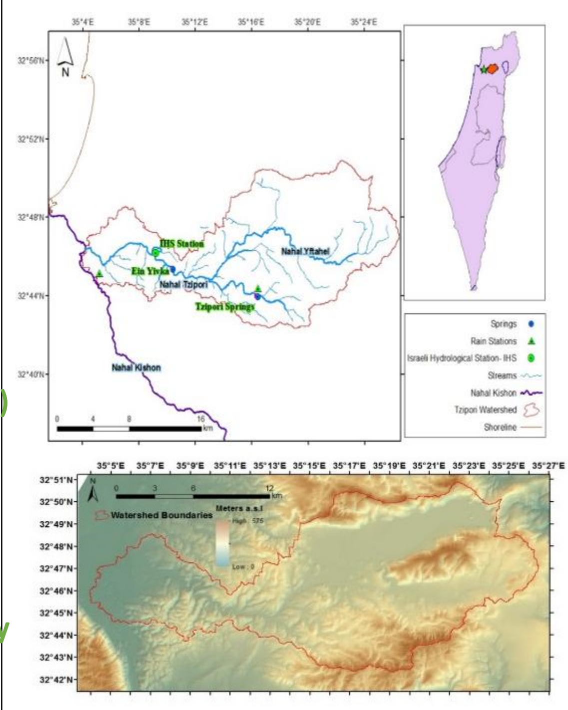
Corenblit et al., 2007



Hortobagyi et al., 2017

Nachal Tzipori

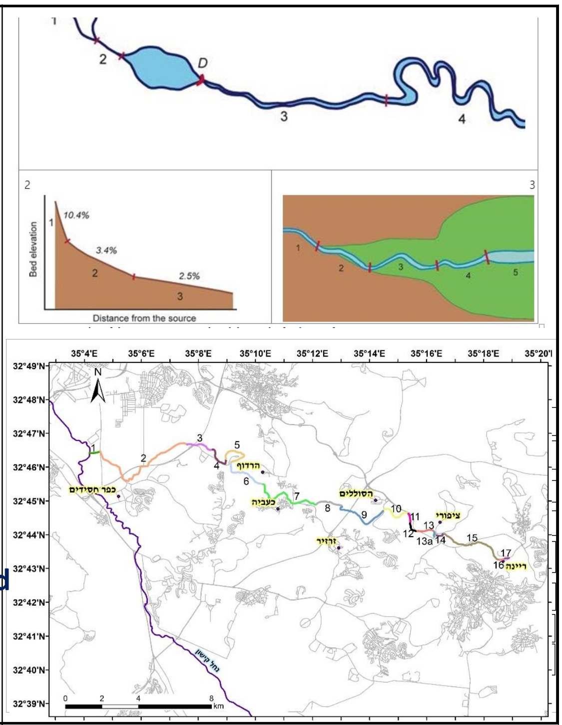
- **Drainage area: 293 km^2**
- **Mediterranean climate**
- **Mean annual rain depth: ~550mm**
- **Main stream: 32 km**
- **Main tributary- Nachal Yiftachel**
- **Several springs (2-3 M m^3) Ein Yivka, Einot Tzipori, Einot Yiftachel**
- **River restoration projects**
- **Public recreational use by 1 million people**



MQI - Parameters

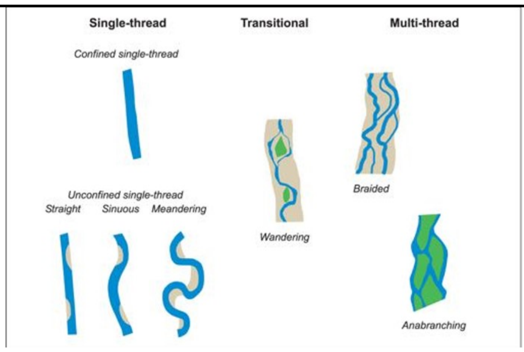
A total of 17 river Segments based on:

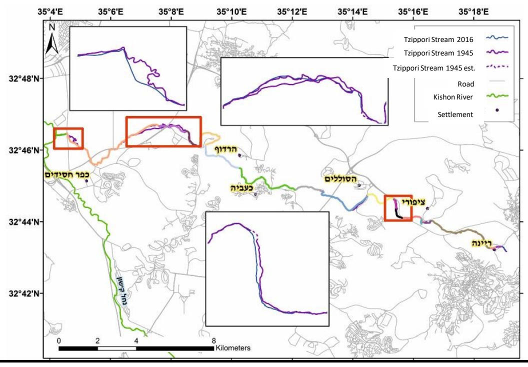
- **River longitudinal profile**
- **Changes in river - width & size**
- **Hydrological Discontinues- dams, reservoirs, infrastructure**
- **176 Cross sections collected**



MQI - Parameters

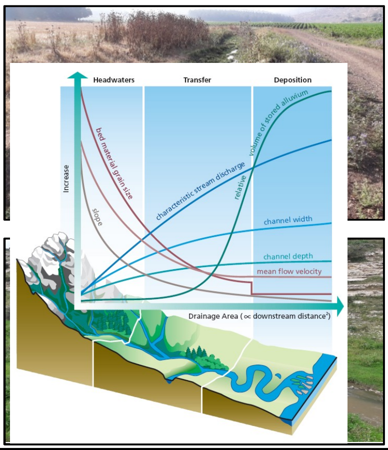
- **Stream channel pattern**
- **Stream sinuosity**
- **Altering sediment transport regime**

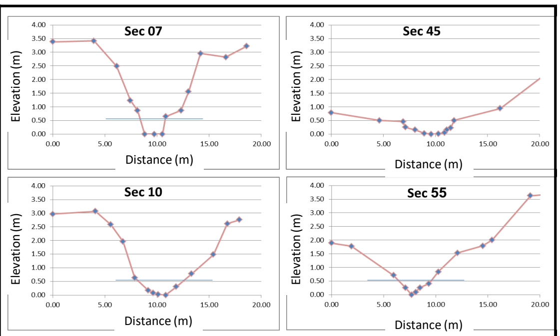


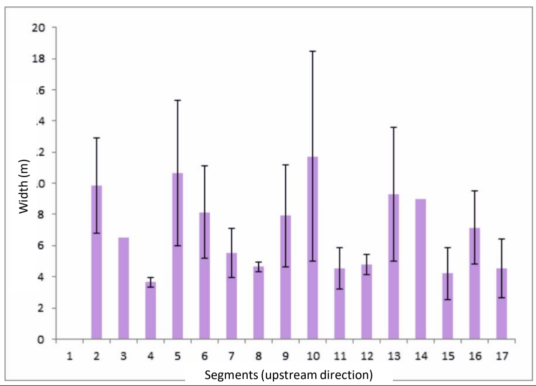


MQI - Parameters

- **Stream cross sections**
- **Channel incision**
- **Lateral connectivity**

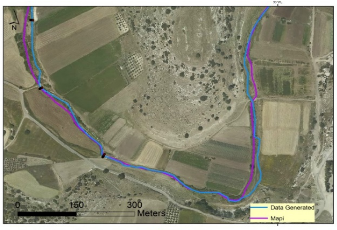


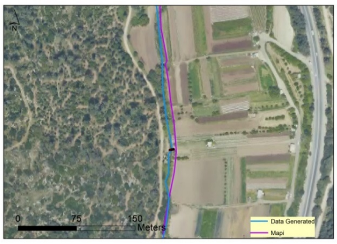




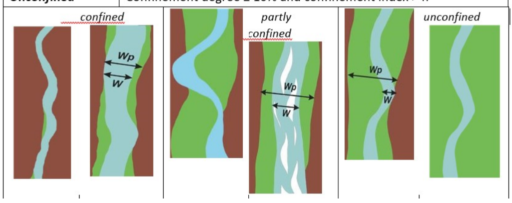
MQI - Parameters

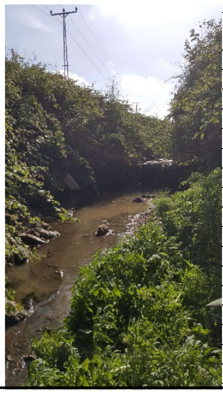
- **Stream confinement**
- **Stream-Floodplain coupling**





Confinement class	Description
Confined	All cases with confinement degree > 90%
	Confinement degree from 10% to 90% and confinement index ≤ 1.5
Partly confined	Confinement degree from 10% to 90% and confinement index > 1.5
	Confinement degree ≤ 10% and confinement index ≤ n
Unconfined	Confinement degree ≤ 10% and confinement index > n

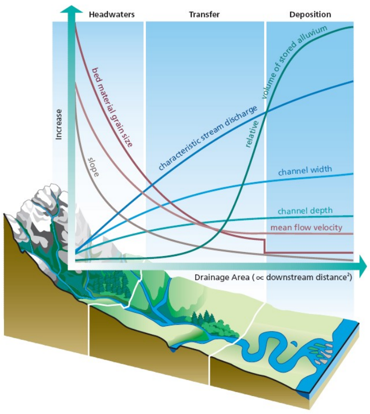


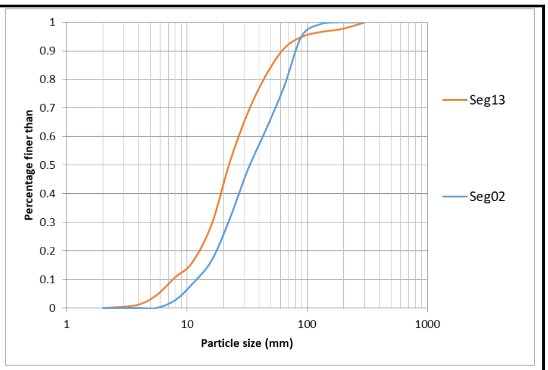


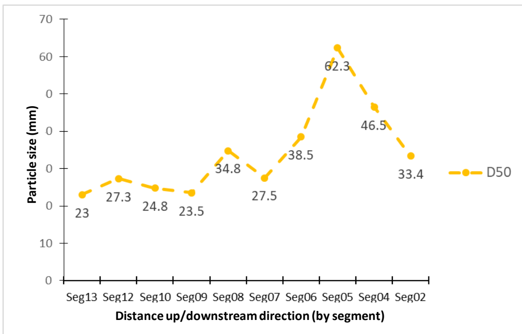
Segment	Sinuosity Index	Confinement Index
1	1	-
2	1.4	103.3
3	1.1	80.8
4	1.7	212.6
5	6.4	109.1
6	1.2	48
7	1.3	76.3
8	1.1	102.2
9	1.4	58.9
10	1.3	27.2
11	1	46.3
12	1.2	46.2
13	1.1	51.1
14	1.2	105.7
15	1.2	53.7
16	1.1	39.7
17	1	29.3

MQI - Parameters

- **Bed material**
- **Downstream fining**

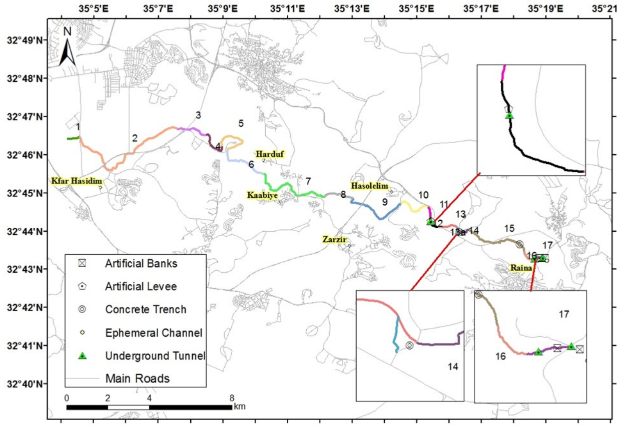


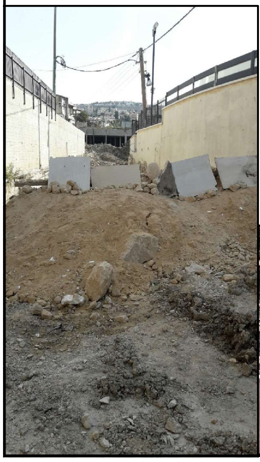




MQI - Parameters

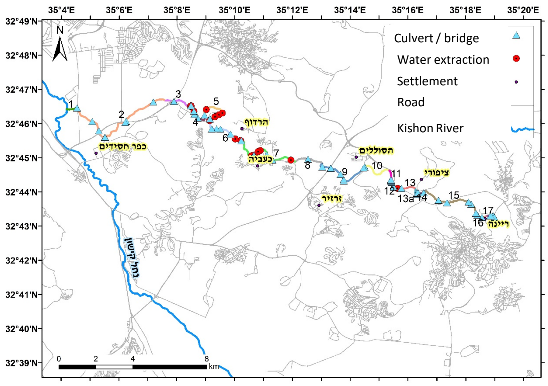
- **Artificial structures**
- **Artificial bed & banks**



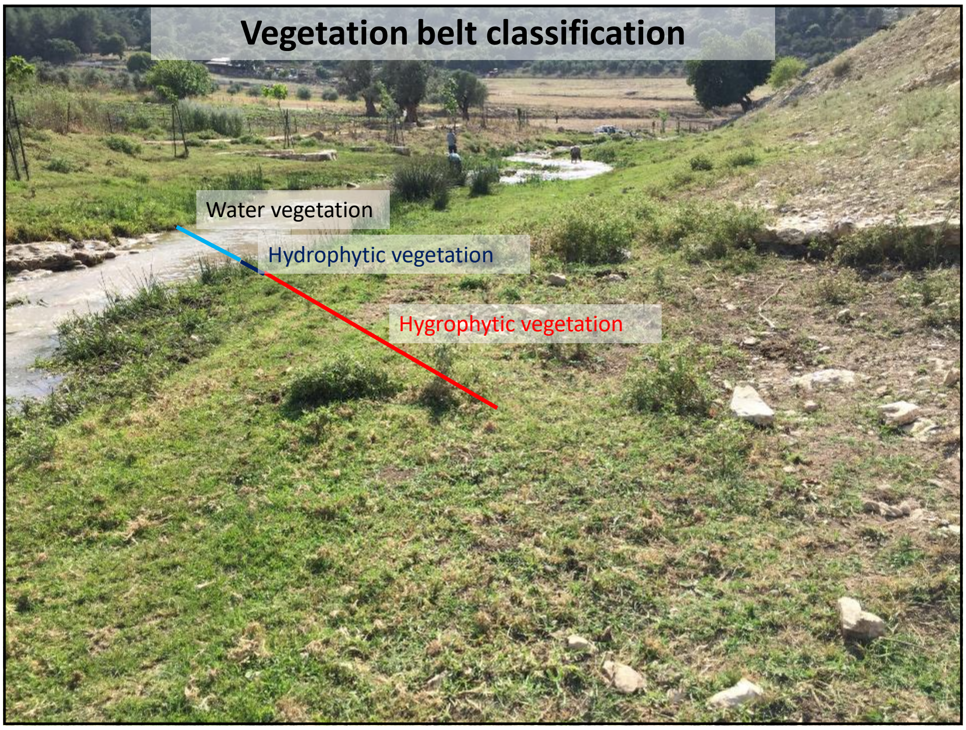


MQI - Parameters

- **Hydraulic constraints**
- **Discontinuity of water & sediment flux**



Vegetation belt classification



Narrow river banks surrounded by agricultural fields

Lateral extent of Riparian vegetation ranged from 9.2 m to 2.6 m – **mean 6.2 m**

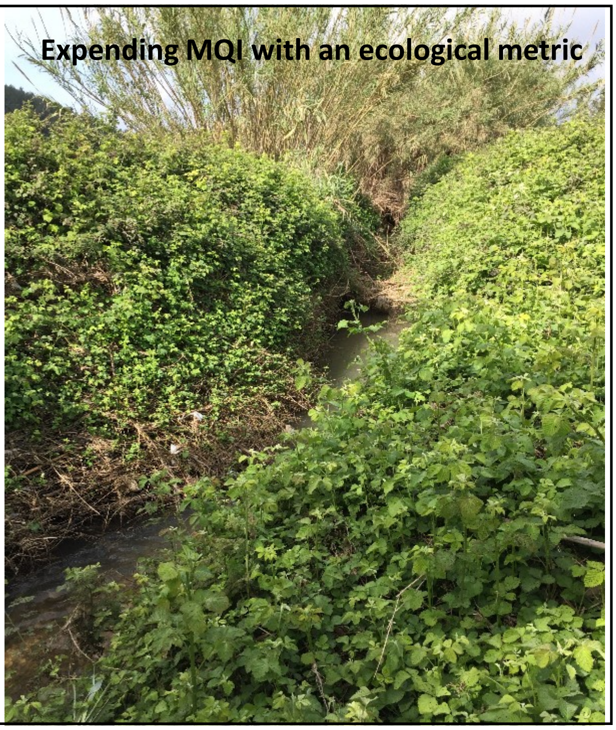
Some areas agricultural lands extend directly to the stream with total absence of functional Riparian vegetation

Riparian vegetation dominated by *Rubus sancta* and *Phragmites australis.*

Monotypic species dominance – Mean species richness per transect range from 2 to 5.2 species

Rubus sancta - 32% cover along the stream

58 plant species limited to a cover of 3%



Cattle grazing along and inside the stream

Highly degraded riparian vegetation dominated by ruderal species

Water quality degradation

Goats grazing along the stream

Shepherds remove locks on fenced restored vegetation areas

Conclusions

Focus on the geomorphological resulted overall in "good value"

Good tool – consistent approach / methodology for comparing / assessing coastal perennial streams

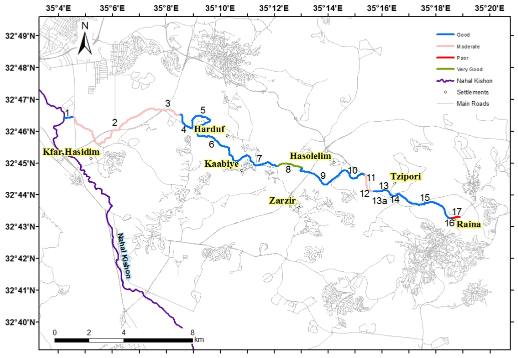
Riparian zone degraded, low ecological value

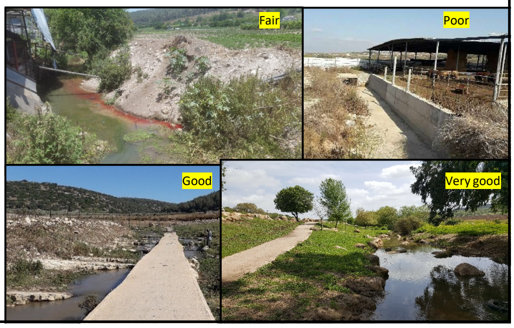
MQI applicable but limited. Provides consistent methodology but needs more holistic metrics

Future work needs to customizing the protocol for agricultural watersheds

Biophysical dysfunctional system

Guiding Intervention actions in Tzipori Stream





Acknowledgments

- Ido Drori; Gil Shtraus; Beeri Kanner – Etgar
- Ofer Cohen – TAU
- Nekudat Hen for their funding