# Towards biological restoration of Tehran megalopolis river-valleys case study: Farahzad river

University of Tehran

[1]Nafiseh Samadi, [2]OveisTorabi, [3]Hossein Akhani, [1,3] Halophytes and C4 Plants Research Laboratory, School of Biology, University of Tehran, nafisehsamadi@khyam.ut.ac.ir, [2]Mahsab Shargh Company, Tehran ,Iran, 2weg@tna-co.com

Mahsab Shargh Consulting Eng. (MSCE)

## Introduction

Tehran, the capital of Iran is located in northcentral parts of Iran on the alluvium of southern Alborz Mountains. Seven rivers originated from the highlands of north Tehran run inside and around the city. The Farahzad river which originates from Tochal mountains, is a permanent river running along the eastern boundary of Pardisan Nature Park. Farahzad River valley like as many of these river valleys has been deformed by a variety of urban utilizations such as building, canals, parks, streets, highways etc. People of Tehran are affected by adverse environmental conditions such as air pollution and scarcity of natural habitats for recreational purposes. Ecological restoration of altered river valleys is one of the priorities of Tehran municipality and has been started as a pilot project in Farahzad river.

❑ **Restoration Goals:** 1. To improve and rehabilitate physico-geographical structure of the area. 2. To restore ecosystem function, vegetation and wildlife habitat. 3. To improve hydrological structure of the area either based on topography or rehabilitation of traditional system known as Qanat.

❑ **Challenges:** Restoration face with different challenges in urban river valley like Farahzad River. Some of these challenges illustrated in fig.1.


Fig. 1. Challenges in the pilot of project: 1. Illegal building construction, 2. Garbage, 3. Waste water release.

## Material & Methods

**Study area:** The pilot restoration project aims to restore 3.2 km of 12.3 km of the river valley where the river is still running in its original/semi-natural place (fig.2). Aerial photos from 1956 and vegetation data collected during 2002 in Pardisan park (3 km southern parts of the valley) by H. Akhani and V. Zarrinpour are used as reference (1).

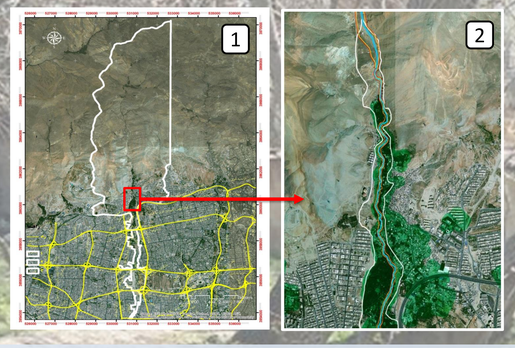


Fig.2: 1.Study area boundary, 2. Pilot area: White line: boundary of valley sides, green layer: vegetation zone in 1956 compere with today land use.

## Results

**Natural Vegetation before 2002:** Plant communities of the Farahzad valley Pardisan Park and montane steppes in the northern parts of the area have been investigated (Table 1). The vegetation of riverine habitat is mostly composed of arboreal species such as *Salix acmophylla, Tamarix ramosissima, Fraxinus excelsior. Halimodendron halodendron* excited as a small patch on a steep slope profiting drained aquifers. *Ailanthus altissima* as an invasive species grow in wide range of habitat (fig. 2) and the cultivated species *Pinus eldarica, Cupressus arizonica and Robinia pseudoacacia* are widely cultivated in the area in particular in Pardisan Park. The hygrophytic species such as *Phragmites australis, Arundo donax, Eupatorium cannabinum, Typha domingensis, Saccharum ravennae* form communities in deep or shallow valleys depending on the water supply from the river or rain runoff or drained aquifers of the surrounding slopes. 10 plant communities were distinguished in dry steppe of the alluvial sloping grounds in altitudes between 1400 to 2000 m largely dominated by *Astragalus microcephalus, Stipa hohenackeriana, Aegilops columnaris, Taeniatherum caput-medusa, Rosa perica and Astragalus compactus.* The main character of these communities is the absence *of Artemisia*, and a remarkable role of grasses in the earlier vegetation period and thorny drought tolerant of suffruticose species in the latter vegetation period in the physiognomy of the area. A clear tendency from herbaceous versus thorny domination species indicate grazing intensity.

For example the plant communities in Pardisan where have no grazing in the 40 years is well represented by grasses than the the communities on the foothills of Tochal where subjected by grazing.

**Present Vegetation of degraded area:** The degraded area are very heterogenous. The semi-natural parts along the river still support growing of hygrophytic species or shrubs of the steep slopes such as *Tamarix ramosissima*, *Salix acmophylla, Fraxinus excelsior, Celtis caucasica* or cultivated species such as *Morus alba, Juglans regia, Platanus orientalis, Acer negundo and Robinia pseudoacacia* in severely degraded area or areas which buildings are removing, ruderal species and pioneer plants such as *Bassia scoparia, Heliotropium europaeum, Amaranthus blitoides*, *A. retroflexus, Persicaria lapathifolia, Echinochloa crus-galli, Chenopodium spp., Sorghum halepense* etc. are frequent. These are mostly nitrophilous plants which are very effective in denitrification of wastewater runoff flowing from the surrounding residential buildings.


Fig.3. Existing vegetation: 4. *Salix acamophylla* community, 5. planted *Plataneus orientalis*, 6. Domination of *Ailanthus altissima* as an invasive species.

Table 1: A synopsis in plant communities of the area based on previous studies in 2002 (1).

| No. | Pardisan Nature Park, Koye Faraz & Evin prison: Stipa grasslandg. 6 | Plot No. | Elevation | Species Richness | Shannon Diversity Index | Habitat | Threats |
|---|---|---|---|---|---|---|---|
| 1 | *Polygonum paronychioides-Stipa hohenackeriana* comm. | 62 | 1400-1470 | 35.8 | 3.42 | Alluvial undulating slopes, soil with scree | Natural places in some parts with low disturbance |
| 2 | *Tragopogon pterocarpus- Stipa hohenackeriana* comm. | 10 | 1415-1457 | 41.6 | 3.54 | Alluvial undulating slopes, soil with scree | Soil disturbance caused by road and bulding construction, in some parts nearby cultivated area by Cupressus arizonica and Robinia and irrigation facilities |
| 3 | *Medicago monspeliaca-Aegilops columnaris* comm. | 21 | 1400-1435 | 29.8 | 3.13 | Valley bed, soil rich in scree | Trampling, flooding, fire |
| 4 | *Rosa persica* comm. | 7 | 1420-1440 | 24.14 | 2.87 | Ruderal place | Intervals of Robinia and Fraxinus trees, irrigation, trampling |
| 5 | *Ducrosia anethifolia-Bromus sterilis* comm. | 6 | 1430-1480 | 28 | 3.13 | W-facing steep slopes of the Cupressus and Robinia cultivated zone | Irrigation, civil construction |
| 6 | *Cupressus arizonica-Robinia pseudoacacia plantation* | 25 | 1420-1480 | 29.7 | 3 | Dense Cupressus-Robinia stands | Irrigation, weeding |
| 7 | *Pinus eldarica-Robinia pseudoacasia plantation* | 11 | 1430-1455 | 32 | 3 | Semi closed Pinus eldarica with small Robinia trees | Irrigation, weeding |
| 8 | *Halimodendron halodendron* comm. | 3 | 1380 | 20.3 | 2.15 | Steep west slope of the valley | Destroyed for park construction |
| 9 | *Astragalus compactus-Stipa arabica* comm. | 10 | 1800-1840 | 40.5 | 3.53 | Alluvial undulating slopes | No impact, strictly protected |
| 10 | *Leutea capularis-Ferula persica* comm. | 5 | 2000-2020 | 20.8 | 2.9 | Scree and gravelly steep slope | Moving gravel, close to a calcareous mine |
| 11 | *Sophora alopecuroides-Galium nigricans* comm. | 7 | 2000-2050 | 29.14 | 2.96 | Road side close to sloping ground | Irrigation and disturbance |
| 12 | *Onosphyxa micraphylla-Astragalus microcephalus comm.* | 15 | 1945-2035 | 18.4 | 2.45 | Alluvial slopes with gravel particles | Human activities |
| | Hygrophilous Communities | | | | | | |
| 13 | *Ailanthus altissima-Salix acmophylla* comm. | 9 | 1370-1380 | 24 | 2.23 | Sandy-gravelly river margin and bed | Destroyed for park construction |
| 14 | *Tamarix ramosissima-Salix acmophylla* comm. | 11 | 1365-1400 | 30 | 2.48 | Riverside with gravelly soil | Destroyed for park construction |
| 15 | *Eupatorium cannabinum-Phragmites australis* comm. | 6 | 1380-1405 | 10.5 | 1.67 | East slope of Farahzad valley | Destroyed for park construction |
| 16 | *Taeniatherum caput-medusae-Phragmites australis* comm. | 11 | 1390-1430 | 18.73 | 2.25 | Emerged underground water from steep east slopes | Destroyed for park construction |
| 17 | *Typha domingensis-Mentha longifolia* comm. | 4 | 1407 | 3 | 0.71 | Bottom of valley along stream | Sometimes fire, drying up the stream |
| 18 | *Saccharum ravennae* comm. | 5 | 1380-1415 | 17.2 | 1.8 | Along the moist valley | Fire |

## Restoration planning

1. Study the existing biodiversity and habitat condition
2. Identifying of degrading factors and recovering soil and topography (destroying illegal buildings in riparian buffer zone, purifying wastewater, controlling and eliminate the invasive plants)
3. Estimation of the riparian buffer zone: 150 m as ecological buffer and 50 m as conservation zone in each sides of the river
4. Select reference landscape to determine plants community structure(5) (Table 1)
5. Salvage vegetation: Conservation of existing plants and planting target species (trees and shrubs) based on planting design
6. Using native ruderal and nitrophilous species for phytoremediation of soil and water (2,3). Most occurred species in the area: *Phragmites australis, Amaranthus* spp., *Chenopodium* spp., *Echinochloa crus-galli*
7. Monitoring the establishment and sustainability of the revegetated area
8. Habitat restoration

## Reference

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