STUDY ON THE RELATIONSHIP BETWEEN HUMAN ACTIVITES AND SPATIAL DISTRIBUTION CHANGES OF *TAMARIX* IN EJINA OASIS

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1. INTRODUCTION

Riparian zones are lands directly adjacent to rivers and streams. In the arid regions, they form remarkably corridors embedded on desert matrix. Riparian zones are an extremely small component of the desert landscape [1]. However, Riparian zones are highly valued resources in the arid regions owing to their high use by animals, their high productivity and biodiversity, and their function in stabilizing riverine environments [2]. Because they cover such a small area and have high biological value, the goal of protection of riparian ecosystems has a higher management priority than nearly any other habitat type in the region that does not contain endangered species. *Tamarix* is a dominant species of riparian vegetation in Ejina Banner desert located northwest China. It is currently undergoing rapid depletion and fragmentation because of direct conversion to irrigated cropland and urban areas. Our objective in this study is to estimate the spatial changes of *Tamarix* shrub by calculating its biomass.

2. MATERIALS AND METHODS

2.1 Data collection

20 sample plots, each being 40 m×40 m in size, were located to measure the species density, the shrub height, canopy perimeter in 2009. The location of each plot was measured with a global positioning system (GPS). Quickbird data were bought from China remote sensing satellite ground station. 91 branches were randomly selected in the plots, measuring the basal perimeter, height and weight of each branch. All branches in three thickets were measured besides their height and canopy perimeter. The data from sample plots were used to build the relationship between biomass and morphologic factors (i.e. height and perimeter). Quickbird image

data were used to extract the information about distribution of *Tamarix* and land use types. Outline of *Tamarix* patches were extracted. And then perimeters and area of the canopy were calculated in ArcGIS.

3. RESULTS

3.1 Biomass of the shrub branch

The relationship model between biomass and height and basal perimeter of branches, can be built based on the investigation data as follows [3]:

$$w = 13.67 + 0.05069 d^2 h \quad (R^2=0.903,\ F=550.9,\ RMSE=191.5\ g) \qquad (1)$$

where, *w* denotes biomass (kg), *d*, basal perimeter (cm) and *h*, height (cm) of single branch.

3.2 Estimation of thicket Biomass

The relationship model between biomass and morphological factors of *Tamarix* thicket (height and canopy perimeter) is expressed [4]:

$$W = -5.753 + 0.09792 P^2 H \quad (R^2=0.951,\ F=267.8,\ RMSE=7.9\ kg) \qquad (2)$$

where *W* is biomass (kg), *H*, height (m) of thicket and *P*, canopy perimeter (m) of thicket. H is highly linear correlated with canopy perimeter, the relationship is:

$$H = 0.9356 P^{0.4572} \quad (R^2=0.809,\ F=126,\ RMSE=0.39\ m) \qquad (3)$$

3.3 Distribution of *Tamarix* shrub in the study area

The image was classified based on a classification technology of the object-oriented [5]. Outline of *Tamarix* patches were extracted (Fig. 1). The distribution area accounts for 90% of total area in the study area. Figure 1 shows large parts suitable for *Tamarix* growth have been converted to farmland.

3.4 Spatial distribution of biomass of *Tamarix*

Perimeters and area of canopy of *Tamarix*, area of farmland were calculated by ArcGIS. The spatial distribution of biomass of *Tamarix* was estimated based on (2) and (3) (Fig. 2). The community of *Tamarix* is dependent entirely on surface or near surface discharge of groundwater for survival. Within riparian corridors, groundwater level varies along lateral (transverse) gradients. Laterally, the groundwater level typically falls with increasing distance from the active channel, paralleling increases in flood-plain elevation that result from sediment aggradation. Along this same gradient, water stress for *Tamarix* growth may increase, due to increase in groundwater depth and decrease in replenishment of shallow soil moisture from overbank floods. Therefore, Tamarix biomass gradually decreases with the increase of water stress. Total biomass of *Tamarix* within entire study area is 69644.7 t. Biomass per unit area is about 0.78 kg/m^2. With the increase of people that transmigrate from other region, many places more suitable for *Tamarix* growth have been converted into farmland. Area transformed is about 127.5 hm^2 each year. Total 9945.9 t biomass of *Tamarix* disappears in ten years in the study area.

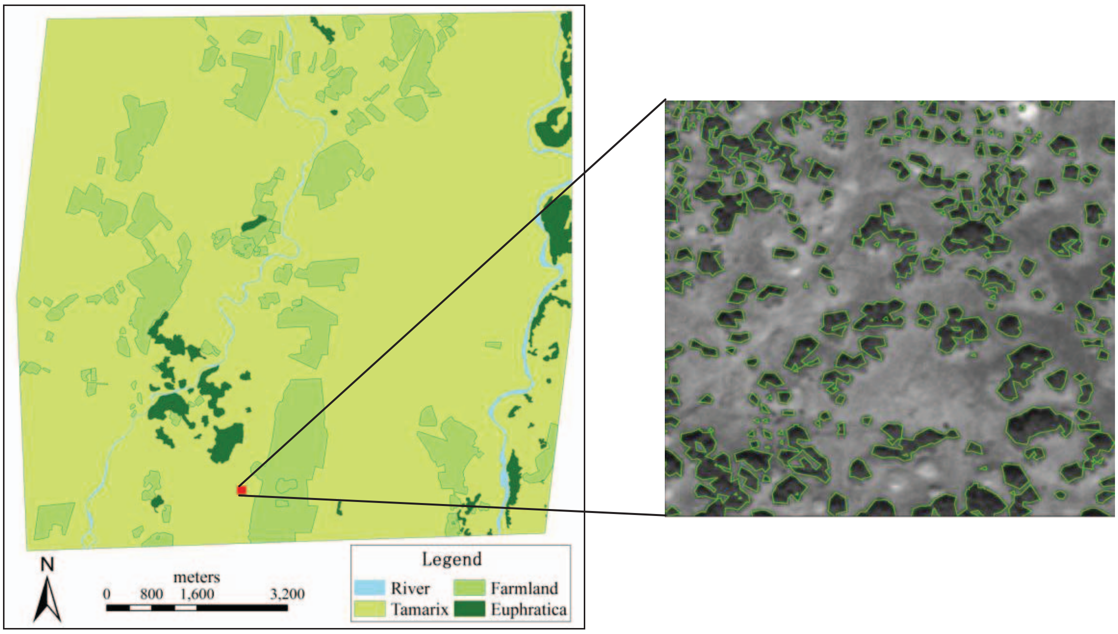

Fig 1 Classification of land use types and distribution of *Tamarix* in the study area (left, classification of land use types; right, *Tamarix* patches in its distribution area)

4. CONCLUSIONS

The biomass of *Tamarix* within entire study area is 69644.7 t, biomass per unit area being about 0.78 kg/m^2 in the study area. A large areas of *Tamarix* distributed have been converted into farmland due to human activities. About 9945.9 t biomass of *Tamarix* shrub has been removed in ten years. *Tamarix* shrub vegetation is currently undergoing rapid depletion and fragmentation. The riparian ecosystem faces a broad range of direct and indirect anthropogenic threats.

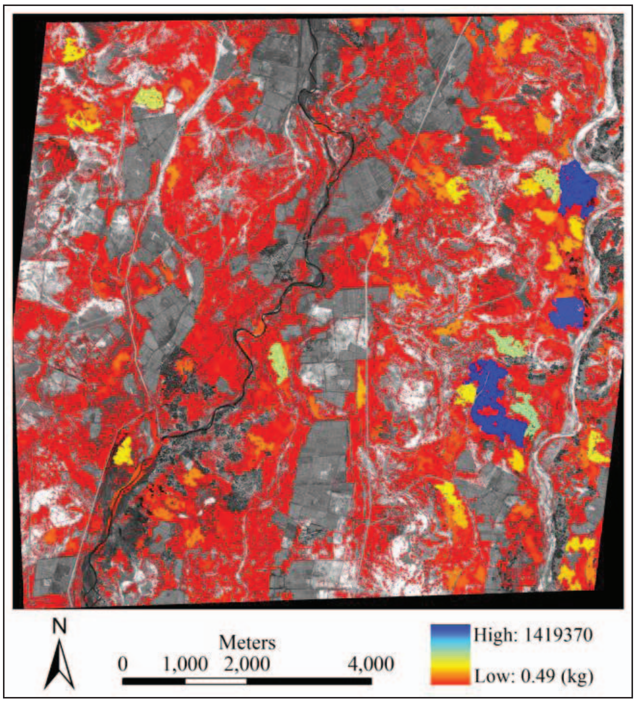

Fig. 2 Spatial distribution of biomass of *Tamarix* shrub in the study area

5. REFERENCES

[1] Howell, J., Benson, D., McDougall, L., "Developing a strategy for rehabilitating riparian vegetation of the Hawkesbury-Nepean River, Sydney, Australia", *Pacific Conservation Biology*, vol. 1, pp. 257-271, 1994.

[2] Lake, P.S., Marchant, R., "Australian upland streams: ecological degradation and possible restoration", *Proceedings of the Ecological Society of Australia*, vol.16, pp. 79-91, 1990.

[3] Dimitris Zianis, Maurizio Mencuccini, "On simplifying allometric analyses of forest biomass", *Forest Ecological and Management*, vol. 187, pp. 311-332, 2004.

[4] Leckie, D.G., Gougeon, F.A., Walsworth, N., "Stand Delineation and Composition Estimation Using Semiautomated Individual Tree Crown Analysis", *Remote Sensing Environment*, vol.85, pp. 355-369, 2003.

[5] K Shackelford, "A Combined Fuzzy Pixel - Based and Object Based Approach for Classification of High - Resolution Multispectral Data Over Urban Areas", *IEEE Transactions on Geoscience and Remote sensing*, vol. 41, no. 10, pp. 2354-2364, 2003.