Soil binding capacity of Phragmites australis and Typha domestic in Hygam wetland

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Abstract: Kashmir is known for beauty as it is bestowed by various natural resources. Lofty mountains specially himalayan region, rivers, forest areas, lakes and wetlands add more beauty and diversity to it. District Baramulla of union territory of Jammu and kashmir is one of the largest District in terms of area and is famous for Hygam wetland. Marshy area of wetland is filled with water throughout the year and is dominated by two species *Phragmites australis* and *Typha domingensis* belonging to two different families poaceae and typhaceae respectively. The load required to remove the root system of each grass vertically from the soil was used as a measure of soil binding capacity. We recorded the soil binding capacity of two species using Large pullout test. *Phragmites australis* with height upto 20 feet can withstand running waters due to its well developed root system and shows highest soil binding capacity.

Keyword: wetland**,** *Phragmites australis*, *Typha domingensis*, soil binding, marshy.

Introduction: Wetlands form a significant part of our ecosystem. Wetlands decrease flooding, remove pollutants from water , recharge groundwater, protect shorelines, provide habitat for wildlife , and perform other various important functions. The wetlands of Kashmir valley are mostly located in the floodplain of River Jhelum and Sindh and are characterized by the varying in Hydro Edaphic features and all the wetlands are linked with each other (Bilal Ahmad, 2020). According to the Directory of Lakes and Water Bodies Jammu and Kashmir (2012) there are 29 wetlands in Jammu and Kashmir State, 16 in the Kashmir valley, eight in Jammu and five in Ladakh. Soil erosion is a serious problem in semi-arid regions, where dry bare soils are very vulnerable to erosion during intensive rainstorms. This results in large on-site soil losses and off-site consequences such as sediment deposition in river channels or reservoirs and flooding (Poesen and Hooke 1997). Planting or preserving vegetation in areas vulnerable to erosion is therefore considered to be a very effective soil erosion control measure (de Baets et al. 2008). The above-ground biomass can temporarily disappear in semi-arid environments; roots may still be present underground and play an important role in protecting the topsoil from being eroded. The use of vegetation in the form of ground bio- and eco-engineering (Stokes et al. 2004). Roots are equal in importance to leaves as the life support system for plants and thus for all life in terrestrial ecosystems (Arora 1991). The recognition of different types of roots is important because these can have different functions. Roots affect properties of the soil, such as infiltration rate, aggregate stability, moisture content, shear strength and organic matter content, all of which control soil erosion rates to various degrees (Gyssels et al. 2005).

Material and method

1.1 Study area: Hygam wetland is one of the famous wetlands of the District Baramulla. It covers an area of 7.25sq. Km and has land cover of 1400 hectares. It has river Jhelum from one side and is connected with Walur lake via Tarzoo. Depth of wetland varies from 1-25 meters with dimensions $34^0$13'30"- 34^0 16' ' N and $74^0$30'2" – $74^0$32'3"E.

1.2 Measurement of soil binding capacity: Large pullout test (Hathway 1962; Mickovski et al. 2007; Devekota et al. 2009) continuously increases. The experiment was carried out in mid year July - august in ,marshy area when most of the area of wetland is filled with water

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Phragmites australis (Cav.) Trin. ex Steud and *Typha domestica* Pers. were pulled out using a dynamometer for accurate

measurement of uprooting force. A portable hanging dynamometer, capable of measuring load of up to 200 kg, was linked between the binding rope and the chain pulley placed on a tripod. The test was terminated once the uprooting force dropped sharply and the plant was uprooted (Atul Kumar Pal et al., 2019). The experiment was repeated five times for both plant species at different locations of wetland in marshy areas to record accuracy and average pullout force.

(A) (B)

(C) **(D)**

Figure 1.1: (A)*Phragmites australis* (Cav.) Trin. ex Steud and *Typha domestica* Pers. , (C and D) Hygam Wetland

Result and Discussion: soil binding capacity of *Phragmites australis* (Cav.) Trin. ex Steud and *Typha domestica* Pers. was measured using a large pullout method. Both the plant species are dominant species of Hygam wetland found in marshy areas. *Phragmites australis* is tall grass belonging to family poaceae, growing upto height of 15-20 feet. *Typha domestica* Pers. belongs to family cyperaceae with height upto 10-15 feet. *Phragmites australis* (Cav.) Trin. ex Steud and *Typha domestica* Pers. possess a well developed root system and that is because they can withstand water logged marshy areas of wetland. In *Phragmites australis* soil binding capacity is more than *Typha domestica*. The average force required for pullout from soil is 54.06. The readings of soil bindings are given in Table 1.1.

Location	Force (lbs) *Phragmites australis*	Force (lbs) *Typha domestica*
1	**38.03**	**23.33**
2	**42.76**	**31.05**
3	**52.41**	**26.19**
4	**51.73**	**28.56**
5	**52.08**	**32.65**

Table 1.1: Force applied to pull out *Phragmites australis* (Cav.) Trin. ex Steud and *Typha domestica* Pers. from soil.

Phragmites australis shows maximum soil binding capacity of average 54.06 while *Typha domestica* shows lower soil binding capacity of average 28.357. However both species are present in the same place in marshy areas.

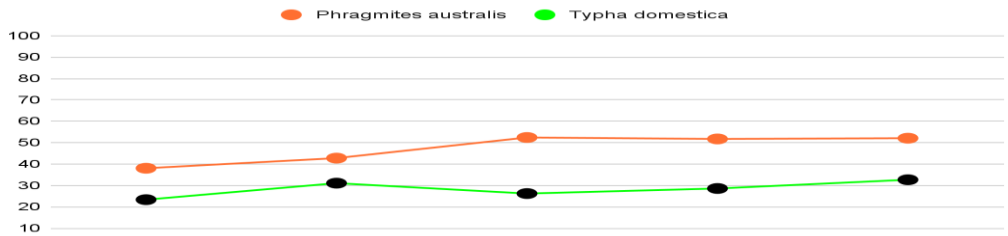

Figure 1.2: soil binding capacity of *Phragmites australis* (Cav.) Trin. ex Steud and *Typha domestica* Pers.

The main difference is in the development of the root system. *Phragmites australis* also develops adventitious roots on lower nodes present inside water. This character of *Phragmites australis* is only found in species present in marshy areas under water.

Conclusion: From this study we concluded that *Phragmites australis* (Cav.) Trin. ex Steud has more average soil binding capacity than *Typha domestica*. However, *Phragmites australis* (Cav.) Trin. ex Steud in land on moist places require more force than average 54.06 lbs. Due to more individual force required to pull out both the species from soil indicates they are efficient soil binders which prevalent soil erosion and withstand water currents in wetland.

References:

1. Arora D (1991). All that the Rain Promises and More, Ten Speed Press, Berkeley
2. Atul Kumar Pal, Akram Ahmed, V. K. Panday(2019). Soil Binding Capacity of Different Forage Grasses in Terms of RootReinforcement Ability toward Soil Slope Stabilization.Indian Journal of Hill Farming 0970-6429
3. Bilal Ahmad Bhat. Present Status and Significance of Wetlands in Kashmir. Indian Journal of Waste Management. 2020;4(1):9–14.
4. De Baets S, Poesen J, Reubens B, Wemans K, De Baerdemaeker J, Muys B (2008). Root tensile strength and root distribution of typical Mediterranean plant species and their contribution to soil shear strength. Plant Soil 305: 207–226
5. F. Essl, H. Gardfjell, D. Gigante, G. Giusso del Galdo, M. Hajek, F. Jansen, J. Jansen, J. Kapfer, A. Mickolajczak, J.A. Molina, Z. Molnar, D. Paternoster, A. Piernik, B. Poulin, B. Renaux, J.H.J. Schaminee, K. Šumberova, H. Toivonen, T. Tonteri, I. Tsiripidis, R. Tzonev & M. Valachovič (2016). European Red List of Habitats. Part 2: Terrestrial and Freshwater Habitats Publications Office of the European Union, Luxembourg. 44 pp.
6. Gyssels G, Poesen J, Bochet E, Li Y (2005). Impact of plant roots on the resistance of soils to erosion by water:
7. a review, Progress in Physical Geography 29:189–217
8. IUCN (2017). Guidelines for using the IUCN Red List categories and criteria. Version 13. Prepared by the Standards and Petitions subcommittee, http://www.iucnredlist.org.
9. N.E. Stork, M.J. Samways, Inventorying and monitoring, in: V.H. Heywood (Ed.), Global Biodiversity Assessment, Cambridge University Press, Cambridge 1995, pp. 459–543.
10. Poesen JWA, Hooke JM (1997). Erosion, flooding and channel management in Mediterranean environments of southern Europe. Progress in Physical Geography 21: 157–199
11. Stokes A, Mickovski SB, Thomas BR (2004). Eco-engineering for the long-term protection of unstable slopes in Europe: developing management strategies for use in legislation. IX International Society of Landslides conference, Rio de Janeiro, Brazil. Landslides: Evaluation & Stabilization (Eds. Lacerda, W. Ehrlich, M., Fontoura S.A.B., Sayao A.S.F.), A.A.BalkemaPublishers,Vol.2,1685–1690