

LANDSLIDE EROSION ALONG THE RACH TRA RIVER, HO CHI MINH CITY, VIETNAM: THE CURRENT SITUATION AND PROPOSED SOLUTIONS

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ABSTRACT

In the study area along Rach Tra, riverbank erosion has become severe recently. It directly threatened both riverine ecosystems and the lives of people in the area. The cutting of wild plants for construction land and sand mining took place in the study area. Sand mining activities were not only the cause of riverbank erosion but also polluted the water in the river basin. Boats exploited river sand mine kept working day and night, along with discharging mud and waste engine oil into the river bed, which contaminated water sources and affected the riverside ecological environment. Generally, the vegetation along the river had the effect of breaking waves and stabilizing the river banks such as *Melaleuca cajuputi*, *Acrostichum aureum*, *Horsfieldia irya*, destroyed, dead or washed away, etc. Vegetation along Rach Tra plays an important role in protecting the shoreline, limiting erosion in order to conserve the civil works along the river. The results of the study provided scientific database, helping managers to develop strategies and plans for the conservation of vegetation, especially the conservation of valuable and rare plant species. Thereby contributing to the development of economic corridor along the river.

Keywords: Erosion Of Riverside, Rach Tra River, Vegetation, Sand Mining.

I. INTRODUCTION

Rach Tra is a large tributary of the Saigon River, so the climatic and hydrological characteristics of Rach Tra closely depends on those of the Saigon River. Rach Tra River has a length of about 44km, which is located in the districts of Cu Chi, Hoc Mon and part of Tay Ninh province, Vietnam [1].

The bottom of the Rach Tra river basin is built from gray soil with strong water absorption but poor water retention, low flow, rapid gathers of flood. The length of the main river is about 10km, and its bed slope was classified as small [2].

The area of the entire Rach Tra river basin is 77.14km². The flow was influenced by tides from the Saigon River. The water resource of the Rach Tra river basin plays an extremely important part in the socio-economic development of Cu Chi and Hoc Mon districts, Ho Chi Minh City, Vietnam.

II. THE SITUATION OF LANDSLIDE EROSION ALONG RACH TRA

People's activities to cut down wild plants to get land to build houses, warehouses and set up wharves close to the shore, this not only destroyed the riverine ecosystem but also increased the burden of the ground. Thereby, creating pressure, causing subsidence and destabilization of the riverbank, leading to the risk of landslide.



Figure 1. The warehouses and buildings built along Rach Tra

Besides, illegal sand mining on the river, especially the situation of digging and sucking deep into the river bed to get sand, caused landslides at the place of digging and sucking sand, as well as changed the flow, causing abnormal landslides, even in places where protection embankments were built.



Figure 2. Illegal sand mining in Rach Tra

Through field surveys along Rach Tra, the section passing through Nhi Binh and Dong Thanh communes of Hoc Mon district; Binh My commune, Cu Chi district, there were many sand barns along the riverbank. The sand mining in the river bed was still taking place frequently, the most common was mining at night. Each boat was equipped with a large suction machine, it could suck up several tens of cubic metres of sand in one night.

We have investigated that, every day in Rach Tra, there were an average of 5-6 boats and ships working as sand shovels, operating continuously and publicly. The ships, boats and barges carrying sand regularly on the river have created strong waves hitting the shore, this caused the existence of clefts along the land bank and increased the risk of landslides.



Figure 3. Vegetation destroyed by riverbank erosion

A survey of some people living along Rach Tra found that during the day, boats and barges sucked sand in the middle of the river, and they started moving closer to the shore to exploit at about 3-4 am. The indiscriminate sand mining caused landslides, making people very worried. Many bamboo bushes and shore protection works created were also gradually damaged, and some works have been sunk into the river, taking away the agricultural land .

III. THE PROPOSED SOLUTIONS

3.1. Proposed solutions to prevent and manage erosion along Rach Tra

- Build constructions to block the waves washing ashore created by moving boats [3], [4].
- Prevent river bank erosion by planting trees to keep the soil near the riverbank [5].
- Post warning signs in landslide-prone areas [6].
- Strictly control sand mining activities on the river [7], [8]. Overcome the imbalance of mud and sand to limit the risk of landslides, besides completely prevent illegal sand mining [9].
- Paying attention to the propaganda and dissemination of the law, raising people's awareness about riverbank erosion prevention [10].
- Fabricate a monitoring system to monitor river bank erosion [11], [12], etc.



Figure 4. The anti-erosion works along Rach Tra

3.2. The role of vegetation along Rach Tra

Vegetation along Rach Tra involved in mitigating the effects of water pollution. The vegetation on both sides of the river acted as a shield against waves and wind, helping to keep the soil and keep the banks from landslide [1].

The composition and distribution of plant species in the study area provided data to assess the impact of sea level rise and saltwater intrusion in the future.

Rach Tra is influenced by the hydrological regime of the Saigon River. The Saigon River is influenced by the semi-diurnal tidal fluctuations of the East Sea. Every day, the water rises and falls twice, whereby the tide penetrates deeply into the canals, causing a significant impact on agricultural production and daily life of people in the area [13].

Among the plant species found in the study area, there were many floating aquatic species capable of participating in the treatment of polluted water [14] and reducing the organic matter content in the water such as *Lemna minor* L., *Polygonum tomentosum* Willd., *Eichhornia crassipes* (Mart.) Solms, etc.

Table 1. List of plants capable of treating water pollution

No.	Scientific name	Local name
1	<i>Lemna minor</i> L.	Duckweed plants
2	<i>Phragmites karka</i> (Retz.) Trin. ex Steud.	Reed tree
3	<i>Ludwigia adscendens</i> (L.) Hara	Red ludwigia, Water primrose
4	<i>Polygonum tomentosum</i> Willd.	Polygonum hydropiper
5	<i>Eichhornia crassipes</i> (Mart.) Solms	Water hyacinth
6	<i>Echinochloa crus-galli</i> (L.) P.Beauv.	Barnyard Grass

7	<i>Ipomoea aquatica</i> Forssk.	Water spinach
8	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	Sessile joyweed , Dwarf copperleaf

IV. CONCLUSIONS

Facing complex landslides along Rach Tra, the interdisciplinary agencies and people need to strictly protect the works to limit erosion and retain vegetation along Rach Tra. The strategy should be about encroachment minimization on the riverbank, limiting the construction near the shore, and large boats should not use due to the serious effects on the land along Rach Tra. It was recommended that the government take measures to prevent the current indiscriminate sand mining, to reduce the risk of riverbank erosion.

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