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Examining The Effect of Reed Mowing Model and Rate on Natural Filtering Areas with The Example of Bendimahi Delta (Van-Turkey)

Özdemir Adizel[1]*, Atilla Durmuş[1], İlhami Kiziroğlu[2]

[1]Yüzüncü Yıl University, Faculty of Science and Literature, Department of Biology, Van, Turkey

[2]Hacettepe University, Faculty of Education, Department of Biology Education, Ankara, Turkey

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Abstract

Reeds emerge in shallow coastal areas where water and land meet. Because of this feature they are at transition and buffer point between two ecosystems. Not only they contain creatures belonging to these two environments but also they help shaping the interaction between the environments in a balanced manner.

A reed which has not been ruined functions just as a technical treatment system. Firstly, the plants in the water cut the speed of the water and makes the particles' in it sink thus providing physical treatment. At eh second stage, the creatures living in reeds decompose the organic substances and realize biological treatment step. At the last stage, plants and other creatures living in reeds takes the substances they need into their bodies thus providing chemical treatment. After passing these stages, the water infiltrates through the dunes and joins the system in a clear manner. Today, cleaning waters by establishing artificial reed pools in the areas, where no natural reeds have grown, has become a commonly used method.

The aim of this study is to put forward the relation between the mowing manner of reed plants which were cut generally for economical reasons in wetlands and the natural filtration by means of Bendimahi example. Images taken from the mentioned area and other satellite images that have been taken from the area during the study, which has taken one year, have been blended with literature knowledge and interpreted.

The idea of mowing a certain amount of reeds every year which has been recommended by the experts may be useful for shallow and still waters without a large amount of water input-output and which do not flow into a water system thereafter. However, this idea does not provide an efficient solution for streams flowing down fast from highlands such as Bendimahi Stream. Instead of this, it will be more appropriate to cut the reeds as wide bands to clean the water and in a way to cut down the speed of the water and provide a dam before it. This model may be applied by cutting different bands every year. The desired continuous filtration will be provided with this system which we can call as "bands model". Implementation of such a model will contribute to the protection of both biodiversity and clean state of Van Lake.

* Correspondence to: Özdemir Adizel

Yüzüncü Yıl University, Faculty of Science and Literature, Department of Biology, 65080, Van, Turkey.

E-mail: oadizel@hotmail.com

INTRODUCTION

The aim of this study is to put forward the relation between the mowing manner of reed plants which were cut generally for economical reasons in

wetlands and the natural filtration by means of Bendimahi example.

Generally, the importance and ecological value of reeds for the creatures are underlined in the resources. It is stated in most of the resources that reeds make a contribution by filtering the polluted water. It is mentioned that cutting reeds in certain amounts make an economical contribution to the local people and it also make them renew themselves. However, there is not a lot of information about the relation between the cutting model of the reeds to be cut and the effect of this upon the filtration, pollution and the creatures.

The subject which is underlined most in the definition of wetlands is the plants living in the water. Most important one of those is the reeds. Most people use the concepts of wetlands and reeds as synonyms. The reeds (*Phragmites*) which are the most important plants in wetlands have genotypes which have adapted to fresh, salty and hard waters [1].

Wetlands exist in shallow coastal areas where the water and land meet. Because of this feature they are at transition and buffer point between two ecosystems. They do not only contain creatures belonging to both environments but also helps the shaping of the interaction between environments in a balanced manner. For example, they cut the speed of waves coming from the sea to the land thus preventing coastal erosion. Or they filter the water streaming down from lands by slowing it down. In addition to this, wetlands has many qualities such as preventing floods, feeding the water resources around it during dry seasons, containing aquacultures which have many economical values and having a rich biodiversity. Since this situation prevents the pollution it is very important in terms of protecting the creatures living in the water [2].

The study conducted by Schmidt et al. reveals how negatively the unplanned cutting of reeds affects the creatures. In the study which has been conducted in Southern France it has been reported that the number of arthropods in mowed reeds has decreased and the birds feeding on these animals have been negatively affected by that [3].

A reed which has not been ruined functions just as a technical treatment system. Firstly, the plants in the water cut the speed of the water and makes the particles' in it to sink thus providing physical treatment. At eh second stage, the creatures living in reeds decompose the organic substances and realize biological treatment step. At the last stage, plants and other creatures living in reeds takes the substances they need into their bodies thus providing chemical treatment. After passing these stages, the water infiltrates through the dunes and joins the system in a clear manner. Treating polluted water with technical methods is quite expensive. This has caused the importance of wetlands to be understood again. Because of this engineering applications for the restoration of wetlands in many countries have become popular [4].

People, after recognizing the reeds' feature for cleaning the polluted water have begun to approach this situation in a more modern way since the 1980's. They continue to treat the water which has been polluted by urban, agricultural or any other kind of wastes into the artificially established reed pools by means of subsurface flow, direct surface flow or combined methods [5-8]. İleydağı Village in Lake Eğirdir Basin is an example in Turkey for treating the wastewaters by filtering them through combined reeds, which is a common method throughout the world [9].

A similar application is being used to clean Lake Apopka which is a very shallow and polluted lake in Florida. Here, polluted lake waters are pumped into

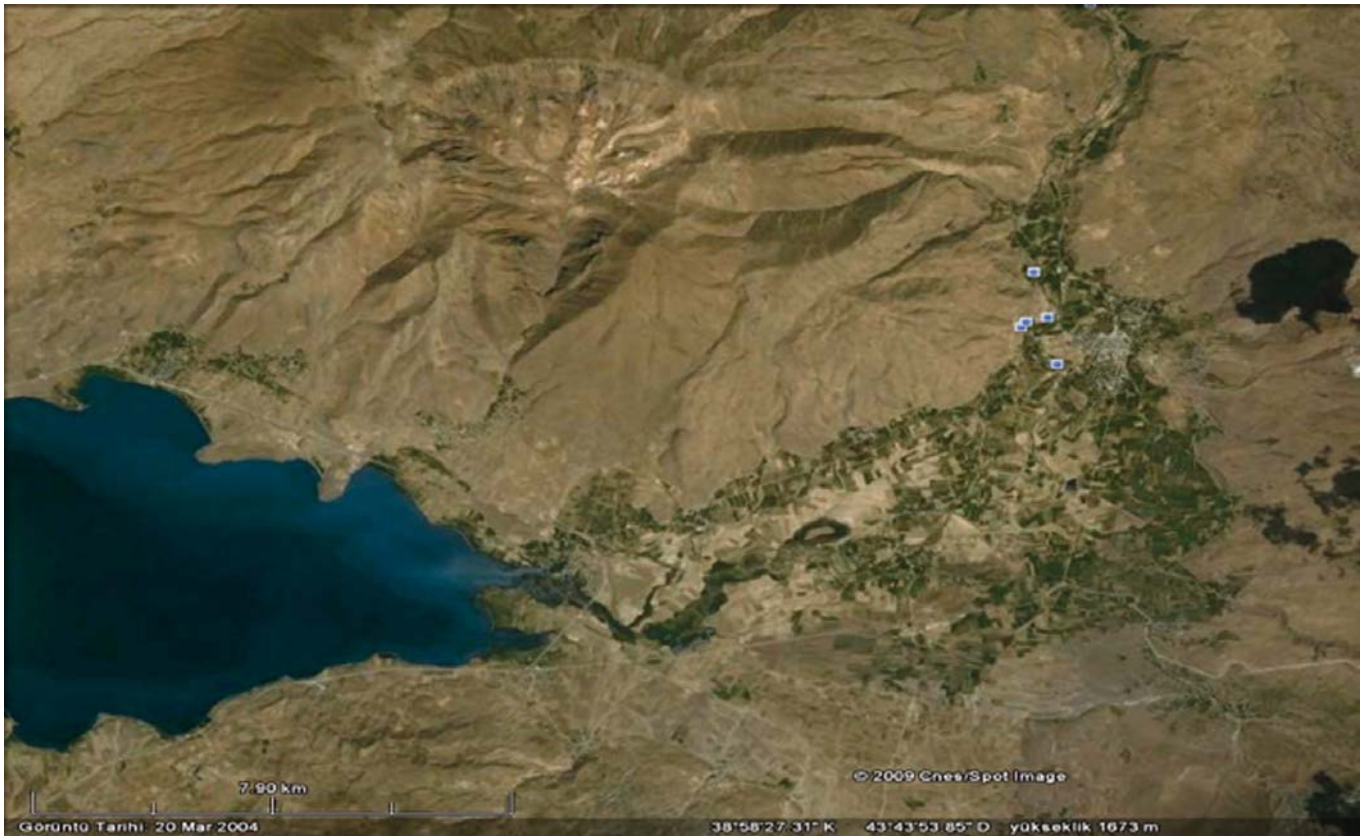

Figure 1. General satellite view of the area (Google earth, access date:10.01.2010).

natural reed areas instead of artificial pools and filtered and the treated water is streamed into the lake again [10].

Reusing wastewater after treating it is very common in dry areas of Australia. With this aim, by use of reeds the polluted water is cleaned by being filtered through artificially formed wetlands with using surface method in Queensland. In this method, polluted waters are cleaned by being filtered through the sets of reed plants which are at a certain distance from each other. Mosquito control for this method, which is an artificial application of the natural treatment, is done by predators living in the reeds [11].

METHODOLOGY

Material of the study is the reeds in Bendimahi Delta. Data have been collected by taking the relation between the cutting models of these reeds into consideration. This research has been done in a period of one year between November 2008 and October 2009. However, data which were collected during ornithological studies done in the area in previous years have contributed to the evaluation.

During this period of one year, investigations have been made and photographs have been taken by visiting the area twice during a season. The area has been visited and photographs have been taken especially in rainy days. Images taken from the area have been interpreted by being blended with satellite images and literature knowledge.

RESULTS

Rain waters of southern slopes of Tendürek Mountain and the spring waters join each other and form Bendimahi Stream. In addition to those, the waters streaming down from the small mountains around join the stream and stream flow down

towards to Lake Van. A delta with the same name has been formed in the area where the stream meets the lake (Figure 1).

In both satellite and photograph images, it has been revealed in the observations conducted that the stream water is quite clean in the sections where it first sprang out but it got more polluted as it stream downs over the mountain. The water's having the muddy color especially in rainy seasons has been evaluated as a clear evidence of erosion. Besides, information has been found out stating that there have been fish deaths since the gills of fish were blocked by mud.

It has been determined that domestic wastes of residences located along the Bendimahi Stream have been mixed into the water directly without having any treatment at all.

Agriculture is being conducted in the area near the stream and delta. It has been found out that chemical fertilizer and pesticides used by farmers have mixed into the water.

In the investigations, it has been found out that polluted water streaming fast through Lake Van have been stopped by reeds sometimes. It has been observed that the waters entering the reeds were treated and were a lot more clean then the water which has bypassed the reeds (Figure 2).

However, it has been revealed in the studies that have been conducted that lots of reeds have been cut down and no planning has been implemented in terms of cutting the reeds and a random implementation has been made. As a result of this, it has been observed that sufficient filtering could not be done since the reeds, which are supposed to provide a dam before the water, were damaged form place to place.

Also, it has been observed that deformation happened in natural stream bed since building sand has been taken from river beds in some areas. It has been seen that water depth has increased in these damaged areas especially in summer time and mass fish deaths happened (Figure 3 and Figure 4).

Figure 2. Situation of waters passing or bypassing through the reeds (Google earth, access date:10.01.2010).

Figure 3. Taking sands from stream bed.

Figure 4. Mass fish deaths in the stream.

It has drawn attention that birds and other creatures living in the delta have concentrated in the parts where the reeds have not been damaged. It has been seen that the birds are less agitated in the areas where reeds exist but displays a panic behavior in damaged areas.

It has been concluded after the investigation that has been conducted that local people who are complaining about Lake Van being polluted and also the authorities have no information about the reeds' functions as a natural filter.

DISCUSSION

It is being understood form the findings that the most important pollution factor in Bendimahi Stream is soil erosion. Level of erosion will be understood better after considering the fact it has advanced to a degree which sometimes caused fish deaths by blocking their gills. Tree formation in the area is almost non-existent. Because of various reasons, preventing the damage to the plants which will stop the erosion, firstly being tragacanths, will make a great contribution to solving this problem.

Generally taking sands from river beds and drainage activities because negative changes in water depth and flow speed.

Treating sewer wastes and other wastes of residents will be an important step in terms of preventing the pollution. For this reason, present natural reeds may be arranged or surface flow, subsurface flow or combined artificial pool methods, which are commonly used throughout the world and mentioned also in the literature, may be used.

Cutting the reeds in a random manner both along the stream bed and in delta section may be interpreted as an indicator of the fact that no protection plan has been implemented about this subject. So, there is a need to explain the sensitivity of the subject to the authorities and local people.

The idea of mowing a certain amount of reeds every year which has been recommended by the experts may be useful for shallow and still waters without a large amount of water input-output and which do not flow into a water system thereafter. However, this idea does not provide an efficient solution for streams flowing down fast from highlands such as Bendimahi Stream. Instead of this, it will be more appropriate to cut the reeds as wide bands to clean the water and in a way to cut down the speed of the water and provide a dam before it. By cutting different bands each year it can be provided for the reeds to renew themselves. The desired filtration will be continuously provided with this system which we can call as bands model. This method and the one

Greenway applies in Queenisland is very similar to each other. Each of these methods includes reed bands located at certain distances to each other. Open water mirrors among the reeds will make the sun to infiltrate into deeper parts. Birds which will proliferate safely among reeds will be effective especially on mosquitoes. Besides, with this model, local people who provide income with mowing reeds will not have a loss of right. Only, the cutting of reeds will be done in a certain order. Moreover, an opportunity to live in a cleaner environment will be provided (Figure 5).

Technical treatment cannot be provided properly since the cost is high in waters mixing in both Bendimahi Stream and Lake Van. For this reason, each area should be separately handled with the help of experts and the present natural reeds should be planned by being restored. Pollution should be prevented by establishing artificial wetlands in the places where there are no natural reeds. Such an implementation will make an important contribution for the clean state of Lake Van to be maintained.

REFERENCES

1. Chambers, M.R., Mayerson, L.A. and Saltonstall, K., Expansion of *Phragmites australis* into tidal wetlands of North America. Aqua. Bot., 64, 261, 1999.
2. Tilton, D., Fahey, B. and Merkey, D., A Wetland Protection Plan for the Headwaters of Johnson Creek and the Middle Rouge River. Rouge River National Wet Weather Demonstration Project; RPO-NPS-TM25.00; Michigan, 1997.
3. Schmidt, M.H., Lefebvre, G., Poulin, B. and Tscharntke, T., Reed cutting affects arthropod communities, potentially reducing food for passerine birds. Biol. Conserv., 121, 157, 2005.
4. Mitsch, W.J., Lefeuvre, J.C., and Bouchard, V., Ecological engineering applied to river and wetland restoration. Ecol. Eng., 18, 529, 2002.
5. Fleming, M.S. and Horne, A.J., Balancing wildlife needs and nitrate removal in constructed wetlands: The case of the Irvine Ranch Water District's San Joaquin Wildlife Sanctuary. Ecol. Eng., 26, 147, 2006.
6. Vymazal, J., The use constructed wetlands with horizontal sub-surface flow for various types of wastewater. Ecol. Eng., 35, 1, 2009.

Figure 5. Suggestion model reeds cut model for the area.

7. Zhang, D., Gersberg, R.M. and Keat, T.S., Constructed wetlands in China. Ecol. Eng., 35, 1367, 2009.

8. Zhang, L.Y., Zhang, L., Liu, Y., Shen, Y. and Xiong, Y., Effect of limited artificial aeration on constructed wetland treatment of domestic wastewater. Desalination, 250, 915, 2010.

9. Gunes, K., Tuncsiper, B., A serially connecte d sand filtration and constructed wetland system for small community wa stewater treatment. Ecol. Eng., 35, 120, 2009.

10. Coveney, M.F., Stites, D.L., Lowe, E.F., Battoe, L.E. and Conrow, R., Nutrient removal from eutrophic lake water by wetland filtration. Ecol. Eng., 19, 141, 2002.

11. Greenway, M., The role of constructed wetlands in secondary effluent treatment and water reuse in subtropical and arid Australia. Ecol. Eng., 25, 501, 2005.