IMPACT: International Journal of Research in Humanities, Arts and Literature (IMPACT: IJRHAL)
ISSN (P): 2347-4564; ISSN (E): 2321-8878
Vol. 7, Issue 6, Jun 2019, 279-286

IMPACT OF PROTECTION ON THE DIVERSITY OF SHRUBS IN THE RAVINE OF OTTANGAN RIVER AT KHANDER, AGRA, U.P

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Received: 06 Jun 2019 **Accepted:** 17 Jun 2019 **Published:** 28 Jun 2019

ABSTRACT

Impact of protection on the diversity of shrub species in the ravine of protected and unprotected area of Ottangan River at Khander has been studied in two years on four topographies as top, slope, bottom & river bank comparatively and recorded that the number of species of shrubs in protected ravine was more in comparison of unprotected ravine. In protected ravine, 14 species of shrubs was noted whereas only 4 species noted from unprotected ravine which was comparatively reduced in form due to biotic interference. More dominant and successful species of the unprotected ravine was Capparis deciduas Forsk. Edgew. and Zizyphus nummularia (Burm.F.) Wt. & Arm. The value of Presence Constance and importance value index of the species which found in the unprotected ravine was high mostly in comparison of a protected ravine.

***KEYWORDS**: Protected Ravine, Unprotected Ravine, Topography, Ottangan, Khander*

INTRODUCTION

As we all know that development & population being up more our country due to this increase in emission of greenhouse gasses(CO_2, CH_4 & N_2O) concentration in the atmosphere by which increase temperature, global warming & climate being change so that our biodiversity directly affected & the number of plants decreased more. The plants play an important role in the conservation of soil and water of ravine. Therefore need for conservation of our plants to improve soil & water in the ravine.

India is one of the mega-center of plant biodiversity, housing an estimated 8% of biota, describe so far. It contains 3 out of 34 biodiversity hot spots of the world as the Western ghats, Western & Eastern Himalayas. In India a lot of efforts have already been made to collect & conserve biodiversity by the Government of India, Ministry of Agriculture, DARE/ICAR through their 6 national Bureau's and by the MOEF, Government of India by (BSI, ZSI, FSI etc.) through their Botanical gardens, Biosphere Reserves "Wetlands", 'National Parks', 'Wild Life Sanctuaries' and 'Conservation Reserves' etc. is in progress.

According to Anonymous (1980), in India, out of a total geographical area of 328.8 million hectares about 175 million hectares (53%) has been reported to be affected by soil erosion & degradation. The rainfall is the main agent of soil erosion & degradation in humid and sub-humid climate but strong wind, high evaporation and high temperature accelerate the process desertification in semi-arid and arid regions. The ravine formation in alluvial soil along the bank of rivers

because of erosiveness of rainwater coupled with the effect of flash floods. In our country, an estimated 36.7 lakhs hectares is ravine land. Out of this, 12.3 lakhs hectares of ravines are located in Uttar Pradesh along which works out to 33% of the total ravine land in the country. In U.P., Agra district accounts for 1.76 lakhs hectares of ravine land mainly located along the river Yamuna. On the conservative estimate, the country is losing a total output of Rs.157 crores a year by failure to reclaim and develop the ravines. The ravines in India are not of recent origin, they date back to the eleventh country and are still growing. An intensive system of gullies forms ravines. These ravines, caused by the major rivers and their tributaries are extending fast towards agricultural lands and habitation (Sharda et al; 1982)

The impact of disturbances on forest vegetation has been well documented (Raup, 1964; White, 1947; Smiet, 1992). The relationship of community properties and disturbances has been examined by several workers (Johns, 1945; Whitemore, 1975; Runkel, 1982). Nicholson & Monk (1974) reported a rapid increase in species richness in the first few years after protections in an old field of Georgia. Panday & Singh (1987) also reported higher species richness in the initial years after protection at Varanasi.

According to Bennett (1955) where the land surface is bared of protective covering or vegetation, erosion agencies become thousand times faster and more furious in their ghastly action of erosion than under natural conditions. The vegetative canopy in the first instance dissipates the energy of raindrops and thus prevents the direct impact of water in its dislodgement of soil particles. The vegetative cover offers resistance to the flow of water on the land surface and prevents runoff from acquiring erosive velocity. As a result of the erosion of soil and nutrient, the degradation of land takes place, which ultimately reduces the capacity of the land to sustain vegetation. It has been observed in the conditions in Agra that with soil and water conservation measures of productivity of land can be improved and restored to produce more biomass/unit area per unit time.

The convention onbiological diversity mandates the preservation, exploration and sustainable use of biodiversity and requires its protection at all levels from the genetic to the ecosystem (Gaston & Spicer 2004, Leveque & Mounolou 2004). The global decline in biodiversity and the loss of species and habitats is enormous (Myers, 1990). Global model estimate that changes in land use and climate as well as anthropogenic disturbances with subsequent habitat fragmentation, will result in a loss of vascular plant species by 25% in the next few hundreds of years in comparison to diversity status in 1995 (Cowling & Samways, 1995; Magurran, 2006; Van Vuuren et al. 2006).

Experimental Site

Khander experimental site is comprised of ravine system made up of different classes of gullies varying from very shallow to very deep. This village is spread in 553 sq. hectares situated in a deep ravine on the sides of Ottangan river. This river has a very high current and the large area of spread. The residents of this village do not build permanent residences due to the high current of the river which destroys their houses. This Ottangan river is formed by a combination of various streams and this village is near the combination site.

Climatic Condition of Experimental Site

The experimental site has dry climate except during the monsoon months, with an average annual rainfall of 765 mm, 90% annual rainfall is received during the monsoon season. Monsoon rains which start in the last week of June and very active in July-August, tapering off by the middle of September, cause of considerable erosion. May-June being the

hottest months when the maximum temperature touches 48°C and the minimum temperature goes as low as 1°C in month of December-January. The evaporation ratio is also high due to strong wind velocity and high temperature.

Materials & Methods

The diversity of shrubs in the ravine of Ottangan river at Khander was studied at four predetermined places in the protected & unprotected areas such as ravine top, slope, bottom and river bank by the quadrate method as suggested by Mishra & Puri (1954) & Mishra (1973). Five quadrats for shrubs were laid at selected spots & size of each quadrate 5 m. square was determined.

The analytical characters as quantitative characters have been studied. The circumference (Perimeter) of shrubs was measured at chest height or blow the first branching whichever was less. The basal area was then calculated from this perimeter. The relative frequency, relative density & relative dominance were calculated according to (Phillips, 1959; Mishra, 1973) by the following formula.

$$\text{Relative frequency} = \frac{\text{No.of quadrats of occurrence of the plants}}{\text{No.of quadrats of occurrence of all the plant species}} \times 100$$

$$\text{Relative density} = \frac{\text{No.of individuals of the species}}{\text{No.of individuals of all the species}} \times 100$$

$$\text{Relative Dominance} = \frac{\text{Total basal area of the species}}{\text{Total basal area of all the species}} \times 100$$

The total of these three parameters gave the **Importance Value Index (I.V.I.)**

Under the synthetic characters, Presence and Constance were calculated from the frequency data in the following five figures (Sharma, 1979).

Presence & Constance 1 = 1% to 20% Frequency

Presence & Constance 2 = 21% to 40% Frequency

Presence & Constance 3 = 41% to 60% Frequency

Presence & Constance 4 = 61% to 80% Frequency

Presence & Constance 5 = 81% to 100% Frequency

RESULT & DISCUSSIONS

During the first year, the study of diversity in shrub species on the top areas of the protected ravine of Ottangan river is done & recorded 13 species whereas 2 species recorded in the tops of the unprotected ravine which shows more difference in diversity of protected & unprotected ravine. Out of 13 species, *Capparis decidua* Forks. Edgew show 74.06 importance value index which was the highest & *Lantana indica* Roxb. Give 5.72 importance value index which was lowest. Out of 2 species, *Capparis decidua* Forks. Edgew gave the highest value of I.V.I. as 133.14 and *Zizyphus nummularia* (Burm F.) Wt. and Arm. Show 166.83 I.V.I. which was the lowest value. The number of shrub species in slope areas of the protected ravine was 6 but in unprotected slope areas of ravine, this number was 2 which represent a difference in diversity of species. Out of 6, *Zizyphus nummularia* (Burm F.) Wt. and Arm. Represent 62.83 I.V.I. which was highest and *Maerua arnaria* Hook. F. & Thoms gave 28.76 I.V.I. which was the lowest. Out of 2, *Zizyphus*

nummularia (Burm F.) Wt. and Arm. Show the highest I.V.I. (160.55) and *Capparis decidua* Forks. Edgew show 139.43 I.V.I. There are 6 species also found in bottom areas in a protected ravine but the bottom area ofunprotected ravine has 3 species of shrubs which show 50% difference in diversity of species of the protected & unprotected ravine. Out of 6 species, *Capparis decidua* Forks. Edgew represents the highest value of I.V.I. as 93.54 and lowest I.V.I. is represented by *Lantana indica* Roxb.(15.85). Out of 3 species, *Capparis decidua* Forks. Edgew shows the highest value of I.V.I. as 133.66 and lowest value of I.V.I.(35.75) represented by *Adhatoda vasica* Nees.

Table 1: Showing Importance Value Index of Shrub Species in the Ravine of Ottangan River in the 1st Year of the Study

Sr. No.	Name of Species	Ravine Top		Ravine Slope		Ravine Bottom		River Bank	
		P.R.	U.R.	P.R.	U.R.	P.R.	U.R.	P.R.	U.R.
1.	*Capparis decidua* Forks. Edgew	74.06	133.14	60.82	139.43	93.54	133.66	97.08	138.93
2.	*C.sepiaria* Linn.	60.57	-	35.48	-	-	-	-	-
3.	*Grewia subinaegualis* Dc.	15.22	-	37.97	-	-	-	-	-
4.	*G. tenex* Forsk. Fiori.	22.66	-	73.63	-	44.49	-	-	-
5.	*Zizyphus nummularia* (Burm F.) Wt. and Arm.	29.32	166.83	62.83	160.55	66.37	130.55	77.32	144.50
6.	*Ipomoea fistulosa* Mark ex choisy	14.87	-	-	-	-	-	-	16.09
7.	*I. hedrifolia* Linn.	7.81	-	-	-	-	-	-	-
8.	*I. pestigridis* Linn.	7.17	-	-	-	-	-	-	-
9.	*I. sendica* Stapf.	17.32	-	-	-	-	-	-	-
10.	*Clerodendrum phlomoides* Linn.	20.47	-	-	-	31.14	-	17.17	-
11.	*Lantana indica* Roxb.	5.72	-	-	-	15.85	-	-	-
12.	*Alberzia lebbeck* Linn. Benth.	6.72	-	-	-	-	-	-	-
13.	*Adhatoda vasica* Nees.	17.21	-	-	-	48.56	35.75	-	-
14.	*Maerua arnaria* Hook. F. & Thoms.	-	-	28.76	-	-	-	-	-
Total		**299.12**	**299.97**	**299.49**	**299.98**	**299.95**	**299.96**	**298.33**	**299.52**

P.R.=Protected Ravine; U.R.=Unprotected Ravine; Absent=-

Table 2: Showing Importance Value Index of Shrub Species in the Ravine of Ottangan River in 2nd Year of the Study

Sr. No.	Name of Species	Ravine Top		Ravine Slope		Ravine Bottom		River Bank	
		P.R.	U.R.	P.R.	U.R.	P.R.	U.R.	P.R.	U.R.
1.	*Capparis decidua* Forks. Edgew	51.31	151.34	89.51	111.09	99.23	157.58	91.13	182.75
2.	*C.sepiaria* Linn.	31.09	-	43.58	-	-	-	-	-
3.	*Grewia subinaegualis* Dc.	37.94	-	30.95	-	-	-	-	-
4.	*G. tenex* Forsk. Fiori.	50.26	-	71.23	-	35.26	-	-	-
5.	*Zizyphus nummularia* (Burm F.) Wt. and Arm.	68.06	148.64	54.02	188.88	83.54	128.05	81.63	103.25
6.	*Ipomoea fistulosa* Mark ex choisy	-	-	-	-	-	-	108.67	13.97
7.	*I. hedrifolia* Linn.	-	-	-	-	-	-	-	-
8.	*I. pestigridis* Linn.	-	-	-	-	-	-	-	-
9.	*I. sendica* Stapf.	-	-	-	-	-	-	-	-
10.	*Clerodendrum phlomoides* Linn.	-	-	-	-	-	-	18.55	-
11.	*Lantana indica* Roxb.	28.43	-	-	-	-	-	-	-
12.	*Alberzia lebbeck* Linn. Benth.	-	-	-	-	-	-	-	-
13.	*Adhatoda vasica* Nees.	31.13	-	-	-	82.23	14.34	-	-
14.	*Maerua arnaria* Hook. F. & Thoms.	-	-	10.62	-	-	-	-	-
Total		**298.72**	**299.98**	**299.91**	**299.97**	**300.26**	**299.97**	**299.98**	**299.97**

P.R.=Protected Ravine; U.R.=Unprotected Ravine; Absent= -

The river bank of the protected ravine has 4 species whereas river bank of the unprotected ravine has 3 species of shrubs only which represent a minor difference in diversity of shrub. Out of 4 species, *Capparis decidua* Forks. Edgew represents the highest value of I.V.I. as 97.08 and lowest value of I.V.I. is represented by *Clerodendrum phlomoides* Linn. as 17.17 and out of 3 species *Zizyphus nummularia* (Burm F.) Wt. and Arm. So the highest value of I.V.I. as 144.50 and lowest value of I.V.I. noted in *Ipomoea fistulosa* Mark ex choisy as 16.09.

The total of I.V.I. of all species of tops, slopes, bottoms and river banks of the protected ravine individually was near about similar comparatively to the total of I.V.I. of all species of tops, slopes, bottoms & river banks of unprotected ravine individually. Such type of result recorded both years of study.

In the second year, the study of diversity in shrub species on top areas of the protected ravine of Ottangan river is done and found 7 species whereas 2 species recorded in the tops of the unprotected ravine which represent the high difference in diversity of protected and unprotected ravine. Out of 7 species, *Zizyphus nummularia* (Burm F.) Wt. and Arm. was given the highest value of I.V.I. as 68.06. whereas the lowest value of I.V.I. was showing by *Lantana indica Roxb*. as 28.43. In the unprotected ravine out of 2, *Capparis decidua* Forks. Edgew was showing highest I.V.I. as 151.34 whereas *Zizyphus nummularia* (Burm F.) Wt. and Arm. was showing lowest I.V.I. as 148.64. A number of species in the slopes of the protected ravine was 6 but in the slopes of unprotected ravine this number decrease as 2 which represent a diversity of species. Out of 6 species, *Capparis decidua* Forks. Edgew was bearing the highest value of I.V.I. as 89.51 and lowest value of I.V.I. was bearing *Maerua arnaria* Hook. F. & Thoms. as 10.62. Out of 2, One species showing highest value of I.V.I. as 188.88 of *Zizyphus nummularia* (Burm F.) Wt. and Arm. and Other *Capparis decidua* Forks. Edgew was bearing the lowest value of I.V.I. as 111.09. There are 4 species recorded in the bottom of the protected ravine whereas 3 species noted from the bottom of the unprotected ravine. Out of 4, *Capparis decidua* Forks. Edgew had highest value of I.V.I. as 99.23 and *Grewia tenix* Forsk. Fiori. was showing the lowest I.V.I. as 35.26. Whereas out of 3, *Capparis decidua* Forks. Edgew representing the highest value of i.V.I. as 157.58 and lowest value of I.V.I. were showing *Adhatoda basica* Nees. as 14.34. From the river bank of the protected ravine 4 species recorded and the river banks of unprotected ravine had 3 species. Out of 4 species, *Ipomoea fistulosa* Mark. Ex choisy. was showing 108.67 I.V.I. which was highest and was 18.55 I.V.I. of *Clerodendrum phlomoides* Linn. which is lowest. Out of 3 species, *Capparis decidua* Forks. Edgew was showing highest I.V.I. as 182.75 whereas *Ipomoea fistulosa* Mark. Ex choisy. was showing the lowest value of I.V.I. as 13.97.

The value of Presence & Constance in the study of the 1st year of the top area of protected ravine revealed that 13 species of shrubs were present there and out of which 2 species such as *Capparis decidua* Forks. Edgew and *Capparis sepiaria* Linn. contained the highest value (05) of Presence and Constance whereas in tops of unprotected ravine only 2 species were recorded in which *Zizyphus nummularia* (Burm F.) Wt. and Arm. contained the highest value of Presence & Constance as (05). There are 06 species recorded in the slopes of the protected ravine in which *Capparis decidua* Forks. Edgew represents the highest value of Presence & Constance as 05

Table 3: Showing the Value of Presence & Constance of Shrub Species in the Ravine of Ottangan River in the 1st Year of the Study

Sr. No.	Name of Species	Ravine Top		Ravine Slope		Ravine Bottom		River Bank	
		P.R.	U.R.	P.R.	U.R.	P.R.	U.R.	P.R.	U.R.
1.	*Capparis decidua* Forks. Edgew	05	04	05	04	04	05	05	04
2.	*C.sepiaria* Linn.	05	-	03	-	-	-	-	-
3.	*Grewia subinaegualis* Dc.	02	-	03	-	02	-	-	-
4.	*G. tenex* Forsk. Fiori.	03	-	04	-	-	-	-	-
5.	*Zizyphus nummularia* (Burm F.) Wt. and Arm.	04	05	05	05	03	05	04	05
6.	*Ipomoea fistulosa* Mark ex choisy	02	-	-	-	-	-	02	01
7.	*I. hedrifolia* Linn.	01	-	-	-	-	-	-	-
8.	*I. pestigridis* Linn.	01	-	-	-	-	-	-	-
9.	*I. sendica* Stapf.	02	-	-	-	-	-	-	-
10.	*Clerodendrum phlomoides* Linn.	02	-	-	-	02	-	01	-
11.	*Lantana indica* Roxb.	02	-	-	-	01	-	-	-
12.	*Alberzia lebbeck* Linn. Benth.	01	-	-	-	-	-	-	-
13.	*Adhatoda vasica* Nees.	02	-	-	-	03	02	-	-
14.	*Maerua arnaria* Hook. F. & Thoms.	-	-	02	-	-	-	-	-
Total		**31**	**09**	**21**	**09**	**15**	**12**	**12**	**10**

P.R.=Protected Ravine; U.R.=Unprotected Ravine; Absent= -

Table 4: Showing the Value of Presence & Constance of Shrub Species in the Ravine of Ottangan River in 2nd Year of the Study

Sr. No.	Name of Species	Ravine Top		Ravine Slope		Ravine Bottom		River Bank	
		P.R.	U.R.	P.R.	U.R.	P.R.	U.R.	P.R.	U.R.
1.	*Capparis decidua* Forks. Edgew	04	05	04	05	05	05	04	05
2.	*C.sepiaria* Linn.	03	-	03	-	-	-	-	-
3.	*Grewia subinaegualis* Dc.	03	-	03	-	-	-	-	-
4.	*G. tenex* Forsk. Fiori.	04	-	04	-	02	-	-	-
5.	*Zizyphus nummularia* (Burm F.) Wt. and Arm.	05	05	04	04	05	05	03	05
6.	*Ipomoea fistulosa* Mark ex choisy	-	-	-	-	-	-	02	01
7.	*I. hedrifolia* Linn.	-	-	-	-	-	-	-	-
8.	*I. pestigridis* Linn.	-	-	-	-	-	-	-	-
9.	*I. sendica* Stapf.	-	-	-	-	-	-	-	-
10.	*Clerodendrum phlomoides* Linn.	-	-	-	-	-	-	01	-
11.	*Lantana indica* Roxb.	03	-	-	-	-	-	-	-
12.	*Alberzia lebbeck* Linn. Benth.	-	-	-	-	-	-	-	-
13.	Adhatoda vasica Nees.	02	-	-	-	04	01	-	-
14.	*Maerua arnaria* Hook. F. & Thoms.	-	-	01	-	-	-	-	-
Total		**24**	**10**	**19**	**09**	**16**	**11**	**10**	**11**

P.R.=Protected Ravine; U.R.=Unprotected Ravine; Absent=-

Where as in unprotected ravine two species recorded in which *Zizyphus nummularia* (Burm F.) Wt. and Arm. contained 05 Presence and Constance which was highest. On the bottom of protected ravine 6 species observed, out of which *Capparis decidua* Forks. Edgew was showing highest (04) Presence & Constance but in unprotected ravine 3 species recorded in which *Zizyphus nummularia* (Burm F.) Wt. and Arm. were showing (05) highest Presence & Constance value. In the river bank of protected ravine 4 species recorded in which *Capparis decidua* Forks. Edgew was contained (05) highest value of Presence & Constance whereas in the unprotected ravine 3 species recorded in which *Zizyphus nummularia* (Burm F.) Wt. and Arm. was showing (05) highest value of Presence & Constance.

During the course of 2nd -year study, it has been observed that in the tops of protected ravine 7 species of shrubs were recorded out of which highest value of Presence & Constance show *Zizyphus nummularia* (Burm F.) Wt. and Arm. as 05 but in unprotected ravine, only 2 species were present in which both showing (05) highest value of Presence & Constance. On the slope of protected ravine 6 species recorded in which 3 as *Capparis decidua* Forks. Edgew, *Grewia*

tenex Forsk. Fiori & *Zizyphus nummularia* (Burm F.) Wt. and Arm. were containing (04) highest value of Presence & Constance than Other whereas unprotected ravine had only 2 species in which one *Capparis decidua* Forks. Edgew highest (05) value of Presence & Constance. On the bottom of protected ravine, 4 species noted, out of which 2 were showing highest (05) value of Presence & Constance as *Capparis decidua* Forks. Edgew & *Zizyphus nummularia* (Burm F.) Wt. and Arm. & in the unprotected ravine 3 species noted in which 2 species as *Capparis decidua* Forks. Edgew & *Zizyphus nummularia* (Burm F.) Wt. and Arm. were showing the same (05) highest value of Presence & Constance. On the spots of the river bank of protected ravine 4 species observed during the course of study, out of which *Capparis decidua* Forks. Edgew was containing (04) highest value of Presence & Constance and in unprotected ravine recorded 3 species, in which 2 species were containing same highest (05) value of Presence & Constance as *Capparis decidua* Forks. Edgew & *Zizyphus nummularia* (Burm F.) Wt. and Arm.

CONCLUSIONS

Impact of protection on the diversity of shrubs in the ravine of Ottangan river revealed that 14 species recorded from protected ravine & 4 species recorded from unprotected ravine which was comparatively reduced form due to grazing effect & biotic interference. More dominant species in the protected ravine were *Capparis decidua* Forks. Edgew & *Zizyphus nummularia* (Burm F.) Wt. and Arm. whereas these species also dominant & more successful in the unprotected ravine. The total of importance value index of all species of the protected ravine was approximately similar to the total of importance value index of all species of unprotected ravine even minutely increase in the unprotected ravine which concluded that the number of individuals of species of the unprotected ravine was near about equal to the number of individuals of species of the protected ravine. The value of Presence & Constance minutely increased mostly of the species which found in an unprotected ravine in comparison to the protected ravine.

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