International Journal of Social Science
Citation: IJSS: 6(1): 21-29, March 2017
DOI: 10.5958/2321-5771.2017.00003.5

Economic Valuation and Causes of Degradation of Pong Dam Wetland of Himachal Pradesh

M.S. Pathania* and Gurrala Anil Kumar

Department of Agricultural Economics, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, HP. India

*Corresponding author: msp1960@rediffmail.com

ABSTRACT

Wetlands are the most productive ecosystem on the earth. The Pong dam wetland is one of the largest man made wetland in Himachal Pradesh. The local people adjoining the Pong wetland also exploit the wetland for crops production, fishing and as such provide significant role in their household system. Keeping this in view, present study has been planned. Two-stage sampling design was employed for the selection of sample. The sample consists of 80 households. The collected data were analyzed by using suitable analytical tools. The literacy rate of the family members of sampled farms was quite high i.e. around 79.40 per cent. The average size of holding was found to be higher among agricultural farmers (0.5 ha) as compared to fishermen (0.07 ha). The sampled farms maintain a livestock unit of 3.83 (SAU). The total income of sample farms was ₹ 2,54,575. On an average 2.11, 1.36, 1.20 numbers of cattle per day per farm were grazed during summer, winter and rainy seasons respectively in owned land followed by 1.72 in summer and 1.48 in winter seasons in wetlands. The time spent for grazing of animals on the wetland was noted 2.95 hours per day per farm. The total quantity of grasses consumed by animals per farm during grazing was 1038.69 kg from wetland, 749.06 kg from CPR lands and 972.77 kg from own land. The estimated income contribution to the sample households from wetland was ₹ 94,213. It was accounted for 59.65 per cent of the total farm income. The sample households were willing to pay for different economic activities and management of wetland. The higher proportions of sample household were willing to pay ₹ 100-150 for these activities. The coefficient of multiple determination in case of willingness to pay indicated that 74 per cent of variation explained by the chosen explanatory variables. The variables like net sown area, household income, share of income from wetland to the total income and awareness about benefits from wetland were the factors influencing significantly to the willingness to pay. The result of Hedonic regression model revealed net sown area, share of income from wetland, education level and awareness of benefits about wetland were significantly affecting the wetland income. It was suggested that to reduce the dependence on wetland for crop cultivation and pressure of chemicals farmers should be provided irrigation facility to grow cash crops on owned lands. Since the fishing business is adopted by large population therefore, the royalty and commission charged from the fishermen should be reduced and facility of mechanized boat at subsidized rate should be provided to fishermen to enhance their efficiency and income of fishermen.

Keywords: Crop cultivation, sown area, population, fishermen, Hedonic

Wetlands are the most productive ecosystem on the earth, recognized globally for their vital role in sustaining a wide array of bio-diversity and provide goods and service to the society. These support millions of people not only to the local population living in their periphery but also to the population outside the wetlands. The Ministry of Environment and Forests, Government of India, has declared at least 21 wetlands of national importance in the country and out of these, three wetlands- Pong Dam, Renuka and Chandertal are situated in Himachal Pradesh. The state of Himachal Pradesh has 27 natural wetlands covering an area of 15 km^2 and five manmade wetlands covering an area of 712 km^2. The Pong dam wetland is one of the largest man

made wetland in Himachal Pradesh. The catchment area of wetland is 12560 sq. km. and located in district Kangra. This reservoir covers an area of 24,529 ha and wetland portion is 15,662 ha. Pong dam wetland was declared a Ramsar wetland site on account of its rich waterfowl diversity and sustainable use of the wetland. The local people adjoining the Pong wetland also exploit the wetland for food grain production, fishing and as such provide significant role in their household system. In addition to local people, the migratory graziers like *Gaddies* and *Gujjars* also get benefit from the wetland. The exploitation of wetland is done in common property resources regime, due to this free ridership of wetlands the pace of degradation are quite high. Scanty attempts have been made in the past for estimation of economic benefits accrued from the wetland. A piece meal works are available on estimate of monitory value of wetlands and their conservation. These are the major factors to be considered in policy making decisions and management practices. Therefore it is important to study the socio economic profile of the people of the catchment area of wetland, economic benefits accrued, and causes of degradation. In present endeavor an attempt has been made to study these parameters.

Methodology

The present study was carried out in Pong Dam wetland located in Kangra district of Himachal Pradesh. It was purposively selected to examine the benefits accrued to the farmers of catchment area. Two-stage sampling design was employed for the selection of sample. At first stage sample of eight villages were randomly selected from the Pong dam wetland. At the second stage the sample of ten households was drawn from each selected village randomly.

The sample consists of 80 households. Both primary and secondary data were collected in order to fulfill the specific objectives of the study. The primary data were collected on well designed pretested schedule to survey method for the agriculture year 2013-14. The suitable analytical tools were employed to analyse the data. Contingent valuation method, Hedonic regression models were used for estimating the different parameters.

Contingent valuation method

The contingent valuation method (CVM) is used to estimate economic values for all kinds of ecosystem and environmental services. To estimate the willingness to pay of the respondents to Pong Dam wetland, Contingent Valuation Method was used. The willingness to pay function was expressed in the following form and both linear and Cobb-Douglas production function was employed. But keeping in view, the value of R^2 and significance of the variables, cobb-Douglas production function was retained for further analysis. The form of function was as follows:

$$Y = a\, X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} X_8^{b8} X_9^{b9}\, e^{u}$$

where,

Y = Willingness to Pay amount (₹/Hh)

a = Constant term

X_1 = Total net sown area (ha)

X_2 = Household income (₹)

X_3 = Family size (No.)

X_4 = Degradation (0= No, 1= Yes)

X_5 = Share of income from wetland (per cent)

X_6 = Education of the respondents

(0 illiterate, 1 Middle, 2 High school, 3 senior secondary, 4 Graduate and above)

X_7 = Distance from residence to Pong Dam wetland (Km)

X_8 = Awareness on wetland benefits (0= No, 1= Yes)

X_9 = Awareness on wetland (0= No, 1= Yes)

b's = Regression coefficients

u = Random term

Where, Y is willingness to pay for upkeep of Pong Dam wetland and the other variables are as defined above,

The significance of R^2 was tested by employing F-test as follows:

$$F = \frac{R^2/(k-1)}{(1-R^2)/(n-k)} \sim F\ (k\text{-}1,\ n\text{-}k)$$

where,

R^2 = Coefficient of multiple determinations

n = Number of observations

k = Total number of parameters to be estimated

Hedonic pricing method

The hedonic pricing method is used to estimate economic values for ecosystem or environmental services that directly affect market prices. In the present study hedonic model was used to study the influence of wetland degradation and effect on the different characteristics of farm land and income of the respondents from Pong dam wetland. The Wetland income function was expressed in the following form and both linear and Cobb-Douglas production function was employed. But keeping in view the value of R^2 and significance of the variables, Cobb-Douglas production function was retained for further analysis. The form of function was as follows:

$$Y = a\, X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} X_8^{b8} X_9^{b9} X_{10}^{b10}\, e^{u}$$

where,

Y = Wetland income (₹/Hh)

a = Constant term

X_1 = Total net sown area (ha)

X_2 = Degradation (0 =No, 1 =Yes)

X_3 = Share of income from wetland (per cent)

X_4 = Education of the respondents

(0 illiterate, 1 Middle, 2 High school, 3 senior secondary, 4 Graduate and above)

X_5 = Distance from residence to Pong Dam (km)

X_6 = Awareness on wetland benefits (0= No, 1= Yes)

X_7 = Awareness on wetland (0= No, 1= Yes)

X_8 = Management level of the respondents (0 = No, 1= Yes)

X_9 = Standard Animal Units (SAU)

X_{10} = Family size (No.)

b's= Regression coefficients

u = Random term

Where, Y is willingness to pay for upkeep of Pong Dam wetland and the other variables are as defined above,

The significance of R^2 was tested by employing F-test as follows:

$$F = \frac{R^2/(k-1)}{(1-R^2)/(n-k)} \sim F\ (k\text{-}1,\ n\text{-}k)$$

where,

R2 = Coefficient of multiple determinations

n = Number of observations

k = Total number of parameters to be estimated

Results and Discussion

Socio economic characteristics of sampled farms

Table 1 presents socio-economic characteristics of agricultural farmers and fishermen according to gender, age, education and occupation. About 53 per cent sampled farms were in the working age group in case of agricultural farmers and 44 per cent in case of fishermen. The average family size was estimated at 6.43 and 5.35, respectively. It can be observed from the table that the literacy rate of the sampled agricultural farmers and fishermen was 82.46 per cent and 74.25 per cent respectively, which was found to be higher among agricultural farmers compared to fishermen. The table revealed that average size of holding was found to be higher among agricultural farmers (0.5 ha) as compared to fishermen (0.07 ha). It has been noted that the total number of livestock in terms of standard animal units (SAUs) was found to be higher in agricultural farmers (4.67SAU) as compared to fishermen (1.31SAU). The livestock units were converted into SAU as per study of Kumbhare *et al.* (1983). Similarly total income of ₹ 2,92,166 per farm for agricultural farmer was higher than fishermen (₹ 1,41,802). The analysis of the table revealed that the different socio-economic parameters were better for agricultural farmers than fishermen indicating the need for improvement of socio-economic parameters of fishermen. Similar trend was noted from the study conducted by Balachandran *et al.* (2005) and Kalpana *et al.* (2007).

Table 1: Socio- economic profile of the sample farms

Sl. No.	Particulars	Cultivators	Fishermen	Total
I	Average family size	6.43	5.35	6.18
II	Education Literacy (%)	82.46	74.25	80.34
III	Average land holding size	0.50	0.07	0.39
IV	Livestock size (SAU)	4.67	1.31	3.84
V	Total income	2,92,166	1,41,802	2,54,575

Association between socio-economic factors and wetland income

The association between socio-economic factors and wetland income has been presented in table 2. As evident from the table, income, literacy, landholding and livestock inventory had positive association with the wetland income. A negative and very low non significant association was noticed with the age of the households showing very poor association of age with wetland income.

Table 2: Association between socio economic factors and wetland income

Sl. No.	Particulars	Correlation	t-stat
1	Age of households	-0.03	0.23
2	Household income	0.63**	7.22
3	Literacy	0.60**	6.61
4	Land holding	0.61**	6.81
5	Livestock inventory	0.12	1.06

Note: **Indicates significance at 1 per cent level of probability.

It was observed that there was higher and significant association of household income, education and size of the landholding with wetland income.

The benefits accruing from wetland to sample households

Number of animals grazed and time spent in grazing of animals

Animal grazing is old common tradition among the farmers since a long time in the hills. The extent of grazing has become common and important factor effecting grazing lands and the economic system of the area. The number of animals grazed and time spent for grazing has been given in Table 3 and Table 4.

Table 3 showed the grazing of number of animals per farm per day in different seasons in different types of lands i.e. owned land, CPR lands and wetland. On an average 2.11, 1.36, 1.20 numbers of cattle per day per farm were grazed during summer, winter and rainy seasons respectively in owned land followed by 1.72 in summer and 1.48 in winter seasons in wetlands. The cattle were not grazed during rainy season in wetland. This may be due to increase in water level of Pong dam. The cattle were also grazed in owned lands during different seasons.

Similar pattern was also noticed for grazing of buffaloes in different types of lands in different seasons. The number of sheep and goats grazed per day per farm was observed very less. This may be due to the reason that large numbers of sample farmers were not keeping sheep & goats. In standard cattle units the number of animals grazed during different seasons in different types of lands varied from 1.92 per day per farm during rainy season in CPR lands to 4.55 in owned lands during the same season. The number of animals (SAUs) grazed in wetland were 3.70 in summer and 3.08 in winter.

Time spent in grazing of animals during different season has been given in Table 4. It was found that sample farmers grazed their animals on owned land, CPR land and wetland. The sample farm grazed their animal for higher time during summer and winter on wetland followed by CPR lands. The time spent for grazing of animals on the wetland was noted 2.95 hours per day per farm. It was also observed from the table that time spent for grazing of sheep& goats was very less and varied from 0.01 to 0.05 hours per day per farm during summer. Among the different categories of animals the grazing hours per day were highest in case of cattle during different seasons followed by buffaloes and ovines. The results of grazing of animals in different type of lands were in conformity with the study conducted by Balachandran *et al.* (2005).

Table 3: Grazing of animals by sample farms during different seasons (No/day/farm)

	CPR land			Owned land			Wetland		
Particulars	**Summer**	**Winter**	**Rainy**	**Summer**	**Winter**	**Rainy**	**Summer**	**Winter**	**Rainy**
Cattle	1.26	1.20	1.10	2.11	1.36	1.20	1.72	1.48	—
Buffaloes	1.07	0.90	0.55	1.63	0.92	1.21	1.32	1.07	—
Sheep & Goats	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	—
ACU	2.86	2.55	1.92	4.55	2.74	3.01	3.70	3.08	—

Table 4: Time spent on the grazing of animals by sample farms

(Hrs/day/farm)

	CPR land			Owned land			Wetland		
Particulars	**Summer**	**Winter**	**Rainy**	**Summer**	**Winter**	**Rainy**	**Summer**	**Winter**	**Rainy**
Cattle	1.48	2.95	1.48	1.48	2.95	1.48	2.95	2.95	—
Buffaloes	1.08	2.05	1.03	1.03	2.05	1.03	2.30	2.05	—
Ovine	0.03	0.05	0.03	0.01	0.03	0.03	0.05	0.05	—

Table 5: Grass consumed during grazing by animals in different seasons (Kg/farm)

Animals	CPR land			Owned land			Wetland		
	Summer	**Winter**	**Rainy**	**Summer**	**Winter**	**Rainy**	**Summer**	**Winter**	**Rainy**
Cattle	114.50	222.79	101.63	191.74	252.50	110.86	311.54	274.77	—
Buffaloes	98.92	161.88	49.30	143.71	165.48	108.46	259.88	192.46	—
Ovine	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.02	—
Total (qty)	213.43	384.69	150.94	335.46	417.99	219.33	571.44	467.25	—

Estimated consumption of grasses through grazing in different seasons

The total quantity of grasses consumed by animals during grazing in different seasons has been estimated and presented in Table 5. The estimates of quantity of grasses consumed during grazing by animals were studied on the basis of study conducted by Dikshit and Birthal (2010). Table showed that wetland was main source for grazing during summer and winter. The quantity of grasses consumed through grazing per farm in summer by the cattle was 312 kg and 274 kg in winter from wetland. The quantity of grasses consumed by cattle during grazing was 191 kg, 252 kg and 110.86 kg from owned land in summer, winter and rainy seasons, respectively. Similarly quantity of 114.50 kg, 222.79 kg and 101.63 kg grasses was consumed from CPR lands by cattle during grazing in different seasons. Almost, similar pattern was observed in case of buffaloes. In case of ovine (sheep & goats) population was very low. This may be due to the fact that less number of sample households was keeping sheep & goats. The total quantity of grasses consumed per farm by animals during grazing was 1038.69 kg from wetland, 749.06 kg from CPR lands and 972.78 kg from own land.

Benefits from Pong dam wetland to sample household

Table 6 showed the income contribution to the sample households from wetland. It was noted from the table that total income accrued to sample households from wetland was ₹ 94,213 and accounted for 60 per cent of the total income. It was evident from the table that the income from fishing and boating accounted for ₹ 24,138 and ₹ 6,150 from the wetland to households. The contribution of crop production (wheat) from

wetland was ₹ 60,844. This share was 59 per cent. The per cent share of grazing was 52 per cent as compared to owned land (48%). Similar results are reported by the Saccchidananda (1998) and Kalpana *et al.* (2007). The sample household collected fuel wood from CPR (Common Property Resources) and owned land during winter season and there was no availability of fuel wood from wetland.

Willingness to pay by sample households

Table 7 showed willingness of sample households to pay for the different economic activities on the wetland and it ranged from ₹ 50 to ₹ 500. Only five per cent of the respondents were not interested to pay for the management of different economic activities. Agriculture was the activity on which respondents were willing to pay upto ₹ 50, ₹ 101-150, ₹ 151-200, ₹ 201-250, ₹ 300-350 and more than ₹ 350 annually by 11.25 per cent, 12.50 per cent, 10 per cent, 16.25 per cent, 7.50 per cent and 12.50 per cent respectively. The study conducted by Prasher *et al.* (2006) also reported similar results.

Factors influencing willingness to pay

The factors influencing the willingness to pay by respondents were analyzed through contingent valuation model to work out the determinants of willingness to pay. Both linear as well as Cobb-Douglas production functions were tried and better fit was used for analyzing the results and has been presented in Table 8. The study revealed that elasticity coefficients in respect of net sown area, household income, share of income from wetland to the total income and awareness on benefits of wetland were significant at one per cent level and positive. This indicated that willingness to pay (WTP) for wetland increased with the increase of these variables. These factors play a crucial role in conservation and increasing benefits from wetland. The education level and awareness level about wetland

Table 6 : Estimated income to sample household from Pong dam wetland

₹/farm)

Sl. No.	Particulars	Sources			Per cent contribution
		Owned land	Wetland	Total	
1	Crops	42344	60844	103188	58.96
2	Fuel	5540	—	5540	—
3	Fodder	17385	1836	25317	7.25
4	Grazing	1167	1245	2412	51.62
5	Fishing	—	24138	24138	100
6	Boating	—	6150	6150	100
7	Total	72532	94213	166745	59.65

Table 7: Per cent distribution of willingness to pay by sample households

(Per cent)

Particulars	₹ 1-50	₹ 101-150	₹ 151-200	₹ 201-250	₹ 300 -350	> ₹ 350
Fishing	—	25.00	—	—	—	—
Boating	—	—	—	—	—	6.25
Fodder	—	—	—	—	—	—
Agriculture	11.25	12.50	10.00	16.25	7.50	6.25
Grazing	—	—	—	—	—	—
Total	11.25	37.50	10.00	16.25	7.50	12.50

coefficient were non-significant but positive indicating that with increase in these factors the willingness to pay increased. The value of R^2 was calculated to be 0.74, showing that 74 per cent of the variation in willingness to pay was explained by given explanatory variables included in the regression model

Table 8: Factors affecting willingness to pay : Regression analysis

Variable	Regression coefficients	Estimated coefficients	Standard error
Constant	b_0	-5.63	1.67
Net sown area	b_1	0.21**	0.06
House hold income	b_2	0.19**	0.07
Family size	b_3	-0.24	0.26
Degradation	b_4	0.14	0.24
Share of income from wetland	b_5	0.62**	0.09
Education level	b_6	0.06	0.21
Distance	b_7	- 0.13	0.13
Awareness on benefits of wetland	b_8	0.36**	0.08
Coefficient of multiple determination	R^2	0.74	0.29
F-value	F	16.79	
Degree of freedom	d.f.	54	

Note: **Indicates significance at 1 per cent level of probability.

Hedonic regression model

In the regression analysis both linear as well as log linear production functions were tried and better fit was used for interpreting the results. The results of the parameters in the hedonic model were estimated by using Cobb-Douglas production function as it was better fit in terms of R^2 value and significance of variables. The results of the model have been presented in Table 9. The net sown area, share of income from the wetland in total income, education level and awareness of benefits about wetland were significant at 1 per cent level. This revealed that with 1 per cent increase in net sown area, share of the income, education level, awareness of benefits on wetland there was increase in the wetland income by 0.64 per cent, 0.56 percent, 0.40 per cent and 0.09 per cent respectively. The regression co-efficient of awareness of management was non-significant but positive this indicates that with the increase in this factor wetland income increased. The analysis explained that 75 per cent of variation in wetland income was explained by the given set of explanatory variables included In the hedonic regression model.

Table 9: Hedonic regression analysis

Variables	Regression coefficients	Estimate of regression coefficients	Standard error
Constant	b_0	6.76	1.40
Net sown area	b_1	0.46**	0.10
Family size	b_2	-0.04	0.26
Education level	b_3	0.56**	0.21
Income share of wetland	b_4	0.40**	0.06
SAU	b_5	0.07	0.10
Degradation	b_6	-0.10	0.11
Distance	b_7	-0.10	0.14
Management level	b_8	0.12	0.27
Awareness on wetland	b_9	0.94**	0.29
Awareness on benefits	b_{10}	0.06	0.28
Coefficient of multiple determination	R2	0.75	
F-value	F	16.18	
Degree of freedom	d.f.	53	

Note: **Indicates significance at 1 per cent level of probability.

Response of sample households about degradation of Pong dam wetland

Table 10 shows the response of sample households about degradation of Pong dam wetland. It was observed that cent per cent respondents response about the degradation was runoff soil followed by releasing of toxic pesticides (97.50%), tilling for crop productions (95%), population pressure (83%), grazing (80%), human sewage (66%). These were major factors responsible for the degradation of wetland. The response of respondents reported by less than 60 per cent sample household

was changing nutrient levels (58%), dumping of crop waste (49%), weeds and eutrophication (48%), solid waste pollutants like polythene (45%), washing waste water (42.50%), lack of maintenance (36%), introducing of non native species (34%). Same pattern was noticed in the ranking of reasons for degradation of Pong dam wetland. The study conducted by Ramachandra *et al.* (2003), Suresh Chandra (2007) and Dhadwal (2008) also reported the similar results about degradation of wetlands.

Table 10 : Response of sample households regarding causes of degradation of wetland (Number)

Sl. No.	Particulars	Response (%)	Rank
1	Population pressure	83.00	iv
2	Human sewage	66.00	vi
3	Washing waste water	42.50	xi
4	Solid waste pollutants	45.00	x
5	Lack of maintenance	36.00	xii
6	Dumping of crop waste	49.00	viii
7	Weeds and eutrophication	48.00	ix
8	Changing Nutrient levels	58.00	vii
9	Tilling for crop production	95.00	iii
10	Introducing non native species	34.00	xiii
11	Releasing of toxic pesticides	97.50	ii
12	Runoff soil (Siltation)	100.00	i
13	Bathing of domestic animals	21.00	xiv
14	Grazing	80.00	v
15	Animal carcass	19.00	xv

Conclusion and Suggestions

The average family size was estimated at 6.43 and 5.35 respectively. The literacy rate of the family members of sampled farms was quite high i.e. around 79.40 per cent. The average size of holding was found to be higher among agricultural farmers (0.5 ha) as compared to fishermen (0.07 ha). The sampled farms maintain a livestock unit of 3.83 (SAU) and the population of cows was found to be highest. The total income of sample farms was ₹ 2, 54, 575. The number of animals grazed during different seasons in different types of lands varied from 1.92 per day per farm during rainy season in CPR lands to 4.55 in owned lands during the same season.

On an average 2.11, 1.36, 1.20 numbers of cattle per day per farm were grazed during summer, winter and rainy seasons respectively in owned land followed by 1.72 in summer and 1.48 in winter seasons in wetlands. The time spent for grazing of animals on the wetland was noted 2.95 hours per day per farm. The total quantity of grasses consumed by animals per farm during grazing was 1038.69 kg from wetland, 749.06 kg from CPR lands and 972.77 kg from own land. The estimated income contribution to the sample households from wetland was ₹ 94,213. It was accounted for 59.65 per cent of the total farm income. The sample households were willing to pay for different economic activities and management of wetland. The higher proportions of sample household were willing to pay ₹ 100-150 for these activities. The coefficient of multiple determination in case of willingness to pay indicated that 74 per cent of variation explained by the chosen explanatory variables. The variables like net sown area, household income, share of income from wetland to the total income and awareness about benefits from wetland were the factors influencing significantly to the willingness to pay.

The result of hedonic regression model revealed net sown area, share of income from wetland, education level and awareness of benefits about wetland were significantly affecting the wetland income. The coefficient of multiple determinant showed that 75 per cent of the variation in income was explained by the chosen set of explanatory variables. The important reasons reported by respondents about the degradation were runoff soil followed by releasing of toxic pesticides, tilling for crop productions, population pressure, grazing, human sewage, etc.

It was suggested that to reduce the dependence on wetland for crop cultivation and pressure of chemicals farmers should be provided irrigation facility to grow cash crops on owned lands. Since the fishing business is adopted by large population therefore, the royalty and commission charged from the fishermen should be reduced and facility of mechanized boat at subsidized

rate should be provided to fishermen to enhance their efficiency and income of fishermen. Awareness through education should be provided among local people with respect to management issues of wetland.

References

Balachandran, S., Fernandes, M. and Deepak S. 2005. A preliminary analysis of the environmental economics of Pong Dam. State council for Science, Technology & Environment Government of Himachal Pradesh. Bombay Natural History Society.

Dhadwal D.S. 2008. Pong Lake- An international Ramsar site in need of management interventions. *Tiger Paper,* **35**: 17-21.

Dikshit, A.K. and Birthal, P.S. 2010. India's livestock feed demand: Estimates and Projections. *Agricultural Economics Research Review,* **23**: 15-28.

Kalpana, A., Hussain, S.A. and Badola, R. 2007. Resource dependence and attitudes of local people toward conservation of Kabartal wetland: a case study from the Indo- Indo-Gangetic plains. *Wetlands Ecological Management,* **15**: 287-302.

Kumbhare, S.L., Sharma, K.N.S. and Patel, R.K. 1983. Standardization of bovine units. *Indian Journal of Animal Sciences* **53**: 547-550.

Prasher R.S., Negi, Y.S. and Kumar, V. 2006. Valuation and management of wetland ecosystem: a case study of Pong Dam in Himachal Pradesh. *Man and Development* 77-92.

Ramachandra, T.V., Rajinikant, H.R. and Ranjini, V.G. 2003. Economic valuation of wetlands. *Journal of Environmental Biology,* **26**: 439-447.

Sacchidananda Mukherjee and Kumar, M.D. 2012. Economic valuation of a multiple use wetland water system: a case study from India. *Water Policy,* **14**: 80-98.

Suresh Chandra, G. 2014. Conservation of wetlands in India: critical review of the adequacy of law. *Indian Forester,* **140**: 113-128.