# An Ecosystem Conservation Approach for Northern Alpine Wetlands

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***Abstract***: To ascertain the importance of wetland conservation and management practices in improving human health associated with water pollution, the paper studies the impact of Saving Wetlands Sky High, a wetland conservation project in northern alpine, on the health of local communities. The study examined the impact of the ecosystem conservation approach on the prevalence and associated health cost of diarrhea and typhoid in communities depending on these wetlands.
The analysis is based on the difference between prevalence of diarrhea and typhoid and related average health cost per year in the communities that benefit from this project and communities, which rely on non-protected or non-conserved wetlands for water supply. The difference in disease prevalence and related health cost of both types of communities are taken as indicators of positive or negative impact of wetland conservation activities. Identification of the impact on human health involved measuring the difference in prevalence of diarrhea and typhoid and related health cost for the treatment group, the community that benefited from the conservation project with the control group, the community depending on non-conserved wetland. Assuming that socio-economic and geographic determinants of health are constant, the treatment group has been observed to have lower prevalence of water borne diseases. This provided lower related health costs for the treatment group ranging from about $4 to $223 per year unlike the control group which ranged from about $11 to $740.

***Keywords:*** *Alpine lakes, Ecohealth, Ecosystem, Health cost, Human health, Wetland conservation and management.*

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## I. INTRODUCTION

Socio-economic and environmental barriers are leading to the degradation of these fresh water reservoirs. This study is intended to identify the significance of alpine wetland conservation and management in improving human health and wellbeing. A key question for the study: is the conservation of alpine wetlands an ecosystem approach to human health and wellbeing? An answer to this question would ascertain if such conservation system is a workable management approach for improvement in human health and well-being. To this end, the analysis in this study identified the impact of wetland conservation and management on the prevalence of water-borne diseases as Diarrhea and Typhoid, and valuing the impact on the health cost incurred in the selected communities. Saving Wetlands Sky-High is taken as a conservation case study via activities such as improvement of drinking water quality through regular monitoring and controlling the point and non-point sources of bacteriological pollution, public awareness sessions, and community involvement programs.

## II. ANALYTIC APPROACH

Figure 1 shows the conceptual model used for the causal relationship between the variables used. It is assumed that conservation of water reserves and their watersheds allows the provision of clean drinking water to the communities which in turn lowers the disease prevalence and the related health cost.


**Figure 1: Conceptual Framework of the Study**

A non-probabilistic sampling method is adopted for collecting data from a total of 113 wetlands in northern alpine. Measurements for prevalence of water borne diseases and associated health cost were taken from two different groups of communities. The treatment group which comprised two conserved wetland communities and the control group comprised two non-conserved wetland communities. The number of households was systematically selected using a skipping factor to determine each household to be surveyed. This was based on the total population and sample size needed. The value of the skipping factor was obtained by dividing the total number of households in each community by the number of households making up 20% of the population. A

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household is defined in this study as "a group of individuals related by blood or marriage living on the same premises and sharing one set of cooking utensils." The data was selected during the peak season for water-borne diseases like diarrhea. The household survey questionnaire was designed to collect data on the general behavioral and socio-economic factors of water-borne diseases including water treatment at home, water handling, family size, monthly income, health cost related to water-borne diseases, patients' profile (age, education, and working status); and direct and indirect cost.

The data types included the dependent (prevalence of diarrhea and typhoid), independent (conservation; behavioral including water treatment, storage, containers used, cleaning frequency, and handling; livestock, open washing, open sanitation, and field runoff), socio-economic (family income and size, awareness and participation of the household family members in the conservation project) variables.

SAS 9.4 was used for estimation analysis via Chi-Square test to identify the relationship between disease prevalence and other independent variables and Two-sample T-test to measure difference in average annual health cost between control and treatment group. MS Excel was used for basic statistics and graphs. The analysis of the data included viewing the relationship between prevalence of diarrhea and typhoid as the dependent variable and wetland conservation and management as the predictor variable. To avoid any bias about the relationship between wetland conservation and disease prevalence, the analysis of the association of disease prevalence with several behavioral variables (as predictor variables) for both control and treatment groups was considered. The impact of wetland ecosystem conservation on disease prevalence included analysis of association of wetland conservation and disease prevalence and the difference of risk of disease prevalence in the control and treatment groups.

## III. Results and Discussion

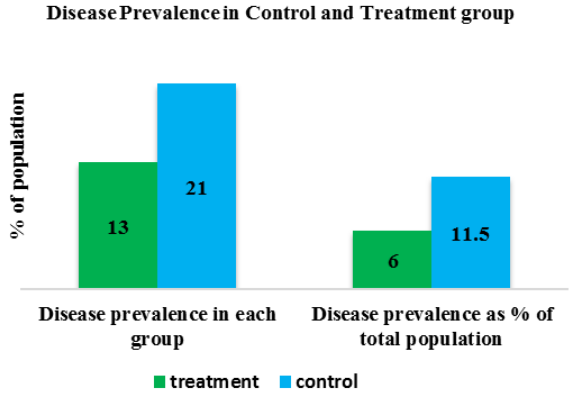


**Figure 2a: Disease prevalence in control and treatment groups**

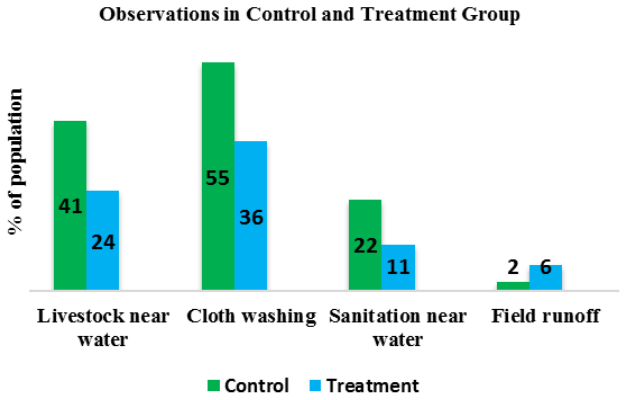


**Figure 2b: Community practices in control and treatment groups**

Figure 2 shows that the prevalence of the diseases in the control group was higher, with a value of 21% of the total population (42 households out of 198 total households), than the treatment group, with a value of 13% of the total population (22 households out of 168 households). It shows also the community practices values observed for the treatment group were lower than those for the control group. As shown in the figure, 11% and 31% of the surveyed households in the conserved communities had livestock near water as compared to 39% and 45% in non-conserved areas. For cloth washing, the percentages respectively were 23% and 43% compared to 50% and 62%; for open sanitation near water, the percentages were 8% and 12% compared to 20% and 26%; for field runoff, the percentages were 11% and 3% compared to 2% and 0%; for water treatment the percentages were 27% as compared to 10%; for water storage, the percentages were 79% as compared to 70%; for type of containers, the percentages were 38.69% (open), 20.24% (closed), and 29.80% (no storage) as compared to 24.24%, 45.96% and 41.07%; for container cleaning the percentages were 48% (daily cleaning), 29% (weekly cleaning), and 1.79% (monthly cleaning) compared to 29.08%, 39.39%, and 0.51%; for water handling, the percentages were 42.93% (consumption directly from container), 20.20% (used vessels with handles), and 7.07% (used vessels without handles ) as compared to 23.21%, 41.07%, and 15.48%. The results obtained from the socio-economic variables indicated negligible difference in the control and treatment groups with a significant difference in the incomes.

**Table 1: Distribution of direct health cost in the control and treatment groups**

| Group | Avg. total Direct $/year | Avg. total Indirect $/year | Avg. $ income/ year | Avg. % income direct cost | Avg. % income Indirect cost |
|---|---|---|---|---|---|
| **Contl.** | 81 | 12 | 1992 | 7.7 | 1 |
| **Treat.** | 50 | 7 | 1337 | 4.4 | 0.6 |

Table 1 shows the distribution of direct and indirect cost in the treatment and control groups. The table indicates that the average annual health cost was higher in control group than for treatment group. The difference in annual health cost for both groups wasn't statistically significant.

## IV. CONCLUSIONS

The paper highlighted the importance of the ecosystem approach for wetland conservation and management, and its impact on human health and associated cost. Using disease prevalence as an indicator of health, the paper demonstrated how improved human health could be an outcome of the ecosystem conservation and management. Analysis of the relationship between ecosystem conservation and human health also involved measurement of some of the behavioral and socio-economic determinants of health, to be aware of any possible effect of these variables, which could mask the effect of conservation on health. The analysis of the outcomes of this project for impact on human health helped understanding the connection between Ecosystem Health and human health

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