K. Khanal et al. (2017) Int. J. Appl. Sci. Biotechnol. Vol 5(3): 345-355
DOI: 10.3126/ijasbt.v5i3.18291

Research Article

Perspective Response of Climate Change Impacts on Agricultural Crops in Sauraha-Pharsatikar VDC, Rupandehi District, Nepal

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Abstract

A survey research was conducted in Sauraha-Pharsatikar VDC of the Rupandehi district to study the perspective response of the farming communities on the impacts of the climate change in agricultural crops. Primary information was collected from household survey by administering pre-tested questionnaire and necessary data were collected from National Wheat Research Project (NWRP), Bhairahawa. Several results are obtained on the recall basis of the respondents thus they can not assumed correctly and all the past information provided by the farmers cannot be cross checked due to the lack of sufficient and reliable system for recording and checking. The trend analysis of rainfall data of Bhairahawa of 30 years (1984-2013) showed that the pattern of rainfall was irregular and it was in a decreasing trend by 1.944 mm per year and average maximum temperature has increased by 0.0.15^{o}C and average minimum temperature has increased by 0.0.61^{o}C per year which justifies that the summers are growing hotter and winters are growing warmer. About 52% of the respondents suggested monsoon starts earlier, 85% suggested there is more intense rain during the monsoon and 91.75% suggested drought has increased. 98.33% of the respondents perceived that the summer has become hotter. In general there is increase in the yield of cereal crops whereas the yield of pulses, legumes and vegetables had declined.

Keywords: Climate change; impact; agriculture; adaptation

Introduction

Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as result of human activity (IPCC). Climate change may be due to natural internal processes or external forcing such as modulations

Article may be cited as:

K. Khanal *et al*. (2017) Int. J. Appl. Sci. Biotechnol. Vol 5(3): 345-355. DOI: http://dx.doi.org/10.3126/ijasbt.v5i3.18291

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Peer reviewed under authority of IJASBT

of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. Climate change has been one of the emerging global challenges in the recent times. Human activities such as excessive use of fossil fuels in industries and transportation have caused increase in the amount of greenhouse gases. This is ultimately contributing to global warming. Natural variability in climate is also responsible for social conditions are undeniably related to the climate (Solomon, 2007). But the recent change in climate conditions has had an adverse effect on these. Temperatures in Nepal have increased more than the global average temperature rise of 0.74°C over the last 100 years (between 1906 and 2005) and 0.13°C per decade in the last 50 years (between 1956 and 2005) (Solomon, 2007).

The population of Nepal is less than 0.4% of the world population and is responsible for only about 0.025% of annual greenhouse gas emissions. However, Nepal is highly vulnerable to climate change impacts. The rise of temperature is high in higher mountain area than elsewhere (Shrestha *et al*., 1999). The concentration of green house gases in the atmosphere has increased significantly sivnce the industrial revolution in 1750s. The amount of carbon dioxide has increased by 31%, methane by 151% and nitrous oxide by 17% (Regmi *et al*., 2007).

There are great chances of people being suffered from the problem of food security. At present context, Nepal is also facing the situation of food deficit and climate change can further increase food insecurity in the country. Local level impacts such as loss of land races, plant and animal species, changes in cropping patterns, scarcity of water due to drying up of wells, decrease in agriculture productivity have been noticed in Nepal (Regmi *et al.,* 2008).

Farmers have been trying to adopt the changing climate to maintain the yield of rice, the main food in Nepal (Regmi *et al.,* 2007). A study report from Nepal also shows that farmers have adopted some measures such as conservation of landraces, alternative practices to reduce water stress, soil erosion and loss, changes in cropping pattern and crop adjustments (Regmi *et al., 2008*). Thus it is necessary to find some adaptation strategies at the local level to cope with the climatic change and climatic variability which will significantly reduce impacts on agriculture dependent livelihoods of farmers and agriculture economy as a whole. Therefore, assessing the potential impacts of climate change on livelihoods is urgently needed for the survival of rural communities.

Methodology

Desk Study

Based on our resource availability, convenience, accessibility and time available for the completion of this research, research area and questionnaire was developed to meet the objective of research. The questionnaire thus developed was pretested and finally it was prepared after consultation with supervisor.

Research Locale/Location

The study was conducted in Rupandehi district of Nepal. For the purpose of our study to assess the impact of climate change on agricultural crops and to know about the general understanding of the farmers on climate change, Sauraha – Pharsatikar V.D.C. was selected for the purpose of our study. Three communities of three different wards were selected namely: Pharsatikar (ward no.1), Jugdihawa (ward no. 4) and Kewalpur (ward no.5) based on their convenience and accessibility.

The residents of these communities were our target communities for the study. By using simple random technique, farmers were selected from each community and by including 20 members from each community 60 farmers were selected in total.

Source of Information

For the collection of necessary information, various techniques and sources were used. For the collection and analysis both the primary and secondary data were used.

The primary information as knowledge of respondents on climate change, perception of the farmers on the changes in climate they have been feeling, impact on agricultural crops, impacts on natural resources, adaptation strategies, etc. Our primary sources of information were the local farmers. Secondary information as meteorological data, statistical data on various aspects as yield, population, areas and other socio economic and ecological factors were collected from the National Wheat Research Program,

Bhairahawa, various journals and publications of Central Bureau of Statistics (CBS), Ministry of Agriculture and Cooperatives (MoAC), Ministry of Agriculture Development (MoAD), research articles of various NGOs and INGOs.

Field Survey

The well prepared questionnaire was administered to the respondent to collect necessary information regarding various aspects of impacts of climate change and it was collected in depth face to face interview. Further information was obtained by administering our questionnaire among the key informants.

Techniques of Data Entry and Analysis

The data thus obtained, both primary and secondary were entered via Microsoft Excel and SPSS. Both the primary and secondary data were analyzed by using the Microsoft excel, SPSS. Data were coded and entered via Microsoft Excel and SPSS for the further analysis. Statistical tools like mean, standard deviation were used to analyze the trend of rainfall and temperature. Both descriptive and inferential statistics were used for the purpose of data analysis and interpretation.

Processing of Secondary Data

Climatic data were collected from the National Wheat Research Program, Bhairahawa.

Collected monthly temperature data were processed in the desirable form as follows: Monthly average temperature for each month was calculated as (T) = ($T_1 + T_2 + T_3 + T_n$)/n, where T_1 represents the first day of the month and T_n represents the last day of the month and n represents the total number of days in the month.

Collected monthly rainfall data was processed as $R = R_1 + R_2 + \ldots\ldots + R_{30}$ where R is total monthly rainfall and R_1 is the rainfall in the first day of the month and so on. $R_a = R_{m1} + R_{m2} + \ldots\ldots\ldots + R_{m12}$ where R_a denotes total annual rainfall and R_{m1} denotes first month of the year and so on.

Results and Discussions

Ethnicity of the Respondents in the Study Area

Out of total respondents, Brahmins were 61.7%, Magar were 21.7%, Tharu were 13.3% and Chhetri were 1.7%. It showed that there was not much of the dominance of ethnic communities in the study area. The population of Sauraha-Pharsatikar VDC is Chhetri 13.07%, Brahmin 32.48%, Tharu 32.65%, Magar 6.14%, Gurung 0.7% and rest others (CBS,2012) (Table 1).

Table 1: Ethnicity of the respondents in the Sauraha Pharsatikar V.D.C., Rupandehi, 2012.

Ethnicity	Frequency	Percentage
Brahmin	37	61.7
Magar	13	21.7
Tharu	8	13.3
Gurung	1	1.7
Chhetri	1	1.7
Total	60	100

Educational Status of the Study Population

Four categories Uneducated, Primary, Secondary and College were selected to assess the educational status of the respondents. It has been found that 31.7% of the respondents have acquired secondary level education, 28.3% have acquired primary level education, 26.7% were uneducated and 13.3% have attained college level education. Majority of the respondents not being able to carry beyond primary and secondary level education may be due to compulsion to bear household responsibilities at early age since there is lack of manpower and agriculture is the only source of income. Literacy rate of Sauraha-Pharsatikar VDC is 78.81% (CBS, 2012) (Table 2).

Table 2: Educational status of respondents in the Sauraha Pharsatikar V.D.C., Rupandehi, 2014.

Education	Level	Percentage
Uneducated	16	26.7
Primary	17	28.3
Secondary	19	31.7
College	8	13.3
Total	60	100

Age of the Respondents in the Study Area

The average age of the respondents was found to be 52.88 with minimum age of 27 and maximum age of 73. 1.67% of the respondents were less than or equal to 30, 16.67% were ranging from 31- 45 and 81.67% of 46 and above. Thus majority of our respondents being above 30 years they can share us their experience of a long span of time which is the prerequisite of our study. The population of the VDC above the age 30 was 38.98% (CBS, 2012) (Fig.1).

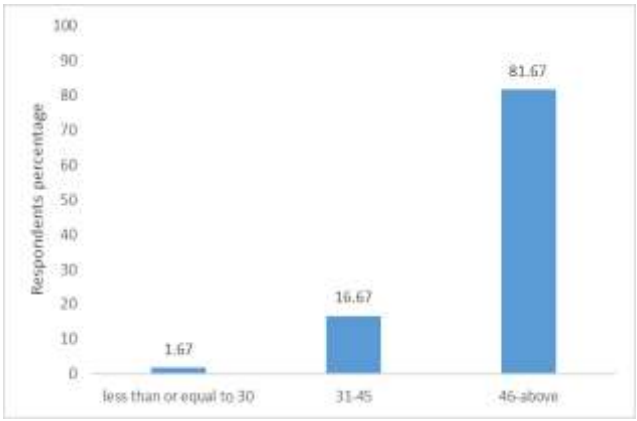

Fig. 1: Age of the respondents in the Sauraha Pharsatikar V.D.C., Rupandehi, 2014.

Size of Family in the Study Area

Family with family members ranged 5-8 are 65%, 9-12 members are in 20% houses, in 13.3% houses there are less than 4 members and in 1.7% houses there are 12 -16 family members. The general size if the family is more than our national average and this might be because of the lack of knowledge, lack of manpower and lack of other sources of entertainment. Average size of the family in the study area was found to be more than the average of the VDC which was 4.85 (CBS, 2012)

Size of Farm of the Respondents

Majority of the farmers have less than 1 bigha of land, whereas about 30% have more than 2 bigha of land, 23.3% of the respondents have land between 1-1.5 bigha and 10% have between 1.5-2 bigha. Farmers with small and large holdings were in nearly equal situation (Fig. 3).

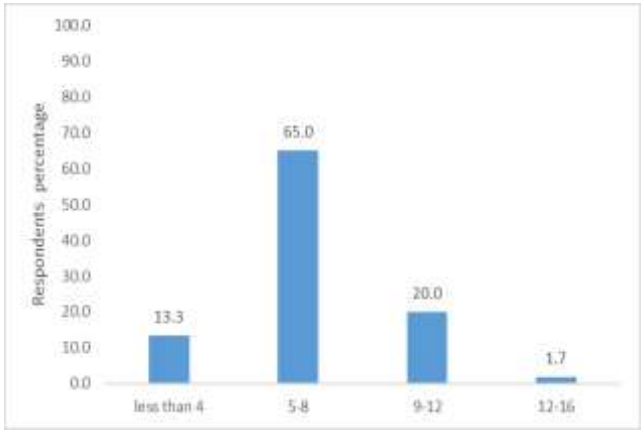

Fig. 2: Family size of respondents in the Sauraha Pharsatikar V.D.C., Rupandehi, 2014.

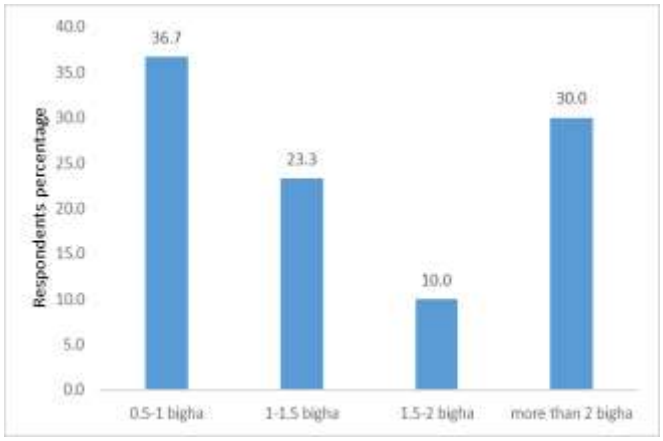

Fig. 3: Size of the land holding of the respondents in the Sauraha Pharsatikar V.D.C., Rupandehi, 2014.

Analysis of Rainfall Data of Bhairahawa in Last 30 Years

Among four monsoon months, average monthly rainfall has increased in the months of June, July and August in during the period of last two decades being more in1994-2003 than 2003-2013. Whereas throughout the period of 1984-2003 it fell sharply during the months of September and it had decreased in the last two decades gradually. Overall rainfall pattern was irregular during the four months of monsoon. There will be more intense summer monsoon even as the number of rainy days decrease (IPCC, 2007) (Fig. 4).

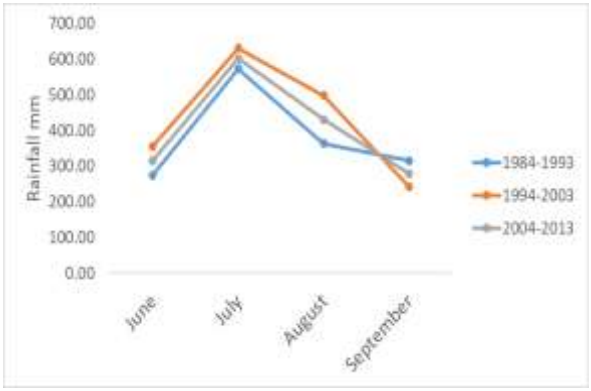

Fig. 4: Trend analysis of average rainfall during monsoon months (Jun. – Sept.) in Bhairahawa (1984 - 2013). (Source: NWRP, Bhairahawa).

Rainfall data of Bhairahawa after analysis showed that the pattern of rainfall was irregular (Fig. 5). Analysis of the climatic data strongly supports farmers' perception. As per the farmers couldn't predict the rainfall pattern and were compelled to change their cropping pattern and these changes were sometime favourable and sometime unfavourable. The trend analysis showed that the fall in total annual rainfall was decreasing by 1.250 mm per year for the last 30 years (Fig. 6). Nepal's precipitation may increase or decrease by -34 to +22% by 2030s and here its decreasing (NCVST, 2009).

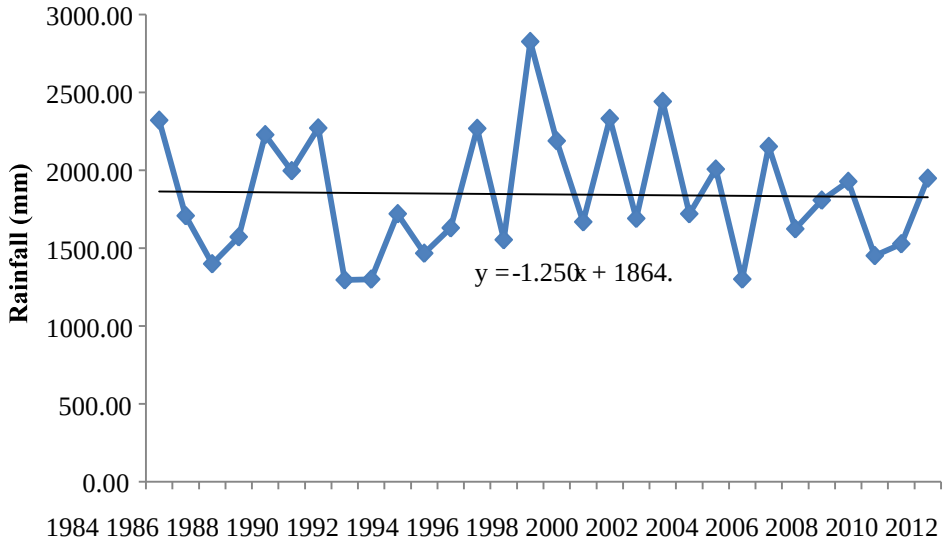

Fig. 5: Trend analysis of total annual rainfall over the last 30 years (1984-2013) in Bhairahawa (Source: NWRP, Bhairahawa).

Analysis of the change in maximum and minimum temperature for last 30 years in Bhairahawa

After the analysis of the minimum temperature of Bhairahawa of 30 years it showed that there is increase in minimum temperature of every summer months is gradually increasing. The month of July had only slight rise intemperature throughout the years but in other three summer months (April, May and June) there is significant rise in the minimum temperature. It suggested that the days are certainly growing hotter (Fig. 6).

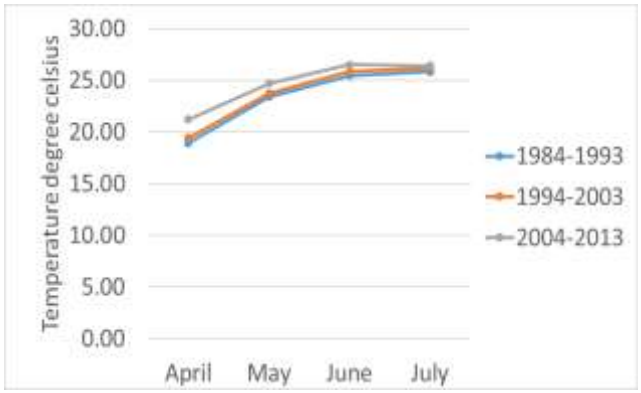

Fig. 6: Trend analysis of minimum temperature during summer months (Apr. - July) in Bhairahawa (1984 - 2013).(Source: NWRP, Bhairahawa).

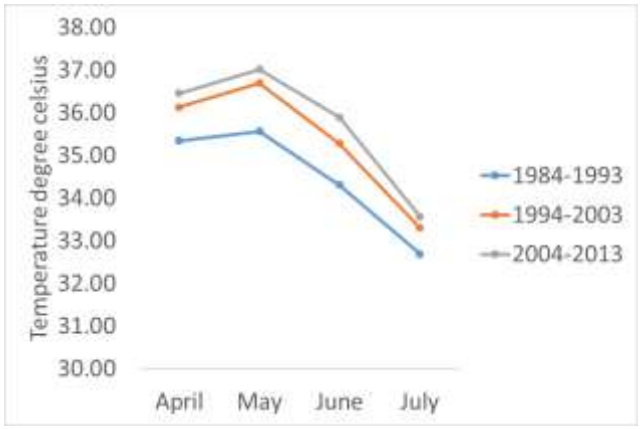

Fig. 7: Trend analysis of maximum temperature during summer months (Apr.- July) in Bhairahawa (1984-2013) (Source: NWRP, Bhairahawa).

Analysis of the maximum temperature of four summer months of Bhairahawa for 30 years showed that there is gradual increase in maximum temperature for every summer months in the increasing order of 1984-1993, 1994-2003 and 2004-2013. The trend analysis strongly suggested that the summer was hotter than the past years (Fig. 7).

Analysis of the minimum temperature of four winter months of Bhairahawa for last 30 years showed the gradual increase in temperature after each successive decade suggesting the winters are becoming warmer (Fig. 8).

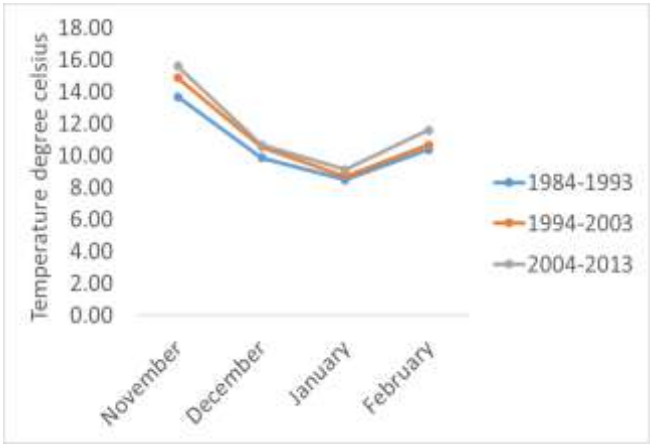

Fig. 8: Trend analysis of minimum temperature during winter months (Nov.-Feb.) in Bhairahawa (1984-2013) (Source: NWRP, Bhairahawa).

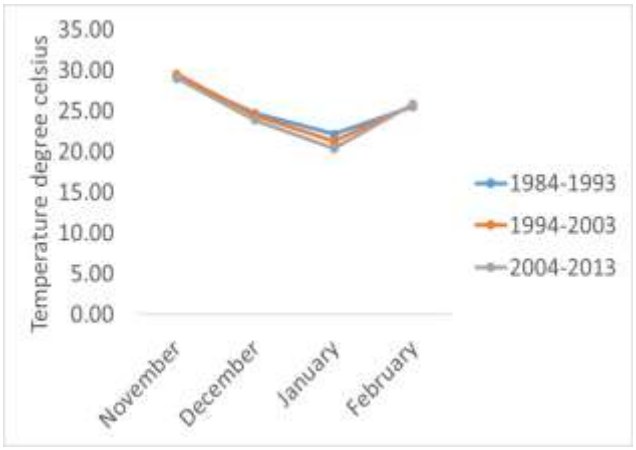

Fig. 9: Trend analysis of maximum temperature during winter months (Nov.-Feb.) in Bhairahawa (1984-2013). (Source: NWRP, Bhairahawa

As per the rise in minimum temperature in winter are gradually becoming warmer (Fig. 9). The summers are getting hotter and the winters are becoming warmer (Chapagain et al., 2009).

Analysis of the maximum and minimum temperature of the Bhairahawa for last 30 years showed that the maximum temperature and minimum temperature had increased significantly over the time. The trend analysis showed that average maximum temperature was increased by 0.004^0C per year and average minimum temperature was increased by 0.068^0C per year (Fig.10). Although the national average maximum temperature was increased by 0.0042^0C per year (Baidhya, 2007), the rate of increase in average maximum temperature was less than national rise in average maximum temperature in the study area. Increase in temperature up to 2^0C will increase the food yields in Nepal (Malla, 2009). The trend analysis strongly supported that the summer was hotter as compared to the past.

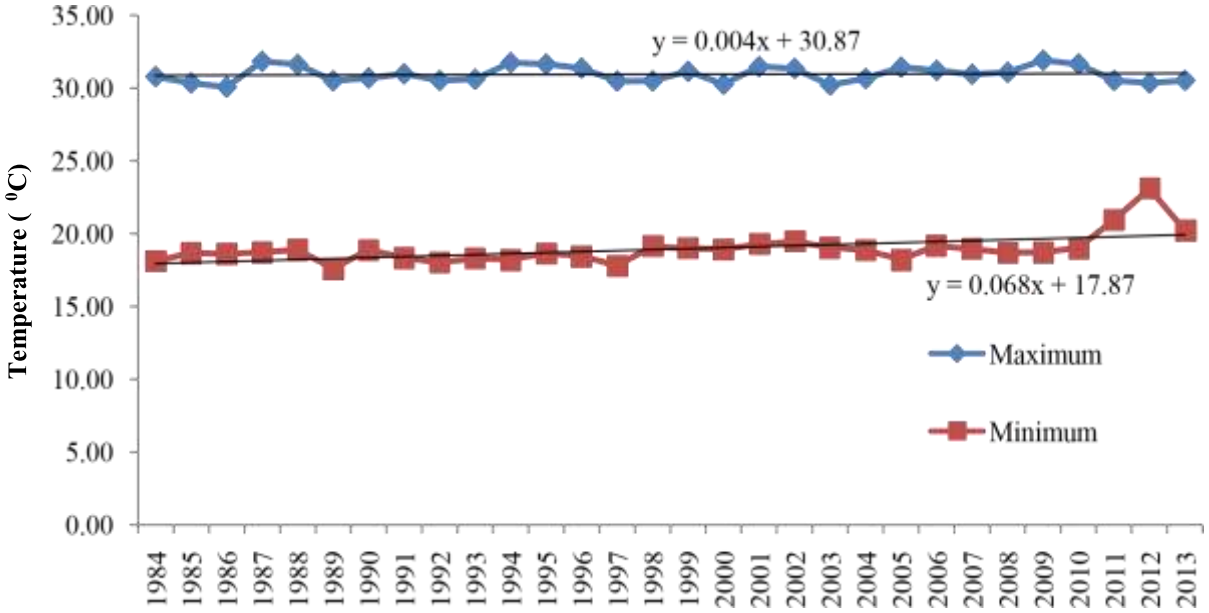

Fig. 10: Trend analysis of average maximum, minimum and average temperature of Rupandehi for last 30 years (1984-2013). (Source: NWRP, Bhairahawa).

Respondents Knowledge on Climate Change and Source of Information

Only 1.7% of the population has knowledge in climate change but others (98.3%) have felt it didn't have the relevant information on what is happening and why it is happening (Fig. 11). The source for information regarding climate change were local NGOs and it other governmental and INGOs haven't taken any steps for making the population aware on this topic.

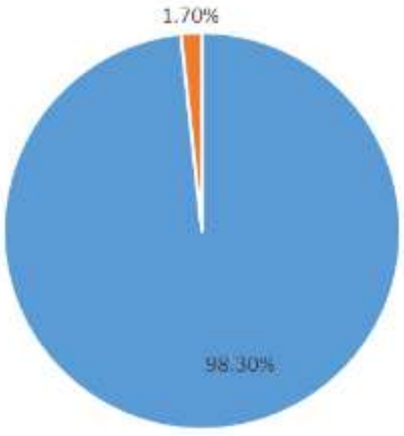

Fig. 11: Knowledge and source of information to climate change via any organization, 2014

Perception of Farmer on Hotter Summer, Colder Winter and Increase in Daily Temperature Range and Their Impact on Agriculture

The study showed that 98.33% respondents perceived that summer has become hotter and among them 5% perceived it has positive change in agriculture and 70% perceived negative impact on agriculture. 95% respondents perceived that winter has become colder and among them 6.67% perceived positive impact on agriculture whereas 35% felt negative impact on agriculture. Farmer shared their view that summer has become hotter and winter has become colder than past (Fig. 12 and 13). Decline in agricultural productivity, loss of local landraces, plants and animal species have been noticed in Nepal (Regmi *et* al., 2008).

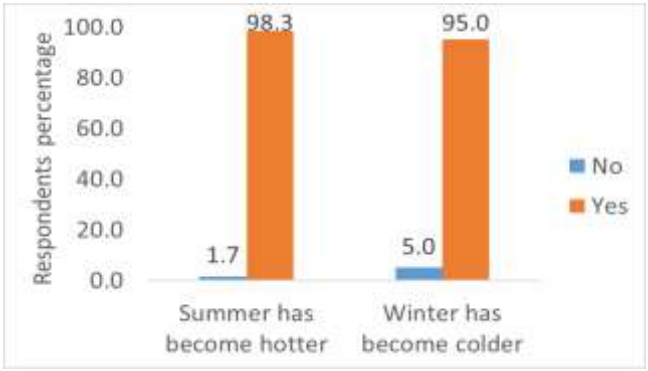

Fig. 12: Perception of respondents on degree of hotness and coldness in the Sauraha Pharsatikar V.D.C.,Rupandehi,2014

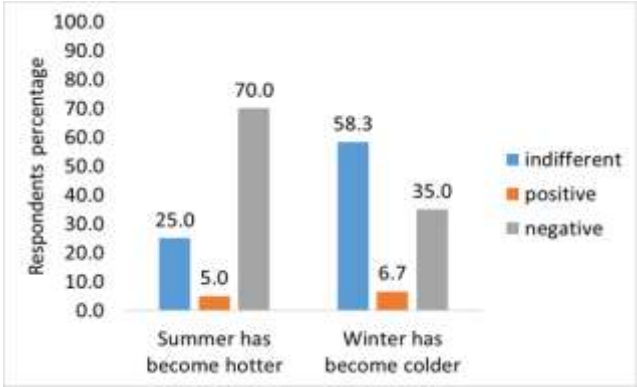

Fig. 13: Perception of farmer on impact of degree of hotness and coldness on agricultural crops in the Sauraha Pharsatikar V.D.C., Rupandehi, 2014.

Perception of respondents on onset and degree of monsoon and drought and their impact on agriculture

The study suggested that 51.7% of respondents perceived monsoon starting earlier and 48.3% suggested monsoon doesn't start earlier and among them 26.7% felt its positive impact on agriculture and 55% felt its negative impact on agriculture. 43.3% respondents perceived monsoon stars later among them 6.67% felt its positive impact on agriculture and 65% felt its negative impact on agriculture. 85% respondents perceived more intense rain during the monsoon among them 25% suggested positive impact and 55% suggested negative impact of its on agriculture. 91.7% respondents perceived drought has increased and 90% suggesting its negative impact on agriculture whereas only 1.67% suggesting its positive impact on agriculture. Similar perception was given by the locals of Pokhare Khola watershed of Dhading district where they suggested rainfall has decreased by two to four months (Baul et al., 2013). Irregular monsoon and erratic rainfall has led to decreased agricultural production affecting food security and livelihood (Regmi *et al.*, 2008) (Fig. 14 and 15).

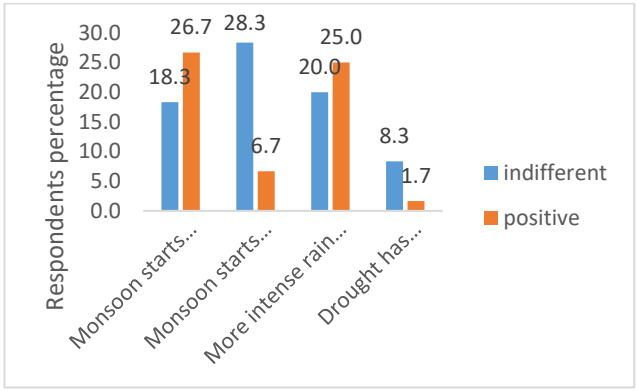

Fig. 14: Perception of respondents on onset and degree of monsoon and drought in the Sauraha Pharsatikar V.D.C., Rupandehi, 2014

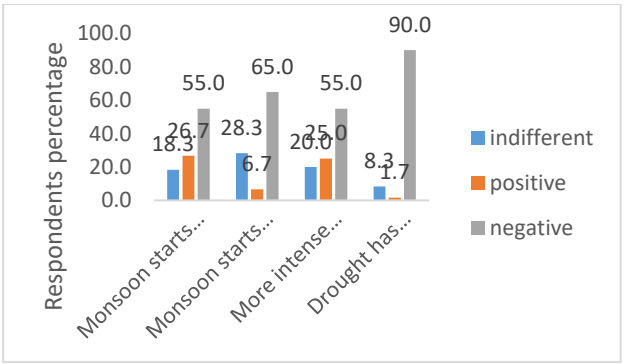

Fig. 15: Perception of farmer of impact on agriculture by the onset and degree of monsoon and drought in the Sauraha Pharsatikar V.D.C., Rupandehi, 2014

Change in vegetation cover

According to farmers' response there was increase in the incidence of invasive species accompanied by the disappearance of some important species. There was increasing trend of the climate in the field which led to the change in survival range of different plants. New invasive weeds emerged or became abundant in the study area such as *gandhe jhar* (*Ageratum conyzoides*). There was disappearance of some legumes species as there yield rapidly declined and the respondents stopped cultivating. 48.33% of respondent perceived that there is occurrence of invasive species, 1.67% perceived there is disappearance of species and 43.30% perceived that there is both invasion and disappearance of the species. Farmers perceived observation of invasive species like nilgandhe (Ageratum spp.), which is not edible for livestock, kalo banmara (Ageratina adenophora (Spreng.)) in the Rasuwa, Bardiya andDhading district (SAGUN, 2009) (Fig. 16).

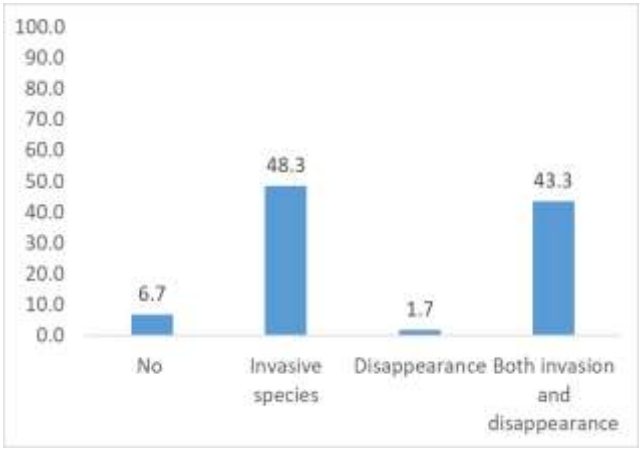

Fig. 16: Perception of respondents on impact of climate change in vegetation cover in the Sauraha Pharsatikar V.D.C., Rupandehi, 2014.

Change in flowering, fruiting and ripening of agricultural crops

Majority of response was indifferent regarding the change in flowering, fruiting and ripening of agricultural crops. Majority of the respondents felt (95%) there was not any change regarding the cereals crops and minority felt the changes occurred earlier (3.3%) and the others felt changes occur later (1.7%). In case of pulses (61.7%), legumes (63.3%) and vegetables (75%) of respondents didn't felt any change and among the remaining pulses (5%), legumes (5%) and vegetables (3.3%) felt that changes occurred earlier and the remaining respondents felt changes occurred later. There is evident that the climate pattern is changing which certainly influences the physiological processes of the plants and thus there are changes in the flowering, fruiting and ripening of the agricultural crops some delayed and some earlier. Flowering of trees 10 - 25 days earlier and earlier ripening of some crops were also perceived by the residents of Pokhare Khola watershed in Dhading district (Baul et al., 2013). The ripening and harvesting of some crops had changed by as much as 10 - 20 days earlier (Sharma & Tshering, 2009) (Fig. 17).

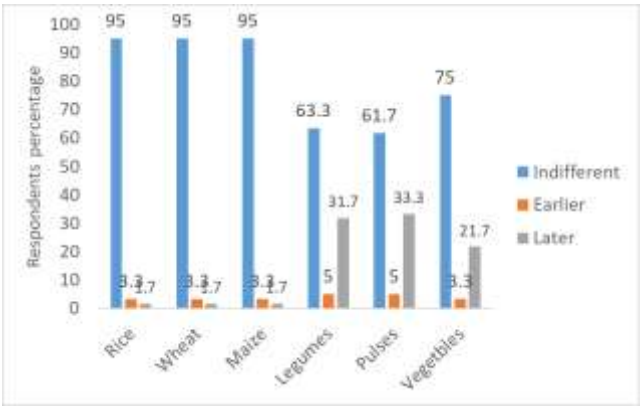

Fig. 17: Perception of respondents on impact of climate change on flowering, fruiting and ripening of agricultural crops, 2014.

Impact of climate change in yield of crops

Majority of respondents suggested that there was increase in the yield of the agricultural crops above 90% in case of cereal crops and 63.3% in case of pulses and legumes and 73.3% in case of vegetables. The rise in temperature and increase in the amount of CO_2 leads to increase in the yield of agricultural crops due to the increased in C:N ratio and increased temperature enhance the process of photosynthesis. Study done on CO_2 enrichment technology in Khumaltar revealed the increased yield of rice and wheat by increase in temperature (Malla, 2009). Wheat's yield increased in western region of Nepal with increase in temperature (MoEST, 2004) (Fig. 18).

Change in incidence of insect and pest due to climate change

All the respondents suggested that there was increase in incidence of insects and pests due to climate change scenarios. There was increasing trend of temperature and humid weather in the study area due to which there is increased number of insects and pests. Grasshoppers and borers infestation was high causing severe damage to the crops. Therefore, there was decline on crop yield on one side and on the other side it increased the cost of production because of the expenses occurred in their management. Diseases and insect pests and infestations in rice, maize, mustard and vegetables, mainly tomatoes were observed in the Pokhare Khola watershed of Dhading District (Baul et al.,2013).

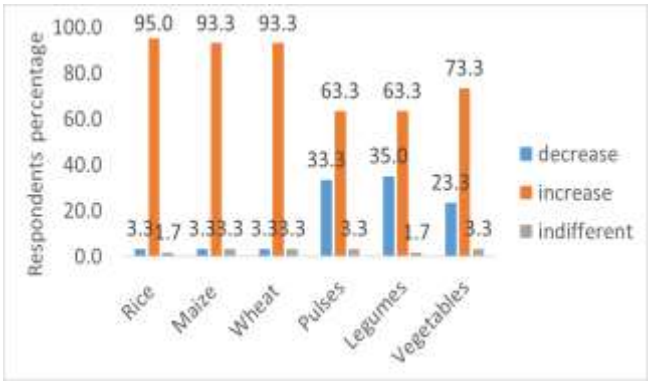

Fig. 18: Farmer perception on impact of climate change on yield of crops in the Sauraha-Pharsatikar VDC of Rupandehi district, 2014

Adverse Impact of Climate Change on Natural Resources

78.4% of the respondents suggested there were adverse impacts on timing of seasonal events, 63.3% of the respondents suggested impacts on geographical distribution of flora and fauna, ecosystem (68.4%), man animal conflict (60%), adverse impact on the abundant, and habitat preference (40%). However, due to lack of the forest, resources in these locality respondents were directly unaware about the adverse impacts on the forest resource and 98.3% suggested presence of adverse impacts on other resources as flow or rivulets, high occurrence of diseases on both plants and animal etc. Climate change has certainly led to the alteration of the change in climate pattern, survivability range of the vegetation and other living organism which has led to the change in the population composition of any ecosystem and the relationship status between the components of the ecosystem (Fig. 19).

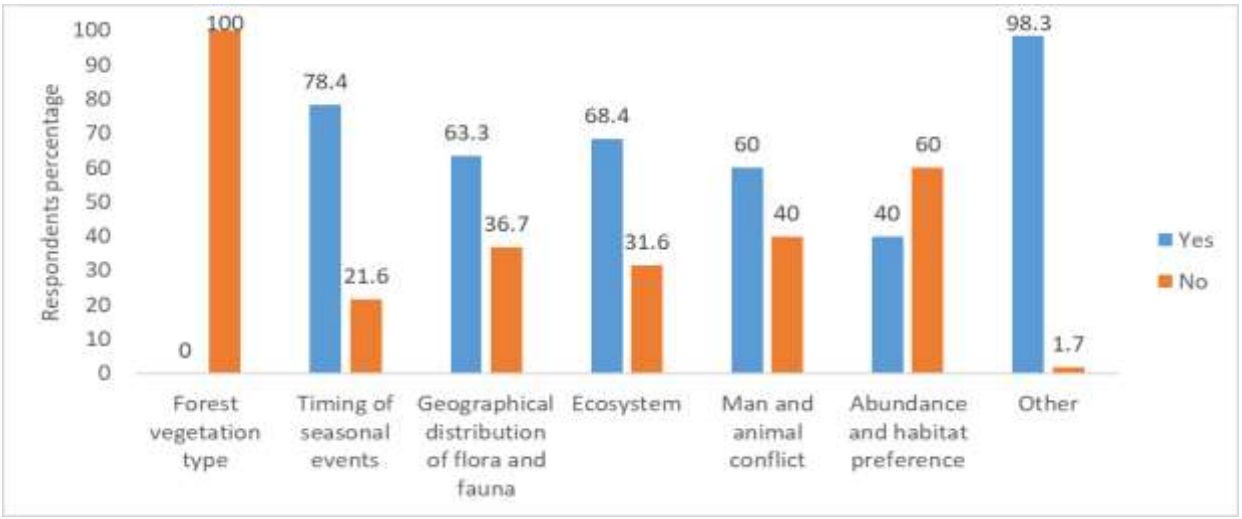

Fig. 19: Farmers perception on adverse impact of climate change on natural resources in the Sauraha-Pharsatikar VDC of the Rupandehi district, 2014.

Impact of Climate Change on Different Aspect of Drinking Water

All of the households have drinking water provision in the form of hand pumps and these water resources have gone under the process of arsenic test. From the arsenic test these sources are proven safe for human consumption. The water table of the region being quiet high there is not problems of drying up of the pumps and the respondents don't have to go anywhere far from their house in any season of the year. 96.38% of the household of VDC have tube well which were proven safe after arsenic test at their home (CBS, 2012).

Adjustments Made In Farming to These Long Term Shifts in Climate

Either knowingly or unknowingly farmers adopted different adaptation strategies to climate change. Farmers adopted different strategies but were varying from each other. 1.67% respondent has made adjustments in his post harvest operations, 90% respondents have made use or purchase of new agricultural implements, 3.33% have made adjustments in their harvesting process, 8.33% have made adjustments in sowing/ transplantation and 8.33% in land/soil/pond preparation. 98.33% respondents have made adjustments by adopting new crops/varieties/breeds/species and 100% farmers adjusted by making the use/purchase of pesticides. Nepalese farmers have been trying to adopt to climate change to maintain yield of rice, the main food in Nepal (Regmi et al., 2007) (Fig. 20).

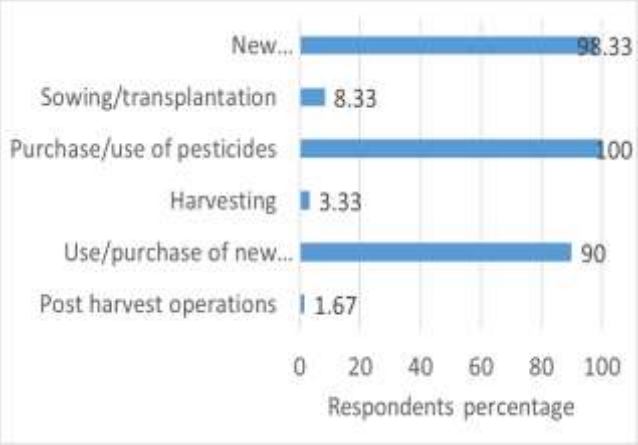

Fig. 20: Adaptaion practices adopted by farmers to cope with climate change in the Sauraha-Pharsatikar VDC of the Rupandehi district , 2014

Best Way to Provide Rapid and Better Access to Climate Change and Agricultural Information

Respondents ranked the community awareness meetings as the top way to provide rapid and better access to climate change and agricultural information. Regular workshops and training were ranked behind this. Respondents ranked training to the local volunteers as the least effective method due to lack of trust among the local volunteers and selfish nature of local volunteers. Farmers ranked others methods of conveying information as radio, television, newspapers, roadside drama, etc above than training to local volunteers.

The Best Way Government Should Help in Combating the Risks of Climate Change

The research suggested that the help respondents wanted most was subsidy in agricultural implements/inputs. Sufficient supply of agricultural inputs, provision of irrigation facility, insurance and other means as training, workshops, etc were ranked accordingly. Farmers in the study area and in general in whole country are resource poor thus they seek the subsidy in agricultural inputs most. Farmers don't get timely supply of required agricultural inputs which hampers their production thus they rank regular and proper supply of agricultural inputs below subsidies. Most of the farming being rainfed and the chance of complete crop failure being minimum respondents rank irrigation facility and insurance respectively below subsidies and sufficient supply of inputs and above other means.

Summary and Conclusion

The study on impact of climate change on agricultural crops was analyzed in Jugdihawa, Kewalpur and Pharsatikar communities of Sauraha Pharsatikar V.D.C. of Rupandehi district of Nepal. Farmers here practice subsistence farming which is being directly affected by the impacts being brought up by the climate change. A sample of 20 households were surveyed from each community selected randomly, thus a total of 60 respondents were interviewed. Primary data were collected from interview

Secondary data were collected from the National Wheat Research Project, Bhairahawa,various journals and publications of Central Bureau of Statistics (CBS), Ministry of Agriculture and Cooperatives (MoAC), Ministry of Agriculture Development (MoAD), research articles of various NGOs and INGOs. Socio demographic study showed that Brahmin were 61.7%, Magar were 21.7%, Tharu were 13.3%, Gurung were 1.7% and Chhetri were 1.7%. Most of the respondents were educated although a huge share of uneducated respondents (26.7%) was also present. Majority of the respondents (98.34%) were above 30 years thus we can believe our questionnaire was better answered and average age of the respondents was 52.88 years.

It has been found that the rainfall variation in Rupandehi district is erratic and is in a continuous decreasing pattern. Analysis of the rainfall data of Bhairahawa for last 33years showed that rainfall is in decreasing trend by 1.944 mm per year. Trend analysis showed that both the average minimum and maximum temperature were increasing significantly at the rate of 0.061^0C and 0.015^0C per year over the last 33 years.

Climate change's impact have been perceived by all the respondents but only 1.7% respondents had formal

knowledge regarding the climate change and they got it via the aid of local NGOs. 98.33% of the respondents perceived that the summer has become hotter, 95% perceived that the winter has become colder, 51.7% perceived monsoon starts earlier and 43.3% perceived it starts later. 85% perceived that there is intense rain during the monsoon and 91.7% perceived there is increase in drought.

The changes occurring in the agro-ecology due to climate change are appearance of some invasive species (48.33%) and disappearance of some useful species (1.67%) and both (43.30%). Cent percent of the respondents suggested there were increased incidence of insects' pests in the agricultural crops.

95% of the respondents perceived flowering, fruiting and ripening were occurring later in cereals, 5% perceived changes occurring earlier in both pulses and legumes and 3.3% perceived changes in vegetables were also earlier. Majority of the respondents perceived increase in yield (95% in cereals, 63.3% perceived in both pulses and legumes and 73.3% in vegetables).

78.4% respondents perceived adverse impact in timing of seasonal events, 63.3% in geographical distribution of flora and fauna, 68.4% in ecosystem, 60% perceived increase in man animal conflict, 405 in abundance and habitat preference and 98.3% perceived other changes.

Cent percent of the respondents either knowingly or unknowingly were the adopter of different adaptation strategies as adoption of new or modified post harvest operations (1.67%), use or purchase of new agricultural implements (90%), changes in harvesting (3.3%), purchase or use of pesticides (100%), modifications in sowing/transplantation (8.33%), use of new crops/varieties/breeds/species (98.33%) and land/soil/pond preparation (8.33%).

Farmers ranked community awareness meetings as the best way to provide information regarding climate change followed by regular workshops, training, training to local volunteers and others as mass communication media, roadside dramas, etc. Respondents perceived subsidy in agricultural implements/inputs as the best help government can provide to them followed by sufficient supply of agricultural inputs, provision of irrigation facility, insurance and other means as training, workshops, etc.

The impact of climate change is visible in different aspects of crop production. Increase of climate is affecting the suitability range of agricultural crops although there is increase in the incidence of insect pests. The residing community in the study area perceived the impact of climate change scenarios affecting the agricultural crops. Farmers also experienced the summer being hotter, winter being colder, increased drought period and infestation of weeds. Although the population in general is literate they are lacking precise knowledge on climate change. Either knowingly or unknowingly they are adapting the practices that help them to address with the negative impacts of climate change.

Acknowledgement

The first author is thankful to IAAS, Tribhuvan University, Nepal for this opportunity to conduct this research as an requirement for Undergraduate Practicum Assessment. This research was conducted under the guidance of Asst. Prof. Subodh Khanal (the second author).

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