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Population Forecast of Nepal from Population Growth Trend (2001-2021)

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Abstract

Number of projected populations are crucial to effective infrastructure and social services, as well as economic planning needed in Nepal. This study investigates the demographic transition of Nepal by exploring the census data on 2001, 2011 and 2021 which was a time characterized great socioeconomic transformation. The aim of this study is to analyze changing growth patterns and deliver a robust population prediction with arithmetic, geometric, and exponential growth models. Inter-census growth rates and information on population doubling times by broad ecological, development and socio-political regions were calculated. The report showed a steep trend decline from 2.25% in the period between 2001 and 2004, to.92% from 2018 to 2021. Therefore, the population doubling time has increased considerably; according to the exponential model, the doubling interval extended from 49.65 years (with reference to the trends from 2001-2011) to 72.23 years (with reference to the trends from 2011-2021). If the same growth rate of 1.1% continues, Nepal's population is projected to stand at approximately 32.55 million by 2031 and increase to about 36.31 million by 2041. These results indicate a transition from "population explosion" to stabilized demographic profile led by increased migration, rapid urbanization 28.22% in 2021 and decreased fertility. This paper provides empirical evidence of demographic transition for a developing economy across Himalayan regions, which will help demographers to identify the slowing momentum of growth towards population control and work towards sustainable urban resource handling linking with regional development through policymakers.

Keywords: *Geometric, forecast, projection, exponential, estimate*

Introduction

In Nepal, over the past 20 years, population growth has decreased significantly and is attributed mainly to declining total fertility rates, high international migration rates and changing socio-economic conditions (Aryal, 2013; Regmi, 2014). The national census data of 2001, 2011 and 2021 provides a detailed empirical foundation for forecasting these future demographic changes (CBS, 2021). Population growth in a generic sense is the change in the number of people residing within a defined geographical locality over an allocated time span, and it naturally influences on resource distribution and environmental sustainability (Bongaarts & Bulatao, 1999). Such trends suggest that Nepal is moving toward a phase of inactivity and away from one of rapid expansion. This demographic transition is due to mass urbanization, better access to education and a shift in the economy from agricultural practices towards service-and-remittance-based industries (Kumar & Paudel, 2024; Aryal, 2008).

The study of human population is multidisciplinary, it provides information on the change in population structure and behaviour, finding of causal relations as well as providing a better explanation (Aryal, 2008). The demographic transitions indicate the changes in not only the population volume, but also in its structure and distribution, as well as in the processes of its development (Aryal, 2013). The population projections reflect the trends upon the basis of constant conditions and variable conditions of declining fertility (Pathak and Ram, 1985; Yadava, 1993). The least developed regions are experiencing the highest rate of population growth as opposed to the developed regions. Probabilities that have influence on the level of population are fertility reduction measures, and other parameters that exist (Yadava, 1993). Hunger, poverty, and illiteracy are some of the complex issues being tackled by policy-makers and researchers due to the high rate of population growth in developed and developing countries. Unchallengable variables such as the huge population, scarcity of arable land and resources, low literacy levels, and an agro-driven economy among many third-world countries are the challenges in these countries. Nepal is a mountainous nation in the Himalayas that occupies an area of 147181 km 2 and has the population density of 181 persons per square kilometre. The population stands at 26.5 million as at 2011 with an annual population growth rate of 1.35. The growth rates have been fluctuating at 2.1 in 1971, upward to 2.6 in 1981, then falling to 2.1 in 1991 and finally to an increase of 2.3 in 2001. The economy is rural-based and agricultural as of 2021 with the total population standing at 29.16 million people with an annual growth rate of 0.92%. In 2011 the rate of inter- census population growth once more dropped to 1.35 and in 202 the population growth rate further declined to 0.92. It has experienced approximately 60 per cent growth in population between 11.6 million in 1971 to 18.5 million in 1991 and in the past ten years by about 27 per cent between 18.5 million in 1991 to 23.2 million in 2001. The percentage of urbanization in Nepal increased more than 14 percent between 2001 and 2011 although this remains lower than the rest of the developing countries. The urban centres increased to 58 in 2001 and 41 more were added by 2011 since 16 in 1971. This growing urbanization has seen an increase in the migration which has influenced the general population of Nepal. Most of the Gross Domestic Products are based on the service sector and non-agricultural sector, and the per capita Gross National Income is very low compared to the developed world. According to the Economic Survey of 2069/70, the per capita income is approximately 700 US dollars, which is not enough to live well in a smooth

manner (MOF, 2013). A quarter of Nepal population lives below the absolute poverty line, with high rate of unemployment and underemployment, and this encourages people to migrate to other countries and areas in search of livelihood opportunities (Aryal, 2013, CBS, 2011). Population growth is considered to be one of the major concerns of socio-economic development in most of the developing nations which resulted to development of various models to examine population change (Bogue, 1969; Bongaarts and Bulatao, 1999; Keyfitz, 1977; Polard, 1973; Kulkarni, 1976; Yadav, 1993; Yadava, 1985). This paper uses arithmetic, geometric, and exponential growth models to discuss the trends in population growth in Nepal using the national census data of the years 2001, 2011, and 2021 (CBS, 2011, 2021).

Methodology

This study employs a quantitative research approach with a longitudinal descriptive design for analyzing population trends in Nepal over the course of 20 years (2001 to 2021). The main data for the analysis were obtained from secondary data recordings of the National Population and Housing Censuses of 2001, 2011, and 2021 by National Statistics office (NSO). Because this study is based on complete national census data, the population in the study was Nepal's overall de jure population, and thus no specific sampling strategy was applied. In order to maintain longitudinal consistency following the country's administrative restructuring in 2015, data from the 2021 census underwent harmonization through recalibrating and re-aggregating proposed province figures into the former five Development Regions using district-level data used. Using Microsoft Excel as the main analytical tool, three mathematic models were applied to calculate one-year intercensal growth rates. These models were used as technical mechanisms to work out population doubling time, and thus represent the basis for interpreting the country's demographic momentum. The analytical process also included comparing the three ecological zones (Mountain, Hill, and Terai) with respect to internal migration patterns and variation of growth in each region as per the former development regions. Through computing and juxtaposing these growth models over the three census decades, this study provides a systematic estimate on the future trajectory of Nepal's population.

Population Forecasting Method

Population forecasting can be undertaken through a great number of models that include arithmetic, geometric and exponential growth methods. Since the growth in population is proportional with time, the geometric or exponential approach is often used with the existing growth trend (2001 to 2021).

Results and Discussion

Table 1 showed the trends of populations, growth rates, population density, and percentage change in the urban population. In 1971, the rates of population growth were 2.1, in 1981 the same was 2.1 which was 2.6 (in 2001) and the same was 1.35 per cent in 2011. The urban population is soaring over time where it was 4% population living in the urban areas in 1971, 6.4% in 1981, 14.2% in 2001 and 17% in 2011. The population density increased significantly in the areas where it was 79 in 1971 to 181 in 2011.

Table 1:

Nepal's population growth rate, density and percentage of urban population in different census

Population measures	1971	1981	1991	2001	2011	2021
Population (millions)	11.6	15.0	18.5	23.2	26.5	29.16
Growth rates	2.1	2.6	2.1	2.25	1.35	0.92
Population Density	79	102	126	158	181	198
% of urban population	4	6.4	9.2	14.2	17.07	28.22
Household size	5.48	5.58	5.56	5.44	4.88	4.37

Table 1 indicates that the population growth rates between 2001, 2011 and 2021 is on the rise but the growth rates in the 2001, 2011 and 2021 are decreasing (1.35, 0.92 respectively). The population density also growing. The urban population growth rate is rising and on 2021 it stood at 28.22 compared to 17.07 in 2011 due to the urbanization and it creates overpopulation, inadequate infrastructure in urban regions and overcrowding. Rural Nepal is facing depopulation, aging and shortage of labor, and also enjoying the remittances. This brings about economic growth and cultural exchange as well as augmented urban pollution, environmental degradation and possible social tensions. The number of people in a household is also declining since 1971 until 2021. Reduction in household size in Nepal is a tendency that is propelled by the reduced fertility and high rate of urbanization.

Table 2:

Population and Population change by development region in Nepal

Characteristics	Total population 2001 census	Total population 2011 census	Total population 2021 census	% (2001-2011)	% (2011-2021)
Urban	3227879	4525781	19296788	40.21	326.37
Rural	19923544	22095022	9867790	10.90	-.55.34
Mountain	1687859	1795354	1772948	6.37	-1.25
Hills	10251111	11475001	11757624	11.94	2.46
Terai	10212453	13350454	15634006	19.07	17.10
Eastern	5344476	5834184	6407620	9.16	9.83
Central	8031629	9713702	10885258	20.94	12.06

Western	4571013	4945190	5326520	8.19	7.71
Mid-western	3012975	3584386	3950097	18.97	10.20
Far-western	2191330	2543349	2644783	16.06	5.95
Nepal	23151423	26494504	29164578	14.44	10.08

Table 2 indicate that there have been considerable space and structural transformations in the population over the two decades. Population in Urban areas has increased to 19,296,788 in 2021 compared to 3, 227,879 in 2001 with its growth rate of 40.21% between 2001 and 2011 and an astronomical 326.37% between 2011 and 2021. Such growth has been associated with high rate of urbanization, rural reclassification, and urban boundaries. Rural population on the other hand recorded a negative growth of -55.34 percent between 22,095,022 in 2011 and 9,867,790 in 2021 which amounted to rural regions transforming into urban areas. There is variability in the forms of growth in Nepal ecological regions. The mountain region of Nepal had increased steadily to 1,687,859, 1,795,354 in 2001 and 2011 respectively and then dropped to 1,772,948 in 2021, which is an indicator of out-migration and low living standards. The hill region of Nepal has a modest growth, which started in 10,251,111 in 2001 to 11,757,624 in 2021. However, Terai region had the greatest population growth between 10,212,453 in 2001 and 15,634,006 in 2021 with growth rates of 19.07% (20012011) and 17.10 (20112021), which made it the most appealing region. The Central region was the most populated with the most rapid increase mainly due to the emergence of the metropolitan regions such as Kathmandu Valley between 2001 and 2011 (20.94%). The growth in the second decade in the Mid-Western and Far-Western regions was slightly lower, indicating a continued movement to the more developed regions and metropolitan centres, and moderate growth in the Eastern and Western parts. Nepal is a country whose population increased by 23,151,423 in 2001, to 26,494,504 in 2011, and 29,164,578 in 2021. The national growth rate recorded a steady slowdown in population growth, with the figure standing at 14.44 (20012011) and 10.08 (20112021). The distribution of the population has however changed drastically due to the rapid urbanization and increase in the population concentration in the Terai and the central parts.

Population Doubling of Nepal

The time required for a population to be double and is calculated with arithmetic growth model, geometric growth model and exponential growth model. The equation of growth model

$p_t = p_0(1 + rt)$

$p_t - p_0 = p_0$ rt

r = $\frac{p_t - p_0}{p_0} = \frac{p_t - p_0}{p_0} \times 100$

So, the arithmetic growth rate during 20011 to 2021 is calculated from

r= $\frac{p_t - p_0}{p_0} = \frac{p_t - p_0}{p_0} \times 100$

Pt = $= p_{2021}$ = 29164578 in 2021

P = Po = p_{2011} = 26494504 in 2011

t = 2021 – 2011 =10

r = $\frac{p_{2021}-p_{2011}}{p_{2011}\times T}$ = $\frac{29164578-26494504}{26494504}$ ×

= 1.01 percent per annum

From geometric growth model

The equation $p_t = p_o\ (1+r)^t$, then growth rate of population during 2011 to 20211 is calculated as

r = $\left[Antilog\ \left(log\frac{\frac{29164578}{26494504}}{10}\right) - 1 \times 100\right]$ = 0.964 percent per annum

From exponential growth model

$P_T = P_o e^t$, then growth rate

During 20211 to 2021 is calculated as;

r = $\frac{log(Pt/po)}{tloge} \times 100 = \frac{log\left(\frac{29164578}{26494504}\right)}{10\times loge} \times 100$ = 0.9602 percent per annum

Population doubling from arithmetic growth rate is calculated

t = $\frac{1}{r} = \frac{1}{0.0101}$ = 99.01 years of time

Population doubling time in geometric growth rate

$\frac{\log 2}{\log(1+r)} = \frac{\log 2}{\log(1+0.00964)} = \frac{\log 2}{\log 1.0964}$ = 72.2 years of time

Geometric doubling of population is computed

t = $\frac{\log 2}{r \log e} = \frac{\log 2}{0.009602 \log e}$ = 72.23

In his article titled An Overview of Population Growth Trends of Nepal, Regmi (2014) has predicted an increase in the population of Nepal two times the population of Nepal which was using the statistics of 2001 until 2011. The paper explains the time doubling of the population of Nepal and the growth of population between 2011 and 2021 and compare the two projections.

Table 3:

Growth rates and Time taken to double the Population of Nepal

Growth Models	Growth rates (2001-2011)	Growth rates (2011-2021	Years taken to double population (2001-2011)	Years taken to double population (2011-2021
Arithmetic	1.444	1.01	66.67	99.01

Geometric	1.349	0.964	49.51	72.2
Exponential	1.350	0.9602	49.65	72.23

Table 3 presents the growth rates of the population and the number of years that are expected to see the population doubled by applying three different growth models, namely, arithmetic, geometric, and exponential, to the population in two census periods (20012011 and 20112021). The Arithmetic Growth Model shows that the growth rate is 1.444% between 2001 and 2011 and decreased to 1.01 between 2011 and 2021. In this scenario, the population would require a period of 66.67 years and 99.01 years to double in the period between 2001 and 2011 and 2011 and 2021 respectively. This is a clear indication of a slowed population growth resulting in it taking more time to increase by half. The rate of population growth in the Geometric Growth Model is now lower than it was in 2011 and 2021 with the population growth rate being 0.964 percent compared to 1.349 percent between 2001 and 2021. It therefore took some 72.2 years in the second decade to increase the population by two times, as compared to 49.51 in the first decade. This represents the slow growth trend in the past 10 years. Similarly, Exponential Growth Model indicates that growth rate was 1.350 percent between the years 2001 to 2011, but it slightly declined to 0.9602 percent between 2011 and 2021. During the first period, the doubling rate of the population was estimated to be 49.65 years; in the second stage the population was estimated to be 72.23 years. The general trend is a declining pattern in population growth between the two census years as all three models show. Doubling time of the population doubles due to the reduction of growth rates between 20012011 to 20112021.

Discussion

The findings of the research paper show that Nepal has experienced a great demographic transition over the past twenty years. Using the arithmetic, geometric and exponential growth models on census data comparing 2001 data to 2021 let's draw a clear trend of a decreasing growth rate. Although the total population of Nepal keeps increasing (as of 2021, it has reached 29.16 million), its growth rate has become extremely low, decreasing compared to the peak of 2.6% in 1981 to one of the lowest in history, 0.92%.

Growth Models and Doubling Time

The most powerful observation of this analysis is that the value of the doubling time of the population has grown significantly. Based on the exponential growth model, the time taken by the Nepal population to duplicate itself has grown over the years since it was about 49.65 years (when the data was collected in 2001 to 2011) to 72.23 years (when the data was collected in 2011 to 2021). A more conservative estimate comes through the arithmetic model which gives a doubling period of almost a century (99.01 years). This trend validates the fact that Nepal is no longer in the population explosion stage but rather in the stabilized demographic profile stage. These results also support and revise those of Regmi (2014), indicating that the process of the slow-down is accelerating at an even higher rate than had been predicted.

Local and Geographical Changes

The statistics show geographical inequality between the population distribution. The Terai has become a steady demographic center in the country with demographic growth steadily up (17.10% in 2011-2021) because of its fertile soil, industrial potential, and the closeness to the Indian frontier. In its turn, the Mountain region has reached the stage of complete diminution (-1.25%), whereas Hill region demonstrates only slight development. This is a hint of enormous internal migration trend where residents are deserting high altitude subsistence-based ways of life in favor of the economic potential of the plains and cities.

The Phenomenon of Urbanization

The 326.37 percent growth in the urban population during 2011-2021 is one of the radical statistics found in Table 2. This astronomical increase must, however, be carefully construed; it is for the most part an administrative reclassification, in which several of the old Village Development Committees (VDCs) have been amalgamated, and the incorporated Municipalities. However, this statistical change also points at a real-life situation: the blistering growth of the urban area and the movement of the population towards centration in the city centers such as Kathmandu Valley. The 55.34 percent reduction in rural population was also associated with a hollowing out of the Nepalese countryside that has a far-reaching implication on agricultural productivity and rural development.

Socio-Economic Forces of Change

These are the reasons behind such dampening growth rates: Falling Fertility: The greater the accessibility to education and reproductive health services, the less the Total Fertility Rate (TFR). Since the number of persons per household has declined to 4.37 in 2021, compared to 5.48 in 1971, it can be seen that the Nepalese family size has decreased.

Migration and Remittances

The migration rates, in especially the young population, to foreign jobs have resulted in a brain drain and a labor drain towards the countryside. Although remittances are driving the economy (Kumar & Paudel, 2024), the natural depressive effect of the physical absence of a significant share of the reproductive-age male population is the birth rate. Socio-Economic Paradigm Shift: The shift of an agro based economy towards service and remittance-based economy has altered the perceived value of the large families and now smaller families can be economically feasible when living in urban areas.

Policy Implications

The change towards slower growth rate and the quick urbanization gives chances as well as challenges to the Government of Nepal. The growing population in the Terai and the cities will cause great strain to the available infrastructure such as water supply, sanitation and transportation. At the same time, it is possible that the depopulation of the Mountains and Hills will leave the areas with an ageing population and understaffed to sustain the local economies. The policy-makers should change their approach of controlling the population growth to managing population distribution. There should be efforts to make the urban planning sustainable in the Terai and offer the working population in the Hill and Mountain districts economic incentive to remain in place to facilitate balanced development of the region.

Conclusion

Using arithmetic, geometric and exponential models, this study examined the population growth trends in Nepal revealed an important demographic transition. Annual growth, which reached a high of 2.6% in 1981, has steadily decreased to the lowest levels ever recorded at just 0.92% in the year leading up to December 2021. The results confirmed that the population doubling time has roughly increased by 22.45 years from about 49.65 years based on the trend between 2001-2011 to 72.23 years corresponding to a range of trail between 2011-2021. This slowdown is predominantly due to plummeting fertility rates, mass international migration and rapid urbanization.

References

Aryal, T. R. (2008). *Migration and occupational mobility in Nepal*. Paluwa Prakashan.

Aryal, T. R. (2013). Application of demographic models to investigate levels, differentials and determinants of fertility of Nepal. *Journal of Institute of Science and Technology*, *18*(1), 148–156.

Bogue, D. J. (1969). *Principles of demography*. John Wiley and Sons.

Bongaarts, J., & Bulatao, R. A. (1999). Completing the demographic transition. *Population and Development Review*, *25*(3), 515–529.

Central Bureau of Statistics. (2001). *Population census 2001 of Nepal: National report*. Government of Nepal.

Central Bureau of Statistics. (2012). *National population and housing census 2011 (National report)*. Government of Nepal.

Central Bureau of Statistics. (2022). *National population and housing census 2021: National report*. Government of Nepal.

Keyfitz, N. (1977). *Applied mathematical demography*. John Wiley and Sons.

Kulkarni, P. M. (1976). Growth of a population after reduction in fertility. *Newsletter*, *11*(1). Population Centre Bangalore.

Kumar, N. K., & Paudel, O. (2024). The impact of GDP growth, remittance and urbanization on poverty reduction in Nepal. *Janapriya Journal of Interdisciplinary Studies*, *13*(1). https://doi.org/10.3126/jjis.v13i1.75582

Ministry of Finance. (2013). *Economic survey 2069/70 BS (2013)*. Government of Nepal.

Pathak, K. B., & Ram, F. (1985). *Trends in reproductive values of the females and momentum of population growth: Analysis for the major states of India*. International Institute for Population Sciences.

Pollard, J. H. (1973). *Mathematical models for the growth of human population*. Cambridge University Press.

Regmi, L. K. (2014). An overview of growth trends of Nepal. *Journal of Science and Technology*, *19*(1), 57–61.

Yadav, S. N. (1993). *On some migration and population growth models* [Doctoral dissertation, Banaras Hindu University].

Yadava, K. N. S. (1985). Population projection up to the lower limit of the reproductive period. *Demography India*, *14*, 146–150.