

CLIMATE CHANGE, "EVERESTIFICATION,"
AND THE FUTURE OF MOUNTAINEERING
ON ANNAPURNA I

by

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ABSTRACT

Climate Change, "Everestification", and the Future of Mountaineering on Annapurna I

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This study aims to research how climate change is affecting the Annapurna Conservation Area in the Western Region of Nepal. This region consists of two mountain districts, three hill districts, and encompasses the Annapurna massif. Temperature and Precipitation data was obtained from the Department of Hydrology and Meteorology, Nepal, spanning thirty years (1988-2018). Monthly, Seasonal and Yearly data were aggregated and averaged for both datasets, and statistical analysis was completed using JMP and Excel. Results indicate overall warming in all districts by 1°C, with higher elevations being impacted more than lower. Precipitation tests show strong seasonal intensity in the summer months, sometimes predating monsoon season, with higher elevations receiving less snow than previously recorded. Additional focus was then turned to Annapurna I in order to analyze expedition data for the last thirty years (1989 – 2019). All 8,000-meter peaks within Nepal were studied for expedition size and experience in order to establish climbing trends that lead to "Everestification." Current trends show an increase in expedition size but a overall decrease in inexperienced climbers. Expedition marketing may play a hand in the future of mountaineering on Annapurna I.

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This is for you

Chapter 1: Introduction

When it comes to high altitude mountain climbing, Nepal reigns supreme. Nepal holds eight of the ten highest peaks in the world within its borders. Annapurna I, located in the western part of Nepal, is the world's tenth highest mountain and is considered the deadliest. An estimated one out of every three climbers will perish on the mountain, most of them on the descent, leading to an impressive 33% fatality rate. Most serious mountaineers consider Annapurna I a life taking mountain and not one to be taken lightly. Prior to 2000, climbers typically saved this mountain for last on their list of 8,000-meter peaks. However, in recent years more attempts have been made to summit Annapurna I by those with less experience. An inexperienced climber may not have the strength to survive when weighed and measured by this mountain. As most understand, mountaineering is not just a test of skill but also a measurement of luck and the ability to know when to turn back and forfeit the summit.

Mount Everest, located just 307 km east of Annapurna, has been climbed by the experienced and inexperienced for over 50 years. The increase in commercialized expeditions has also increased the number of people who lack the experience to summit the mountain successfully without Sherpa assistance (Arnette 2019). Mountains like Annapurna and K2 cannot be compared to Everest in terms of numbers of climbers because the conditions are not comparable. Interestingly though, the term 'Everestification' first appeared in the media in 2008 in response to overcrowding on K2 when 30 climbers rushed to the

summit, and 11 perished (Explorers Web 2019). In the spring of 2019, thirty-one climbers made the summit of Annapurna, with one fatality.

A critical element of every expedition is equipment logistics. Nepal does not allow equipment to be flown to basecamp. Therefore, climbers and expedition companies employ porters to carry supplies to the mountain (Ministry of Tourism, Nepal 2019). In the Annapurna region, porters carry equipment along the Annapurna Conservation Area (ACA) trekking circuit, and up to basecamp, while Sherpa carries equipment above basecamp. While Nepal sets rates and weights limits for porters, the regulations often are not enforced (Grant-Sasson, n.d.). Sherpa's then carry equipment and lead members above base camp. Each camp above basecamp must be supplied with the necessary equipment and oxygen. Additionally, Climbing Sherpa assist members on summits as well as climb on their own accord.

Trekking in the Annapurna Conservation Area provides a dynamic source of revenue for Nepal. Fees for permits make up thirty percent of the tourism revenue. At the same time, other streams of income include hotel stays, food purchases, merchandise sales, and the hiring of porters and guides (Ministry of Tourism, Nepal 2018). In 2018, tourism in Nepal generated almost \$2 billion in revenue and supported over a million jobs (Nepalisanar 2018). This country relies heavily on tourism to subsidize its economy; 2018 was the first year in which a million foreign tourists visited Nepal (Nepalisanar, 2019).

The population in and around urban centers in Nepal increased from 221,272 in 1981 to more than 500,000 in 2012 (Rimal et al. 2018). This increase

in the urban population, coupled with unstable mountain slopes, creates hazardous areas that are further complicated by high precipitation and delicate terrain (Ruiz-Villanueva et al. 2016). Temperatures have increased notably in the villages around the ACA, with warmer temperatures in the winter months and hotter mid-day temperatures in the summer (Prasad 2016). Rapid melting in High Mountain Asia (HMA) leads to an increase of glacial lake outburst floods and landslides that can destroy villages and cost lives. Adequate reporting weather stations have not been established in this region of HMA, making analyzing weather trends above 7000 meters extremely difficult. In addition, weather in higher elevations is unpredictable and currently being modeled from remote satellites (Nsidc.org 2020).

As just described, mountaineering on Annapurna I is a complex system that relies on many moving parts surrounded by a climate that is changing. This thesis attempts to address multiple parts while asking two main questions:

- 1) How is climate change affecting the Annapurna Conservation Area?
- 2) In the age of increasing popularity of mountain climbing, is "Everestification" already happening on Annapurna I?

This thesis consists of seven chapters. Chapter One introduces all sections within. The next chapter, Chapter Two, is the literature review which contains historical context on the region and climate background. Chapter Three, methods, consists of data collection and analysis. Chapter Four delivers results. Chapter Five discusses tourism and the people of the region. Chapter Six follows with

commercial expeditions. Lastly, Chapter Seven finishes this thesis with concluding thoughts.

Chapter 2: Literature Review

This literature review provides background information on climate, glacial change, and mountaineering on Annapurna I and in the Annapurna Conservation Area (ACA). This review begins with a historical overview of the mountain region, early expeditions, and the Nepalese people. The next section will follow with a timeline overview of temperature, precipitation, and their relation to glaciers. A discussion on past and present mountaineering, trekking, and its direct effect on tourism follow.

Annapurna I & the Annapurna Conservation Area

Annapurna I, located in the Western region of Nepal in the Greater Himalayas, lies amid many smaller peaks within the family range and sits at the center of the Annapurna Conservation Area (ACA).



Figure 1 Map outline of the Nepal with the ACA region in color

At 4000 meters in elevation and lying north of the city of Pokhara, this sanctuary remained closed to outsiders until 1956 (Mierow 1997). The Annapurna

Conservation Area consists of 7,629 sq. km that wraps around the Himal and contains a glacial basin. The Nepalese government and the National Trust for Nature Conservation created the area in 1986 to promote tourism while preserving vital lands and resources. In 1990, the 880km sanctuary was included in the broader conservation plan. Many people who call the area home still consider the mountain, as well as the sanctuary, sacred. As a result, and because the sanctuary falls within the most common caravan route up to Annapurna base camp (ABC), local customs and gestures of respect must be observed, as explained in more detail below.

Annapurna Conservation Area

In 1977 the Annapurna Conservation Area had an estimated number of visitors that surpassed that of the mighty Khumbu/Everest region (CBS 2020). In 1996, the ACA was extended farther north into the Mustang region to include the Annapurna base camp. This expansion allowed for additional fee collection for those wishing to go to Annapurna base camp. Trekking the circuit exposes individuals to a wide variety of climates and altitudes. They experience the subtropical lowlands, home to bamboo forests, rhododendrons, and conifer forests, as well as high alpine meadows, fast-flowing rivers, and glaciers. Two deep valleys accentuate the path: Kali Gandaki as well as Marsyangdi. Multiple peaks rise high behind the rhododendrons and forests, including Lamjung, Annapurna II, Annapurna III, Annapurna IV, Machhapuchhare, Gangapurna, Hiunchuli, Annapurna Dashin (South) and lastly, the highest of them all, Annapurna I (8,091 m).

Early Expeditions

At 8,091m, Annapurna I is the 10th highest mountain in the world, and of the 14 over 8,000m peaks, was the first to be summited in 1950. It would be another 20 years before another summit would be recorded, and it would not be until 1978 that the first female would reach the peak. In the 30 years following Herzog's summit in 1950, twenty expeditions attempted a summit on Annapurna I. Of those, eight teams recorded a summit (approximately 23 people) had made it to the top. All of the summits, save one, took the North face route. Seven of the twenty teams reported death and twelve abandoned attempts due to various reasons such as death, injury, or bad weather.

Before 1978 women had been prohibited from attempting summits as the mountains are considered holy by the Gurung. In 1978, Arlene Blum's thirteen-member all-woman team attempted to reach the summit of Annapurna I. Two members and two Sherpa reached the peak, and two climbers died. As of 2019, Blum's team has been the only all-women team on Annapurna. There have been three summit bids by single female members (those not part of teams) since 1978, only one made the summit. All three of these attempts consisted of one female climber (lead) and one male Sherpa (Himalayan Database 2019).

Nepalese People

The Nepali people are multiethnic, multi-spiritual, and multicultural. Nepal consists of 125 ethnic/caste groups (including the Gurung, Magar, Thakalis, Tamangs, Chhetris, Brahmins, as well as occupational castes; Kamis,

Damais and the Sarkis), combined into four broad groups-- Khas Hill, Madhesi Tarai, Janajati Hill, and Marwadi- Punjabi. The people in the Annapurna region mostly come from the first three groups. The people of this area practice two main religions: Buddhism and Hinduism. The higher in elevation, the more devout the people become. The Nepali believe that permission to climb the mountain must be granted by asking the mountain through prayer and ritual. Even so, many temples or shrines may be off-limits to foreigners.

Nepal remains in its infancy for equality between the sexes. While women do lead 58% of the households in the Annapurna region, the woman is not considered the head of the home (K.C et al. 2019) Women may run the daily household chores and parent the children. However, the role of the authoritarian of the home belongs to the husband or eldest male in the house. The families in this region typically live in close quarters with maybe one or two rooms and 4-5 children. In 2015, 48% of women aged 15 years or older did not have any form of formal education. Since families must pay to send a child to school, most save as they can to send one child, usually a male. Women tend the household matters, and men work in agriculture or pick up work during the tourism season. While women may transport goods locally, they cannot be hired to trek supplies up to basecamp (Shrestha et al. 2012)

Porters & Sherpas

It is essential to make a distinction between porters and Sherpas. Porters carry supplies to base camp but never above it. Sherpas carry above base camp to the higher camps and set up ropes for climbers. Climbing Sherpas are sometimes

a part of a team of climbers and summit. Additionally, Sherpa, with a capital "S," is an ethnic group while lowercase sherpa is derived from Sherpa, and denotes the climbing assistants. It is essential to note the differences and take care to use them in the proper context.

The porters of Nepal are poor farmers who often compete with pack animals for jobs (Grant-Sasson 2016). They rely on peak seasons to make enough money to support their families for the rest of the year as the volume crops they produce typically just sustains their families—they have none to sell. Porters in the Annapurna Conservation Region average around 8 to \$10USD per day and carry loads up to 25lbs (Khadka 2015). Porters currently face the problem of the lack of oversight of assignment placement and enforcement of weight limits (Khadha 2015).

Sherpas can be hired from outside of the region, typically from the Khumbu/Everest region, competing with the locals where pay can differ by quite a wide margin, with rates varying by experience. In contrast to the porters, climbing agencies do have oversight and protections for the Sherpas, such as weight limits.

Regional Climate

Dry deserts bind the Annapurna region to the north, Dhaulagiri Himal to the west, Marysandri valley to the east, and lower foothills to the south. The climate in this area, typically subtropical in the lower hills (700 – 1500 m), becomes more arctic at the higher (4000 -8848 m) elevations (Shrestha et al.

2012). Winter precipitation comes from the east and accounts for most of the annual rainfall. This area has been experiencing changes in season length due to the variability of weather and climate change.

Climate Trends

High Mountain Asia (HMA) region does not have long term air temperature records readily available for analysis; however, measurable increases in air temperature have been recorded across HMA, with acceleration in overall warming over the last decade.

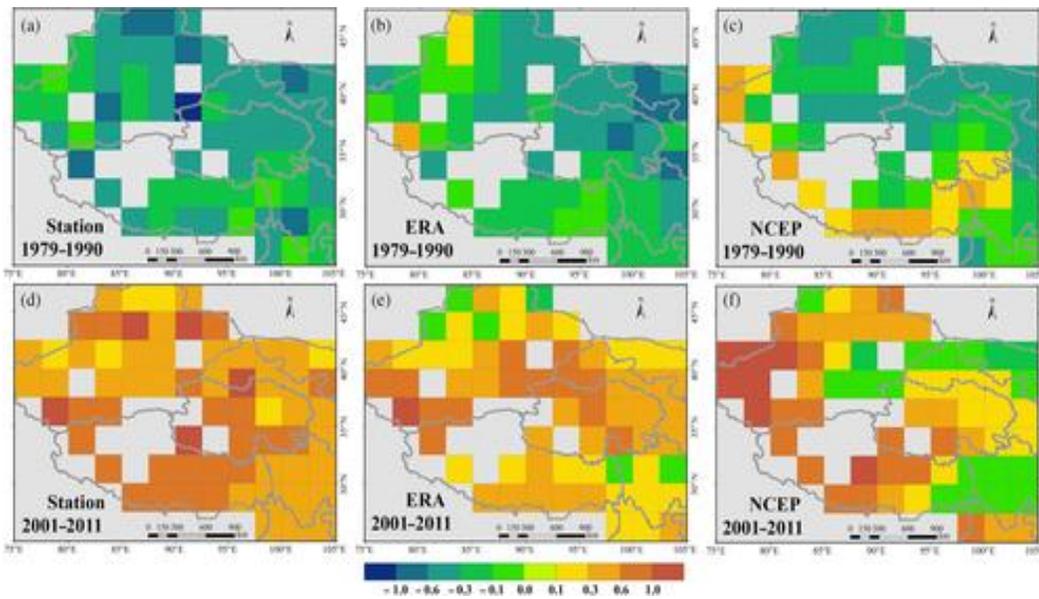


Figure 2 Graph of decadal mean anomalies of temperature (Song et al. 2016)

Decadal mean anomalies of temperature ($^{\circ}\text{C}$) relative to the period 1991–2000 mean for (a) stations during 1979–1990, (b) stations during 2001–2011, (c) ERA-Interim during 1979–1990, (d) ERA-Interim during 2001–2011, (e) NCEP/NCAR during 1979–1990, and (f) NCEP/NCAR during 2001–2011. (Song et al. 2016)

The increase in temperatures at elevations above 4000 m suggests a decrease in precipitation in the form of snow, contributing to glacial change. Climate modeling has always been intricate in the Himalayan region due to its location and higher elevation storms. Even so, we know the area has experienced several significant climate warming incidents over the last decade.

Over the last decade, average and maximum temperatures have increased, with the summers having less precipitation than that of previous years (Konchar et al. 2015) It is predicted that there will be a rise in the severity of impacts of future warmings. Climate modeling in 2003 projected an average increase of 1.2 °C by 2050 and a projected 3°C increase by 2100 (Agrawala 2003).

Glaciers

Climatic changes, both directly and indirectly impact glaciers. Glacier mass balance controls ice flow dynamics and the severity of erosion (Maurer et al. 2019). Higher altitude increases ablation and accumulation by radiative and atmospheric forcings. Over time, snow accumulation can generate more erosion, which will then increase relief, and thus increase landslides and supraglacial debris. Glacier dynamics, regulated by climate and lithospheric processes like earthquakes and erosion, also influence glacial mass balance (the loss or gain of ice in a glacial system) (Bhardwaj et al. 2016) The hills area experience glacial lake outburst floods (GLOF) when glaciers experience retreat and erosion. Glacial lakes pepper the landscape of the ACA, many of which reside on or under changing glaciers. Because of the dynamics of these lakes, when they release

water, the result can be catastrophic. GLOFs break dams and cause calving, destroying everything in their path.

The ability to locate and monitor these glacier lakes has continued to be a challenge (Sam, Kumar, and Bhardwaj 2019). Satellite imaging has become increasingly popular and useful; however, it is essential to note that using spectral data alone can lead to erroneous information. Advanced spaceborne thermal emission and reflection – visible and near-infrared (ASTER-VNIR) data collection provides a reliable alternative. However, no entirely accurate method exists, as atmospheric interference can impact these results (Racoviteanu, Armstrong, and Williams 2013).

[Annapurna & Tourism](#)

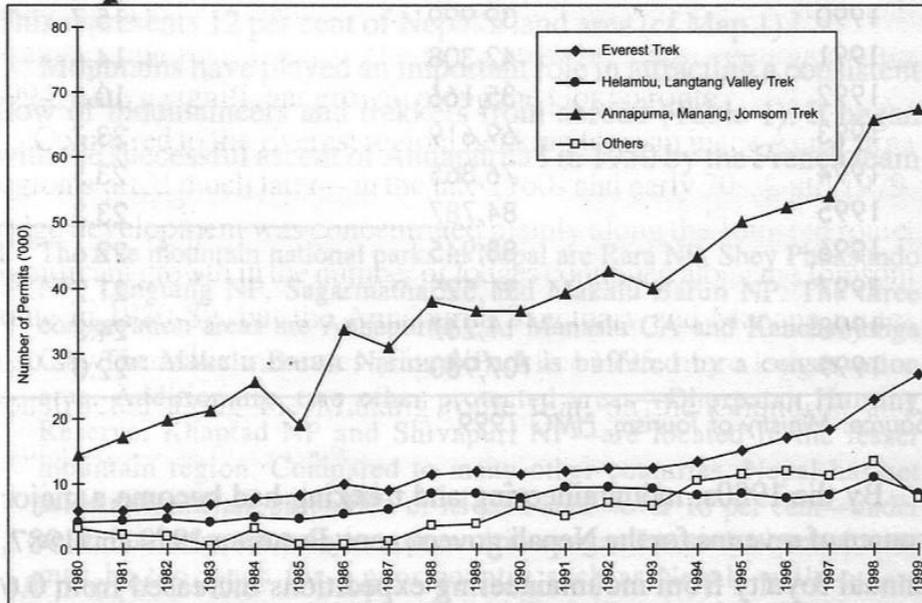
While not the highest of the Himalayan mountains, Annapurna I is considered the most dangerous mountain because of changing terrain, violent windstorms, and frequent avalanches (Firth et al. 2008). Sherpas in this region believe "Annapurna is a life taking mountain" ("New Route and Deaths on Annapurna - World's Deadliest Mountain - Rock and Ice" n.d.). With a low summit success rate, it gives one pause to know that this mountain also carries a 33% fatality ratio (Himalayan Database 2019). The majority of factors that inhibit success relate to bad weather (high snow storms, bad wind) or adverse conditions (avalanches, deep snow). As the climate continues to change, these factors will continue to intensify. While technology has significantly improved over the last fifty years in terms of weather satellites and storm projections, conditions on the mountain are still as unpredictable as ever.

This 'Everestification' of Annapurna results in part from 'peak-bagging,' a term used for mountain enthusiasts who want to summit all fourteen of the over 8000-meter peaks. Annapurna used to be pretty low on that list, climbed only when several of the other more accessible mountains had been summited; however, that may not always be the case. With the lines on Everest getting worse every year, some people may pay to be taken up K2 or Annapurna instead ("K2 2019 Summer Season Coverage | The Blog on Alanarnette.Com" n.d.). However, significant differences between these summits exist. On Everest, fixed ropes for climbers get placed beforehand to ensure safety on the pre-determined route that climbers follow. Not so on Annapurna, the routes get muddled, and the terrain changes just as much as the weather does (Sherpa 2017).

Trekking in this region also has its dangers. In 2014, forty-three trekkers in the ACA circuit lost their lives when an unexpected storm blanketed the valley ("Nepal Blizzard: Survivor Tells of Friends' Deaths on Annapurna Circuit | World News | The Guardian" n.d.). The Nepalese government knew of the coming storm but failed to anticipate the intensity and destructive power. Because of the vast area of the ACA, no warning system exists for the tourists. In 2019, heavy snowfall caused an avalanche that took two lives. Even in the warm months, the circuit has dangers (Mishra et al. 2019). Glacial lake floods are always a present threat and must be monitored closely. In 2012, thirteen trekkers lost their lives in a glacial lake floods. Houses, livestock, and villages also felt the wrath of the flood (BBC 2012). This threat, however, does not stop the thousands of people

from trekking the circuit every year, and as climate change increases, so does the threat to these villages and tourists.

Fig. 3: Number of trekking permits issued during 1980-1999.



Source: HMG 1999.

Figure 3 Trekking permits issued 1980 to 1999 (Sanjay)

Before 1999, all visitors were issued permits to trek in any region. This regulation was changed in the fall of 1999, and only those heading to mountains would need a permit. This figure shows how trekking traffic was steady for all regions save Annapurna, which has steadily grown over the years. Image from *Tourism and the Environment*, Sanjay K. Nepal.

In 1980, 14,332 foreign visitors registered to hike the Annapurna Circuit, this number jumped to 35,800 in 1990 and increased again in 1999 to 67,000 visitors (Figure 3). The year 2017 recorded the highest number of foreign visitors with 158,578 (Ministry of Tourism Nepal 2018). The increase in tourism has also

meant an increase in lodging, food suppliers, and porters to support trekkers and climbers. While trekking generates a considerable amount of revenue, mountaineering also brings in a fair amount. In 1992, mountain climbing permits brought in \$303,100USD, and that increased to \$548,100USD in 1997 ("Ministry of Finance - Government of Nepal" n.d.).

The primary occupation in the ACA region is agricultural work, with porter work coming in second. As most porters work seasonally, the local economy relies heavily on keeping tourism alive and healthy. However, tourism in this region has its downsides as well. As mentioned previously, this area remains sacred to those who live within its borders, and there have been conflicts over the number of people granted permission to enter it during trekking seasons. A large number of visitors puts a strain on already scarce resources -- food, fuel, and lodging -- in some areas.

Chapter 3: Methods

This study will attempt to understand how climate change affects the Annapurna Conservation Area, and what variables might be affecting the sustainability and safety of mountaineering on Annapurna I. Analyzing and understanding the changing meteorological conditions is necessary in order to maintain healthy environments, as well as economic stability.

Regarding Annapurna I, long considered one of the world's most dangerous mountains, experts have debated whether or not it will become the next Everest in terms of climber congestion. This study will analyze thirty years of expedition data on Annapurna I, as well as other 8,000-meter peaks, in order to observe trends.

Timeline analysis starts in 1989 and ends in 2019.

Study Area

The Annapurna Conservation Area covers 7,629 square miles and spans over five different districts, namely; Mustang, Manang, Myagdi, Kaski, and Lamjung. The area has two distinctive climate regions within 120 km and covers the entire Annapurna massif. The southern hills area (Myagdi, Lamjung, and Kaski) receives heavy and frequent rainfall, whereas the northern mountain region (Mustang and Manang) receives considerably less rainfall. This area also contains the world's deepest gorge, Kali Gandaki. At 2,520 meters from river basin to mountain tip, this area serves as part of the Annapurna Circuit trekking route. The Annapurna Conservation Area is the largest protected area in Nepal.

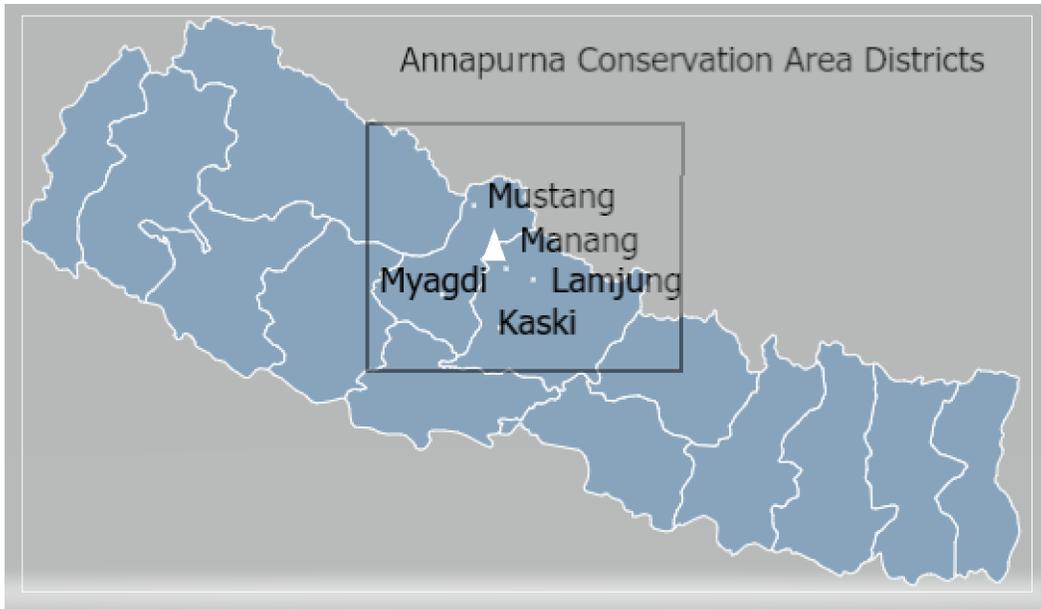


Figure 4 Map of Annapurna Conservation Area Districts

Annapurna massif is fifty-five km long and made up of sixteen peaks over 6,000 m, thirteen over 7,000 m, and one peak over 8,000 m. Annapurna I, at 8,091 meters, lies on the border of the Gandaki and Dhaulagiri zones, and it was the first peak to be climbed in 1950. Below is a panoramic view of the more prominent peaks above 6,990 meters.



Figure 5 photo of all peaks over 6,997 m in the ACA. /8000ers.com

Data Collection

The Nepal Department of Hydrology and Meteorology (DHM) provided historical temperature and precipitation data. This data consists of daily recordings of maximum and minimum temperature as well as precipitation readings from 70 meteorological stations throughout the region from 1988 to 2018. Of these 70 stations, 30 had less than ten years of consistent data. Independent variables used in the analysis included elevation, latitude, longitude, aspect, and slope. Additionally, pre-existing glacial data was analyzed to quantify a relationship between glacial change and glacial lake outburst floods (GLOFs). Glacial data was obtained from the Global Terrestrial Network for Glaciers and the Global Land Ice Measurements from Space (GLIMS).

Historical mountaineering data was obtained from The Himalayan Database as well as from *8000ers.com*, a database that tracks expeditions in Pakistan. Full expedition data was pulled from 1989 to 2019 and analyzed for expedition size, success, aborted summit bids, deaths, and member experience. Manual searches substituted missing data in public records. Data were compiled for all eight mountains over 8,000 meters in Nepal.

Natural disaster and hazard data were obtained from The Central Bureau of Statistics, Nepal. Historical data include floods, landslides, earthquakes, and avalanches.

Data Analysis

Locations

Meteorological data were obtained for all five districts within the Annapurna Conservation Area. Mustang and Manang regions have the mountain classification, while Myagdi, Kaski, and Lamjung are classified as hill regions.

This region lacks weather stations in the higher elevation bands. A new station has been set up in the Everest region, but measurements are not quantifiable at this time. Table 1 below shows all districts, with altitude, classification, and coordinates.

Table 1 Districts within the ACA

Districts	Altitude m	Classification	Lat (N) in degree	Long (E) in degree
Mustang	2000 - 6400	Mountain	29.25	83.75
Manang	1000 - 6400	Mountain	28.75	84.25
Myagdi	300- 6400	Hill	28.75	83.25
Kaski	300-6400	Hill	28.25	83.75
Lamjung	300-6400	Hill	28.25	84.25

Temperature Data

Daily maximum and minimum temperatures were averaged monthly, seasonally, and annually for analysis. The seasons were defined as winter (October – February) and spring (March-September). Annual data were averaged on a calendar year basis.

Precipitation Data

Daily precipitation totals were aggregated into monthly, seasonal, and annual for analysis. The seasonal data timeline is the same season definition set in temperature. Precipitation was analyzed both in accumulation as well as averages. Levels were recorded in millimeters (mm). Annual data were averaged on a calendar year basis.

Glacial Data

Glacial polygons were mapped with ArcGIS pro to show location and size. Review of previous studies was done in order to understand changes that have occurred over the last thirty years. This region has the least glacial lake outburst floods in Nepal (Bureau of Statistics, Nepal). That being said, they still can and will occur. Glacial lakes were analyzed with ArcGIS pro for temporal analysis. Below is a picture of the Gangapurna lake in Manang.



Figure 6 photo of Gangapurna Lake in Manang Photo: Peng Wei

Mountaineering

Mt. Everest, Lhotse, Cho Oyu, Dhaulagiri I, Kangchenjunga, Makalu, Manaslu, and Annapurna I were all individually studied. Multiple data sets were extrapolated from the raw data, including total expeditions, expedition size, previous mountaineer experience, summit successes, and deaths during this period. Each mountain was evaluated independently and compared against Everest.

Chapter 4: Results

Temperature and Precipitation

Monthly average temperatures in the Annapurna Region show a clear seasonal cycle from 1988 to 2018. The average temperature peaks in July, with its lowest occurring in December (Figure 7). The average temperature is above 0° C from May to September for both mountain and hill regions.

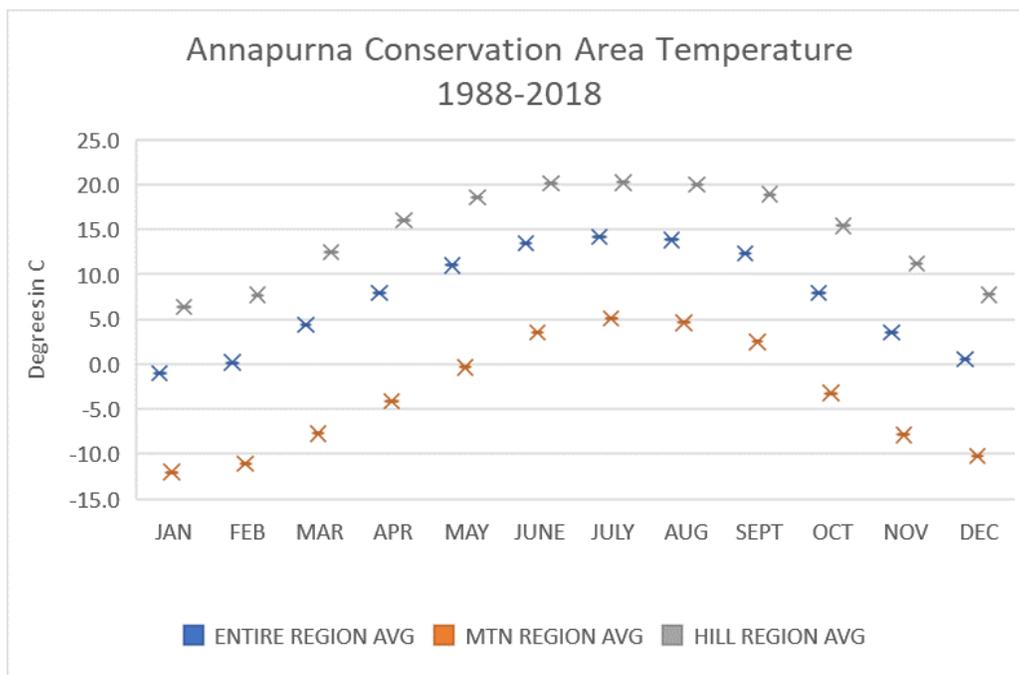


Figure 7 Graph of ACA average temperature by month 1988- 2018

Precipitation varies based on region. The mountain region receives considerably less rainfall than its hill counterparts (Figure 8).

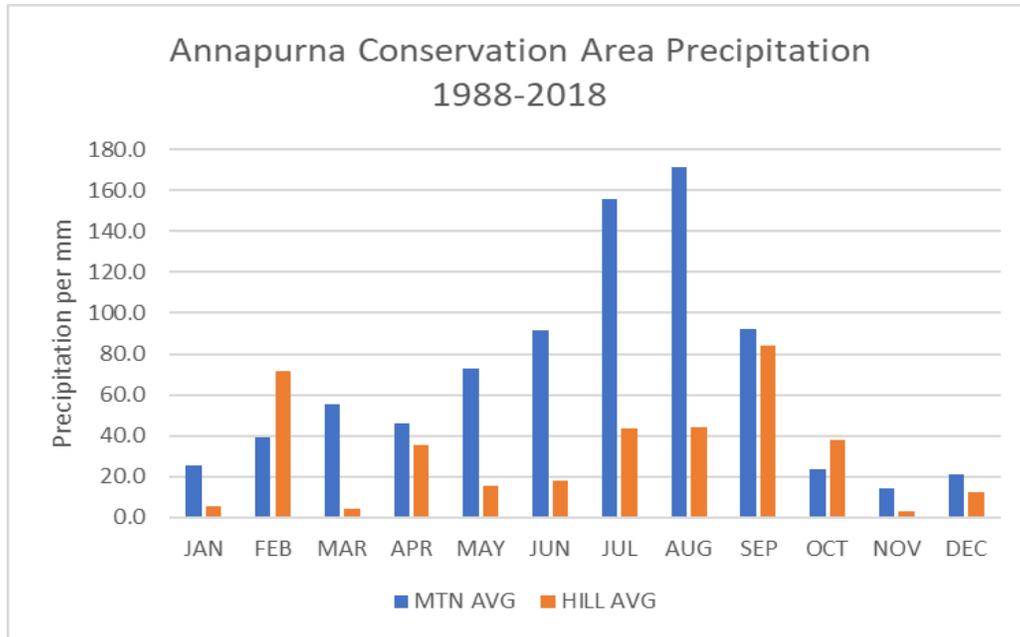


Figure 8 Graph of ACA precipitation by region 1988-2018

When the entire region is analyzed, the monthly average rainfall also shows clear seasonal cycles. June to September, the average total rainfall is relatively high due to the monsoon season (Figure 9).

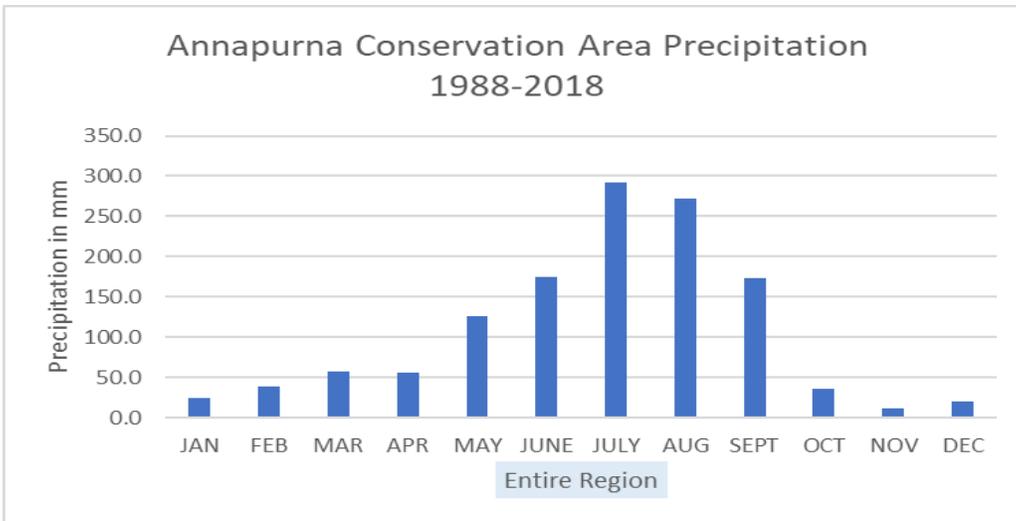


Figure 9 Graph of Average precipitation for the entire ACA region 1988-2018



Figure 10 Graph of season temperature vs season for all districts in the ACA

Districts were then broken down into season charts in order to see seasonal trends more clearly over the last thirty years (Figure 10). Winters are getting warmer and shorter. Lastly, each region was studied for the variances within their districts. The sheer size and elevation gradient ensure that what the weather feels like in one district, may not feel the same in another.

Glaciers

Glacial mapping in this region roughly began in 2000. Before this, Satellite imagery was unreliable due to image noise (cloud cover) or from the political climates that surround this region. According to Lovell et al., glaciers in the Annapurna region have decreased by 8.5% between 2000 and 2016. They found that most of the decrease was due to glacial fragmentation. With the increasing air temperature and lower precipitation in the higher elevations, climate change may be lending a hand in the instability of the glaciers (Lovell et al. 2016)

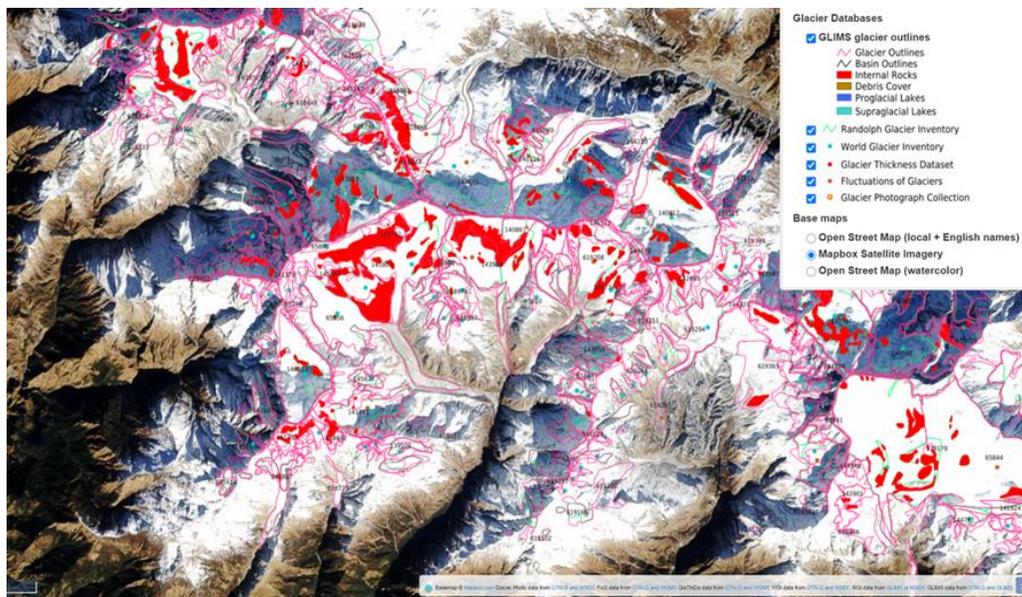


Figure 11 Glacial map of ACA region. Created with GLIMS/ArcGIS

In the last thirty years, the number of avalanches reported within the Annapurna range has remained consistent, and there is not enough data to test variable relationships in this region Lovell et al. found this to be the case as well during their study of the region.

Glacial lakes in the ACA are monitored for size and stability annually per the Ministry of Home Affairs. The ACA has had two Glacial lake outburst floods in the last thirty years, and the threat rises every monsoon season (Table 2).

Table 2 ACA glacial lakes

Glacial Lakes in the Annapurna Conservation Area							
District	Total	Elevation <100m	Elevation 100-499m	Elevation 500-1999m	Elevation 2000-2999m	Elevation 3000-4999m	Elevation >5000m
Lamjung	23	0	0	5	4	14	0
Kaski	29	0	0	22	0	7	0
Manang	66	0	0	0	0	26	40
Myagdi	33	0	0	5	14	13	1
Mustang	78	0	0	0	2	5	71

Mountaineering

Individual Peaks

When looking at expedition numbers, no other mountain comes close to Mt. Everest. At 8.848 meters, it remains on the list for many adventure climbers. Commercial expeditions took hold in the late 1980s and 1990s, and with the excitement came tragic learning curves. The 90s were a time of many notable

failed expeditions, with loss of circumstance and loss of life. Climbing mountains can be inherently dangerous, more so for those of little to no experience. The first set of graphs is on each mountain and is the percentage of inexperienced climbers (those with no mountaineering experience above 6,000 meters) from the total expedition number.

Up first is Everest. We expect to see a high number of inexperienced climbers on this mountain due to its tourism allure. It has long been established that this is a mountain that money will help one summit, where skillset cannot. There is a false sense of security that says if you pay for the guide, Sherpa, equipment, oxygen and miscellaneous other needed supplies, that you will be guaranteed a safe, successful ascent and decent. The reality is much different when you are on the mountain.

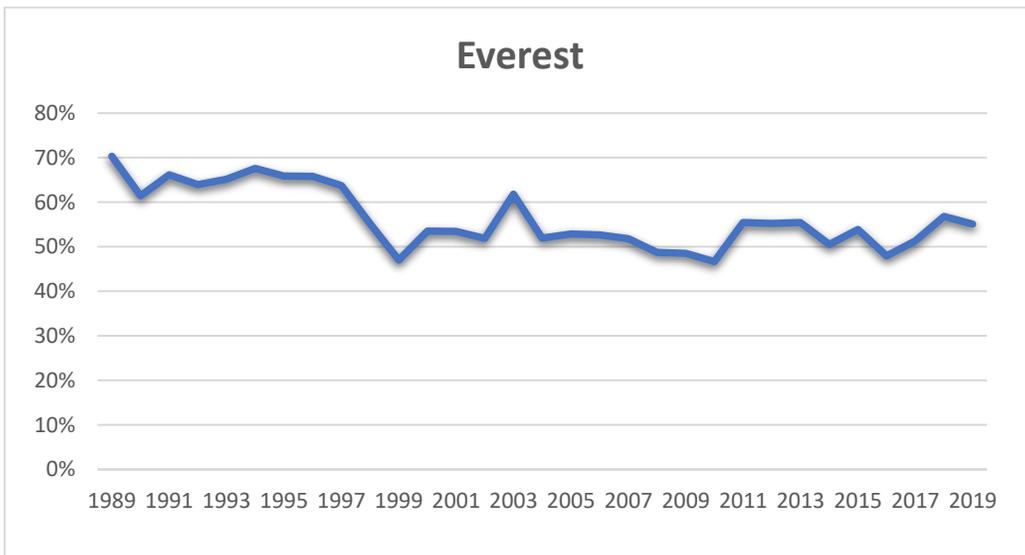


Figure 12 Graph of percentage of inexperienced climbers on Everest



Figure 13 Photo of Everest / Core Treks

Expedition sizes on Everest dropped in the early 2000 and rose back up again around 2005. They have stayed relatively consistent in numbers, 300-500 total members per season. However, this number is only accounts for the numbers above base camp. It does not include Sherpas, HA workers, or base camp personnel. The exception to this was the 2014- 2015 seasons, I will explain more on that with the total members per summit graph.

Cho Oyu, 8,188 meters, ranked as the sixth highest mountain in the world, is also considered the most straightforward and the easiest climb of those over 8,000 meters. With the lowest death -summit ratio, it is considered the training ground for professional mountaineers. The inexperienced percentage trend per year is what we would expect to see on this peak.

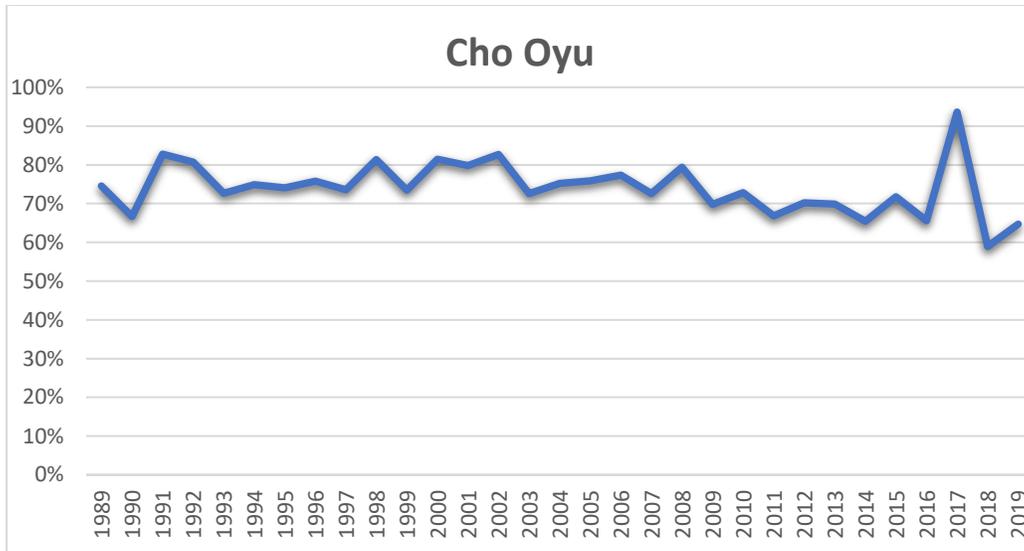


Figure 14 Graph of percentage of inexperienced climbers on Cho Oyu



Figure 15 Photo of Cho Oyu /Gorka Adventures

Lhotse, 8, 516 meters, has long been considered Everest's twin in the mountaineering community. Climbers for both peaks start from Everest Base Camp (EBC), and Lhotse follows the Everest route up to the yellow band, then splits off to the couloir. See Figure 16 below chart for situational understanding. I

would expect to see most years to be within the 30 – 60% range of climbers due to its proximity to Everest.

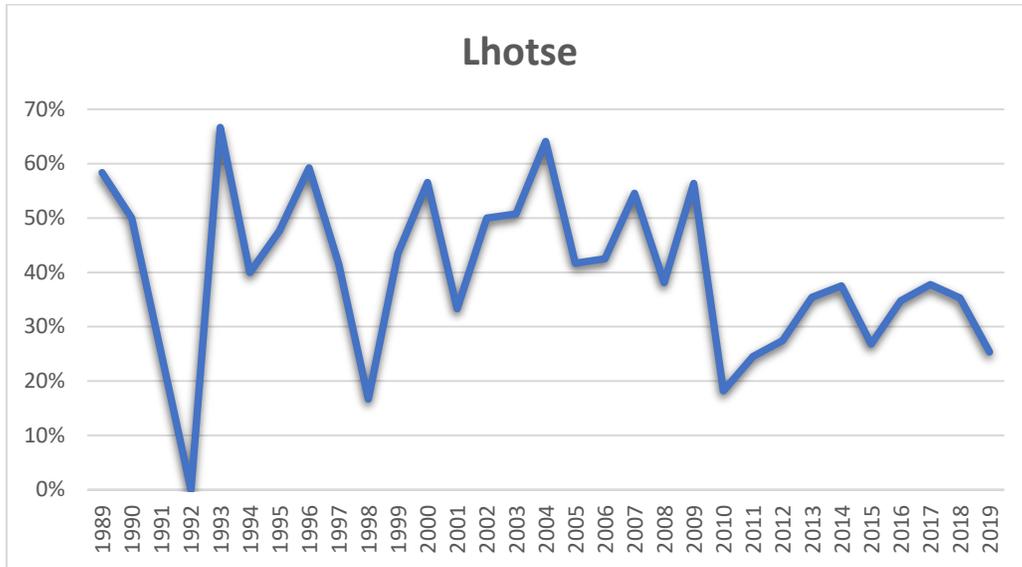


Figure 16 Graph of inexperienced climbers on Lhotse

The image on the next page is a view from EBC. The line going up is considered the yellow band; it connects Lhotse and Everest high camp routes and a standard acclimatization route for climbers before they attempt the summits a few days later.



Figure 17 Photo of Lhotse / Alan Arnette

Kangchenjunga, the third highest mountain in this study, stands at 8,586 meters. Located at the easternmost point in the range, it has a reputation for being unforgiving. Acclimatizing on this mountain is not only difficult due to the distances between camps, but it is also reportedly hard to find guides who have summited this peak (Arnette 2018).

Looking at Figure 18 below, we can see a distinctive drop in inexperienced climbers beginning in 2001. This was due to India closing down the Indian side of the mountain to all expeditions. The Sikkim view this, as well as 20 other peaks as holy places. The country agreed to close down the peaks, but a court in 2019 overturned that decision and reopened the peaks to foreigners. Many Sikkim are not happy with this decision ("Sikkim Shocked at Centre's Decision to Open 'Holy' Peaks of Kanchenjunga for Expeditions" 2019).

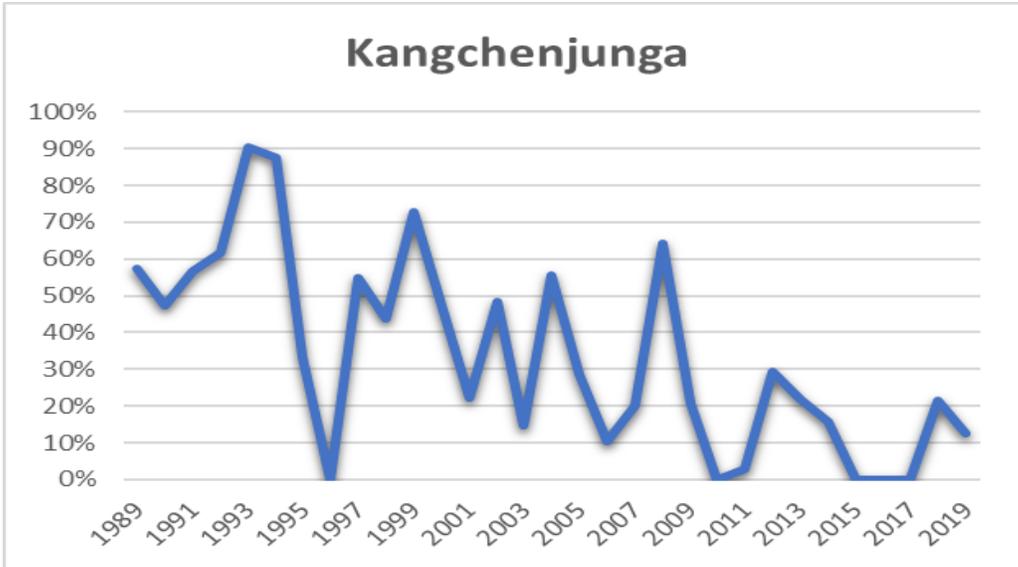


Figure 18 Graph of percentage of inexperienced climbers on Kangchenjunga

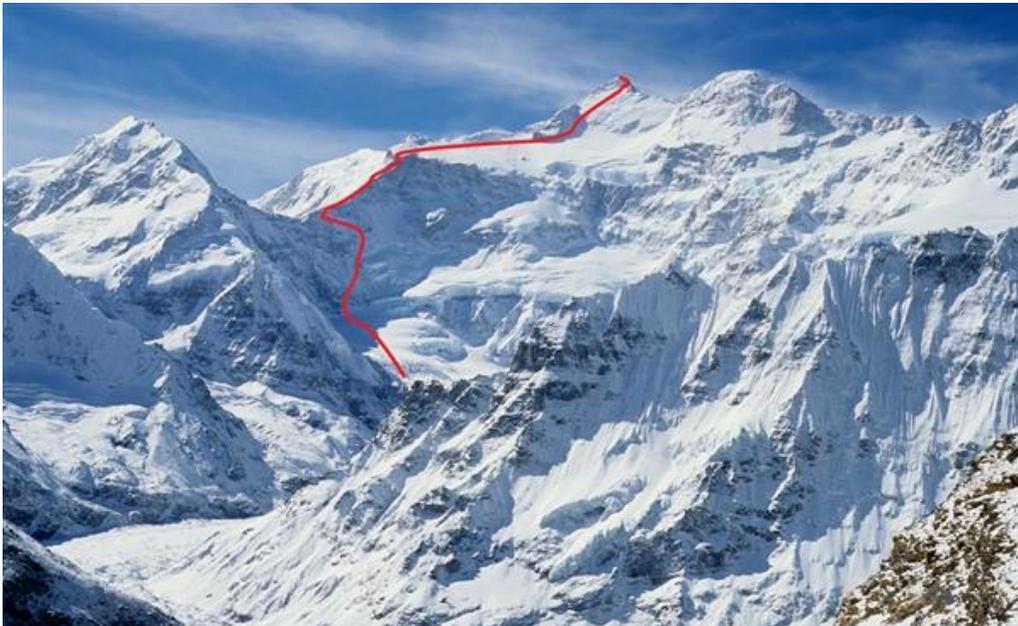


Figure 19 Photo of Kangchenjunga /Lindsay Griffin

Figure 20 shows Manaslu, located 64km east of Annapurna, and reaching 8,163 meters above sea level. This mountain has had its share of tragedies. There have been thirty-two avalanche fatalities in the history of the Manaslu ("The Himalayan Database, The Expedition Archives of Elizabeth Hawley" n.d.). Avalanches are not unique to this mountain, many of the ones in this list carry this particular danger, but on Manaslu, there is no safe areas to wait out avalanches. Even so in 2016, over 150 climbers summited this peak in two days. Between 40 – 60% of the climbers on Manaslu lack experience.

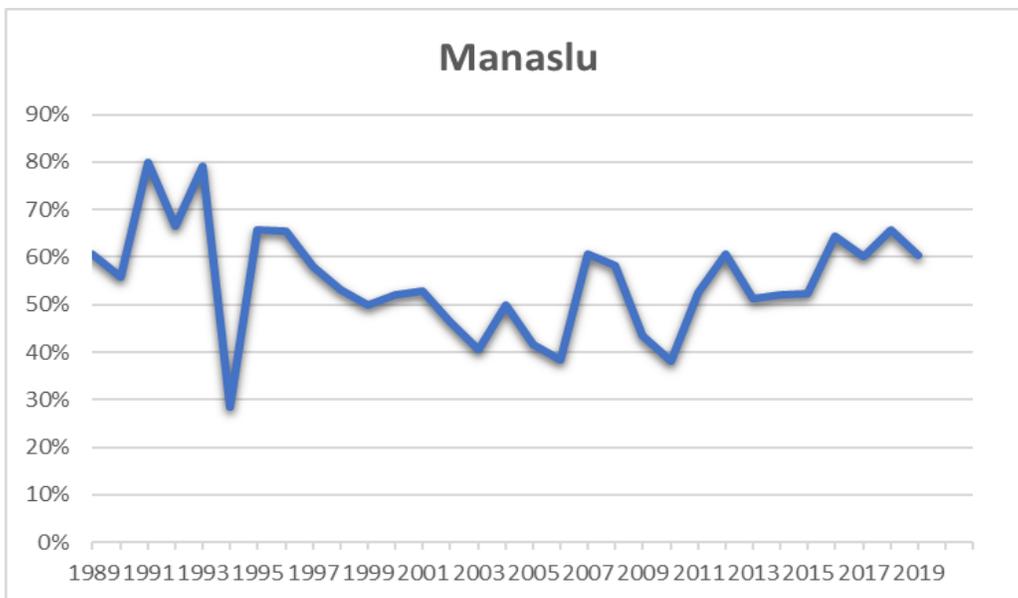


Figure 20 Graph of percentage of inexperienced climbers on Manaslu



Figure 21 Photo of Manaslu / Fredrik Strang

Makalu is the world's fifth-highest peak at 8,463 and is a double peak. Located on the Nepal/ China border, it has a distinctive pyramid shape. While not considered a terribly difficult climb, it has claimed the lives of experienced climbers in the recent past.



Figure 23 Photo of Makalu / Alan Arnette

Lastly, we take a look at Annapurna I. Located in the Annapurna Conservation Area and standing at 8,091 meters, this mountain has the distinction of being called "The life taking Mountain" (Mingma Sherpa, 2015). The trend line in the graph below depicts a decline in inexperienced climbers on recent expeditions. This is a good thing due to the tremendous technical skills needed for ascending this mountain. The dramatic drops in 2001 and 2013 can be associated with the catastrophic avalanches that occurred in those years.

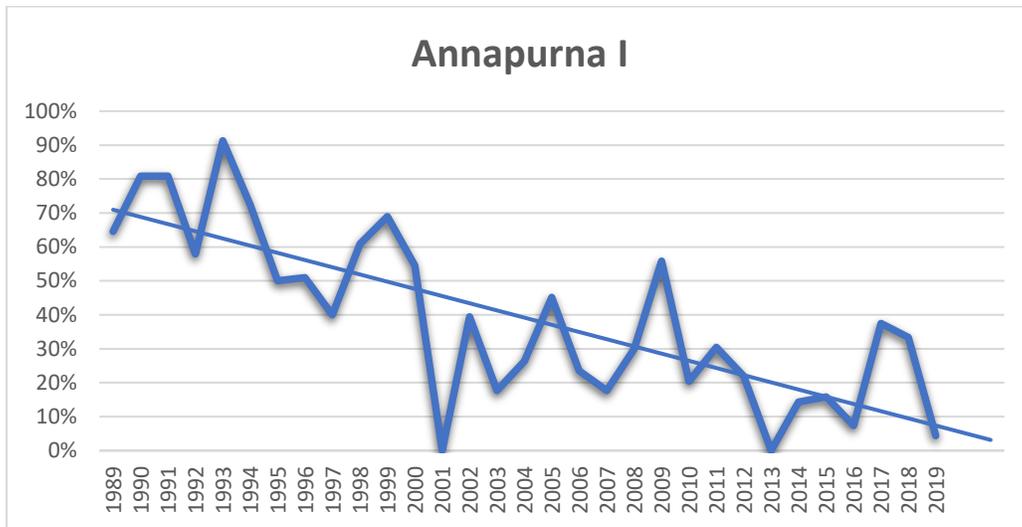


Figure 24 Graph of the percentage of inexperienced climbers on Annapurna I



Figure 25 Photo of Annapurna I / Mohan Nagarajan

When mountaineering first began in the early twentieth century, most expeditions were scientific projects or publicly sponsored political events. Those that were not lucky enough to join up with one of these groups paid for the expeditions themselves. Early expeditions also were led by experienced mountaineers whose training came from government, military or leisurely means. By the late 1980s and 1990s, names like Mountain Madness and Adventure Consultants were making a name for themselves by promising a 100% Success Rate on Everest in 1995 (Boukreev and DeWalt 2015). It is important to note that both men who started the previously mentioned companies, died the following year, on Everest.

Over the last few years, the numbers on Everest have increased to concerning numbers ("Traffic Jams Are Just One of the Problems Facing Climbers on Everest," n.d.). The data is damning, overcrowding, not enough supplies, inexperience, thefts. It was a Shakespearean play that played out on a global scale.



Figure 26 Photo of Everest Line / Sabin Thakuri

Another issue that is lurking in the background is, will other peaks become overcrowded to the point of 'Everestification'? The increase in the number of climbers on any given mountain that might create the same conditions that are seen on Mt. Everest. Given that Annapurna falls into the over 8,000 m group and currently lacks the crowds, it might draw more attention. However, mountaineers are at odds as to whether or not that could ever happen.



Figure 27 Photo of Everest / Eli Saikaly

Figure 28 on the next page, is a graph shows all members of expeditions above basecamp on each mountain from 1989 to 2019. While the percent of inexperienced climbers may be declining, the numbers that drove to these mountains are not. Expeditions are alive and well in Nepal, and the data does not indicate a slowdown anytime soon. From the data, we can see that most mountains have a pretty variable web and flow, except for Everest and Annapurna I, which have maintained a steady course.

Members Per Mountain vs. Per Year

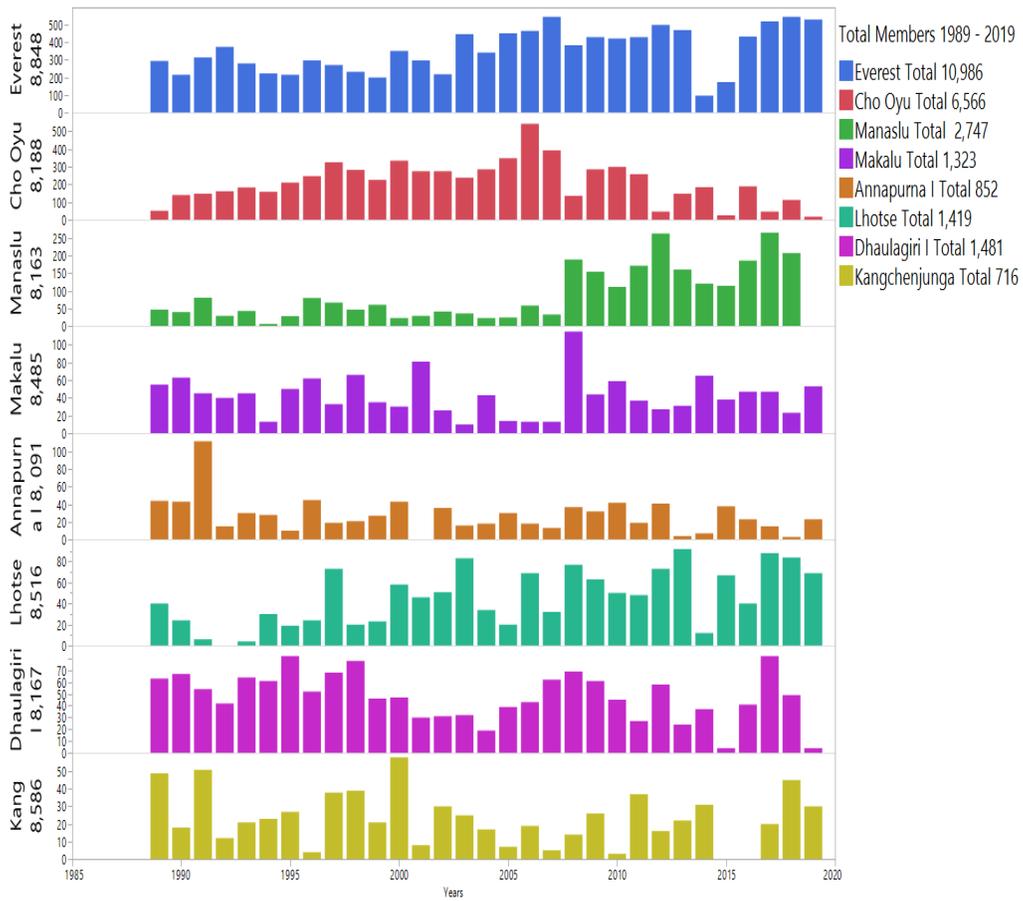


Figure 28 Graph of members per mountain vs per year

Chapter 5: Tourism and the People

Tourism

Nepal has a young history of tourism. Tourists have only been coming to the Annapurna region since the 1950s. Mountaineer Maurice Herzog brought attention to Annapurna I when he made the first summit on June 5, 1950. The mountain was again in the spotlight in 1978 when the first women team, led by Arlene Blum, summited on October 15 of that year. Early tourism emphasized the sacredness of the Himalayas and the temples that were built within their shadows. As more Westerners began to arrive, some of the origin stories were lost.

Tourism data for Nepal begins in 1964, with 9,526 visitors, and as of 2018, 1,173,072 were reported.

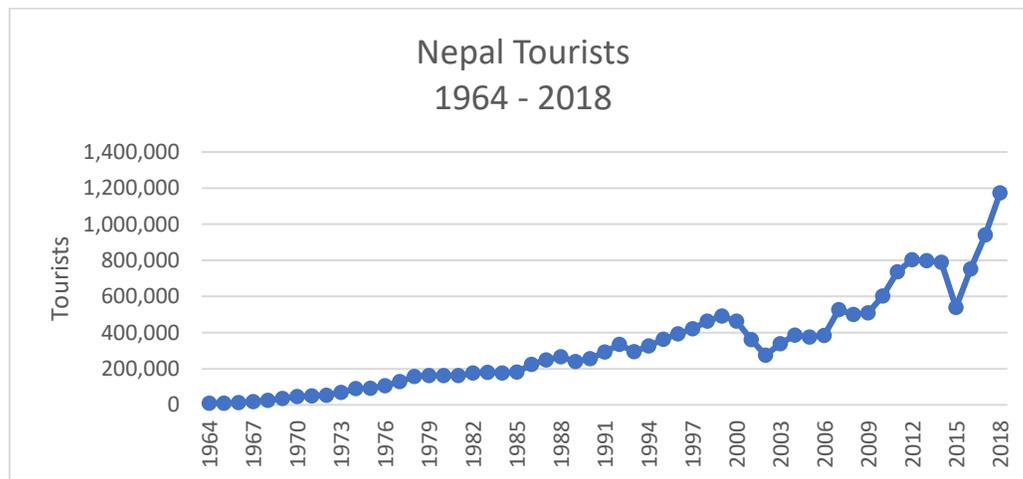


Figure 29 Graph of Nepal tourists vs year

This steady increase in tourists has relieved the pressures on a depressed economy and gives people in rural areas access to income. According to the Tourism Statistics of Nepal, 2018 report, revenue from tourism that year was \$703,179. The average tourist spent \$44 a day while in Nepal (Nepal Tourism Statistics 2018).

Tourism has influenced changes in the people and the environment in the Annapurna region. The economy in this region is based on agriculture; however, tourism has diversified economic practices. Where sheep breeding and growing grain was the primary occupation, now villagers can grow what is needed for their family to eat comfortably, supplementing that by becoming teahouse or lodge owners. There also is an increase in the need for porters and guides to keep up with the Annapurna circuit trekking demand.

Economic disparity has also increased due to tourism. Families that lived along the trekking routes tend to have higher income and better employment outcomes than those elsewhere ("Central Bureau of Statistics – Central Bureau of Statistics," n.d.). While tourism may be beneficial in economic means, it can play a different role in the environment. Increased lumber harvests, fossil fuel use, land degradation, and additional garbage accumulation all weigh on the environment.

The Nepalese People

The five districts within the Annapurna Conservation Area are comprised of many different Caste ethnic groups. Below, you will find a map of information

about the inhabitants living within each district. While the mountains and valleys may lie within, it is the people who are the Himalayas.

Mustang District

Lhopa, Thakali, Gurung, and the Chhetri ethnically dominate the Mustang district. Mustang consists of upper and lower regions. The people of upper Mustang call themselves "Lowa", which means people of the North in the Tibetan language. The Lowa people practice Tibetan Buddhism. Lower Mustang are Thakali and they practice Hinduism and Buddhism. There are many theories about the division of the district, however upper Mustang's proximity to the China border is the easiest explanation. Until 1992, foreigners were forbidden from entering the upper Mustang. They could enter Mustang district but they could not cross the boundary line between lower and upper Mustang. The change in 1992 occurred because the Upper Mustang region came under the jurisdiction of the Annapurna Conservation Area.



Figure 30 Photo of the Lhopa People of Upper Mustang / Pelegrine Treks



Figure 31 Photo of Thakali people of Lower Mustang / Pelegrine Treks

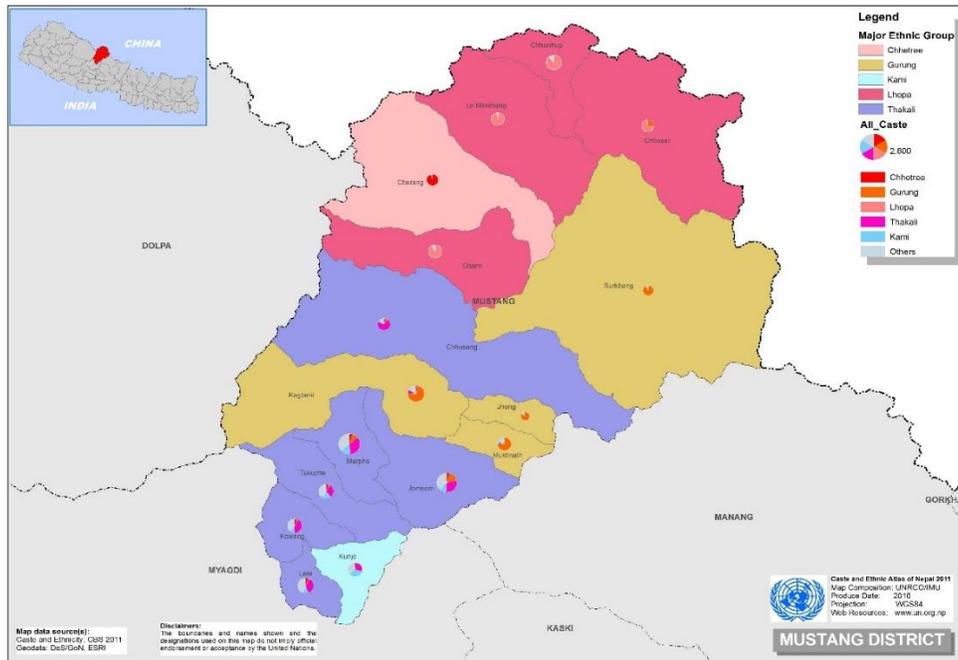


Figure 32 Map of the Mustang District / UN

Manang District

Manang is the least populated district in Nepal, and yet it boasts balanced diversity within its borders. The major groups are Bhote, Gurung, and Tamang. The Manangi, as they are called, speak Gurung and are nomadic traders. They are predominately Buddhist, while Hindu festivals still occur.



Figure 33 Photo of Manangi Women / Khatalife



Figure 34 Photo of Manangi Men / Khatalife

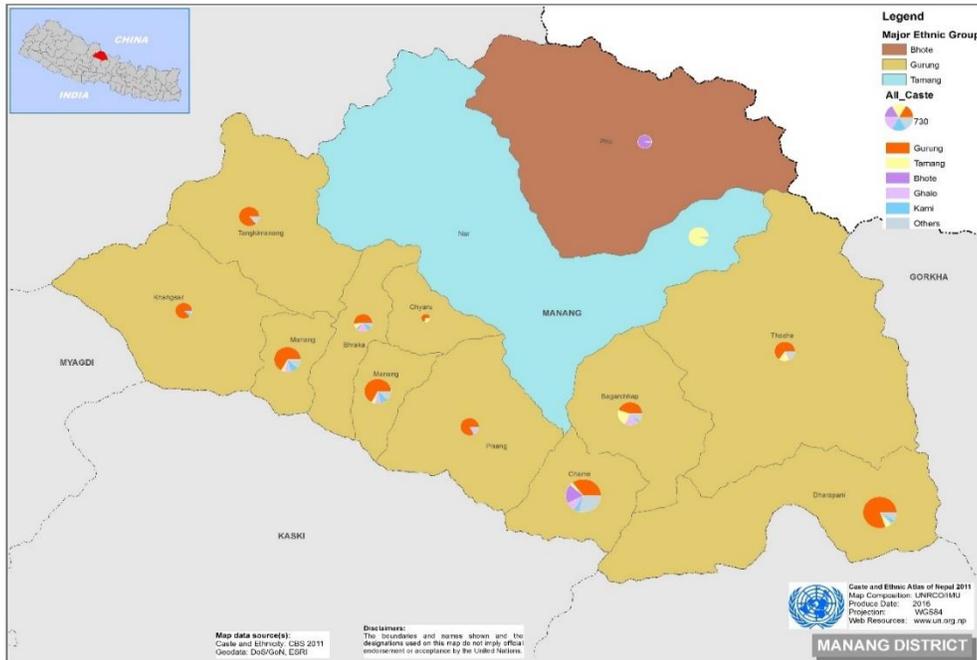


Figure 35 Map of Manang District / UN

Myagdi District

Myagdi is home to the Chhantyal, Magar, Kami, and the Chhetree people. The Chhantyal and Magar are two of the largest groups in this district. Chhantyal speak Kham and are Buddhists. The Magar speak a variety of languages, predominately Nepali and Magar. Hinduism is their religion, with some tribes practicing other ethnic religions (Joshua Project 2020). The Magar are one of the oldest tribes in Nepal (Joshua Project 2020). This region is home to some of the more desired treks on the Annapurna Circuit such as Ghorepani Poon Hill Trek.



Figure 36 Photo of Chhantyal People / Joshua Project



Figure 37 Figure of Magar people / Joshua Project

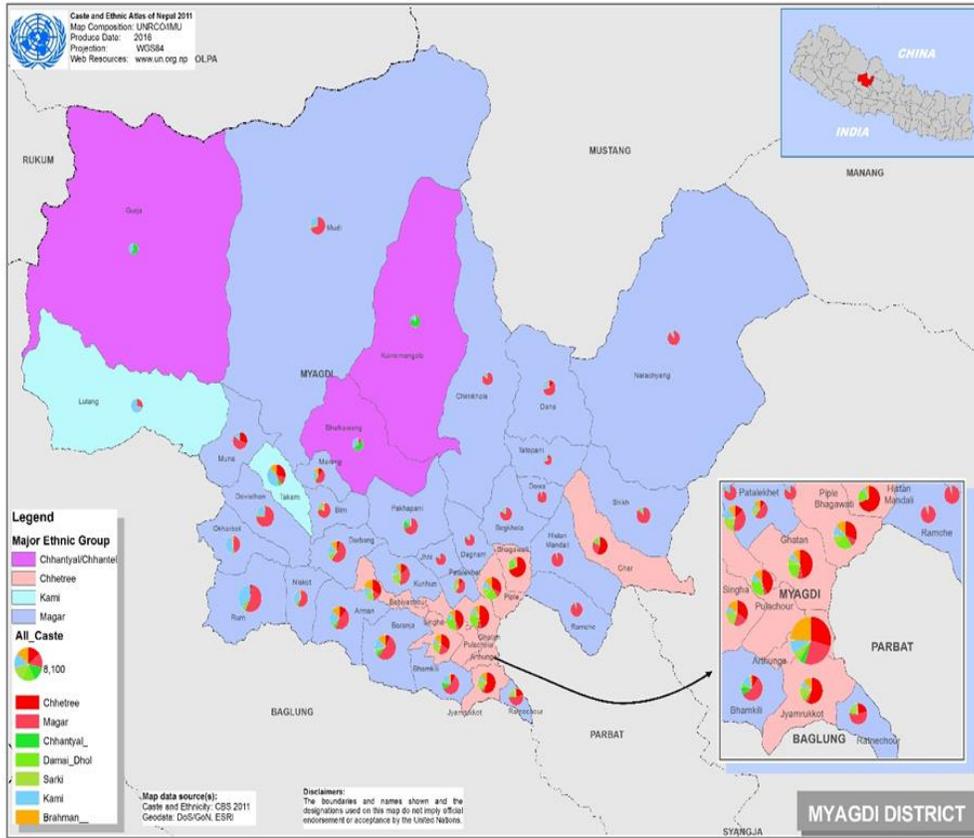


Figure 38 Map of Myagdi District / UN

Kaski District

Kaski is the largest tourist district within the region. The major ethnic groups in this region are Gurung, Kami, Kumal, Magar, Chhetree, and Brahman-Hill. This is a unique district in that the universal language is Nepali, with Gurung coming in second. This district has a mixture of Buddhism, Hinduism, Shamanism and Christianity.



Figure 39 Photo of Brahman- Hill People / Tyman



Figure 40 Photo of Gurung man / Tyman

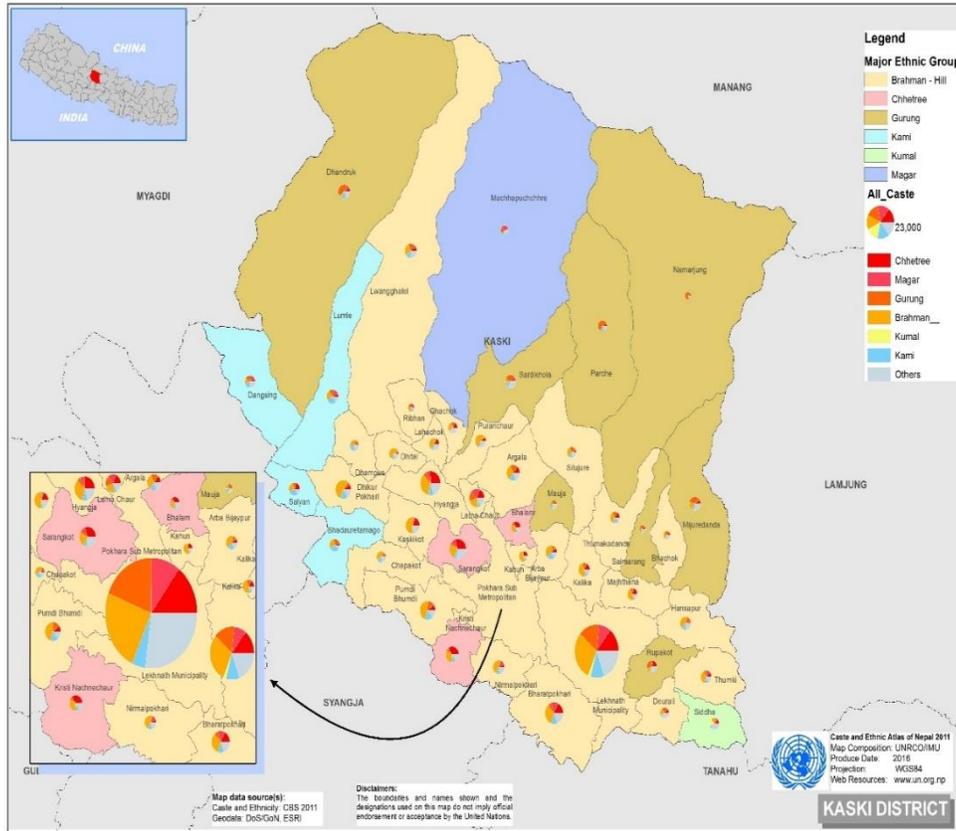


Figure 41 Map of Kaski District / UN

Lamjung District

The Braham-Hill, Gurung, Dura, Chhetree, Newar, and Magar are the major ethnic groups represented in the Lamjung District. The majority of the district speaks Nepalis. The Dura tribe's language was reported as extinct according to several sites. The loss of language is thought to be due to the older generations not handing it down (Schorer 2016). This district practices Hinduism and Buddhism.



Figure 42 Photo of Dura Women / Sangsoma

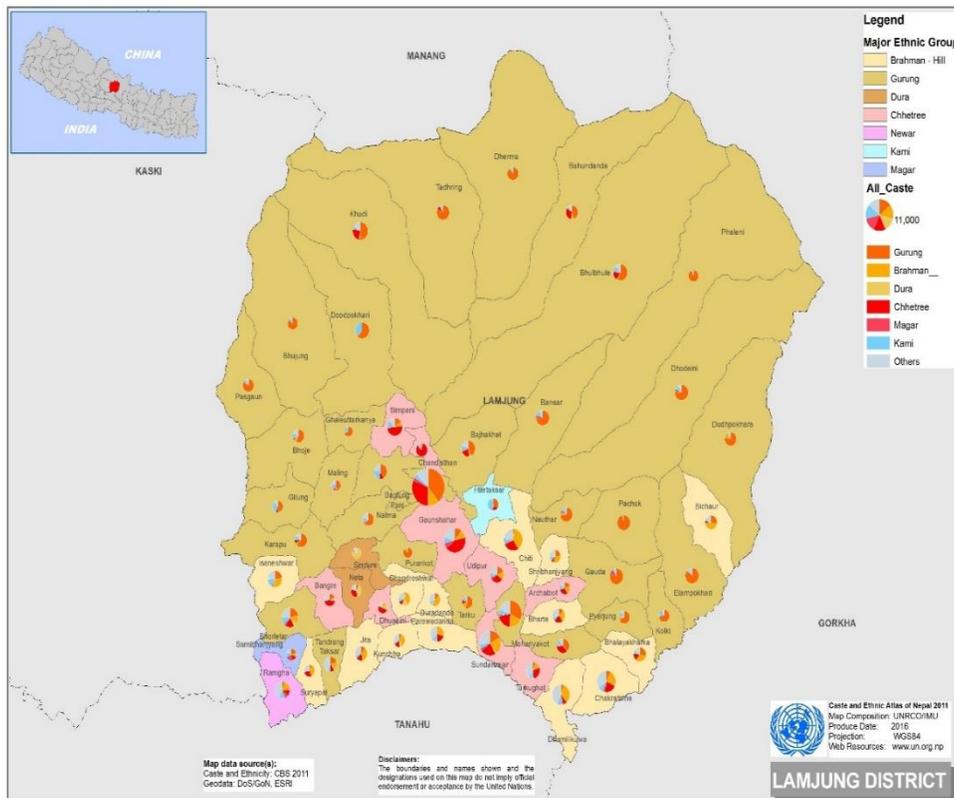


Figure 43 Map of Lamjung / UN

Roads

One major change that tourism has brought to the region is roads. While some see the construction of roads as a blight on the beautiful landscape, others praise them for the ease and strength in development it has brought to the locals. Roads have allowed easier transport between villages as well as to medical facilities, where previously the only way to get to a hospital was by expensive helicopter rides. Not only are trips easier, but supplies are now accessible. Remote villages in upper Mustang can now drive down to Jomsom or Pokhara in hours where it previously took them days on foot.

Exports are on the rise as locals are now able to transport their goods. With the increase of export capability, locals can also increase the prices of their goods. In 2011, Mustang produced over 3000 tons of apples, but were only able to export 700 tons due to lack of roads and accessibility (Grant 2011). Product exports are the only increase on the roads, locals have seen an increase in tourist vehicle traffic as well. Where trekkers previously spend days on a trail, now sections are being skipped by vehicle based on itinerary. This cuts revenue from the locals that would normally feed and house trekkers along the way (Grant 2011). This increase in traffic can cause issues with noise, pollution and degradation of landscapes.

Part of the allure of trekking in Nepal is the remote, majestic views that are not modernized. Roads and airports are changing not only the landscape but the experience as well. On the Tibetan side of Everest, there is a pristine asphalt road that will deliver climbers to Everest's base camp door. This road is

applauded by some for mainstreaming the tourist line, however others see it as contributing to the problem of commercial expeditions.



Figure 44 Photo of Tibet side Everest Base Camp parking / Morrison



Figure 45 Photo of Road leading to EBC on Tibet side /Morrison

Chapter 6: Commercial Expeditions

Code For Leaders and Climbers (1932)

A Leader Should

1. Know where he is going and how to get there.
2. Take proper equipment for party such as rope, first aid kit, maps, compass, etc.
3. Know the personnel and ability of his party.
4. See that climbers are properly equipped for the trip.
5. Start early enough so as to complete trip by daylight.
6. Appoint a rear guard for entire trip.
7. Set pace suited for trip, conditions and personnel.
8. Keep watch of progress of party and individuals, and check same frequency.
9. Not hesitate to turn back if weather or other conditions are unfavorable.
10. Be prepared, and know how, to overcome unexpected difficulties.
11. Instruct in special climbing technique.
12. Should point out landmarks and keep party informed as to where they are.
13. Not relax vigilance at any time during trip.

A Climber Should

1. Obey the leader
2. Know the kind of trip and his ability to make trip.
3. Properly equip himself.
4. Be physically and mentally fit.
5. Stay behind leader and in front of rear guard.
6. Not relax vigilance at any time during trip.
7. Carry a reliable light, matches, extra clothing and food.
8. Familiarize himself with trip both before and during trip.
9. Not take needless risk.
10. At all times endeavor to improve his climbing technique.

There are fundamental rules that every mountaineer must abide by. These are rules that don't change with the country, expedition or era. If there was bible for mountaineering, these would be the commandments. They are simple rules for a complex sport. One that is not only continuing to grow, but one that is bending those rules.

History

The first expedition on Everest was in 1921. While it wasn't successful, it started the drive that continues to present day.

Figure 46 Excerpt from *Mountaineers* / PH W Playton



Figure 47 Photo of first Everest Expedition / Britannica

Tragedy

Everest wouldn't be officially summited until 1953, by Edmund Hillary and Tenzing Norgay. Three years after the Annapurna I Summit by Maurice Herzog and Louis Lachenal. There has always been a race to the top, some with success and many with tragedy.

Table 3 Mountaineering Deaths 1921- 2020 / Himalayan Database

Mountaineering Deaths for all 8,000-meter peaks in the Himalaya 1921 - 2020			
Cause of Death	Number of Climbers	Location	Number of Climbers
Avalanche	223	Route Preparation	322
Fall	206	Descending	242
AMS	78	At/Above Basecamp	82
Illness (non AMS)	52	Ascending	60
Exhaustion	38	Expedition Evacuation	33
Exposure/Frostbite	36	Total	739
Disappearance	29		
Other (unknowns)	25	Health vs Weather Related Collective Deaths	
Crevasse	22	Total AMS Related	113
Icefall Collapse	16	Total Weather Related	42
Falling Rock/Ice	14		
Total	739		

In Table 3 above, we can see a breakdown of the deaths that have occurred on these peaks over the last century. In 2014, sixteen Sherpa died tragically due to an avalanche on the Khumbu Icefall (Arnette 2014). In 1970, this same region killed six Sherpa in an avalanche (Himalayan Journal 1970). This area is a known danger and has worried expeditions for years. "The head part of the Icefall where the glacier inclines around at 6,100 m. and the caved in area around 5,700 m. are two of the most dangerous places in the Icefall" (Isserman 2008).

Immediately after the 2014 tragedy, Sherpa took a stand against the expeditions by refusing to climb or work. It was understandable, many of them had just lost family and friends. The strike created a lot of tension on the mountain with media portraying it as the Sherpas were getting violent with the Westerners.

Tim Mosedale gave an interview on the mountain stating:

Time and again the Sherpas have stated that their argument is not with the Westerners and there is no animosity towards us. Their beef is with the government. They are sorry that we are caught in this tangled web on the sidelines but at the same time we (and the mountain) are being used as political leverage to get what they want. Obviously, everyone wants better working conditions for the Sherpas but by holding us to ransom they are controlling the situation. (Arnette 2014).

Their issues were indeed with the government in that they were demanding to cancel the season to grieve for the friends and the mountain. Additionally, they wanted the government to increase payouts to the families of the deceased Sherpa as well as better insurance. The argument was met with a deaf government ear; expeditions would continue as far as they were concerned. In the end, the season closed early due to mutual agreements from expedition companies on the mountain and the Sherpa. There would be no expeditions on Everest, or most of the 8,000-meter peaks in the Himalaya without the Sherpa. Their knowledge, skillset and nature of their demographic (high elevation tribes) makes them the perfect mountaineer. However, they are facing increasing numbers like never before and the clients are not the same mountaineers you found in the 1950s.

Modern expeditions carry with them a little bit of luxury, from helicopters, personal cooks, and two to one Sherpa ratio. All of this can lead to overcrowding on the mountain as more and more people sign up for expeditions they may not be qualified for. Kami Rita Sherpa holds the record for twenty-four summits on Mt. Everest. He comes from a family of mountaineering men, his father was one of the first professional guides with the opening of the peaks to foreigners in 1950,

his brother has scaled Everest seventeen times. They know a thing or two about the mountain and what it takes to make it successfully.

In his opinion:

Overcrowding is nothing new. This is not the reason people are dying. It's pressure on young climbers by some companies describing Everest as easy. Everest is never easy. (Sherpa 2019).

Climbers have grown to assume that as long as they have the Sherpas that they will be safe, in reality there is only so much they can do at that elevation. It really does come down to climber skill.

Marketing

Expedition companies have never had a problem luring people in with the promise of a view that only the most elite can see. While the elite view hasn't changed, the way to it most certainly has. There are many options when booking your expedition company and each should be weighed carefully. You can book with a smaller Nepalese company to climb Everest for between \$36,000USD to \$42,000 USD. Both of the companies that were looked at had a pretty grey area in terms of climbing background requirements. The New Zealand company, Adventure Consultants is about \$69,000 USD, who's name you might remember from the 1996 tragedy on Everest. They have great book recommendations if you aren't a seasoned climber.

RMI Expeditions and Mountain Madness from the United States will cost you between \$67,000 USD to \$70,000 USD dollars but be prepared to show proof

of mountaineering skill. These two companies have a higher qualification standard than most expedition companies reviewed so far.

Seven Summit Treks has been in the news a lot and not always for the right reasons. 2019 saw seven of their clients die (Arnette 2019). This company is a giant in terms of expeditions, averaging at least 10 expeditions a year on various mountains (Himalayan Database 2020). They have slick marketing and they seem to know how to target the inexperienced.

Figure 48 below is taken from their webpage and is targeted at those who may not have the skill to climb, but have the money.

 Duration:	45 Days	 Country:	Nepal
 Max. Altitude:	8848 M / 29029 Ft.	 Walking Per Day:	5 - 6 Hours
 Nature:	Hotel + Lodge	 Grade:	
 Best Season:	SPRING	 Group Size:	MIN 1 and MAX 5

TRIP INTRODUCTION

top of the highest summit in the world for an added price. If you want to experience what it feels like to be on the highest point on the planet and have strong economic background to compensate for your old age and your fear of risks, you can sign up for the VVIP Mount Everest Expedition Service offered by Seven Summit Treks and Expeditions. This service facilitates you to experience the feeling of accomplishment that one gets while succeeding in an adventurous sport, all while providing highest levels of safety and comfort that can be imagined in such a difficult landscape.

Figure 48 Screenshot of Seven Summit Trekking Marketing / SST

For \$130,000 USD, this VVIP trip includes: 1 UIAGM Guide, three Everest Summiteer Sherpa, one photographer, Lobuche Peak route (meaning you climb from Lobuche and not the yellow tape line on Everest). This is targeted at

the wealthy who maybe have a bucket list or who just have the money to spend.

In case you missed it in Figure 48:

If you want to experience what it feels like to be on the highest point on the planet and have strong economic background to compensate for your old age, weak physical condition or your fear of risks, you can sign up for the VVIP Mount Everest Expedition Service offered by Seven Summit Treks and Expeditions (Seven Summit Trekking).

In looking through their site, they also offer expeditions to K2 in the winter. This is a dangerous offer as the only mountain to have not been summited in the winter thus far is K2. Their site doesn't give a definitive requirement as to the climber's skill level that's needed, it doesn't however say it's difficult.

Who can climb a peak?

Experience or no experience, it requires certain level of fitness to climb a peak. Depending upon the altitude and difficulty level, some training might also be necessary. However, there are certain mountains that can be climbed by a trekker or someone with no experience at all.

Figure 49 Screenshot of Seven Summit Trekking climbing experience / SST

Annapurna I is offered for \$7,000. Let that sink in. Seven Thousand Dollars. How much of a gamble are you willing to take for seven thousand dollars? Annapurna I is always lower than Everest due to popularity, but the fear is that with the overcrowding on Everest, where else might climbers go to reach that ultimate view?

Chapter 7: Conclusion

The average temperature in the ACA region has increased by 1°C over the last thirty years. The temperature increase is more acutely felt in the higher elevations. Precipitation modeling data tells us that the monsoon season is bringing heavier precipitation to the hill region and less to the mountain region. As the Annapurna massif creates a large rain shadow at the skirt of the mountain, this, too, could affect the seasonal variations. Warmer temperatures and wetter climates create dangers with slope stability and glacial lake wall solidity. The increase in landslides and GLOFs is not out of the question as a revisit for the next thirty-year projection.

Annapurna I is a dangerous mountain, and there is no data to dispute that. The data shows that the hypothesis is not true and that "Everestification" is not happening on Annapurna I at this time. The increase in climbers, however, is not the only thing to watch in the future. Annapurna I weather has become more unpredictable in the last few years and avalanches more frequent. Every mountain has its own sacred carrying capacity, and it is possible that we have not established Annapurna's limits yet.

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In Memoriam

This body of work is dedicated to the memory of those Sherpa who lost their lives on these mountains.

Unknown Sherpa	Chong Rinji Sherpa
Chettan Sherpa	Dakiya Sherpa
Babu Lall	Dorje Sherpa
Unknown Sherpa	Pasang Kami Sherpa
Lobsang	Unknown Sherpa
Pasang Sherpa	Pemba Sherpa
Dilli Bahadur Verma	Pasang Nima Sherpa
Pemi Dorje Sherpa	Ang Nima Sherpa
Bal Bahadur	Pemba Tshering Sherpa
Ang Norbu Sherpa	Shanti Rai
Chhowang Sherpa	Unknown Sherpa
Unknown Sherpa	Maila Magar
Pemba Phutar Sherpa	Tika Ram Magar
Tenzing Sherpa	Ram Bahadur Shrestha
Karki	Keepa Sherpa
Ang Mingma Sherpa	Pasang Norbu Sherpa
Ang N Mingma Sherpa	Nima Norbu Sherpa
Ang Rita Sherpa	Kancha Gurung
Ang Tendi Sherpa	Dil Bahadur Rai
Gyalze Sherpa	Ang Dawa Sherpa
Pasang Nima Sherpa	Ajiwa Sherpa
Pemba Rinji Sherpa	Kami Sarki Sherpa
Phurba Tenzing Sherpa	Unknown Sherpa
Rinsing Ongyal Sherpa	Ang Dawa Sherpa
Wangel Sherpa	Tchiring Chumbi Sherpa

Lhakpa Nuru Sherpa
Nuru Wangchuk Sherpa
Wangchu Sherpa
Wangel Sherpa
Chandra Gurung
Dawa Sange Sherpa
Jangbu Sherpa
Lhakpa Tendi Sherpa
Tenzing Sherpa
Ang Dorje Sherpa
Lhakpa Nuru Sherpa
Lhakpa Gyalu Sherpa
Sukaraj Limbu
Riku Sherpa
Ngati Sherpa
Ang Tshering Sherpa
Ang Tshering Sherpa
Kami Dorchi Sherpa
Sange Pemba Sherpa
Dawa Dorje Sherpa
Ang Dawa Tamang
Pasang Nima Sherpa
Pasang Nuru Sherpa
Pemba Gyalzen Sherpa
Chuldim Gyalzen Sherpa
Chhong Ringee Sherpa
Prakash Kundip Karki
Karma Wangchu Sherpa

Ongchhu Sherpa
Sarki Sherpa
Pramod Sunar
Nima Dorje Tamang
Sumba Sherpa
Lhakpa Rita Sherpa
Udhav Prasad Khanal
Drabey Bahadur
Rajan Magar
Hasta Bahadur Gurung
Nil Prasad Gurung
Pasang Gelu Sherpa
Tashi Chhiring Sherpa
Dawa Dorje Sherpa
Temba Sherpa
Bibas Gurung
Phu Dorchi Sherpa
Dawa Sherpa
Asman Tamang
Dawa Wangchu Sherpa
Temba Sherpa
Bhoj Kumar Rai
Gopal Rai
Dorje Sherpa
Pema Chhiring
Pemba Sherpa
Da Tenji Sherpa
Lhakpa Ongyal Sherpa

Ang Phurba Sherpa

Ang Ngima Sherpa

Ang Dawa Sherpa

Dawa Gyaljen

Phujung

Nima Tenji Sherpa