Abstract Nepal has been identified as the fourth most vulnerable nation to climate change in the world. It faces complex environmental problems that are differentiated further by topography. Within an average span of 4.097° N latitude (26.337° and 30.434° N) and an approximate north-south distance of 184 km, the elevation ranges from 62.75 m in the south (latitude, 26.3717° N, and longitude, 86.926° E) to 8848 m in the north (latitude, 27.9875° N, and longitude, 86.9267° E). While the south experiences unprecedented floods and high temperatures ranging from 10° to 48 °C, the north faces a frigid tundra climate (−36 °C/−33 °F to −18 °C/−0.4 °F at the peak of Mt. Everest). The north also is prone to glacial retreats and glacial lake outburst floods (GLOFs) because of the rapid melting of ice due to high rates of increase in temperature at higher altitudes than at lower elevations. The mid-hills face problems such as floods, landslides, and water shortages. Variations in regional rainfall patterns continue to affect the environment. In the mountain region, the annual rainfall ranges from 140 mm (in the west) to 900 mm (in the east). In the mid-hills, temperature fluctuates from place to place, where the soils are very thin and extremely erodible in steep slopes with very little organic matter to bind them together. Lack of irrigation facilities has caused limited farming to some areas, especially, along the narrow terraces in the mid-hills. Though the southern Tarai plain has been serving as a breadbasket for Nepal, it is also not free from climate anomalies. Unprecedented floods often wash away fertile farmlands from the Tarai plain. Global climate change is affecting the patterns of rain events, hydrological cycles, and associated floods and landslides, crop production, and habitat shift, encouraging the incidence of new diseases and parasites. These geographic variations in Nepal’s landscape have led to the development of varied cultures and adaptive patterns. Added to these complexities, environmental problems are also compounded due to political instability leading to policy inconsistency that often influence trading with and transit through India—Nepal’s immediate and influential neighbor. Recently, Nepal has become a place of interest for both China with the Belt and Road Initiative (BRI) and the United States of America (USA) with the Millennium Challenge Corporation (MCC). Politicians are weighing their ideological debates whether these two projects are good for the sustainable development of Nepal.
**Political Changes** Climatic and topographic variations aside, three influential politico ideological phases that Nepal recently went through have created unstable political regimes hindering the country’s economic development.

First, each major political transformation concerned with Nepal has been made under India’s influences; for example, the agreements between Rana and Monarch in 1951 to end the 104 years autocratic regime and the 12-point agreements between the Maoists and seven mainstream parliamentary parties in 2006 to conclude the decade-long Maoist armed conflict (1996–2006), all were done through the mediation of India. Though the promulgation of the new constitution in 2015 through the Constituent Assembly was seen as the culmination of the seven decade-long political struggle in Nepal history, Nepali politics could not remain uninfluenced by Indian policies including the carving of Nepal into seven federal units.

Second, the first democratically elected Prime Minister of Nepal, B. P. Koirala’s stand in 1960 to make each decision independently without consultation with India including the diversification of Nepal’s diplomatic relations, such as recognizing the state of Israel, establishment of diplomatic relations with India’s rival, Pakistan, and strengthening Nepal’s relationships with China at a time when the Sino-India war was in the offing, which, eventually occurred in 1962 which made India unhappy. With the clandestine support of India, King Mahendra dismissed the democratically elected Koirala government before it completed 1 and half years of its 5-year tenure. As India took B. P. Koirala’s foreign policies as the beginning of the erosion of India’s traditional foothold at her doorstep, this Indian view facilitated King Mahendra’s action of dismissing Koirala’s government. King Mahendra always saw Koirala as an arch rival to his direct monarchial rule. In one-on-one interviews during this research with some politicians who worked closely with King Mahendra expressed that actually the king knew Koirala’s patriotic intentions, but intermediaries and King Mahendra’s ambitious attitudes created rift between these two leaders. The differences between King Mahendra and Prime Minister Koirala created never-ending political instability that offered room to India to repeatedly interfere in Nepal’s internal matters.

Third, King Mahendra (1955–1972) played off India and China’s cards to advance and accomplish his ambitions. Each time he narrated his actions against the elected government as necessary steps to strengthen his version of national unity and his nationalistic position. Using his version of nationalism, King Mahendra also clandestinely helped Nepal Communist parties to grow to counter and suppress the Nepali Congress Party. King Mahendra’s coteries blamed Koirala being close to India because of B. P. Koirala’s involvement in the Indian Independence Movement and his friendship and long association with many Indian political leaders and parties.

Because of these three major events and the lack of a charismatic and visionary political leader to wisely handle Nepal’s complex and fragile geopolitics, Nepal’s every political change has yielded space to outsiders. The country has continued to suffer from external meddling and undue interference in internal affairs. Today, over 50,000 international/non-governmental organizations (I/NGOs) are actively involved in Nepal’s so-called development. These I/NGOs are involved not only
in development but also in various nefarious activities including religious proselytization, weakening the social fabric of unique unity in diversity, which has been Nepal’s national strength. Overtly or covertly, several I/NGOs are creating fissures among harmoniously instituted Nepali communities. Climate change on one hand and cultural and political upheavals on the other have made Nepal a political and sociocultural laboratory for many international organizations and donor agencies in the names of implementing various Bikash Mantras (development formulae) including interfering with the country’s structural adjustment policies (SAPs) since the late 1980s. These Bikash Mantras (and SAPs) have led to the privatization of many industries with the national implementation of neoliberal economic agendas since the 1990s. As a result, Nepal has been overburdened beyond her absorbing capacities, with many industries being closed and the income gaps between rich and poor widening. Even the Marxist and Leninist believers with their socialistic agendas have been supportive of the implementation of neoliberal agendas without questioning their capitalistic faults since they undermine their political stances of “equity and social justice.” These controversial ideological infusions in the central governance of Nepal—namely, socialism and privatization—have further widened the gaps between rich and poor compelling 1200–1500 working age people to leave the country each day for work elsewhere. Despite their Marxist roots and affirmed ideology of peoples’ equity and social justice, many of these popular advocates of socialistic political ideologies have been all too ready to join Nepali capitalists in terms of hoarding personal resources and operating profitable businesses such as private educational institutions, hospitals, industries, and many “so-called social service centers.” Not surprisingly, then, in 2016, Nepal ranked 121/180 in its national “corruption index.” Though this figure is a reduction from 154/180 in 2011, yet, it is still high for a South Asian nation. The Transparency International 2018 report lists Nepal among the most corrupt countries ranking 124 out of 180 (Transparency.Org. 2018).

This chapter presents a short description of contemporary environmental conditions of Nepal in comparison with the rest of its South Asian neighbors and presents a summary of how South Asian politics and climate changes have had an impact on Nepal’s development. Then it succinctly presents how the ongoing political developments have been influencing Nepal’s overall development in the age of global climate change. It also presents a synoptic overview of each chapter that follows and adds a concluding summary section to each chapter.

**Keywords** Nepal · Contemporary environmental analysis · Climate change · Physiography · Geographic information systems (GIS) · Remote sensing · South Asia · Complex environmental problems · Elevation
1.1 Introduction

This book undertakes a comprehensive assessment of Nepal’s environmental challenges from spatial and temporal perspectives. Nepal represents many features of South Asian countries in terms of (a) physical topographic variations; (b) demographic changes—rapid population growth, diverse cultures, internal and international migrations; and (c) remittance\(^1\) (Kaphley 2020)-based economy, massive social awakening with socioeconomic changes, as well as environmental degradation, which includes increasing deforestation, land degradation and soil erosion, extreme variations of rainfall patterns and intensities, and wide temperature variations, all causing ecopolitical conflicts for food and shelter. Because of these multiple problems leading to ecopolitical struggles, like other South Asian countries, Nepal has become a political and cultural laboratory for many donor agencies and to neighboring and other friendly countries. Beyond such complexities of physical, human, and environmental diversities, Nepal struggles with its exposure to neoliberal capitalism and the penetrations of modernity and globalization, which are mediated through the praxis of development by the state (and political elite). Additionally, a polarized yet still continuing political conflict between the centrist and leftist parties in this fledgling democracy, together with seismic devastation caused by the April 25, 2015, deadly earthquakes, Nepal continues to struggle in her developmental efforts against many heavy odds.

Presenting a much-needed new turn of events from the unsuccessful past of continued poverty and political gridlock, a new inclusive democratic constitution was promulgated with the provision of a Federal Republic with a commitment to create the bases of socialism by adopting democratic norms and values (Constitution of Nepal 2015). The new constitution federates Nepal into 7 provinces and 753 local political units\(^2\) down from over 3700 units. Elections were held for three levels of governances in 2017: (a) village and municipal levels, (b) provincial level, and (c) federal level. In all three levels of governances, the leftist—Nepal Communist Party—emerged victorious with the majority of the seats in all three levels of elections by pushing the central left Nepali Congress Party (NCP) into the opposition despite it garnering a reasonable amount of popular votes (almost close to the Communist alliances) under the proportional representational system (details in

---

\(^1\)Nepal’s remittance contribution stands at the 23rd position in the world, and it contributes 31.3% to the country’s national GDP. Worldwide, India tops the list of remitters in 2016 with $67.70 billion followed by China ($61.00 billion), the Philippines ($29.70 billion), Mexico ($25.70 billion), France ($24.60 billion), Nigeria ($20.80 billion), Egypt ($20.40 billion), Pakistan ($20.90 billion), Germany ($17.50 billion), and Bangladesh ($15.80 billion). Given the length of time Nepali have gone overseas to earn remittances which they send back to their family households at home, Nepal now sends its manpower to 59 countries for work with a maximum number of workers going to Malaysia, Qatar, Saudi Arabia, United Arab Emirates, Kuwait, and other countries.

\(^2\)Under the new constitution of 2015, Nepal’s 75 districts are restructured to 77. There are seven provinces, 753 local units (6 metropolis, 11 sub-metropolises, 276 municipalities, 460 village councils, and 6743 wards).
The left party combined with the Madhesi regional party has almost a $\frac{3}{4}$ majority in the federal parliament. The ongoing political agitation in the southern Tarai region that was at the climax before the general election of 2017 has gone into a dormant phase recently. India was backing this agitation to influence Nepal to construct a constitution of India’s liking by imposing an economic blockade while the country was severely suffering from the devastation of mega earthquakes in 2015. Now New Delhi seems to have corrected its policies towards Nepal after India aggressively promised to implement several development projects in Nepal and provided access to four seaports and three dry ports (Times of India 2018). Nepal’s desperate seeking of access to the ocean for international trade and transit opportunities via China’s Guangzhou port in Guangdong province and proposing the linking between Shigatse–Kyurung (Kerung or Keyrung) and Kathmandu via railway line (Fig. 1.1) and China’s willingness to facilitate these endeavors has certainly sent a shock wave through Indian politics (Chellaney 2017). Most likely,

3Nepal will be able to access Shenzhen, Lianyungang, Zhanjiang, and Tianjin. These ports are around 3300 km distances from Kathmandu as opposed to 1127 km distance to Haldia in West Bengal, India. Also, Nepal will be allowed to use Lanzhou, Lhasa, and Shigatse land ports.

4China’s plans to extend the Lhasa–Shigatse railway line to Nepal’s capital and further to Lumbini, the birthplace of Lord Buddha, in Southwest of Nepal along the Nepal-India border.
this has forced India to revisit its international trade policy towards Nepal. At the same time, many local skeptics are expressing their concerns that Nepal might fall into a punitive debt trap fashioned by China (Singh 2018). After the Communist Party of Nepal (CPN) came into power with an overwhelming majority from the 2017 general election in all three levels of elections, India’s Modi government lost no time signing a treaty with Nepal to construct Raxaul (Bihar) to Kathmandu railway lines (Fig. 1.1) terming it an approach to enhance people-to-people contact and bulk movement of goods and services between India and Nepal. Though both, India and China, are willing to connect Kathmandu via railway from their respective nearest border points, it is in an experimental phase. Since India has a history of delaying development activities she has undertaken in Nepal with the motive of keeping Nepal under her control, only time will tell which country will first connect Kathmandu, if it happens at all, with railway lines. With the recently changing policies of India towards Nepal, the Tarai, southern region of Nepal, seems to have some political stability. This has facilitated the flow of trade smoothly between India and Nepal though the trade deficit with India has been increasing in each successive year.

During the general election of 2017, the Nepal Communist Party-Maoist (NCP-M) and the Nepal Communist Party—Unified Marxist-Leninist (CPN-UML) jointly contested against the center-left Nepali Congress Party (NCP) and got the overwhelming majority in the federal parliament. Out of seven provinces, the Communist Party has an overwhelming majority in six provinces. In Province 2 (Fig. 1.1), the regional Madhesi Parties have formed a provincial government with the support of the communist parties. After the general election of 2017, both the NCP-M and CPN-UML are united to form the Communist Party of Nepal (CPN). The CPN also has control over the majority of the local level governments and

5Political economists are warning Nepal not to fall into China’s predatory debt trap through the Asian Investment Bank (AIIB) citing examples of the strategically located Hambantota seaport that Sri Lanka was forced to lease to China for 99 years after failing to clear its debt. Likewise, politicians also cite examples from Argentina to Namibia to Laos that have been ensnared in a Chinese debt trap. Under China’s debt trap, Kenya might be forced to lease its busy port of Mombasa to China. Some are equating China’s aggressive financial diplomacy as “dragon pray” with the European colonial period (1839–1860) of Opium Wars, which China terms its “century of humiliation,” that ended in 1949. Others argue that under China’s Belt and Road Initiative (BRI)—“project of the century”—and China’s way of influencing AIIB’s financing under “its own rules and norms,” different from International Monetary Fund (IMF) and the World Bank (WB), as a non-transparent financial diplomacy. Because of the non-transparent financial diplomacy, China may take control over natural assets as in Turkmenistan’s natural gas and may even ask for a military base as it did in debt burdened Djibouti in 2017 with an annual lease of $20 million.

6It is questionable whether China will undertake the massive Kyurung-Kathmandu railway project because it is watching whether Nepal accepts the $55 million grant provided under the Millennium Challenge Corporation (MCC) by the US Government. Nepali politicians are divided into two groups—accept MCC’s grant or reject it. Though China has stated that it is up to Nepal’s decision to accept or reject MCC’s grant, arguments are that China strongly desires that Nepal rejects MCC’s grant. Many pro-China lobbying Nepali politicians believe that this MCC’s grant is a ploy of the United States to strengthen its presence in Nepal to watch China’s activities.
bureaucratic machineries (PTI 2017). With the formation of CPN, Nepal now has a stable government unlike in the past when 24 different governments were formed between 2009 and 2016.

The current political stability in Nepal is an opportunity to (a) focus on the management of her natural resources and to improve her environments: for example, identifying risk-prone areas due to glacial lake outburst floods (GLOFs) and shifting people to safer areas; (b) developing hydropower projects; (c) properly managing forest resources that not only have been overly exploited to meet energy and constructional timber needs but also in various developmental activities: (d) improving the ecosystem services of downstream communities through the proper management of various watersheds while regulating bulldozer engineering that has rendered many people victims of developments; (e) controlling illegal cross-border trade operations including human trafficking; (f) better managing of its dense population that shares 0.387% of the global population living within 0.109% of the total global land surface and emitting 0.027% of the global greenhouse gas; and (g) managing its rivers that contribute 80% of fresh water needs for over 700 million people living along the Indo-Gangetic belts (Bajracharya et al. 2015; Worldometers 2019). These issues of Nepal have to be seen from the South Asian prospective.

1.2 Nepal’s Environmental Problems in the South Asian Context

The land of Nepal emerged some 50 million years ago, when India broke apart from the supercontinent of Gondwana and collided with the Eurasian continent. Out of this tremendous collision, the land mass of Nepal was formed along with the Himalayan mountain range in the northern part of India (Bhattarai 2003; Miehe et al. 2016). This mountain chain constitutes various peaks including the highest peak of the world—Mount Everest. The mountain chains have helped the peoples of South Asia not only from its hindrance of the Mongolian invasion in the thirteenth century, but also from the fierce, cold winds that swept across the northern plains. These mountain chains today serve as a source of fresh water from the glaciers and

---

7The Communist party has won the largest number of seats in all three levels of election held in 2017. The Communist Party has strong holds in NGOs, trade unions, private as well as community schools, colleges, banks, and hospitals. In fact, the community and government-funded schools became fertile grounds for recruitment of Communist cadres starting from the 1960s, when erstwhile King Mahendra’s policy clandestinely supported the Communist movement in Nepal to counter the Nepali Congress Party. Leftists were allowed to freely distribute Maoist Redbook, books on the lives of Mao, Kim Il Sung, Lenin, Fidel Castro, and Ho Chi Minh in every part of Nepal. People distributing any of the books written by B. P. Koirala of the Nepali Congress Party were severely penalized; those who distributed such books were terminated from their jobs, their properties were confiscated, and they were imprisoned under the offensive act against the state.
snows, while they separate South Asia in general and Nepal in particular from East Asia, especially, from China (Bhattarai 2003).

Nepal’s land area of 147,181 square kilometers (sq. km.) represents only 3.27% of South Asia’s eight national clusters—Afghanistan, Bangladesh, Bhutan, India, the Maldives, Pakistan, and Sri Lanka. Nepal is bordered (1415 km long) to the north by the People’s Republic of China and to the south, east, and west by the Republic of India with whom it shares a 1850 km long “porous” border. Area wise, Nepal is 23 times smaller than India and 68 times smaller than China. Nepal’s total population of 26.5 million as of 2011 (excluding absentee population), barely, is 1.65% of the South Asian population. In comparison to India, Nepal’s population is barely 2.197%, and in comparison to China, it is 2.089%. Population wise, Nepal is almost 46 times smaller than India and 49 times smaller than China. Despite such a modest presence in terms of comparative landmasses and populations, Nepal’s geo-ecological conditions are representative of her neighboring South Asian countries with over 125 ethnic communities and 43 different languages. Nepal’s land mass represents “stair steps to the sky” ranging from 62 meters (m) in the south to 8848 m elevations of Mount Everest in the north within a distance of 184 km. Numerous rivers and tectonic valleys crisscross the landmass interspersed with rugged and highly dissected terrains (Bhattarai 2003). It’s a spectacular landscape, with majestic mountains and glaciers (Miehe 2015) and is managed by an extensive network of parks and protected areas, which attract many tourists.

Landlocked Nepal is 1127 km away from the nearest seaport at the Bay of Bengal in the West Bengal State of India. Kathmandu, the capital city, is 3000 kilometers—km–(1900 miles) away from the Chinese capital Beijing, 900 km (550 miles) away from the Indian Capital New Delhi (Great Circle Distance 2011), but politically both are considered equidistant from Kathmandu. However, Nepal’s relation to India differs from China because of the long-standing “bride and bread” relationship with India. The treaty of 1950 between Nepal and India allows thousands of Nepali to serve in the Indian military, government jobs, various factories, companies, and farms in India (GKToday 2019).

There are often arguments that the 1950 Nepal-India treaty gives a lot of upper hand to India to disproportionately influence Nepal, and it needs immediate revision to contextualize the relations. Their arguments are that identifying (finding) the “major loopholes” of the 1950 treaty for correction would rejuvenate Nepal-India’s bilateral relationships, and it will also help to bolster regional security, political stability, realignment, and economic flexibility. An eminent person group (EPG) was jointly constituted by Nepal and India to look into the various aspects of Nepal-India relations including the provisions of the 1950 treaty. This EPG has completed the

---

8Porous because of an inevitable plethora of crossings due to its unevenly guarded, Nepal/India national boundary-line

9Formally, it is called the Treaty of Peace and Friendship, which was signed in Kathmandu on July 31, 1950.
preparation of report for submission\textsuperscript{10} to both the governments. Political leaders from the ruling Bharatiya Janata Party (BJP) recently said that India is not bound and willing to go by the report submitted by the EPG. Different interpretations are found about the 1950 Nepal-India’s treaty. Some of these recent interpretations have even raised curiosity on how Nepal was able to get the membership of the United Nations in 1955 (UN n.d.), and some credit to the 1950s Nepal-India treaty.

Nepal applied to the United Nations for membership in 1949. The Soviet Union objected to Nepal’s application on the erroneous plea arguing that Nepal is not an independent country. The Soviet (Russian) interpretation was that Nepal was fully dependent on the United Kingdom (UK) and, eventually, on India because India was a colony of the UK (Bhasin 1970a, b, 1994). However, according to Mohanty (2019) and Rana (2009), the 1950 treaty helped Nepal to get the membership of the United Nations in 1955 as an independent state.\textsuperscript{11} The background of the treaty goes back to the 1940s, the period of World War II (Sept 1, 1939–Sept 2, 1945) when Great Britain needed help with money, manpower, timber, and ammunition to fight against the Germans and Japanese in Asia. Juddha Shumsher Jang Bahadur Rana (Ja ba ra) was the Prime Minister (September 1, 1932–November 29, 1945) and the head of the Rana Dynasty in Nepal. He had close relationships with the British, who ruled over the Indian subcontinent from 1857 to 1947.\textsuperscript{12} During the British colonial period, Mahatma Gandhi, Jawaharlal Nehru, and Subash Chandra Bose of the Indian subcontinent were actively involved in the Quit India Movement against the British. Bose, the Head of the State and Government (21 October 1943–18 August 1945) of India, sided with Nazi Germany and Imperial Japan during World War II against the British (Hayes 2011; Stein 2010; Gordon 1990). With the help of Japan and Nazi Germany, Bose was successful at capturing various parts of India including West Bengal, Assam, and upper Burma from the British (Bayly and Harper 2007; Chatterji 2007). The British were annoyed with Bose’s actions of cooperating and aligning with the Japanese and Nazi German forces. To take immediate actions against the Bose’s military, the British needed additional military forces. The British approached Nepal’s Rana rulers for help\textsuperscript{13} and in return, the British even lured

\textsuperscript{10}Eminent person group (EPG) was formed in January 2016 and finalized its report for submission in 2018 and submitted to the Indian Prime Minister; however, PM Modi has not accepted this report. Some argue that it is an indication of India not desiring to implement the recommendations of EPG, but blaming India outright may not be justifiable because there might be multiple reasons for this delay. Time will justify what will happen in the future.

\textsuperscript{11}The treaty upholds the territorial integrity and national sovereignty of both nations.

\textsuperscript{12}Actually, the British started ruling the Indian subcontinent from the late 1700s with East India Company; many historical records indicate the period of 1857–1947 as the British colonial period in the Indian subcontinent.

\textsuperscript{13}During the field visit to Nepal by one of the authors in 2016, 2017, 2018, 2019, and 2020 he interviewed some historians who revealed that at the request of the British, erstwhile Nepali PM Juddha Shumsher JBR sent Nepali military (Gurkhas) under the command of his son Kiran Shumsher JBR (KS Rana) to help the British against the Japanese and Nazi German forces. In return, the British promised that they would return the lands that were annexed by the British during the Sugauli Treaty (December 2, 1815, duly ratified on March 4, 1816, between the East India
Nepal’s Rana reign to give perennial access to the Bay of Bengal by annexing some land of India to Nepal (Rana 2009). Earlier, the British had returned some of the lands of western Tarai including Banke, Bardiya, Kailali, and Kanchanpur (called Naya Gaon—new land for Nepal) in favor of Nepal Rana’s active participation to suppress the Indian Sepoy Rebellion of 1857 in Lucknow.

The British rule in India ended in 1947, and Jawaharlal Nehru became the first Prime Minister of the Republic of India from August 15, 1947 to May 27, 1964. Nehru’s Deputy, Vallabhbhai Patel (August 15, 1947–December 15, 1950), strongly advocated to annex Nepal into India like the Indian state of Sikkim today. Patel’s move delayed Nepal getting the membership of the United Nations until 1955, when many independent states similar to Nepal were granted memberships of the UN. Nepal became an independent state because of the British’s good relations with Nepal’s Ranas (Rana 2008). However, because of Nepal’s geopolitical conditions and its over dependence on India to have access to ocean for international trade, India has been playing a “big brother’s” role in Nepal’s political and economic developments (Karan and Ishii 1996). Additionally, pegging Nepali currency with Indian currency (Khanal 2011) has given an additional upper hand to India to influence over the Nepalese economy. The Indian economy has grown much faster than the Nepali economy in the last 15 years, and Nepal’s trade deficit with India stood at US$ 75 billion as of 2015 (Economic Survey 2015), and today, it has swollen further. Too much dependence on India and ballooning trade deficits often hurts the Nepali economy beyond imagination.

Today, Nepal’s landlocked situation and heavy dependence on a narrow range of the primary commodities it exports makes Nepal one of the poorest landlocked states among 10 Asian, 2 Latin American, 12 East European, and 14 African countries.
The right of landlocked countries to free and unhindered access to the sea has been mentioned in various international agreements, such as the Barcelona Declaration of 1921, the Geneva Convention on the High Seas of 1958, and the New York Convention on Transit Trade of Landlocked States of 1965. Yet, Nepal faces several problems to access to the sea. India imposed undeclared economic blockades in 1989 and 2015, which brought about political and economic turmoil in Nepal (Bhattarai 2015; Gautam 2015; Pandey 2015).

Some attempts have been made to alleviate the landlocked conditions of Nepal (that are similar in nature to the triple frontier in South America14); such discussions between Nepal and India have been largely “empty rhetoric.” In 1997, the Koshi Study Agreement was signed between the governments of Nepal and India to conduct a detailed study of the 165 km long Koshi Navigation Canal, which would link Chatara in Sunsari districts, Nepal with the nearest seaport, by way of the Ganges, and Bhagirathi and Hooghly river systems of West Bengal, India (Chap. 6). Of the 165 km length, a 120 km distance would be within the Indian Territory. This 165 km long proposed canal also would have helped to expand the volume of Indian trade with Tibet via Nepal and, probably, would have reduced Nepal’s trade imbalances with India.

Nepal has traditionally been dependent on its southern neighbor for over 65% of its trade (Iyengar 2016). Despite such dependence on trade, India sometimes blocks key checkpoints and prevents the passage of essential goods from India. For example, the blocked in 1989 and 2015 under different pretexts resulted in a shortage of fuel, medicines, and other vital supplies that created humanitarian crises in Nepal. Because of this trade blockade by India, Nepal lacked many industrial materials, and many industries remained closed, compelling many working age people to leave Nepal for other countries in search of jobs. Such an exodus leaves many farmlands barren. The ecosystem dynamics of the mid-hills have been weakened beyond revitalization. Many terraces constructed by immense labor input for small-scale subsistence production through the conservation of moisture and soil in the hilly regions are turned into barren lands in the plains, hills, and mountains. Many of these terraces and other farmlands have lost fertile soils due to massive soil erosion and “landsliding.” As a result, the north–south orientated Nepali landscape fails to provide adequate ecosystem services to the downstream communities. These changing environmental conditions have impacted Nepal’s overall economy, and many among the country’s young generations are cultivating anti-Indian sentiments, which might very well weaken the century-long Roti-Beti ka Sambandh (“bread and bride”) relations with the people of bordering states—Bihar and Uttar Pradesh of India.

Nepal and India have crosscutting ties at the people-to-people levels. Since India looms large as the sole representative of the region in political, social, and cultural

---

14Argentina, Paraguay, and Brazil have a natural convergence of two rivers—the Parana River (Brazil) and the Iguazu River (originating from Brazil and flowing along the border of Brazil and Paraguay). This triple frontier has given water access to landlocked Paraguay to the Argentina Sea (South Atlantic Ocean) thus alleviating Paraguay’s pain of being landlocked.
spheres (Bhattarai 2003), often the world views South Asia solely from Indian perspectives. Though Nepal was never colonized by any countries, the political boundaries among the South Asian countries are the creations of British colonialism, and their boundaries are the result of the past exercises to build states based upon the Westphalia model that gave primacy to the idea of sovereignty.

Despite remaining free from colonial influences, “Nepal suffers from the Indian [informal] semi-colonial influence still today even after the neoclassical general equilibrium theory and the concepts of ‘trickle down,’ and ‘growth pole’ came into discussion in the late 1970s” (Isard 1972 in Bhattarai 2003). The neoliberal theory has failed to address Nepal’s contemporary environmental problems because its market mechanisms failed under monopolistic competition where Indian dominance persisted (Bhattarai 2003). These historical accounts revealed that Nepal’s contemporary environmental problems are inherited from the post-colonial modes of production system, which are inherited in successive development plans of Nepal without rectifying accompanying drawbacks. Today, Nepal continues to suffer under the Indian post-colonial mindset, which often prevents the endogenous forces, such as community decision-making to satisfy local needs of the people from becoming self-empowered. To alleviate Nepal from various problems due to possible blockade repeatedly, the Nepali Government is working seriously to access the sea through China for international trades and transit. Nepal and China in principle have agreed to establish seven checkpoints along the China-Nepal border and to expand railway services from Shigatse-Kyurung to Kathmandu via the Rasuwagadi-Kyurung region (Fig. 1.1). Although Nepal’s recent efforts to sign various treaties with China seem to be a challenge to India, both China and India are interested in expanding their economic activities through Nepal to their countries. In particular, both neighbors will benefit from Nepal’s land bridging and by utilizing the potential of Nepal’s hydropower (See Chap. 6).

1.3 Water Resources

Over 210 billion cubic meters (bm³) of surface waters flow annually within Nepal, which amounts to 118,200 m³ km⁻², four times the world average (Bhattarai 2009) and 2.27% of the world’s water resources (Shrestha 2007). It is claimed that the country’s surface water has the potential to produce 83,290 megawatt (MW) of electricity (Shrestha 2007). Furthermore, according to the Water and Energy Commission Secretariat (WECS 2004), 50% of this potential energy is economically viable. Yet, merely 1% of the total hydropower potential has been tapped so far, with only 24% of financial contributions from the private sector (Chap. 6). Nepal’s total domestic hydroelectricity demand ranges from 22,000 to 23,000 MW.

Of the total potential hydropower energy of 83,290 MW, 51% would be generated from perennial snow rivers, while 49% is expected from storage and runoff rivers. More than 6000 rivers and rivulets, totaling about 45,000 km in length, eventually drain into the Ganges River in India through several upstream river
systems. These rivers have a total drainage area of about 194,471 km$^2$, 76% of which is within Nepal with a drainage density of 0.3 km$^{-2}$ (Bhattarai 2009; Gyawali 2003). Thirty-three rivers have drainage areas exceeding 1000 km$^2$. The dominant feature of Nepal’s water resource is that even though the country occupies only about 13% of the catchment of the Ganges River basin, it contributes as much as 70% in the lean season and around 40% of its average annual flow to the Ganges River (Bhattarai 2009). Because of these “dependencies” of India on Nepali rivers, India as Nepal’s southern neighbor is always concerned with how Nepal’s hydropower can be shared. And India uses a plethora of political tools to ensure that Nepal’s hydropower development remains firmly in its grip to ensure meeting its water needs during the lean period by linking with Nepal’s rivers. With a view to ease acute shortages of water in western and southern parts of the country, India plans to have an inter-river linking project (IRL). It involves development and management of water resources and is understood to include the utilization of Himalayan River water of Nepal with the construction of high dams on Nepali land. This networking of rivers is a serious issue which Nepal is yet to grasp and understand the gravity and impact it will have.

Quite simply, the development of Nepal’s hydropower would help alleviate energy problems both in Nepal and in India’s Ganges River basin, helping both to move away from burning fossil fuel and powering local economies with renewable energy. For Nepal in this troubled era, Nepal needs to make more use of this potential supply of the country’s hydropower, whether in partnership with India, with a third party, or independently. This is needed as a moral imperative for poverty alleviation and strengthening food security through irrigation, environmental conservation, employment generation, and retaining working manpower within the country. By utilizing its water resources, Nepal can achieve tremendous success in local development without severe environmental impacts. For example, the electricity driven ropeways hauling goods in the “stair steps to the sky” between two inaccessible points by roads (Bhattarai 2003, 2009) would miraculously hasten Nepal’s economic development with the improvement in living conditions of people. Ropeway transportation would have been three times cheaper to build and operate than an equivalent un-metaled road, eight times quicker to install, and twice as energy-efficient (Gyawali et al. 2004; Gyawali 2019) when compared to the use of petroleum products for transportation in the difficult physiography of Nepal.

1.4 Physiography

Nepal has a complex physiography within a short span of 1.3° N latitude. Snow-capped Himalayas located in the north contribute to “white water”; however, they are not uniform in their latitudinal distribution; the winter snow line is much lower in the west than in the east (Google Earth 2019) [Chap. 3]. South of the snowed high mountain lies the Mahabharat Mountain ranging from 2500 to 4499 m. South of the Mahabharat range are the Siwalik Hills (1500–2499 m). The Siwalik range also
constitutes two parallel hill ranges: the Churia Range (up to 1499 m) which is a continuation of Shiwaliks (Siwaliks in Nepal) in India and the Mahabharat range (1500–2499 m), which form east-west-oriented Valleys or Duns, often known as the Inner Tarai (Bhattarai 2003). Many minor rivers, often called southern rivers, originate from the Siwalik. They are much smaller, and most of them have insignificant or no flow during the dry season but cause maximum damages to lives and properties during the monsoon season—especially from the deposition of debris coming from the denuded catchment areas. Fast-flowing debris-filled floodwaters also change the course of these rivers in their lower reaches (Chaps. 3, 6, and 8). Over 41% of the Nepalese population inhabit the valleys and lower reaches of these minor rivers (Chap. 2).

South of the Siwaliks are the Bhabar and Tarai regions below 1499 m. These are extensions of the Indo-Gangetic Plain, and these areas used to have thick forest coverages until the 1980s. They are drained by various types (major and minor) of rivers, which have been both a blessing and curse for the Tarai as they facilitate in irrigation for different crops but also cause severe damages to river banks and flood plains due to monsoon flooding (Chap. 3). These floods also bring much debris, and below urban centers, they carry and deposit industrial effluents downstream. The Tarai region also has the advantages of ground water with an annual estimated recharge rate of 11.6 bm³ (billion cubic meters) (Gyawali 2003). The underground waters are used for both drinking and irrigation. Recently, however, arsenic has been noticed in several underground waters of the Tarai region. Additionally, surface waters also are polluted from unmanaged sewages that drain directly into rivers without treatments. Several waterborne diseases have been reported while using such water for agriculture and other purposes. These challenges coupled with the variations in temperatures, rainfall, and soil types in different topographic regions (Chap. 3) make Nepal’s environmental situation very complex.

1.5 Complex Environmental Problems and Human Adaptation

According to Maplecroft’s ranking (2011), Nepal has been identified as the fourth most vulnerable nation in the world to climate change. Vulnerability measures a country’s exposure, sensitivity, and ability to adapt to the negative impact of climate change. The Notre Dame Global Adaptation Initiative (ND-GAIN) measures the overall vulnerability by considering vulnerability in six life-supporting sectors—food, water, health, ecosystem service, human habitat, and infrastructure. Nepal’s ND-GAIN index as of 2019 ranks Nepal as 131 with a vulnerability score of 0.516 and readiness score of 0.313 (ND-GAIN Country Index 2019). This mountainous and rugged country faces many complex environmental problems that vary with topography. For example, the Himalayan mountain range faces problems from snowmelts, glacier retreats, and glacial lake outbursts, while the areas of the middle
hills below the higher Himalayas face problems of landslides and water shortages. The southern Tarai belt faces unprecedented floods, drought, and fire, yearly. Though geographers have long discarded the theory of environmental determinism, these geographic variations have led to the development of varied cultures and adaptive patterns, very much in accordance with the fluctuating severity of the disparate environmental conditions.

In the mountain region, the annual rainfall ranges from 140 mm (in the west) to 900 mm (in the east), and temperatures fluctuate from 9 to 10 °C during June/July but remain very low in the remainder of the months. This low temperature becomes insufficient for the growth of plants in the alpine regions (Chaps. 3, 5, 7 and 8). In the mid-hills and mountainous regions, the soils are very thin, because they are very much a residuum after all nutrients are leached out with very little organic matter surviving (Chap. 5). The climatic conditions of mountainous, medium-high elevations can support pasture, forestry, livestock production, orchards, and recreational land use types. At higher elevations, farming is possible only in limited areas and mainly along the narrow terraces. However, because of the low temperatures at higher elevation, there are fewer incidences of parasites and diseases on livestock, which is good for the growth of small ruminants (Chap. 5). In the mid-hills, temperature fluctuates between 2 and 17 °C during December/January, between 13 and 27 °C during June/July. The average rainfall in this region varies from 1000 mm (in the west) to 2800 mm (in the east), with more winter rain in the west than in the east (Chap. 3). Phyllites, schists, gneisses, limestone, quartz, colluviums, and some carbonaceous soil materials (Chap. 5) characterize the geology of this region.

The southern Tarai region is characterized by an average daily temperature ranging from 7 to 24 °C during December/January and from 24 to 41 °C during June/July. Annual rainfall totals in the Tarai range from 600 mm (in the west) to 1300 mm (in the east), with winter rain occurring in the west. Alluvium materials are found along the banks of rivers and streams in this region. These soils are often dark in color, high in organic matter and fertility, and less susceptible to erosion. Such soils support intensive cultivation (and multiple cropping) of paddy rice, wheat, potatoes, vegetables, and other agricultural crops (Chap. 5).

The country’s varied topography offers different farming opportunities, but climate change is likely to bring about changes in the existing soil fertility and moisture conditions (Chaps. 3 and 5). The temperature is rising slowly in the country’s southern lower elevations, whereas the changes are rapid in the higher elevations. The 2007 report of the Intergovernmental Panel on Climate Change (IPCC) projected declining crop yields by 2.5–10% by the 2020s and 5–30% by the 2050s as compared to the 1990s levels in the Asian continent: all being a consequence of current patterns of climate changes (Masters 2007). Undoubtedly, Nepal will also face similar problems. The most recent climate report (of 2018) suggests that temperatures in the higher elevations (3000–4000 m) of Nepal are increasing and becoming potentially favorable for goat farming in mountainous area that generally had supported the raising of yak, mules, and heavily furred sheep. The middle elevations (2000–3000 m) may soon be able to raise a mixture of goats,
cattle, and a few buffalo, while the lower elevations (<2000 m) may be able to support more buffalo, cattle, and goats (Paudel 2011). However, the extremity of temperatures that vary within a shorter time period might be unfavorable for animal husbandry as animals cannot tolerate temperature extremities.

Since the second half of the twentieth century, there have been several notable environmental changes in Nepal. As a result, Nepali have been changing their lifestyles in different geographic regions. Similar to Hayami and Ruttan’s (1971) postulation that investment in the development of new technology becomes a function of detection of change in the resource endowments with respect to climate changes, Nepali farmers have developed a tapestry of human-environment relations to adjust to the changing climatic conditions. For example, crops were selected according to the seasons, and the production was satisfactory; however, recently, due to abrupt climate change, phonology of crops has been affected, and various diseases have prevailed in high altitude regions that were previously only confined at the lower elevation (Chap. 3). The change in winter weather conditions is presumed to be due to industrialization in the bordering towns of India that emit gaseous pollutants sufficient enough to block solar radiation during winter when air movement in Tarai is slow. Generally, thick fog covers Nepal’s entire lowland region during the winter, and cases of the dying-back of several agricultural crops, and even human casualties due to more extreme cold waves are often reported (Bhatta 2011; MyRepublica 2019).

Unpredictable weather due to intense rainfall and dry monsoon are causing various climatic disasters such as landslides and floods. For example, in 2004, (a) an avalanche on Mount Everest near Everest Base Camp killed 16 Nepali guides; (b) 30 deaths were reported at the Annapurna area from an unexpected storm in 2014 (Vergano 2014); (c) a record-breaking flood submerged more than 1000 houses in Gulariya of Bardiya District in 2014 (LWR 2014); and (d) 300 people were killed in Sindhupalchok District due to unprecedented water blocking in Bhote Koshi River due to a huge landslide in 2014 (Ministry of Irrigation 2014). In 2015, (a) a landslide killed 53 people, in the Taplejung District (Times 2015); and (b) a massive landslide blocked Kali Gandaki River for 24 h forming a huge reservoir that temporarily submerged many villages (AnyamastiOnline 2015). Every year, an average of 688 deaths have been recorded as a consequence of the extreme heat in Nepal (Bhatta 2015a, b). These environmental anomalies suggest that Nepal needs location-specific information to deal with her environmental abnormalities.

1.6 The Need for Location-Specific Information

The above account reveals that there are multitudes of location-specific problems in Nepal, which are a direct, or indirect, result of global climate change. That said, these problems have not really been addressed due to the lack of information on biophysical and ecological processes. Detail studies of ecosystem services at various topographic regions of Nepal are needed through the integration of both natural science
and economic elements on geographic information systems (GIS) and remote sensing platforms (Chap. 3). This book deals with the changing climatic conditions of Nepal with location-specific case examples. Biophysical data such as soil types, water resources, temperature, rainfall, slope, aspects, vegetation, agricultural crop types, population, and animal husbandry practices are gathered for six elevation ranges. Soil types are gathered from the 1:50,000 scale maps prepared by the Land Use and Mapping Project (LRMP 1984). Temperature and rainfall data are obtained from the Department of Hydrology and Meteorology of the Government of Nepal. Such data is brought into GIS and remote sensing platforms for spatial analyses. Slope and aspects are derived from 30 m × 30 m resolution elevation data. Land use and cover for 1980, 1990, 2000, and 2010 information is derived from 30 × 30 m resolution Landsat imagery. Population data was gathered from the Ministry of Environment and Population and the Census Bureau of Statistics. This data was brought into the GIS and remote sensing platforms gridded at 30 m × 30 m resolution to interpolate/estimate population at various elevation levels.

We believe that our collection of spatial information will be useful in land productivity modeling and development planning at different locations by elevations. Land productivity modeling is essential because about 33% of Nepali people are landless; still the government has set aside 18.3% of land for strict conservation and nulling to increase this conservation area to 23.5%. Nepal’s environmental problems have to be analyzed from the political economy and ecosystem conservation perspectives not only just for efficiency and effectiveness criteria but also for equity, justice, and legitimacy purposes together with other ethical concerns. Due to increasing human pressures on limited natural resources, the traditional intrinsic value arguments are not enough to capture the utter dependence of human well-being on natural capital. It is essential to analyze contemporary environmental conditions to help plan development activities based on the changing environment. For example, when the snow line is moving higher, mountain streams are rushing each year, the monsoons are becoming erratic, the Himalayas are retreating rapidly, newly formed lakes are swelling quickly, and the number of glaciers are increasing with the decrease in the amount of waters. As the temperature rises at higher elevations, farming activities also vary by elevation as various subtropical flora and fauna are migrating to the higher elevations. These changes can only be predicted if we have location-specific biophysical information.

Economists often argue their notions of monetary valuation based on the neoclassical economic theory (Straton 2005); however, estimation of the economic value of nonmarket ecosystem goods and services requires information such as where the value was originated from and how much people are willing to pay for an additional unit of the good and service. Neither the supply side (value originated from) nor the demand side (willingness to pay) can adequately consider a complex set of biophysical and ecological relations that lead to the provision of ecosystem goods and services (Straton 2005) without biophysical data gathered for specific locations. Ecological resources are crucial to the current and future productive
capacity (Daily et al. 1997) at each geographic location. However, the economic method of price allocation mechanism has historically failed to reflect crucial information about the quality of ecological resources. Details of location-specific information however would help to determine the true values of ecological resources and various ecosystem services provided at various scales.

One of the ways to link natural sciences and economy is to use geographic information systems (GIS) techniques to evaluate location-specific spatial and temporal problems. GIS helps to explain the ecological functionality at the helm of economic problems. For example, soil is a complex ecosystem made up of rocks, nutrients and minerals, organic matter, gases, water, and biota. However, these relationships vary over time. The connections between these elements determine the productivity of soil that can be equated into economic values (Daily et al. 1997). Any changes in the environmental components depend upon the connections among associated factors with their surrounding environment, which often change at spatial and temporal scales. In absence of specific information, economic values of ecosystem services depend upon the subjective evaluation by users; however, if detail location-specific information is available, spatial and temporal relationships can be converted into a monetary unit at various geographic conditions through the analysis of growth efficiency. Montieth (1972) defined growth efficiency of plants as the ratio of chemical and radiant energy stored and assimilated by the foliage during the period of photosynthesis, which is based on the type of plant and geographic location. Location-specific information is needed to develop a bio-economic (inter-twine relationship between ecology and economy) model and to predict land productivity. A Bio-economic model considers the problem in its entirety rather than in isolation within the defined goals of sustainability. This type of analysis assumes a great significance for Nepal that faces rapid population growth within fragile ecological environment. Each day over 1200–1500 young working age people leave the country for remittance. Though remittance is helping the country’s tepid economy by contributing almost 33% of the total gross domestic products (GDP), merely depending on remittance for the country’s economic future is not a sustainable solution. Utilizing available land resources and developing new farming technology from the resources gained from remittances might create a path for sustainable agricultural development. The varied topographical conditions of Nepal restrict farmers from owning large plots of land for commercial farming. Some productive lands are scattered in inaccessible areas that have various spatial environmental situations. Location-specific information would help to capture these variables and develop a production model at different agro-climatic conditions. Nepal has to deal with its strategic location very carefully because of its sandwiched situation between India and China. Often Nepal faces some border issues that have to be dealt with extreme caution. Very charismatic leadership is needed to diplomatically tackle location-specific border issues that often change with the courses of river.
1.7 The Border Disputes Between Nepal and India

Nepal-India relations are deep, wide-ranging, and unique, but there are also some complexities. These complexities have become further difficult to resolve due to India’s repeated actions of undermining Nepali sovereignty. Nepal and India share 1808 km long border in the east, west, and south, as per the article 5 of the Sugauli Treaty of March 4, 1816. The river courses of Mechi, Gandak (Narayani), and Mahakali also serve as border between Nepal and India. Within 1808 km long border, there are disputes at 71 places. Among them, the Mahakali river alone covers 326 km long international border that also include the most contentious areas of Limpiyadhura, Kalapani, and Lipu Lekh. The dispute for these places has spanned the last seven decades. The 1816 Sugauli Treaty between Nepal and British India placed all the territories east of the Kali (Mahakali) river, including Limpiyadhura, Kalapani, and Lipu Lekh, at the northwestern front of Nepal, on its side. The borders of Nepal, India, and China intersect Lipu Lekh. In 1961, Nepal and China fixed pillar number one at Tinker pass with the understanding that pillar number zero (the tri-junction of Nepal, India, and China) would be fixed later (Bhattarai 2020). Lipu Lekh pass is 4 km northwest and Limpiyadhura 53 km west of Tinker pass. Since 1962, Kalapani has become the most politically contentious issue with India after the Sino-India war ended and India transfixed military station at Kalapani (30.227469 °N, 80.919581 °E) within the Nepali territory. Probably, India assumed that this high-elevation (3650–6180 m) area will be a safer place to monitor any Chinese activities in the north across the border, and it might serve as a strategic military point. India has similar strategic location of Meghdoot at Siachen glacier (35.461415 °N, 77.040047 °E; elevation 5753 m) between the Pakistan and India disputed Kashmir border. Probably, India assumes that Kalapani could be as strategic location as Meghdoot. India constructed infrastructure to support a strong military base at Kalapani without any permission from Nepal. Since 1962, Nepali is restricted by India to visit Kalapani area. India claims that the area of Kalapani was granted to India by King Mahendra at the written request from Pandit Jawaharlal Nehru, the then Prime Minister of India. Some scholars assume that King Mahendra accepted the request of PM Nehru in favor for India’s clandestine silence on King Mahendra’s dictatorial actions of dismissing the democratically elected two-third majority government of B. P. Koirala in 1961 within 1.5 years of its 5 years term. The arguments are that India was displeased with B. P. Koirala’s action of establishing diplomatic relationships with India’s arch rival Pakistan in 1960. India also was not pleased with Koirala’s action of recognizing the state of Israel as a nation state. During this cold war period siding with the USA by Nepal when India was close to USSR was not a favorite move of Koirala. India also disliked Koirala’s response refusing to join hand with India to take joint actions against China on the Mustang incidence of June 1960 where the Chinese military killed a Nepali soldier assuming him as a Khampa rebel. PM Nehru wanted Nepal to join hands with India and take actions on China because as per PM Nehru’s doctrine, any attack on Nepal and Nepali by other countries would be considered as an attack on India. However,
PM Koirala rejected this argument of PM Nehru and wrote a protest letter to China arguing that it is an issue between Nepal and China, and India does not need to be involved on it. In response to Koirala’s protest letter, China paid compensation to the soldier’s family who was killed by the Chinese troop. Arguments are that since India disliked many of Koirala’s actions, his dismissal by King Mahendra was also at India’s interest. Since India and King Mahendra had similar interest to dismiss PM Koirala, King Mahendra might have taken Nehru’s request for Kalapani positively. The other argument is that King Mahendra gave this disputed territory to India for his personal benefit. One of the Nepal’s foreign ministers in 2015 stated that King Mahendra traded Nepal’s Limpiyadhura, Kalapani, and Lipu Lekh areas to India with three tons of gold. The foreign minister further stated that because of this personal deal, King Mahendra remained silent about the evacuation of Kalapani military installment by India, while other 16 Indian military check posts were removed in 1969 during the time of Nepali PM Kirti N Bista. These northern check posts along the Nepal-China border were established in 1952 during the time of Nepal’s PM Matrika P Koirala to assist Indian PM Nehru’s doctrine of declaring Nepal’s northern Himalayas as the security frontier of South Asia. As of today, no one has officially justified King Mahendra’s green nodes to India to transfixed military check post at Kalapani. The blame of trading Limpiyadhura, Kalapani, and Lipu Lekh with three tons of gold has been criticized even at the grassroots levels both in India and Nepal.

The Indian presence in the area of Kalapani came to the frontline of Nepali politics after the advent of democracy in 1990. Since that time, Nepal has been raising this issue with India at prime ministerial levels. Both Nepal and India have recognized Limpiyadhura, Kalapani, and Likpu Lekh as unresolved border issue requiring an optimal resolution. On August 2014, when Narendra Modi became the first Indian Prime Minister to visit Nepal in 17 years, Nepal’s Prime Minister Sushil Koirala raised this issue again. The two prime ministers agreed to resolve the issue on a priority basis and directed their foreign secretaries “to work on the outstanding boundary issues including Kalapani and Susta” (Bhattarai 2020:1). A review of 1816, 1819, 1827, 1830, 1834, 1835, 1837, 1846, 1856, 1860, 1879, and 1880 maps prepared by the Survey of British India clearly revealed that the [Maha]Kali River was the western international border between Nepal and India. Kali River originates from Limpiyadhura (30.420828 °N, 80.565186 °E). This river flows east via Adi Kailas (30.319280 °N, 80.633360 °E) south of Parvati Kunda (30.355047 °N, 80.656872 E), Kuthi Village (30.307948 °N, 80.760161 °E), Navi Village (30.232808 °N, 80.921159 °E) and flows west via Kali Temple (30.222454 °N, 80.910658 °E). Kali River with its tributaries becomes the main Mahakali River below Chhangru Village and flows south forming Nepal–India’s western border. Both Kali and Mahakali Rivers together make 326 km Nepal’s western international border with India as per the Sugauli Treaty article 5.

Nepali political parties launched several campaigns of hoisting Nepali flags at Kalapani; however, all turned to be seasonal because many of them were targeted to
catch up the public nationalistic sentiments during the periodic elections. Moreover, no Nepali was allowed to reach to the Indian-occupied Kalapani to hoist the Nepali flag, despite this area being a Nepali territory. Thus far, all the past attempts have been dissipated because of the lack of a strong diplomatic and institutional backup. Nepal’s total geographic area of 147,181 sq. km. is shrinking as India has encroached Nepal’s 606 sq. km area in over 71 places of 23 districts out of 77 districts of Nepal (Fig. 1.2) (Shrestha 2019).

In 2015, China and India signed an agreement to make Lipu Lekh a bilateral trade point between the two countries. Nepal protested against the inclusion of its territory, Lipu Lekh, in the China and India’s joint statement of 2015. Nepal sought explanations both from China and India on why Nepal was not consulted on such a sensitive issue and demanded that the two countries make necessary corrections to reflect the ground realities (Bhattarai 2020). Nepal considered this as a flagrant violation of the principle of sovereignty. China responded to Nepal’s written protest of Prime Minister Sushil Koirala and suggested that Nepal and India should resolve this issue. India however, time and again has ignored this call from Nepal. Nepal has welcomed the improved relations between India and China. However, Nepal demands that they “respect its core concerns of sovereignty and territorial integrity” (Bhattarai 2020)

In response to India’s inclusion of Limpiyadhura, Kalapani, and Lipu Lekh in its map on November 2019, Nepal published a new map (approved from the Nepali parliament) including Limpiyadhura, Kalapani, and Lipu Lekh on June 13, 2020. The inclusion of these frontiers changes Nepal’s total area from 147,181 sq. km to 147,516 sq. km with the addition of 335 sq. km (TKP 2020). India has rejected Nepal’s new map, calling it a “unilateral act” that is not based on historical facts or evidence (Reuters 2020). The chief of the Indian Army described Nepal’s protests as triggered at the “behest of someone,” widely considered to be alluding to China (News India 2020). Since then Nepal and India are at the diplomatic deadlock with no official friendly communications except for a telephonic talk between Indian PM
Blaming Nepal of acting at the Chinese behest is an insult to Nepali people who are fiercely proud of their historic independence. Nepal judges every issue on its merits without “fear or favor” and takes positions in the supreme interests of the nation. Nepal’s political parties, despite their ideological differences, have shown the capacity to forge a consensus in safeguarding the country’s sovereignty and territorial integrity (Bhattarai 2020). At this point, India is very reluctant to return the occupied Nepali territory for three reasons: (a) importance of military strategic points; (b) religious importance of Mansarovar that can be accessed through Dharchula of India (encroached Nepali territory where India has constructed an 80-km long road); and (c) trade possibilities between China and India. To resolve the border issue between Nepal and India, diplomatic approaches seem to be the only option for Nepal. It might help to dispel current anger, but it does not resolve the issue forever. A diplomatic approach however may resolve this issue permanently. Using Nepali knowledge treasures and available official documents to convince India and bring back the lost territories will be the true patriotic actions for Nepal. There are strong past precedents of such patriotic actions.

As per international border expert, B. N. Shrestha, in 1960, there were border disputes between Nepal and China in 32 locations including Mt. Everest and Gauri Shankar Himal. These issues were resolved amicably once for all when Nepali PM B. P. Koirala visited China in 1960. Of the 32 disputed locations, 30 were resolved at the local levels, but for Mt. Everest and Gauri Shankar, needed some homework to convince the Chinese authorities because Mt. Sagarmatha’s name was famously known in China by Chomolungma (珠穆朗玛; Chinese: Zhumulangma). Accordingly, Chinese leadership argued that Zhumulangma belongs to China because there is no equivalent Nepali name for this mountain. Having sense that feelings of the Chinese leader, PM Koirala himself visited the private residence of famous Historian, B. R. Acharya, and gathered historical evidence to justify that Mt. Everest and Gauri Shankar Himal are within the Nepali territory and there is Nepali name for Zhumulangma. PM Koirala used published records received from Historian B. R. Acharya to convince the Chinese leadership that Nepali name of Zhumulangma is Mt. Sagarmatha (Mt. Everest). Accordingly, PM Koirala was successful to convince the Chinese leaderships that both Mt. Everest and Gauri Shankar belong to Nepal. In a joint communique in Beijing at the concluding visit of PM Koirala, Chinese PM Zhou Enlai stated that based on the evidence submitted by PM Koirala, both Mt. Everest and Gauri Shankar are in Nepal. Later in April 1960, Chinese PM Zhou Enlai during his Nepal’s visit at the invitation of Nepali PM B. P. Koirala met a press conference at the Singh Durbar at the end of his official visit. As per international border export, BN Shrestha, Nepali Journalist Mr. Ramesh N Pandey asked Chinese PM Zhou Enlai about Mt. Everest. Chinese PM Zhou Enlai reiterated his earlier stand and stated that based on the evidence submitted by PM Koirala, Mt. Everest belongs to Nepal from all aspects. In 1962, during his China’s visit, King Mahendra and Liu Shaoqi (erstwhile PM of China) signed another treaty between Nepal and China. No border issues surfaced at that time. That means the solution Nepali PM B. P. found was a permanent one. These are the solutions Nepali
people are looking from the current leadership. Nepali media broadcast opinions from various scholars that provide strong evidence to justify that Limpiadhura, Kalapani, and Lipulekhs are Nepal’s integral parts. A collection of information from these speakers could be the permanent solution to resolve Nepal India border disputes. A think tank comprising of high-ranking diplomats, cartographers, security experts, historians, university professors, research scholars, and military officers will definitely help finding solutions to the current stalemate. Kathmandu really has no choice, but to look for diplomatic outlets with proper evidence. Nepal and India’s deep historical relationship is at the peoples’ level. Through diplomatic approach, Nepal needs to make the New Delhi establishment realize how counterproductive this will become ignoring the wills of Nepal, Nepali, and its diaspora. India must learn where Nepal is moving since India’s unilateral economic blockade when Nepal was slowly recovering from the deeply wounded 7.8 Richter scale deadly earthquakes in 2015.

1.7.1 The Border Issues and Beyond

India is blaming that Nepal is acting on China’s behest to publish a new map of Nepal including the areas of Limpiyadhura, Kalapani, and Lipu Lekh. India is concerned why Nepal is becoming closer to China than with India despite the unique and people-to-people level relationships between Nepal and India. However, India’s repeated actions are pushing Nepal close to China. Nepal’s two major political parties, the Nepali Congress Party and Nepal Communist Party were formed in India while their leaders were self-exiled there. Both parties have some relationships with the Indian establishments. Since the 1990s, Nepali people willingly or unwillingly are voting these two major parties of Nepal in power, and these two parties are the actors to improve or weaken the relationships with India. Historically, the Nepali Congress Party has been a benign friend of India. However, in the recent days, it has been at its historic lowest ebb in term of people representation in the three tiers of government of Nepal formed after the 2017 general election. This happened for various reasons.

First, Nepal’s Royal Palace until the 1990 clandestinely promoted the left group to weaken the underground organization of the Nepali Congress Party because the Royal Palace’s coteries were of the belief that the communist party could be suppressed through administrative actions, but the Nepali Congress Party is difficult to destroy administratively because of its democratic posture. Thus, weakening the underground organization of the Nepali Congress Party using the communist forces became one of the royal palace’s strategies in order to strengthen the partyless Panchayat system in Nepal. This trend continued from the 1960s until the 1990s. Cadre-based communist parties emerged strong from rural to urban areas using their dedicated organization skills. The Communist Parties also utilized the election opportunities available within the partyless Panchayat system and somehow influenced the government’s decision-making, but the Nepali Congress Party
rejected to participate. This strategy of the Nepali Congress Party weakened its organizational base.

Second, India had disliked B. P. Koirala from the very beginning because he was difficult to manipulate on nationalistic issues despite India’s continuous support to Koirala during his asylum in India from 1968 to 1974. In order to weaken B. P. Koirala, India promoted Nepal’s regional Tarai parties where the Nepali Congress used to have its strong hold.

Third, again and again, India has imposed economic sanctions against Nepal violating the international norms and rights of a landlocked country to have a free access to the nearest seaport. India’s unilateral economic sanctions against Nepal gave unsurmountable troubles to the Nepali people. Despite such harsh actions on Nepal by India, Nepali Congress Party always took a diplomatic approach to resolve the issues between Nepal and India, whereas the Nepali Communist Parties stood belligerently against India in slogans. Though the tones of these slogans were dynamic while in opposition and in government, the Communist Parties established themselves as the most nationalistic parties. Nepali Communist parties and the royal palace coterie blamed Nepali Congress Party being pro-Indian for its soft diplomatic tone to resolve any disputes between Nepal and India. To some extent, both the royalist and communist parties became successful in their endeavors to give an impression that the Nepali Congress Party is pro-India. India imposed unilateral economic blockades when Nepal failed to act at the Indian interests. For example, India imposed an economic blockade on Nepal for 6 months for not agreeing to incorporate some of the articles that India suggested to include in the Nepal’s Constitution of 2015. India’s repeated economic blockades on Nepal and unsurmountable troubles it gave to the Nepali people pushed Nepal closer to China.

Fourth, India strategically has slowed down the developmental activities in Nepal, for example, Hulaki Rajmarg (Postal Highway) undertaken by India is over four decades long, but it is still incomplete (Chap. 7). Likewise, India has created several obstacles in the development of hydropower projects (Chap. 6). Probably, India is working with the objectives of keeping Nepal as an India’s dependent state due to Nepal’s landlockedness. The Nepali Communist Parties belligerently present themselves anti-Indian to show their nationalistic color and vigilantly oppose India’s slow actions in Nepal’s development, especially, during the periodic elections while the Nepali Congress always seeks diplomatic approaches which are not visible at the grass root level.

Fifth, India clandestinely sheltered and supported the Nepali Maoist Party leaders during the Maoist insurgency period (1996–2006) in Nepal. India used a double sword against the Nepali Congress government during the Maoist insurgency period in Nepal. On one hand, India declared the Nepali Maoist Party as a terrorist group and joined the international forum to defame it; on the other hand, India provided shelter and logistic support to the Nepali Maoist leaders in India during the insurgency period. The Nepali Maoist Party disturbed developmental activities, destroyed many infrastructures in Nepal, killed thousands of Nepali Congress cadres, and ceased their properties, drove them out from their homes during the time of Nepali Congress Party government. This also weakened the Nepali Congress Party.
Sixth, in 2017, just before the general election, the two major communist parties, the Maoist-Center and United-Marxist and Leninist, united forming a Nepal Communist Party (NCP). The NCP secured almost 2/3 majority in the general election of 2017. Ideologically, the NCP-led government is finding a much comfortable working niche with the Chinese government, and even CPN of Nepal is committed to translate the Chinese Xi’s model in all levels of Nepal’s government and Nepali life.

Seventh, the Chinese Built and Road Initiative (BRI) project advanced in China at a time when Nepal has the strongest communist government. Though India desires that Nepal does not accept the loans from China to implement any parts of the BRI projects in Nepal, because of the past lingering trends of India in Nepal’s development, Nepal cannot wait to have its economic development at a snail pace merely depending on India. Nepal is closely working with China in the implementation of BRI project and India dislikes it.

Some of the Nepali politicians are arguing that it is the right time to break the Indian hegemony in Nepal and expedite the BRI project at a war footing. Indian media are now spreading rumors that Nepal has completely gone to China’s lap, and it is expediting anti-Indian activities through Nepal-India’s open border. Regrettably, India states that the border issues between Nepal and India came at a time when the world is suffering from COVID-19, and India is having a difficult border issue to deal with China. India also argues that though there are multiple border issues between Nepal and China including the encroachment of Nepali land in the Humla district by China (though it has been refuted by Nepal’s foreign ministry), Nepal is hiding these issues, but amplifying the none issue of Limpiyadhura, Kalapani, and Lipu Lekh. India expresses its unhappiness stating that India has helped Nepal throughout its history including the establishment of democracy and providing help during the time of crises such as the time of deadly earthquakes of 2015 in Nepal. India unhappily states that Nepal is awarding India for her cooperation by unilaterally publishing a map including the territories of India. However, it is not Nepal, but the actions of India itself are hurting India and deterioration bilateral relationships between Nepal and India. If India repeats its actions of imposing unilateral economic sanctions against Nepal, it pushes Nepal further closer to China under compulsion. Taking this advantage, China also is coming too aggressively in every aspect of Nepal’s development. Geographically, culturally, and environmentally, it would have been much easier for Nepal to work closely with India, but India’s big brotherly roles have pushed Nepal away from India. For examples, while comparing the cost of construction of the proposed railway lines between Kyurung (Tibet-China) and Kathmandu and Raxual (India) and Kathmandu (Chap. 7), the cost of Chinese railway seems too expensive as compared to the proposed Indian railway. Environmentally, establishing connectivity with China through rail and road is riskier than with India. Economically there are fears of being fallen on China’s debt trap like the construction of Sri Lanka’s Hambantota Seaport with the Chinese debt. The cultures between Nepal and China are far dissimilar than with India and the people of India and Nepal do not need a visa to travel. Despite such deep relationships, it is surprising why the Indian establishment never realizes Nepal’s geography and its close cultural affinities with India in real
practices except for sugarcoated political speeches. India’s micromanagement practices in Nepal’s internal politics are pushing Nepal away from India despite Nepal’s unwillingness to do so making Nepal-India’s relationships harder. It was not easy for Nepal to ratify a new map from the parliament without having a dialog with India, but it came under compulsion. According to the Ministry of Foreign Affairs, Nepal sent several diplomatic requests to have a foreign secretarial level meeting as mandated by two Prime Ministers several times since the 1990s. However, India never listened to the Nepal’s please, which made Nepal to ratify a new map including 335 sq. km. area comprising of Lipiyadhura, Kalapani, and Lipu Lekh. Now the total area of Nepal has changed from 147,181 to 147,516. Since Nepal has already ratified the new map from the parliament, the border issue is becoming further complicated. With the ratification of the new map from the Nepali parliament, now the issues can only be discussed at the prime ministerial levels of the two countries, which make it further harder. Weakening relationships between the geographically interlinked two neighbors of South Asia does not help to sustain the contemporary environment. Nepal and India not only share cultures and socio-demographic and economic relationships, but also they are tied with ecosystem services. Nepal serves as the upper watershed and India as the lower catchment. In other words, both countries are linked together biogeographically and hydrologically. If it rains in Nepal, India gets the flood, and if Nepali land becomes drier, it affects Indian agriculture. The border dispute between the two countries must be resolved diplomatically. Both countries should consider all three—maximalist, middle, and bottom-line—diplomatic approaches, and there must be a give and take in the negotiation. As John F Kennedy once said “Let us never negotiate out of fear but let us never fear to negotiate.” Both the countries should have free and fair dialogs and resolve the border issues diplomatically. Neither Nepal desires to confront militarily with India nor does it desire to go to the International Court of Justice. Issuing statement by military supremo on border issue (World Population Review 2020) and making the mole a mountain does not help to resolve this conflict. Issuing statement by a military unit only creates tensions between the two countries. It may even invite external forces into play, which will irreparably damage the South Asia’s contemporary environment and ruin the geographically tied ecosystem services between Nepal and India.

1.8 Organization of the Book

In order to address the above problems, the book is divided into nine chapters. Chapter 1 describes the geographic settings of the country with general references to the South Asian region and provides the background of the subject matter discussed throughout the book. Chapter 2 presents the demographic conditions of Nepal and analyzes the varying levels of social and economic developments to explain how different development activities have impacted the growth and structure of population and how the resultant technologies modified human-environmental interactions including migration and urban settlements. It also discusses the economic
transformations and dramatic breakthroughs in health and family planning technology, which have been fundamental forces driving the country’s demographic transition. This chapter also explains whether the transition from high to low mortality and fertility has brought favorable conditions for social and economic development or whether there has been an uneven distribution of population. Finally, it also presents an account of major ethnic distribution of population of Nepal and the much-debated federal structure of the Republic of Nepal as enshrined in the New Constitution of Nepal 2015 (2072 B. S.).

Today, Nepal encounters the problem of increased competition for limited farmland, unauthorized deforestation and ethnic strife over local resource access. Further, Chap. 2 analyzes how increased land competition has led to ecopolitical battles in the low elevation Tarai region. Competition for scarce resources and growing landlessness has also contributed to the increase in rural-to-rural and rural-to-urban migration as well as international migration. Although international migration and a growing diaspora have contributed to the survival of Nepal’s frail economy run through remittances, such international brain drain has created a shortage of trained professionals capable of helping and managing environmental planning and sustaining ecosystem services in various watersheds of Nepal.

Chapter 3 presents the issues surrounding environmental sustainability, which is an essential objective for human well-being because the management of natural resources provides ecological services vital for human survival both in the near-term and the distant future. The long-term viability of such ‘natural capital’ is critical for many areas of human endeavor; for example, conservation of natural resources and food security, health and welfare and the alleviation of poverty. This chapter also assesses how input/output dynamics of land productivity contributes to sustainable systems in various South Asian environments as Nepal.

Chapter 4 presents the significant issues associated with the urbanization in Nepal. It utilizes geospatial information needed in the development process and presents professional approaches to urban-based environmental sustainability. The continued development of geospatial information science requires the integration of the diverse technologies and analysis methods available. To do so, it requires the people who use or manage them to understand the fundamentals of how the various geospatial technologies work and the types and quality of information these technologies produce. It addresses the challenges associated with the integration of science and conscience being faced by the development planners, resource managers and environmental scientists working to resolve local, regional and national ecological and socioeconomic issues faced by Nepal in the race of ruralopolis, classifying many rural areas into municipalities, and to ‘smart cities.’

Continuing with a mix of methodological and empirical examinations, Chapters 5 analyzes how existing agricultural practices are changing in the context of global climate change. This chapter explores various policies on poverty alleviation through agricultural planning and resource allocation for the coming decades based on a scientific analysis of the changes and trends taking place in Nepal’s diverse environments.

Chapter 6 analyzes policies related to energy sectors. It brings some information from Chap. 3 and puts Nepal’s current and future energy scenario in relation to the
social and organizational issues and their relationship with the political stability in
the country. Nepal is claimed to be one of the richest countries in inland water
resources; however, only close to 3% of the energy is harnessed as of today. This
slow pace of development of hydropower in Nepal is in sharp contrast to the
situation of the landlocked South Asian country Bhutan that exports 1500 MW of
electricity to India to augment its revenue. It discusses why despite many hydrol-
power potentials, Nepal is failing to take advantage of hydropower while neighbor-
ing countries are faring so well.

Chapter 7 evaluates the status of development infrastructures, especially the road
network, in relation to the distribution of population and the quality of life. Infra-
structure plays a significant role in promoting economic growth and human
well-being. In rural areas of Nepal, infrastructure has a wide-ranging impact on
individuals, households and communities both in terms of income and other quality
of life indicators. This chapter examines both direct and indirect benefits of infra-
structure development and the impacts of infrastructures on decision-making. Fur-
thermore, this chapter also discusses how infrastructure can affect income and health
both, and in turn, how income and good health affect quality of life. Economic
benefits such as increased income, employment, productivity gain, better income
distribution and diverse opportunities available due to infrastructure development
are also evaluated. Additionally, this chapter also evaluates how social benefits such
as time savings with the construction of roads and speedy communication environ-
mental improvement, skill development, capacity building, and improved informa-
tion help to sustain the quality of life.

Chapter 8 presents the authors’ comprehensive empirical assessments of Nepal’s
most heavily researched and problematic human-environmental consequence,
namely, tropical and subtropical forest degradation and deforestation and its accom-
panying patterns of endangered species. Much of this macro-level, geospatial exam-
ination is based upon the authors’ original field research. This chapter evaluates
contemporary situations concerning Nepal’s “endangered species” and the threats
they are facing, because of habitat reductions. These exotic species’ continued
existence is threatened by the unregulated nature of the Nepal/India/China border
and the difficulties local authorities face in securing forest reserves against poaching,
illegal logging, and habitat destruction. Their plights serve as an illuminating
example that human-environment relationships also have consequences for the
“wildlife” whose existence, or extinction, is threatened along with the parallel
threatened diminution of resource bases for rural peoples’ livelihoods. Chapter 9
will present the summary of the book.

This book utilizes many examples of environmental cases spanning the diverse
landscapes of Nepal to demonstrate how useful information GIS tools can be in
effective decision-making and record keeping in such a problematic South Asian
“developing country.” This approach will help local and regional development
agencies and experts’ working to alleviate rural poverty, while at the same time
helping ameliorate the stressed environments and move towards sustainability
solutions. Through various examples, this book demonstrates how it is possible to
save planning time for development engineers who often spend 40–60% of their time
validating information. GIS can reduce such project delivery time by 20–50%. This book presents cases of how GIS can help in the improvement of data management through a better understanding of spatial phenomena. It also presents illustrated examples of how GIS applications incorporate integrated methods to utilize locational information to connect various disciplines, such as natural sciences and social sciences. Through the uses of GIS and remote sensing platforms, we integrate both quantitative and qualitative information and spatially analyze location-specific contemporary environmental issues. Our examples presented in this book will be useful worldwide both in academia and for real world problem solving.

We have presented spatial information at a finer scale to investigate whether spatial variations in climatic resources prompted the development of location-specific farming technologies and whether farmers have responded to climate changes in redesigning their farming systems and settlement patterns at various elevations. We investigate whether or not the introduction and adaptation of location-specific agricultural practices, adoption of climate appropriate management practices, and institutional changes have helped farmers to improve their living conditions at various elevations. We believe that location-specific information derived from our analyses also would help implement various development activities in a sustainable way.

Geographically, Nepal suffers from her sites and situations. Though a vast diversity of natural resources and physiography have been boons for Nepal, the political characters of “passing the buck” (Gautam 2015: 42) and populist, rhetoric, and jingoism have pushed Nepal back in development even as par to the developing mountainous landlocked country Bhutan. India’s big brother’s treatment to Nepal has not been developmentally friendly in many cases. Likewise, China’s concerns on Nepal’s actions on Tibetan refugees often put Nepal in a quandary. The first democratically elected Prime Minister B. P. Koirala referred to Nepal’s situation as, “a man sleeping [resting] between two standing elephants.” His contention was that one can’t sleep while standing elephants are on both sides and are competing with each other to be powerful economic, political, and military influences. China is now the world’s second largest economy, with the largest foreign exchange reserves. China’s foreign direct investments and Belt and Road initiative stand as the towering expressions of its growing economic might and geopolitical ambition. And, while trying to catch up with China, India always tries to counter Chinese activities. Nepal, due to its geographic location, must stride at the international forum, and it must be active enough to be recognized by international community rather than remaining inside the Indian and/or Chinese curtain. B. P. Koirala’s vision for Nepal’s need to stand independently and be recognized internationally with free and unhindered access to the nearest ocean for international trade has come true as India unilaterally and unofficially often blocks all economic activities with Nepal, for example, the case of 1989 and 2015–2016. Koirala was a great advocate of democratic socialism because in his opinion, capitalism ignores the welfare of the poor and communism is not workable in a country like Nepal (Adhikari 2018). Thus, through democratic socialism, B. P. wanted to make Nepal a self-sustained nation without undue and unwarranted influences from her neighbors and beyond, while remaining constructively engaged with all, for promoting national interests.
The economic blockade by India on Nepal in 2015–2016 has caused a loss of over US $7 billion dollars between September 20, 2015, and February 07, 2016 (Yadav 2016). At the time of writing this manuscript, Nepal is ruled by the Communist Party of Nepal (CPN) with a 2/3rd majority. This CPN was formed by the union of the Communist Party of Nepal United Marxist-Leninist (CPN-UML) and Communist Party of Nepal-Maoist Center (CPN-M). Though during the general election of 2017, both CPN-UML and CPN-M contested election on a common manifesto, but as separate parties, both parties merged together after the election. During the general election of 2017, both Communist leaders—KP Oli and Pushpa Kamal Dahal, ‘Prachand’—spoke very aggressively against India, and blamed India for all ills in Nepal. Communist Parties garnered maximum votes on the anti-Indian plank. After the election, both Communist leaders reached out to China to lessen the overdependence of Nepal on India, which was essential given India’s repeated interferences on Nepal’s internal matters. Many argue that India trusts “Prachand” more than it does Oli because “Prachand” was sheltered by India during the Maoist insurgency period in Nepal between 1996 and 2006. Others argue that both leaders are trying to appease India to strengthen their political grips in their party as many elected representatives in Nepali Parliament are close to India for various reasons, and both Prachand and Oli need their support. Earlier, India accused the communists of always tilting towards China and that these communist parties are unfriendly to India. Contrary to this perception, CPN remained in close relationship with India (before India-Nepal border issues emerged) and China. The opposition party—the Centrist Nepali Congress Party—is very weak in the federal, provincial parliaments, and local governments in terms of the number of seats it represents at each level.

The current CPN-led government is strengthening its relationship with China for international trade, having learned the bitter lesson from 2015 India’s economic blockade and the negative economic impacts it had on Nepal. India’s big brother behavior on Nepal despite Nepal’s willingness to maintain a balanced relationship between New Delhi and Beijing has scared Nepal’s political parties. It has been the consistent policy and position of Nepal not to allow any activity on its soil against its neighbors. Trust-based relationships with neighbors are key to peace, stability, and prosperity for Nepal. Only a peaceful, stable, democratic, and prosperous Nepal will contribute to peace, stability, and prosperity in the neighborhood and beyond. It is time for Nepal to seriously understand that it has a very tight rope to walk, regarding the foreign policy matters. Nepal truly needs detail location-specific information to defend its position be that with the Lipulekh, Kalapani, Limpiadhura, Susta, and many troubled zones (being submerged during the rainy seasons) along Nepal and India border. Location-based information would help Nepal not only in monitoring of contemporary environmental issues but also to defend her arguments to mitigate flooding along the India and Nepal border during rainy seasons, to contain anti-Tibet activities in the name of the Buddhist religion, and terrorist penetration to India through Nepal-India’s porous border (Williams 2012). If Nepal succeeds in this
front, it will help her to act as a land bridge\textsuperscript{15} between China and India and benefit from their economic activities (THT 2019). It is our hope that through the analysis of spatial and temporal information, this book will facilitate policy makers to devise environmentally friendly policies while maintaining healthy and balanced relations with New Delhi and Beijing.

1.9 Conclusion

This chapter first presented Nepal’s environmental issues with the rest of the South Asian countries, and then it discussed how the differences \textit{arising time and again} with India not only impacted trade and transits but also the contemporary environmental conditions of Nepal. On the political front, this chapter also briefly discussed how Nepal is becoming a playground for various international actors. It also briefly mentioned the repercussions of B. P. Koirala’s ambitious political articulation to expand Nepal’s international relations with China and Pakistan and with Israel. Further, it also briefly mentioned B. P’s approaches to democratic socialism to uplift the (most) downtrodden society of Nepal. This chapter also mentioned the role of China and India in Nepal’s overall development. It discussed the possibility of Nepal being developed as a land bridge between the two neighboring giants India and China to benefit from their economic dynamism.

It also explained Nepal’s most important water resources and presented a brief background on why Nepal has not been able to harness the vast hydropower. Of the vast water resources of Nepal, ‘then it explained how geotechniques can be used to relate complex ecological problems belonging to various elevations ranging from 62 to 8805 m with socioeconomic and demographic information. This chapter argued that by relating ecological and socioeconomic information with elevations, this book \textit{would be worth of} (will serve as) a reference for bio-economic modeling to assess the land productivity through the analysis of location-specific issues. Then this chapter briefly explained the complex environmental situation of Nepal in relation to its steep physiography within a latitudinal span of 1.3° N. Finally, this chapter presented a synoptic view of each chapter to be included in this book.

References

Adhikari AP (2018) Revisiting BP’s socialism. https://myrepublica.nagariknetwork.com/news/revisiting-bp-s-socialism/?categoryId=opinion. Accessed 16 Aug 2018

\textsuperscript{15}Chinese President Xi Jinping during his visit of Nepal on October 12, 2019, has made commitment to help turn landlocked Nepal into a “land-linked country” by boosting connectivity between the two neighbors
Great Circle Distance (2011). http://www.chemical-ecology.net/java/lat-long.htm. Accessed 12 Jan 2012

Gyawali D (2003) Rivers, technology and society. Zed Books, London. (Nepali edition as Water in Nepal, published in 2001 by Himal Books and Panos South Asia, Kathmandu)

Gyawali D (2019) Panijahajma Bharatiya Swartha (Indian Interest in Hydrotransportation—Ships). https://www.setopati.com/opinion/175530?fbclid=IwAR0iLBDy73x-wOGd6Oniu8MVB48KV0aczrIGxLdP7nBD8Ogm2qwFIUrEQ. Accessed 27 Mar 2019

Gyawali D, Dixit A, Upadhyaya M (2004) Ropeway in Nepal: context, constraints and coevolution. Kathmandu Electric Vehicle Alliance and Nepal Water Conservation Foundation, Kathmandu

Hayami Y, Ruttan VW (1971) Agricultural development: an international perspective. The John Hopkins University Press, Baltimore

Hayes R (2011) Subhas Chandra Bose in Nazi Germany: politics, intelligence and propaganda 1941–1943. Oxford University Press, Oxford. ISBN 978-0-19-932739-3

Isard W (1972) Location and space economy. MIT Press, Cambridge

Iyengar R (2016) What the Nepalese Prime Minister’s visit to China says about the wider politics of Asia: caught between the world’s populous nations: Nepal must pull off a delicate balancing act. Time. http://time.com/4270239/nepal-prime-minister-oli-visit-china-beijing-india/. Accessed 25 Mar 2016

Kaphley P (2020) What is the news of Pradeshi? March 23, 2020 (2076 BS, Chaitra 10, Tuesday) Naya Patrika. https://www.nayapatrikadaily.com/news-details/39251/2020-03-22?fbclid=IwAR1mWOL5JGKRn-3yEnO2v79ZuGvGiel1t0RNcnCxo6pgKpcd8g1ZMgia4E. Accessed 23 Mar 2020

Karan P, Ishii H (1996) Nepal: a Himalayan kingdom in transition. United Nations, Tokyo

Khanal M (2011) Ditching the peg can do wonders. http://www.myrepublica.com/portal/index.php?action=news_details&news_id=34988. Accessed 11 Jan 2012

LRMP (1984) Land resource mapping project. Ministry of Forest and soil Conservation. His Majesty’s Government of Nepal

LWR (Lutheran World Relief) (2014) Situation report: flooding in Western Nepal, October 17, 2014 (No. 1). Lutheran World Relief: Sustainable Development, Lasting Promise. http://programs.lwr.org/att/cf/%7BB8ed291f8-702d-4e2e-9821-68d75e0105d2%7D/SITREP-_NEPAL_FLOODING.PDF. Accessed 18 Oct 2014

Maplecroft (2011) The global risks atlas 2011. https://www.maplecroft.com/about/news/gra_2011.html. Accessed 25 Mar 2016

Masters J (2007) The landmark 2007 IPCC report on climate change. IPCC, 2007. https://www.wunderground.com/resources/climate/ipcc2007.asp. Accessed 02 Feb 2020

Miehe G, Pendry C, Chaudhary R (eds) (2015) Nepal: an introduction to the natural history, ecology and human environment of the Himalaya. Royal Botanic Garden, Edinburgh

Miehe G, Pendry CA, Chaudhary RP (2016) Nepal: an introduction to the natural history, ecology and human environment of the Himalayas. Royal Botanical Garden Edinburgh, Edinburgh, p 560 s. ISBN 978-1-910877-02-9

Ministry of Irrigation (2014) Report on Jure landslide, Mankha VDC, Sindhupalchowk District. http://www.sabo-int.org/case/2014_aug_nepal.pdf. Accessed 25 Sept 2014

Mohanty A (2019) The India-Nepal peace and friendship treaty: need for a critical reappraisal. The Contemporary Asian Studies, January 6, 2019. http://utsenergyjournal.org/2019/01/06/the-india-nepal-peace-and-friendship-treaty-need-for-a-critical-reappraisal/#_ftn21. Accessed 7 Jan 2019

Monteith JL (1972) Solar radiation and productivity in tropical ecosystems. J Appl Ecol 9:747–766

MyRepublica (2019) Kathmandu Valley witness cold, snowfalls in Chandragiri. https://myrepublica.nagariknetwork.com/news/kathmandu-valley-witnesses-cold-snowfalls-in-chandragiri/. Accessed 27 Mar 2019

ND-GAIN Country Index (2019) ND-GAIN index country rankings. https://gain-new.crc.nd.edu/. Accessed 23 Jan 2020
References

Williams K (2012) The rights accorded the landlocked countries in the law of sea convention 1982. May 31, 2012. 17 pages. https://www.bartleby.com/essay/The-Rights-Accorded-the-Landlocked-Countries-in-FK856CC43RZZS. Accessed 7 Jan 2019

World Population Review (2020) Nepal Population 2020 (Live). https://worldpopulationreview.com/countries/nepal-population. Accessed 05 Aug 2020

Worldometers (2019) Countries in the world by population (2019). http://www.worldometers.info/world-population/population-by-country/. Accessed 27 Mar 2019

Yadav A (2016) Is India really behind Nepal’s economic blockade? Scroll.in. https://scroll.in/article/802653/is-india-really-behind-nepals-economic-blockade. Accessed 7 Jan 2019