

1 Land Degradation in Nepal

2 A Review

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By

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30 **1. INTRODUCTION**

31 The topic of land degradation in the Nepali context is gaining attention by the
32 researchers in recent years. A simple article search of a topic “Land degradation in Nepal” in
33 Google Scholar resulted in 66 articles for the past decade 2010-2019 which is only about half,
34 31 articles for a decade earlier in 2000-2009. For a country with limited land resources and
35 growing population where over 240 million cubic meters of soils are estimated to be eroded
36 only from its hills annually (USAID, 1978) and a total of 336 million tons of soil enters India
37 through the Nepali rivers annually (Brown, 1984). The severity of soil, a national
38 comprehensive policy on land management warrants utmost attention to the issue of land
39 degradation.

40 Land degradation represents the gradual decreases in the biological productivity of
41 land because of human activities. It occurs due to physical, biological, and chemical
42 processes because of direct or indirect anthropogenic exploitation (Blackie & Brookfield,
43 1991; MOEST, 2008). Land degradation is the substantial decrease in either or both of an
44 area’s biological productivity or uselessness to humans (Eswaran et.al., 2001; Johnson &
45 Lewis, 2007). It is considered as a reduction to lower rank which causes the devaluation of
46 the land in terms of crop productivity. So, land degradation could manifest itself as a social
47 problem. The definitions of land degradation show that environmental depletion of land due
48 to human-induced events falls under the land degradation.

49 According to Sauer (1956) and Pyne (1993) land degradation is an evidence of human
50 impact on global environmental change which can be verified by looking at the historical
51 evidence of land degradation. After the domestication of fire, the relationships among early

52 technologies and the quest for food and shelter were increased in such a way that humans
53 started to scatter on a larger spatial scale in a short temporal scale. The innovation of tools
54 and fire enabled prehistoric humans to control the natural world, but their impacts were
55 minimal compared to the change brought by the agricultural revolution in later years. This led
56 to heightened control over the geographical areas and promotion of the quantity, quality, and
57 availability of the favored food crops. Intensive use of cultivated and uncultivated landscape
58 transformed humanized landscape completely where forest could not grow. Due to shifting
59 agricultural practice, the communities had to reduce the fallow cycle, either due to internal
60 population growth or due to mobility constraints to neighboring communities. The migration
61 of prehistoric people from one region to another region for food and shelter, fire
62 domestication for heating and cooking; agricultural shifting from one place to another and
63 need of additional quantity of food for growing population have magnified land degradation
64 (Johnson & Lewis,2007).

65 There are proximate and underlying causes of land degradation (Geist & Lambin,
66 2002). Proximate causes include biophysical factors that drive land degradation. It represents
67 the degradation of land quality due to human-induced reasons. It involves unsuitable land use
68 practices along with improper land management that includes traditional agricultural work in
69 steep slopes without proper soil protection measures (Lambin et.al., 2006).

70 Underlying causes of land degradation represents unsustainable land management
71 practices (Von Braun et.al, 2013). It has no visible impacts on the land, but it stimulates other
72 factors to ruin the land (Mirzabaev et.al., 2016). Land degradation occurs when land
73 management is poor or natural forces are strong enough to overcome any effort of land
74 management by humans to control the effects of the natural events (Blakie & Brookfield,
75 1991). Exploiting land for agricultural works on hill slope, extraction of stone, sand and
76 gravel from the rivers and deforestation are taken as unhealthy practices (Maskey et.al, 2003).

77

78 2. LAND-DEGRADATION: THE NEPALI CONTEXT

79 Nepal is a country with fragile geology, suffers from land scarcity as defined by the
80 Food and Agriculture Organization of the United Nations (FAO, 2011). It is facing the
81 challenges of land degradation as both the natural and manmade activities are playing roles in
82 land degradation (Karkee, 2004).

83 Based on agro-ecology, Nepal is divided into five ecological regions-Terai (14%),
84 Siwalik (14%), Middle Mountain (30%), High Mountain (19%), and High Himalaya (23%).
85 Both the hill and mountain regions occupy 70% of the country's total land and suffer from
86 soil erosion, landslide, and washing away of the topsoil (Maskey et al., 2003). The hills and
87 mountains are fragile and vulnerable to landslides whereas Terai is generally threatened by
88 flooding and sedimentation (Acharya & Kafle, 2009).

89 Land degradation is not an absolute term because the process itself depends on the
90 land use category (ICIMOD, 2000). Land degradation varies as per physiographic zones
91 (Figure 1). Generally, rock falls, rockslides, avalanches, and glacial lake outbursts are the
92 faces of land degradation in the mountainous region (5000m - 8848m). Mass wasting
93 rockfall; gully erosion; surface erosion (rill and inter-rill) and riverbank cutting mostly occur
94 in high and middle mountain regions (2100m-5000m). The Shiwalik range (1200m-2100m) is
95 also a vulnerable zone of soil erosion. Terai (70m-1200m) is suffering from flooding, river
96 shifting, riverbank cutting and water logging. Dry districts of Nepal- northern parts of
97 Manang, Mustang, and Dolpa districts fall under this category (Joshi & Shrestha, 2003).
98 Likewise, the Shiwalik hill and middle mountain areas are highly susceptible due to soil
99 erosion (Brown, 1984). The soil coming from hill and mountain to make deposits at the
100 riverbed in Terai is high so the riverbed in Terai is rising by 35cm to 45cm annually which is
101 further leading to expanding river overflow at farmland (Dent, 1984). The loss of soil quality

102 and quantity are damaging plots of farmland which is a serious threat for land dilapidation in
103 the hill (Sitaula et. al., 2000).

104

105 [Insert Figure 1 here]

106 **FIGURE 1** Physiographic zones of Nepal

107

108 The work of GLP (2005) reveals that rural ecosystems have suffered due to land use
109 changes from soil erosion brought by topography, intense monsoonal rainfall, and
110 hydrological processes. However, identification and quantification of external causal
111 variables on land degradation research have often been done without giving adequate
112 attention to the linkage of land degradation and associated factors (ICIMOD, 2000).

113 Data from Landslide Susceptible Index (LSI) shows that 77% of Nepal's land area
114 have high or very high susceptibility to landslides (Figure 2-LSI, Table 1-Province level
115 LSI). Also, based on land cover data from 2015 (Figure 3-Land cover Table 2-LSI for
116 different LC types of Nepal) 80% or more of the land cover types have a high or very high
117 LSI except cropland and impervious area.

118

119 [Insert Figure 2 here]

120 **FIGURE 2** Nepal-Landslide Susceptibility Index (Source: *Stanley & Kirschbaum, 2017*)

121

122

123 [Insert Table 1 here]

124 **TABLE 1** Percentage of land area under different categories of LSI for all seven provinces

125 (Source: *Stanley & Kirschbaum, 2017*)

126

127

128

[Insert Figure 3 here]

129

130 **FIGURE 3** Nepal-Land cover map (*Source: Gong, et. al., 2013*)

131

132

[Insert Table 2 here]

133 **TABLE 2**Percentage of land cover area under different categories of LSI for Nepal

134 (*Source: Stanley & Kirschbaum, 2017 and Gong et.al., 2013*)

135

136 The situation explained above shows the importance of understanding the causes of land
137 degradation in Nepal.

138

139

140 **3. CONTRIBUTING FACTORS OF LAND DEGRADATION**

141 There could be several factors that can trigger land degradation. Classical perspective
142 holds farmers accountable for their lack of knowledge on the technology, skill, and
143 perspective to keep the farmland intact (ICIMOD, 2000). The classic view identifies
144 structural causes of land degradation related to population, ignorance, and backwardness.
145 Similarly, a mismatch of resource distribution and inappropriate technologies are popular
146 views of land degradation. The neo-liberal view mentions that bias in terms of property
147 rights; institutions, price, and rapid population growth, which play roles in land degradation
148 (Biot, 1995). A review of the available literature in Nepal shows the following causes of land
149 degradation (Table 3)

150

151

[Insert Table 3 here]

152 **TABLE 3** Summary of causes of land degradation in Nepal

153

154

155 **3.1 Proximate causes**

156 *a. Sloppy topography*

157 Fragile geological structure of Nepal is a proximate cause of land degradation
158 (Karkee, 2004). Cultivation in hill slopes is common in Nepali agriculture (Figure 4). For
159 centuries, farmers have adopted a shifting cultivation in sloppy land in many parts of the
160 world including Nepal (Maskey et.al, 2003). The washing away of soils due to slope-wash,
161 gully and mass movement occurs on all slopes. Flash floods from overloaded streams in deep
162 valleys washout and widen their channels. As a result, about 50 percent of the eroded
163 material carried away into the lowland widening gullies and waterways (Gardner & Gerrard,
164 2003; Brown & Wolf, 1984). Human influence combined with such fragile geology plays
165 roles for subsequent landslides, avalanches, and floods in Nepal (Figure 5). For example,
166 turbulent rivers have damaged 400,000 hectares of productive farmland (LRMP, 1986) which
167 shows minimal human influence on the sensitive topography can bring significant ecological
168 hazards.

169

170

[Insert Figure 4 here]

171 **FIGURE4** A typical Nepali landscape fueling land degradation due to sloppy landscape,
172 river undercutting, un-engineered road construction, and traditional farming in Lalitpur,
173 Nepal (red arrows) and terrace farming (yellow arrows) (*Source: Authors, November 2020*).

174

175 *b. Land use and land cover change*

176 Land use and land cover change is a prominent cause of global environment change
177 which is active in the mountain regions as well (Koerner & Ohsawa, 2005). Study shows that
178 mountain regions are more vulnerable for over exploitation, fragmentation, and degradation
179 of land resources (Chaudhary et.al., 2007).

180

181 [Insert Figure 5 here]

182 **FIGURE 5** Lack of land cover (area around red arrows) has accelerated the land degradation
183 in Ranajor stream in Ramechhap, Nepal (*Source: Authors, May 2020*).

184

185 Nepal has about 25% of the land suitable for agriculture while 33% of the land is able
186 to grow forest cover (Karkee, 2004). However, human influence on the ground vegetation by
187 cattle grazing exceeds the carrying capacity, has already been common. The shifting
188 cultivation together with overgrazing has damaged the vegetation threatening the grassland
189 ecosystem. The overgrazing has loosened the soil so has eased to wash away the soil that also
190 accelerates the surface runoff (Neupane & Thapa, 2001). Land degradation drivers include
191 reduction of vegetation covers due to drought too (Symeonakis & Drake, 2010). Furthermore,
192 Drake & Vafeidis (2003), Symeonakis & Others (2007) agree that land use and land cover
193 change accelerate the land degradation process. Gisbert et.al., (1994); Aidi & Grau (2004);
194 Radel & Schmook, (2008) highlight the role of migration to be responsible for land use and
195 land cover change.

196 Pre-monsoon is a season to lose the soil in Nepal when there is no vegetation
197 (Atreya, 2002; Atreya et.al., 2006). In pre-monsoon, 60 to 80% of the total soil and nutrients
198 are lost in Nepal due to high wind flow (Scheier & Shah, 1999). Land with plants are more
199 protected and less affected by soil erosion. In developing countries, the loss of soil cover is

200 very common due to farmers' unknowingness and lack of forest management awareness
201 (Pimentel, 2006).

202

203 *c. Soil erodibility*

204 The hill and mountain areas are fragile and vulnerable to the landslide in Nepal. Land
205 degradation is the greatest challenge in recent years and Nepal is not an exception (GON,
206 2015; Karkee, 2004). An estimate shows that 26 billion tons of soil is being eroded annually
207 from crop and grazing worldwide (Brown & Wolf, 1984). In the case of Nepal, the turbulent
208 rivers erode a total of 336 million tons of fertile soil through the main river system to India
209 (Brown, 1981) (Figure 6).

210

211 [Insert Figure 6 here]

212

213 **FIGURE 6** Road construction in the sloppy land without proper consideration of hydrology,
214 Bhorle, Dolakha, Nepal (*Source: Authors, July 2020*)

215

216 *d. Fertilizer, pesticides, and disease*

217 Use of pesticides and chemical fertilizer is ongoing as an inappropriate agricultural
218 activity in Nepal (Maskey et.al., 2003). This increases production in the short run but
219 degrades soil quality in the long run (Bajracharya & Sherchan, 2009). Further, the overuse of
220 pesticides and chemical fertilizers to produce more food for a growing population has
221 hastened the degradation of the soil property. Although intense cultivation and excessive use
222 of chemical fertilizer have damaged soil productivity, there is no existing control mechanism
223 in Nepali regulations (ICIMOD, 2004).

224 The middle mountain region, because of intense cultivation and use of chemical
225 fertilizers, has been found to be acidic where the pH value of soil was 3.3 and 7.5 with the
226 mean pH value 5.8. For instance, cultivation practices such as introduction of double or triple
227 annual crop production, uncontrolled use of chemical fertilizers (ammonium sulfate and urea)
228 are increasing the pH values of soil (Tripathi, et.al.,1999). Tripathi et.al., (1999) also found
229 that using less organic manure or reducing use of lime by other means raises the
230 concentration of acid in soil. This proves that the overuse of chemical fertilizers and
231 pesticides have been contributing to increase the soil acidity. Consequently, the productivity
232 of the land deteriorated for most of the crops (Tripathi et.al., 1999).

233

234 *e. Unsustainable land management*

235 Fragile economy and farm policies fuel land degradation as these factors motivate
236 people to exert the pressure on land (Karkee, 2004). The incompetence of land
237 administration, and syndicate in urban real estate sectors are two issues that complicates the
238 land management problem in Nepal. Although, the Government of Nepal has passed a bill but
239 so far it is unable to address the regional and urban land issues. Government is still not able
240 to provide digital land survey and administrative services to the people (Chand, 2019) making
241 it very hard for transparent and accessible land management services to the public.

242 Regional and urban development planning and land use issues and approaches are
243 conflicting. Land management is a special problem for spatial planning in rural and urban
244 Nepal which has spurred challenges in land governance. In Nepal, statutory practices, land
245 use, and land zoning do not have clear objectives which have resulted in many loopholes and
246 failed to address irregularities in land management. Due to policy gaps at the national and
247 provincial levels, the pressure from internal migration and investment in urban real estate has
248 brought regional imbalance in the national economy (Chand, 2019). Locals have a low level

249 of acceptance of the land management plan and policies due to low level of participation in
250 its formulation and haphazard institutional overlap. For example, the government offered
251 parcels of land or new housing or financial aid to the beneficiaries in the Freed Bonded
252 Laborer Rehabilitation Program in the Terai region, but the beneficiaries were not ready to
253 accept the offer. The beneficiaries demanded housing at the market center where land is
254 already scarce. Including this, the involvement of brokers in land parceling is leading to the
255 over fragmentation and degradation of agricultural land (Chand, 2019).

256 Open space is encroached in the name of land management and spatial planning.
257 Before the promulgation of the Constitution 2015, the Town Development Committee, an
258 autonomous agency was active in most of the 217 municipalities in the country to manage
259 government owned land in urban and suburban areas (Chand, 2019, Pradhan, 2015). It used
260 to allocate the land for public infrastructure but the performance of the Town Development
261 Committee was dismal and is often criticized for distributing the land for vested interest in
262 such a way that there is no government and public land left over. Public is also leading to
263 degrade the religious, trust, protected areas, grassland, community forest in the name of
264 squatters, and natural disaster victims (Chand, 2019).The cumulative impact of fast-growing
265 population, internal migration, unmanaged but rapid urbanization, encroachment of arable
266 land, public land and other resources are widespread in Nepal (MOLRM, 2015).

267

268

269 *f. Urbanization and infrastructure development*

270 Unmanaged and rapid urbanization has resulted in land encroachment and loss of land
271 productivity in Nepal (GON, 2015). Construction of roads, and settlements have magnified
272 the environmental degradation (Neupane & Thapa, 2001). Unscientific road construction in a
273 fragile landscape is a cause of soil erosion and landslide in Nepal. Construction of non-

274 engineered roads using bulldozers has been destructive to Nepali landscapes. The use of
275 bulldozers in road construction destroys groundwater flow path, destroys plant and
276 vegetation, cultivated land, and the natural stability of the slope. As a result, deposition of
277 debris over paddy fields is common (Dahal, 2019).

278

279 [Insert Figure 7 here]

280 **FIGURE 7** Soil erosion due to un-engineered road construction using Bulldozer in
281 Bagmati Rural Municipality, Lalitpur, Nepal (*Source: Authors, May 2020*)

282 Figure7 represents a typical Nepali landscape being exploited with unscientific
283 practice of road construction using bulldozer and excavator. The surface run-off washes out
284 the loose soil during monsoon which also blown away by air during the dry season causing
285 severe air pollution

286 Construction of housing complexes that change the land cover permanently is another
287 cause of land degradation. For example, in 2012, Department of Urban Development and
288 Building Construction under the Ministry of Urban Development purchased 4,070 square
289 meters of land to provide housing to poor city squatters in Ichangu Narayan Housing project
290 (currently, Nagarjun Municipality, Kathmandu) which has not been favored by the targeted
291 beneficiaries so all 227 housing units remained vacant though another similar type of housing
292 project in Kirtipur, Kathmandu is said to have succeeded (The Kathmandu Post, 2019;
293 Chand, 2019).

294 Agricultural land in most of the locations of the country are turning into urban and
295 semi urban settlements (The Kathmandu Post, 2019). For example, there were 10 urban cities
296 in Nepal in 1952 to 1954. The number of the cities rose to 16 in 1961. Likewise, the number
297 of urban cities has been recorded 23, 58, and 191 in 1991, 2001 and 2014 respectively. Now,

298 Nepali land has been facing the pressure of 263 municipalities, 6 metropolises, and 11 sub-
299 metropolises (Dahal & Timilsina, 2017).

300

301 ***g. Traditional agriculture in terraced land***

302 Poor agricultural practices play roles to lose the organic soil particles that contribute
303 to land degradation (Symeonakis & Drake, 2004). The cultivation in high sloped ground
304 without protective measures moves soil away. Neupane & Thapa, (2001) discuss that
305 agricultural works in steep slopes without soil conservation measures such as terracing and
306 adding organic manure has increased soil erosion.

307 Cultivation in sloppy lands with greater than 40 degree is common in Nepal
308 (Maskey,1995). The shifting cultivation patterns have hampered the regeneration of the forest
309 diversity (Acharya et. al., 2008). Traditional cultivation that includes shifting cultivation on
310 sloppy ground without protective measures destroys the water resistivity of soils
311 (Maskey,1995). Cultivating land for crops without replenishing plants and nutrients has
312 threatened the sustainability of soil. As a result, soil loss through surface erosion from the
313 cultivated land on hills is rampant and varies from less than 2 tons per hectare annually to as
314 high as 105 tons per hectare (Acharya et. al., 2008).

315

316 **3.2 Underlying causes**

317 ***a. Population, and poverty***

318 Population and poverty are often blamed for land degradation in Nepal (ICIMOD,
319 2000). Nepal's Land Policy 2015 also points out that the country is losing the quality of land
320 due to overpopulation. Cultivation in sloped land, a finite natural resource, is continuing due
321 to the lack of enough land to grow food for the population. It is a vicious cycle of mutually
322 reinforcing processes in which degradation has provoked poverty and poverty has further

323 worsened land (GON, 2015). Human influence on land to grow more food is dismantling the
324 biophysical property of soil (Joshy et. al., 1997).

325 Similarly, inappropriate agricultural activities in the face of population pressure are
326 contributing to deforestation, shifting cultivation, and the use of pesticides and chemical
327 fertilizers in Nepal. The modification of shape and chemical composition of soil to grow
328 additional food to feed the growing population have resulted in loss of land productivity and
329 its usefulness to biodiversity (Maskey et.al.,2003). The loss of soil with nutrients lowers
330 agricultural productivity that further impacts rural livelihoods (Gautam, 2000).

331

332 ***b. Migration and land abandonment***

333 Land abandonment is a result of migration which is a social phenomenon (Benayas
334 et.al., 2007) (Figure 8). In recent years, Nepal is experiencing massive outmigration. Nepali
335 society is also transforming to be more urbanized due to commercialization and monetization
336 (Seddon et al. 1998). The male out migration has led to labor shortage and ‘feminization’ of
337 the agricultural labor force (ADB, 2013). The traditional agricultural practice could not
338 contribute to the livelihood of the subsistence farmers. On the other hand, landlessness of the
339 people has limited the access to other natural resources. As a result, the paying capacity of
340 people for health, education and social services remained worrisome. This has led to
341 outmigration and those family members who have their family members out migrated, have
342 abandoned the cropland to remain fallow (Paudel, et.al., 2014).

343

344 [Insert Figure 8 here]

345

346 **FIGURE 8** Abandoned agricultural land in Baiteshwor Rural Municipality-5, Dolakha,

347 Nepal (*Source: Authors, October 2020*)

348

349 People migrate internally to different cities when land becomes scarce (Seddon et.al.,
350 1998; Graner & Gurung, 2003; Kollmair, et.al., 2006). The migration to foreign countries or
351 to the Terai or urban and semi-urban areas alters the demography of hill (Seddon et al.,
352 1998). Statistics show that 1,3491 people used to leave their origin via legal route for Gulf
353 countries every day in 2014 for employment. The absence of the youth labor force
354 necessitates women or elderly people to nurture the land. People's choice to move to the
355 valley or nearby cities causes land abandonment (Gurung, personal communication, 2013).
356 Migration created ignorance over land that further has resulted in loss of land-based
357 ecosystem (Gisbert et.al., 1994; Aidi & Grau, 2004; Radel & Schmook, 2008). A study in
358 Lamjung district of Nepal has identified that the shortage of agricultural labor in the village,
359 and in the home are causes of land abandonment (KC & Race, 2019). Similarly, the Land Use
360 Policy 2015 of Nepal recognizes that migration is a cause of land encroachment in urban and
361 semi-urban areas.

362 The migration has further made labor wage expensive. The local people have not
363 been able to pay the workers from the unproductive agricultural works leaving the land
364 fallow (KC & Race, 2019).

365

366 *c. Deforestation*

367 Many developing countries have been facing deforestation as a major environmental
368 problem over the past decades (Gautam et.al., 2004). Deforestation is a cause of land
369 degradation as it stimulates the weakening factors of the water resistivity of soils (FAO,
370 1994). The historical documents available at district and national levels show that
371 deforestation started in Nepal in the late 18th century when the government was lured for
372 revenue, selling forest products to India (Mahat, 1985). The conversion of forest land to

373 agricultural land occurred at a rapid pace in Nepal to feed the growing population (Collins &
374 Jenkins, 1996; Maskey et al., 2003). The land degradation in Nepal is an outcome of
375 deforestation, while deforestation is a result of both the proximate and underlying driving
376 forces (Acharya, 2011) (Figure 9). Study shows that Forest fire which leads to deforestation,
377 is one of the major causes of land degradation. Anthropogenic role of deforestation resulted
378 in the loss of flora and fauna, erosion of topsoil, occurrence of landslides in the hill and
379 flooding in the plain areas that made land poorer in quality (Karkee, 2004).

380

381

382

[Insert Figure 9 here]

383

FIGURE 9 Deforestation for agricultural land in Lalitpur district, Nepal,

384

(Source: Authors, October 2020)

385

386 The direct forces to forest land conversion include but are not limited to over-
387 extraction of forest products, intentional forest fire, free grazing, illegal logging and shifting
388 cultivation. For example, collection of firewood and grass for cooking fuel and livestock is
389 common in Nepal (Bajracharya, 1983; Axinn & Axinn, 1983). About 200 hectares of forest
390 turns into deforested land or degrades and fragments into shrubs or bush areas daily. This
391 reduces the plant species and soil erosion together with nutrients (Gautam, 2000).

392

393 Globally, above 9 million hectares of forest clear-cut disrupting the forest ecosystem
394 each year. The land after deforestation is agriculturally unproductive, biologically poor, and
395 more flammable (Uhl & Buschbacher, 1985; Uhl, 1987), which is the case in Nepal too.
396 Despite, Nepal is counted as a country having good progress in forest coverage of 26% in
397 1992 to 45% in 2016 (Gill, 2019). After 1970, Nepal implemented forest conservation
activities mobilizing community forest users' groups who were responsible to formulate,

398 implement and review their forest strategies. This program has been a successful program in
399 forest conservation in Nepal (Kandel & Kandel, 2004).

400

401 ***d. Land tenure and property rights***

402 Land in Nepal has been under the control of elites, (e.g. *Jamindars*) marginalizing a
403 large section of population from generations. Until the 1960s, land was held in various forms
404 of tenure such as *raikar*, *birta* and *guthiorkipat* systems in Nepal. But in recent years,
405 transferring the ownership of public lands to the politicians mainly with the help of power
406 brokers, from across the political class and spectrum, using the loopholes in laws and
407 regulations has been rampant (Republica, 2020).

408 The amendment to the Land Act 2001 revised the ceiling of landholding aiming to
409 benefit marginalized people, but the attempt failed as there was no “excess” land found for
410 reconciliation. Likewise, the policy failure is heavily criticized as “land reform in law” rather
411 than “land to tiller.” (Sharma & Khanal, 2010). The unstable politics and government, land
412 ownership rights, labor utilization and taxation caused fluidity in the land productivity. This
413 argument tells us that the land reform act could not assure the right of land to marginalized
414 people in Nepal (Regmi,1976; Regmi,1978). Subsequently, institutional arrangement and
415 policies for land use planning seems ineffective (FAO, 2010; Sharma & Khanal, 2010). So,
416 the Government of Nepal established the National Land Use Project in 2000 to address land
417 use problems, but again it remained ineffective due to political fragility. As a result, people
418 who were unsure of their future right over land, appeared reluctant to nurture the land. The
419 carelessness of larger scale landholders has been continued in losing soil property which are
420 necessary for crops and biodiversity (FAO, 1994).

421

422 ***e. Farm and non-farm employment***

423 KC & Race (2019) found that 22% of the households have been planning to shift to
424 non-farm business and jobs outside agriculture sectors. Similarly, their research shows that a
425 similar percentage of farmers are seeking overseas employment. Some farmers at the village
426 are eager to join the army. It is likely that the occupation shifting of farmers will one day
427 result loss of the farming knowledge, practices, and interest of youth on agriculture.
428 Agricultural sector is ignored as an unproductive sector for job creation, low productivity and
429 lack of career advancement. From time memorable, agriculture is taken as an occupation of
430 uneducated people for their subsistence. Nepali youth have lack of access to finance,
431 information, market, knowledge, and skills which make them alienated from agriculture. Due
432 to lack of innovation and care given by educated people, current agricultural practice in
433 Nepal is neither profitable nor environmentally sustainable (Koirala, 2018).

434 The Government of Nepal has an estimate that it needs to create 1.5 million jobs to
435 meet the unemployment crisis that include 225,000 migrant workers who are likely to return
436 from abroad and engage in agriculture due to Covid-19. However, government preparedness
437 in terms of budget is limited to about 351 million US Dollars for fiscal year 2020/2021 which
438 has not been encouraging (Kaini, 2020). Despite this, many youths still perceive agriculture
439 as an ‘dead-end’ career too. Youth entrepreneurs are entering into commercial farming using
440 advanced agricultural technology. So, examples of using labor-saving technology in crop and
441 livestock production have been noticed (Kaini, 2018). For instance, commercial vegetable
442 farming by a young couple in Kailali district, Nepal geared up with modern agricultural skill
443 and knowledge. Likewise, examples of NGO, INGOs and government organizations are
444 investing resources to attract youth into agriculture are slowly giving exciting results (Feed to
445 Future, 2019).

446

447 *f. Technological change*

448 The population growth and market opportunity necessitate farmers to change farm-
449 technology that alters the ways of farming (Boserup, 1965; Ruttan, 1984; Grigg, 1992).
450 Technology is an elastic production factor having unlimited capacity in agricultural
451 intensification (Ali, 2004). Although technology supports increased food production, it
452 stimulates land degradation in many ways. It exerts negative impacts on land such as it loses
453 soil particles and hampers soil organism. As a result, the application of technology in sloppy
454 land reduces soil quality and productivity (Koeman, 1985; Winteringham, 1985; Commoner,
455 1988).

456 Technology accelerates the rate of groundwater extraction. For example, mechanized
457 irrigation pumps extract high quantities of underground water resulting in its depletion. The
458 water lift pump pulls up the underground water with dissolved salt that increases soil acidity,
459 soil salinity and plays roles to decrease useful chemicals. Use of HYV rice cultivators leads
460 to loss of aquatic species and decline rice fodder yield. Similarly, using tiller breaks the soil
461 particles that leads to soil erosion (Ali, 2004).

462

463 **4. ACTS AND LAND USE POLICIES OF NEPAL**

464 The constitution of Nepal (2015), Land Use Act of 2019 and Land Use Policy of 2015
465 and lay out the key legal framework that the Government of Nepal wants to manage its land
466 resources. The Constitution of Nepal (2015) has provisioned the policies related to
467 agriculture and land reforms. The constitution opens the door for scientific land reform and
468 ends dual ownership. The inactive land ownership is discouraged by provision of carrying out
469 land pooling. The constitution aims to develop land use policies to manage, commercialize,
470 and industrialize the land. Similarly, the constitution also focuses on the farmers' access to
471 the land, market, and agricultural input.

472 Land Use Act 2019 provisions of preparing industrial corridors, special zones to pay
473 attention to the economy, projects at different levels, protection of natural and physical
474 heritage having national importance. It necessitates to focus on places with religious and
475 cultural importance and the areas that are sensitive due to security, disaster, and
476 environmental issues (GON, 2019).

477

478

479 **4.1 Problems identified by the Land Use Policy, 2015**

480 The Land Use Policy, 2015 of Nepal pointed out emerging problems that need to be
481 addressed for conserving the land resources of the country. The most severe land problem to
482 the coming generation is obviously the food insecurity which is linked directly to loss of land
483 productivity and transformation of arable land into non-agricultural land. The policy aims to
484 control land fragmentation that reduces the agricultural land. Nepal earthquake 2015 made
485 realization that Nepal lacks designated land due to congested urbanization for disaster rescue
486 operation. Similarly, exponential growth in urban population is another severe problem as it
487 causes rapid encroachment of arable land. Ecological degradation due to environmental
488 pollution, climate change, water related disaster (soil erosion, flood, sliding) is another
489 problematic area that needs to be addressed by the land use policy. Also, the natural or
490 anthropogenic exploitation of land in mountains and hills pose a threat in the riparian land.

491

492 **4.2 Provisions made by Land Use Policy, 2015**

493 Land Use Policy 2015 aims to mitigate problems associated with land use in Nepal by
494 addressing its weakness in its implementation particularly in the context of the new political
495 structure of federal Nepal. The Land Use Policy 2015 has offered fifteen major focus areas
496 for the sustainable use, protection, and conservation of the country's land resources for

497 infrastructure development, human settlement, and food production. The fifteen focus areas
498 can be grouped in three major fields of action (Table 4):

499

500 [Insert Table 4 here]

501

502 **TABLE 4**

503 Summary of the Land Use Policy 2015 of Nepal-Authors adaptation

504

505

506 The policy emphasizes on using Land use classification as the blueprint for zoning land for
507 various beneficial uses and developing tools to implement the policy transparently, which
508 ultimately help meet the goals of Nepal's Land Use Policy.

509

510

511 **5. CONCLUSION AND WAY FOREWARD**

512 This review of understanding the broader context and causes of land degradation in
513 Nepal shows that Nepal has already facing severe problems of land degradation. This
514 situation if unabated would continue to grow and several anthropogenic activities are
515 accelerating the rate of such degradation in the country.

516 The country needs to seriously invest its resources to stop land degradation and
517 minimize its negative impacts. There are several successful land conservation efforts which
518 has shown promise to help in this regard. A Sustainable Agriculture Management efforts in
519 *Chure* region of Nepal along the southern boarder helped manage land for generations and
520 keep ecosystem services functional (Dhakal & Acharya, 2016; WWF, 2017), A ‘Sustainable
521 Soil Management Program’ (SSMP)which helped increase soil productivity and breaking the

522 vicious cycle of poverty in the neediest section of the demography in some rural areas
523 (ICIMOD, 2020; Helvetas, 2020), and efforts by Local Initiatives for Biodiversity, Research
524 and Development (ICIMOD 2020) are noteworthy. Lessons from such efforts can help
525 federal and local governments to devise practical solutions to stop land degradation in the
526 country.

527

528

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