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## Title

### Opportunities and Barriers for Wood-Based Infrastructure in Urban Himalayas: A review of select national policies of Nepal

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## Abstract

Nepal's policy landscape to identify the opportunities and barriers for wood-based infrastructure (WBI) as a tool to increase urban resilience. The 2015 Gorkha earthquake in Nepal highlighted the systemic vulnerabilities of a small landlocked developing nation to the risks of living in a fragile mountain landscape when combined with high rates of poverty, rural to urban migration, and weak governance. New wood-based infrastructure has the potential to tackle the systemic vulnerabilities to earthquakes by increasing rural livelihoods, reducing rural to urban migration, and improving building materials and construction. Thus, WBI can help Nepal in achieving disaster risk reduction (DRR) goals and achieve emission reduction targets through carbon sequestration. However, implementing WBI in Nepal requires a careful evaluation of Nepal's policy landscape to identify opportunities and barriers for operationalizing. By using a supply chain framework, Nepal's major policies distributed across forestry and environment, natural resource management, and urbanization that influence wood-based infrastructure were analyzed. We found that policies aimed towards sustainable development, disaster risk reduction, and climate change support the establishment of WBI while policies of conservation, forest harvesting policies, and lack of clarity in implementation result in increased barriers towards WBI. We propose the conservation and forest harvesting policies should further incorporate livelihood enhancements, which should expand opportunities available to WBI.

Keywords: earthquake resilience; urbanization; wood-based infrastructure; policy; livelihoods; mountain landscapes

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## Introduction, scope and main objectives

The Gorkha earthquake of 2015 cost an estimated \$7 billion in damages, killed 8,800 people, injured tens of thousands, and left many homeless in the developing and landlocked country of Nepal (Goda et al. 2015; Nepal Planning Commission 2015). Large earthquakes do not necessarily lead to such large death tolls, Chile and Japan suffered similar magnitude earthquakes in the past but only had six deaths and zero deaths respectively (CNN n.d.; Press 2015). The reason for such low impact in these countries is because both nations have aggressively incorporated DRR efforts in their growth and development processes.

One-fourth of Nepal's citizens fall below the poverty line, classified as making less than \$1.90 per day (GoN 2016; Ferreira et al. 2015), and most of them live in rural areas. The lack of employment opportunities in rural areas has caused rural poor to migrate to urban areas and increased the demand for cheap housing in urban Himalayan landscapes (Banerjee et al., 2014; Goodall, 2004; Hoermann & Kollmair, 2009; Tiwari & Joshi, 2015). This demand for cheap housing under weak governance is often met with poor and unsafe housing construction in hazard-prone fragile landscapes (Devkota 2012). The combination of high demand for cheap

housing, poor construction codes, unsafe building locations, and the use of suboptimal construction materials are credited as a major reason that caused such devastation in the Gorkha earthquake (Bothara et al., 2018). Further, the production and use of construction material (i.e. bricks, steel, concrete) is energy and resource-intensive, polluting, and environmentally destructive (Babor et al., 2009; Bhat et al., 2014; Nidheesh & Suresh Kumar, 2019) significantly increasing the environmental footprint of these new urban developments in Nepal.

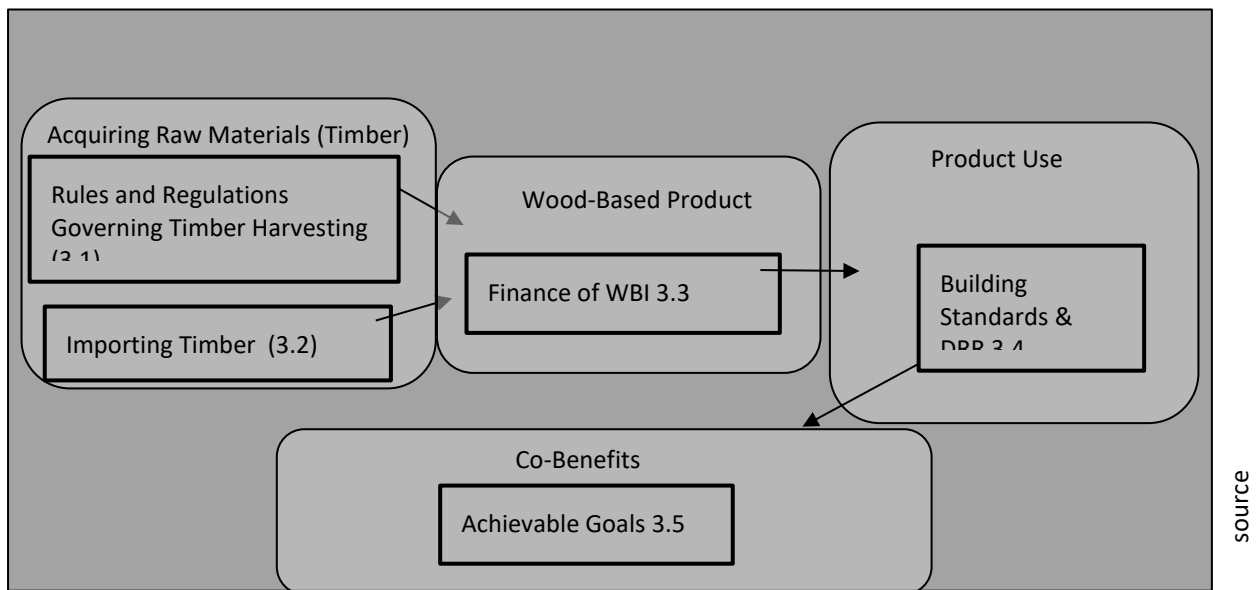
Systematic efforts to reduce Nepal's vulnerability to earthquakes should not only tackle the hazards but also deal with root causes of vulnerability i.e. rural poverty and resource degradation. Wood-based infrastructure (WBI) using new wood technologies (example CLT) presents a promising solution. WBI made from locally sourced wood can tackle root causes of vulnerability i.e. rural poverty and rural to urban migration by providing rural livelihoods, making urban building constructions resistant to earthquakes (Brose 2018, Lindt et al. 2020), alleviating the housing shortage (Devkota 2012), and increase environmental sustainability through increased carbon sequestration (Zeng et al. 2013, Aryapratama and Pauliuk 2019) thus supporting Nepal's Paris commitments. While WBI based earthquake-resistant urban infrastructure can significantly increase Nepal's Disaster Risk reduction goals and increase urban resilience, it is necessary to evaluate WBI's feasibility within Nepal's current policy landscape.

The objective of this paper is to determine the potential opportunities and barriers that are directly relevant to WBI in Nepal through the review of policies, legislations, programs, and processes currently operating within Nepal. The paper is divided into the following sections: The methods section describes the supply chain framework used for analysis along with the process of identifying and evaluating different policies. The results section identifies the policies, programs as they present opportunities and barriers to WBI. The discussion section synthesizes the opportunities and barriers across all policies and processes. and provides key recommendations. Finally, we conclude by summarizing our efforts and findings.

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## Methodology/approach

A supply chain framework (Figure 1) informed by Becker et al. (2011), is used to identify key policies, legislations, and programs that (directly/indirectly) influence the WBI in Nepal. The supply chain framework consists of five major attributes 1) Rules and Regulations Governing Raw material (Timber) Harvesting; 2) Imported Raw material; 3) Forest and Wood-Based Products 4) Construction and Implementation and 5) Co-Benefits Achieved. Policies were identified based on these attributes and analyzed for their direct or indirect influence (Opportunities and Barriers) on the WBI. A desk-based review was conducted of peer-reviewed publications, global trade databases, current active/inactive policies and programs, and grey literature for understanding their current conditions, as a keyway to review the opportunities and barriers of WBI. Databases such as the World Bank, UN Comtrade, and Observatory of Economic Complexity were used to collect information on trade, forest resource, industry, and other pertinent data (UNComtrade 2021; GoN 2017; RSS 2019; World Bank 2017; OEC 2019).



**Fig. 1:** Type of environmental, economic, and social policies organized by steps in a theoretical WBI supply chain. Titles correspond with the sections they are discussed within the results section.

## Results

### Rules and Regulations Governing Timber Harvesting

**Community Forest Regulations:** In Nepal, community forests are a decentralized approach to land management and make up 23% of the total land in Nepal. Legitimized by the Forest Act (1993) and the Forest Regulation Act (1995), both policies gave local communities the power to manage forests in a manner they saw fit (Baral and Vacik 2018; Baral et al. 2018). A decentralized approach allows community forests to harvest timber within their forest under the Annual Allowable Harvest (AAH). However, due to strict harvesting policies, AAH is rarely achieved (Baral and Vacik 2018). Harvesting timber under current policies acts as a barrier.

**Forest Harvesting Policies:** The Forest Products Collection, Sale, and Distribution Directives (2014) were created to encourage prescribed timber harvest, giving CFUGs the ability to achieve their AAH. Following this, the Department of Forests released two circulars. The Circular-MFSC 2011 discouraged harvesting green trees and encouraged CFUGs to target 4D trees (dead, dying, decay, or disease) and, in comparison, the Circular MFSC 2012 restricted AAHs to 178m<sup>3</sup>/ha. Both circulars generated under the goal of increasing forest health have made wood harvesting operations extremely difficult. Such policies are often seen as an effort by the state to centralize the decentralized forests (Timsina 2005; Baral et al. 2018; Basnyat et al. 2018) and are barriers for WBI.

**Conservation:** The Wildlife Conservation Act was created in 1957 and led to the subsequent development of the National Parks and Wildlife Conservation Act (1973), where the aim was to regulate consumptive and non-consumptive uses of biodiversity to sustain the welfare of the people, while also providing for the conservation of natural areas and additional wildlife species. Conservation efforts through these acts have influenced citizens to believe it should be the main management objective. The slogan, "let's plant trees, and conserve forests," has led to forest management decisions being driven by social preferences rather than science (Baral and Vacik 2018). These efforts have created public and official perceptual barriers around the use of forests for sustainable wood harvesting.

## Importing Timber

An alternative to locally harvesting timber is importing raw wood and wood products. Currently, India, China, Japan, Africa, and Indonesia are among the highest sources of wood imports in Nepal (UNComtrade 2021; GoN 2017; RSS 2019; World Bank 2017; OEC 2019). It was found that in 2015, Nepal imported 88 billion Indian rupees (USD 1.198 Billion) worth of softwood which was 80% of the total wood use. In response to the heavy utilization of foreign importation, the Government of Nepal created the Forest Investment Program (2017). Still, in 2018-2019, Nepal spent 6.61 billion Indian rupees (US 75 million) on wood imports (RSS 2019). Still, imported wood only fulfills 51% of the wood demand (Nuberg et al. 2019). Meeting this demand from internal resources would create an estimated one million full-time jobs for Nepal (Nuberg et al. 2019). Importing wood and wood products could be an opportunity for WBI in Nepal in the aspect of obtaining cheap resources as local wood is extremely expensive (Mausam 2016). However, importing wood can create future barriers to WBI from the perspective of enhancing local livelihoods.

## Finance of WBI

**Technology Transfer:** Introducing WBI in Nepal will need technology transfer and poses several financial risks. The Foreign Investment and Technology Transfer Act (FITTA 2019) reduces some of the risks for international investors in the Nepalese market. This policy aims to create a friendlier investing environment in exchange for external resources, introduce modern techniques of management, provide access to new technologies, and produce employment opportunities (Dulal 2019). Under this policy, the WBI project would fall under the technology transfers (licensing of foreign intellectual property, franchising, management, technical and marketing services) and expand the current industry in Nepal. FITTA acts as an opportunity for implementing WBI into Nepal.

**Sawmill Regulation:** Timsina (2005), shows that sawmills struggle to make profits in Nepal. The studied community forest sawmill was only able to employ roughly 13 thousand individuals and provide \$15,000 (USD) in wages during a seven-year period. Additionally, the Ministry of Finance imposed a 40% tax on the sale of all community forest products and the Divisional Forest office imposed a 10% value-added tax from both CF and sawmill which caused the sawmill to close for a brief time. The process of documentation and licensing to operate a sawmill incurs large transactional costs. Lengthy bureaucratic hurdles and taxes contribute to the suboptimal production of forest goods in Nepal (Evans 2017; Poudyal et al. 2020). Therefore, sawmill regulations act as a barrier to WBI.

## Building Standards & DRR

**Building Regulations:** The Building Act (1998) is an attempt to enforce building standards for safer living and to withstand earthquakes, fires, and other natural calamities. The Act signifies that Nepal wants to improve its infrastructure standards and that the threat from natural calamities is too great to be ignored. However, this policy has failed to make local entities responsible for executing regulations (Nepal et al. 2018). Currently this policy functions as a barrier in which blueprints need to be compliant and approved by the Ministry of Physical Planning. Further enforcing and enhancing the Building Act's standards to include building material grade can become an opportunity for WBI.

**Disaster Risk Reduction:** The Disaster Risk Reduction and Management Act (2017) and the National Policy for Disaster Risk Reduction (2018), both guide government agencies, NGOs, and private sectors in adopting processes in infrastructure and construction work towards achieving both the SDGs and a disaster resilient Nepal (UNDRR 2019). The Disaster Risk Reduction Act (2017) outlines six needs for DRR integration, the most important being to ensure a "Build Back Better" approach for post-disaster recovery, rehabilitation, and reconstruction. On the other hand, the National Policy for Disaster Risk Reduction (2018) was designed as a long-term policy aiming to achieve DRR and development goals by the year 2030. This policy states that 80% of the DRR budget will go to local level implementation. WBI could fit the specifications of DRR and support local-level implementation. An opportunity for WBI is the policies aimed at DRR. These policies give guidance for

how NGOs, agencies, and private sectors can further implement DRR. A building better approach is exactly what WBI should provide to prevent future disasters resulting similarly to the Gorkha earthquake.

#### Achievable Goals (Co-Benefits)

**Climate Contributions:** Due to Nepal's disproportionately high vulnerability to the impacts of climate change and Nepal's commitment to mitigation of global climate change, National Climate Change Policy (2011) was created. In addition, the National Adaptation Program of Action (2010) and the Framework on Local Adaptation Plans of Action (2019), both aim to reduce adverse effects of climate change to natural and social sectors. Nepal's First Nationally Determined Contributions (NDC) announced in 2016, focused on developing mitigation-friendly forest management systems. One desired goal was to increase forest carbon stock by at least 5% by 2025 as compared to 2015 levels. The Second NDC expanded upon and created a framework to the same goals set by the First NDC. These NDC's are a very promising opportunity for WBI as they can transfer forest carbon into wood products and will reduce carbon emissions by 40% (Liu et al. 2016). New wood products being a greener alternative to building materials will also align with the National Adaptation Program of Action (2010) and the Framework on Local Adaptation Plans of Action (2019). Additionally, increasing locally sourced wood material can further reduce the global warming potential of the product by another 14% (Chen et al. 2019). Thus, policies around climate mitigation and adaptation provide strong opportunities for WBI.

**Livelihood Enhancements:** Introducing a WBI enterprise in Nepal will also increase livelihoods. In one study, it was found that wood-based enterprises benefit 115 households and employ an average of 2,527 individuals in one community forest (Dhakal et al. 2018). While this is a low number of employed individuals, meeting the 51% gap between supply and demand in wooden products would result in an estimated one million full-time jobs in Nepal (Bhandari et al. 2019). The potential to increase livelihoods and achieve co-benefits through the proper implementation of WBI in Nepal is certainly an opportunity.

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## Discussion

In the following sections, we synthesize the opportunities and barriers that will help in deciding the future efforts associated with WBI in Nepal.

### Opportunities

Nepal's policies and processes associated with enhancing livelihoods, implementing infrastructure with DRR properties, supporting climate mitigation, and providing technology transfers positively support the implementation of WBI. Attracting foreign investment in the WBI business while risky opens several avenues for collaborating with Nepal entities. FTA opens opportunities for multilateral funding and transfer of technologies under the Green Climate Fund. Community-based forest management provides the opportunity both for locally sourced timber and increases in rural livelihood thus reducing the root causes of vulnerability. Importing timber can be seen as a barrier in the long run. However, it can act as an initial bridging step towards creating and promoting WBI. International wood supply chains used for importing timber can also provide the necessary support for new wood technology and products.

### Barriers

Within Nepal, policies and regulations that address forest harvesting and taxation along with inconsistency in the application of these policies act as major barriers to the implementation of WBI. Such barriers stall the production of timber products for urban development, employment opportunities, and growth in technical skills (Timsina 2005; Baral et al. 2018; Basnyat et al. 2018). Narrow perception within communities and government "conservation should be the only management objective" (Baral and Vacik 2018) creates a barrier towards sustainable harvesting of timber for WBI.

### Recommendations

Identified opportunities are low-hanging fruits for the implementation of WBI in Nepal and should be incorporated in the implementation road map for WBI within Nepal. Following are the specific recommendations. Nepal needs to provide incentives for CFUG to earn livelihoods by participating in sustainable timber harvest while maintaining conservation goals. There needs to be a thorough reevaluation of the tax code around wood products and industries. Efforts should be made to strengthen the linkages between National Disaster Risk Reduction policies and Nepal's Forest rights act. WBI construction should be directly linked to Nepal's climate commitments in terms of carbon sequestration and avoidance of emissions. Linkages between WBI, Carbon Sequestration, and DRR can create opportunities for funding from Green Climate Fund, multilateral funds, and other bilateral donors. Nepal's FTTA should prioritize WBI by providing incentives for collaboration between technology providers and private entrepreneurs within Nepal forestry.

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## Conclusions/ wider implications of findings

Determining the potential of implementing WBI in Nepal requires a careful evaluation of Nepal's policy landscape. By using a supply chain framework, Nepal's major policies across natural resource management, finance, and urbanization that influence WBI were analyzed. We found that policies aimed towards sustainable development, disaster risk reduction, and climate change support the establishment of WBI while policies of conservation, forest harvesting due to lack of clarity in implementation result in barriers. WBI presents an opportunity that can help Nepal achieve several SDG goals simultaneously. However, efforts are needed to synergize forest harvesting policies and rural livelihoods. Our analysis shows that there is a healthy set of policies that can support the implementation of WBI in Nepal.

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## References

- Aryapratama R, Pauliuk S. 2019. Estimating in-use wood-based materials carbon stocks in Indonesia: Towards a contribution to the national climate mitigation effort. *Resources, Conservation and Recycling*. 149:301–311. doi:10.1016/j.resconrec.2019.06.010.
- Babor D, Plian D, Judele L. 2009. Environmental Impact of Concrete. *Bulletin of the Polytechnic Institute of Jassy, CONSTRUCTIONS ARCHITECTURE Section, Tomme LV (LIX), Fascicle 4, pages 27-36 (2009)*. LV (LIX).
- Banerjee S, Black R, Kniveton D, Kollmair M. 2014. The changing hindu kush himalayas: Environmental change and migration. In: *People on the Move in a Changing Climate*. Springer. p. 205–227.
- Baral S, Meilby H, Khanal Chettri BB, Basnyat B, Rayamajhi S, Awale S. 2018. Politics of getting the numbers right: Community forest inventory of Nepal. *Forest Policy and Economics*. 91:19–26. doi:10.1016/j.forpol.2017.10.007.
- Baral S, Vacik H. 2018. What Governs Tree Harvesting in Community Forestry—Regulatory Instruments or Forest Bureaucrats' Discretion?

Basnyat B, Treue T, Pokharel R. 2017. Branding “Scientific Forestry” in the Community Forests of Nepal: A Case Study from the Midhill District.

Becker DR, Moseley C, Lee C. 2011. A supply chain analysis framework for assessing state-level forest biomass utilization policies in the United States. *Biomass and Bioenergy*. 35(4):1429–1439. doi:10.1016/j.biombioe.2010.07.030.

Bhandari PKC, Bhusal P, Paudel G, Upadhyaya CP, Khanal Chhetri BB. 2019. Importance of Community Forestry Funds for Rural Development in Nepal. *Resources*. 8(2):85. doi:10.3390/resources8020085.

Bhat MS, Afeefa QS, Ashok KP, Bashir AG. 2014. Brick kiln emissions and its environmental impact: A Review. *J Ecol Nat Environ*. 6(1):1–11. doi:10.5897/JENE2013.0423.

Bothara J, Ingham J, Dizhur D. 2018. Chapter 11 - Earthquake Risk Reduction Efforts in Nepal. In: Samui P, Kim D, Ghosh C, editors. *Integrating Disaster Science and Management*. Elsevier. p. 177–203. [accessed 2020 Jul 22]. <http://www.sciencedirect.com/science/article/pii/B9780128120569000117>.

Brose AAJ. 2018. Peripheral timber applications for waste wood material in extreme climates and earthquake risk regions [PhD Thesis]. Massachusetts Institute of Technology.

Chen CX, Pierobon F, Ganguly I. 2019. Life Cycle Assessment (LCA) of Cross-Laminated Timber (CLT) Produced in Western Washington: The Role of Logistics and Wood Species Mix. *Sustainability*. 11(5):1278. doi:10.3390/su11051278.

CNN BDF and SA. Powerful earthquake strikes off the coast of Chile. CNN. [accessed 2020 Jul 20]. <https://www.cnn.com/2014/04/01/world/americas/chile-earthquake/index.html>.

Devkota K. 2012. Dynamics of Urbanization in Nepal: The Role and Response of Local Government. Alliance for Social Dialogue.

Dhakal SR, Sharma AR, Paudel G. 2018. Investment and benefits associated with community-based forest enterprises in Nepal. *Banko Janakari*. 28(2):52–59. doi:10.3126/banko.v28i2.24188.

DoF. Circular Issued on 2nd December; Department of Forests (DoF): Kathmandu, Nepal, 2011.

DoF. Circular Issued on 30th September; Department of Forests (DoF): Kathmandu, Nepal, 2012.

Dulal UR. 2019. An Overview of Foreign Investment and Technology Transfer Act (FITTA), 2019. Sinha Verma Law Concern. [accessed 2021 Jun 1]. <https://www.svlclaw.com/resource/an-overview-of-foreign-investment-and-technology-transfer-act-fitta-2019/>.

Evans K. 2017 Mar 15. Tenure and trade: How to make a living from the forests of Nepal. CIFOR Forests News. [accessed 2021 Jul 26]. <https://forestsnews.cifor.org/48838/tenure-and-trade-how-to-make-a-living-from-the-forests-of-nepal?fnl=>.

Ferreira F, Jolliffe DM, Prydz EB. 2015. The international poverty line has just been raised to \$1.90 a day, but global poverty is basically unchanged. How is that even possible? [accessed 2021 Jul 9]. <https://blogs.worldbank.org/developmenttalk/international-poverty-line-has-just-been-raised-190-day-global-poverty-basically-unchanged-how-even>.

Goda K, Kiyota T, Pokhrel RM, Chiaro G, Katagiri T, Sharma K, Wilkinson S. 2015. The 2015 Gorkha Nepal Earthquake: Insights from Earthquake Damage Survey. *Front Built Environ*. 1. doi:10.3389/fbuil.2015.00008.

GoN. 1993. Forest Act; Government of Nepal (GoN): Kathmandu, Nepal, 27.

GoN. 1995. Forest Regulation, 2051; Government of Nepal (GoN): Kathmandu, Nepal.

GoN. 1998. The Building Act, 2055.

- GoN. 2011. Climate change policy, 2067. :11.
- GoN. 2014. Community Forest Product Collection and Sale Directive; Government of Nepal (GoN): Kathmandu, Nepal.
- GoN. 2016. First Nationally Determined Contribution (NDC).  
<https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nepal%20First/Nepal%20First%20NDC.pdf>.
- GoN. 2017. Investment Plan for Nepal Investing in Forests for Prosperity at a Time of Transformation.  
[https://www.climateinvestmentfunds.org/sites/cif\\_enc/files/fip\\_ip\\_nepal.pdf](https://www.climateinvestmentfunds.org/sites/cif_enc/files/fip_ip_nepal.pdf).
- GoN. 2017. Disaster Risk Reduction and Management Act, 2074.
- GoN. 2019. The Foreign Investment and Technology Transfer Act, 2075.
- GoN. 2020. Second Nationally Determined Contribution (NDC).  
[https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nepal%20Second/Second%20Nationally%20etermined%20Contribution%20\(NDC\)%20-%202020.pdf](https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Nepal%20Second/Second%20Nationally%20etermined%20Contribution%20(NDC)%20-%202020.pdf).
- GoN/MoE. 2010. National Adaptation Programme of Action (NAPA) to Climate Change. Kathmandu: Government of Nepal, Ministry of Environment.
- GoN/MoE. 2019. National framework on local adaptation plans for action (LAPA). Kathmandu: Government of Nepal, Ministry of Environment.
- GoN. 2018. National Policy for Disaster Risk Reduction.  
<http://www.drrportal.gov.np/uploads/document/1476.pdf>.
- Goodall SK. 2004. Rural-to-urban migration and urbanization in Leh, Ladakh. *Mountain research and development*. 24(3):220–227.
- HMG. 1973. National Parks and Conservation Act 2029. *Nepal Gazette* 2029–11–28 B.S: 5 pp.
- Hoermann B, Kollmair M. 2009. Labour migration and remittances in the Hindu Kush-Himalayan region. International Centre for Integrated Mountain Kathmandu.
- Lindt JW, Amini MO, Rammer D, Line P, Pei S, Popovski M. 2020. Seismic Performance Factors for Cross-Laminated Timber Shear Wall Systems in the United States. *J Struct Eng*. 146(9):04020172.  
 doi:10.1061/(ASCE)ST.1943-541X.0002718.
- Liu Y, Guo H, Sun C, Chang W-S. 2016. Assessing cross laminated timber (CLT) as an alternative material for mid-rise residential buildings in cold regions in China—A life-cycle assessment approach. *Sustainability*. 8(10):1047.
- Mausam. 2016 Jun 20. Over 80 per cent of timber imported from foreign countries. *The Himalayan Times*. [accessed 2021 May 18]. <https://thehimalayantimes.com/kathmandu/80-per-cent-timber-imported-foreign-countries>.
- MoLJCAPA. 2017. Disaster risk reduction and management act 2017. Kathmandu: Ministry of Law, Justice and Parliamentary Affairs.
- Nepal Planning Commission. 2015. Nepal earthquake 2015: post disaster needs assessment. Government of Nepal.
- Nepal P, Khanal NR, Sharma BPP. 2018. Policies and Institutions for Disaster Risk Management in Nepal: A Review. *Geographical Journal of Nepal*. 11:1–24. doi:10.3126/gjn.v11i0.19546.



- Nidheesh PV, Kumar MS. 2019. An overview of environmental sustainability in cement and steel production. *Journal of Cleaner Production*. 231:856–871. doi:10.1016/j.jclepro.2019.05.251.
- Nuberg I, Shrestha KK, Bartlett AG. 2019. Pathways to forest wealth in Nepal. *Australian Forestry*. 82(51):106–120.
- OECD. 2019. Nepal (NPL) Exports, Imports, and Trade Partners | OECD - The Observatory of Economic Complexity. [accessed 2021 Aug 13]. <https://oec.world/en/profile/country/npl#trade-products>.
- Poudyal BH, Maraseni T, Cockfield G. 2020. An assessment of the policies and practices of selective logging and timber utilization: A case study from natural forests of Tarai Nepal and Queensland Australia. *Land Use Policy*. 91:104422. doi:10.1016/j.landusepol.2019.104422.
- Press A. 2015 May 30. Earthquake measuring 8.5 magnitude shakes most of Japan. *The Guardian*. [accessed 2020 Jul 20]. <https://www.theguardian.com/world/2015/may/30/japan-earthquake-85-magnitude-ogasawara-islands>.
- RSS. 2019. Country's dependency on wood increasing, timber import exceeds Rs 6 billion. *My Republica*. [accessed 2021 May 18]. <http://myrepublica.nagariknetwork.com/news/70395/>.
- Timsina NP. 2005. Supporting Livelihoods through Employment: The Chaubas-Bhumlu Community Sawmill, Nepal. :23.
- Tiwari PC, Joshi B. 2015. Climate change and rural out-migration in Himalaya. *Change and Adaptation in Socio-Ecological Systems*. 1(open-issue).
- UN Comtrade. 2021. Nepal | Imports and Exports | World | Plywood, veneered panels and similar laminated wood | Value (US\$) and Value Growth, YoY (%) | 2003 - 2017. [accessed 2021 May 18]. <https://tredeconomy.com/data/h2/Nepal/4412>.
- UNDRR. 2019. Nepal policy for disaster risk reduction (2018) - Policy, Plans & Statements - Knowledge Base - PreventionWeb.net. [accessed 2021 Jul 21]. <https://www.preventionweb.net/english/professional/policies/v.php?id=64693>.
- World Bank. 2017. Nepal Wood Imports by country 2017 | WITS Data. [accessed 2021 Nov 10]. [https://wits.worldbank.org/CountryProfile/en/Country/NPL/Year/LTST/TradeFlow/Import/Partner/by-country/Product/44-49\\_Wood](https://wits.worldbank.org/CountryProfile/en/Country/NPL/Year/LTST/TradeFlow/Import/Partner/by-country/Product/44-49_Wood).
- Zeng N, King AW, Zaitchik B, Wohlschlaeger SD, Gregg J, Wang S, Kirk-Davidoff D. 2013. Carbon sequestration via wood harvest and storage: An assessment of its harvest potential. *Climatic Change*. 118(2):245–257. doi:10.1007/s10584-012-0624-0.