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A call for *'management authorship'* in community forestry

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ABSTRACT

Community forestry is becoming an increasingly popular forest management model worldwide. Community structure, property rights, and institutional perspectives of community forestry have been discussed so far. Yet, the question of how to integrate scientific knowledge into indigenous practices has not been sufficiently articulated, and this is the most significant issue in uncertain yet complex socio-ecological systems. Examining the current policy struggle of scientific vs indigenous practices in a pioneering country of community forestry–Nepal, we propose a framework of 'management authorship' in community forestry. As opposed to the classical approach of 'biosphere people' influencing 'ecosystem people' by injecting science into the community, this perspective paper would be instrumental in integrating science into indigenous practices without compromising capacity, confidence, and stewardship of local actors over the resulting adaptive management practices.

1. Introduction

Community forestry (CF) program has been practiced for decades in developed and developing countries for environment conservation with livelihood support and economic development (Brown, 2021; Hajjar et al., 2021; Nagendra, 2018). CF is one of the successful examples of community based natural resource management. More than half a billion people are engaged in some form of CF, and it represents the most crucial socio-ecological interdependencies of the tropical landscapes in the global south (Aryal et al., 2019; Baynes et al., 2015; Butarbutar et al., 2019; de la Mora et al., 2021). While standing as a compelling approach to sustainable forest management, the CF program has also been contested from various social, institutional, and managerial perspectives. A plethora of literature can be found explaining social dynamics and institutional perspectives on CF (Aryal et al., 2019; Gilmour, 2016; Hajjar et al., 2021; Kimengsi and Bhusal, 2022; Laudari et al., 2019). Yet, critical analyses of the CF program from its management perspective have rarely been undertaken in the past.

Institutionalization and de-institutionalization of public policy, especially for community based natural resources, have been examined and evaluated from multiple perspectives, including the structure of the community (Poteete and Ostrom, 2004), property rights and decentralization (Agrawal and Ostrom, 2001; Gilmour, 2016; Schlager and Ostrom, 1992), needs and interests (Carr, 2004), institutions (Clark, 1990; Hardin, 2009), embedded rules and social accountability (Cox et al., 2010; Harkes, 2006), environmental justice (He et al., 2021), and many others. However, these theoretical constructs are not enough to explain the inherent dynamics of knowledge factors in managing CF, as evident by the current policy turmoil in CF in Nepal. Being one of the pioneer countries in CF, Nepal has about five decades of experience on successful implementation of the CF program, engaging half of the country's population for managing one-third of the total forestland in Nepal (Aryal et al., 2020, 2019; Laudari et al., 2022; Maraseni et al., 2014). However, the country is currently suffering policy chaos in CF, regarding the management approach, whether it be indigenous or scientific (Aryal et al., 2022).

The debate of scientific management and indigenous management is not a new issue in forestry sector. In case of Nepal, application of operational forest management plan in 1995 has augmented the debate of scientific management in community based natural resource management (Laudari et al., 2019), which has been dominating the policy sphere of Nepal's forestry sector since 2014 with the endorsement of scientific forest management (SciFM) guideline by the government of Nepal. Most forest technicians and experts are in favor of applying SciFM practices while community activists (including national federation of CF users) and social scientists are in opposition to the application of SciFM

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in CF. Alongside the mounting debates of management approach, the practices of SciFM have been applied in many CFs throughout the country, especially in the southern lowland and mid-hills region. Being aligned, the Forestry Sector Strategy of Nepal has also aimed to implement SciFM in at least 50 % of forest areas in the Southern lowlands of Nepal by 2025. However, after a series of protests and campaigning from a group of community actors against the SciFM (*see in detail*: Aryal et al., 2022), the government of Nepal suspended SciFM policy in 2021. Differing perspectives and worldviews, actors' coalition, and political interest might be one scholarship of analysis, but the conflict of knowledge is among the most populated discursive struggles in this policy domain. Accordingly, more than 750 community forests, 30 collaborative forests, and 7 block forests, comprising a total area of 177, 000 ha, is currently on-hold with no forest management activities. Recently held– 7th National Workshop on Community Forestry (June 2022) was expected to guide the management trajectories of community forestry but became unsuccessful in specifying management modality as such. A full-fledged ethnographic study might be required to dig out the complex socio-ecological systems, yet we aim to communicate the synopsis of the most emerging policy idea– 'management authorship' through this perspective paper. This paper is based on the witnessing of first two authors in policy pathways of Nepal's community forestry for more than two decades, and engagement of the first author in numerous formal and informal investigations and case studies (both bureaucratic and scholarly in nature) about the debates of SciFM in CF at the field level over the last five years.

2. The knowledge factors

Territorial and local knowledge was threatened by modernization, technology and development in the 20th century (Dove, 2006). In the economy-led world of development discourse, there was a counter argument in favor of indigenous knowledge that it can serve as a long-tested unique knowledge system for conservation and development (Ford et al., 2016; Nazarea, 1999; Sillitoe et al., 2002). Accordingly, the concept of indigenous knowledge was mainstreamed in global environmental discourse. For example, the Rio declaration (1992, Principle 22) emphasized on the integration of indigenous knowledge for environment protection; the World Bank reformed its policy to embrace role of indigenous people in development since 1996; the UN celebrated 1995–2004 as the 'indigenous people' decade to focus on international efforts on strengthening human rights, health, education, and development; and the International Labor Organization adopted a convention (# 169) in 1989 with the central aim to protect human rights of Indigenous and Tribal people.

If we may borrow a term defined by Dasmann (1976), 'biosphere people', who have the misconception that market economy and state institutions can fix environmental problems, are leading and representing numerous national and international environmental organizations (Gadgil et al., 2021). Along with the thread of global environmental change, four different worldviews are prominent in global political economy: market liberals, institutionalists, bio-environmentalists, and social greens (Clapp and Dauvergne, 2011). Former two worldviews correspond directly to the biosphere people. For example, market liberals believe on human ingenuity, and encourage economic growth, technological innovations, and open market, while institutionalists seek for global institutions and capacity building to solve environmental problems. Bio-environmentalists and social greens, who advocate for welfare and returning autonomy to the local levels for managing natural resources, are also from the category of biosphere people. All these worldviews supposed to have knowledge superiority within themselves, the only difference with the latter two is that they believe on indigenous people being put forward and rewarded for managing natural resources. It is not about egalitarian or elitism of knowledge superiority but place-based heritage of science and arts. Alternatively, indigenous people might also possess different worldviews depending on their formal or informal engagement in knowledge production system. But, in reality, indigenous people, categorized as 'ecosystem people' by Dasmann (1976), who directly depend and heavily rely on nearby natural resources, are far away from the ideation and framing of national and international policy instruments. Consequently, global, as well as state actors, have considered indigenous knowledge as something that has to be cared for, protected, and preserved. But the genuine intensity of the knowledge system and generations of tested problem-solving ideas have rarely been embraced in the global policy arena. Classical debate of indigenous knowledge vs. western science might be one scholarship for discussion regarding socio-economic development; however, here we focus the importance of putting indigenous people as the management authors and frontliners rather than policy readers/adopters to manage the natural resources of their immediate surroundings.

3. Indigenous vs scientific practices in community forestry

Forest is a major source of various provisioning and non-provisioning ecosystem services for resource dependent rural communities (i.e., indigenous people or community actors) in developing countries. The CF program, formally started in 1978, has been a milestone in Nepal's forestry sector which embraced and formalized the age old practices of indigenous forest management (Acharya, 2002; Fisher, 1989; Gilmour, 1990). In the last five decades, the CF program has been considered as one of the most successful community based forest management models in the global policy arena (Aryal et al., 2019; Gilmour, 2016; Laudari et al., 2022). The success of the program is attributed to validation, internalization, and institutionalization of the indigenous practices of forest management in nation's priority of action for forest and ecosystem management (Aryal et al., 2021). Moreover, Nepal's CF is supposed to address eight design principles of managing commons by Ostrom (1990), five key factors of CF success (i.e., equity, property rights, governance, benefit sharing, and external support) by Baynes et al. (2015), key predictors of successful CF program (i.e., national context, tenure rights, user-group context, biophysical condition, and management intervention) by Hajjar et al. (2021), and the presence of 'community of practice' as suggested by Arts and de Koning (2017). Management plans and technical guidelines for forest management under CF was also flexible enough to accommodate the uniqueness of various types of communities, for example, the *Sherpa* community in the high mountain region exhibits different practices of management while the *Tharu* community in the lowland region practices different approach to forest management. These variations in indigenous practices are accommodated in CF policy and programs.

Scientific practices in CF (i.e., SciFM) have emerged as a critic to the indigenous practices that CF has been adopting passive management, failing to satisfy the growing market demand of forest products despite forestland covering half of the total area of the country. SciFM in CF is similar to the indigenous practices in terms of governance and institutions, except for technical prescription of forest management. Basically, SciFM employs a structured silvicultural system (i.e., irregular shelterwood system), which involves silvicultural activities such as preparatory felling, regeneration felling, cleaning, thinning, and other post-harvesting operation (Awasthi et al., 2020). To carry out the operations, the forest area is divided into various periodic blocks based on the rotation period of the target tree species, and each periodic block is further divided into annual sub-blocks based on the regeneration period of the species (Awasthi et al., 2015). Intensive silvicultural activities are carried out in subsequent annual sub-blocks for the whole rotation period. In brief, SciFM is overly technical for CF users in terms of regeneration strategy, stand growth and yield regulation (Aryal et al., 2022). There is nothing to lose for CF users by adopting SciFM, except their confidence of management, albeit they are benefitted by the increased supply of forest products, improved forest health, and the rural economy. Clearly defined boundaries, property rights, benefit

sharing, and various other institutional arrangements remain the same for both indigenous and scientific practices in CF. Although some scholars have criticized SciFM as the silvicultural madness and recentralization of well-established CF institutions (Basnyat et al., 2020, 2018; Poudyal et al., 2020), neither the government policies are indicative of recentralizing CF (MFSC Nepal, 2019, 2014) nor it is just a mere silvicultural madness. Instead, forest health and regeneration under SciFM are improved through scientific management over the indigenous practices (Aryal et al., 2022; Awasthi et al., 2020). The difference that SciFM makes to CF might be the issue of community ideals, confidence, capacity, and credibility of the CF users towards the forest management model as such.

4. Management authorship: a way forward

Management prescriptions in CF are highly influenced by the actors involved in planning and designing the set of forest management activities. Other things being the same, CF users define and design forest management activities in indigenous practices of CF. In scientific practices of CF, forest technicians and bureaucrats (precisely, a team of experts) define and design the management activities and CF users obey and try to adopt the scientific practices (Aryal et al., 2022; Laudari et al., 2019). In other words, SciFM in CF is a reflection of what de Koning et al. (2014) and Ojha (2006) blame forestry specialists and technicians for influencing indigenous communities by injecting science, a clear example of 'biosphere people' influencing 'ecosystem people' by imposing a set of new knowledge systems (Dasmann, 1976). In the dynamic socio-ecological construct and exacerbating climate uncertainties, it is not recommended to pick-up the status-quo of a single knowledge system, be it indigenous or scientific. Indigenous and scientific knowledge can be integrated as suggested by Turnhout et al. (2012) in wildlife management in India. Rather, we suggest creating a situation where indigenous people (or the CF users in our case) are capable and confident enough to refine their practices based on their own state of mind and context.

We acknowledge previous efforts to integrate new knowledge into the existing social institutions by Wenger (2000) about 'community of practice', implying the importance of knowing-while-doing through a series of interaction and social learning. He introduced the notion of belonging in the success of organizations via engagement (doing together), alignment (compatibility with external environment) and imagination (designing the pathways of action). Similarly, Leach et al. (1999) proposed 'environmental entitlements' to fix the multilayered institutional matrix of CF practices which focus on legitimate command of community actors over the resources for effective delivery of community based forest management practices. The concept of 'citizen science' has also gained momentum in the recent years to empower the communities to engage in scientific endeavors of resource management (Hecker et al., 2018; Irwin, 1995). Likewise, the 'practice-based approach' believes that communities only accept new institutional arrangements if they are practical and legitimate to them (Arts et al., 2014; Nicolini, 2016). Those theoretical constructs tend to synchronize new introduced institutions (with new knowledge systems) to the already existing institutions (with indigenous practices), basically a bricolage practices in a multifaceted and nested institutional interface (Cleaver, 2002). The perspective of who owns the output knowledge system is not quite answered, which is crucial in sustaining the new hybrid institutions. It is not a mere 'conundrum of rebranding' as suspected by in Cooper et al. (2021) with regard to community science or citizen science in representing formal scientific enterprises, but we are concerned with the value of place-based knowledge, inherited scholarship of science and arts, and stewardship of adaptive and improvised knowledge system in community based natural resource management.

In this regard, we have proposed a new perspective in community forestry, *management authorship*. In the context of community-based forest management, our proposal comes with the definition of management authorship as "*the state of forest owners being themselves the creator or designer, planner, and implementer of a set of rewarding forest management activities under their management jurisdictions*". Management authorship envisions ecosystem people (i.e., CF users) to own their resources not only in terms of their property right but also to the set of management activities of the resources, satisfying both ecological integrity and social aspirations. Intellectual property rights (i.e., copyrights and patents) are rather the formal endorsement of the original source of intellect (Maskus, 2000; May and Sell, 2006). Management authorship, however, is an informal set of skills and knowledge that enable community actors being the Master of Management for their natural resources. Having put the ecosystem people at the center, we do not advocate that indigenous knowledge should be preserved as practiced as such. Rather, we believe in adaptive management of natural resources including need-based improvisation in indigenous knowledge to cope with the emerging uncertain yet complicated socio-ecological systems. Unlike management authority, which is ensured by legislations, management authorship aims to evaluate the stewardship, capacity, and credibility of the communities towards adaptive management in practice. Management authorship is expected provide credits to the community for overall management ability, effectiveness, and efficiency. It envisions creation of a new idea or designing of existing and reformed idea, planning, and deciding appropriate management scheme (including the selection of best available management activities) by the community actors themselves for better performativity.

In its primitive form, management authorship framework can be explained through Fig. 1. Indigenous practices which are designed and practiced by indigenous people might take generations to reform according to the changing context. In scientific management framework, an idea with technical and/or scientific advancement is overlaid to the long-held existing idea in a community. Similarly, scholars and technicians (including philosopher) dominate indigenous people through their power of expertize in the discursive platform of institutionalization. This form of modification in the management ideas due to the imposition of introduced institutions (invaded management) to the existing institutions causes a radical shift in management regimes but claimed to produce unexpected results. For example, de Koning and Benneker (2013) term this as the bricolage practices which determine how the introduced institutions interact with the existing institutions. The introduced institutions (or the set of knowledge) might be accepted, rejected, or partially accepted (i.e., accepted with modification) which is dependent on the existing logic of practice of the indigenous communities (Arts et al., 2014). For instance, an approach to forest management might be legitimated if it is linked to age-old community practices, adopted if it fits with the necessities of embedded practices, and rejected if it clashes with the identity and knowledge of the community (Cleaver, 2017). In this regard, the outcome of scientific management framework is highly uncertain because the existing idea or the logic of practice is deeply rooted to the social institutions that have been developed for the centuries.

As an alternative to the unpredictable institutional reform, management authorship framework allows more flexible and plausible institutional arrangement in CF. In the proposed framework of management authorship, neither scholars/technicians invade indigenous people through the power of knowledge, nor is scientific innovation injected to the indigenous practices directly. Instead, indigenous people are exposed to scientific innovation through direct or indirect means of demonstration, exposure, or any other forms of extension activities. Rather than one way flow of introduced idea to existing idea, management authorship allows forward and backward linkages between the ideas allowing introduced ideas to be informed and inspired from the existing ideas as well. The framework of management authorship believes that only the ecosystem people know the best use of existing idea (i.e., indigenous/traditional knowledge), and they deserve full rights on either continuation or modification of the existing ideas. Technology

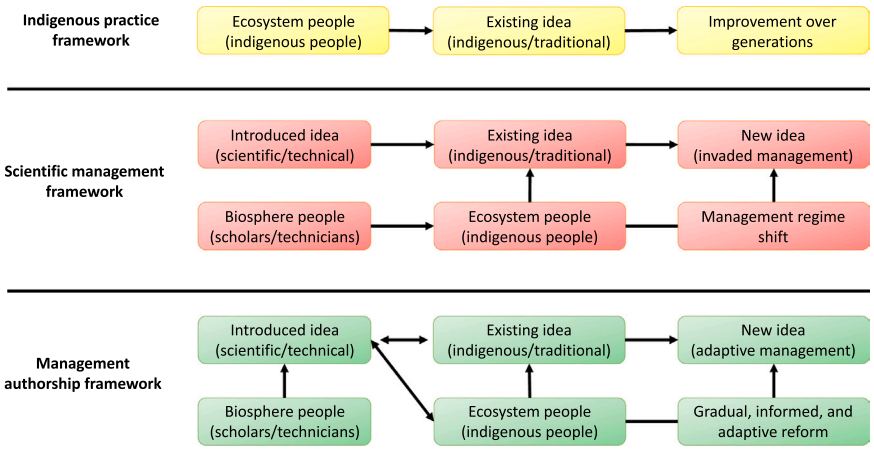

Fig. 1. Comparative illustration of indigenous practice, scientific management, and management authorship framework

and development might be different notions that can be applied to the private sector, or the state controlled natural resources. But communal resources are different in that only communities know their interdependency with the natural resources of their vicinity. Likewise, the institutionalization of a new set of ideas or reformed ideas in CF is a long process, implying a gradual, informed, and adaptive reform through knowing-by-doing. Eventually, the introduced idea comes to the new idea over which the indigenous people have full confidence and management authorship.

5. Conclusions

As a promising approach to natural resource management, community forestry (CF) has been an instrumental model globally. However, the emerging reform in management approach to the CF, as required to address complex and uncertain socio-ecological systems, has been contested on the verge of scientific vs. indigenous knowledge. Management prescriptions developed by technicians are not sustained in CF even if those practices are technically sound, ecologically viable, and economically profitable. As we observed in Nepal, community forest users do not always accept the forest management recipe of external scholars or technicians neither in form of power of knowledge nor the scientific innovativeness. The current policy turmoil of management practices and prescription in Nepal's CF program have shown the need for the framework of management authorship in managing natural resources. We argue that management practices, resulting from the integration of scientific and indigenous knowledge, are sustained only when CF users hold their capacity, credibility, and stewardship over management practices. As evident through the de-institutionalization of scientific practices in one of the world's pioneer countries in CF, Nepal, there is a clear message that management authorship is the next step in promoting adaptive management of community based natural resource management worldwide. While adopting the management authorship framework, neither is the science injected to the indigenous practices, nor do the scholars/technicians invade community people through their power of knowledge. But the community actors are exposed to the science and innovation, and they understand the science by themselves in their own context of existing management practices and make the necessary gradual reform in their indigenous practices through adaptive management practices.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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References

Acharya, K.P., 2002. Twenty-four years of community forestry in Nepal. Int. For. Rev. 4, 149–156. https://doi.org/10.1505/IFOR.4.2.149.17447.

Agrawal, A., Ostrom, E., 2001. Collective action, property rights, and decentralization in resource use in India and Nepal. Polit. Soc. 29, 485–514. https://doi.org/10.1177/0032329201029004002.

Arts, B., de Koning, J., 2017. Community forest management: an assessment and explanation of its performance through QCA. World Dev. 96, 315–325. https://doi.org/10.1016/j.worlddev.2017.03.014.

Arts, B., Behagel, J., Turnhout, E., de Koning, J., van Bommel, S., 2014. A practice based approach to forest governance. For. Policy Econ. Assess. For. Gov. - Anal. Concepts their Appl. 49, 4–11. https://doi.org/10.1016/j.forpol.2014.04.001.

Aryal, K., Laudari, H.K., Ojha, H.R., 2019. To what extent is Nepal's community forestry contributing to the sustainable development goals? An institutional interaction perspective. Int. J. Sustain. Dev. World Ecol. 0, 1–12. https://doi.org/10.1080/13504509.2019.1627681.

Aryal, K., Ojha, B.R., Maraseni, T., 2021. Perceived importance and economic valuation of ecosystem services in Ghodaghodi wetland of Nepal. Land Use Policy 106, 105450. https://doi.org/10.1016/j.landusepol.2021.105450.

Aryal, K., Rijal, A., Maraseni, T., Parajuli, M., 2020. Why is the private forest program stunted in Nepal. Environ. Manag. 66, 535–548. https://doi.org/10.1007/s00267-020-01343-z.

Aryal, K., Laudari, H.K., Maraseni, T., Pathak, B.R., 2022. Navigating policy debates of and discourse coalitions on Nepal's Scientific Forest Management. For. Policy Econ. 141, 102768 https://doi.org/10.1016/j.forpol.2022.102768.

Awasthi, N., Bhandari, S.K., Khanal, Y., 2015. Does scientific forest management promote plant species diversity and regeneration in Sal (Shorea robusta) forest? A case study from Lumbini collaborative forest, Rupandehi, Nepal. Banko 25, 20–29. https://doi.org/10.3126/banko.v25i1.13468.

Awasthi, N., Aryal, K., Bahadur Khanal Chhetri, B., Bhandari, S.K., Khanal, Y., Gotame, P., Baral, K., 2020. Reflecting on species diversity and regeneration dynamics of scientific forest management practices in Nepal. For. Ecol. Manag. 474, 118378 https://doi.org/10.1016/j.foreco.2020.118378.

Basnyat, B., Treue, T., Pokharel, R.K., 2018. Silvicultural madness: a case from the "Scientific Forestry" initiative in the community forests of Nepal. Banko 54–64. https://doi.org/10.3126/banko.v27i3.20542.

Basnyat, B., Treue, T., Pokharel, R., Baral, S., Rumba, Y., 2020. Re-centralisation through fake Scientificness: The case of community forestry in Nepal. For. Policy Econ. 115. https://doi.org/10.1016/j.forpol.2020.102147.

Baynes, J., Herbohn, J., Smith, C., Fisher, R., Bray, D., 2015. Key factors which influence the success of community forestry in developing countries. Glob. Environ. Change 35, 226–238. https://doi.org/10.1016/j.gloenvcha.2015.09.011.
Brown, H.C.P., 2021. Youth, migration and community forestry in the Global South. For. Trees Livelihoods 30, 213–225. https://doi.org/10.1080/14728028.2021.1958065.
Butarbutar, T., Soedirman, S., Neupane, P.R., Köhl, M., 2019. Carbon recovery following selective logging in tropical rainforests in Kalimantan, Indonesia. For. Ecosyst. 6, 36. https://doi.org/10.1186/s40663-019-0195-x.
Carr, A.J.L., 2004. Why do we all need community science? Soc. Nat. Resour.
Clapp, J., Dauvergne, P., 2011. Paths to a Green World, Second Edition: the Political Economy of the Global Environment. MIT Press.
Clark, C.W., 1990. The optimal management of renewable resources. Math. Bioecon. 2, 2.
Cleaver, F., 2002. Reinventing institutions: bricolage and the social embeddedness of natural resource management. Eur. J. Dev. Res. 14, 11–30. https://doi.org/10.1080/714000425.
Cleaver, F., 2017. Development Through Bricolage: Rethinking Institutions for Natural Resource Management. Routledge, London. https://doi.org/10.4324/9781315094915.
Cooper, C.B., Hawn, C.L., Larson, L.R., Parrish, J.K., Bowser, G., Cavalier, D., Dunn, R.R., Haklay, M., (Muki), Gupta, K.K., Jelks, N.O., Johnson, V.A., Katti, M., Leggett, Z., Wilson, O.R., Wilson, S., 2021. Inclusion in citizen science: the conundrum of rebranding. Science 372, 1386–1388. https://doi.org/10.1126/science.abi6487.
Cox, M., Arnold, G., Tomás, S.V., 2010. A review of design principles for community-based natural resource management. Ecol. Soc. 15.
Dasmann, R., 1976. Future primitive: ecosystem people versus biosphere people. Coevol. Q. 26–31.
Dove, M.R., 2006. Indigenous people and environmental politics. Annu. Rev. Anthropol. 35, 191–208. https://doi.org/10.1146/annurev.anthro.35.081705.123235.
Fisher, R.J., 1989. Indigenous Systems of Common Property Forest Management in Nepal. Environment and Policy Institute, East-West Center.
Ford, J.D., Cameron, L., Rubis, J., Maillet, M., Nakashima, D., Willox, A.C., Pearce, T., 2016. Including indigenous knowledge and experience in IPCC assessment reports. Nat. Clim. Change 6, 349–353. https://doi.org/10.1038/nclimate2954.
Gadgil, M., Berkes, F., Folke, C., 2021. Indigenous knowledge: from local to global. Ambio 50, 967–969. https://doi.org/10.1007/s13280-020-01478-7.
Gilmour, D.A., 1990. Resource availability and indigenous forest management systems in Nepal. Soc. Nat. Resour. 3, 145–158. https://doi.org/10.1080/08941929009380714.
Gilmour, D., 2016. Forty years of community-based forestry: a review of its extent and effectiveness. FAO Forestry Paper.
Hajjar, R., Oldekop, J.A., Cronkleton, P., Newton, P., Russell, A.J.M., Zhou, W., 2021. A global analysis of the social and environmental outcomes of community forests. Nat. Sustain. 4, 216–224. https://doi.org/10.1038/s41893-020-00633-y.
Hardin, G., 2009. The tragedy of the commons. J. Nat. Resour. Policy Res. 1, 243–253. https://doi.org/10.1080/19390450903037302.
Harkes, I.H.T., 2006. Fisheries Co-management, the Role of Local Institutions and Decentralisation in Southeast Asia: With Specific Reference To Marine Sasi in Central Maluku, Indonesia. Leiden University.
He, J., Martin, A., Lang, R., Gross-Camp, N., 2021. Explaining success on community forestry through a lens of environmental justice: local justice norms and practices in China. World Dev. 142, 105450 https://doi.org/10.1016/j.worlddev.2021.105450.
Hecker, S., Haklay, M., Bowser, A., Makuch, Z., Vogel, J., Bonn, A. (Eds.), 2018. Citizen Science: Innovation in Open Science, Society and Policy. UCL Press. https://doi.org/10.2307/j.ctv550cf2.
Irwin, A., 1995. Citizen Science: a Study of People, Expertise, and Sustainable Development, Environment and Society. Routledge, London; New York.
Kimengsi, J.N., Bhusal, P., 2022. Community forestry governance: lessons for Cameroon and Nepal. Soc. Nat. Resour. 35, 447–464. https://doi.org/10.1080/08941920.2021.2006844.
de Koning, J., Benneker, C., 2013. Bricolage practices in local forestry. In: Arts, B., Behagel, J., van Bommel, S., de Koning, J., Turnhout, E. (Eds.), Forest and Nature Governance: a Practice Based Approach, World Forests. Springer, Netherlands, Dordrecht, pp. 49–67. https://doi.org/10.1007/978-94-007-5113-2_3.
de Koning, J., Turnhout, E., Winkel, G., Blondet, M., Borras, L., Ferranti, F., Geitzenauer, M., Sotirov, M., Jump, A., 2014. Managing climate change in conservation practice: an exploration of the science–management interface in beech forest management. Biodivers. Conserv 23, 3657–3671. https://doi.org/10.1007/s10531-014-0781-8.
Laudari, H.K., Aryal, K., Maraseni, T., 2019. A postmortem of forest policy dynamics of Nepal. Land Use Policy, 104338. https://doi.org/10.1016/j.landusepol.2019.104338.
Laudari, H.K., Aryal, K., Maraseni, T., Pariyar, S., Pant, B., Bhattarai, S., Kaini, T.R., Karki, G., Marahattha, A., 2022. Sixty-five years of forest restoration in Nepal: lessons learned and way forward. Land Use Policy 115, 106033. https://doi.org/10.1016/j.landusepol.2022.106033.
Leach, M., Mearns, R., Scoones, I., 1999. Environmental entitlements: dynamics and institutions in community-based natural resource management. World Dev. 27, 225–247. https://doi.org/10.1016/S0305-750X(98)00141-7.
Maraseni, T.N., Neupane, P.R., Lopez-Casero, F., Cadman, T., 2014. An assessment of the impacts of the REDD+ pilot project on community forests user groups (CFUGs) and their community forests in Nepal. J. Environ. Manag. 136, 37–46. https://doi.org/10.1016/j.jenvman.2014.01.011.
Maskus, K.E., 2000. Intellectual Property Rights in the Global Economy. Peterson Institute.
May, C., Sell, S.K., 2006. Intellectual Property Rights: a Critical History.
MFSC Nepal, 2014. Scientific Forest Management Guideline, 2014.
MFSC Nepal, 2019. National Forest Policy 2019.
de la Mora, G.D., la, M., Sánchez-Nupan, L.O., Castro-Torres, B., Galicia, L., 2021. Sustainable community forest management in mexico: an integrated model of three socio-ecological frameworks. Environ. Manag. 68, 900–913. https://doi.org/10.1007/s00267-021-01512-8.
Nagendra, H., 2018. The global south is rich in sustainability lessons that students deserve to hear. Nature 557, 485–488. https://doi.org/10.1038/d41586-018-05210-0.
Nazarea, V.D., 1999. Ethnoecology: Situated Knowledge/Located Lives. University of Arizona Press.
Nicolini, D., 2016. Knowing in Organizations: a Practice-Based Approach: A Practice-Based Approach. Routledge, New York. https://doi.org/10.4324/9781315290973.
Ojha, H.R., 2006. Techno-bureaucratic Doxa and challenges for deliberative governance: the case of community forestry policy and practice in Nepal. Policy Soc. 25, 131–175. https://doi.org/10.1016/S1449-4035(06)70077-7.
Ostrom, E., 1990. Governing the Commons: the Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge, UK.
Poteete, A.R., Ostrom, E., 2004. Heterogeneity, group size and collective action: the role of institutions in forest management. Dev. Change 35, 435–461. https://doi.org/10.1111/j.1467-7660.2004.00360.x.
Poudyal, B., Maraseni, T., Cockfield, G., 2020. Scientific forest management practice in Nepal: critical reflections from stakeholders' perspectives. Forests 11. https://doi.org/10.3390/f11010027.
Schlager, E., Ostrom, E., 1992. Property-rights regimes and natural resources: a conceptual analysis. Land Econ. 68, 249–262. https://doi.org/10.2307/3146375.
Sillitoe, P., Bicker, A., Pottier, J., Sillitoe, P.P., 2002. Participating in Development: Approaches to Indigenous Knowledge. Psychology Press.
Turnhout, E., Bloomfield, B., Hulme, M., Vogel, J., Wynne, B., 2012. Listen to the voices of experience. Nature 488, 454–455. https://doi.org/10.1038/488454a.
Wenger, E., 2000. Communities of practice and social learning systems. Organization 7, 225–246. https://doi.org/10.1177/135050840072002.