Banko Janakari

A Journal of Forestry Information for Nepal

Silviculture for sustainable forest management in Nepal

Shankar Adhikari
Guest Editor
Silviculture Division, Department of Forests

The role of silviculture in forest management has long been acknowledged to enhance forest productivity, uphold profitability and promote social well-being. Silviculture is understood as an art and science of cultivating and raising forest crops. As an art, silivicuture architects the composition and shape of forest; and as a science it predicts growth and stock of forest; and makes forest management systematic. However, all forests do not follow the same silvicultural system. It varies with species, age, geographical condition and management objectives of forest. Different types of silvicultural systems are in vogue in managing different types of forests in Nepal. Silvicultural system based forest management could be a vehicle to achieve Nepal's forestry sector vision "Forestry for Prosperity". Considering this fact, the Department of Forests, and the Department of Forest Research and Survey have organized the First National Silviculture Workshop, February 8–10, 2017 entitled "Silviculture for Sustainable Forest Management (SFM)". This special issue on Silviculture contains 18 selected papers from the workshop and covers a broad spectrum of forest management from the nursery and plantation management to the management of natural forest under various silvicultural system and forest management regimes.

The first paper in this issue by Gilmour [1] has extensively discussed the silviculture issues in the context of community forestry (CF). The author argues that "appropriate silviculture" is an important aspect in selection and use of silviculture in CF because silvicultural approaches and prescriptions need to be compatible for local users, as it has to promote long-term sustainability. For instance, silvicultural system and practices in CF with Terai broadleaf forest should be different from that of mountainous coniferous forest. The author further concludes that CF will not achieve full potential only through the conventional silvicultural management; rather it is possible if a holistic view is taken and a number of conditionalities are met. These conditionalities include secure tenure, an enabling regulating framework, good governance, viable technology, adequate market knowledge and a supportive bureaucracy; out of them, appropriate silviculture is one of the prerequisites coming under the viable technology. This argument is supported by Paudel [2], which has acknowledged the fact that despite being technically sounds, past efforts on silviculture based forest management in Nepal have failed due to lack of institutional capacity, political back-up, and conflict in the country. Considering the lessons

learned in the past, the author highlighted the vision of "Forestry for Prosperity", resulting in scientific forest management initiative. Yet there are several challenges to spearhead the SFM practices including inadequate human and financial resources, weak institutional and professional competency, and lack of professional and political commitments.

Plantation establishment and management of planted forest is another important aspect discussed in the workshop. Paudel and Acharya [3] assessed the survival status of planted seedling in fourteen CFs in Parbat district. Of total eleven species planted, only 58.6% survival rate was reported one year after the plantation. Small seedling size and unhealthy seedlings were identified as the main causes of seedling mortality followed by improper transportation and handling, fire, weeds, droughts, diseases, and grazing practices. The authors suggest that regular monitoring of plantation sites, and assessment of survival rate on different ecological zones on a regular basis for the effective establishment of planted seedlings in the forest. Although the earlier case has identified survival issues of the plantation in early age, Dangal and Das [4] presented a successful case of *Pinus patula* plantation establishment and/or management in a denuded hill of Kavrepalanchowk district, and impact of management practices on growth pattern. The authors conclude that the growth rate decreased after 12 years and the cumulative increment was higher in the lower density class but was found to have retarded rapidly after 15–17 years of age. One important lesson learned from the management implication on the growth pattern that planned thinning from the early age of 10–12 years and the final felling at the age of 30±5 years is found appropriate for *P. patula* to maximize volume production.

Plantations on a degraded land not only maximize volume and fulfill the forest products requirements but also contribute to forest landscape restoration (FLR). Besides Pine plantation, a bamboo plantation is also a viable option for FLR. Gautam et al. [5]illustrated another successful case of FLR on the degraded site of Dhaneshwor Baikiwa CF in Kavrepalanchowk district. It has converted the degraded site into the productive forest through monopodial moso bamboo (*Phyllostachys pubescens*) plantation, which could be scaled-up in a similar geographic location of Mid-hill region of Nepal.

Unlike planted forest, natural forest management is considered quite complex, and management practices and their impact on forest condition also vary from one forest type to another, and one management regime to another. A comparative study by Pokharel *et al.* [6] on forest cover changes in community forests with other management regimes shows that silvicultural practices in community forest areas have brought relatively better positive changes in the forest condition of Siwalik region of Nepal. In line with earlier findings of Pokharel *et al.* [6], Khanal and Adhikari [7] further illustrated how silviculture based scientific forest management supports regeneration promotion and income generation in Rupandehi district. The authors found out 6.4 times increase in seedlings and 3.4 times increase in saplings after one year of regeneration felling operation with a significant increase in income and local employment in that Terai district. In contrast, Basnyat *et al.* [8] strongly argued against the concept of

replicating the exact practices of scientific forest management in Terai to Mid-hill community forests as having little practical relevance due to differences in biophysical and socioeconomic status in different regions. This is because of administrative decisions being more powerful in guiding forest management decisions and suggested the replacement of existing scientific approach with adaptive management in CF. Yet, the authors don't oppose the ideas of applying silviculture operations in CF, instead argue for forest management operations such as forest protection, silvicultural and tending operations, should be implemented as mentioned in the management plan.

Despite the fact that forest inventory is the basis of designing and implementing silvicultural system and management operations in forests including CF, Baral *et al.* [9] suggested that the inventory results did not provide proper guidance on the selection of silvicultural operations in CF. Rather, silvicultural operations and systems were decided without a clear definition of the management objectives and they were very generic and largely ignored site-specific forest stand conditions. Therefore the authors strongly argue that the silvicultural operations of CF should be decided based on the management objectives and conditions of the forest, while also considering the ecological and economic value of the concerned forest.

Further, two papers in the special issue deal with the preparation of local volume table of important species in Terai region. Silwal *et al.* [10] emphasized the need of using the height to crown base as an important variable that affects main stem volume of *Shorea robusta* for a given diameter tree at a site, whereas Shrestha *et al.* [11] also acknowledged the importance of local volume tables for precise site-specific volume and therefore developed local volume tables for three important tree species, namely *Dalbergia sissoo, S. robusta* and *Terminalia alata.* These volume tables are expected to complement the field measurement and ease in volume estimation. This might further support designing and implementing appropriate silvicultural system in different forest types. Three papers in this special issue particularly took up this with reference to Terai and Mid-hill forests.

The paper by Subedi *et al.* [12] review silvicultural system applied in the Terai region of Nepal under scientific forest management to regulate yield and suggest new methods of thinning in natural forests with reference to Buddha Shanti collaborative forest in Nawalparasi district. The authors argue that irregular shelterwood system is an appropriate system of forest management while adopting the combination of area and stem control method for yield regulation. Yet, it is found that the prescribed system follows quite a rigid methodology, cumbersome and time taking process requiring total enumeration even to find out the most frequent size of pole in selected sub-compartment. On the other hand, based on the silviculture trial in Mid-hill of Nepal, Edwin *et al.* [13] examined the crown and regeneration response of Pine and Sal forests to selected silvicultural systems and practices such as uniform shelterwood system, selection system, and negative thinning with contrasting observation in both forest types. For example, whilst rigid silvicultural systems like shelterwood and selection systems were found creating canopy gap larger than negative thinning in Pine plantations and the rate of natural regeneration was directly related with the canopy gap, in Shorea-Castanopsis-Schima (Sal-Katus-Chilaune)

forest, negative thinning created canopy gap larger than selection system due to removal of 4-D trees. Yet the authors conclude that selection and shelterwood systems are better than current practices of negative thinning in this study. Moreover, in their another paper by Edwin *et al*, (14), further raised the question regarding the relevancy of current management practices based on the use of negative and crown thinning in matured community forests. The authors then proposed a new approach of q-factor for two reasons: (i) to address the existing problem resulting from the current management practices; and (ii) sustainable community forest management for wider adoption and policy recommendation.

The leasehold forest (LHF) management is relatively less studied areas in Nepal. To fulfill this knowledge gap, Yadav *et al*. [15] highlighted the significance of LHF for socio-economic benefits to the vulnerable and poor farmers through increased productivity of forestland with the use of appropriate silviculture operations.

In the only paper of special issue discussing the institutional modalities of community forests in Nepal, Paudel *et al*. [16] proposed "Silvo-Institutional Model" for a more productive, sustainable and equitable management of CF in Nepal. Two key findings of the paper include: (i) earlier efforts of silviculture-based forest management did not consider the policy and institutional dimension, as a result, those initiatives have failed in the past; and (ii) despite current initiatives looks promising from an active utilization of CF, they have faced with complex institutional and regulatory barriers.

Despite the fact that silvicultural and management issues of different forest types and regimes were primarily discussed in earlier papers, crosscutting issues such as changing forests condition in a depopulated rural landscape, and invasive species are also discussed in this issue. For example, Poudel *et al.* [17] have illustrated an interesting relationship between migration and forest cover changes. With increased migration and farmland abandonment in the Mid-hill, area under forests and shrub lands has increased and growing stock of CF is also increasing. However, these forests lack proper management and posed a higher risk of forest fire. In another paper dealing with the control measures of invasive species in grassland area, Aryal *et al*. [18] concluded that controlled fire is better than manual cutting for the management of grassland.

Overall, silvicultural systems and practices were developed in Nepal and several attempts were made to practice somewhat in isolation as a purely technical issue for SFM. As seen in this special issue, however, silviculture based SFM needs both technical and socio-economic aspects including appropriate inventory and resource assessment, silvicultural system and operations as well as proper institutional and governance modalities with the active engagement of relevant stakeholders. As rightly pointed out by Paudel [2], various aspects to be considered for SFM in Nepal include: (i) create an enabling environment towards SFM; (ii) institutional reorganization; (iii) reducing non-forestry workload of forestry staffs; (iv) establishment and strengthening of robust information system; (v) promoting long-term scientific research to better understand the response of various silvicultural systems

and management regimes; and (vi) increased investment in forest management.

As shown by multiple examples from various authors in this special issue, appropriate application of silviultural systems and various operations is the piv otal for the overall enhancement of forest productivity, profitability and sustain ability. It can be assured that the community and nation both receive increased benefits from the implementation of silviculture based forest management in Nepal. All relevant stakeholders including forest administration, local communities, academician and civil society need to come closer in developing and implementing site specific silvicultural systems for ensuring sustainable forest management and harness larger economic and ecological returns.

Footnote:

1. Gilmour, D. Silviculture and community forestry: looking backwards, looking forwards. 2. Poudel, K. C. Silviculture for Forest Management in Nepal. 3. Paudel, G. and Acharya, R. Survival status of young plantations in Parbat district, Nepal. 4. Dangal, S. P., and Das, A. K. Effect of management practice and age on increment in *Pinus patula* plantations in Nepal. 5. Gautam, G. P., Aryal R. R., and Lamichhane, P. Restoration of degraded land through Moso bamboo *(Phyllostachys pubescens)* plantation in the Mid-hills of Nepal. 6. Pokharel, B. K., Upreti, D. R., Niraula, R. R., and Pokharel, R. R. An assessment of the impact of silviculture and forest management regimes to forest cover change in the Churia region during 1992 to 2014. 7. Khanal. Y. and Adhikari, S. Regeneration promotion and income generation through scientific forest management in community forestry: a case study from Rupandehi district, Nepal. 8. Basnyat, B., Treue. T., and Pokharel R. K. Silvicultural madness: a case from the "Scientific Forestry Initiatives" in the community forests of Nepal. 9. Baral, S. G., Vacik, H., Chhetri B. B. K., and Gauli, K. The pertinent role of forest inventory in making choice of silvicultural operations in community forests of Nepal. 10. Silwal, R., Baral, S. K., and Chhetri, B. B. K., Modeling taper and volume of Sal *(Shorea robusta Gaertn. f.)* trees in the western Terai region of Nepal. 11. Shrestha, H. L., Kafle, M. R., Khanal K., Mandal, R. A., and Khanal, K. Developing local volume tables for three important tree species in Nawalparasi and Kapilvastu districts. 12. Subedi, V. R., Bhatta, K. D., Paudel, I. P., and Bhattarai, P. Application of silvicultural system, yield regulation and thinning practices in natural forests: case study from western Terai. 13. Cedamon, E., Paudel, G., Basyal, M., Nuberg, I., and Paudel, N. Crown and regeneration responses to silviculture systems in Pine and Sal forests: preliminary results from silviculture trials in Mid-hills Nepal. 14. Cedamon, E., Paudel, G., Basyal, M., Nuberg, I., and Shrestha, K. K. Applications of single-tree selection guideline following a DBq approachon Nepal's community forests. 15. Yadav, K. K., Kafley, G. P., and Yadav, K. P. Linking silvicultural aspects of pro-poor leasehold forestry for socio-economic benefits to the poor and vulnerable communities. 16. Sharma Paudel, N., Ojha, H., Shrestha, K., Cedamon, E., karki, R., Paudel, G., Basyal, M., Nuberg, I., and Dangal, S. Towards active utilisation of community forestry: Silvo-institutional model for sustainable forest management in Nepal. 17. Poudel, M., Kafle, G., Khanal, K., Dhungana, S., Oli, B. N., Dhankal, A., and Acharya, U. Linking land use and forestry transition with depopulation in rural Nepal. 18. Aryal, U., Wagle, B. H., Lamichhane, B., Parajuli, A., and Thapa, P. Effectiveness of control measures of *Mikania micrantha* on grassland: a case study from grassland in Sauraha area of Chitwan National Park.

Note:1-18 are papers published in BankoJanakari, Special Issue on Silviculture, Special Issue No. 4, 2018.