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A REVIEW

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Indigenous knowledge in traditional agroforestry systems of Kashmir valley: Current challenges and future opportunities

M.A. ISLAM, K.N. QAISAR AND G.M. BHAT

ABSTRACT : The traditional agroforestry systems have gained wider attention in the international agreements and among academicians and policy makers for their multifunctional role and dynamics of ecosystem services. The multifunctional traditional agroforestry systems support substantial ecosystem services and livelihoods to the rural communities in Kashmir. They are considered to be adaptive to the climate change situations and serve as efficient means to carbon sinks. Due to the remarkable significance of traditional agroforestry systems in the valley ecosystem, environment and livelihood, the systems have been considered as a promising land use pattern in the valley. With climate change rapidly impacting both ecosystems and services in the valley, the sustainability of dynamic traditional agroforestry systems is now facing new challenges and vulnerabilities. Indigenous knowledge on traditional agroforestry is an integral part of the culture and history of the local communities which offer opportunities for sustainable management of resources and support socio-ecological and socio-economic benefits. The indigenous knowledge on agroforestry needs to be further strengthened through research and development to achieve the goals of sustainable development.

KEY WORDS : Indigenous knowledge, Traditional agroforestry, Ethno-medico-botany

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INTRODUCTION

The management of lands in the Kashmir valley by growing multipurpose trees species and intercropping understory crops and fruits, livestock raising and protection of adjacent forests for variety of services is an adaptive century-old indigenous practice of the rural communities (Mughal *et al*., 2000 and Islam *et al*., 2015). Such practices, recently been defined as agroforestry, is now a collective name for land use system and technologies involving trees combined with crops and/or animals on the same land management unit (Nair, 1993 and King and Chandler, 1978). The environmental services that

MEMBERS OF RESEARCH FORUM

Address of the Correspondence : **M.A. ISLAM,** Faculty of Forestry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Benhama, GANDERBAL (J&K) INDIA Email: ajaztata@gmail.com

Address of the Coopted Authors : K.N. QAISAR AND G.M. BHAT, Faculty of Forestry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Benhama, GANDERBAL (J&K) INDIA

traditional agroforestry systems can provide, and especially their potential contribution to the conservation of biodiversity, have recently attracted wider attention among the conservation scientists (Mcneely and Scroth, 2006; Bijalwan *et al*., 2011 and Islam *et al*., 2016). The Intergovernmental panel for climate change has cited traditional agroforestry as one of the options to reduce emissions and enhance sinks of green house gases (IPCC, 2007). The IPCC land use change and forestry report concluded that transformation of degraded agriculture land to agroforestry has far greater potential to sequester carbon than any other land use change (Nautiyal *et al*., 2003 and Pandey, 2007). The traditional agroforestry systems in the Kashmir valley are at the subsistence level evolved through trial and error practices of farmers to meet their needs of food, fibre, fodder, fuelwood, medicine and timber (Banyal *et al*., 2011 and Islam *et al*., 2012). The systems are characterized by substantial diversity and high degree of self-reliance that promote low cost sustainable development in ecosystems, protect and conserve ecological systems, and improve economic efficiency of the farming community, while climate change has induced negative impacts (Islam and Quli, 2016 and Quli *et al*., 2016). However, in-depth study on indigenous knowledge in traditional agroforestry systems of Kashmir valley is lacking and available literature is limited. This review is designed to discuss the traditional agroforestry systems of Kashmir valley, their functions, services, ethno-medico-botany, indigenous traditional knowledge (ITK) on agroforestry systems, need for their preservation, constraints in preservation, measures for preservation, current challenges and future opportunities.

Traditional agroforestry systems of Kashmir valley:

The system and practices of agroforestry vary considerably in their structural complexity and species diversity, their productive and protective attributes and their socio-economic dimensions (Mughal *et al*., 2000). The prevalent traditional agroforestry systems of Kashmir valley are:

Boundary plantations :

This oldest traditional model is practiced on plain paddy fields. Farmers generally do not plant any tree within the paddy fields, but if the same land lies besides a road then people plant trees on the road side. In addition to this if a canal passes through the farmers land, then on both sides of the canal farmers plant *Salix* trees. Other trees raised are *Populus deltoides*, *P. nigra* and *Aesculus indica* and the spacing is maintained at 1.20 m x 1.20m. This model is adopted by marginal as well as small and big farmers. *Avena sativa* and *Brassica* spp. are grown during winter. These lands suffer from impended drainage and are not suitable for any other agricultural crop except paddy during summer.

Agrisilviculture on sloping lands :

This system is practiced by people residing on the mid-mountains or at the foothills of mountains. These hilly areas are completely devoid of vegetation and suffer from scorching heat during summer and lack of moisture in the months from May onwards till winter sets in. People raise forest tree species around their farms, which serve as boundaries as well as provide much needed fuel and fodder. Sometimes trees may be found scattered inside the farm area also. Amongst the agricultural crops maize is raised as monoculture as it can survive under moisture stress conditions compared to other crops. During winter, mustard and at some places vegetables like brassica, carrot, reddish, turnip etc. are grown. Trees planted by the farmers in these lands are *Robinia pseudoacacia, Ailanthus altissima, Aesculus indica, Populus nigra, Salix alba, Ulmus wallichiana and Juglans regia*. Except for *Juglans regia* spacing of trees is maintained at 1.20m x 1.20m. Problems of the area include lack of water in streams during summer, exposed denuded surface and low agricultural output.

Agrisilviculture in hills and forests :

This type of agroforestry system is practiced in the hilly areas and in the forests. People in these areas live in the vicinity of or in the forests. The forests in the region are composed of evergreen trees in the form of *Cedrus deodara, Pinus wallichiana, Abies pindraw* and *Picea smithiana* besides, some broad leaved species like *Populus* spp., *Salix* spp., *Ulmus wallichiana* are also found in the area. The farmers generally grow maize/ bean in the summer season, while during winter oat fodder are raised. In some areas different vegetables are also grown for local consumption.

Agrisilviculture in flat or plain lands :

The land in plain areas is fertile and very well suited for agriculture. Farmers whether marginal or small keep

a separate area within the paddy fields of the size of about 500-600 m^2 which is generally raised in comparison to paddy field. This area is kept surrounded by tall trees of *Populus deltoides, Populus nigra, Salix alba* and sometimes *Robinia pseudoacacia* and the spacing is very close. Some trees are kept scattered within the farm also. Vegetables are grown both in *Rabi* as well as *Kharif* seasons. *Rabi* season vegetables include knoll-khol, turnip, radish, carrot, onion, peas, spinach, garlic etc. In *Kharif* season vegetable like tomato, brinjal, chilies, capsicum, french beans, cucumber, bottle gourd, bitter gourd, pumpkin, potato etc. are grown.

Hortisilviculture :

This system is practiced on slopes with or without irrigation facility. The main purpose of the system is the production of fruits for marketing. Fruit trees are grown at regular spacing within the farm at a spacing ranging from 3m x 3m to 3.5m x 3.5m depending upon the fruit tree species. Forest trees are grown on all the four sides of the orchard in single or double rows along the boundary. The trees are planted at a close spacing of 1.2m x 1.2 m and the purpose of growing these trees is wood for packing of fruit, timber for construction and fuel wood production. Forest trees species raised are *Aesculus indica, Ailanthus altissima, Populus deltoides, P. nigra, Salix alba, Robinia pseudoacacia* and *Ulmus wallichiana.* Fruit trees include *Juglans regia, Prunus cerasus, P. amygadalus, Malus pumila,* Peach, Plum, Cherry, Apricot etc.

Hortisilvipasture :

This system is practiced on sloppy lands but in some cases it has been observed in orchards located on plain lands. The system has all the components of hortisilviculture as listed above and in addition pasture grasses (*Festuca pretense/ Dactylis glomerata*), legumes (*Trifolium pretense/ T. repens*) or *Avena sativa* are also grown in these orchards when the fruit trees are in juvenile stage. *Avena sativa* is grown during winter as there is no shading effect on the crop during winter.

Hortisilviagriculture :

This system is practiced in places where orchards are located either on terraces or flat lands with irrigation facility throughout the year. In this system people devote a little area within the orchard for raising vegetables during *Rabi* and *Kharif* season for domestic consumption. The vegetables are intercropped between fruit trees whose spacing is maintained at 6m x 6m and the vegetables grown are knoll-khol, cabbage, cauliflower, turnip, radish, carrot, onion, peas, spinach, garlic, tomato, brinjal, chilies, capsicum, french beans, cucumber, bottle gourd, bitter gourd, pumpkin, potato etc. Trees and fruit components are same as that of hortisilviculture. Earlier the problem with the system was that people used to raise vegetables in the small area for domestic consumption only while as the rest of the area is not utilized for agriculture, but with the passage of time some farmers in north Kashmir are now utilizing the whole orchard for raising vegetables for commercial purposes.

Homegardens

Kitchen gardens or multistoried homesteads are found throughout the valley and is generally common among those farmers who have a land holding of about 500-1000 m^2 located just around their residence. On the piece of land people raise fruit trees and vegetables of all kinds during *Rabi* and *Kharif* season. Poultry is also reared on the same piece of land. Besides, people raise tall trees of *Populus deltoides, Ulmus wallichiana or Salix alba* along the boundary in single or double rows in close spacing. Fruit trees may consist of apple, cherry, peach, plum, almond, queens apple etc. Sometimes all the fruit trees may be found growing in the kitchen garden. Vegetables are grown in interspaces of fruit trees and may include cabbage, turnip, radish, carrot, onion, peas, brassica etc.

Function and services of traditional agroforestry systems :

Social functions:

The social impacts of agroforestry practices on people are as under.

Food habits:

Adoption of agroforestry helps in sufficient production of food grains resulting in variation of food habits among people.

Communication exposure:

Adoption of agroforestry necessitates people to get in contact with field extension functionaries, radio, newspaper etc. to gain more information on agroforestry.

Migration:

Practicing of agroforestry facilitates increased self-employment opportunities through interventions such as nursery raising, mat weaving, basket making etc. resulting in gradual decrease in migration.

Nature of occupation:

With the adoption of agroforestry, people stop their traditional profession like hunting, gathering forest produces etc. and concentrate only in farming.

Economic functions:

The economic outcomes of agroforestry practices on people are as under.

Family income:

With the adoption of agroforestry people start getting more income by selling the fruits and timber every year. Subsidiary activities like mat weaving, basket making, honey collection, sheep / goat rearing etc. are also taken up as an integral part of agroforestry which also in turn contribute to the increased family income.

Employment status:

Agroforestry provides employments to the local people at their door step throughout the year as a result the migration is reduced to a maximum extent.

Livestock possession:

Agroforestry ensures good and cheap fodder which in turn increases livestock production.

Supplementary income:

One of the uniqueness of agroforestry is the promotion of traditional subsidiary occupation due to the availability of raw materials for these activities. As a result people start many subsidiary ventures like basket making, mat weaving, wicker crafts etc. which add to the total family income.

Farm expenditure:

The expenditure incurred by the people on the farming increases marginally, but not significantly.

Ecological functions:

The ecological consequences of agroforestry practices on people are as under.

Biomass production:

There is significant increase in biomass production *viz.*, fodder, fuel, timber etc. with the adoption of agroforestry. Plantation of a combination of fodder, timber and fruit species like *Populus deltoides, Salix alba, Ulmus wallichiana, Morus alba, Morus nigra, Robinia pesudoacacia, Platanus orientalis, Celtis australis, Ailanthus altissima, Malus domestica, Pyrus communis, Punica granatum, Juglans regia etc.* not only meets the household fuelwood needs, fodder needs of the cattle and timber needs for agricultural implements but also add organic matter to the soil.

Groundwater recharge:

Several studies explicitly indicated that there is a significant improvement in the ground water availability due to tree based farming interventions. Farm pond was one such major intervention made to harvest excess runoff rainwater in agroforestry plots. These farm ponds are located in the upper/ middle catchment of the land which enhances the percolation which in turn recharges the groundwater Table 1.

Dependency on natural forest:

The agroforestry adoption reduces the dependency of people on the natural forests for fuel, fodder, fruits, fibre and timber needs.

Incidence of pest and diseases:

The incidence of pests like mealy bugs, termites, shoot and stem borer is reduced as they are preyed upon by birds, who make their nests in trees and some birds are also attracted by the fruits in the agroforestry plots.

Climate change:

There is significant difference in atmospheric temperature, rainfall pattern and edaphic characters due to the adoption of agroforestry. Possible reason is that tree species might have acted with regard to the modification of micro-climatic parameters. Also the tap-root system of various trees acts as a barrier to soil erosion by holding soil particles tightly. Other associated ecological impacts are carbon sequestration, pollution reduction, biodiversity conservation and protection of wildlife habitat.

Cultural functions:

The potential cultural services provided by agroforestry include maintenance of local cultural heritage, creation of recreation opportunities, enhancement of landscape, preservation of spirituals, values, beliefs, customary rituals, habits, totems, festivals, taboos, folklore, traditional recipes etc. Thus, the agroforestry can bring significant social, economic, ecological and cultural impacts that are desirable for the society and hence, agroforestry can achieve effectively social, economic, ecological and cultural sustainability (Gangadharappa *et al*., 2010; Arunachalam and Arunachalam, 2012; Segnon *et al*., 2015 and Islam and Quli, 2016).

Ethno-medico-botany of traditional agroforestry systems :

The traditional agroforestry systems recorded 183 species of ethno-medicago-botanical importance, representing 97 genera and 51 families (Table 1). There are 14 categories of ethno-medicago-botanically important plants characterized based on the products in the traditional agroforests *viz*., fodder (49), fuel (28), vegetable (29), cereals (4), pulses (4), medicinal (8), ornamental (9), fruit (19), timber (7), fencing (7), cottage industry (7), spice (7), edible seed/ nut (4) and oilseed (1) (Fig. 1).

Indigenous traditional knowledge (ITK) on agroforestry systems :

The traditional/cultural knowledge embedded within the rural societies of Kashmir is the inherent identity that is very unique and diverse in all respects for traditional agroforestry management and conservation. It is reflected in their cultivation system, ethno-biology and health and nutrition management. The people happened

Table 1 : Ethno-medico-botanical plants of traditional agroforestry systems

Use category	Plant species
Fodder/ browse	*Achillea millefolium, Anagallis arvensis, Avena fatua, Capsella bursa pastoris, Celtis australis, Centuria iberica, Chearophyllum* spp., *Chenopodium album, Convolvulus arvensis, Conyza Canadensis, Cynodon dactylon, Eriache armitii, Foeniculum vulgare, Fragaria nubicola, Geranium pretense, Indigofera heterantha, Morus alba, M. nigra, Malva neglecta, Oxalis corniculata, Populus deltoides, P. balsemifera, P. nigra, Plantago lanceolata, Plantago major, Poa angustifolia, P. annua, Polygonum plebieum, Potentilla reptans, Ranunculus acris, R. arvensis, Robinia pesudoacacia, Roripa spp., Rumex nepalensis, Salix alba, S. fragilis, S. triandra, S. viminalis, Setaria glauca, Sisymbrium irio, Sorghum halepense, Stellaria media, Trifolium pretense, T. repens, Tulipa stellata, Ulmus wallichiana, Veronica persica, Vicia sepium* etc.
Fuel	*Ailanthus altissima, Celtis australis, Cotoneaster nummularia, Cydonia oblonga, Eriobotrya japonica, Fragaria x annanasa, Indigofera heterantha, Juglans regia* *Morus alba, M. nigra, Malus x domestica, Platanus orientalis, Populus deltoides, P. balsemifera, P. nigra, Prunus persica, P. amygladus, P. armeniaca, P. avium, P. domestica, Punica granatum, Pyrus communis, Robinia pesudoacacia, Salix alba,* *S. fragilis, S. triandra, S. viminalis, Ulmus wallichiana* etc.
Vegetable	*Abelmoschus esculentus, Amaranthus caudatus, Brassica oleracea, B. campestris var. rapa, B. caulorapa, Capsella bursa pastoris, Capsicum annuum, Centuria iberica, Cucumis sativus, Cucurbita moschata, Cucurbita pepo, Daucus carota, Dryopteris spp., Lagenaria siceraria, Malva sylvestris, M. neglecta, Mentha arvensis, Oxalis corniculata, Portulaca oleracea, Ranunculus arvensis, Raphanus sativus, Rumex nepalensis, Sisymbrium irio, Solanum tuberosum, S. lycopersicum, S. melongena, Spinacia oleracea, Taraxacum officinale* etc.
Cereals	*Avena sativa, Oryza sativa, Triticum aestivum, Zea mays* etc.
Pulses	*Phasyeolus vulgaris, Pisum sativum, Vigna sinensis, V. mungo* etc.
Medicinal	*Adinatum capillus, Artemisia absinthium, Cannabis sativa, Cotula anthemoides, Cynodon dactylon, Fumaria indica, Nepta cataria, Prunella vulgaris, Sisymbrium irio* etc.
Ornamental	*Cedrus deodara, Cupressus torulosa, Pinus wallichiana, Salix babylonica, S. matsudana, Tamarix spp., Thuja orientalis, Tulipa stellata, Viburnum grandiflorum* etc.
Edible fruit	*Berberis lyceum, Celtis australis, Cydonia oblonga, Eriobotrya japonica, Fragaria nubicola, Fragaria x annanasa, Malus x domestica, Morus alba, M. nigra, Prunus persica, P. armeniaca, P. avium, P. domestica, Punica granatum, Pyrus communis,* *Rosa moschata, Rubus fructicosus, Rubus niveus, Vitis venifera* etc.
Timber	*Juglans regia, Platanus orientalis, Populus deltoides, P. balsemifera, P. nigra, Robina pesudoacacia, Ulmus wallichiana* etc.
Fencing	*Ailanthus altissima, Berberis lyceum, Cotoneaster nummularia, Rosa moschata, Rubus fructicosus, Rubus niveus, Viburnum grandiflorum* etc.
Cottage industry	*Arundo donax, Indigofera heterantha, Salix viminalis, S. daphnoides, S. triandra, Typha elephantia, T. angustifolia etc.*
Spice	*Allium cepa, A. porrum, A. sativum, Bunium bulbocastanum, Coriandrum sativum, Foeniculum vulgare, Tigonella foenum graecum* etc.
Edible seed/ nut	*Juglans regia, Malva sylvestris, Prunus amygladus, P. armeniaca* etc.
Oilseed	*Brassica compestris*

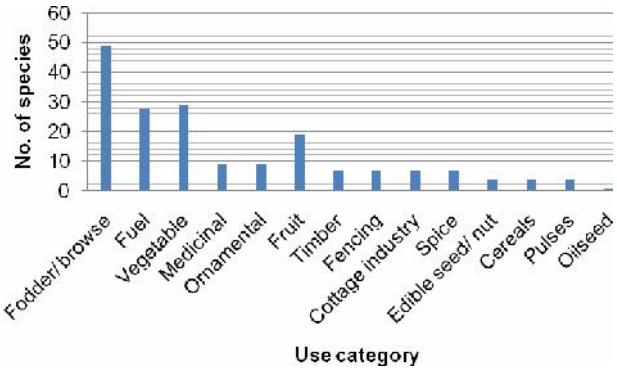

Fig. 1 : Distribution of plant species under different use category

to be primarily rural and their economy is predominantly agricultural, based on natural seasons comprising and exploited on primitive methods. The people have rich knowledge about the indigenous agroforestry practices especially in:

– Multipurpose trees and shrubs
– Tree/ crop combination
– Agricultural tools
– Preparation of planting materials
– Soil working methods for agroforestry plantation
– Spacing and plantation geometry
– Tending operations (e.g. weeding, cleaning, thinning, crown manipulation, pollarding, shading etc.)
– Protection measures (e.g. insect/ pest management, disease control etc.)
– Application of FYM and manures
– Crop selection
– Crop rotation
– Mixed cropping
– Intercropping
– Trees plantation on the ridges of the fields in upland
– Soil and water conservation measures
– Bunding and terracing of land according to slope
– Time and stage of harvesting of agroforestry products
– Extraction and processing of agroforestry products
– Use of roots, leaves, fruits, stem, etc., in different ways as food, fodder, medicine, ethno-veterinary, fuel, fencing, implement making, etc.
– Grading and sale of agroforestry products
– Gender linkage

The traditional knowledge have been derived from the people's farming experience through trial and error method and handed down from previous generation to present generations (Singh and Sureja, 2008). Many of these indigenous methods and practices are very human in nature and can play an important role in sustainable suitable agrforestry production (Deb *et al*., 2009). This indigenous knowledge may be exploited and blended with existing scientific technologies to explore more sustainable and human friendly methods of agroforestry practices (Sharma *et al*., 2009).

Need for preservation of ITK on agroforestry :

There are number of reasons why there is need to preserve the ITK on agroforestry.

To improve the livelihoods of ITK holders and communities :

ITK is a valuable asset to indigenous and local communities who depend on ITK for their livelihood as well as to manage and exploit their local ecosystem in sustainable manner. For example, local communities depend on indigenous crop varieties for sustainable agroforestry and for selection of superior genotypes from these.

To benefit national economy :

ITK has been recognized as a valuable input into modern industries such as pharmaceuticals, botanical medicines, cosmetics and toiletries, agriculture and biological pesticides. Most of industries look for the time tested traditional knowledge information for developing novel products having commercial acceptability. Hence, protecting ITK has the potential to improve the economy of many developing countries by greater commercial use of their biological wealth and increasing exports of ITK related products.

To conserve the environment :

The traditional communities are intelligent and have made agrroforestry sustainable through their different agroforestry practices. They create a balance between the environment and requirement.

To prevent bio-piracy :

Biopiracy refers either to the unauthorized extraction of biological resources and / or associated ITK or to the

patenting, without compensation of spurious inventions based on such knowledge or resources. The documentation would help register knowledge-base, prevent bio-piracy and promote bio-prospecting.

Constraints in preservation of ITK on agroforestry:

With rapid development in globalization, liberalization of international trade and commerce advances in technology, the traditional agroforestry systems are confronted with many constraints (Islam and Quli, 2016). Although constraints always are different in various systems, they are mainly from common aspects such as policy, population, the market system and land use changes.

Lack of good policies :

As for traditional agroforestry systems, policies from the government can have a huge impact on smallholders. However, these regions still lack good policies currently which include two aspects. One is some existing policies impede and constrain the development of agroforestry; the other is there are not enough aggressive policies to promote and stimulate the development of traditional agroforestry.

Long-term investment :

Agroforestry management is a long-term investment; however, the rights of land tenure and trees ownership are not clear which will discourage people from continuing agroforestry.

Out-migration :

In recent years, there is the phenomenon where the young generation from the ITK sites migrates out to the other places. The situation is becoming so severe that it will cause the disappearance of the traditional agroforestry that will help to sustain agroforestry systems in the future. When no people participate in production activities, the knowledge, technology and culture will all disappear.

In-migration :

In addition, due to the increasing population in some places due to in-migration, it causes negative consequences. The expansion of agricultural land into forested and hilly areas results in land degradation from soil erosion and deforestation. Further, the fragmentation of land cannot support the effective management of agroforestry.

Lack of marketing and information facilities :

The smallholders of traditional agroforestry management cannot always have enough information and a clear understanding of the market. This may lead to poor actions and loss of economic benefits.

Lack of extension and communication facilities :

Lack of training or expertise, unavailability of information about agroforestry, lack of technical literatures, low use of information sources, low extension contact etc.

Psychological constraints :

Lack of of interest, lack of motivation, lack of risk taking ability, unfavourable attitude, low aspiration etc.

Environmental constraints :

Adverse climatic conditions, landslides, flood, drought, high wind velocity, low temperature, water stress etc. discourage people from continuing agroforestry.

Social constraints :

Lack of social participation, low educational status, acute poverty, lack of community/ group approach, lack of leadership etc. prohibit people from agroforestry adoption.

Lack of co-ordination :

Lack of co-ordination among different sectors can also have adverse impacts on the development or maintenance of agroforestry systems.

Measures for preservation of ITK on traditional agroforestry :

The following measures to protect and develop traditional agroforestry systems and associated ITK are suggested:

Involvement of GOs, NGOs, CBOs and local Government :

Continuation to improve and enlarge the impact of traditional agroforestry systems through the policies and programmes of community based organizations, governments and non-governmental organizations is

imperative. For some traditional agroforestry systems in danger, local governments should actively declare guidelines to protect and promote sustainable development.

Policy, regulation and the institutional context :

Policy, regulation and the institutional context play a significant role affecting the smallholders of traditional agroforestry systems. It is not sufficient to guarantee the maintenance by farmers without policy. There are so many concrete policies which are very important in traditional agroforestry management such as land tenure, stakeholder input, appropriate technologies and extension services, private and public partnerships and so on that we cannot list all of them. However, it is worth noting that when the government enacts a policy, it should be oriented towards creating favorable conditions for traditional agroforestry systems and in this way meet the goals of poverty alleviation, food security and sustainable development of natural resources.

Provision of incentives :

For smallholders of traditional agroforestry management, ensuring their own food security and enhancing incomes are the most important factors that they concerned about. In this aspect, governments should think about more channels to provide incentives to farmers.

Recognition of ecosystem services :

Traditional agroforestry systems provide ecosystem services especially in climate mitigation, and as there is a tendency in the world to promote carbon sequestrated in agroforestry systems these could be sold in carbon credit markets. This is a way to support labour intensive practices. Payment of ecosystem services (PES) can be a measure executed in traditional agroforestry systems.

Encouragement of eco-tourism :

Base on the unique folk custom, dietary habits, attractive landscapes and so on, eco-tourism should also be encouraged to develop income sources in some of the traditional agroforestry regions.

Participation of younger generation :

Younger generation should play an important role in creating a bridge between farmers and governments, as well as between region and global institutions. Among the younger generation, fewer people should be engaged in agroforestry management. Traditional knowledge and technology should be protected and recorded swiftly by local community authorities.

Publicity of precious value of traditional agroforestry:

Local communities should vigorously publicize the precious value of traditional agroforestry systems and thus enhance the pride and protection consciousness of local farmers and their families.

To protect and develop traditional agroforestry systems still has a long way to go and the connection with Governmental Heritage Systems is a good approach for these systems.

Reduction in the tax :

The governments should also help to reduce the tax and other external interventions as much as possible; on the other hand, government should explore multiple means to increase the income of farmers.

Future prospects of traditional agroforestry in Kashmir :

Although traditional agroforestry systems are confronted with many threats and challenges, it is still noticeable that more and more governments and non-government organizations are paying much more attention to these systems in the world. For instance:

– ICRAF was established in 1978 with the goal of initiating and assisting the generation and dissemination of appropriate agroforestry technologies for resource-poor farmers and other land users.

– All India Co-ordinated Research Project on Agroforestry (AICRP) was launched in Shere-e-Kashmir University of agricultural Sciences and Technology of Kashmir in 1983 to understand indigenous practices for developing and delivering technologies based on sustainable agroforestry practices on farms, marginal lands and wastelands for different agro-climatic zones in India.

– To strengthen the agroforestry in India a National Research Centre for Agroforestry (NRCAF) was established by ICAR at the campus of Indian Grassland and Fodder Research Institute (IGFRI) at Jhansi in 1988 to develop technological packages of different

agroforestry practices for various agro-climatological zones for transfer to farm fields and wastelands.

– National Agriculture Policy was enforced in 2000 emphasizing that "*farmers will be encouraged to take up farm/ agroforestry for higher income generation by evolving technology, extension and credit support packages and removing constraints to development of agroforestry"*.

– The Globally Important Agricultural Heritage Systems (GIAHS) designation was initiated by FAO in 2002 whose goal is to establish a long-term programme to support systems like agroforestry and enhance their global, national and local benefits derived through their dynamic conservation, sustainable management and the enhanced viability of the system.

– India has adopted the National Agroforestry Policy-2014, which seeks to overcome many of the obstacles to the adoption of agroforestry in the country, including adverse policies, weak markets and a dearth of institutional finance.

– Supportive Government policies on forest resources management and trade of Jammu and Kashmir also have encouraging impact on strengthening of traditional agroforestry systems in Kashmir.

– The day by day increasing gap between demand and supply of forest products moving us towards a serious ecological disaster which can be averted only by carrying out systematic plantation programmes on massive scale.

– To meet ever increasing demand for fuel wood, timber and raw material for agro-based industries, there is no way out except adopting agroforestry as a land-use system for sustaining agricultural production and productivity.

– Besides, availability of assured irrigation and market access to get remunerative prices from agroforestry products in future will encourage cultivation of cash crops, fruits and plantation of trees for timber and raw material for various agro-based industries.

– The way to the future for traditional agroforestry systems in Kashmir is positive despite of the daunting challenges on the way.

Conclusion :

Traditional agroforestry systems already have a long history of hundreds of years in practice and still play a significant role in the valley today, especially in rural areas. In this era of globalization and food insecurity, more and more governments and non-governmental organizations are paying attention to traditional agroforestry systems because of their economic, ecological and socio-culture benefits. The traditional agroforestry systems of Kashmir *viz*., Boundary plantations, Agrisilviculture on sloping lands, Agrisilviculture in hills and forests, Agrisilviculture in flat or plain lands, Hortisilviculture, Hortisilvipasture, Hortisilviagriculture and Homegardens have rich agricultural and associated biodiversity, multiple ecosystem services and precious socio-culture values at a regional and global level. The ITK on agroforestry are really very effective and need to be documented, validated and exploited for ensuring agroforestry productivity, sustainability and adaptability. Although traditional agroforestry systems are confronted with many threats and challenges, such as population growth, migration, market impact, climate change and so on, as long as governments and non-governmental organizations, local communities and smallholders can co-operate with each other, traditional agroforestry systems will be effectively protected and will remain in the future a sustainable land use practice. Institutional mechanisms need to be developed to regulate and protect access to ITK and benefit sharing arising from the commercialization of agroforestry resources.

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