Sustainable Forest Management of Benguet Pine in the Cordillera, Philippines

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Abstract

The Benguet pine forest watershed in the Cordillera Region of Luzon, represented by the species scientifically known as ***Pinus kesiya*** Royle ex Gordon of the family Pinaceae, has played a key role in the continuous functioning of the ecosystem. However, the resource base is coming under increasing pressure and being abused and misused. It is a fragile ecosystem, which, once deforested, will result in the impairment of the upland hydrologic cycle. In order to meet the growing needs and aspirations of the people, backup technologies have been generated, however, only few are suitable to the particular conditions, constraints, materials and needs. To sustain the productivity of the pine forest watershed, strategic actions and technological innovations are continually applied.

The Benguet pine forest offer opportunities for the development of human capacity to alleviate the status of forest-dwellers and promote economic growth in the ecoregion. It is here that important hydroelectric dams are found that supply electricity for the whole of Northern Luzon, the Philippines. Because of the unique terrain and vegetation, mini hydroelectric power plants were established to augment supply of electricity. Also, it is the main source of various renewable resources such as food, timber, forage, wildlife, water for domestic, agriculture and industrial use, soil and recreational sites. To enjoy most of it, these must be sustainably managed, protected and conserved to obtain and maintain goods and services for the people.

Introduction

In the Philippines, pure Benguet pine forest are found in the highlands of Northern Luzon forming distinct forest in the provinces of Benguet, Mt. Province, Abra and Ifugao. It is scientifically known as ***Pinus kesiya*** Royle ex Gordon, an intolerant species, described in the locality as "saleng" of the family Pinaceae. Benguet pine grows naturally well between altitude of 500 to 2,500 meters (1,600 to 8,000 feet) above sea level but it is best developed at elevations ranging from 900 to 1,500 meters. It must be thickly forested otherwise, the water flowing its slope will carry much soil causes heavy siltation of streams and rivers. Generally, it has been and remains the main source of mine timber for mining operations in Benguet, the principal raw materials for handicraft and construction lumber. Moreover, important hydroelectric dams are found in the mountain pine forest region. The existence of such dams will serve as a source of water for irrigation in agriculture and development activities. Also, it serves as a habitat for fishes which might be a good source of livelihood for the nearby communities. Because of the landscape features, it can be also a pride of eco-tourism destination. If properly managed, protected and conserved, it will continue to provide goods and services contributing to the socio-economic development of the Cordillera Administrative Region.

Discussion

Status of the Pine Forest Watershed

The pine forest watershed has been viewed ultimately as land dominated based resource considering water as the immediate priority in all basic needs, source of raw materials and related natural resources. The problems encountered that cause an aggravating threats to the pine forest watershed are: soil brushing and site degrading activities; indiscriminate forest fire; and abandonment of watershed areas that are turned to worthless and unproductive state, unable to support anything.

The series of catastrophic events, forces or activities mentioned render the watershed unproductive and unstable, leading to a state of criticality which poses detrimental environmental consequences and implications, among which are:

1. Accelerated surface runoff and soil erosion
2. Active gullying
3. Genetic erosion
4. Climatic change
5. Erratic behavior of river system
6. Siltation of reservoirs and water ways
7. Serious water problem
8. Incidence of tree/vegetation pests and diseases
9. Reduction of on-site and off-site values
10. Imbalanced plant-water-soil-animal-people relationship

Strategic Actions and Innovations

The generated technologies which have been developed and considered effective are:

A. Thinning

The application of thinning is made in immature stands to stimulate the growth of trees that remain and increase the total yield of useful materials. Surplus trees are removed for the purpose of concentrating on the potential wood production of the stand in a limited number of selected trees. In a 10-15 year natural Benguet pine stand, heavy thinning should not reach the maximum limit of cutting which might have an adverse effects on the hydrology and soil properties including the understorey vegetation. In this case, thinning should be done manually, but to facilitate the thinning operation only light energy-powered machine should be used to minimize damage in the area (Florido 1981). In a similar case, thinning can be done on a 30-year old natural Benguet pine stand. This will increases the amount of rainfall that reaches the ground water supply for human consumption and utilization. In order to harmonize watershed management in Benguet pine forests, particularly a 30-year old stands, it is advisable to conduct only either moderate or light thinning. Heavy thinning may harshly expose the mineral soil such that soil erosion is hastened (Veracion and Lopez 1975).

B. Prescribed Burning

Forest fire is one of the problems in forest watershed particularly the pine forest. It is simply the application of fire to wildland fuels in either natural or modified state, and under specified environmental condition which allow the fire to be confined in a pre-determined area and at the same time produce the

intensity required to attain planned resource management objectives. Some of the uses considered appropriate and practical are: reduction of hazardous fuel, disposition in the logging/farm debris, site preparation for direct seeding or planting, improvement of forage for grazing, control of pest and diseases, improvement of access, enhancement of wildlife habitat, and enhancement of landscape appearance.Frequent burning should be avoided not to accelerate surface runoff that may yield greater amount of sediments thereby causing heavy siltation of the river basin during the rainy months. Prescribed burning can be applied in a 20-25 year old Benguet pine stand during the month of December without significant impact especially on soil erosion as well as the understorey vegetation. Depending on the purpose of burning, still it can be applied even in the month of February, provided that the slope of the area has an adequate vegetative cover (at least 578 trees/ha or more and not very steep). In addition, soil erosion rates obtained from moderate burning revealed that it is much lower than the acceptable limit of soil erosion (Costales 1991). The construction of fireline of at least 8 meter width is appropriate to establish in a moderately sloping site with low-growing vegetation (Tubal and Noble 1995). Direct supervision should always be guided with plan of attack in order not to create wildfire and that may cause serious damage to life and property.

C. Enrichment Planting of Some High Yielding Forage Crops

Combining the understorey of pine forest trees with forage crops is an advantage in the production of more than one useful goods and services on the same area in order to uphold the concept of multiple use forestry. In terms of forage crops, napier (***Pennisetum purpurea***) and kikuyu (***Pennisetum claudestinum***) can be recommended as a vegetative cover which provide forage for animals and at the same time protect soil erosion. This explains further, that it has the capacity in retarding surface runoff and sediment yield, planting the aforementioned grasses in place of ferns and cogon which dominate the natural understorey could be deemed viable (Kabugi 1992).

D. Sustainability of Some Agricultural Crops and Livestock Combined with Benguet Pine Trees

Agroforestry in practice is one effective strategy in sustainable land management system that increases the yield of the land. The land is idealized for the production of agricultural and forest crops including animals simultaneously or sequentially on the same unit of land. Cultural management practices that are compatible with the cultural practices of the local population can be combined and applied.

Radish (***Raphanus sativum***) and sweet potato (***Ipomea batatas***) are suitable for planting under a natural Benguet pine (partially open). However, sweet potato can also be an effective crop in minimizing surface runoff and soil loss (Rawal 1991). On the other hand, coffee under pine with a spacing of 3 m x 3 m is also recommended within the Benguet province where pine favorably grows which prefers sandy loam with soil pH ranging from 4.6 to 6.0. Coffee seedlings can also be planted in gaps between pine trees but not closer than 3 meters. Agroforestry crop such as tiger grass (***Thysanolaena maxima***) planted at 1 meter intervals along the contour can be also adopted considering long term effects and economic benefits. The inflorescence called panicles can be also gathered in the manufacture of soft brooms thus augmenting the income of the people (Costales et at. 1984).Livestock production using goats could now be integrated harmoniously with timber production. The ideal stocking rates that could be followed are 4-8 goats/ha (Noble and Botengan 1989).

E. Biodiversity Enhancement

The pine forest ecosystem have its own uniqueness as one among the important life support system in the Cordillera. The understorey vegetation are composed mainly of dominant species like ***Cyrtococcum patens***, ***Themeda triandra***, ***Imperata cylindrica*** and Bracken fern. In the pine forest, there is lesser wildlife found, nevertheless, mammals identified are the Philippine deer (***Cervus sp.***), wild pig (***Sus celebensis***, tree shrews (***Tupaia sp.*** and ***Urogale sp.***) and ground shrews (***Suncus sp.*** and ***Crocidura sp.***) Also found are rats of the genera Crateromys and Phloemys of Mt. Data (2,310 m asl.) and avian species like Zosterops, Dicaenum, Nectarina, Pyrrhula, Loxia and Erythrura (Viray and Peñafiel 1992).

To protect and conserve the remaining biodiversity of the pine forest ecosystem, adopted the strategies and actions of the National Biodiversity Strategy and Action Plan (NBSAP) sets forth. The six strategies identified are:

1. Expanding and improving knowledge on the characteristics, uses and values of biological diversity.

2. Enhancing and integrating existing and planned biodiversity conservation efforts with emphasis on in-situ activities.

3. Formulating an integrated policy and legislative framework for the conservation, sustainable use, and equitable sharing of the benefits of biological diversity.

4. Strengthening capacities for integrating and institutionalizing biodiversity conservation and management.

5. Mobilizing an integrated Information Education and Communication (IEC) system for biodiversity conservation.

6. Advocating stronger international cooperation on biodiversity conservation and management.

F. Application of Soil and Water Conservation Measures

To rehabilitate and conserve the watershed better, vegetative or biological, structural engineering and combination of both or vengineering have been given prior importance as one solution to watershed degradation.

- **Vegetative/Biological Measures**

  It employs the planting of vegetation presently available in the area which are compatible to the prevailing site conditions. Techniques involve the use of saturation planting, bench brush layers, wattling, fascine and sodding.

- **Structural Engineering**

  It employs skills in infrastructure in controlling accelerated surface runoff, soil erosion, nutrient loss (leaching) and other soil degrading activities. These infrastructures include: checkdams (masonry, stone, loose rock, vegetative checkdams, etc.), earth dam reservoirs like gabions, rip raps, bench-terracing, stream channeling, contour ditching and gully plugs.

- **Vengineering (Combination of Both)**

The use of vegetation for the control of erosion maybe either as a supplement to structural/mechanical in the stabilization of soil that prevents sedimentation and siltation deposited into the streams and river basin.

G. Natural Regeneration Management

Natural regeneration is not a problem in the silvicultural management of pine forest but rather it is very supportive in regenerating seedlings under healthy mother trees. It needs a spacing of 2 m x 2 m purposely, if the plantation is for timber production. But, if intended for protection purposes such as in watershed areas in the pine region, spacing must be closer to provide immediate cover. For beautification, as in parks and roadsides, the recommended spacing is 8-10 meters. Natural regeneration qualifies to have at least 15 to 20 healthy seed trees with diameters of 30-40 cm at breast height per hectare can produce adequate stocking. These remaining seed trees should be scattered evenly throughout the area to minimize overstocking or reproductions on some portions and scarcity in other portions. At a distance of about 20-30 meters between mother trees, there are about 5,092 to 5,741 seedlings as regeneration on a one hectare area. The success of Benguet pine forest to regenerate itself cannot be doubled, provided it is given the needed silvicultural treatment and proper protection from weeds, fire, animals and insect pests.

H. Water Quality Assessment

The streams and rivers developed from the tributaries of Benguet pine forest watershed prove to be useful as a reservoir in providing water for urban and rural areas. In order to maintain the water flowing coming from the tributaries brought about by over exploitation, waste water disposal, and other indirect effects on the hydrologic cycle, the water quality parameters used by the Environmental Management Bureau (EMB) are the following: biological oxygen demand (BOD), dissolved oxygen (DO), total coliform organisms, pH, total suspended solids, total dissolved solids, conductivity, salinity, and temperature.

I. Programmes on Public Awareness

Formal Degree Programs

In the Philippines, the subjects in forestry courses in the undergraduate studies, graduate school and post secondary courses and related discipline offered by the state, universities and colleges are essentially informative and practical with special interest to the forest and forestry sector, promoting sustainable management, protection and nature conservation.

The Educational Institutions in the Cordillera which are supportive to the vision, mission, mandate and policy thrust of DENR, we have:

- Abra State Institute of Science and Technology (ASSIST), Lagangilang, Abra
- Benguet State University (BSU), La Trinidad, Benguet
- Ifugao State College of Agriculture and Forestry (ISCAF)
- Kalinga-Apayao State College (KASC), Bulanao, Tabuk, Kalinga
- Mountain Province State Polytechnic College (MPSPC), Bontoc, Mountain Province
- Easter College, Guisad Road, Baguio City

Non Formal Programs

The Department of Environment and Natural Resources also conducts training-workshops and seminars related to the development, management, protection and conservation of the pine forest watershed.

J. Implementation of Policies

The Philippines has promulgated policies which are concerned with the protection, conservation and proper utilization of Benguet pine forests. Currently, it is implemented and strictly adhered based on the provision of Presidential Decree No. 705 known as the Revised Forestry Code of the Philippines, adopts the following policies:

1. The multiple uses of forest lands shall be oriented to the development and progress requirements of the country, the advancement of science and technology and the public welfare;

2. Land classification and survey shall be systematized and hastened;

3. The establishment of wood processing plants shall be encouraged and rationalized; and

4. The protection, development and rehabilitation of forestlands shall be emphasized so as to ensure their continuity in productive condition.

Conclusion and Recommendation

The Forest Management Bureau (FMB) has been pursuing its task in managing the watersheds through the following programs/projects such as the rehabilitation and conservation, watershed protection and resource development utilization. These can be considered as a quick advantage toward the improvement of the biophysical features of the pine watershed. And apply the technological innovations best suited to its need and accord to the existing laws, policies, rules and regulation in the management of the Benguet pine forest watershed. Discourage styles of forest destruction which may degrade the upland watersheds and inculcate the value of the pine forest watershed by means of massive and continuing information, education and communication campaign (IEC). Overall required is continuing educative action so that everyone in various walks of life will be aware of their responsibilities and become willing to do what they can to help.

To ensure support in the protection and conservation of our remaining Benguet pine forest, the following are recommended:

- Include indigenous people of the Cordillera specifically the barangay level in all discussions, formulation of plans, and implementation of projects/programs
- To extend technical assistance and skilled human resources in performing the activities with the highest level of interest and widest unfailing support
- To set aside funds for the sustained productivity and stability of Benguet pine watershed
- To perform scientific land use planning that would properly allocate resources and land areas to various uses

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