Biodiversity conservation envisioned to livelihood development in Nagaland

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Abstract

Nagaland is located in one of the twenty five hotspots of the world in terms of biodiversity. It has a rich and varied heritage of biodiversity owing to its varying physiographic and geo-climatic conditions favourable for luxuriant growth of vegetation in both flora and fauna. It varies from tropical rain forests to alpine vegetation and from evergreen forests to sub-tropical climatic region. A study of Biodiversity conservation was carried out mostly from Kohima and Mon district, villages are namely Viswaema, Jakhama, Kigwema, Mima, Phusama, Jyotsoma, Khonoma, Mezoma, Kohima, Longwa, Mon, Chengmo, Lampong Sheanghah etc. The villages are located on the top of ridges or on slopes, at altitudes of 500 to 2,500 meters above mean sea level. The survey was conducted on the basis of random sampling. The survey revealed that 50 nos. of species of broad leaved, 22 species of Bamboo, 40 species of medicinal plants, 5 species of canes, 4 species of coniferous and 354 species of orchids were prevailing in the study area and most of them are epiphytes or lithophytes. There are about 41 species of mammalian fauna, 43 species of avian fauna, and 8 species of reptilian fauna. The faunal diversity in study area is also rich with rare birds and animals. World's tallest Rhododendron trees found in Japfu Mountain of Kohima district were recorded in the Guinness Book of World. Most of species, both flora and fauna, appears to be endangered may be due to heavy biotic pressure, interference, reckless deforestation etc. flora like Dipterocarpous macrocarpous (Hollong), Shorea assamica (Makai), Rodhodendron Spp., Mesua ferra (Nahar), Arundinaria graminifolia (Bamboo orchid) etc. Endangered fauna like the largest Asian mammal, Elephant, Melurses ursinus (Sloth Bear), Prionodon pardicolor (Spotted linsang, Tiger-civet), Panthera tigris (Tiger), Macaca assamensis (Assamese macaque).

Study revealed that most of the species, both flora and fauna, appears to be endangered due to heavy biotic pressure/ interference and reckliess deforestation.some exotic flora and fauna species has already became extinct. Some flora and fauna are also preserved by the Naga society. They have taken lots of conservation practices like Pani-kheti, bamboo drip irrigation, Terrace cultivation, community land ownership; Zabo farming system, Alder based farming system, and green manuring. This type conservation practices and farming systems has increased at least three times higher socio-economic return of Nagaland than any other conservation practices. Hence, bio-diversity of Nagaland varied with fertile soil, agro-ecological situations of plains as well as valleys, hills, tilla land, immense water resources, human resources of ethnic diversity and cultural groups, could be potential sources for economic development of Nagaland and the north east region as a whole. To preserve the bio diversity of the state, ecology and gene pool, judicious management and care of natural resources are necessary. Local systems of conservation and traditional knowledge may also to be given importance.

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(Key words: Biodiversity Conservation, Livelihood Development, Nagaland.)

Introduction

Nagaland is one of the seven states in the northeastern region of India. The state of Nagaland extends between 25^0 05'and 27^0 10' North latitude and 93^0 28' and 95^0 05' E longitudes *(Singh, 2010)*. The capital of the state is Kohima 339 km distant from Guwahati. Sixty-seventy major ethnic groups of people are the inhabitants of the region *(Hore, 2005). As per schedule,* there are 16 nos. of major tribes in the state are *Angami, Ao, Chakesang, Sema, Chang, Khiamungan, Kuki, Konyak, Lotha, Phom, Pochury, Rengma, Sumi, Sangtam, Yimchungre, and Zeliang (Bareh,2001).* The area of the state is 16527.0 km^2 with a population of 19,88,636. The population density is around 120 persons/ km^2 with literacy rate of 67.11%.

Nagaland is a hilly state with high mountains, deep gorges, lush valleys, and winding streams. The dominant geographic feature of the landscape is the Naga Hills, which run all the way through the state and contribute to the mountainous terrain *(Singh, 2010).* Nagaland comprises a part of the hill ranges which separates the basins of three major rivers, i.e., the Brahmaputra, the Chindwin and the Barak. The hills of Nagaland are in parallel folds running from north to south. The Saramati Peak (3,841 m) is the highest *(Singh, 2010)*. There are around 1,317 villages in Nagaland. About 150 of these villages are located in the foothills, along the state's boundary with Assam in the west. The remaining villages are located on the top of ridges or on slopes, at altitudes of 500 to 2,500 meters above sea level. Nagaland has a total land area of 1,650,705 hectares of which about 1,450,000 hectares land is owned by the people in the villages (*Bareh 2001*)

People of Study Area

Nagas are basically tribal people and every tribe had its own effective system of self-governance since time immemorial. The present Nagaland was only a district called "Naga Hills" within the state of Assam till 1957. A tribe is distinguished by its language, mores and customs. Each tribe tends to treat itself as a race apart. The patrilineal descent is the vehicle of continuity which provides stability to the Naga social structure (*Bareh, 2001*). The social structure has its special ethical and moral values which enjoying a member to clearly recognize what is its own, what belongs to the neighbour and what belongs to the village as a whole. In the Naga society, elaboration of the descent groups provides a scaffold for organizing social relationships amongst the territorially divided social groupings, particularly the clans and lineages. In Naga society, there is no class or caste. Socially, a tribe consists of subdivisions called clans. The Naga tribes follow the exogamous principle in marriage except Konyak chiefs (*Sadangi, 2008*).

A Naga village may more appropriately be defined as a cluster of independent clans occupying distinct clan-territories. These clan localities had come to be described as *khels* during the British period. Each clan traditionally enjoys its autonomy in terms of its exclusive political, social and economic rights over well-defined land and forest areas including water resources and fishing areas.

In the classless, caste-less Naga society, women have traditionally enjoyed a high social position, with a pivotal role in both family and community affairs. However, being a patriarchal society with strong warrior tradition, it is considered an honour to be born as a man. The traditional culture and customs expect a Naga woman to be obedient and humble; also expect her to perform the roles of wife, mother, child bearer, food producer and household manager. She also supplements the household income by weaving colorful shawls, an activity which is done exclusively by women. Women are highly respected and given a great deal of freedom, however, they are traditionally not included in the decision-making process of the clan or the village.

Nagaland has an agrarian economy with over 70% of the population dependent on agriculture, and maintains a rich genetic diversity in crops such as rice, millet, maize, pulses, sugarcane, potato, coffee, cardamom, tea, etc. Rice is the important food grain *(Singh, 2010.)*

Agro-climate of Study Area

High rainfall agro-climatic condition of a place plays a vital role in crop planning, irrigation scheduling, water harvesting as well as in design of infrastructures for green houses for horticultural,

floricultural etc. The classification of agro-climatic zones of North Eastern Region of India (excluding Assam) have been based on altitude, rainfall pattern, temperature variations, topography, soil etc. Nagaland is classified into six agro-climatic zones namely: Alpine zone, Temperate and sub-alpine zone, Sub-tropical hill zone, Sub-tropical plain zone, Mild Tropical Plain zone and Mild tropical hill zone (*Borthakur, 1992*). The mean maximum varies from 21.0 to 31^{o}C whereas annual mean rainfall varies from 920 to 2500 mm in the study area (*Sadangi'2008*).

Methodology

A wide range data has been collected on socio-cultural, demographic, reproductive history, health aspects etc. which are manifested through an intricate series of changes. The methodology for the study of the target area, flora, fauna, biodiversity, conservation and preservation etc. has been given detailed in this chapter. A format was designed for the benchmark survey. The indicators included bio-physical, socio-economic as well as infrastructure related and including practicing of indigenous/ traditional farming system. The survey was conducted during 2005-2007 by Research Associate, Sr. Research Fellow/ contractual workers under the supervision of scientists and anthropologists. The study envisages covering nine villages namely *Viswema, Jakhama, Kigwema, Mima, Phusama, Jytosoma, Mesoma, Khonama and Kohima* from Kohima District (*Angami* Region) and four villages from Mon District i.e. *Lampong Sheanghah, Mon, Chengmo and Longwa* about 100-800 farm families in each village. The considerable indicators are food sufficiency, land quality, forest area, preservation of biodiversity and ecological conservation.

The questionnaire was designed with a schedule for evaluating biodiversity conservation as well as socio-economic characteristics of the participants in the survey. The schedule was containing question on age, gender, house hold size, total annual income, total land owned, total land cultivated, land tenure system, land use pattern, number of children, child nutrition, farming system, labour on farm, food habits, indigenous technical knowledge (ITK), cultural heritage, house pattern, animal rearing and hunting, flora-fauna, medicinal plants, agricultural and horticultural crops, soil and water conservation practices etc. Format for Baseline information is provided in Annexure – I.

Result and Discussion

Biodiversity

Nagaland is very rich in bio-diversity, both flora and fauna. Even today some pockets of forests are covered with gigantic trees, where sun- rays cannot penetrate. Due to reckless and uncontrolled cutting of trees for timber, firewood, continued *Jhum* cultivation and annual fire in vast tracts of land, forests got degraded and barren, which accelerated diminishing of the most of the original characteristics of the forests. Though geographically being a small state, Nagaland has several types of forests, mainly because the state is mostly tropical, and the altitudes range from a few hundred meters to about four thousand meters. The major types of forests found in the state, as per the classification of Champion & Seth, are as follows:

1. Northern tropical wet evergreen forests.
2. Northern tropical semi- evergreen forests
3. Northern sub-tropical broad leave wet hill forests
4. Northern sub-tropical pine forests.
5. Northern Montana wet temperate forests
6. Temperate forests.

The local population is intricately involved with the forests for their sustenance, be it agriculture, timber, items of woods for day to day or the uses of medicinal plants etc. These forest products are also their main source of economy. Therefore, when the main stay of the people is dependent on forests,

destruction of forests is imminent and thereby endangering many valuable species. Due to the primitive method/ practice of cultivation (*i.e. slash and burning*) the rich biodiversity of the state is dwindling year by year. Most of species, both flora and fauna, appears to be endangered due to heavy biotic pressure/ interference and reckless deforestation.

Flora

Out of two biodiversity hotspots of north east India, Nagaland belongs to Indo-Burma hotspot *(Mittermeier et al., 2004).* The state is having 2250nos. of floral species out of 8550 floral species of the region. Among these species world's tallest Rhododendron tree were also found. Rhododendron has been found in *Japfu Mountain of Kohima* district is recorded in the *Guinness Book of World*. Commonly found floras in the survey are as follows:

Dipterocarpous macrocarpous (Hollong), *Shorea assamica* (Makai), *Rhododendron* Spp*., Mesua ferra* (Nahar), are rare and endangered spp. *Panax gensing* (Gensing) is found only in Tuensang district at higher altitude which is endangered. *Aquilaria agallocha* (Agar) is also an endangered species.

Bamboo

There are 17 nos. species of bamboos available in the state. The important *spp.* of bamboos is as follows:

Canes

Around 5 nos. of species of namely, *Calamus rotang, Calamus flagellum, Calamus erectus, Calamus gracilis and Calamus floribundu were* found in the survey.

Coniferous

About 4 nos. of coniferous namely *Pinus khasyia (Indigenous), Pinus caribiae* (Exotic), *Pinus petula* and *Cryptomeria japonica* (Exotic) were found.

Broad Leaved

Survey revealed around 50 nos. of following broad leaved species in Nagaland.

Lagerstromia speciosa (Ajhar), *Tectona grandis* (Teak), *Mangifera indica* (Am), *Alnus nepalensis* (Alder), *Morus laevigata* (Bola), *Tetrameles nudiflora* (Bhelu), *Trewia nudiflora* (Bhelkar), *Betula alnoides* (Betula), *Canarium resiniferum* (Dhuna), *Gmelina arborea* (Gomari), *Cinnamomum cecicodaphne* (Gonsoroi), *Nyssa javanica* (Gahorisopa), *Terminalia myriocarpa* (Hollock), *Adina eligocephala* (Haldisopa),*Cedrela toona* (Jatipoma), *Podocarpus nerifolia* (Jinari), *Altingia exelsa* (Jutuli), *Duabanga grandiflora*(Khokon), *Albizzia procera* (Koroi), *Anthocephalus kadamba* (Kadam), *Shorea assamica* (Mekai), *Endospermum chinensis* (Phulgomari), *Melia azadirach* (Ghoora-Neem), *Stereospermum chelonoides* (Paroli), *Magnolia spp.* (Sopas), *Cassia fistula* (Sonaru*), Bombax ceiba* (Semal), *Ficus nervosa* (Robar), Spondias axillaris(Hog plum), *Michelia champaca* (Titasopa), *Bischofia javanica* (Uriam), *Juglans regia* (Walnut), *Mansonia dipikai* (Badam), *Phoebe goalparensis* (Bonsom), *Dipterocarpus macrocarpus* (Hollang), *Terminalia chebula* (Hilika), *Schima wallichii* (Gogra), *Mesua ferrea* (Nahar), *Albizzia lebbeck* (Siris), *Quercus Spp*. (Oaks), *Artocarpus chaplasha* Sam), *Chukrasia tabularis* (Bogipoma), *Terminilia bellerica* (Bahera). *Hovenia dulcis(Coral tree), Acrocarpus fraxinifolius(Mandani), Bucklandia populnea(Pipli), Pseudostreblus indicus(Tsüngkoh)*

Medicinal Plants

The prominent species which are found in Nagaland are: *Panax pseudo-gensing* (Gensing), *Taxus baccata* (Yew), *Aquilaria agallocha* (Agar),*Solanum khasianum, Ocimum sanctum* (Tulsi), *Aegle marmelos* (Bel), *Rauvolfia serpentina* (Sarpgandha), *Elaeocarpus ganitrus* (Rudraksha), *Dioscorea deltoides (*Kath Aloo), *Emblica officinalis* (Amla), *Swertia chirata* (Chirata), *Rubia cordifolia, Oroxylum indicum, Clerodendrum colebrookianum, Passiflora edulis.* Some of the medicinal plants are listed in below which are using by Angami Naga in Nagaland (Table 2)

Orchids

Nagaland has about 354 spp. out of 1250 spp. of orchids found in India. Most of the Orchids here are epiphytes or lithophytes. A few terrestrial orchids are also found in the state. Rarely found and endangered species of orchids available in the state are: *Thunia*- 1no. species, *Arundinaria graminifolia* (Bamboo orchid), *Renenthera* (Red vanda), Rhynchostylis (Fox-tail*), Pleoni, Phauis* (Ground orchid)-2nos of species, *Paphiopedilum*-1no. species, *Cymbidium tigrinum*-1no. species. The Orchids species fund in Nagaland are mentioned in the Table 3.

Fauna

The largest Asian mammal, Elephant is endangered spp. The other endangered spp. are *Melurses ursinus* (Sloth Bear), *Prionodon pardicolor* (Spotted linsang, Tiger-civet), *Panthera tigris* (Tiger), Macaca assamensis (Tailed pig). The Gaur, or Indian Bison in habitats in Intangki National Park and Fakim Wildlife Sanctuary and other hilly areas is facing extinction from Nagaland The different species of horn bills and tortoises are also endangered. There are 41 nos. mammals (Table 4), 8nos. reptiles (Table 5), 43 nos. of bird species have been found in Nagaland (Table 6).

Conservation Measures and Practices

About 85-90 percent of land in Nagaland was under community ownership. Originally, the Nagas were head hunters and food gatherers. They have land for shifting cultivation, settled cultivation and forests reserves to meet food, vegetables, medicine, fruit, fuel, timber and other requirements. Wild meat was an integral part of tribal culture in Nagaland. Indigenous gun for hunting were present in almost every house. Degrading of forests and high rate of hunting has led to a quick decline in the population of wild animals, density of orchids, wild medicine, fruits (wild products). In spite of some student organization and Village Council adopting rules to prevent collection of any wild products, people do not generally follow the rules. But it has been observed that the people of Khonoma village have accepted the Wildlife (Protection) Act 1972. They have formulated rules and regulations for the management of the Khonoma sanctuary and ecosystems. The villagers do not destroy the forests and its products for which Khonoma has been declared as "*Green village*".

They have taboos as well as rituals related to conservation of forest, wild products, the ultimate objective of which is the conservation of ecosystem. For example, Angami people as a team of young girls and boys go and collect bamboo (small and thin) and broom grass from the forest for chasing chicken fishing and sweeping purposes before Sekhreni festival, which indicate they do not disturb the forest in all the times.

Conservation of Soil and Water

The soil conservation practices in agriculture aimed to maintain productivity for sustained production of crops. The term soil conservation includes the preservation and restoration of lands *(Singh, 2002)*. In most of the agricultural fields, soil erosion is minimized through traditional methods such as by bamboo clums, stones and gunny bags filled with soil *(NIC, 2001)*. A form of bamboo fence (called *Tempale*) is erected by Ao tribe (especially in the slope) to prevent the top soil and fertile soil from being washed away by rain. A sort of small stones and logs (small) are placed hither and thither or wherever necessary to check soil being carried away by rain. Trees are planted, especially in the sloppy areas to hold soil and thus prevent soil erosion. Adopted terrace cultivation to prevent soil erosion. Some non-cereal crops such as grass clover (*Trifolium repens* Linn) and alfalfa (*Medicago sativa)* conserve the organic matter in the soil. Thus growing these crops tends to conserve soil even if some minerals are carried always in the removal of crops (*Singh, 2002* and *Chinnamani, 1977*). Applying green leaf and farmyard manure is the traditional method of improving the condition of the soil, in which green leaves and farmyard manure are ploughed into the soil. It helps in improving soil fertility through fixation of nitrogen using microorganisms *(Sarma, 2002, Satapathy, 2002 and Laxminarayan, 2002).*

Conservation of agricultural diversity (crops and vegetables)

Paddy

Rice is the principal food crop of the region and was extensively cultivated (72 percent of the total cultivated area) in upland, lowland and deep-water conditions *(Hore, 2005).* Paddy, after harvest were collected and kept in a very big container made of bamboo called *Mosem/Okhi* which has a capacity of 200–250 bags (Molule). A kind of funnel shaped structure called *Tsukbong* were kept in the middle of the container so that air was allowed to circulate inside the container and thus prevent the paddy from getting spoilt/rot, in Angami areas they use net type structure as inner wall of the *okhi* made of bamboo for the same purpose as like Ao tribe and they cover with *orha*(lid) and the join between grannery and *orha* they plaster with mud to prevent from insects. In this way paddy were kept throughout the year without being spoilt. Thus about 5–7 bamboo containers (*Mosem/ Okhi)* were kept in a special hut meant for paddy called granary which were constructed at a distance away from residential house in Ao houses but in Angami houses they keep granary in front of the drawing room or both side of the main door to show their socio-economic status. Moreover in Angami areas outsiders were not allowed to touch their granary. Rice-*Oryza sativa* L. *spp.* was found in the survey.

Maize

Maize after harvest are tied in a bunch and hung in the open air usually away from fire *i.e*., dry and airy place. But in Angami areas they hung in the kitchen for eating and sowing (seed) purposes. In this way, they can be kept long till the next season. Maize-*Zea mays* L. spp. was found in the survey.

Naga Dal and Other cereals

After harvesting, these were stored in a light container usually made out of bamboo. These are stored in the container and are made use throughout the year. Wheat-*Triticum aestivam* L. and Sorghum-*sorghum bicolor* L. were fund in the survey.

Bamboo Shoot

Bamboo shoots after collection from the forest could be preserved in following different ways.

Liquid Form

Bamboo shoots were crushed and made into paste. After that they were wrapped lightly in a banana leaf and a stone was placed over it so that by its pressure and weight, the juice present in the bamboo were drained well and collected in a container placed below it. The juices were stored in a bottle or big bamboo in an air tight condition. It was used in making different dishes.

Solid Form

The remaining solid form *i.e.* after the juice has been drained properly it was stored again in different container and was kept throughout the year. It was considered as one of the special food item among Ao Naga in particular and also Naga in general.

Dried Form

The solid form is again dried in the sun properly and stored in container. It is used throughout the year without being spoiled.

Yam

Yam bulb: After harvested, it is kept in the open cool, dry place so that moisture is removed from the bulb so as that it does not get spoiled.

Yam stem: Stem is cut into pieces and dried properly and kept in a bamboo container.

Yam leaf: Leaves are collected and cut into small pieces, dried and stored in an indigenously made pouch made out of palm leaves.

Sweet Potatoes

After harvesting they are kept in cool, dry place and are utilized throughout the year.

Gooseberry

After collection, they were boiled with little salt and dried after which they were stored in a container.

Chilly

After harvesting they dry and wrapped with banana leaf and hung inside the C*hullah* and use throughout the year.

Chow Chow (*squash*)

Tanghkul, Angami and other community of Naga tribes in order to conserve knoll-khol, dig pit whose length and width depends on the quantity of Chow-chow to be conserved. The depth is usually ¾ meter. The Chow-chow is kept covered with earth. By this indigenous method, Chow-chow remains fresh for 6 months to 1 year.

Conservation of Land by Customary Law

Individual ownership of land was absent in Naga society. The land was classified as either clan land or village land. Even today their traditional land holding systems are prevailing in the society. All clan land will be village land but all village land will not be clan land. Only those who are very rich purchase land. And that's how private or individual ownership come into existence. But that land should be permitted from the seller party's clan members. Till today they don't have any specific measuring unit for land or any given area. To measure the land they have some kind of boundaries (demarcated area) through laws which is called customary law. Customary law is very strong among all the Naga tribes, be it in Nagaland or Manipur (Tanghkul/Zeliangrong) or Arunachal Pradesh. Transfer of land is going on from generation to generation. The ownership differs from community to community among the Naga tribes. For e.g. among the Ao, Sema, Lotha etc. the first son of the family owns the main share of the land but in Angami tribe, the youngest son gets major part of the property. Though the land can be used for cultivation, they lack the authority to sell, lease or deal with any monetary work of the land. They have specific land for cultivation either for *Jhum* or terraced cultivation.

Biodiversity results from the combined interactions and relationships between natural circumstances and human influence. The single most important factor generating reduction in biodiversity is human land use, and thus changes in land use practices *(Catizzone. et. al.,* 1998).Land use system affect the pattern and diversity of vegetation (*Cernusca et. al.* 1992; *Tappeineir &Cernusca,* 1993) and fauna (*Tscharntke & Greiler,* 1995). Preservation of biodiversity cannot be pursued only with the protection single species, or habitats, or foundation of reserves. Biodiversity is interlinked with human land use (*Chemini& Rizzoli*-2003). The simplest definition of biodiversity is the number of species living an area. The set up of local faunas results from a series of processes that were summarized by *Schluter& Ricklefs* (1993). The land conservation is directly related to natural resource conservation (forest, soil, water, flora, fauna etc.) i.e. the conservation of biodiversity.

Major Customary Rules and Regulations in Study Area

1. For purchase of land by any person, he needs to consult with other members of the clan. It is only after the consent granted by the other members of the clan that the land can be purchased.
2. For share cropping and shifting cultivation they do not have specific tenure. They shift from one place to another depending on the variety of crops, types of cultivation.

3. An individual cannot take his sole decision regarding share cropping. It depends on other members of the clan.
4. All the members of the clan participate for lease to land or any monetary decisions by all the members of the clan
5. The benefits whether to be shared by individual or all the members depends on the decision taken by the clan members.
6. Clan fund is used for purchasing of land. All the members of clan contribute equal amount of money and that money is used for purchase of land which will be called as clan land.
7. Restricted forests are not allowed for cultivation and any other purposes. They have specific forests for fuel or furniture / constructive purposes.
8. An important rule is that forest products can be sold but not forests. They are of the belief that forests are their traditional property/right and should be preserved. And for this reason, the percentage of forest land is more than in any other areas. They feel that the sale of forest is giving away their tradition/identity.
9. If anyone migrates from one place to another he need to donate his share of forest land to other members of the clan but the sale of forest land cannot be done.
10. If anyone in the clan wants to sell land for need of money in time of emergency, he should make known his problem to the other members of the clan. The members of the clan will try to solve the problem by themselves without the involvement of any outsider. The land is either purchased by an individual or a group of members in the clan.
11. Plantation in forest with clan to clan or any others, there should be agreement for tenure and monitory benefit or products. Everything will be decided by the members of the clan not individually.
12. For any land dispute or other problems that arise in clan will be solved by clan members; for inter clan, the Village Council Chairman. But inter clan affairs from Village Council will again come to clan members to make situation normal. The punishment will be shared by the other members of the clan for inter clan affairs.

Customary practices play an important role in conserving and protecting the biodiversity, thereby providing an indirect protection. For instance, in the *Khasi* community of Meghalaya, villages own groves, which are the common property of the community. Composed of mainly oak and rhododendrons trees, these are held as sacred. It is treated as an offence for anyone to cut timber in the grove, except for cremation purposes. Again the *Todas* of Nilgiri Hills in South India believe that the Goddess *Tokissay* created them their unique buffaloes. Many of the peaks and grasslands where they graze their buffaloes are enshrined in their myths and legends and are sacred to them. Therefore the *Todas* who are vegetarians neither hunt animals nor till the earth for agriculture. The *Nishi* tribe of Arunachal Pradesh hunts the hornbill for the use of its beak in their traditional headgear; there is an inbuilt conservation mechanism within their culture to protect the bird in the form of customary prohibition on the killing of the bird during the breeding season (*Srivastava*'2004). Another instance from Nagaland, after the death of any clan member, they do not go forest/ do not cut tree / do not disturb the natural resources. It is naturally imperative that local bodies and customary law be empowered, since by protecting biodiversity. Customary laws can be of great and advantage in order to recognize and continue these practices. Therefore it becomes almost essential to strengthen biodiversity.

Conservation of Forest /Ecology/Ecosystem:

Nagaland has been endowed with a wide variety of forest types on account of its unique geographic locations and wide range of physiographic terrain obtained in the state. Forest occupy an area of approximately 8, 62,930 ha of which government forest account for 11.7 percent. The private forests

vested with the villagers are being haphazardly, unscientifically exploited without taking into consideration the future supply.

Though in old time, the people were not aware about the conservation of ecology or ecosystems, they were having a sense of conserving the forests and ecosystems in traditional ways. The villagers were not allowed to cut trees without taking permission from the other members of their respective clan. Permission had to be sought for fishing and other aquatic products from the local authority. Generally permission is granted to the groups rather than to an individual so as to share the benefits among large number of people. In order to maintain and regulate water supply to the fields, the surrounding hills were covered with forests.

Restricted forests are not allowed for cultivation and for any other purposes. They have specific forests for fuel or furniture / construction purposes. An important rule is that forest products can be sold but not the forest. They are in the belief that forests are their traditional property/right and it should be preserved. Due to which, the percentage of forest land is more than in any land holdings. They are of the belief that sale of forests is like giving away their traditional identity. Moreover, no member of the clan was allowed to sell his share of forests while migrating from one place to another; he could only donate to any of his fellow clan. Plantation in forest could be done by the clan members.

Department of Forest has initiated Joint Forest management during the year 1997 with an objective to conserve Forest ecology/ ecosystem. They have involved a total of 55 communities managing an area of 650 ha. More than 85percent of forests are privately owned in Nagaland with a provision to provide the share to the private owner at the time of harvesting. But private owner should not utilize the land for own forestry purposes.

Conservation through some indigenous farming system

Several farm-level water management innovations and traditional practices have been tried in the past namely; integrated watershed management with a water harvesting structure as an integral part, sustainable multi-commodity farming systems, *Zabo* system of cultivation, *Bamboo drips*, *Pani-kheti, Apatani system* and more recently storing rainwater in plastic-lined ponds *(Jalkund*) or ferro-cement tanks (*FCT*).

Survey also revealed that indigenous farming systems are playing a vital role for natural resource conservation and on farm resource recycling in North-Eastern hilly region as well as in Nagaland. The indigenous farming system that are predominant in Nagaland are *Zabo system, Alder based system, Jhum kheti* (Shifting cultivation) and *Pani-kheti* system. These indigenous agricultural practices are mainly based on scientific knowledge of plants, conservation practices and land use systems.

Zabo farming system

The word *'Zabo'* means impounding of water which is a superb system of rain water harvesting. *Zabo* system is locally known as *Zura* system is practiced by Chakesang tribes. This system is a combination of forestry, soil and water conservation. *Zabo* is practiced in Phek district of Nagaland state. This farming system has a combination of forestry, agriculture and animal care with a well-founded conservation base, soil erosion control, water resources development and protection of environment. This farming system is followed on the hill slopes up to 100 percent or even more (*Mishra and Sharma, 2001).*

It has a combination of forest towards the top of hill, water harvesting tanks in the middle for agriculture and paddy field followed by cattle yard at the lower side with well-founded soil and water conservation base. The tank is used for storage of water for the crops as well as for irrigation during the crop period. Special techniques for seepage control in the paddy plots are followed. Paddy husk is used on shoulder bunds and puddling is done thoroughly so that seepage of water through the bund is checked. Special techniques for seepage control in the paddy plots are followed. Paddy husk is used on

shoulder bunds and puddling is done thoroughly. The catchment area is generally kept under forest cover without disturbing by activities such as cutting and burning of trees. The water carries with it the dung and urine of the animals to the fields. This serves as good source of nutrition for the crops.

The *Zabo* farming system is a traditional agriculture and forestry land use system which has an inbuilt water harvesting and recycling systems with well founded conservation base to control soil erosion, proper management of soil fertility and available water. It is a viable practice of resource management and maintenance of ecological balance.

Alder based farming systems

In this system soil fertility is maintained by planting Alder (*Alnus nepalensis*) in the system which can fix atmospheric nitrogen. This involves planting of the alder trees to enhance the soil fertility with crops such as maize, Job's tears, millet, potato, chili, pumpkin, barley etc. The alder grows well on lands varying in altitude from 800 to 3,000 m. It is a non-leguminous tree that fixes atmospheric nitrogen through nodules on the roots. Besides fixing atmospheric nitrogen, the litter of the trees adds to the soil phosphorus, potassium, calcium, and other nutrients through the addition of biomass. The Nepalese Alder *(Alnus nepalesis)* tree based TEK which is incorporated both during the cropping and the fallow phases of *Jhum*, widespread throughout the Angami tribe of *Khonoma* village near Kohima. This fixes up to 120kg N per hectare per year, and is the starting point and the basis for identifying a number of other tree species, for a redeveloped *Jhum (Ramakrishnan, 2008).*

Pruning of alder tree is done regularly to maintain required height and green biomass is recycled in the system. Whereas, branches are used as fire wood and Alder leaves are also a medicine used for blood coagulation. The *Jhumia of Khonoma* village under Kohima district of Nagaland plant alder trees in the *Jhum* cycle area and traditional agricultural crops basically with the idea that their root nodules improve soil fertility by fixing atmospheric nitrogen. It also increases crop yield and reduces soil erosion, besides providing shades to plantation crops like coffee at lower altitude and cardamom at higher altitude. Normally, a *Jhumia* cultivates the field for 2 years within a nine years span, but the alder-based system allows two harvests in every 4 to 5 years. The system involves pollarding of alder trees in two phase i.e. (i) Initial pollarding and (ii) cyclical/subsequent pollarding. This practice has been in use since about 100 years by the whole community. The ability of the alder trees to develop and retain fertility of the soil has been fully utilized by farmers in Angami, Chakhesang, Chang, Yimchunger and Konyak area in Nagaland at varying altitudes *(Gokhle et al., 1985).*

Large cardamom alder based farming system

The large cardamom (*Amomum subulatum* Roxb.) based farming system is one of the most important among them. Large cardamom as an under growth occupies the middle tier in the three-tier forest constitution with alder (*Alnus nepalensis*) as the dominant companion. Large cardamom is one of the most stable cash earners for the people of Khonama. Normally large cardamom has been observed to thrive well in association with the Himalayan Alder (*Alnus nepalensis* D. Don) and hence, this companion is also called as the large cardamom–*Alnus* farming system.

Shifting cultivation

The Shifting cultivation developed in Mizoram and Nagaland for survival of people living on the slopes was the best way to sustain soil fertility and productivity, and to conserve and use the bio-resources in a sustainable manner. This highly organized agro-ecosystem called *Jhum* is based on empirical knowledge accumulated over centuries. It involves slashing of vegetation, burning it before the onset of monsoon, raising a mixture of crops on temporarily enriched soil for a year or two, leaving it fallow for a few years and returning for another cropping cycle after a gap of 5-15 years *(Singh, 2008)*. This type of cultivation system is also called as *Slash and Burn* agriculture and still prevalent in Nagaland. The area under shifting cultivation (*Jhum or Swidden cultivation*) is about 74,040 hectare and under

terraced cultivation is 61,060 hectare during 1994-1995. Shifting cultivation covers over 73 percent of the total arable area of the state. It is mostly concentrated in the districts of Mokokchung, Tuensang, Wokha, Zunheboto and Mon (*Sharma, 2010)*. The farmers have started maintaining agro-biodiversity in *Jhum* fields by sowing agricultural crops amidst naturally regenerated plants preserved in *Jhum* cycle. Boundaries are demarcated through the cultivation of creeper crops like cucumber, pumpkin etc. Almost all the crops grown in the field are also found near the household. Due to such agricultural bio-diversity practiced by the farming community in Nagaland, the villagers are almost self-dependent. The practice of shifting cultivation is an important factor for village life through a wide range of food, medicine, fiber and fuel crops. The main advantage of the practice is that the ecosystem is maintained and preserved, besides ensuring availability of food; fuel etc., including medicinal plants for immediate local use. Local varieties of paddy, maize, soybean, millets, root crops, mustard and wide range of vegetables besides timber like teak, hollock, titachap and alder in specific areas. Almost all the farmers in higher altitude have been practicing this since 50–60 years. Proper support of the laid log/bamboo is ensured to last for at least three years, as the farmers go up to third year. Thus, the soil erosion and speed of the run-off water are checked and moisture is conserved in the soil and on the bund and serve as additional barrier as also to get additional harvest. This practice results in increased crop yield.

During the month of February/March natural vegetation is slashed for clearing the jungle and the dried biomass is burnt.Rice, maize, minor millets, tapioca, cucumber, pumpkin, chillies etc.are the major crops grown under shifting cultivation which also serves as vegetative barrier for soil conservation. Almost all the crops grown in the field are also found near the household. After cultivating for 1-3 years, the land is abandoned for regeneration of fertility and a new area is searched for *Jhumming*. The productivity of crops are very low *e.g.* rice productivity is 0.5-1 t/ha in *Jhum*. Under a mixed cropping system in Jhum land, the farmer harvests crops sequentially as and when the crop matures over aperiod of a few months; after harvesting the economically useful component, they recycle the biomass into their agricultural plot, which decomposes rapidly. Weed biomass pulled out of their plots were put back into the system for similar reasons; about 20 percent biomass of weeds, which they leaves in *situ* without being pulled out serves as important nutrient conservation role on the hill slope, which otherwise could be lost through erosive/ leaching process. Socially selected and/or valued species of indigenous agricultural systems and those from natural systems often have ecologically significant keystone value; these keystone species often play a key role in nutrient enrichment of the soil; such species helps in redeveloped land use systems with community participation.

***Pani-kheti* system (rice cultivation in terrace)**

In this system runoff from forest area on hill top is diverted into rice fields by contour terracing on the hill slopes to ensure water pounding. This ensures availability of water to rice and check weed growth in paddy field. All the left over crop and weed biomass are recycled into the system. Terrace cultivation is widely practiced by the tribal communities. The major crops include rice, maize, millets, pea, oilseeds (rapeseed/mustard and niger), fibers, sugarcane, tobacco, potato, etc. The farmers also cultivate a variety of temperate, subtropical, and tropical vegetables, which includes pea, carrot, chili, onion, melon, spinach, cucumber, brinjal (eggplant), tomato, brassicas, yam, and arums in home garden as well as in terraced field. They may be a monocrop or in mixed cropping system with diverse ingredients. The important cropping systems are rice–mustard, rice–pea, maize–mustard, ginger–mustard (*Singh, 2010*). All the indigenous farming systems are that local crop varieties and animal breeds are used which varieties are also needed to preserve in quality in-terms of nutrient content. All the works are done manually or with animal power and in organic farming methods. Therefore, all the indigenous farming systems are very important for keeping natural resources intake position.

Bench Terracing

Department of Soil & Water Conservation, Nagaland has initiated land development programme with terracing through farmers' participation during the year 2003-04. The terraced construction has been taken up in the land up to 30 percent slope with 50 percent subsidy by the Government and remaining 50 percent has been contributed by the beneficiaries. The scheme will stabilize 5574.00 ha of hill slopes and foot hill areas during the whole project period which otherwise will be subjected to heavy soil erosion and environment degradation.

Conclusion

The survey in thirteen villages of Nagaland revealed that bio-diversity of the state is rich and varied in nature. Biodiversity also changes with the variation of physiographic and geo-climatic condition of the state. Variation of topography also gave the state as a unique biodiversity in the region. Under this survey, 2250nos. of floral species out of 8550 floral species of the region, 17 species of bamboo, 5 species of canes, 15 species of medicinal plants, 354 species of orchids, 41 species of mammals, 8 species of reptiles, 43 species of birds have been found. Among the all the flora species, world's tallest Rhododendron tree were also found in *Japfu* Mountain of *Kohima* district which has already been recorded in the Guinness Book of World. Study revealed that most of the species, both flora and fauna, appears to be endangered due to heavy biotic pressure/ interference and reckliess deforestation.some exotic flora and fauna species has already became extinct. Some flora and fauna are also preserved by the Naga society. They have taken lots of conservation practices like *Pani-kheti*, bamboo drip irrigation, *Terrace cultivation*, community land ownership; *Zabo* farming system, *Alder based* farming system, and *green manuring*. This type conservation practices and farming systems has increased at least three times higher socio-economic return of Nagaland than any other conservation practices. Hence, bio-diversity of Nagaland varied with fertile soil, agro-ecological situations of plains as well as valleys, hills, tilla land, immense water resources, human resources of ethnic diversity and cultural groups, could be potential sources for economic development of Nagaland and the north east region as a whole. To preserve the bio diversity of the state, ecology and gene pool, judicious management and care of natural resources are necessary. Local systems of conservation and traditional knowledge may also to be given importance.

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Table 1 The important species of bamboos found in Nagaland

Sl. No.	Name of bamboo species	Sl. No.	Name of bamboo species
1	*Sinarundinaria griffithiana* (Munro) Chao & Renv.	10	*Dendrocalamus hookeri* Munro Kohima, Wokha
2	*Arundinaria griffithiana* (Munro) Saramati	11	*Dendrocalamus hamiltonii* Nees et Arn ex Munro
3	*Sinarundinaria elegans* (Kurz) Chao & Renv.	12	*Dendrocalamus giganteus* Munro Kohima, Mao.
4	Arundinaria elegans (Kurz) Puliebadze, near Kohima.	13	*Dendrocalamus calostachys* (Kurz) Kurz
5	Sinarundinaria rolloana (Gamble) Chao & Renv.	14	*Schizostachyum polymorphum* (Munro) Majumdar
6	*Arundinaria rolloana* (Gamble) Japfü Range, Kohima.	15	*Pseudostachyum polymorphum* Munro) Longsachu near Wokha
7	*Sinarundinaria nagalandiana* Naithani Niriyo Peak, Wokha.	16	*Schizostachyum dullooa* (Gamble) Majumdar
8	*Chimonobambusa callosa* (Munro) Nakai	17	*Teinostachyum dullooa* Gamble) Yikum near Wokha
9	*Arundinaria callosa* (Munro) Puliebadze above Kohima and Mao.		

Table 2 List of Plants that are used for Curing Different Ailment of Angami Naga

LocalName (Tenydie)	English name	Scientific name	Parts used	Uses
Wapa		Heliotropium indicum	Leaf	It is used for eye problem and also as feed for pig
Salu	Ild Tulsi	Oeimum sanctum	Leaf and juice	Headache, fever. Also used in pickle preparation
Wara	Pennywort	Centella asiatica	Leaf and juice	Leaf used for stomach problem & vegetable. Juice is for conjunctivitis
Mepyo		Leonurus sibinicus	Juice of leaf	Headache & fever
Allovera (Prickly pear)	Aloe vera	Cactaceae aps.	Leaf	Leaf juice used stomach & skin problem
Ova	Seasam(wild)	Sesamum indicum	Seed	Used for vegetable & as ointment
Rupro	Alder	Alnus nepalensis	Leaf	Leaf paste used cuts
Muduram	Guava	Psidium guyava	Leaf boiled	Used in dysentery & Diarrhoea
Rummu		Rubus ellipticus	Root	High fever
Kekhronhasi		Tamarindus indica	Seed	Snake bites
	Touch me not	Mimosa pudica	Root	Roasted rice pasted & juice of root together used in taking out pus from boils
Tomato	Wild tomato	Solanaceae sps	Leaf	Juice is used in kidney pain
	Goose berry	Phyllanthus embica	Fruit	Juice is used in dysentery
Kikoise	Wild brinjal	Solanum torum	Fruit	Juice used for stomach problem
Kipfu		Solanum kurzi	Fruit boiled	Used for stomach pain
Zepne		Salanum sps.	Leaves boiled	Used for stomach ache
Parazhi		Meriea esculata	Bark boiled	Used for stomach ache
Mekrinipu		Jropotum sps.	Leaf juice	Applied on boil to take out pus
Kuchurabi		Side acuta	Stem piece	Tie around the neck with thread with clothes
Thayle	Banana	Musa sps.	Stem boiled	Boiled juice drink for diarrhoea
Peza		Menea explanta	Bark	As powder mixed with water and drink for dysentery
Lemon + Keshu	Lemon +Snail shells	Citrus sps. + Snail shells	Snail shells dissolved in lemon juice	The juice drink for malaria
Zerpru		Solanum sps.	Leaf boiled	Juice drink for malaria
Tsomhu		Rhusjavanica	Fruit	As powder mixed with water and drink for cholera
Metsuniu		Phlogacanthus pubinaris	Leaf boiled	Drink for gastric problem

Table 3 List of Orchid species found in Nagaland

Sl. No.	Name of orchid species	Sl. No.	Name of orchid species
1	*Acampa papillosa*	51	*Bulbophyllum umbellatum*
2	*Acampa rigida*	52	*Bulbophyllum uniflorum*
3	*Acampa wightiana*	53	*Bulbophyllum viridiforum*
4	*Acanthephippium striatum*	54	*Bulbophyllum wallichi*
5	*Acanthephippium sylhetense*	55	*Calanthe alismifolia*
6	*Aerides crassifolium*	56	*Calanthe alpina*
7	*Aerides fieldingii*	57	*Calanthe angusta*
8	*Aerides multiflorum*	58	*Calanthe biloba*
9	*Aerides odoratum*	59	*Calanthe brevicornu*
10	*Anoectochilus crispus*	60	*Calanthe chloroleuca*
11	*Anoectochilus elwesil*	61	*Calanthe clavate*
12	*Anoectochilus grandiflorus*	62	*Calanthe densiflora*
13	*Anoectochilus griffithi*	63	*Calanthe foestermannii*
14	*Anoectochilus roxburghii*	64	*Calanthe gracilis*
15	*Anthogonium gracile*	65	*Calantheherbacea*
16	*Aphyllorchis montana*	66	*Calanthe manni*
17	*Aphyllorchis prainii*	67	*Calanthe musuca*
18	*Appendicula cornuata*	68	*Calanthe plantaginea*
19	*Arachis bilinguis*	69	*Calanthe puberula*
20	*Arachis cathcartii*	70	*Calanthe tricarinata*
21	*Arundina graminifolia*	71	*Calanthe triplicata*
22	*Ascocentrum ampullaceum*	72	*Calanthe vaginata*
23	*Ascocentrum curvifolium*	73	*Calanthe vestita*
24	*Ascocentrum micranthum*	74	*Calanthe whiteana*
25	*Ascocentrum miniatum*	75	*Cephalanthera ongifolia*
26	*Brachycorythis obcordata*	76	*Ceratostylis himalaica*
27	*Bulbophyllum aculiflorum*	77	*Ceratostylis teres*
28	*Bulbophyllum affine*	78	*Cheirostylis griffithii*
29	*Bulbophyllum andersonii*	79	*Cheirostylis pusilla*
30	*Bulbophyllum careyanum*	80	*Cleisocentron trichromum*
31	*Bulbophyllum caudatum*	81	*Cleisostoma aspersum*
32	*Bulbophyllum cylindraceum*	82	*Cleisostoma filliforme*
33	*Bulbophyllum dyeranum*	83	*Cleisostoma simondii*
34	*Bulbophyllum elatum*	84	*Cleisostoma striatum*
35	*Bulbophyllum eulepharum*	85	*Cleisostoma subulatum*
36	*Bulbophyllum gambeiel*	86	*Cleisostoma racemiferum*
37	*Bulbophyllum guttulatum*	87	*Coelogyne barbata*
38	*Bulbophyllum gymnopus*	88	*Coelogyne corymbosa*
39	*Bulbophyllum helenae*	89	*Coelogyne cristata*
40	*Bulbophyllum hirtum*	90	*Coelogyne flaccida*
41	*Bulbophyllum hymenanthum*	91	*Coelogyne fuscescens*
42	*Bulbophyllum leopardinum*	92	*Coelogyne griffithi*
43	*Bulbophyllum leptanthum*	93	*Coelogyne hitendrae*
44	*Bulbophyllum odoratissimum*	94	*Coelogyne longipes*
45	*Bulbophyllum ornatissimum*	95	*Coelogyne micrantha*
46	*Bulbophyllum pencillium*	96	*Coelogyne nitida*
47	*Bulbophyllum piluliferum*	97	*Coelogyne occuitata*
48	*Bulbophyllum polyrhizum*	98	*Coelogyne ovalis*
49	*Bulbophyllum reptans*	99	*Coelogyne prolifera*
50	*Bulbophyllum rigidum*	100	*Coelogyne punctulata*

Table 3 Continued

Sl. No.	Name of orchid species	Sl. No.	Name of orchid species
101	*Bulbophyllum rothschildianum*	151	*Coelogyne raizada*
102	*Bulbophyllum roxburghii*	152	*Coelogyne rigida*
103	*Bulbophyllum secundum*	153	*Coelogyne schultesii*
104	*Bulbophyllum striatum*	154	*Coelogyne stricta*
105	*Coelogyne viscosa*	155	*Dendrobium williamsonii*
106	*Corymborkis veratrifolia*	156	*Diplomeria hirsuta*
107	*Cremastra wallichiana*	157	*Diplomeria pulchelia*
108	*Cryptochilus lutea*	158	*Diplomeria championi*
109	*Cryptochilus sanguineus*	159	*Epigeneium amplum*
110	*Cymbidium aloifolium*	160	*Epigeneium fuscescens*
111	*Cymbidium cochleare*	161	*Epigeneium rotundatum*
112	*Cymbidium devonianum*	162	*Eria acevata*
113	*Cymbidium elegans*	163	*Eria alba*
114	*Cymbidium ensifolium*	164	*Eria amica*
115	*Cymbidium eburneum*	165	*Eria bambusifolia*
116	*Cymbidium iridioidea*	166	*Eria biflora*
117	*Cymbidium lancifolium*	167	*Eria bractesces*
118	*Cymbidium longifolium*	168	*Eria coronaria*
119	*Cymbidium lowianum*	169	*Eria dasyphylla*
120	*Cymbidium macrorhizon*	170	*Eria excavata*
121	*Cymbidium mastersii*	171	*Eria graminifolia*
122	*Cymbidium pendulum*	172	*Eria muscicola*
123	*Cymbidium tigrinum*	173	*Eria paniculata*
124	*Cymbidium tracyanum*	174	*Eria pannea*
125	*Dendrobium acinaciforme*	175	*Eria spicata*
126	*Dendrobium anceps*	176	*Eria stricta*
127	*Dendrobium aphyllum*	177	*Eria vittata*
128	*Dendrobium bensoniae*	178	*Eulophia bicallosa*
129	*Dendrobium bicameratum*	179	*Eulophia graminea*
130	*Dendrobium candidum*	180	*Eulophia nuda*
131	*Dendrobium chrysanthum*	181	*Flickingeria fimbriata*
132	*Dendrobium chrystoxum*	182	*Flickingeria fugax*
133	*Dendrobium crepidatum*	183	*Galeola falconeri*
134	*Dendrobium densiflorum*	184	*Galeola lindleyana*
135	*Dendrobium denudans*	185	*Gastrochilus acutifolium*
136	*Dendrobium devonianum*	186	*Gastrochilus calceolaris*
137	*Dendrobium eriaeflorum*	187	*Gastrochilus distichus*
138	*Dendrobium falconeri*	188	*Gastrochilus inconspicuum*
139	*Dendrobium farmeri*	189	*Gastrochilus pseudodisticus*
140	*Dendrobiumfimbriatum*	190	*Geodorum densiflorum*
141	*Dendrobium formosum*	191	*Goodyera foliosa*
142	*Dendrobium gibsonil*	192	*Goodyera fusca*
143	*Dendrobium heterocarpum*	193	*Goodyera hispida*
144	*Dendrobium hookerianum*	194	*Goodyera procera*
145	*Dendrobium infundibulam*	195	*Goodyera repens*
146	*Dendrobium jenkinsii*	196	*Goodyera schiechtendaliana*
147	*Dendrobium lindleyi*	197	*Goodyera secundiflora*
148	*Dendrobium longicornu*	198	*Goodyera viridiflora*
149	*Dendrobium moschatum*	199	*Habennaria acuifera*
150	*Dendrobium nobile*	200	*Habennaria dentate*

Table 3 Continued

Sl. No.	Name of orchid species	Sl. No.	Name of orchid species
201	*Dendrobium ochreatum*	251	*Habennaria ensifolia*
202	*Dendrobium porphyrochilum*	252	*Habennaria furcifera*
203	*Dendrobium primulinum*	253	*Habennaria intermedia*
204	*Dendrobium pulchellum*	254	*Habennaria malleifera*
205	*Dendrobium stuposum*	255	*Habennaria pactinata*
206	*Dendrobium terminate*	256	*Habennaria stenopetala*
207	*Dendrobium thysiflorum*	257	*Herminium lanceum*
208	*Dendrobium transparens*	258	*Herminium macrophyllum*
209	*Dendrobium wardianum*	259	*Herminium monorchis*
210	*Hetaeria rubens*	260	*Oberonia recurva*
211	*Hygrochilus parishii*	261	*Oreochis foliosa*
212	*Kingidium deliciosum*	262	*Ornithochilus difformis*
213	*Kingidium taenialis*	263	*Otochilus alba*
214	*Liparis assamica*	264	*Otochilus fusca*
215	*Liparis bistriate*	265	*Otochilus lancilabius*
216	*Liparis biturberculata*	266	*Pachystoma senile*
217	*Liparis bootanensis*	267	*Panasia unifllora*
218	*Liparis caespitosa*	268	*Paphiopedilum hirsutissimum*
219	*Liparis cordifolia*	269	*Papiopedilum insigne*
220	*Liparis delicatula*	270	*Paplionanthe longicornu*
221	*Liparis distans*	271	*Paplionanthe teres*
222	*Liparis longipes*	272	*Pecteilis gigantea*
223	*Liparis nervosa*	273	*Pecteilis susannae*
224	*Liparis odorata*	274	*Pelanthanthera insectifera*
225	*Liparis pardoxa*	275	*Perisrtylus affinis*
226	*Liparis petiolata*	276	*Perisrtylus chloranthus*
227	*Liparis plantaginea*	277	*Perisrtylus constictus*
228	*Liparis platyrachis*	278	*Perisrtylus densus*
229	*Liparis pulchella*	279	*Perisrtylus falla*
230	*Liparis resupina*	280	*Perisrtylus goodyeroides*
231	*Liparis viridiflora*	281	*Perisrtylus mannii*
232	*Luisia inconspicua*	282	*Perisrtylus prainii*
233	*Luisia prachystachys*	283	*Phalus flabus*
234	*Luisia prachystachys*	284	*Phalus longipes*
235	*Luisia teritifolia*	285	*Phalus mishmensis*
236	*Luisia trichorhiza*	286	*Phalus tankervilliae*
237	*Luisia zeylanica*	287	*Pholidota articulate*
238	*Malaxis acuminata*	288	*Pholidota calceolate*
239	*Malaxis biaurita*	289	*Pholidota convallariae*
240	*Malaxis cylindroatachya*	290	*Pholidota grifithii*
241	*Malaxis josephiana*	291	*Pholidota imbricate*
242	*Malaxis khasiana*	292	*Pholidota imbricate*
243	*Malaxis latifolia*	293	*Pholidota imbrcata*
244	*Micropera mannii*	294	*Pholidota protacta*
245	*Micropera rostrata*	295	*Pholidota rubra*
246	*Monomera barbata*	296	*Phreatia elegans*
247	*Neogyne gardneriana*	297	*Platanthera arcuata*
248	*Neotianthe secundiflora*	298	*Platanthera stenantha*
249	*Neottia listeroides*	299	*Pleione hookeriana*
250	*Nephelaphyllum cordifolium*	300	*Pleione humilis*

Table 3 Continued

Sl. No.	Name of orchid species	Sl. No.	Name of orchid species
301	*Nervilia aragoana*	328	*Zeuxine goodyeroides*
302	*Nervilia prainiana*	329	*Zeuxine gracilis*
303	*Oberonia acaulis*	330	*Zeuxine nervosa*
304	*Oberonia clarkel*	331	*Zeuxine strateumatica*
305	*Oberonia ensiformis*	332	*Pleione maculata*
306	*Oberonia griffithiana*	333	*Pleione praecox*
307	*Oberonia iridifolia*	334	*Poneoorchis chusua*
308	*Oberonia longilabris*	335	*Pteroceras suaveolens*
309	*Oberonia mannii*	336	*Renanthera imschootiana*
310	*Oberonia micrantha*	337	*Rhynchostylis retuasa*
311	*Oberonia obcordata*	338	*Robiquetia succisa*
312	*Oberonia orbicularis*	339	*Satyrium napalense*
313	*Oberonia pachyrachis*	340	*Schoenorchis gemmata*
314	*Oberonia pyrulifera*	341	*Smitinandia micrantha*
315	*Sunipia bicolor*	342	*Spathoglottis ixioides*
316	*Sunipia candida*	343	*Spathoglottis plicata*
317	*Thelasis longlifolia*	344	*Spathoglottis pubescens*
318	*Taeniophyllum khasianum*	345	*Spiranthes sinense*
319	*Thunia alba*	346	*Uncifera obtusifolia*
320	*Thunia marshlliana*	347	*Vanda alpina*
321	*Tropidia curculigoides*	348	*Vanda bicolor*
322	*Tylostyles discolor*	349	*Vanda coerulea*
323	*Uncifera acuminata*	350	*Vanda cristata*
324	*Vandopsis vandarum*	351	*Vanda pumila*
325	*Yoania prainii*	352	*Vanda tesselata*
326	*Zeuxine abbreviata*	353	*Vanda testacea*
327	*Zeuxine flava*	354	*Vanda undulata*

Table 4 Commonly found Mammals in Nagaland are as follows

Sl. No.	Common Name	Scientific Name	Sl. No.	Common Name	Scientific Name
1	Asian Elephant	*Elephas maximus*	22	Slow Loris	*Nycticebus causeang*
2	Gaur (Indian Bison)	*Bos gaurus*	23	Otter	*Lutra lutra*
3	Jackal	*Canis aurius*	24	Wild Dog	*Cuon alpinus*
4	Tiger	*Panthera tigris*	25	Orange billed Himalayan Squirrel	*Cirrus unicolor*
5	Sambar	*Cervus unicolor*	26	Mangoose	*Herpester spp.*
6	Leopard	*Panthera pardus*	27	Musk Deer	*Moschus moschiferous*
7	Barking Deer	*Muntaiqus muntijak*	28	Binturong	*Arctictis binturong*
8	Wild boar	*Sus scrofa*	29	Jungle cat	*Filis chaus*
9	Sloth Bear	*Elursus arsinus*	30	Mole rat	*Bandicota bengalensis*
10	Serow	*Capricornis sumatraensis*	31	Indian hare	*Lypus nigricolis*
11	Hoolock	*Hylobatus hoolock*	32	Martin	*Martis spp.*
12	Common Langur	*Presbytis antillus*	33	House Mouse	*Mus musculus*
13	Macaque	*Macaca spp.*	34	Field Mouse	*Mus booduga*
14	Leopard Cat	*Filis bengalensis*	35	Goral	*Nemarahidus goral*
15	Himalayan Squirrel	*Callosciuras pygerythru*	36	Clouded Leopard	*Niofolis nibulosa*
16	Pangolin	*Manis crasicaudata*	37	Palm Civet	*Paguna larvata*
17	Civet	*Vivirra Spp.*	38	Wood cat	*Rattus blaufardi*
18	Wolf	*Canis auririus*	39	House cat	*Rattus rattus*
19	Fruit bat	*Cynoptirus sphinx*	40	Fulvous fruit bat	*Tousettus leschinuitas*
20	Porcupine	*Hystrix indica*	41	Indian fox	*Vulpis bengalensin*
21	Hispis hare	*Caprogus hispisdus*			

Table 5 Commonly found Reptiles in Nagaland are as follows

Sl. No.	Common Name	Scientific Name	Sl. No.	Common Name	Scientific Name
1	Monitor lizard	*Varanus prasinus*	5	Common krait	*Bungarus caeruleus*
2	Tortoise	*Geochelone elegans*	6	Banded krait	*Bungarus multicintus*
3	Python (reticulate)	*Python reticulatus*	7	Viper	*Vipera russelli formosensis*
4	King cobra	*Ophiophagus hannah*	8	Common cobra	*Naja naja*

Table 6 Commonly found Birds in Nagaland are as follows

Sl. No.	Common Name	Scientific Name	Sl. No.	Common Name	Scientific Name
1	Greyheaded fishing eagle	*Ichuophaga nana*	23	Rufousnecked hornbill	*Aceros nipalensis*
2	Crested serpent eagle	*Pilernia cleala*	24	Goldenbacked throated woodepecker	*Dimopium shorii*
3	Bearded vulture	*Gypactus barbatus*	25	Darjeeling pied woodpecker	*Picoides darjellensis*
4	Forest eagle owl	*Bubo nipalensis*	26	Redaered by woodpecker	*Lythipicus pyrrhotis*
5	Collared pigmy owlet	*Tus bakkameena*	27	Bluenapped pitta	*Pitta nepanlensis*
6	Collared scope owl	*Laucidium brodei*	28	Mrs. Gould's sunbird	*Aethopyga gapldinale*
7	Tragopan	*Tragopan blythii*	29	Nepal Yellow backed sunbird	*Aethopyga nipalensis*

8	Kaleej Pheasants	*Lophura leucemelona*	30	Black breasted sunbird	*Aethopyga saturata*
9	Common hill patridge	*Arboraphila forqueola*	31	Firetailed yellow backed sunbird	*Aethopyga ignicauda*
10	Common pheasants	*Entropus simensia*	32	Longtailed broadbill	*Serilophus lunatus*
11	Red Jungle fowl	*Gallus gallus*	33	Red drumped swallow	*Hirundedaurice*
12	Peacock pheasants	*Polyplectron bicalcaratum*	34	Tyflers swallow	*Hirunderustice tyleri*
13	Pin tailed green pigeons	*Treron apicauda*	35	Balcknapped ariole	*Oriolus chinesis*
14	Rutous turtle dove	*Streptopolia orientalia*	36	Himalayan tree pie	*Dendrocitta formosee*
15	Marrnbacked imperial pigeon	*Ducula badia*	37	Bronzed drongo	*Dicrurus aeneus*
16	Emerald dove	*Chalcophapa indica*	38	Large brown thrush	*Dicrurus aeneus*
17	Himalayan Jungle nightjar	*Caprimulgus indicus*	39	Lesser racket-tailed drongo	*Dicrurus renifer*
18	Indian roller	*Coracias bengalensis*	40	Large racket tailed drongo	*Dicrurus paradiseau*
19	Chestnut threaded bee-eater	*Morapa leschanaulti*	41	Black drongo	*Dicrurus adaimilis*
20	Bluethreated barbet	*Mengalaima lineata*	42	Grey drongo	*Dicrurus leucephaecus*
21	Great barbet	*Megalaima virens*	43	Clouded Leopard	*Niofolis nibulosa*
22	Great pied hornbill	*Buceros bicornis*			

Annexure-I

Format for Base line Information

A. Location. Date: _____/_____/_____.

1. District _____, State_____, Village_____.
2. Investigator _____.
3. Name of household owner with address_____.

B. Land holding Pattern

1. Land holding _____ (bigha/ha/acre).
2. What kind of land you possess? Put (√) (Cultivated/Fallow/waste/any other).

i. Valley land/Low land area_____.
ii. Upland area _____.
iii. Jhumland area_____.
iv. Do you take land on lease? _____ (Yes/No).
v. What are your leasing system prevailing in your area? _____.

C. **Indigenous practices for Biodiversity Conservation**

1. What are the Indigenous Farming System Practices prevailing in your area? _____.
2. Give detail about all the indigenous Farming System Practices with methods/ procedure etc.
3. What are the Indigenous Storing System prevailing in your area?_____.
4. Give detail about all the indigenous storing systems with methods/ procedure etc.
5. By-products, Conservation if any (give detail):_____.
6. What are the existing modes of Indigenous medicine:_____.
7. Name of Indigenous Medicine and its uses:_____.

D. Sources of knowledge

1. From where you get information regarding Indigenous farming system/ improved farming system practices? _____.
2. Whether the present knowledge is sufficient to increase the socio-economic stability?

E. General Family Information

1. Total Family Size_____, Males_____, Females_____, Children (< 18 years) M_____F_____
2. Family details (including children and those who are outside village)

Sl. No.	Name of Family Member	Sex	Age	Relation to Respondent	Profession	Income Profession
1	Respondent			Self		
2						

F. Environment

Please try to think back to the situation two decades ago and expose detail. Would you say that the quality of the environment in your community has changed?

Particulars	Better (4)	About the same (3)	Worse (2)	Don'5t know (1)
Agricultural Production				
Grasses in the pastures				
Trees in & around the village				
Medicinal plants in/ around the village				
Flora & Fauna in/around the village				
Drinking water quality				
Water logging Situation				