

## **Biodiversity and recipe Contests: Innovative socioecological approaches to capture ecological knowledge, related livelihoods and conserve biodiversity in eastern Himalaya, Arunachal Pradesh**

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In recent years, erosion of local indigenous biodiversity knowledge has been seen as one of the major global threats to biodiversity. Government and various developmental agencies have been trying to articulate ways of preserving biodiversity and its associated knowledge systems through education and knowledge documentation. Organizing “biodiversity contests” among younger generations of indigenous and local people, and recipe contests of uncommon forest plants and field crops among rural women are two important methods to reduce erosion of indigenous biodiversity knowledge. In view of the importance of such approaches, the National Innovation Foundation (NIF), Ahmedabad, Gujarat, India has been organizing biodiversity knowledge contests and recipe contests from 2003 onwards among *Adi* tribal members, especially school children and rural women, respectively in selected schools and villages of East Siang district of Arunachal Pradesh. The villages in which to hold recipe contests were selected purposively based on forest cover, ethnicity, remoteness and people’s livelihood dependency on forest resources. Initially, the projects were explained and rapport established with participating schools and villages around the district. Different events including radio talks, public meetings, contact with key individuals, circulation of posters and pamphlets and group discussions were organized. In second phase, individual schools and villages were contacted to set up the biodiversity and recipe contests. We found that school children demonstrated encouraging results by presenting systematic herbaria of local plants, including uses, ecology and source of information. The children from rural backgrounds were found to be more knowledgeable than those from more settled areas, and were able to contribute more than 100 forest and semi-forest plants in their collections. Creation of vertical knowledge networks created by the school children through contest was evolved. These group contests resulted in revealing more knowledge about local biodiversity as compared to individual participation, reflecting synergism. In the case of the recipe contests, *Adi* women showed a sound knowledge of local biodiversity, presenting as traditional foods more than 50 indigenous forest based plants, many of which are locally uncommon. Significantly, the *Gaon Burha* (village headman) further helped to diffuse the knowledge network created from this activity. We found that creating a platform on which local knowledge systems can inform, interact with and transform formal knowledge systems in a collaborative and cooperative way, as in these biodiversity contests ultimately can contribute to conserving biodiversity more effectively.

**Keywords:** Biodiversity contests, recipe contest, indigenous knowledge, youth, women’s knowledge, conservation, knowledge network.

## Introduction

For many indigenous and tribal educators, culturally responsive science curriculum has to do with their passion for making cultural knowledge, learning about biodiversity, language and the values of natural resources. For those who are not so linked to their local culture and biodiversity, it has more to do with connecting what is known about formal science education and people's everyday know-how. Local knowledge and learning about biodiversity refers to a process of acquiring, applying and interacting with a unique body of knowledge developed by groups of people who are indigenous to a specific geographical area<sup>1</sup>. Throughout the world, concern has been expressed about an ongoing and accelerating loss of traditional knowledge and biodiversity based learning systems, and many have searched for ways to preserve both<sup>2</sup>. Some of the mechanisms by which traditional knowledge is lost include the erosion of vernacular languages, cultural erosion, and disintegration of joint family systems and hence the intergenerational learning chain<sup>3</sup>. Furthermore, these knowledge systems are threatened from a general degradation of biodiversity resources<sup>4-6</sup>. Complementing academic knowledge with traditional knowledge in formal education systems and designing more formalized structures for culturally responsive education are sometimes presented as a means by which biodiversity-based traditional knowledge may be conserved.

Recent trends in programs and policies for environmental education (EE) reveal that EE can be more effective if it can make use of prior experiences that children bring to schools, often acquired within their own communities through informal learning modes<sup>7-9</sup>. Conserving indigenous biodiversity in the long term without generating and supporting curiosity and commitment among children, the future leaders of the society will face problem. Hence, environmental and biodiversity based education is required from beginning of children's schooling to enhance the process of sustainable development<sup>10</sup>. Similarly, biodiversity conservation seems difficult if not impossible if the process does not build upon the excellence in biodiversity knowledge among elders, both men and women, as well as children in any community. The need to link commitment and competence in the field of biodiversity conservation was seen as a major challenge and resulted the idea of biodiversity and recipe contests among school children and rural women respectively<sup>6</sup>. If we expect our educational planners, curriculum developers and classroom teachers to participate in indigenous biodiversity

conservation – given that the literature on the ways and means of facilitating such fusions of knowledge is scanty<sup>11</sup>. We must provide educators with some basic information on the state of knowledge, belief and attitude about biodiversity and natural resources conservation in general, especially information that might in some way affect the learning process<sup>12</sup>.

The direct involvement of students, teachers<sup>13</sup>, and local communities is necessary in successful collaborative investigations of local environmental issues<sup>12</sup>. The values and interests of various groups, and unfolding of local biodiversity issues must be made explicit through a prior commitment to teaching a body of knowledge/skills that can play a significant role in conservation and the sustainable use of local biodiversity<sup>14,15</sup>. Today, many of the younger generation do not have an interest in interacting with elders to learn local knowledge about biodiversity. The object of the biodiversity contests is to help rebuild the learning process for biodiversity knowledge reconnecting the younger generation with their parents and grand parents and raising their awareness about value of indigenous biodiversity<sup>6</sup>.

Looking to the importance of conserving and transferring biodiversity based indigenous knowledge systems to the new generation, these biodiversity contests have been implemented successfully in various parts of India, Bhutan and Vietnam. In India, many states including Gujarat, Madhya Pradesh, Rajasthan, Andhra Pradesh, Tamil Nadu, and Arunachal Pradesh are organizing these contests to reduce knowledge erosion and thus help to conserve local biodiversity. These contests have been organized through members of the Honeybee Network and National Innovation Foundation (NIF), Ahemdabad Gujarat collaborators.

### **Methodology for organizing biodiversity contests among school children**

Following the lead of these organizations, we organized biodiversity contests for school children, through selected schools of Pasighat, East Siang district, Arunachal Pradesh. The area is dominated by *Adi* tribe who is primarily dependent upon the forest based livelihoods and slashes and burn agriculture (jhum cultivation system). The contests were initiated at the local level through public announcements, pamphlets and a group meeting with teachers, children and community members several days prior to each contest. On the day of the contest, the children would bring plant specimens they had collected to school. A jury consisting of teachers, knowledgeable and interested community members, and forest staff would interview each child and score them on

their knowledge according to the following criteria: number of specimens presented and their novelty, their knowledge about the plants (such as habitat, growing habits etc.), knowledge on the uses of the plants, and presentation style<sup>12,13</sup>. Winners were awarded prizes such as teaching/learning materials. Follow-up activities included: creating a school herbal garden, establishing a school herbarium, and developing various displays. Biodiversity covers the entire range of living organisms from plants, to vertebrates, invertebrates and microorganisms<sup>16</sup>, but in the contest we covered only plants, and participating children were advised not to kill and bring any faunal sample, otherwise they will get negative marks. They were also instructed not to uproot any floral species in their sample presentation. The specific goal of the biodiversity contest was, therefore, to assess the extent of children's knowledge about the identification and use of local plants. Biodiversity contests of this type have taken place for a number of years in a variety of rural settings but the insights reported in this paper were gained mainly from recently conducted contests in rural schools of Gujarat (Sherry Chand and Shukla, 2003). This case study of 87 potential biodiversity contestants was conducted during the year 2004, from contests held in selected schools viz. Balek, Boying, Mirbuk, Mirku, and Pasighat Secondary Schools of East Siang district, Pasighat, Arunachal Pradesh.

#### **Recipe contests among rural women: Informal learning about biodiversity conservation**

Along with the biodiversity contests, another type of learning based contest, recipe contests, were organized to emphasize knowledge about uncommon crops and uncultivated plants among different age groups of *Adi* women. The recipe contests celebrated local knowledge about plants used in cuisine, as well as some with medicinal or health value. Identifying and using various uncommon plants for different dishes by the women folk is a well known social and cultural process that adds value to local biodiversity and through which many plant species have been conserved by local women from time immemorial<sup>17</sup>. The idea of organizing recipe contests was parallel to the biodiversity contests: (i) to recognize and reward knowledgeable women for their efforts in identifying, (ii) conserving, and (iii) adding to the value of and using uncommon plants of forest and croplands<sup>3,6,17-19</sup>. For these contests, different *Adi* dominated villages – namely, Gune, Balek, Rasam, Boeng and Yabgo – were selected purposively on the basis of their proximity to forest resources and the dependency of

the local population on the indigenous flora. Through this activity, rural tribal women, engaged in such interactive knowledge creation and exchange, have opportunities to demonstrate their culinary creativity and local knowledge with regard to wild plants and crop uses<sup>3,19</sup>. These contests have often been organized for village women recognized for their knowledge and culinary skills; they are asked in advance to create new recipes, using unconventional and un-cultivated/wild plants. Each dish was judged using such criteria as: i) number of different plants/plant parts used, ii) conservation value, ii) taste, and iv) the participant's knowledge of the different plants or plant parts used in her dishes. The recipe contests are generally publicized through pamphlets or appropriate available local media such as radio, posters, village gatherings, etc. On the day of the contest, the participating women brought the dishes and/or outline the methods of preparing them (if the plant ingredients are not available at that particular season/year/location) to a central place. A local jury of local knowledgeable women experts, community leaders, local healers and concerned formal scientists was set-up to evaluate the participants. The winners were awarded prizes in the form of a certificate and/or kitchen utensils, etc. in a public gathering in the village. The winning recipes were displayed and shared with local communities and schools under the leadership of the *Gaon Gurha* (customary chief of a village), who later addresses the participants, recognizing their knowledge and accomplishments and emphasized the value of locally available plants. Successful recipe contests have involved about 25-30 women from a village, or in some cases, 5-6 mother-daughter teams. The dishes prepared often represented the wise use of wild vegetables, and often have special nutritional values. Some were dishes that helped to cope with extreme seasons and calamities, and other dishes are recognized as having medicinal values or health benefits.

## **Results and Discussions**

### **A. Approach and methodological learning about the biodiversity contest**

The biodiversity contests were limited to school-going children aged 10 through 17 years, and were conducted as an extra-curricular innovation with the help of school teachers, the *Gaon Burha* and All India Radio, Pasighat. The targeted objectives were to identify and support knowledgeable children in ecological matters, strengthening the process of vertical and horizontal learning among children through displays of specimens and the dialogue surrounding them, establishing knowledge networks, generating respect for excellence in biodiversity knowledge through recognition and reward, and

inventorying children's knowledge of local plant diversity. The most striking feature of the Dee Ering Secondary School, Pasighat was that the students who came first listed as many as 100 different species of plants along providing samples and noting their uses. The adult who was considered the best could identify 125 species.

### **Step-1 Building participation**

A rapport-building and contact process was attempted by approaching the wisemen, school-teachers and All India Radio, Pasighat and introducing them to the concept of biodiversity with special reference to the indigenous knowledge system. After thorough discussions, we determined ways by which a maximum participation of school children could be assured. Later on, the wisemen suggested that it would be ideal if we bring all the consulting wisemen, teachers and school children together with their parents to one platform. To create environment awareness, an effort was made to enlist the participation of school-teachers, school-children and their parents by elaborating on problem of water quality and availability and its relation to biodiversity in the environment of the concerned schools and villages. Unfortunately, at that time land slides due to heavy rain were a major problem, but these events served as a catalyst to help motivate previously indifferent people and helping to enlist a good level of participation. Networking, with lectures in every school and spreading the message through school teachers and students, was one of the valuable means to ensure successful participation in the biodiversity contests.

It was decided that parallel extension of this message would be broadcasted through the All India Radio, Pasighat to make the local children and their parents fully aware of the contest and to activate their curiosity and promote local knowledge of plants. Through this, we realized, they could generate and disseminate knowledge through vertical and horizontal learning (among the children and between the parents and children). We also hoped to rebuild and support lateral knowledge networks among the parents and grandparents. We distributed a printed pamphlet explaining the aims of the contest and the procedure for participation to students, teachers, and *Gaon Burha*. In all the schools, children gather in the morning (8.00 am. Fig. 1) for the national anthem. Hence, this occasion was selected as a forum for explaining the concept of biodiversity and for distributing the printed pamphlets to communicate the idea of this educational experiment on the indigenous biodiversity, and to convince them to participate in the contest and.

### **Step-2 Use of wise students to increase empathy among participants**

During the time of introducing the concepts of biodiversity and the idea of the contest to the wisemen, school teachers (Fig. 2) and children, it was necessary to use the regional language. To explain and promote the concept to the students the organizer selected a recognized wise student proficient in the regional language. With this student leader promoting the concept of biodiversity, many other children came to the organizer to learn more about biodiversity and its relevance to society. The organizer was surprised to find a competitive environment among the children; they all wanted to know and document all the information on biodiversity through different sources, especially with the prizes and certificates as incentives. It was necessary to allow sufficient time – five or more days – to allow the students to learn about biodiversity, to seek out knowledge from their peers, parents, grandparents and other sources, and to document this knowledge and present it in front of the organizer.

### **Step-3 Mode of documentation and presentation of biodiversity-based knowledge**

Before the contest began, the students were informed that the first prize would go to those who received the highest marks for their project. The criteria were for the students to write about a minimum of 30 local plants and their uses, along with preparing a sample to enter into the contest. In each school another criterion was kept for the participants that the total strength of children in each school should not be less than 20 to organize the potential contest. One mark for each was given for naming the plant, recording its use and providing a sample, thus total marks 3 to each plant. The students used different ways to present their ideas regarding biodiversity. The process of obtaining samples of the plants was found to be most significant to determine the knowledge of the children (Fig. 3). Surprisingly, the use of pictures (in the cases where the students could not find samples of a plant), was found by the traditional healers and *Gaon Burha* to be a rational and legitimate alternative. In few cases, as well, students used cartoon drawings and sketches for different plant materials, and this was also considered by the local wisemen to be very appropriate.

#### Step-4 Assessment of contest results

On the fixed day when the contest ended, the organizer went to each class in order to collect the samples and answer books from the students. As per the rules of the contest, four students from each school were selected as first, second, third and fourth prizewinners. The prizes included historical books, tiepin-boxes, pens, pencil crayon sets, etc., and all the prize winners received a certificate. In one case, the student receiving the second prize provided the highest number of samples, but the number of practices documented was considerably lower than those of the student awarded first prize. Because of this, there was some discussion between the organizer and wisemen about who should receive first prize, but the organizer followed the rule, and therefore the first prize was given to the student providing the maximum number of uses and practices relating to plant biodiversity. One exception was in the Mirbuk School, where a girl awarded the second prize (on the basis of the scores) could demonstrate her knowledge by discussing each plant sample and its complete range of uses in treating many human diseases and in making ethnic foods. On the basis of her exceptional demonstrated knowledge, her second rank upgraded and accordingly she was awarded first place (Case Study-1, Fig. 4).

#### Case Study-1

Miss Tokmem Jamoh (13 yrs), studying in class-VI. Her father is an educated well-established serviceman while her mother is a housewife and from a middleclass family background. Through the biodiversity contest in the Mirbuk middle school, Miss Jamoh's genius and her outstanding knowledge of biodiversity and its applications was discovered. She was the first-prize winner of the contest based on her demonstrating the maximum number of indigenous plants (more than 100) and their usage among *Adi* tribe of Pasighat. Notably, she had a strong curiosity about the old traditions and locally available plants, and she knew about their use in medicines and ethnic foods. She started learning about cooking of ethnic foods and vegetables from her grandmother at the age of 9 years. She knows to prepare more than 30 indigenous recipes. For example, she knows about cooking delicious mixed vegetables like *Paput*, *Marsang*, *ogin*, *Opungamak*, *Koppi*, etc. At the time of the biodiversity contest she produced a large number of samples of indigenous plant that are commonly found in her local area, including *Lidung-opung*, *Oko-libo*, *Mikyot*, *Situng*, *Tamu*, *Babing*, (wild *Colocasia*)



*Nirong, Maduri, Engra, Onger, Oyik, Dilap, Koppy, Koppir, Takeng* (ginger), *Orri* (Coriander), *Peron* (indigenous soybean), *Omari* (papaya), *Bayom* (local brinjal), *Ekum* (bamboo shoots), and *Juroney*. She knew the complete methods for using some local plants, for example, the use of *Babing* in treating bone dislocation. Similarly, the local plant called *Take-Sirik*, which is a kind of perennial parasitic plant growing on perennial woody trees, is used in curing bone fractures. In the first step its tender leaves are crushed then the extract is mixed in the lukewarm water and drunk. She demonstrated many medicinal plants, such as *Lidung-opung, Tamo, Oko-libo, Mikyot, Situng*, which are helpful in curing many diseases. She knew how to prepare the local beer (*Apong*) from *Mirung* (finger millet). As she stated:

*“Very few of my friends know how to prepare the Peron Namsing [a ethnic fermented food made from indigenous soybean and used as chutney],” This food is made from local soybeans which are first boiled, then, after slight roasting, they are preserved in Ekkam leaves (a kind of wild banana). At the time of use it is again wrapped in Ekkam leaves and placed in the fire for roasting. Then, after adding local ginger, it is eaten as chutney with local rice”.*

She had learned from her mother how to prepare pickles from local bamboo shoots (dry bamboo shoots and fresh bamboo shoots), as well as the methods of propagating medicinal plants and local vegetables. Ms Dai noted that mostly medicinal plants are found in the forest, but now people plant them in their own kitchen gardens to use at their convenience.

Ms Dai's grandmother stated that:\

*Ms Dai's level of knowledge about plants and biodiversity is unusual; most children do not like to learn about traditional medicinal plants.*

Further, Ms Dai stated that:

*“My grandmother often says that it is necessary for survival to learn local biodiversity and related practices of conservation, because people nowadays run directly to the doctor in case of even the minor stomach pain, while during the olden days people were accustomed to using only indigenous medicinal plants for all kinds of diseases. The Adi community should at least keep their traditional system of healing, because of its efficacy, easy local availability and cost effectiveness. I*

*learned from my grandmother, that a well-mannered and knowledgeable child will only come from a well-mannered and knowledgeable mother; hence we have to learn many things from my grandmother to become a complete woman.*

*In Adi parlance it is often said by my grandmother that “Alak Em Ekum Lo Lemanka”, (“after marriage a girl has to go to the next family and while going, her hands will also go along with the common wisdom.”) Therefore a girl should always try to learn more than a boy.*

She now knows more than 37 plants which have either medicinal use or use as vegetables and most of these were unknown before this contest. She perceived that the biodiversity contest is the best approach to learning local botany and assignments and homework involving collecting and learning about local plants should also be given to every student. The *Adi* wisemen should also be invited into the class to talk about the names and uses of local plants. In addition to it these types of biodiversity based learning programs, information can be relayed by the All India Radio, and there should also be a special biodiversity contest for the old people of the society.

#### **Step-5. Creation of a knowledge network by participating children**

The main objective in organizing the contest among children was to check the erosion of indigenous knowledge about the biodiversity and to promote opportunities for learning and gaining the knowledge with elders of society. For this, students can create networks in rural society to achieve higher marks in the contest. The student bagging first prize after being interviewed told the organizer that he had combined his own thinking with his mother’s knowledge, his grandfather’s knowledge, the traditional healer’s knowledge, his neighbor’s knowledge and other family member’s knowledge as his first-hand wisdom network in the society. During the process of learning and documenting the different plants and the use of biodiversity even his grandparents had developed a secondary network with the traditional healers and pastoralists to acquire the biodiversity-based knowledge to support their grandson and to assure him receiving the first prize. Similarly, a lateral learning took place even among the participants and their dropout (those who could not participate in the contest) school children also.

### **A.1. Results related to the participants and plants**

The total number of participants was 87, with a minimum age of 10 and a maximum age of 17 years old. The mean age of participants was 13 years. The students were from different class ranges, from classes V to X. Of the total, the majority (68.0 per cent) were female, while only 32 per cent were male participants under biodiversity contest. The total number of prizes awarded in the five schools, including consolation prizes, was 30. Two-thirds of the contest winners were female. The best performers (55.0 per cent) were from village areas, with 30 per cent from semi-urban areas and only 15.0 percent were from urban areas. This indicates the importance of closeness to the natural and rural environment in learning about nature.

Our analysis showed that on average the students wrote about 52 plants, and presented samples of an average of 44 plants (Table 1). Most of the plants identified and written about were vegetables, while the average use of plants in ethnomedicines and other purposes. A pattern of using different plant parts is presented in Table 1, which indicates the *Adi*'s wisdom in identifying the edible portions of different plants and thus enhancing the value to them. Possibly this was only by chance, but the best samples presented by the first-prize winner of a school were almost from the indigenous plants, some of them uncommon and unknown even to the contest organizers.

Out of the total of 52 plants in a best sample, a good majority (76.9 %) were ethnic vegetable plants existing in the locality, which are utilized by the women folk in the form of leafy vegetables to enhance food and nutritional security. It can be inferred that indigenous vegetables still provide a major and significant contribution in the local diets of the *Adi* tribe and most of the younger children can readily learn about these important foods. Ecological analysis of the local plants indicates that a maximum number of plants (48.5 %) were collected from forest areas. The contribution of local kitchen gardens to the total number of plants in the biodiversity contests was just over 40.0 per cent while the contribution of shifting land and local areas was 15.0 per cent.

The sources of knowledge learned about local biodiversity were also analyzed (Fig. 5). Over 35.0 per cent of the contribution of knowledge about local plants was from the grandmothers, followed by the mothers (17.0 %) and grandfathers (14.0 %) respectively. The learning about the local flora and its use from other sources was also

significant. In this learning process, the *Gaon Burha*, maternal grandmother and neighbour played an interesting role in creating knowledge networks and transferring culturally important knowledge of biodiversity to the children. From this result, it can be inferred that extended family systems, where the grandmother is an integral part of the family and helps to care for the grandchildren still forms an indispensable role in transmitting biodiversity based indigenous knowledge to the younger generations<sup>12</sup>.

### **A.2. Group contests: Indigenous knowledge and biodiversity**

An attempt was also made to determine the difference in individual and group knowledge distribution patterns among the college students of different tribes of Northeast India. In this regard, a contest was organized at the college of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh. The contestants were asked to participate as individuals (Fig. 6) or in groups voluntarily (Fig. 7). They were informed about participating in the contest only two days in advance to avoid bias and to learn the extent of own local knowledge about biodiversity and its use. Small exercises were given to these contestants pertaining to day-to-day life, such as what types of foods are consumed and from where are these available? What kinds of local store bins are used and from what materials are they made? What are local techniques for preserving surplus meat, fish and other food? (Fig. 8). What types of local implements are used for catching fish catching and from which species of tree/plants are they made? (Fig. 9). Similarly, what kinds of local wine are used and from what materials are they produced, and how are they prepared? (Fig. 10). It is quite clear from the empirical data presented through figures 7,8 and 9 that there was a difference in the extent of knowledge in individual and group exercises for the students. Groups of students were found to perform better than students individually. Further conducted experiment indicate that even the same student who was performing poorly in the individual contest was able to express local knowledge about indigenous biodiversity better when placed in a homogenous group. Thus, we concluded that synergistic effect can play a significant role in the learning process relating to biodiversity. The students who belong to rural settings were more knowledgeable than students residing in urban areas.

#### **Step-6 Feedback of wisemen**

To know the impact of the organizer's novel act, it was important to get the feedback from both the student participants and the local wisemen about the contest. In

one awards ceremony, a girl who had won first prize narrated about this contest in *Hindi* tone as:

*“Aj es biodiversity contest se malum hua hai ki hamre as pas jo bhi plants hain wo bekar nahin hain, bahut kam ke hain. Iske alwa aj hi pata chala ki hamara Arunachal plants ke bare main bahut dhani hai, ye sab jankari hamko hamare mata-pita aur dadi man se mili”*

These translate as:

*“After participating in the biodiversity contest we came to know that the plants occurring in our surroundings are more useful, and our learning took place with parents and grandmother.”*

The wisemen’s responses indicate that students broadened their traditional know-how considerably through the contest and at the same time, that dormant knowledge was activated and remembered by wisemen, pastoralists and old persons of the society. To some extent, broken networks of learning and practicing of indigenous plant knowledge and materials have also been rebuilt among the wisemen, pastoralists and school children. The importance of biodiversity was renewed in the minds of rural people with the process of identification of local plants with children. A sense of confidence was regained among girl students and different ideas for sustainable use of different plant species were developed in the society.

#### **Step-7. Feedback and networking of school teachers**

The following feedback was provided by the school teachers regarding the biodiversity contests: The contests are a good kind of tool to develop a plant museum in the village school (65.5%) and can act a kind of “social dam” to control the knowledge erosion among the newer generation (85%). The role of this contest is more significant in creating awareness about the importance of locally available plants (69%) and this process can lead the children to develop a kind of knowledge relationship or bridge with their old parents (55%). The information about local plant made available through these contests is useful not only to children, but is also new for some teachers (48%). This process of joint learning can develop a positive attitude among both students and teachers towards our environment, promoting its conservation and sustainable utilization (38%).

## **B. Results of recipe contest: Learning with rural *Adi* women**

The recipe contest was adopted as an approach to learn indigenous knowledge systems pertaining to local recipes made from uncommon and unusual plants which are either cultivated in shifting lands or garden lands or occur naturally in forests or surrounding areas. The experiment was applied in six villages with a carefully designed methodology. This approach has helped tremendously to feature more than 40 varieties of ethnic foods consumed by the *Adi* tribe of Pasighat. Some of these recipes are demonstrated in the [figure 11](#). It was observed that in forests, deserts and mountains, women from *Adi* tribal peoples possessed an outstanding knowledge of local plants and their sustainable use and management for domestic health, agriculture, livestock and natural resource use (Singh, 2004b). The knowledge of rural women regarding local biodiversity contributes not only to the improvement of livelihoods, health and nutrition, but also holds potential for the sustainable management of natural resources. The different knowledge patterns held by different age groups towards uncommon plants and crops can be explored. Further it has been found that a higher age of a person does not necessarily ensure higher knowledge of the environment and biodiversity. There are many other factors such as interest and curiosity that affect the extent of one's knowledge (see the case study-2 of Ms Anjali).

### **Case study-2**

It was an interesting event during the recipe contest to meet with a budding age girl, Ms Anjali, who won first prize ([Fig. 12](#)). Though she is economically poor, she is rich in knowledge systems about indigenous biodiversity and its use in the preparation of ethnic foods. Anjali (13 yrs), belongs to Gune Village of East Siang District, Pasighat. But she is originally a native of the Dhemaji District of Assam State. In search of a better livelihood, she came to Pasighat at the age of 8-9 yrs as a child labourer. Her major duty is to look after the children of rich *Adi* tribal members and to cook for them where she works. From childhood, she has loved cooking, gardening, collecting forest vegetables and working in kitchen gardens. At 13, she knows about more than 40 indigenous vegetables and their preparation processes. She was rich in the knowledge about preparing ethnic foods from indigenous plants naturally found in the local forests as well as grown in the kitchen gardens. From her, some plant species that are commonly found as well as uncommon plants species were explored that are not available in her native village but are available in Pasighat. Indigenous vegetables like

*Banko, Kopi, Obul, Oko-libo, Nypok, Ojgok, and Gam* are integral part of her daily cooking. She had carried out some interesting knowledge from her native place to her working place and indigenous plants which are used in making some ethnic foods are found in her native place, but not at Pasighat include *Gendha, Mani-muni, Kutura, loofa, Tengamara, and Gobor-Patta*. These were not known to the villagers where she currently lives. She narrated that:

*“I know some of the indigenous plants used for making the ethnic foods which are common at both the places i.e. at Dhemaji district and Pasighat. These plants, like Pettu, Asi-tapa, Engah, Kopi, Kerala, Takang, Etting, are very interesting and used for cooking many local foods either pure or after mixing with local fishes. There are some ethnic foods made from local plants and these are prepared in different forms at my native place. These foods, like pettu, Asi-tapa, Katchu, are locally found plants and used in the daily diet as vegetables. In these foods the Adi of the Pasighat area use bamboo-shoots in every food as a mixture and for flavour, but at my native place the local people use oil and masala.*

She knows various modes of vegetables propagation, like stem cutting, seed sowing, leaf cutting, rhizome cutting, etc, as she stated that:

*“To collect the local vegetables and prepare the food needs more time to search in the jungle, so it is better to plant them in either kitchen garden or shifting land by using different propagation methods”.*

She further reported that:

*‘I know some of the ethnic food made from local plants, which helps both in treating diseases and nutrition. In this regard, Onger is for pressure, Gam is for pressure, Tengamara is for digestion and Nypok is for sugar patients. I could learn it from my mother and family elders. Every family member of my guardian goes to their respective official and other works, so all the time I found me as a best friend of my guardian’s mother who is an old lady. I share my native knowledge with her and she tells me many things not only about local plants and foods but also about local culture, festivals, changes over time and roles and responsibilities of girls and women in society’.*

From this recipe contest some interesting facts can be learned. Different patterns of knowledge systems related to local biodiversity and its use pattern have been explored. Livelihoods and local biodiversity based information reveal that a great majority of different indigenous herbs (43.0%), plants (27.0%), shrubs and bush (29.0%) contribute to food security and are used in making a variety of ethnic foods (Fig. 13). Out of these native floras, the contribution of different plant parts, like leaves (32.0%), fruits (22.0%), stem (11.0%) and tubers (9.0%), could be observed, which signifies the wisdom of women in identifying the various edible parts (Fig. 14). These plant parts not only significantly contribute to the local diet but also play a pivotal role in the household economy. Herbs, plants, flowers, fruits and shrubs contribute a major source of income (85.0%) in the total income generated from indigenous plants (Fig. 15).

Therefore, on the basis of the recipe contest results obtained from various villages of *Adi* women, it could be inferred that women folk are the real custodians of biodiversity conservation and directly contribute to the preservation process for most uncommon and unusual plants<sup>19</sup>.

### **Conclusion and policy implications**

From the foregoing study we conclude that children's participation in biodiversity analysis through the contest was not just a matter of a competition but also was beneficial for children, teachers and wisemen, helping them to learn about biodiversity and to develop a knowledge network. Socially critical environmental education will be more useful and practical, if it relies on approaches that build on local knowledge systems and approaches like biodiversity contests and recipe contests. It will help to create a platform on which local knowledge systems can inform, interact and transform with formal knowledge and connect the holders of these multiple knowledge systems in collaborative and cooperative learning and action networks. For greatest success, these innovative approaches will have to be tailored to remove constraints in establishing effective communication with the underprivileged and less-articulate groups of children, women and socio-economically disadvantaged tribal communities<sup>12,13</sup>.

When traditional healers and local facilitators are given an opportunity to express and share their local wisdom about biodiversity among the children, they can use several participatory means such as drawing pictures of medicinal trees and plants



and their relation to the ecosystem to communicate their ideas. The process of developing and creating the settings for biodiversity analysis through contests based on local wisdom may initially seem weak due to a lack of confidence in the participants, but as soon as the interactions among and between children, teachers, wisemen and pastoralists increases, the learning process for biodiversity will significantly strengthen. The concluding model (Fig. 16) of biodiversity contests infers that through creating knowledge networks, biodiversity contests may help to transfer wisdom from the older generations to the newer generations through various types of learning, and media. In turn, this may result into enriching the existing body of knowledge and reducing the rate of knowledge erosion. Further the outcomes of such biodiversity contests diffuse in the social system vertically and horizontally, and through this process, the learning networks and knowledge dams retaining sustainable biodiversity conservation strengthen.

The enabling conditions under which the methods of biodiversity contests and recipe contests function are their simplistic local ways and down-to-earth approaches to communication through informal/learning and teaching, promoting links between and interests in more than one generation and their knowledge systems and creating conditions for local knowledge systems to nurture and interact with formal knowledge systems<sup>20</sup>. Biodiversity and recipe contests are, however, more process-oriented methods, which helped to create platforms for future actions which not only assisted in the recognition of local knowledge but also combined it with formal knowledge and created a model for sustainable co-management of local biodiversity. Unfortunately, these efforts seldom attract the attention of policy makers, development agencies or mainstream educators (and more specifically environmental educators) and have remained neglected. Barring a few exceptions, most of these efforts have been limited to short-term projects and somehow have not become a regular part of mainstream or formal education due to variety of reasons, including the lack of effective communication among various stakeholders and most importantly, between knowledge creators, supporting institutions and policy makers. Some of these communication barriers, if addressed, could help to overcome the impracticality and limitations of socially critical environmental education in making use of local knowledge systems and conserve the biodiversity by making knowledge dam<sup>6,17,18</sup>.

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Table 1. Results related to plant samples collected by school children in the biodiversity contests ( N: 87)

Particulars related to plants	Mean values
Total number of plants named by participants	52.1
Total number of samples produced	43.5
Number of plants used as vegetables	29.0
Plants used for medicine and other usage for people	17.3
Plants used for medicine and other usage for animals	14.2
Plants used for their stems	24.2
Number of herbaceous plants	13.9
Number of shrubs	14.3
Plants used for their flowers	10.3
Plants used for their rhizomes	08.3
Plants used for their bulbs	16.3
Plants used in their whole form	21.3
Plants used for their fruits	15.3
Plants used for their grains	30.3
Plants used for their leaves	35.5



Fig. 1- Announcements and addressing the students about the biodiversity contest during the morning anthem singing



Fig. 2. A lady teacher addressing the children about the importance of the biodiversity contest



Fig-3. Natural sampling of local with plants with their name and use presented by a contestant for the evaluation



Fig. 4 Miss Tokmem Jamoh, receiving the first prize of biodiversity contests organized in Mirbuk Middle School, Pasighat

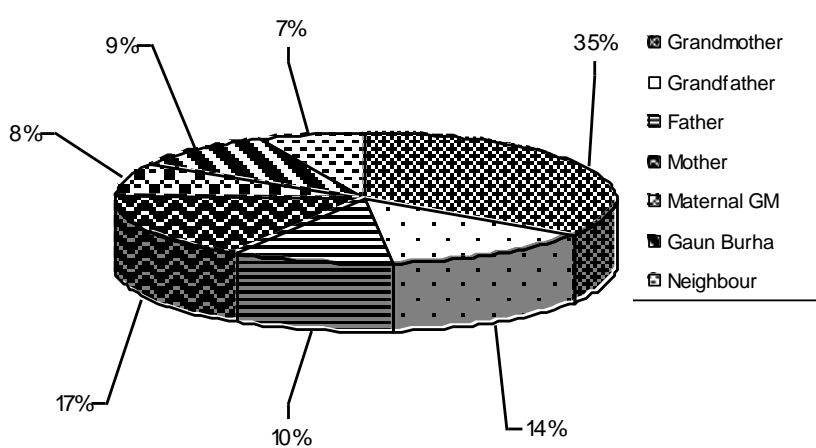


Fig. 5 Percentage contribution of different knowledge sources in transferring the biodiversity based local knowledge among children



Fig. 6 Individual contestants of biodiversity



Fig. 7 Group contestants of biodiversity

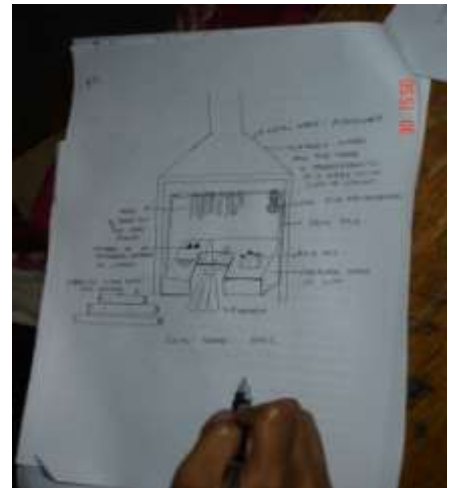


Fig-. 8 Local techniques of food preparation and preservation

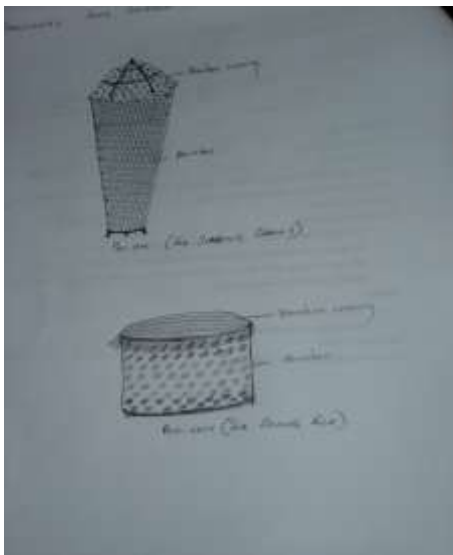


Fig. 9 Local tools made local bamboo for fish catching

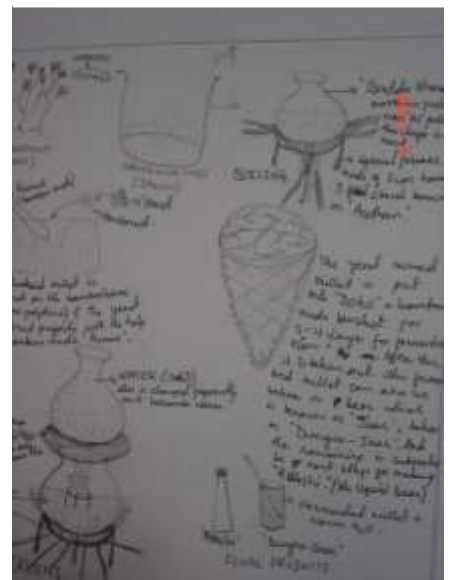


Fig. 10 Local method of preparing beer from finger millet and fox millet



Fig. 11 Ethnic foods made from local uncommon plants



Fig. 12 Ms. Anjali winning first prize in Gune village during indigenous recipe contest

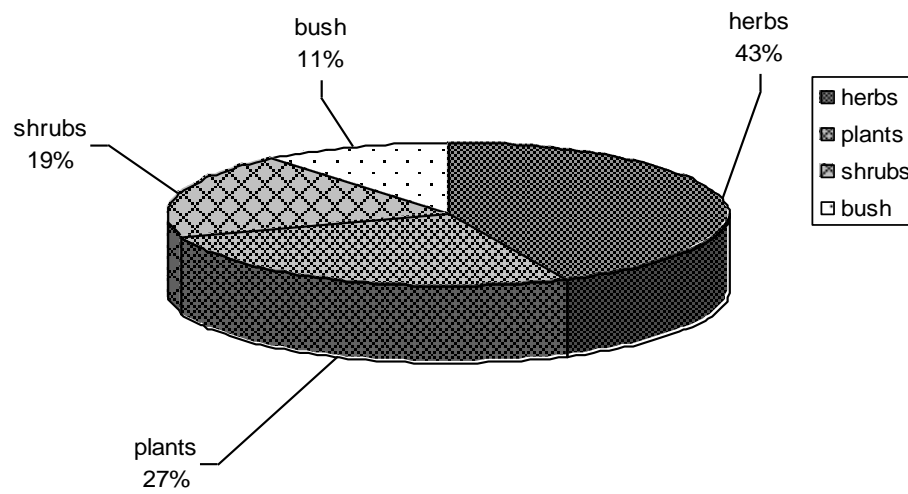


Fig. 13 Percentage contribution of indigenous plants in making local recipe

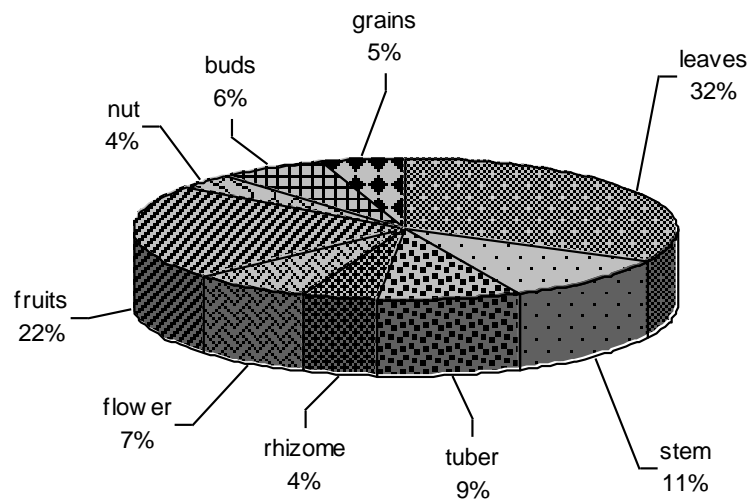


Fig. 14 Percentage contribution of plants part in local food

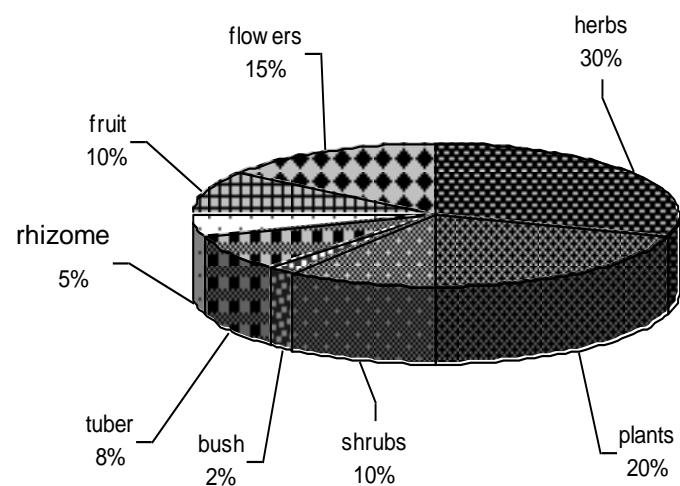


Fig. 15 Percentage contribution of different plants in household economy of women



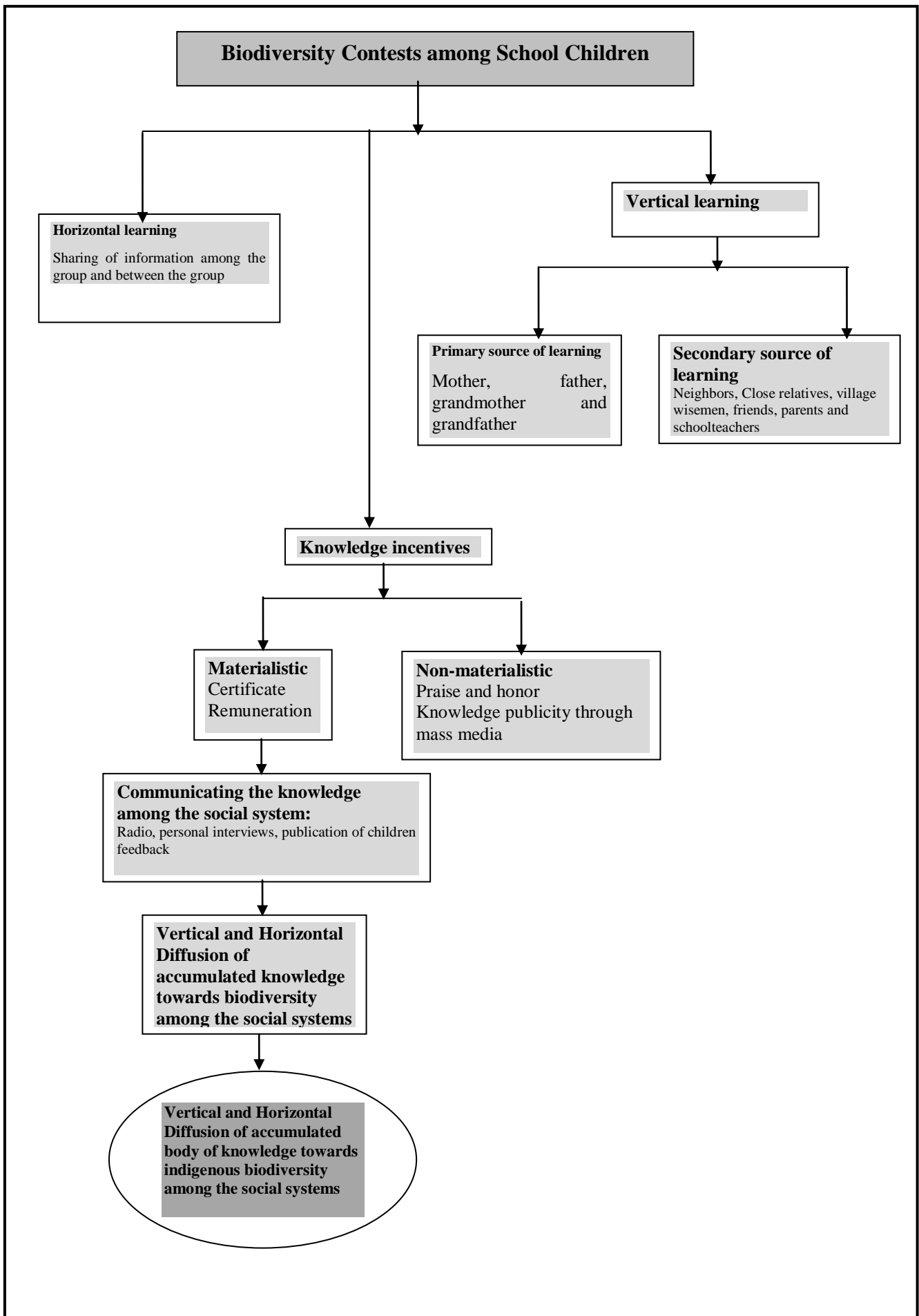


Fig. 16 Biodiversity learning through biodiversity contests