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# Traditional Irrigation System of Ziro Valley in Arunachal Pradesh

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***Abstract***

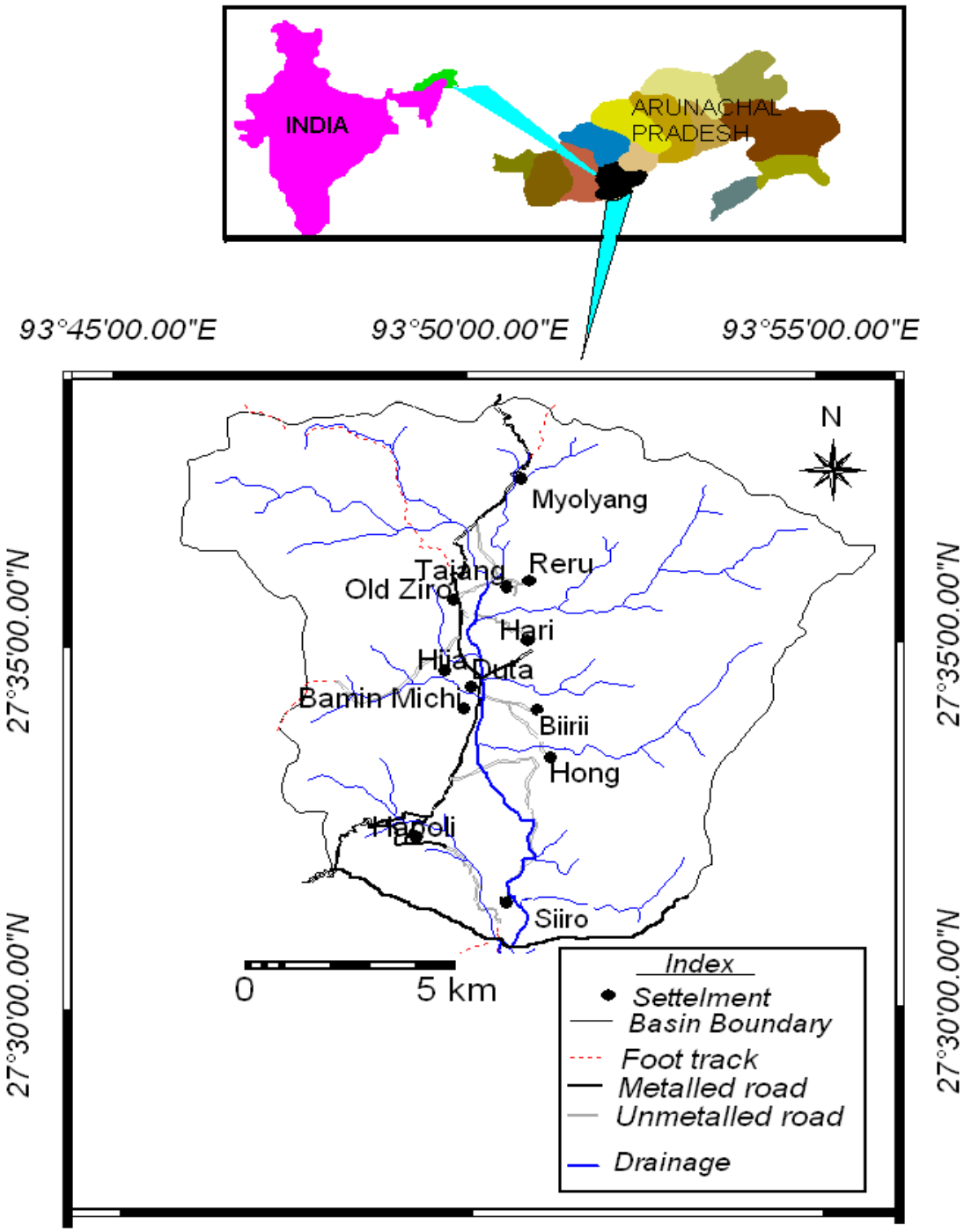
*Irrigation activities have substantially contributed to the massive growth in agricultural production that enables to feed ever growing population. Worldwide irrigated land has increased from 50 million hectares in 1900 to 466 million hectares today. Much of this increase has been in developing countries. For example in 1950 India had an irrigation potential of 22.8 million hectares which has risen to 105 million hectares. However, in many cases, water resources have been overdeveloped. There has been overspending on capital and significant cost in terms of loss of ecosystem, extinction of fish species and contamination of water sources. This has happened due to underestimated or neglect of economical and ecologically viable traditional irrigation technologies which are time tested and location specific. Documentation and validation as well as valuing of traditional irrigation practices may have a pivotal role particularly in fragile mountain ecosystems. The main objective of the study carried out were to examine the traditional irrigation practices used by the farmers in the Ziro valley, the nature of community participation and the changes they are facing. Group discussion among different age groups of the Apatani was held involving both men and women. Special attention was paid to older farmers in order to understand the exact nature of traditional irrigation system and its transition.*

## Inoduction

Arunachal Pradesh, a state in the extreme north-east of India has great ethnic cultural diversity with 26 major and 105 minor sub-tribes. The region is well known for its rich eco-cultural heritage as well as the wealth of traditional ecological knowledge amongst the farmers. As agriculture is the main livelihood activity in the region. It is vital that the production systems are managed efficiently. The Apatani tribe in the Apatani valley situated in the central western part of Arunachal Pradesh through traditional irrigation

systems locally called *Bogo*, has been successfully managing their agro-ecosystem for many years. However, in recent times, with the migration in search of jobs and other laborers coming in, many of these traditions, practices and knowledge are at danger of being diluted or lost.

When traditional knowledge and practices developed over centuries are shared within the tribe who work on the land together, it clearly supports sustainable agro-ecosystem management in this region. The Apatani is known for their system of rice and fish cultivation in the valley which produces rice for their own consumption. This is a highly evolved indigenous farming system, the energy and economic efficiency of which is very high partly due to effective irrigation practices.



**Traditional system**

The Apatani system of irrigation is more than a century old. The practice has been worked on and perfected through community involvement and equitable sharing of water resources. In this system, water is tapped near the forest in the foothills of the valley to supply the agricultural land. The water is distributed via numerous small canals so that every plot of land is well supplied with irrigated water for rice cultivation and fish culture. This also ensures that any surplus water is drained back to the main canal without the loss of any organic manure.

Terraces made along the gradient are connected using bamboo pipes of small circumference 10-15 cm at the higher elevations where water intake is lower. In the lower valley where the volume of water is greater, pine pipes of larger circumference 15-20 cm are used. These pipes are made from trunks split vertically, hallowed out and then the two parts are put back together. Water from the bamboo and pine pipes is not allowed to cascade from one plot to another; bamboo barriers are fixed on the upper elevations where the volume of water is greater. Further, to contain losses of organic matter or fish from the plots, bamboo traps or straw bedding have been introduced into all plots. In addition, the outflow pipes are placed five to eight inches above the surface of the lower plots so that water from lower plots cannot flow back to the upper plots. The dimensions of the dykes or bunds change from higher elevations towards the valley floor. At higher elevations, the plots are wider, whereas at lower levels the bunds are narrower.

To curtail soil erosion from the main canal, bio-fencing measures such as planting with phragmites sp, ligustrum sp, etc., have been carried out and wooden barrier of pinus wailichiana A. B. jacks. Castanopsis sp or bamboo species have been installed to limit the flow of water. Weeding of Houttuynia cordata thumb is not done as it is considered good for soil binding and stabilization of the bunds. Bamboo is also used to support the wider bunds. The bunds are repaired every year before rice is planting. Ploughing is not done in the rice plots so as to avoid soil loss but spades may be used to till the land before irrigation.

**Equitable sharing**

The Apatani traditional community has evolved using diverse management tactics. They have set a group called Bogo which is seen as the most important group as there are limited water sources for irrigation in the Ziro valley and good water management is essential for efficient production in the rice-fish system. These irrigation systems are managed by the traditional farmers' group led by *Bogo Ahto*. The *Bogo Ahto* is mainly headed by a male member as it requires heavy work. The group manager leads all the activities, although in some cases the financial transactions are made by the finance secretary or *Passer Binee*. The *Bogo ahto* post can be held for one to three years and is selected from within the group. Organization size normally ranges between as low as three and a high of nearly 110 households depending on village size and irrigation canal length. The main task of the organization is construction and maintenance of the water supply system and regulation of the efficient sharing of water among the group. The vision of this group is reflected in the management and sharing of water in the community which recognizes that water is the common concern which binds the group. The farmers knows that traditional practices are very important for maintaining sustainable production systems and that farmers associations are the foundations of these practices. Most farmers recognize that without farmers' organization agro-ecosystem management will easily weaken and the technical ecological knowledge which supports it will quickly erode.

Sharing of water through irrigation and its pipes

Since water is most important for the cultivation, the entire community has a stake in it and its equal distribution ensures collective survival and social cohisiveness within the community. The proper distribution of water is regulated by a few nominated members of the community who ensures its equitable distribution and is empowered to resolve any conflicts that arise. Each year repairing of the canal is carried out by collective participation, whereby one person from each houses hold provides their labour. Some villages within the community have a small grant for the upkeep and maintenance of the canals. Each plot owner is bound to provide equal supplies of water to the neighbouring plots and violation of such regulations is dealt with by the community institution called *Builyang*. The division of labour is such that men repair the bunds and canals while women manage the plantations and weeding through to harvest. The harvesting is done jointly by both with women cutting the spikes and men doing the threshing.

**Irrigation and soil fertility**

The canal draining the village waste water which carries organic material particularly the bio-degradable waste from the homesteads that comprises of vegetable waste, poultry and piggery manure. It is a good source of fertilizer and is also connected to the irrigation canal which is further draining into the agriculture fields. In addition, the organic material decomposed leaves litter leaching from the forest floor is collected in separate pipes connected to the main canal, so that wherever the additional forest run off reaches the canal. It goes on to the plots. Plots not connected to the main canal collect any organic material from the forest through the normal bamboo pipe connected to the plots above them. The extra organic materials accumulating near the inlet pipe is spread by hand on other parts of the plot. The traditional perception is that the run-off from the forest with trees such as Ficus spp. are more fertile compared to forest with Quercus spp., Castanopsis spp etc. This traditional perception may be correlated with the decomposition of leaf litters as the litter of Ficus spp. decomposes faster that of Quercus spp. and castanopsis spp.

**Transition and future options**

Traditional irrigation systems are now in a transitional phase mainly due to outside interventions. It has been quite evident that the traditional check dam and irrigation canal are slowly and steadily transformed by the use of concrete and iron materials from the outside sources. This transition not only endangers Apatani's ecological knowledge but also risks the future survival of the population, as the concrete reduces the movement of fishes from down to upstream and it also lacks a breeding centre. In the traditional system there is enough space for breeding as the channels are made of wood and bamboo which is not common in concrete construction. Though the Apatani are believed to be a very conservative community, now some of the traditional irrigation management systems are verge of extinction due to the integration of outside technologies. It is common for the youth to leave the communities in search of jobs, which create the shortage of traditional labour. In addition, outside labour forces are increasingly coming to the area for timber forest products. Due to socio-cultural, climate and physiographic differences, these people have different management techniques which often dilute the Apatani traditional practices. The Apatani will still need labour from outside but now they are trying to cope with the emerging situation by being aware that their system is very efficient yet delicate and realizing the need to preserve their time tested knowledge by documenting it for future generations.

Sharing of water through ditch made up of concrete

Except for financial support, particularly for erosion control, fencing and drainage maintenance, the farmers do not receive or seek any technological intervention or other help from any outside agencies. Outside experts have highlighted the Apatani rice fish culture system as one of the most efficient crop production system, encouraging the Apatani farmers to continue their traditional practice. The ingenuity of the Apatani community is well reflected in its traditional water management system and in the sharing of resources for optimum utilization. The traditional system of wet rice cultivation which is a purely organic farming system is functional even today and is modified by the community as and when required. There is optimum utilization of available natural resources such as bamboo, cane, pine, phraagmites sp., Ligustrum sp., and castanopsis sp. In order to check soil erosion, conserve soil fertility and raise fish as an integrated manner along with the cultivation of the many available rice varieties. The Apatani irrigation system offers

environmental implications in sustainable resource management and may be replicated in similar micro ecological conditions.

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