

Sustainable Management of Natural Resources- A Lesson from Apatanis



Environmental Science

KEYWORDS : Apatanis, traditional, land use, indigenous

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ABSTRACT

Apatanis have been practicing natural resource management informally since the time immemorial. This informal way of land use is part of their community. They utilise their resources for their benefit without harming the environment. Even jhum cultivation is not found in this valley where forest is destructed for cultivation. The paper seeks to study the traditional forest and agricultural land use pattern and unique paddy cum fish cultivation system of Apatanis with its economic aspect. Forest is divided into four main types on the basis of ownership like Private eg Bije(Bamboo forest) and Samsung(Pine forest), Kinsman ownership eg Uru morey(Mixed forest), Clan ownership eg Hallu morey(Pine, Castanopsis and mixed forest) and Village ownership eg Lemba booth(mixed forest) and Polung(grazing land). In addition to this there is sacred forest called Ranthil where religious activity is done and remained undisturbed. Agricultural land also divided into five different types. People use various product of this forest for different activities. The paddy cum fish cultivation is an integrated farming of paddy and fish together in the same plot. Millets are also produced on the bunds. So they get triple benefit from single plot simultaneously at a low input cost and with high output. They are pioneer in this field to make possible the integrated paddy cum fish cultivation at a low input and with high output cost.

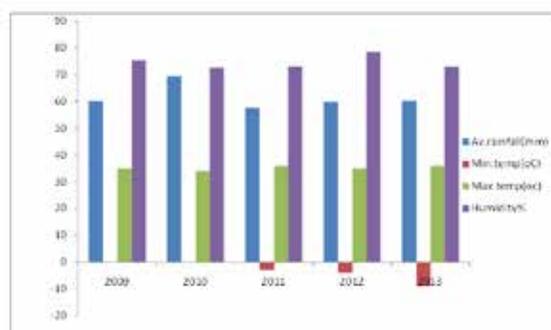
INTRODUCTION

The Ziro valley is located at an altitude of approximately 1572m and 27°32' to 27°37' latitude and between 93° 48' to 93° 53' longitude. The Ziro valley which is located in the heart of Lower Subansiri district of Arunachal Pradesh is inhabited by a tribe named Apatani.

The Apatanis belong to the Tibeto- Mongoloid stock. All Apatanis trace their ancestor from one legendary ancestor 'Abotani'. Apatanis are surrounded by Nyishis on the north, west and south, the Hill Miris on the North and Siyajuli and Dolungmukh on the East. Apatanis are very skilled to utilise their limited natural resources properly through unique land use and indigenous farming system. The indigenous system of farming is an integrated aquaculture cum agriculture system in which two variety of rice (Mipya and Emoh) and fish (Ngih) are raised together. Millets are also cultivated on the bunds separating the terraces. The Apatanis do not practice jhum cultivation and is the only agrarian tribe practicing settled agriculture in this part of the state (Saikia and Das, 2008). The integrated paddy-cum-fish culture is an environment friendly, low-cost, low-risk additional economic activity with multiple benefits including increased incomes and greater availability of fish to rural farming community. (Moyong, Saroh and Yage, 2012). The Apatani people of this area are getting benefit through double cropping i.e. paddy cum fish simultaneously in the same plot and in same period of time without any supplementary. (Modang Reena & Anku Nani, 2014)

Ziro enjoys a temperate climate. It belongs to sub tropical to temperate climate. Average annual rainfall is 70-80 mm. Maximum temperature raises to 35°C and minimum temperature falls to 0°C. In 2011, 2012 and 2013 minimum temperature fell down to -3°C, -4°C and -9°C respectively. Average humidity is generally from 72- 78%.

Fig 1 -Climatic condition of Ziro valley



Ziro has both red soil and brown hill soil. The main rocks are Schist and Dolomite covered with humus. The P^H of the soil is slightly acidic due to presence of Fe in the soil. The chemical properties of the soil are as follows-

Table 1- Soil parametres

Properties	Value
Soil P^H	5.18
Organic carbon (%)	4.19
Available phosphorous(kg/Ha)	8.22
Available potash(kg/Ha)	22.13
Available Iron (ppm)	26

METHODOLOGY

The paper is based on both primary and secondary sources. Primary data are collected through questionnaire, formal and informal interview of villagers of ten main villages using random sampling method. Data were collected on indigenous land use, cultivation and economic yield. Collected data are tabulated and statistically cultured. Secondary data are collected from offices like dept. of Agriculture, dept. of Fishery, dept. of soil, dept of Forest and Meteorology dept. Drainage and land use maps are prepared using topographical maps and Google earth satellite imagery.

RESULT AND DISCUSSION

Indigenous land use

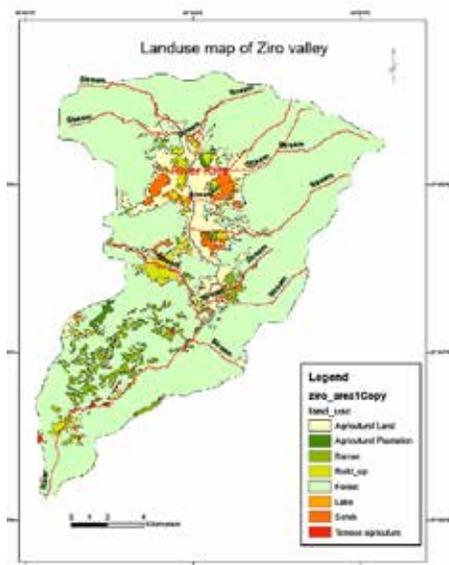
Apatanis classify their land on the basis of traditional norms to make best use of their limited resources. The practice of afforestation is in vogue among Apatanis from the time immemorial.

The forest are guarded and maintained under traditional norms and customs by all community members as various forest products fulfil the basic need of Apatani life style. Following is the indigenous classification of land of Apatanis-

Table2 – Land use classification of Apatanis

Landuse type	Size in hecto-	Own-ership	Plant sp.
Forest			
Bije(Bamboo)	.25 - .51	Private	Phyllotachys bambu-soides, Chimnobambu-sa callosa, Bambusa tulda ,
	.64 - 1	Private	<i>Pinus wallichiana</i> , <i>Castanopsis</i> spp.
Morey			
Uru morey	1.5 - 3	Kins-man	Mixed forest
Hallu morey	6.5 - 8	Clan	Pine, Castanopsis and mixed forest
Lemba booth	7 - 10	Vil-lage	Mixed forest
Polung	.09 - 1	Vil-lage	Village grazing land
Ranthil	.09 - 1	-	Pine and other trees (Restricted forest)
Agricuture			
Ballu	.04 - .05	-	Vegetable, chillies, pulses etc (at home)
Yollu	Do	-	Vegetable, chillies, pulses etc (away from home)
Lyapyo	.002-.6	-	Millet
Jaebe-Aji	.003-.87	-	Paddy (wet rice cum fish cultivation)
Ahi- Farang	.04 - .06	-	Pears,plum,apple,peach etc

Fig 2 – Land use map of Ziro valley



WET RICE CUM FISH CULTIVATION

The wet rice cum fish cultivation system in the Ziro valley was introduced by a fishery officer in 1965 on 23 plots on experimental basis. At that time the production of fish was 150 kg/ha/year. Presently this system covers an area of 497 hector and the production of fish is 300-350 kg/ha/year.

Field preparation starts from the month of December/January. Bunds of about 40-1m height are prepared to maintain the water level in the field. In the terraces of higher elevation bund of height about 90cm-1m are constructed and in the lower elevation bunds of height about 40 -80cm are constructed. For this field preparation continues till the end of the spring. Weeding is done three to five times and the weeds are dumped in the field to decompose. They prepare the field by dumping household wastes, chicken and pig excreta, crop residue etc. Inorganic fertilizers are not used. They burn the rice stubbles that are left in the field after harvesting. Sometimes vermicompost and cow dung is used. Paddy cultivation is started in the month of February-March in special nursery and is transplanted to the

field from April-May up to June-July. Within one month of transplantation fingerlings are stocked in the field. The nurseries are kept wet before plantation. The streams coming up from the mountain are diverted towards the paddy fields through artificially prepared earthen channels. The levels of water in the fields are maintained by flooding or draining the excess water through the inlet/outlet duct called 'Hubur' made of bamboo. Bamboo fencing is done to avoid erosion on the bunds. Water flows automatically from the fields at the upper elevation to the lower fields due to gentle slope through the network of channels and meet the major stream at the lowest level. In each terrace small pits are dug where these fingerlings are stocked.

In every plot 2-3 canals of depth of about 1-2 feet are dug. During sunny days when the water dries up then water remains in these canals and fishes come to these canals. During water scarcity period fishes again go back to the pits where water still remains. Tali ngiyi (*Channa* sp) and aji ngiyi (*Punitus* sp) are naturally available in the field. Other variety stocked is aji ngiyi i.e Common carp viz *Cyprinus carpo*, *Cyprinus carpio* var. *communis* (Scale carp), *Cyprinus carpio* var. *specularis* (Mirror carp) , *Cyprinus carpio* var. *nudus* (Leather carp) and *Ctenopharyngodon idella* (grass carp). Grass carp species feeds on the leaves of paddy plants and so this variety is stocked when the paddy plants grow above the water level. Rice varieties are Mipya ,Empo and Pyapin. Emos are Emo RA, Elang RA, Empo hatte. Mipya is mainly pyat mipya. Pyapin are RA pyapin, Tipe pyapin, G pyapin, Polo pyapin and Kobya pyapin. All of these are indigenous variety. The first fish harvesting starts after 30-40 days of

initial stocking of fishes and can be continued in the same gap for several times. Double harvesting is also done. Millets are cultivated on the bunds in the month of April- May. The total production of fishes is 300-350kg per hector per year. The rice production is 2-3 ton per hector.

ECONOMICS FOR ONE HACTOR AREA OF PADDY FIELD FOR INTEGRATED FISH CULTURE: 1 ha= 10,000 sq. m INVESTMENT

A.FIXED CAPITAL

RATE	AMOUNT
Rs \$/ sq m	Rs 80,000

(Raising and widening of dykes, excavation of trenches ,loosening and levelling of soil, provision for inlets and outlets with

bamboo screen etc)

B. RECURRING COST

a. Cultivation of paddy (From sowing to harvesting including labor)	Rs 200/labor	Rs 15,000
b. Cultivation of fish		
i. Cost of fish seeds	Rs 1/fingerling for 4000 fingerling	Rs 4000
ii. Packaging charge of fish seeds including the container	Rs 45/tin for 30 tins	Rs 1350
c. Cultivation of millet (From sowing to harvesting)		Rs 4,000

C. MISCELLANEOUS COST

Including transport etc
Rs 5,600

Total annual cost = A + B + C = Rs(80,000+15,000+4000+1350+4,000+5,600)= Rs 1,09,950

2. INCOME

- a. Sale of 4 ton of rice @ Rs 22/ kg
Rs 88,000
- b. Sale of minimum 500 kg of fish @ Rs 150/kg
Rs 75,000
- c. Sale of 2 q of millet @ Rs 20 / kg
Rs 4,000
- Total income a+ b+ c = Rs (88,000+ 75,000 + 4,000) = Rs 1,67,000

**Net profit in the first year= Total income – Total cost = Rs 1,67,000 – 1,09,950
= Rs 57,050**

**Net profit in the second year= Total income-Recurring expenditure (as no fixed capital)
=Rs 1,67,000- 15,000+4000+1350+4,000+5,600
= Rs 1,67,000- Rs 29,950
= Rs 1,64,050**

Hence the system is extremely viable.

CONCLUSION

The paddy cum fish farming of Apatanis is totally an organic farming process. They do not use any pesticides and inorganic fertilizers for paddy cultivation. Even they do not use any additional food for the fishes. Their century old indigenous forestry and paddy cum fish farming indicates their immense traditional knowledge and management skill to utilise the limited resources perfectly and have made these systems highly sustainable .They fulfil the basic need by utilising the locally available material without harming the environment. The forest provides fodder for livestock while firewood, food and medicine for humans and timber for house construction (Maikhuri, 1996; Upreti and Sundriyal, 2001), and the runoff from forest floor to valley carry

nutrients (Kumar and Ramakrishnan, 1990). The Apatani with highly developed age-old valley rice cultivation has often been counted to be one of the advanced tribal communities in the north-eastern region of India (Haimendorf, 1962).Wet rice cum fish cultivation is practiced in many parts of Asia and world but due to high input cost it becomes a barrier to the farmers. Apatanis have become pioneer for the rest of the world as they have made possible the paddy cum fish cultivation not only at a low input cost but with a high output. The profit and use of local materials have made it both economically and ecologically feasible to the community.

REFERENCE

- Saikia S.K and Das D.N., 2008, Rice – fish culture and its potential in rural development: A lesson from Apatani farmers, Arunachal Pradesh, India. Journal of Agriculture and Rural Development, 6 (1 &2),125-131. | Moyong Otem, Sarah Vicky and Yage Mamu, 2012, Cost benefit analysis of paddy cum fish culture in Ziro valley of Arunachal Pradesh, India, Asian Journal of Research in Business, Economics and Management, vol. 2(12), 159-166. | Modang Reena and Anku Nani , 2014, Pisciculture oriented Agriculture in the Ziro valley, International Journal of Scientific and Research publication, vol 4(4). | Kumar A, Ramakrishnan PS. Energy flow through an Apatani village ecosystem of Arunachal Pradesh in north-east India. Human Ecology, 1990; 18(3):315-336. | Maikhuri RK. Eco-Energetic analysis of village ecosystem of different traditional societies of Northeast India. Energy, 1996; 21(12):1287-1297. | Upreti TC, Sundriyal RC. Indigenous resources and community dependence: A case study from Arunachal Pradesh, India. Grassroots Voices: A Journal of Resources and Development, 2001;6(1-2): 28-39. | Haimendorf CVF. The Apatanis and their neighbours, Oxford University Press, London. 1962.