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Leased farming degrading the farmlands? Analysis of farmers' perceptions in Andaman and Nicobar Islands, India

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ABSTRACT

This study was undertaken in Andaman and Nicobar Islands by conducting primary survey of leased-in and non-leased land cultivators. Total agriculture land of the islands decreased due to massive tsunami followed by earthquake during 2004. Due to various biotic and abiotic factors, land degradation in these islands is high, and land leasing practice aggravates it. The leased rent varies from ₹ 17,500 $ha^{-1}annum^{-1}$ to ₹ 26,500 $ha^{-1}annum^{-1}$, and both cash and crop sharing mechanisms are practiced. Our analysis indicated that soils of leased land are degraded, and were categorized from moderate to severe level of degradation. The main reasons observed were that leased-in farmers mostly cultivate vegetables wherein more cultural working is required, which leads to loosening of soil and permits soil erosion at higher rate. Since, these islands receive more than 2800 mm rainfall annually with high intensity, it leads to faster erosion of soils. As the conservation measures need high investment, leased-in farmers are hesitant to invest due to short time lease of agreement (1 to 2 years). Thus, the study highlights that there should be clear cut policy for leased land to protect the limited and fragile agri-ecosystem of Andaman and Nicobar Islands. The findings will provide information for future research and policy decisions on leased land practices.

1. INTRODUCTION

Most Indian states banned or restricted leasing of agricultural land to prevent the abusive tenancy arrangements of the past. But more state governments are now adopting a model of leasing law proposed by the Government of India think tank NITI Aayog (2016). Indian states are increasingly allowing land to be leased, but campaigners say the move has not helped the rural poor to obtain land as promised six decades ago (Jose and Padmanabhan, 2015). States largely failed to redistribute land in line with laws passed almost 60 years ago (Haque, 2012). To improve rural poor's access to land, the only solution is liberalizing land leasing laws. Present land leasing will not solve landlessness issue (Sharma and Jha, 2018). However, encouraging leasing instead of redistributing land is a gross failure of the state to understand needs of the poor and landless. By 1962, all Indian states had adopted laws that limited the amount of land an individual or family could own, and surplus land was meant to be redistributed amongst the poor for farming. However, it was noted by Haque (2012) that only about 2 Million ha (M ha) was redistributed to approximately six million poor farmers. There has been criticism about the social and economic implications of this system, and in course of time, lease land farming was either legally banned or prohibited in many parts of India.

Amidst the ongoing controversy over structure and characteristics of the new land lords (Reddy and Shaw, 2013), there is agreement on the fact that lease farming continues in India either as share cropping or as fixed rent tenancy. At the same time, lease farming has generally been portrayed as an efficient and explorative agrarian institution, notwithstanding the fact that empirical evidences vary widely under different situations (Deininger *et al.,* 2012; Bezbaruah and Goswami, 2013). In Haryana, lease contracts were oral, mostly on annual basis (Sangwan, 2000). Studies found that there has been a significant difference in owned and leased farming productivity (Bhowmic *et al.,* 2003). As per the 59th round of NSS (2003), about 11.5% farmers lease

in land, and this accounts 6.5% area under leased-in farming in India (Government of India, 2005).

A more recent set of arguments is that rental markets transfer land to poor-but-efficient producers due to presence of household agricultural ability and imperfections in labour and capital markets (Deininger *et al.,* 2012; Otsuka *et al.,* 1992). The resource allocation can be equally efficient in both with and without rental arrangements under the costless enforceable efforts for tenants' work by the landlord (Cheung, 1969; Shaheen *et al.,* 2006).

The farmers in Andaman and Nicobar Islands were settled and rehabilitated after Independence by providing 2.0 ha of valley and 2.0 ha of slopping lands. In due course of time, most of them are either in government service or doing other income generating activities, apart from agriculture (Chand *et al.,* 2019). In recent past, many of the farmers have leased out agriculture land, partially or fully, to other farmers. The leased-in lands are likely to suffer from several land degradation problems, such as erosion, salinity, weak soil health etc. With this background, this study was aimed to examine the extent of leased-in land, rent offered, and impact on soil and water resources. The perceptions of leased-in and non leased-in farmers on the extent of land degradation, and its management need to be examined. Therefore, these aspects were studied in detail, and they are presented in subsequent sections.

2. MATERIALS AND METHODS

Data Collection and Analysis

Farmers who had taken the land on lease as well as owner farmers were randomly selected, and at least 15 farmers from each location were selected for detailed data collection from South Andaman. Data from 146 farmers were collected on aspects of extent of area leased-in, rent paid, period of lease, agreement written or not, bank account opened or not, number family members engaged in agriculture, farmer is local or migrated from some other part of country, condition of land owners, socio-economic back ground of the leased-in farmers, background information of non-leased farmers, crops cultivated, agricultural practices followed, extent of encroachment of government land, application of inputs to crops, availability of identity card, credit taken, soil and water conservation (SWC) measures followed, etc. Secondary information was also collected from published reports of research institutes, line departments, and Directorate of Statistics and Economics of Andaman and Nicobar Islands.

Analysis of Soil Fertility and Categorization of Extent of Land Degradation

Soil samples were collected from both leased-in and non leased farmers' fields and analyzed. The status of land degradation was categorized crop-wise as d_0 = no degradation; d_1 = slight; d_2 = moderate; d_3 = severe; and, d_4 = very severe degradation. The factors considered while categorizing status of degradation were extent of soil erosion, nutrient loss and landslides / landslips occurrences etc. The findings have been explained in subsequent sections.

Analysis of Perception of Leased-in Farmers

For the study, Likert type scale was used to understand the perceptions of the leased-in and non-leased farmers. Perceptions about practices concerning SWC, and environment and climate related problems were measured using five-point Likert type scale (Patrick and Musser, 1997; Meuwssen *et al.,* 2001) as 5 = very much essential, 4 = essential, 3 = neutral, 2 = not essential and 1 = not essential at all. Similarly, non leased land owners' perception on same attributes was measured. The mean values and standard deviation (SD) were worked out for logical interpretation. The reliability of Likert type scale was tested by using Cronbach's Alpha test developed by Lee Cronbach in 1951, as under, which indicates if the test designed is accurately measuring the variable of interest of the study.

Cronbach's Alpha Formula: $$\alpha = \frac{N.\bar{c}}{\bar{v} + (N - 1).\bar{c}}$$

Where, α (or *coefficient alpha*) = Cronbach's alpha; N = the number of items; $\bar{c}$ = average covariance between item-pairs; $\bar{v}$ = average variance.

Reliability Analysis

Data on perception of land degradation management strategies were analyzed from reliability point of view (Table 1). It was observed that Cronbach's Alpha values were nearing to 0.9 for awareness and 0.7 for perception. This indicates high level of consistency in the observations collected.

The descriptive statistics was carried out in STATA 14.0 computer programme.

Table: 1
Questions reliability analysis on land degradation management

Dimensions	Number of items	Cronbach's Alpha
Awareness about soil and water conservation measures	7	0.8826
Perception	11	0.6534

Background of Study Area

The total area is about 8249 km^2, out of which 78% area is occupied by south, north and middle Andaman, and 22% is occupied by Nicobar Islands (Table 2). Literacy rate is higher than national average in the Islands. First attempt of settled agriculture by clearing forests was made by Archibald Blair in 1779 at Chatham Island, and by the year 1901, about 10,198 ha of forest land was cleared, and 4,198 ha was put under cultivation. *Gliricidia* alley cropping system is very famous and maintained almost by all the farmers, but in recent past, these lands are facing challenges

Table: 2
General features of Andaman and Nicobar Islands

S.No.	Particulars	Andaman and Nicobar Islands	South Andaman District
1.	Total geographical area (sq km)	8249	3106
2.	Per capita geographical area (ha)	2.17	1.31
3.	Total forest area (sq km)	6629	2673
4.	Per capita forest area (ha)	1.74	1.13
5.	Total population (0000 No.)	37.99	23.76
6.	Total leased out operational holdings (%)	13.4	18.9
7.	Literacy rate (%)	86.27	88.49
8.	SC/ST population (%)	7.05	11.24
9.	Total number of land holdings (000 No.)	11.35	5.07
10.	Operational holdings (000 ha)	22.69	7.96
11.	Total livestock population (0000 No.)	17.56	5.53
12.	Total milk production (00 MT annum^{-1})	157.02	75.52
13.	Total meat production (0000 kg annum^{-1})	33.88	18.51
14.	Total egg production (00000 No.)	989.55	525.915

Source: Directorate of Economics and Statistics (DES), 2016

(Meena *et al.,* 2015). Agroforestry and traditional production systems that include home gardens were recently re-evaluated as effective measures for adapting to climate and ecosystem changes (Dagar, 1995; Meena *et al.,* 2017). The agriculture area that peaked in early part of this century (50,000 ha, 6% of geographical area of Islands) lost some farm lands due to tsunami of December 26, 2004, and at present stands at 22,690 ha worked by 11,350 farmers (DES, 2016). The Andaman and Nicobar Islands are blessed with plenty of water resources exclusively from mean annual rainfall of 2900.8 mm (1967-2014).

Though rice crop is grown successfully in *kharif* season, but perennial crops (plantation crops, spices, fruits) under homestead farming, which are subjected to post-monsoon soil moisture stress, are encountering yield penalties (Raja *et al.,* 2012). A significant number of farmers have leased out their land on annual rent basis. A person, who comes from the mainland for want of part time job, business and other alternate income generating activities, takes land on lease basis and cultivates vegetables for supplying to local market. These islands are self sufficient in terms of poultry and fish production, whereas cereals, pulses, oilseeds and vegetables are imported from the mainland at higher price (Shrawan *et al.,* 2018). Therefore, to sustain the local production, clear cut land lease policy is essential.

Status of Soil and Water Resources of A&N Islands

Success of agriculture (crops, animal husbandry and inland capture fisheries), and logging from forestry is directly dependent on health of soil, water, climate, energy (fire) and biodiversity. In general, the island soils with humus on top have 0.20-0.95% organic carbon (OC) with mild to moderately acidic reaction, whereas in coastal areas prone to tidal floods, acid sulphate and salinity are experienced (Meena *et al.,* 2015). The Island soils in general show deficiency of nitrogen, phosphorous, calcium, magnesium, and sulphur (Swarnam *et al.,* 2009). Iron and aluminum toxicity were also major concerns for low rice productivity in lowland (Meena *et al.,* 2008), and low water holding capacity (10-20 cm m^{-1}) coupled with moderate water intake rate in high intensity rain fall zone of Islands. Low fertilizer application (1,065 Mg in 2013-14) to crops as against estimated requirement of 8,000 Mg annum^{-1} of primary nutrients (NPK) poses a great challenge to sustainable use of land for farming (Gangaiah *et al.,* 2015). As tillage on slopping lands (>45^{o}) accelerates soil erosion (Pandey and Venkatesh, 2003), broad bed and furrow (BBF) technology helps in enhancing the income of farmers in water logged saline soil areas by diversified farming *viz*., vegetables, fish, paddy and fodder throughout the year. For soil fertility management, various approaches like green leaf manuring under *Gliricidia* alley cropping system in vegetables with 8.0 Mg ha^{-1} *Gliricidia* fresh leaves was also found promising for improving brinjal yields by 1.9 Mg ha^{-1} over control (Meena *et al.,* 2015, 2016, 2018).

3. RESULTS AND DISCUSSION

Socio-Economic Features of Leased-in Sample Households

Households having a limited family labour and/or assets along with off farm jobs are likely to rent out land, as their labour force can achieve limited coverage. On the other hand, those having good number of assets and large number of adults tend to rent in, to spread their assets over a larger area. They have most likely exceeded efficient scale for the assets they own, or have found more remunerative employment outside farming, or some combination of these, and other circumstances. Given limited alternative employment opportunities, leasing in and share-cropping provides low household income with an economic opportunity. Data collected from 146 leased-in farmers from ten locations of South Andaman indicated that the average family size was about five persons, and on an average, they obtained > 1.0 ha land on lease. The extent of leased-in land per farmer was higher in Wandoor (1.6 ha) followed by Frargunj (1.5 ha) and other areas (Table 3). Rent was paid in terms of cash on half yearly or yearly basis by majority of farmers, and on an average, land rent varied from ₹ 17500 ha^{-1}annum^{-1} to ₹ 26,500 ha^{-1}annum^{-1}. Some farmers shared

Table: 3
Socio-economic features of the leased-in farmers

Locations	No. of farmers	Family size (No.)	Land leased (ha)	Type of lease	Education status*	% of migrants	Possession of any ID card	Leased-in rate annum^{-1} ₹ ha^{1}
Ferrargunj	17	5.8	1.5	Cash	Medium	58	42	25650
Bambooflat	16	5.9	1.3	Cash / share crop	Low	39	61	19500
Wandoor	15	4.6	1.6	Cash / Share crop	Medium	45	55	18000
Hamfrigunj	11	5.7	1.2	Contract / share crop	High	66	34	20000
Herbertabad	13	5.4	1.0	Cash / Contract	Medium	71	29	20000
Chouldhari	15	4.8	1.1	Cash / Contract	Low	38	62	17500
Mitthakhadi	14	4.3	0.8	Cash/Contract	Low	39	61	22000
Port Mourt	16	4.5	0.7	Cash Contract	Medium	25	75	18000
Namunaghar	13	5.4	0.9	Cash	Medium	35	65	23400
Shipghat	16	7.7	1.2	Cash /Contract	High	17	83	26500
Overall	146							

**Indicates the level of education (Low = primary, Medium = 8 to 10th; and High = more than 10th standard)*

the crop production where part of inputs used were supplied by the land owner.

These islands have fragile coastal ecosystem with high probability of natural hazards for agricultural resources. Majority of the respondents who took land on lease were literate with low level of literacy (up to 8th standard). The percentage of migrants among the sampled leased-in farmers varied from 17% to 71%. They migrated from mainland as tourists and took land on lease for vegetable and high value crops cultivation (Chand *et al*., 2015). In due course of time, they brought their family members, including children and relatives. Preliminary survey indicated that leased-in farmers mainly migrated from Indian states, but infiltration from neighbouring countries also could not be ruled out since during the survey, as about 40% farmers did not possess any relevant document for identification. Apart from this, they did not even have a bank account. Hence, they were not able to take any support from financial and educational institutions. Therefore, ultimate goal of government schemes was getting defeated due to non eligibility of these farmers for getting benefits. In general, farmers were not adding or supplementing anything to soil health improvement due to short period of lease agreements.

Further, it was observed that mostly vegetable crops, *viz.,* bottle-gourd, cowpea, chillies, bitter-gourd, brinjal, okra and cucumber, were cultivated by these farmers. The returns were shared either as money paid directly to the land owners (on annual and per ha basis), even as an advance payment, or sharing of crop production. Contract farming was also practiced by some of the respondents. Majority of them stated that lease contract was for a short period of one to two years. Hence, if they invested for SWC, they will not enjoy the benefits if owners pass on land to other fellow farmer by cancelling the contract. The investment will go waste and it will be a direct loss to the investor since owners did not pay anything for such works. In such circumstances, it was difficult for them to maintain good soil health.

Soil Fertility in Leased Farming Areas

The soils are moderate to fine in texture, acidic in reaction and non-saline. Soil fertility status was analyzed from samples (Table 4). It was observed that these soils are rich in OC, particularly near to forest areas due to litter decomposition. However, vegetable cultivation areas were poor in OC. Among the different locations, OC content was higher in Bamboo flat followed by Ferrargunj. Similarly, nitrogen and potassium contents were also found to be higher in Bamboo flat and Ferrargunj. Among the different land uses, nitrogen and potassium contents were found to be higher in forest land. Soil fertility status in non-leased farming area indicated that soil organic carbon (SOC) content, and available nitrogen and potassium were higher due to sustainable use of agricultural land and proper management practices.

Land Degradation in Leased Farming Areas

Morphological features of leased-in land in selected

Table: 4
Soil fertility status of leased-in and non-leased farming areas

Fertility parameters	Leased-in land						Non-Leased farmers					
	Arecanut	Coconut	Vegetables	Cucurbits	Cowpea	Forest	Arecanut	Coconut	Vegetable	Cucurbits	Cowpea	Forest
Organic carbon (%)	0.64	0.73	0.52	0.53	0.72	1.7	1.3	1.4	1.6	0.9	1	2.3
Nitrogen (kg ha^{-1})	136	208	96	115	157	191	210	225	223	180	170	246
Potassium (kg ha^{-1})	95	126	89	92	104	112	127	142	135	103	109	118

sites of South Andaman indicated that mostly land covers are plantation and vegetable crops along with reserved forest. The topography is moderate to steep slopes leading to accelerated runoff and sediments flow. Erosion classes identified by Sahoo *et al*. (2013) for Andaman and Nicobar Islands are very slight (< 5 t $ha^{-1}yr^{-1}$), slight (< 5 to 10 t ha^{-1} yr^{-1}), moderate (<10 to 15 t $ha^{-1}yr^{-1}$), moderately severe (<15 to 20 t $ha^{-1}yr^{-1}$), severe (< 20 to 40 t $ha^{-1}yr^{-1}$), very severe (<40 t to 80 t $ha^{-1}yr^{-1}$), and extremely severe (>80 to 10 t $ha^{-1}yr^{-1}$). Soil working in vegetable fields caused high soil loss up to 124 t $ha^{-1}yr^{-1}$. The soil erosion and nutrient loss due water erosion in vegetable cultivation, coconuts, arecanut, home garden and moist evergreen forest on undulating topography of the island was high (Pandey and Chaudhary 2010). Area wise and crop wise status of degradation in leased farming is given in Table 5. The crop wise status of degradation in leased-in farms indicate that okra, brinjal and cowpea had moderate to severe level of land degradation, which varies from d_2 to d_3 levels. At Chouldari and Port Mourt, degradation is severe under okra cultivation. This is matter of concern and needs to be checked since the Islands are prone to high risk of erosion and soil fertility loss due to low soil depth. In case of brinjal crop, Herbertabad had severe level, while other places had slight to moderate level of degradation. It has been argued that level of degradation cannot be zero by adoption of possible conservation measures, but it can be minimized from severe to slight level. Therefore, land owners and leased-in farmers should adopt conservation measures to stop further degradation. It has been also suggested that vegetable cultivation needs to be advocated with SWC measures in these islands as Coastal Regions (Chaudhuri *et al.,* 2008).

Perceptions of Leased-in Farmers on Soil Degradation and Management

We considered that for soil health and water conservation, farmers that leased-in land and also those that did not lease will adopt conservation measures, as presented in the Table 6. Based on Likert scale, nine important practices followed by non-leased farmers were considered for analysis. We observed that lease-in farmers perceived soil health and water conservation to be not much important as the scale value turned out to be very low e.g. in case of use of FYM, the scale value was 1.87 (not essential), while for non-leased farmer it was 3.11 indicating it is essential to apply FYM to their fields. The scale value for use of vermicompost was high, which indicated that both types of farmers gave importance to this practice. While green manuring, mulching, water saving and multi storey cultivation practices were observed to be not essential as their scale values were less. However, standard deviation also was less than one, indicating low variability in the response of the farmers. It means all farmers in this category perceived in similar way. In the case of non lease farmers, perceptions on the same issues were different and higher, indicating these measures were essential. Cultivation practices like vegetables cultivation, crop rotation and perennial crops cultivation were considered as common for leased and non-leased farmers, but the scale values were higher for non lease farmers, and SD values also more than one for vegetable cultivation indicating high variability in decisions about it. Both types of farmers protect their crops from climate change (high rainfall and temperature) and consider them essential.

4. CONCLUSIONS

Average family size of leased-in farmers was about five persons, which indicated that they have family labour to work on lease-in farming land, which on an average was more than 1.0 ha. Rent was paid in terms of cash on half yearly and yearly basis by majority of farmers, and on an average, ₹ 17,500 $ha^{-1}annum^{-1}$ to ₹ 26,500 $ha^{-1}annum^{-1}$ was paid to the land owner. As most of leased-in farmers were migrants, they did not possess any relevant document for identification and, therefore, were not able to take any support from financial and educational institutions, and were not adding or supplementing anything for soil health improvement due to short period of lease agreements (1 to 2 years). Compared to leased-in farmers, soil fertility status in

Table: 5
Status of land degradation in leased farming areas

Locations	Cucurbits	Okhra	Brinjal	Cowpea	Arecanut	Status
Ferrargunj	d_2	d_2	d_2	d_1	d_2	Moderate
Bambooflat	d_2	d_2	d_1	d_1	d_1	Low to moderate
Wandoor	d_1	d_1	d_1	d_3	d_1	Slight
Hamfrigunj	d_2	d_1	d_2	d_1	d_2	Moderate
Herbertabad	d_1	d_2	d_3	d_2	d_1	Moderate to severe
Chouldari	d_2	d_3	d_1	d_1	d_1	Slight
Mitthakhadi	d_2	d_1	d_2	d_2	d_1	Moderate
Port Mourt	d_2	d_3	d_2	d_1	d_2	Moderate to severe
Namunaghar	d_1	d_1	d_1	d_1	d_1	Slight
Shipighat	d_2	d_1	d_2	d_1	d_1	Slight
Degradation class	d_0 = Nil	d_1 = Slight	d_2 = Moderate	d_3 = Severe	d_4 = Very severe	

Table: 6
Perceptions of leased-in and non-lease farmers on soil and water resource management

S.No. Particulars on which perceptions were asked	Lease farming		Non-lease farming	
	Score	SD	Score	SD
A. Soil health and water conservation				
1. Use of FYM	1.87	0.20	3.11	0.85
2. Use of vermi-compost	2.83	0.45	2.52	1.12
3. Green manuring	1.67	0.76	3.82	0.87
4. Contour farming	2.83	0.82	3.21	0.65
5. Mulching	1.82	0.16	2.42	1.28
6. Water saving techniques	1.81	0.81	3.32	0.08
7. Multi-storey cultivation	1.81	0.81	2.11	0.75
8. Rainwater protection	1.83	0.82	2.23	0.81
9. Cultivation across slope	1.91	0.19	3.45	0.96
B. Cultivation practices				
1. Vegetable cultivation	2.84	0.16	3.53	1.23
2. Perennial crops cultivation	1.82	0.87	3.21	0.78
3. Crop rotation	2.81	0.96	3.23	0.98
4. Traditional agriculture	1.80	0.85	2.12	0.43
C. Environment and climate related problems				
1. Protect crops from high rainfall	2.83	0.85	4.01	0.79
2. Protect crops from high temperature	3.84	0.84	3.35	0.83

non-leased farming area indicated that SOC content, and available nitrogen and potassium were higher due to sustainable use of agricultural land and proper management practices. It was observed that degradation status was d_1 to d_4 indicating moderate to severe level of degradation in leased-in lands. SWC practices were mostly followed by non-leased farmers. Perception about soil health and water management and protection from harsh climate were found to be essential for non leased farmers, whereas leased-in farmers were least careful to maintain health of soils. The study highlights that policy to protect lease-in lands from degradation, and to protect the limited and fragile agri-ecosystem of Andaman and Nicobar Islands is very much essential. The findings will provide information for future research and policy decisions on leased land practices.

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