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Cap and trade permits to regulate overgrazing in India: an exploration

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Abstract

Objective: This study explores how a system of cap and trade that can be applied to limit open grazing of goat population in India.
Methods/Findings: Though cap and trade are common widely applied to control air and water pollution, its exploration in the case of open grazing of goats is relatively novel. The ideas are tested through focus group discussions (FGDs) with 182 goat keepers in six different agro-ecological zones across India. Results showed that the goat owners overwhelmingly favoured a cap and trade system wherein the village council ("Panchayat") acts as the regulator setting an overall legal limit on grazing load or stocking rates (based on the system's carrying capacity), and then grant households a certain number of permits to graze. Households that do not meet their cap can buy permits from others that have a surplus.
Application: The study indicated that the administrative and social challenges may inhibit adoption of such a radical change from traditional free-for-all open grazing system.
***Keywords*:** overgrazing, permit system, user fees, focus group discussions, cap and trade.

1. Introduction

India's 135 million goat heads – constituting 15% of world's goat– is reared by over 14 million households [1]. Economically weak and socially backwards communities keep goat for subsistence. India is second in the world in goat meat production and its gross domestic product value is Rs. 386 billion (US$ 6 billion). There are four major goat production systems in the country, namely extensive grazing, tethering, intensive and semi-intensive production. Primary source of goat nutrition is through extensive grazing/browsing with zero marginal supplements. India's grazing lands constitute of about 4% of the country's total land surface. Improper management practices at very high grazing pressures can undermine environment while scientifically managed goat grazing can be a useful contribution to conservation [2]. The damage to common property resources from poor management of livestock is well documented [3]. What is less understood is that open grazing does not meet the full requirements of animal nutrition, leading to undernourishment, morbidity, and stunted growth [4]. Of late, there has been interest in applying cap and trade to land conservation. California's Sustainable Agricultural Land Conservation program (SALC) provide incentives for agricultural practices that mitigate climate change. Tropical grasslands and forests play a particularly important role in stabilizing atmospheric emissions because they are the main source of terrestrial carbon emissions, and they contain massive biomass carbon stocks. Land improvement initiatives likely can be implemented faster than a transition away from carbon intensive energy production.

The theoretical articulation of cap and trade can be traced to Coase [5], Crocker [6], and Montgomery [7]. The instrument was launched as part of the US Acid Rain Program in Title IV of the 1990 Clean Air Act. Later, various national governments, cities, and companies have adopted such trading systems, notably for mitigating climate change [8]. With the coming in force of Kyoto Protocol in February 2005, more countries and companies opted to participate in emissions trading [8]. In 2015, according to the International Carbon Action Partnership, there were 17 emissions trading systems for greenhouse gas emissions in force across four continents, spanning 35 countries, 13 states or provinces and seven cities [9].

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India too launched a scheme in 2011 which involves capping the total pollution by 1000 industrial units in 4 states, issuing permits to each industry on how much pollution it can individually emit in the air, and then allowing them to buy and sell those permits. Cap and trade as a government mandated, market-based approach in contrast to command-and-control environmental regulations such as best available technology standards and government subsidies has seen wider acceptance in controlling pollutants or emissions. Use of cap and trade to control overgrazing is relatively novel.

The objective of this study is to explorehow a cap and trade system can be applied with the intention that part of the external environmental costs is absorbed by the goat owners, open grazing is controlled, and growth of goat population is limited.

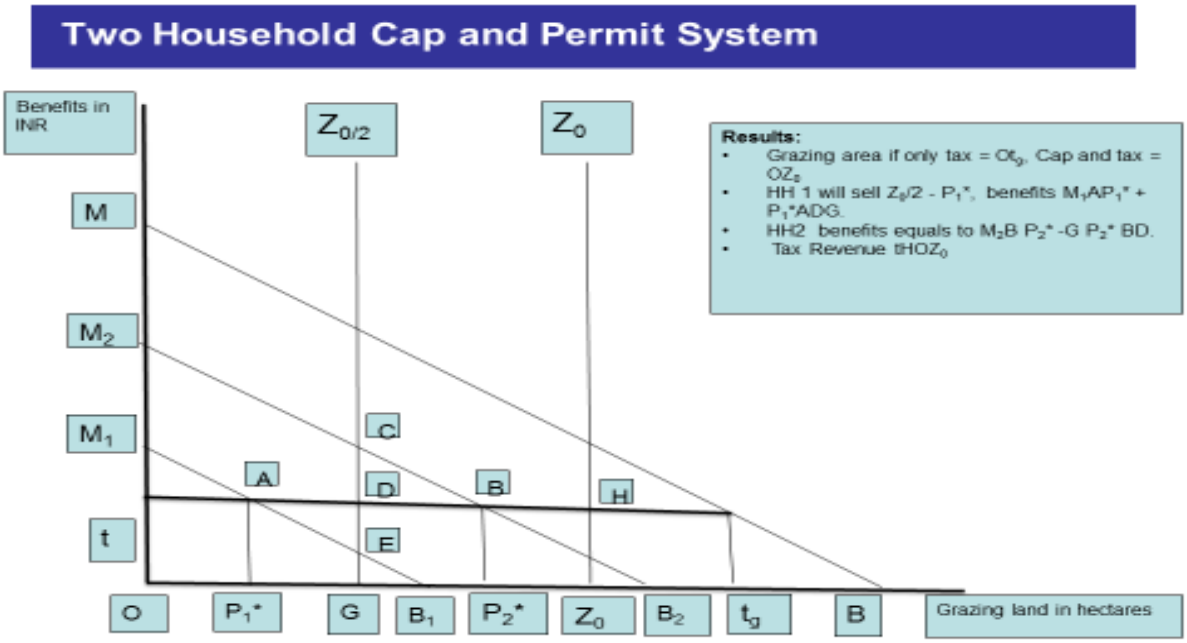
2. Materials and Method

1. Theory of cap and trade

Figure 1 hypothesizes how a cap and trade permit system might operate to control grazing. Under a transferable grazing permit (TGP) system, households must have a permit to graze and each permit specifies exactly how many animals the household is allowed to open graze. The permits are transferable; they can be bought and sold. The village council issues a predetermined number of permits needed to maintain balance between ecological regeneration and the green fodder need of goat population. If the market for permits is competitive and transaction costs of trading is zero, households will trade permits and an equilibrium price for permits will be determined in the market at which the demand for permits is just equal to their supply. We expect that households with high marginal costs of abatement will be buyers of permits, while households with low costs of abatement will be sellers of permits. The permits could be initially distributed free of costs to all existing owners of goats in the village, implicitly recognizing their traditional rights to graze.

To illustrate, the TGP system, we assume a two-household economy: household $h_1$having B_1number of goats, and household h_2 having B_2 number of goats, where $B_1<B_2$. The total grazing load is $(B_1+B_2)*f_1$. $f_1$isthegreen fodder consumption of each goat. Ideally, $(B_1+B_2)*f_1 \leq c_1$. $c_1$is the regeneration capacity of the land. Since, the village council is not aware of what the true regeneration capacity, it choses an arbitrary standard of grazing load being Z_0. Each household gets $Z_0/2$ permits.

Figure 1. Comparison of uniform standards policy with tradeable grazing rights system in a two-household economy



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M_1B_1 is the marginal benefits from grazing for household 1. M_2B_2 is the marginal benefits from grazing for household 2. MB is the aggregate marginal benefits from grazing for both households and is obtained by horizontally aggregating the individual marginal benefit curves.

We can now compare the impact on grazing land usage under a TGP policy and a uniform standard policy.Uncertainty a tax t was adopted, grazing area would be OB_1 for household 1 and OB_2in the case of household 2. The aggregate grazing would get reduced by OB – Ot_g.Under a uniform standards policy, each household has to reduce grazing to $Z_0/2$. Benefits to household 1 is M_1AEG and household 2 is M_2CDG. The grazing load will be OP_1* + OG which less than Z_0 – a sub-optimal solution from the point of the regulator. Under a tradeable permit, after both households are allotted $Z_0/2$permits free and allowed to trade their grazing permits. Household 1 will use P_1 permits and sell $Z_0/2 – P_1$ at price u_0. Its benefits equal to$M_1AP_1 + P_1ADG$. Compared to uniform standards policy, household 1 gains the area ADE. Household 2 will buy P_2- $Z_0/2$ permits at a price of u. Its benefits equal to $M_2BP_2 – GP_2$* BD. Compared to a uniform standard policy, household 2 gains the area BCD.

Gain for society while achieving the same Z_0 level of grazing as with a uniform standard is now ADE+BCD.The TGP system is thus Pareto superior to the uniform standards system. A TGP system gives households more flexibility in their methods for complying with aggregated standard.

2. Survey

To provide a real scenario, the idea of tradeable permit for goats was presented to 182 participants in six focus group discussions (FGDs) conducted between January and May 2016 in six different agro-ecological zones in the Indian states of Bihar, Jharkhand, Rajasthan, Odisha, Uttarakhand, and Uttar Pradesh. The six FGD locations represented 6 agro-ecological zones.Agro-ecological regions are classified by the National Bureau of Soil Survey & Land Use Planning. An agro-ecological zone refers to the land unit carved out of agro-climatic zone superimposed on landform which acts as modifier to climate and length of growing period.

The participants of all FGDs were self-selected. They represented a cross section of villagers: farmers, goat owners, grazers, elected village council members, government employees and others. It was felt that anopen house discussion with all interested parties in a common place in the village would provide an opportunity to air varied perspectives, argue, and arrive at some negotiated outcome. Open grazing is done on common property resources where in theoretically every resident of the village has a say in its management. Therefore, instead of asking individuals in the privacy of one-to-one interaction, it was felt discussions at open forums would provide more insights, and be more conducive to build consensus on user charges. The common characteristics of all the locations is that they primarily rely on public land owned for grazing their animals.

The following steps were followed in all FGDs:

1. The purpose of the FGD -repeatedly explained - was to collect ideas for a cap and permit system appropriate for the village where FGD was being held.
2. Information was collected on the total number of households residing in the village, and of them how many are owning goats.
3. The number of goats in the village was estimated.
4. The group was asked if they considered the current number of goats in the village was in excess of what natural regeneration of the village common land could support.
5. Since all groups felt that grazing was in excess of natural regeneration, they were asked if there was a mandatory reduction of 20% goat population by the village council (regulator), and permits issued to all current goat owners, how they would respond.
6. Thereafter, the participants were asked if the required level of reduction in goat population is achieved, what amount they are willing to pay to secure their annual rights to grazing.

Each FGD lasted 6-8 hours, and were conducted in local dialects. To facilitate discussion, a map of the main grazing area was drawn on ground, colours were used to show areas used for grazing and watering.

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3. Results and Discussion

Salient information from the FGDs is presented in Table 1.

Table 1. Findings of the FGD on cap and permit on goat population in different agro ecological regions

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Regions	Eastern Plain, HotSub humid (moist) (13.1)	Hot moist/dry sub humid transitional (11.0)	Hot Sub-humid (12.3)	Hot Humid Arid (4.1)	Hot Semi-Arid, with alluvium derived soils (N8 D2)	Western Himalayas, Warm Sub-humid (14.5)
Village, District and State	Karjhausa, Banka, Bihar	Unchdih, Gumla, Jharkhand	Dasrathpur, Keonjhar, Odisha	Muradwas, Alwar, Rajasthan	Barukharkhur, Banda, Uttar Pradesh	Simyal, Nainital, Uttarakhand
# households (HH)	164	74	70	103	190	74
HH owning goats	89	63	60	30	110	20
Total goat population	273	378	182	150	443	100
Goat population reduction deemed optimal by FGD	-20%	-15%	-30%	-20%	-30%	-22%
Cost of an adult female goat US$	38.46	38.46	56.92	40.00	53.85	41.54
# participants in FGD	32	12	41	30	39	28
WTP for permitMin / Max US$	2.31/ 3.08	2.46/2.77	2.78/3.40	2.85/3.23	2.23/2.77	2.69/3.15
WTP Max-Min deviation in %	33%	13%	22%	14%	24%	17%

The table shows that 372 of the 675 households – i.e. more than 55% of the households - in the selected villages owned goats. On an average, the households owned 4 goats. The cost of an adult female goat varied between $38.46 in Bihar and Jharkhand to $53.85 in U.P. In general, the willingness to pay for trading permit per goat per year was estimated to be in the range of US$ 2.23 to US$ 4.46 (Rs. 145 to Rs. 290). The value of the permit was highest in Rajasthan. There is a positive correlation between the value of the permit and cost of live goat. A general refrain in the FGDs was that permits should be issued for 2 years duration at a time by the village council ("*Panchayat*").

The FGD offered rich insight into the pros and cons of acap-trade permit system. A matter of considerable debate was how the permits would be distributed; a uniform standard reduction of 20% was not felt right from equity point of view. Those with larger herds should take bigger hit, leaving those with 3 goats untouched.The FGDs felt that we could start with a predetermined reduction target, adjusted from time to time to match natural regeneration rates. The idea that the green fodder offtake must not exceed the local carrying capacity of grazing land was quickly understood. Alwar and Banda where drought like condition has persisted felt a reduction of 30% in goat population was adequate, the percentile reduction was less in higher rainfall areas of Bihar, and Jharkhand. The participants observed that a cap and permit system would restore "rule" as opposed to "free for all" regime.

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The establishment of rights would enable voluntary agreement among permit holders, through voluntary agreements, to practicerotational grazing and planting of fodder trees. Many landless goat rearers, in drought-hit Keonjhar, Gumla and Banda, migrate to other parts of the country in search of work. They welcomed the idea that they can sell their permits for limited periods to others and reclaim the same on return from migration. A side benefit perceived was that the permit system would encourage people to opt for stall feeding of their goats.

Theoretically, cap and trade provide a cost-effective way to limit number of goats, coping with the grazing carrying capacity. The cap can be tightened whenever so needed. A reduction in number of goats may increase availability of fodder regenerated in common lands. However, practical implementation of such an unprecedented scheme is fraught with administrative and political challenges [10, 11]. While placing rigidly-enforced caps on grazing may be justified from an environmental standpoint, enforcement such methods are administratively unpopular being contrary to age-old traditional practices, and has the potential of further pushing up the cost of goat meat. There might be strong criticism on grounds of equity that it would most negatively affect the poor. To some extent, the resistance can be reduced by combination of gradual cap on grazing, citizen action, and outright ban on grazing in ecologically fragile areas. Incentives for stall-feeding of animals will help. Finally, citizen action is a very potent force, and must accompany all effective interventions to reduce environmental degradation.

4. Conclusion

Cap and trade could be an economically efficient way to reduce overgrazing, and indirectly reduce low-quality livestock population. Market based instruments are only option, where command and control legislation to place quantitative limit on households on how many goats they can keep is either absent or not feasible.To conclude, there is need to pilot cap and trade in various agro-ecological zones to build the knowledge base for wide scale replication. A programme to monitor conditions of grazing lands on a real-time basis is the first that could be rolled out and serve as a source of information to gauge impact of voluntary cap and trade system.

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