DISAPPEARING COMMON LANDS: A PERSPECTIVE EMPHASISING ENCROACHMENT AND ENFORCEMENT COSTS

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Summary

Encroachment has gradually yet pervasively reduced the area of common land throughout much of India, and has proved to be a critical mechanism for the transfer of property rights from the group to the individual. Even though governments are willing to spend time and money, it is often too costly to prevent and reverse all the encroachment. Not only is the common land lost, and any public good aspects associated with it, but this tacit method of privatising the land often leads to an ad hoc redistribution of the land, that tends to harm the poorer members of the community who are more likely to rely on the common land. These issues are considered in this paper, a result of research undertaken in Karnataka State, India. The characteristics of encroachment that were observed in Karnataka, typical of encroachment throughout India, are discussed with reference to the current literature.

Using a dynamic optimisation model, this paper considers explicitly the actions of encroacher and the government over time as the area of common land is reduced, in particular the time path of encroachment and enforcement spending, and the efficiency and equity issues that are raised under a number of different scenarios.

The literatures that deal with these issues cannot account for many of the features central to a discussion of encroachment. Despite a recent focus in the property rights literature over the cost of defining and enforcing private property rights, little attention has been given to the related issue of the optimal strategy for managing common lands when the enforcement of the boundaries is costly. The enforcement literature considers optimal punishment strategies when enforcement is costly. However, the analysis is static, implicitly giving an optimal level of crime that can be undertaken each period. This is not sufficient when considering the encroachment of land. Since land is a non-renewable resource, there are cumulative effects from allowing encroachment, and no long run equilibrium level of encroachment, rather an optimal path.

Given that the government may be unable to prevent the eventual loss of all common land, and the ad hoc reallocation of resources that tends to result, issues are raised such as the optimal path for the conversion of common land to private, whether the regularisation of encroachment is an efficient or equitable method of privatising land, and what the optimal timing of enforcement spending should be.

Introduction

In southern India, common property land, of the order of 20% of village land in Karnataka (Nadkarni and Pasha, 1991), in its many different guises has had a pervasive impact on rural areas.[1] Village tanks have been the major source for drinking water for livestock, bathing, and washing, in addition to direct irrigation; they have been critical for ground water recharge, benefiting all those who use well irrigation.[2] *Gomal* lands - namely village grazing lands - have often been the only source of grazing for livestock. Forest lands have provided watershed and environmental benefits in addition to providing timber and non-market extractive products.

Despite recognition of the benefits they offer, common lands in India, as throughout much of Asia, have been disappearing over the last several decades (Jodha (1990, 1992), Nadkarni and Pasha (1991), SPWD (1993)). Between 1951-2, and Jodha's 1982-3 survey (Jodha, 1986), the area of common land in his surveyed villages declined between 31% and 52%. The Society for the Promotion of Wastelands Development (SPWD) has found similar reductions in common land area throughout the dry lands of India. Some of this decline in the area of common land is a result of formal conversion of land for cultivation, but much has been a consequence of gradual encroachment by individual farmers, often followed by "regularisation" of the land.[3]

There has been little formal recognition or analysis of encroachment as the critical mechanism for what is effectively the transfer of property rights from group to individual. In this paper, encroachment as a mechanism for the conversion of land from common ownership to private ownership is considered in detail, both empirically and theoretically. The empirical observations come from fieldwork undertaken in Karnataka, India, in 1995. These observations are discussed in the light of the property rights and enforcement literatures that do not accommodate many of the dynamic issues that are raised by encroachment. A dynamic model is developed, recognising that an analysis of

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1 The term common land here refers both to land owned and managed by a village unit, and to government land that tends not to be actively managed and often resembles an open access resource

2 Tanks are three-sided embankments on sloping terrain constructed to retain run-off water above the surface level. They are the most common form of surface water irrigation in southern India.

3 Regularisation of land involves the granting of title to the person occupying the lands, generally for some nominal fee, hence legitimising, *ex post*, the encroachment.

encroachment requires the consideration of an optimal path of transition of property rights, rather than an equilibrium.

Encroachment - observations from the field

Throughout Karnataka, most encroachment can be categorised into one of two types: "boundary" or "stand-alone." Farmers who cultivate land adjacent to the common land typically will encroach by year by year extending slightly the boundary of their land into the common land. In dryland areas, a farmer will move the boundary markers just a few meters each year. Farmers say that in this way, it is much harder for the encroachment to be noticed, and that if it is, the authorities are unlikely to take actions because of the high costs associated with evicting an encroacher relative to the small amount of land lost. Hence farmers understand that their actions can affect the probability that they get to keep the land that they encroach. Often the farmer will not cultivate the encroached land for the first year, preferring to wait to see whether anyone notices the encroachment before assimilating the strip. Similarly, landless people, who make "stand-alone" encroachments, tend to encroach where their actions are least visible, initially selecting a small area of land, hidden from view within a densely vegetated area, constructing a house, and farming the land around the house, slowly extending the area cultivated each year.

The common feature of encroachment in Karnataka is that it occurs gradually.[4] It is difficult to spot, and even when the authorities believe that encroachment has occurred, they cannot easily identify where the private land ends and the common land begins. Further, the longer encroachers have been occupying particular land, the harder they will fight to remain. Hence, if encroachment is not spotted early, it is much more costly, if not impossible, to remove the encroacher from the land.

Through encroachment year by year, no matter how small the amount in any one year, ultimately discrete areas of common land disappear completely. In one study village in Karnataka,[5] all twelve acres of government revenue land had been encroached, the *gomal*

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4 In the forested areas in western Karnataka, encroachment occurs on a much larger scale. In these areas, the land holdings of individual farmers tend to be large, often covering several hundred acres, and under relatively dense vegetation, and so it is much harder to identify encroachment. Farmers have been much bolder, encroaching tens of acres at a time, constrained only by the availability of labour to convert and cultivate the land. Landless people who have settled in the forest areas may have been cultivating for many years before anyone notices.

5 Kuthinagere, Bangalore Rural District

land of five acres originally had been reduced to half an acre, to which there was no longer public access so it had in effect disappeared, and four acres of the tank bed, originally fourteen acres, were being cultivated, while much of the forest land had been assimilated into the private holdings of those with bordering land. In Kodagu, a forested district of Karnataka, only half of the *deva kadu* - sacred groves that are common access lands - that existed in 1900 remain.

Measures taken to prevent encroachment involve two distinct steps: detection and punishment, both of which are costly and only partially successful. Following the sweeping land reforms that were introduced throughout India following independence from the British in 1947, responsibility for common lands was transferred from village communities that took an active responsibility for the management of the commons, to village "panchayats" and the state Revenue and Forest departments.[6] The Forest department has tended to be proactive about detection of encroachment, defining and monitoring forest boundaries, generally using stone markers, ditches, and patrols. In contrast, the Revenue department in Karnataka, relatively short of funds for protection of common land, tended to be reactive, relying on villagers to bring to its attention the encroachment before it will take any action. To prove that encroachment has occurred, the Revenue department undertakes a land survey, and compares the boundaries with the records of the village accountant. If encroachment is proven the Revenue department then decides whether to punish the encroacher by imposing a fine or to take the matter to civil court to try to evict the encroacher.

Each method of punishment, either a fine or eviction, can be used by the enforcer to deter the rate of encroachment but each has very different consequences, especially for the rate of loss of land. By imposing a fine the enforcer deters encroachment but accepts the loss of the land. The maximum level of the fine is likely to be lower than the opportunity cost of losing the land, since it will be capped by the present wealth of the encroacher.[7] Eviction, in contrast, is both a method of deterring encroachers and of attempting to reverse the loss

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6 Jodha (1986) describes these panchayats as 'village level replica of the "government"', formal institutions that did not encourage village participation in the management of common resources.

7 The assumption that a monetary fine cannot be higher than the wealth of the individual is common in the enforcement literature. For example, Shavell (1991) assumes that 'a monetary sanction cannot be higher than an individual's wealth', Sutinen and Andersen (1985) the assets of a firm. If a farmer loses the encroached land, he or she loses potential income from the land every year.

of common land. This aggressive strategy is generally progressive in terms of income distribution since the poor tend to be more dependent on common land.[8] Further, it re-enforces perceptions that encroachment is not acceptable. The implicit cost to the encroacher of the punishment is high, since an infinite stream of income from the land is lost. However, the transaction costs are significant, both in terms of the punishment process, and the costs of recovering the land and reconverting it to its original state, if this is even possible. Typically it takes ten to fifteen years to evict someone through formal channels.

It is now recognised (see, for example, Demsetz (1964), Cheung (1987), Anderson and Hill (1990), de Meza and Gould (1992), Mendelsohn (1994)) that the costs of defining and protecting private rights can dissipate any efficiency gains that can be realised through private ownership and management of land.[9] However, little attention has been given to the converse: the cost and feasibility of maintaining property as common access, whether managed or open access.[10] That is, the cost of preventing the loss of encroachment, or alternatively, enforcing a common property regime, has largely been ignored.

The recent literature on enforcement focuses on optimal strategies given that enforcement is costly and there is a limit to the maximum penalty that can be imposed (usually the wealth of the individual). Stigler (1970) writes that the 'goal of enforcement ... [is] to achieve that degree of compliance with the rule of prescribed (or proscribed) behaviour that society believes it can afford.' An equilibrium may well exist where it is optimal to allow some level of crime rather than take on the costs of preventing all criminal acts: either the cost of monitoring outweighs the social cost of the crime; or, by not taking account of marginal deterrence, increasing the punishment for less costly crimes can induce criminals to switch to more costly crimes.[11]

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8 The loss of common land has had a negative impact on income distribution, as highlighted by Jodha (1990). Studies undertaken in India suggest that the rural poor rely on common lands for 80% of fuel requirements (surveyed villages, SPWD (1993)), 20% of income, and 80% of grazing requirements (Jodha 1986).

9 Note that once transaction costs are included, the starting point for the analysis will influence the optimal property rights regime.

10 One notable exception is Clarke et al. (1993) which is concerned with the costs of enforcing usage rights on state-owned forests.

11 For some of the more recent literature, see for example, Helsley and Strange (1994), Mookherjee and Png (1992, 1994), Polinsky and Shavell (1979, 1984), Shavell (1991, 1992).

Nevertheless, the literature has paid little attention to dynamic issues concerning incomplete enforcement. In part, this is because, for many crimes that are discussed in the literature, there are no cumulative effects from allowing some level of the crime to go unpunished each period. Hence most of the analysis is static, considered only within a single-period framework. For these static analyses, an equilibrium is found such that each period, there is a positive and constant level of the crime permitted, and a positive and constant level of enforcement spending.[12]

The loss of common land through encroachment is fundamentally different from related issues such as poaching of timber or other extractable goods from a government forest.[13] Both can be considered thefts of community resources, but whereas poaching is the theft of a flow of goods, leaving the quantity of forest unchanged but the "quality" reduced, encroachment of land reduces the quantity of the common resource, without necessarily affecting the quality of the remaining resource. Hence, the path of the encroachment, rather than an equilibrium steady-state level, must be considered. Authorities can try to prevent the loss of the common land, yet unless they can stop all encroachment every period, eventually all the land will be gone.

The static perspective taken in most of the enforcement literature is not sufficient to discuss the optimal level of prevention of encroachment. Land is a finite resource, hence there are cumulative effects of encroachment.[14] There is no long-run equilibrium whereby each period some given level of theft of a non-renewable stock is allowed, for the resource will be exhausted. The only static equilibrium can be that there is no theft but a finite stock, or no remaining stock. Further, it ought not to be assumed that there is some constant equilibrium level of enforcement spending each period. For example, whenever some level of encroachment is permitted in a given period, the total area remaining in the following period is reduced, which will influence the costs of enforcement and the marginal value of

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12 For example, Polinsky and Shavell (1979) consider the "crime" of double parking: that people double park in each period without getting caught does not change any parameters in the next period since there is the implicit assumption that at the end of a period, the person who has double parked removes the vehicle.

13 Clarke et al. (1993) have undertaken a dynamic analysis in as much as they determine the optimal path to a steady state for a forest where there is timber poaching. However, the dynamics are only transitional, at equilibrium there is a constant flow of timber, rate of poaching, and enforcement effort.

14 This can be considered analogous to comparing the optimal extraction of a renewable with a non-renewable resource. In analysing the former, an equilibrium *flow* of the resource is determined. For the latter, a path for extraction of the *stock* of resource is determined: in general, the result is the exhaustion of the stock.

the common land in the next period. Hence, rather than considering an equilibrium level of encroachment that weighs the costs of enforcement with the benefits from keeping the land common access, it is necessary to consider an optimal path for encroachment.

Once it is recognised that it is costly to prevent encroachment, a policy of allowing some encroachment to occur may be optimal. However, if the long-run equilibrium is the loss of all common land to encroachment, as has occurred in many villages in Karnataka, this approach may be an expensive way to arrive at the inevitable privatisation of government land.

In practice, in Karnataka, a number of different responses to encroachment can be observed, each to a greater or lesser degree: "laissez-faire" where encroachment occurs unchecked; punishment of those who are detected encroaching, either by imposing a fine, or evicting them from the land; and up-front explicit privatisation of the common land.

Each of these responses to encroachment has different implications for efficiency of land use, equity of land distribution, and the total cost of enforcement. Depending on, among others, the relative costs of detection and removal of encroachers, the relative value of land in common and private ownership, the weight put on efficiency versus equity, the cost of formally privatising the land, the ability to reverse the "damage" of encroachment, each of the reactions of the authorities to encroachment discussed above could be optimal. That is, the optimal response may be endogenous to an environment that is changing over time. As the area of common land is reduced due to encroachment and the marginal value of common land changes the amount spent on enforcement and the rate of encroachment will change.

The model

The following dynamic optimisation model illustrates some of the issues raised in the discussion above. When modeling a system, there is a trade-off: a complex model can represent details of the real world more accurately, but less intuition and fewer insights can be gained from it. The model described below is based on a number of stylised facts that are pertinent to the interaction between encroacher and enforcer that I have observed in Karnataka. The model is multiperiod, taking the perspective of the enforcer, who takes decisions each period knowing that these decisions will impact on future periods.

In the model, each period a countably infinite number of myopic, risk-neutral farmers choose the area of land that they will encroach, knowing that there is some probability that they can lose the land if caught, so as to maximise expected net revenues from cultivating that land. The only input for farming is land, to which there are constant returns, and farmers get no private benefit from the common land. Farmers know that they can influence the probability of being caught since the larger the area they encroach, the more visible it is, and hence the more likely that the authorities will notice it.

The authorities in turn try to prevent this encroachment by patrolling the area of land and punishing those who are caught. The enforcer influences the probability of detecting an encroacher through the *intensity* of enforcement spending; that is, the level of spending per unit area of the remaining common land. The enforcer is forward looking, and maximises over time the net present value of the common land, less the costs of enforcement, plus some proportion of the value of encroached land to those who encroach.[15]

In this model, it is assumed that all those who are detected are costlessly punished only for the land that was encroached in the period when the detection occurred. This is a simplification of the observation that it is much less costly to remove someone from newly encroached land than land that has been occupied for several years. Further, a reduced form equation is used to represent the actions of the farmers: the issues facing an individual farmer, whether at the end of a period she or he gets to keep the encroached land and remain "in" the game, or loses the land and is "out" of the game, are subsumed into the reduced form relating the rate of encroachment to the level of enforcement spending by the authorities. Making these simplifying assumptions in this paper allows modeling of the points made above without adding excessive complexity to the model.

The following notation is used (time subscripts subsumed, all values per period):

V_E = per-unit net revenues from encroached land

V_C = per-unit net revenues from common land

A_E = area of land encroached

F = per-unit area enforcement spending

γ = effectiveness of per-unit enforcement spending

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15 Clarke et al. (1993) suggest that some value of the theft be included in the objective function of the enforcer 'to reflect the concerns of Milliman (1986) that some weight be attached to the proceeds of successful theft.' In fact, in much of the enforcement literature, the enforcer maximises overall social welfare in which case, the total value of a crime to the perpetrator should be included in the objective function of the enforcer.

λ	=	weight attached to value of encroached land
p	=	probability of detection of encroachment
R	=	interest rate
k_1, k_2, k_3		constants for calibration of value of common land
E		denotes expectation

The myopic farmer faces the following optimisation problem each period:

$$\underset{A_E}{Max}\ V_E A_E\left(1 - p\left(A_E, F\right)\right)$$

The forward-looking enforcer maximises the following:

$$\underset{F}{Max}\ \sum_{t=1}^{\infty}\left(V_{C,t}\mathrm{E}A_{C,t} + \lambda V_{E,t}\mathrm{E}A_{E,t} - F_t P_t\right)\cdot\left(\frac{1}{1+R}\right)^t$$

For the enforcer, λ is a choice variable that takes on a value between zero and one. λ=0 implies that the enforcer is concerned only with optimising the value of the common land, less the enforcement costs. If λ=1, then the enforcer can be considered a social planner, maximising overall welfare, including the value of the land to the encroacher.

The probability of detecting an individual encroacher is an increasing function of the intensity of enforcement spending, and an increasing function of the area encroached by the individual. A logistic function is chosen to represent this probability. This function is calibrated based on interviews in Karnataka as to the likelihood of an encroachment being detected.

$$p(detection) = \frac{F}{1 - \left(\dfrac{A_{\max} - A_E}{A_E \bullet (1 + \gamma F)}\right)} \qquad 0 \le p \le 1$$

Empirical observations suggest that the value of common land relative to private land tends to change as the relative area allocated to each change. A typical scenario is adopted in which the marginal value of common land increases as the remaining area of common land decreases.[16]

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16 There may be some critical minimum area of common land below which the per unit area value of the land falls off rapidly, but this is not discussed here.

$$V_C = -k_1 \bullet A_C^2 + k_2 \bullet A_C + k_3$$

Operationalising the model

A multi-period numerical dynamic optimisation model is used to solve for the optimal path of encroachment and enforcement spending under the above scenarios. A numerical model can capture the path of parameters that vary non-linearly over time as the area of common land decreases. Further, it can capture discrete changes in policy regime within a single run of the model.

The model is thirty periods with an appropriate terminal value to simulate an infinite time horizon. A 10% interest rate is used. The annual net revenue from one acre of private land is taken to be 1000 rupees. This is typical of the net returns that a farmer in Karnataka would get from one acre of rain-fed *ragi* - finger millet - the typical crop grown in the dry land areas of the region of study.

The constants k_1, k_2, and k_3 are 1,15,0 respectively, chosen such that the marginal returns to the common land vary from 500 rupees per acre to 1500 rupees per acre as the area of land is reduced from its initial value to zero. This allows the optimal strategy for enforcement of common land to vary as the marginal value of the common land increases within a single run of the model.

γ can be varied to explore the impact of changing the effectiveness of spending on detection costs on the optimal path. For the base case scenario, γ is 10.

Discussion of results

The level of encroachment and hence the rate of loss of common land, the amount spent on enforcement, and the implications for equity of access to land, are explored through six simulations that vary assumptions about enforcement costs, punishment regimes, and the objective function of the enforcer, namely the government.

A. Optimisation over common land only when enforcement costs are zero

To compare different scenarios the base case is chosen whereby the government keeps all the land as common access. The NPV per acre is 10,000 rupees. See figure 1.

B. Maximisation of overall social welfare when enforcement costs are zero

To maximise overall social welfare, the authorities allocate sufficient land to private ownership such that the marginal values of the common and private land are equated. Given the calibration above, 50% of the land is immediately allocated to private use and 50% for common land. The NPV per acre is 11,250 rupees. See figure 2.

C. "Laissez-faire" approach

The government allows encroachment to occur unchecked. The land is instantly and costlessly converted from common to private access. Enforcement costs are zero, and the area of remaining common land is zero. This can be considered equivalent to the costless ad hoc privatisation of the land. The net present value per acre of land under this laissez-faire scenario is 10,000 rupees.

D. Maximisation of value of overall social welfare when enforcement is costly and punishment is eviction from the land

Loss of common land to encroachment occurs rapidly when the authority maximises overall social welfare: within twenty periods, only 20% of the original area of common land remains. Enforcement spending is relatively low, on average 5% of the total value of the land. The time path of enforcement spending shows a discrete jump. In the first period, enforcement spending is low since the marginal value of the common land is lower than that of the private land and so it is optimal for some of the land to be privately held. Once the marginal values of the common and private land are equal, further encroachment occurs but at a slower rate, and so the marginal value of common land becomes greater than that of the private land. This differential is due to the presence of transaction costs. The welfare loss under these conditions compared with scenario B is small, 6% relative to the control, yet the optimal path for the ownership of the common land differs significantly. See figure 3.

E. Optimisation over common land only when enforcement is costly and punishment is eviction from the land

Enforcement costs, and hence the dead weight loss associated with this policy, accounting for 15% of the overall value of the land. The path for the enforcement spending is much smoother than for the welfare-optimising enforcer. After twenty periods, over 80% of the common land remains. The overall welfare loss relative to the efficient outcome is high,

22%, yet the area of common land remaining is closer to that under the control scenario. See figure 4.

F. Optimisation over common land only when enforcement is costly and punishment is a fine

To compare this scenario with that described above, the fine is set such that the myopic encroachers are indifferent to a fine or eviction from the land. Despite this, the pattern of enforcement spending and the rate of loss of common land differs significantly from a policy of eviction. In this example, the costs of eviction and imposing a fine are considered the same since costs of detection and enforcement are subsumed into one function. In practice, it is much more costly to evict than to fine, so there will be greater implications for the choice of punishment.

Summary Table

Scenario	NPV (rupees per acre)	NPV as % of *A*	Enforcement costs as % of NPV of *A*	Common land remaining after 20 periods
A: Base Scenario	10,000	100%	0	100
B	11,250	113%	0	50
C	10,000	100%	0	0
D	10,520	105%	5%	22
E	8,942	89%	13%	81
F	8,600	86%	16%	79

A. Optimisation over common land only when enforcement costs are zero
B. Maximisation of overall social welfare when enforcement costs are zero
C. "Laissez-faire" approach
D. Maximisation of value of overall social welfare when enforcement is costly and punishment is eviction from the land
E. Optimisation over common land only when enforcement is costly and punishment is eviction from the land
F. Optimisation over common land only when enforcement is costly and punishment is a fine

Discussion of results

The model exhibits a number of features that are representative of what we observe in reality. In particular, when there is incomplete enforcement, because enforcement is costly, encroachment is found to be gradual. This is a result from the model, the behaviour was not imposed.

Further, when enforcement is costly, authorities must make tradeoffs between efficient outcomes, maximising over the value of all land, common and encroached, and equitable outcomes, where all villagers have access to land. The objective function of the authority has a critical impact on the rate at which the common land is encroached. The choice of punishment regime, whether to impose a fine or evict the encroacher if caught, also has implications for rate of loss of land and level of enforcement spending when considering a finite resource such as land.

For a given finite area of common land, over time, the optimal policy regime can change. Consider when enforcement is costly, the authority that maximises overall welfare will first appear to encourage encroachment, until the marginal values of private and common land are equated. But after this occurs, the intensity of enforcement spending is increased to slow down the rate of encroachment. For example, when land was plentiful at the turn of the century, people were encouraged to be pioneers, to claim land and cultivate it as their own: the 1894 Forest Policy encouraged people to cultivate any forest land that could sustain crops. Hence forests had no intrinsic rights over land. Yet as land became more scarce, and the marginal value of the remaining common property land increased, actions that we once encouraged were condemned, and attempts were made to punish those encroached through legislation making any further taking of the common land, that is encroachment, illegal.

Concluding comments

This paper presents a relatively pessimistic perspective of the future of common land, given that it is costly to protect the boundaries of the land. However, in practice there are some costs to encroaching that are not taken account of in the model, and there are ways to reduce the costs of enforcement and hence reduce considerably the rate of loss of land. For example, when locals are actively involved in protecting the common land, encroachments can be identified much earlier than if detection is left to the authorities. The earlier encroachment is detected, the easier and hence less costly it is to evict. There are further

benefits if local people perceive the true value of the common land: if the villagers have a stake in the common land, the relative benefits from encroaching are reduced, and there is a greater incentive to prevent actively further encroachment.

The tools of analysis that are used in the literatures that explore issues of enforcement and property rights are not sufficient to take account of issues concerning the transfer of property rights through the mechanism of encroachment, an illegal activity. This is because land is a finite resource, and therefore optimal paths, rather than equilibria, must be considered. The approach and model that I have presented here offer a first step in this analysis.

Figure 1: Maximisation of Value of Common Land when Enforcement Costs are Zero

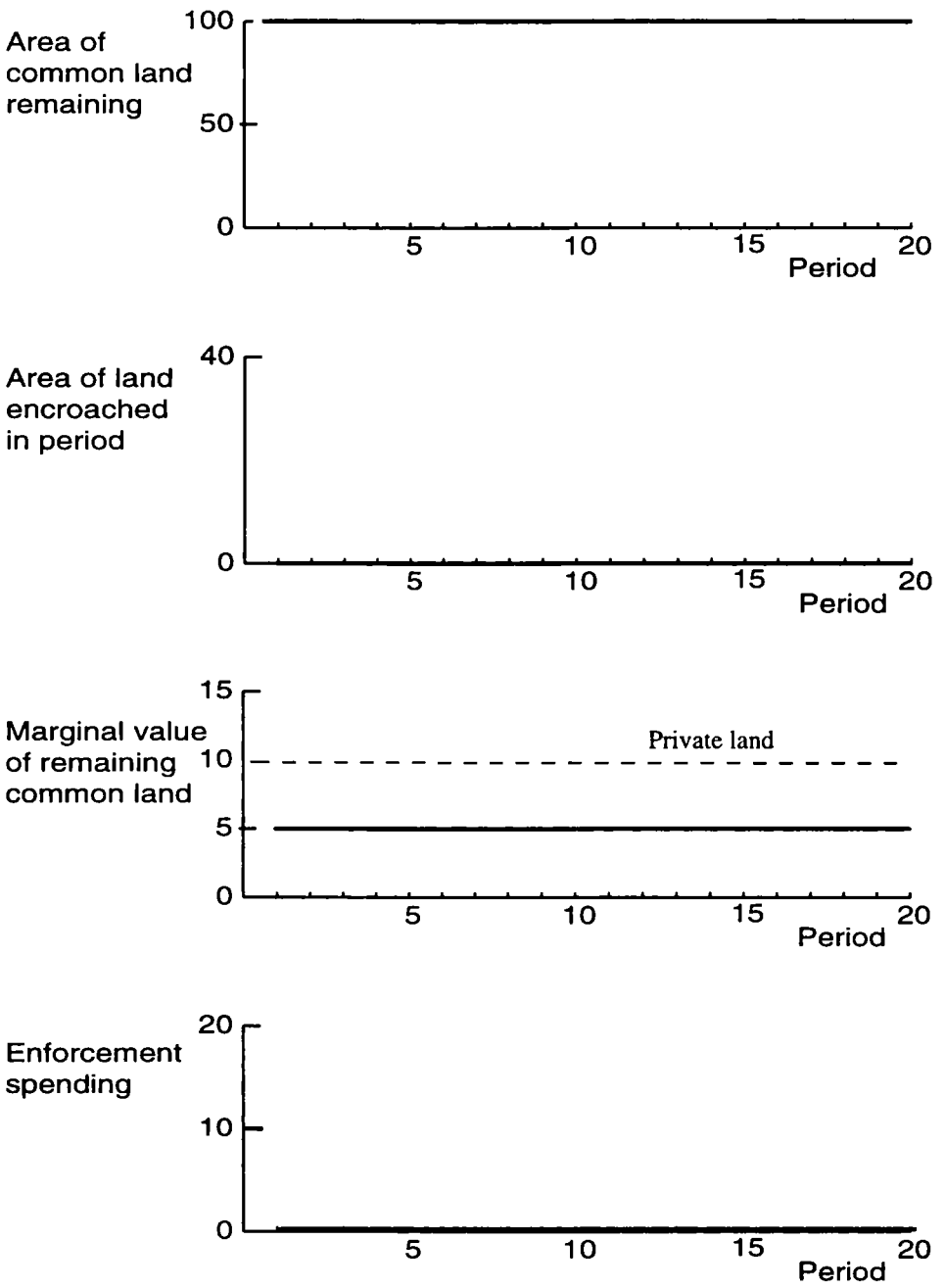


Figure 2: Maximisation of Overall Social Welfare when Enforcement Costs are Zero

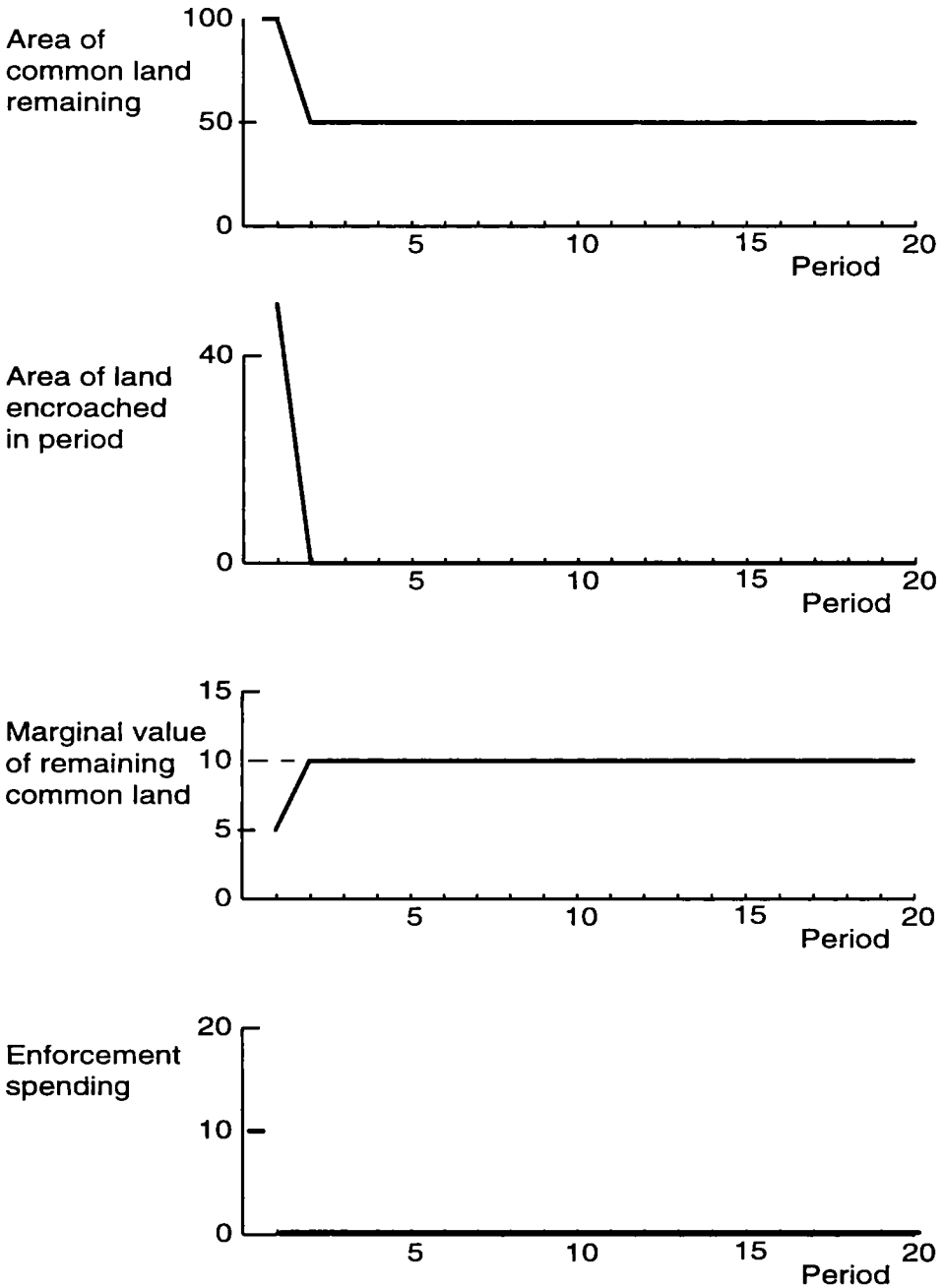


Figure 3: Maximisation of Overall Social Welfare when Enforcement is Costly

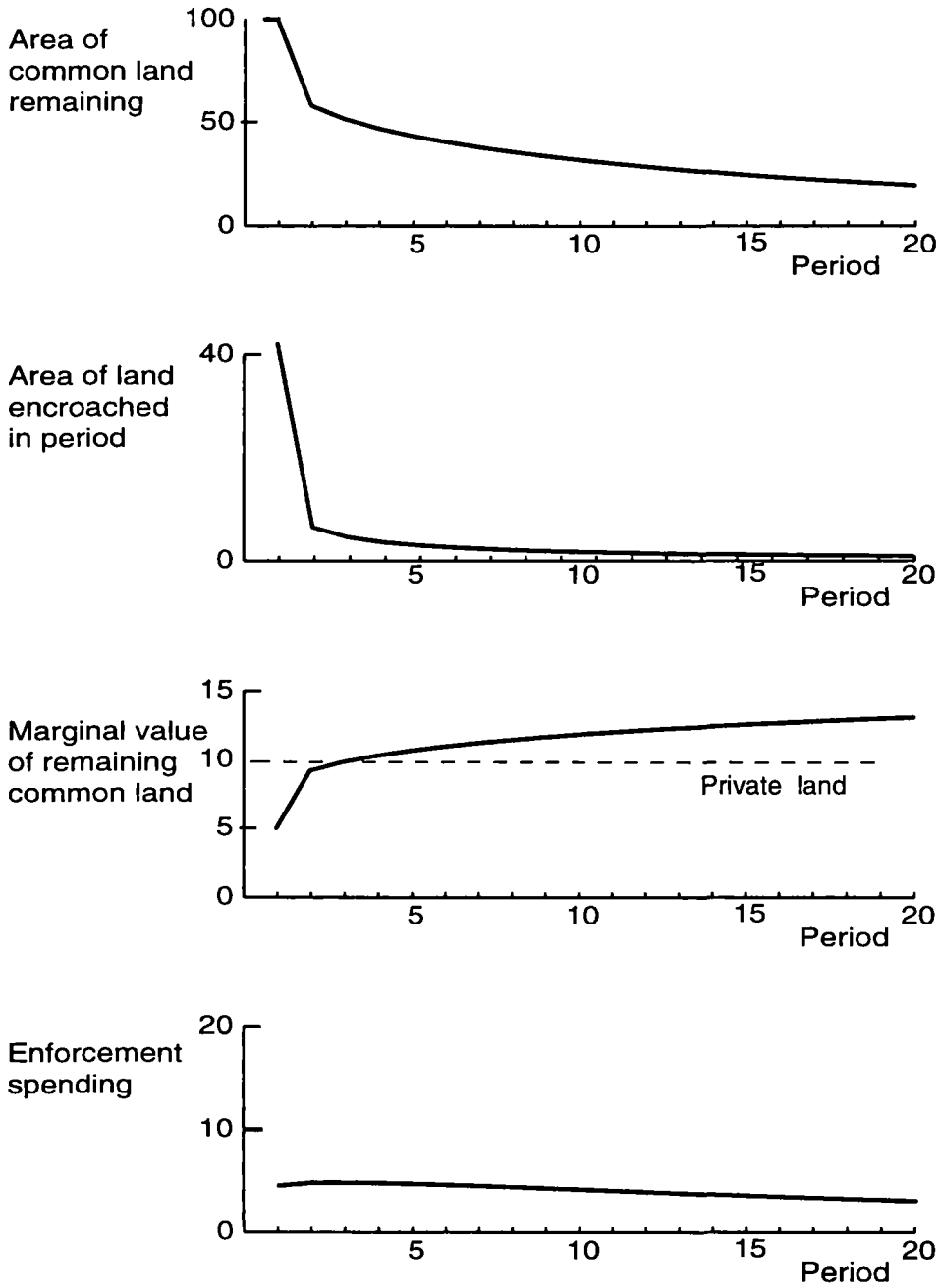
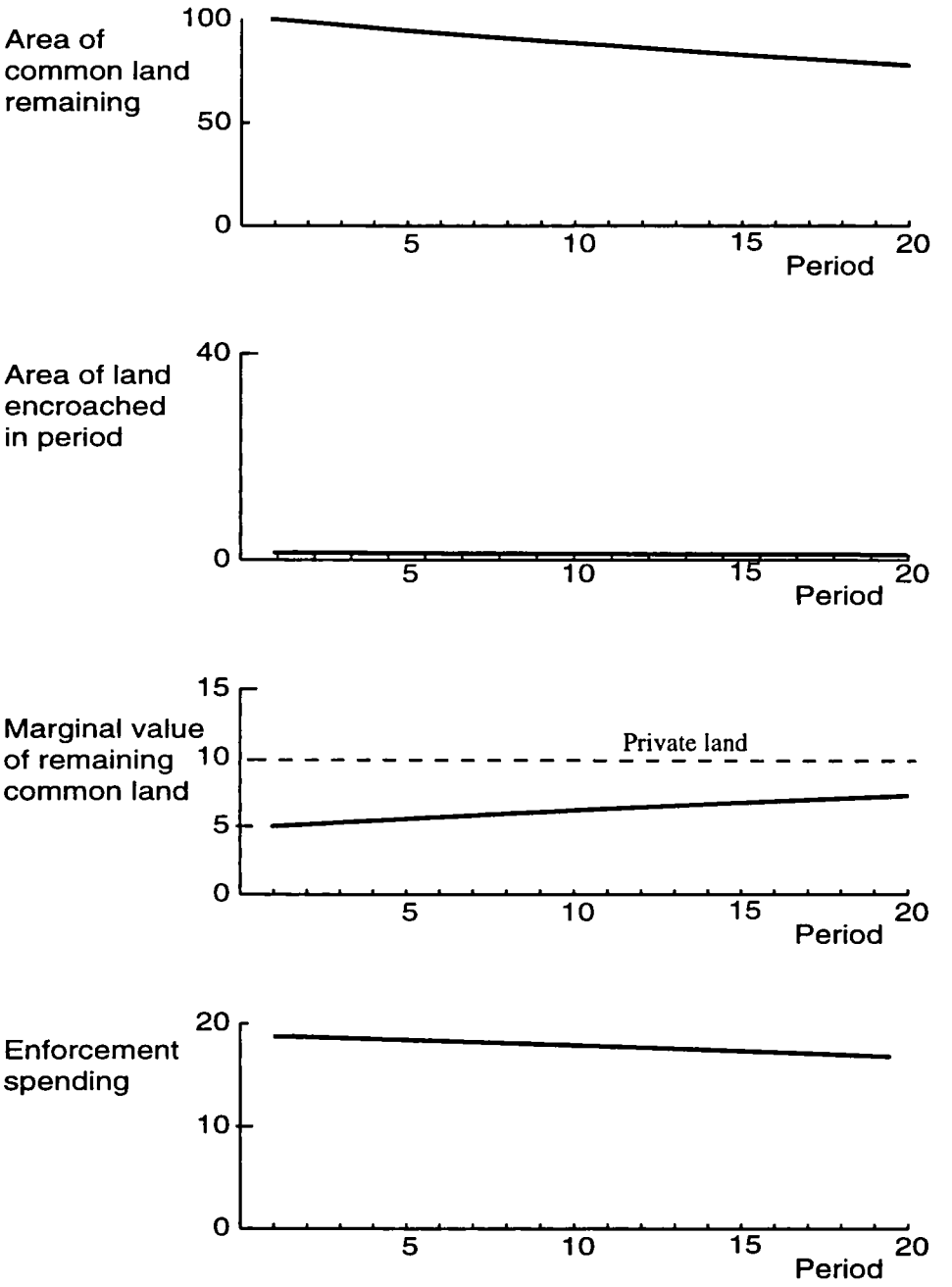


Figure 4: Maximisation of the Value of Common Land when Enforcement is Costly



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