Planning and Sustainable Management: A Re-Examination of the Peri-Urban Problem

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This paper examines the economics of urban expansion onto rural land in light of the sustainable management requirements of New Zealand's Resource Management Act. It finds that if conversion of land from rural to urban uses is practically irreversible because of the high cost of restoring rural qualities, it creates a user cost or inter-temporal externality which planning controls could address. Comparison of the methods for implementing such a policy show tradable development rights have high efficiency, but there are legal, practical and political obstacles to their use. A form of zoning which differentiates the controls between areas on the basis of the effects of particular activities in those areas may be the best practicable option, albeit at some loss of allocative efficiency.

1. Introduction

Ever since the Brundtland Commission defined "sustainable development" as that which "meets the needs of the present without compromising the ability of future generations to meet their own needs", economists, planners and legislators have given increasing prominence to ways of implementing sustainability (see, for example, Daly). This coincided with a time when fiscal restraint and other motives have brought the efficacy of government intervention increasingly into question. Public choice theory has painted government agencies not as dispassionate agents, setting policies to resolve conflicts in the public interest, but rather as bodies prone to various kinds of "interest group capture", not least by the bureaucrats themselves. The recent collapse of centrally planned economies has reinforced criticisms of planning for being a largely negative tool, unlikely to outperform private interests in "picking winners" in resource allocation. And real world examples, such as Houston, Texas, which has minimal planning control and gives wide vent to private negotiation to resolve conflicts, show that the absence of planning need not be calamitous.

In face of this questioning of traditional approaches, planners need to re-evaluate their tools, and in some instances they have no choice, for legislation is moving to require them to do so. An example is New Zealand's Resource Management Act (RMA), passed in 1991 to replace and consolidate over sixty previous environmental enactments covering town and country planning, rivers management and pollution control.

The purpose of this Act, stated in section 5, is to promote "sustainable management" of natural and physical resources. This is defined as "managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety while -

- sustaining the potential for natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
- safeguarding the life-supporting capacity of air, water, soil and ecosystems; and
- avoiding, remedying or mitigating adverse effects of activities on the environment."

A principal feature of the Act is its emphasis on controlling "effects" rather than the activities themselves. Previous planning legislation, aimed at achieving "wise" resource use, often *prescribed* permitted activities through controls and zoning, but under the new act activities can only be *proscribed* on the basis of their effects. Another feature of the Act is the specification of a hierarchy of considerations in implementing it, from matters of "national importance" (section 6), such as protection of coasts, natural features, flora and fauna, public access to waterways; "other matters" (section 7) such as protection of heritage, fish habitat and intrinsic values of ecosystems; and the principles of the Treaty of Waitangi (section 8), the 1840 agreement under which Maori ceded sovereignty to the British Crown in return for the rights of British subjects and undisturbed possession of their resources.

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The executive functions under the Act fall mostly on local government, with oversight at national level undertaken by the Ministry for the Environment and, in the specific case of coastal policy, the Department of Conservation. Regional councils, an intermediate tier of local government in New Zealand which evolved from former catchment boards with boundaries aligned along natural watersheds, are autonomous elected bodies responsible for issuing consents for various resource uses (such as discharges into water, soil or air). They also prepare regional policy statements, outlining broad strategies for resource use. These are binding on all the region's constituent city and district councils, separately elected bodies which fulfill the roles traditionally associated with local government, such as provision of local services, roads, parks and drainage, and preparation of local plans for development control.

Economics has had a major influence on the design of the RM Act. One of its specific intents is to reduce the opportunity costs of land use planning procedures, streamlining the previous multiplicity of legislation and associated permits and regulations, which were widely criticised for imposing delays on land use adjustments and distorting the allocation of land. Interventions would be limited to internalising external effects into resource use decisions, thus making the control more closely fit the "problem". Section 7 of the Act makes efficient use and development of resources a matter of importance, and Section 32 explicitly requires administering bodies to assess the costs and benefits of any policy introduced under the Act.

In this context, is there a role for zoning? Long a prominent weapon in the land use planners armoury, it has an unfortunate association in New Zealand with the prescriptive period, when it was used to prohibit changes such as conversion of farmland to forestry or subdivision for residential and horticultural smallholdings. Many land-using groups, such as farmers, foresters, tourism developers and so on, believe that if there is, it is very much reduced from its former level.

This paper re-examines the possible role for planning under the new legislative framework, with specific reference to the example of peri-urban land conversion. It outlines the economic principles pertinent to decisions on land use changes, and discusses whether there might be reason to intervene to influence the rate of change. It then compares a number of instruments which might be used to implement such intervention across a series of common criteria. It concludes that there may be an economic case for intervention and a form of zoning, albeit different from that encountered in the past.

2. A Framework of Economic Analysis

Although the RMA's section 32 "duty to consider alternatives, assess benefits and costs" is not intended to be restricted to the formal procedures of economic cost-benefit analysis (CBA), this technique nevertheless provides a useful framework within which to compare policy options (Ministry for the Environment). The basic formula for cost-benefit analysis involves calculating the net present value of benefits from a project or policy over its lifetime.

$$NPV = \Sigma (B_t - C_t - E_t)/(1+r)^t$$

where B_t, C_t are the respective benefits and costs of the project in each period t and E_t is a separate item for net environmental damage, which may be broadly defined to include effects on both the physical and social environments. The chosen discount rate is r, such that $1/(1+r)^t$ is a discount factor indicating the present value of $1 in each subsequent year, t.

A project is acceptable if it yields positive net benefits, or if the benefit:cost ratio exceeds some preset target greater than 1. Proposals which fail to satisfy this test imply a greater loss than benefits gained and should be rejected on efficiency grounds (Pearce *et al.*, 1989).

If local government is regarded as an agent to a collective principal, its constituents, the costs of importance in a council's appraisals include:

- administrative costs: those incurred by the council in devising, implementing and monitoring its policies and plans;
- compliance costs: those incurred by the council's constituents in adhering to the policies and plans;
- allocative costs: the opportunity costs incurred when resources are prevented from moving to their highest valued (optimal) use (or when sub-optimal use is encouraged).

The extent to which CBA in practice covers the full range of social costs and benefits, and hence the optimality indicated by its results, is open to question

(Hanley and Spash). However, this breakdown of costs remains a useful frame of reference when comparing options, given that all options will entail some mix between these different types of cost.

2.1 Economics and Sustainability

The idea of sustainable development has shifted the conventional, narrow focus of natural resource economics on sustained yield from a single resource stock to a wider consideration of sustaining a vector of service flows obtained from the natural environment. The sustainability requirement that present advancement should not be at the expense of the future has similarities to Pareto optimality, under which resources are allocated in such a way that it is impossible through reallocation to make one person better off without making someone else worse off. Strict optimality is rarely demonstrable, but Pareto improvements can be achieved by applying a "compensation principle", which proceeds with changes if the resulting net benefits are sufficiently large for the gainers to compensate the losers and still leave everybody better off. Sustainability can be implemented by pursuing economic efficiency through CBA subject to future generations being "compensated" for environmental damage inflicted for current gain, either through restoration of the natural environment out of the proceeds of development, or, to the extent that they are substitutable, replacing natural environmental resources with artificial or modified resources (for instance, native forests with recreational uses are partly substitutable by exotic tree plantings) (Pearce and Turner, 1990).

Sustainable management under the Resource Management Act could therefore be approached by making economic activity subject to the maintenance of the capacity of environmental "stocks" to yield useful services to the community. These include its roles as:

- a source of materials which can be transformed by production processes into useful goods and services (e.g. food, water, timber);
- a source of space and attributes consumed directly (e.g. for housing, amenity or cultural purposes etc);
- a source of bio-physical processes capable of absorbing and assimilating wastes (such as water and nutrient cycles).

Such an inventory approach is familiar to the land use planning tradition. Where the economic perspective differs is that the stocks are not defined in purely physical terms, but rather in terms of the relative value of services obtained from them. Resource transformations at the margin are permissible so long as the benefit obtained from so doing exceeds the cost. So provided *all* relevant costs - including environmental damage - can be specified, converting land from rural to urban which yields positive net benefits can be consistent with sustainability.

2.2 Economics of Peri-Urban Land Conversion

The expansion of cities onto surrounding farmland has often been perceived as a problem in the past and addressed in planning regulations and legislation, sometimes with perverse results. Minimum subdivision rules intended to contain urban expansion deterred some land use intensification (e.g. conversion to horticulture) by imposing a capital threshold on establishing new land-based businesses, and extended urban areas, by shifting onto 10 acre blocks the demand for rural-residential housing which could have been satisfied by denser settlement patterns. This stifled demand for rural residences, increased the cost of servicing that which remained, and had little effect in retaining primary production in peri-urban areas, where high quality land is frequently under-utilised, devoted to sheep fattening or "horseyculture" rather than to its more valuable cropping potential.

Land provides a fixed stock of "space" on which various activities take place to provide services for consumption and welfare gain. Such services - housing, transport, amenity, food supply - are flows, potentially infinite given sound management, and non-storable in the sense that what is lost one year cannot be recovered in the next. But contrary to the presumption behind previous planning controls, production is not "lost" through urbanisation, merely transformed from primary production to urban outputs. The peri-urban "problem" was mispecified, and attempts to control it were defying the comparative advantage of such land in providing space for urban services.

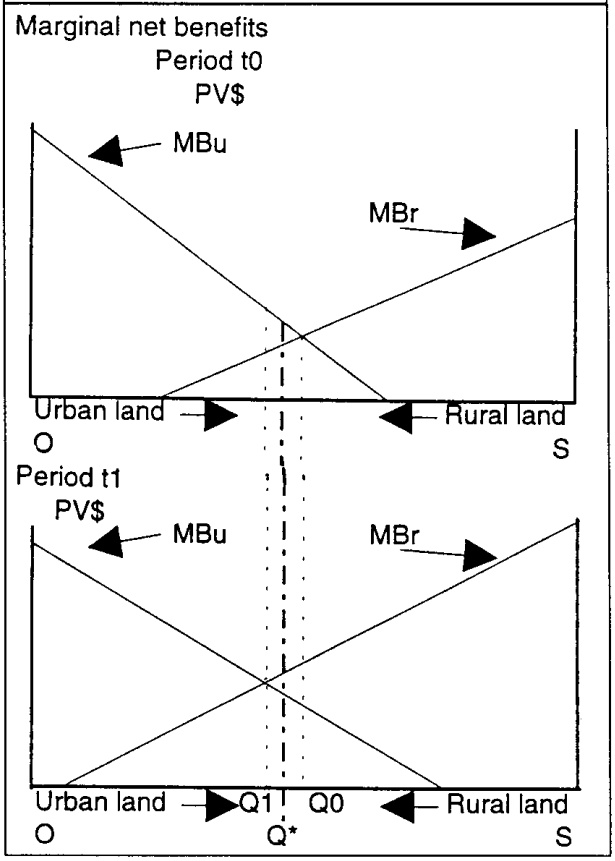
Conversion of farmland to urban uses creates a range of environmental effects, but it also changes the relative scarcity and abundance of different types of site. The opportunity cost to agriculture, or the discounted stream of net outputs lost in perpetuity, is only one part of the economic cost of conversion. Another is the cost

of servicing the residential development, which may vary from one locality to another in quite a different pattern from the lost agricultural benefits (Copeland). Then there are consequential environmental costs such as pollution patterns or transport externalities (McDonald). There can also be subtle value transfers when urbanisation restrictions are relaxed, for instance, slackening of demand for housing in the city limits with resulting falls in property values within them. Such intra-community transfers are usually ignored in CBA, but in a local setting there is a case for levying those who gain development rights so as to compensate those who lose, a process which would also change the relative cost of greenfield and brownfield developments and slow down the rate of conversion. Economic efficiency requires that new residents should face the full costs of extending the city's limits, which if ignored will be shifted onto existing ratepayers, while at the same time undermining existing property values.

If urban land is so costly to restore to rural uses that conversion can be considered practically irreversible, such land use change imposes an inter-temporal externality on the future which is unlikely to be fully accounted for in current market prices. Viewing an area of land as a finite stock facing competing demands, land conversion becomes an exercise in optimal resource depletion. A formal description of the theory is illustrated in the accompanying diagrams[1], in which the x axis represents the fixed total stock of land (OS), and the Q quantities represent the division between urban uses (measured from the left-hand axis) and rural uses (measured from the right-hand axis) in two distinct periods. In any one period the optimal allocation of land to urban and rural uses would be determined by equating the marginal net benefits obtained from each activity (MBu=MBr). If, as is likely, those allocations differ between periods an efficient compromise would be to trade off the present value of net benefits between periods. In the diagram, where earlier desired urbanisation (Q0) would preclude the later period desired rural land area (Q1), the optimal allocation (Q*) occurs where the first period restrains urbanisation to a point between Q0 and Q1 where its opportunity cost just equals the present value opportunity cost met by the future in not achieving Q1.

The "cure" for an inter-temporal externality is to impose some policy mechanism to reflect the "user cost" of conversion, which in the context of land use planning, could be an actual charge or some physical constraint to slow down the rate of irreversible

Figure 1: Intertemporal Land Allocation to Urban and Rural Uses



changes. The choice of mechanism depends on which is most efficient in implementation, as determined through comparison of the various options' costs and benefits. These mechanisms also substantially alter the distribution of property rights between landowners and communities, a factor with some political significance.

While this implies there may be justification for some form of land use planning, it does not necessarily support some of the traditional approaches, such as delimitation of rigid zones for specific uses. Allocative efficiency would be more likely if choices are allowed to be exercised, within constraints set to minimise environmental externalities, both within and between time periods. The loss of environmental service creates opportunity costs - social, environmental and private - which intervention seeks to be reflected in the

[1] Adapted from John McInery, "Natural resource economics: the basic analytical principles"; Chapter 3 in Butlin J.A. (1983) *Economics and Resources Policy*.

"price" of each land use, leaving decisions to be made through private choices in the market. As population increases, those services which are not readily transportable - e.g. housing, recreation sites etc - become relatively more scarce and valuable, whereas other, more transportable goods and services such as food are more likely to be traded with other regions, or obtained locally with more intensive use of the diminishing area of farmland. So the opportunity cost of converting farmland to urban uses is likely be become progressively less over time, relative to the opportunity cost of converting public open space and natural areas, and retaining the latter becomes more important than preserving farmland. Despite expected increases in food demands, there are limits to how much farmland is worth retaining near cities to the exclusion of other uses.

Translating this theory to a planning context, given expectations about future trends in population and demands for land space over a defined planning horizon, an estimate could be made of what proportion of land in the region would be required for urban expansion, incorporated into a plan or resource policy as a target or ceiling rate of land conversion. The aim would be to confer on the residents at the end of the horizon an undepleted capacity for land use services - i.e. that pattern of land availability in the region which provides an admittedly larger population with similar access to housing, recreation opportunities, food, transport and other services as is experienced today. Such a restriction creates an economic rent on the rights to urban development land, which the planning authorities may attempt to capture by auctioning off those rights to potential developers, in addition to specifying the standards and prices necessary to ensure each development covers the full costs of service provision and remedying environmental damage. Such auction proceeds, which might be termed a "community return", would avoid the value increments from planning zones change being captured by the landowners (Young). This has traditionally encouraged "rent-seeking behaviour" (such as property speculation and lobbying for zone changes) which, although potentially profitable for private individuals, can be wasteful from the perspective of a social cost-benefit analysis. And by adding to the cost of land conversion, such auctioning should shift the balance of development options in favour of "brownfield" sites, reducing the rate of urban expansion onto "greenfield" sites.

The auction bid is a form of royalty which provides a return to the community from the economic rent derived from the change in community land availability. Broad choices for extracting a resource royalty or rental are between a) an upfront bid or tendering process; b) a gross royalty (such as percentage of turnover on subsequent business earned by the development); or c) a net royalty which attempts to extract the excess profit conferred by resource scarcity (Heaps and Helliwell). For land use conversion rights, option a) is most practicable, provided there are sufficient potential tenderers to avoid the bidding process breaking down under "thin" market conditions. Design of development rights requires careful specification, to ensure that bidders know what they are bidding for and to restrict possibilities for speculative misuse of rights acquisition. This bidding would apply only to irreversible land-use changes, for which conversion imposes a user cost. Reversible changes of ownership or land use (e.g. pasture to orchard) can be determined through market choices, as at present.

A form of zoning might be justified if councils could identify "iso-cost contours" depicting the different levels of social cost from developing particular areas. These consist of the costs of forgone land use opportunities, servicing infrastructure (e.g. road and drainage systems) and environmental externalities (e.g. impacts on aquifers). The most susceptible areas would have the highest contours, and the highest specifications required of development to lower the likelihood of unwanted environmental side-effects. For instance, development over aquifer replenishment areas might be made conditional on the tightest specifications for drainage and sewerage removal, with strict liability in the event of contamination occurring. These conditions may be prohibitive for some types of development, but not for all.

In sustainability-based planning the continued availability of environmental services is more critical than their location-specificity, so zoning could be more fluid than traditional zoning practice. The essential element of such a zoning device would be in signalling the full cost ($C_t + E_t$) of the resources used. Traditional zoning addresses this economic perspective only to a limited extent. Economically-based zones would be permeable rather than rigid, since there will always be some uses whose users' willingness to pay is sufficient to justify meeting the highest standards to allow the development to proceed outside its normal location. Such zones could also encourage land use patterns which have been anathema to planning tradition, such as ribbon development around existing fixed infrastructure with capacity to spare, where, other things

being equal, the iso-cost contours for development will be lowest.

Some planners and architects have claimed that sustainability requires stricter zoning and more compact cities, but sustainability is not the same as self-sufficiency. It is more economically efficient for localities to specialise in activities where their comparative advantage is greatest, which in the case of the peri-urban fringe is usually in residential or industrial land uses. Put another way, substantial opportunity costs are incurred if restraints on land conversion prevent activities from taking advantage of the proximity to urban markets.

Is land conversion sufficiently irreversible to require intervention? While changes between rural activities are generally reversible (e.g. pasture and orchard), conversion from rural to urban may be "practically irreversible", or irreversible at reasonable cost. Although activities come and go, their effects on the landscape will only be reversed if the resulting benefits (of new uses, avoided costs of local contamination) exceed the costs of restoration. Abandoned urban structures, derelict buildings and contaminated sites persist, imposing costs and reduced efficiency on the affected communities, because their reversion to more useful states is not costless and takes time, money and effort. Uncertainty about the change in rural use values over time may over-estimate the value of development, and requires a more conservative decision criterion in the evaluation of irreversible land use changes than would otherwise be applied (Hodge).

The foregoing suggests there may be an economic justification for addressing sustainability by influencing the rate of conversion of rural land to urban uses; allocating the scarce stock of convertible land; and ensuring whatever development takes place meets standards which cover the full external costs of development. Such a procedure faces hurdles in the institutional structure set by the Resource Management Act, in which controls over resource conversion are split between two tiers of local government, regional and district. The information required to prepare iso-cost contours may be prohibitively expensive. Yet a measure such as land use zoning might be designed to similar effect, albeit somewhat broad-brush in application and not always driven by strict cost-benefit principles.

3. Options for Land Conversion Policy

A council has a range of possible options open to it for implementing a policy of urban containment. The distinctions between them are often vague, since few are mutually exclusive of each other. There is a broad choice between "Do nothing" - letting free markets prevail, on the presumption that the choices of multitudinous private sellers and buyers will perfectly capture through exchange prices all relevant environmental costs and future user costs from land conversion - or intervention of some form. This is an inadequate prescription for dealing with many environmental concerns because:

(a) it is impossible to fully specify enforceable rights and entitlements for trading in environmental commodities, so "externality" effects fall on unwitting third parties;

(b) even if it were possible to fully specify rights, there are thresholds in environmental effects, which may be exceeded with dangerous consequences by the cumulative impact of innumerable, unco-ordinated individual actions;

(c) the efficiency of market competition depends on unrealistic assumptions, such as perfect information for all actors of all current and future use possibilities for land.

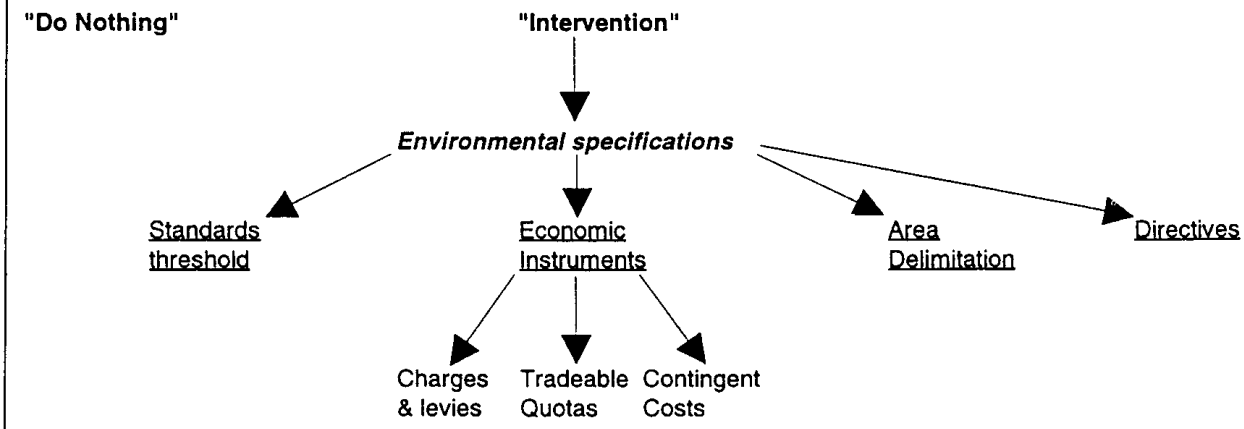
Such incompleteness of environmental markets provides scope for an intervening body, to correct such market failures. Not all such interventions will necessarily improve on the "do nothing" situation, and options should be compared through a cost-benefit test so as to select measures which achieve environmental sustainability with economic efficiency (Figure 2).

At the least, specification of some standards to avoid environmental costs is likely to be common to all the intervention options. Beyond that, the broad distinctions are:

(a) standards threshold approach: any land use change is permissible provided the required environmental standards are complied with;

(b) economic instruments, defined as measures designed to influence behaviour by changing prices or creating new markets: these are broadly divided into:

Figure 2: Options for Land Conversion Policy



- market adjustments through price devices such as charges, levies, royalties and taxes ;
- market creation through tradable permits, quota entitlements and property rights;
- contingent costs, which punish(reward) bad(good) behaviour, such as fines, penalties, performance bonds and deposit refund schemes;

(c) delimitation of areas (e.g. green belts) or zoning;

(d) directives on land use by the central planning agency (the former "Moscow model").

Given the characteristics of each option, which is likely to yield the highest net benefits applied to urban containment policy?

The criteria adopted here to compare the various intervention options are:

(a) effectiveness in achieving environmental targets, such as sustaining resource potential, safeguarding life-support capacities and mitigating adverse effects outlined in section 5 of the Resource Management Act;

(b) certainty and predictability with which those affected can anticipate the measures, and avoid waste by taking appropriate responses;

(c) flexibility to allow users to choose their own cost-minimising responses to controls;

(d) administrative costs for the authority applying the measures, including costs of information, processing applications, planning and monitoring the outcomes;

(e) compliance costs for those affected by the measures, including the costs of meeting prescriptions and of delays in processing applications;

(f) allocative costs caused by incentive structures which divert resources away from their highest valued uses.

Taken together, these criteria provide indicators of efficiency, defined broadly as maximising the net benefits over time from available resources, from the viewpoint of the community as a whole. A further distinction which must be borne in mind is that between *real resource effects*, which directly affect efficiency by changing the ratio of outputs (benefits) obtainable from a given set of inputs (costs), and *intra-community transfers or pecuniary effects*, which simply redistribute benefits and costs without neces-

sarily affecting the overall level of net output (or net benefits).

3.1 The Standards Threshold Approach

Under this approach, any activities would be conditional only upon certain standards being met: for instance, containing discharges within a certain limit of parts per million of their receiving medium. Well-specified standards give resource users reasonable certainty as to their effect, and if free to choose whichever method is best for them in meeting a required standard, such an approach would appear to have high flexibility and moderate to low compliance costs. If the set standards take the form of prescribed equipment to use, flexibility would be less and the compliance costs and allocative costs are likely to be moderate to high.

There are two drawbacks with a standards threshold approach. It imposes formidable information requirements on the regulatory authority, with consequently high administrative costs. And by themselves, standards do not readily handle cumulative discharges and effects, creating the possibility of critical environmental thresholds being surpassed through the combined effect of separate, individual decisions. Nor does it explicitly handle the scarcity in environmental resources, such as capacity to receive discharges. An ideal standard would continuously adjust to cumulative conditions, but in doing so resource users would lose certainty. The standards threshold approach is therefore likely to be ineffective in aggregate environmental protection and to incur potentially high allocative costs.

3.2 Economic Instruments

The Resource Management Act (s24(h)) makes reference to what are termed "economic instruments". In the economic literature these are usually contrasted with approaches such as regulation and control, or education programmes, which by implication may be seen as "non-economic". Economic instruments are commonly portrayed as being more efficient than non-economic instruments because of the greater choice they leave those affected: polluters able to clean up their activities cheaply can do so and avoid the economic instruments, while those who can't, pay up. But the distinction between economic and non-economic measures is somewhat artificial: most regulations have associated charges and penalties, and price or permit systems depend on some regulation of the entitlements conferred by them. Any measure which impacts on the costs of activities (including regulations) can be regarded as having an economic effect, and the most efficient measure - i.e. the one achieving a desired outcome at the least cost overall to all the affected parties - depends on the circumstances of each case.

3.2.1 Prices, charges, levies and taxes

Economists have long recognised that market transactions may create third party effects or externalities (see Pigou, for example), where the private costs and benefits on which market decisions are based diverge from the full social costs and benefits arising from those decisions. A common remedy for such problems is to change the price of transactions by applying a "corrective" tax or charge as a supplement to market prices, so that private decisions internalise the full social consequences.

In principle this approach could have wide applicability to the Resource Management Act: if a cost could be assigned to each unit of adverse effect - effects on aquifer, living space, amenity and so on - these could be reflected in the price of applications to change land use and activities. In practice the costs of gathering the information necessary are prohibitive, and local authorities are politically and legally constrained on what charges they may set. Another problem with the pricing approach in practice is that it cannot readily deal with cumulative impacts and "threshold" effects. In principle prices should rise as that critical point is approached - e.g. each increment of waste in a receiving medium brings forward the date when alternative capacity will be required, which has a present value cost - but in practice price structures do not move effortlessly, particularly not when environmental effects display a high degree of uncertainty. So although pricing scores highly in terms of allocative efficiency, it also entails high administrative costs if implemented properly. If not implemented properly, the risk of allocative inefficiency increases because decisions will still be based on prices which do not reflect full social costs.

There are several possible variants on price adjustments - resource royalties, pollution taxes, impact fees, user group charges. All have the general limitations of prices, and some have specific drawbacks - such as the fudging of individual incentives on user group charges. The local property tax, or rates, is a coercive charge to fund collective services which cannot be funded by other means, primarily a revenue device of last resort which creates little price incentive.

3.2.2 Quotas, tradable permits and market creation

A range of instruments attempt to overcome the uncertainty over aggregate effectiveness of the pricing and standards approaches by imposing a quantitative limit on aggregate effects (such as discharges) and allocating these rights in some way to resource users. Simple quotas and permits confer something of value on permit holders, and their allocative efficiency can be improved by making them transferable, so that permit holders have incentive to use them or trade them to someone else who values them more highly.

Traded permit systems are unsuitable for non-point sources of pollution where monitoring is impractical, and trading may break down in "thin markets" with few participants. A recurring problem is whether to sell the initial rights through an auctioning process, or to grant incumbent polluters with rights ("grandfathering"), which gives them a competitive advantage over new entrants with cleaner technology. In practice, tradable permit systems appear to have substantially reduced the cost of administering clean air controls in the USA, but experience has been mixed and more inconclusive in other applications, such as water rights (Tietenberg).

With respect to land use planning, tradable permits could in principle be applied to land conversion: if the development rights reside in the community, it could extract a return from conferring that right through bonus bidding or other royalty processes. In New Zealand the legality of this approach, and whether the right rests with the district or regional authority, is open to doubt.

Tradable permits provide high certainty in achieving environmental objectives, high flexibility for individual users, and moderate predictability for users (since the value of permits will fluctuate with market conditions). Allocative and compliance costs are low, but administrative costs may be moderate to high if the permit authority is involved in monitoring the use of and trade in permits.

3.2.3 Contingent costs

Contingent costs, such as penalties, fines, performance bonds and legal liabilities, may be used as enforcement devices to back up other economic instruments. They exert incentives on users through the impact of "expected values" of damages/fines paid, given by the product of scale of damages/fine times the probability of its payment.

In practice contingent costs have a more complex incentive effect, since there are various enforcement options ranging from the persuasive to the mandatory, including self-regulation, financial incentives, civil liabilities, criminal penalties, licence suspensions and withdrawal. Since the emphasis on these different components, and their cost and incentive implications, vary widely, generalisation of their strengths and weaknesses is difficult. They may be quite effective in the context of land use planning if the effects being controlled are difficult to conceal (such as land use conversion). But administrative costs are relatively high, due to the monitoring and enforcement activity.

3.2.4 Subsidies

Subsidies are payments intended to assist specific users overcome obstacles to their involvement in an activity. They can be directed at end users or at service suppliers, and may take various forms: direct grants, subsidised prices, soft loans and tax (or other payment) waivers. They collect funds across a broad collective (taxpayers or ratepayers) and direct them to a targeted band of recipients, and they will be allocatively inefficient if they impose a substantial burden on the funders. Their effectiveness depends on uptake rates and whether they induce a long term change in behaviour: for instance, subsidised energy conservation measures may be counter-productive if consumption increases in response to lower apparent energy costs. In the past, subsidies have been widely used for land reclamation and encouragement of agriculture, but they have questionable relevance to peri-urban land conversion in a setting where activities are supposed to cover their full environmental costs.

3.2.5 Property right approaches

Another possible approach to environmental issues is to refine property rights and entitlements, so that individuals can trade amongst themselves to achieve optimal resource uses[2]. Although potentially allocatively efficient, such approaches can have high administrative and compliance costs, since they depend on rights being "fully specified" and on actual and potential rightholders being able to negotiate with each other.

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[2] The seminal article is by Ronald Coase (1960), "The problem of social cost"; *Journal of Law and Economics* 3(1), 1-44.

In practice, such negotiation suffers from high transaction costs and breaks down amongst numerous parties: it may also fail with small numbers because of the "thin market" problem and distorted "strategic" bidding. The practical infeasibility of full specification of rights can be regarded as the reason for intervention in environmental policy. In the past, rights to exploit new uses for a resource often accrued as presumptive rights to the adjoining landholding, creating windfall gains for the owner, while imposing external impacts on the neighbourhood.

Environmentalists are often critical of property rights approaches in creating "rights to pollute" and incentives to profit from degradation, but this ignores the fact that any intervention measure implicitly creates or curtails entitlements. Properly specified rights create an interest in the resource and an incentive for sustaining its productive capacity. However, property rights are integral to, rather than distinct from, other instruments of land use control.

3.3 Area Delimitation and Zoning

Area delimitation or zoning is a common tool of land use planning. Providing the zone-setting process can adequately cover the range of effects being controlled (a caveat common to all the intervention options), zoning provides a relatively high certainty of environmental outcomes. Zone boundaries aligned to iso-cost contours, with different standard specifications within those zones, could be instrumental in ensuring developments cover the full social and environmental costs. In practice, the information requirements for such iso-cost mapping suggest that zoning will only approximate to such a pattern.

Zoning provides high predictability for landholders, tempered somewhat by strong incentive to "rent seek" by lobbying for zone changes which could be alleviated by a supplementary charge or levy on zone-induced value changes. Zoning is moderately restrictive of land user flexibility and implies low to moderate compliance and administration costs. However, its allocative costs may be moderate to high. It does not provide positive incentives to seek the best allowable activities in a zone, and will always throw up anomalous boundary problems, where potentially highly beneficial activities are proposed on the wrong side of the line and must incur lengthy "departure" proceedings to gain approval. "Permeable boundaries" and transitional zones might improve allocative efficiency, but the added complexity of such a system would add to administrative costs and detract from its predictability to users.

3.4 Directives

A directive approach requires the planning authority to not only define broad zones permissive of certain activities but to actually ensure that certain uses occur in certain places. It implies strong restriction on resource user flexibility, a high degree of intervention and substantial information requirements on the part of the authority. The certainty of environmental outcomes is potentially high, but predictability for users is low if directives change from one period to the next. Compliance costs (in the form of users' opportunity costs), administrative costs and allocative costs are all high. An extreme example of the directive approach is the "Centrally Planned Economy" model, whose practical implementation in Eastern Europe was not encouraging for either economic performance or environmental protection.

3.5 Local Government Powers

While the foregoing suggests a broad range of options, in practice local government is constrained by statutory limits to its authority. In the particular, the practical opportunities for economic instruments appear limited under New Zealands resource management legislation.

- Section 36 of the RMA allows administrative charges on resource consent holders, but these are not powerful economic instruments, being limited to recovery of "reasonable costs of administration".

- Section 108 of RMA provides for financial contributions of cash, land, works or services for a purpose specified in a local plan, including "compensating" the environment by providing for positive effects to offset adverse effects. These provide a legal basis for impact fees which internalise the environmental costs of development, but earmarking contributions to specific ends will be economically inefficient if expenditures become revenue driven out of proportion to real need.

- Sections 108-111 of RMA provide for performance bonds as a condition of some consents, and sections 339-342 further specify offences under the Act. Such contingent costs are applicable to

land use conversion, but act as fall-back provisions, rather than primary planks of policy.

- Sections 2, 67 and 220 of RMA empower councils to collect other contributions towards specific purposes in a plan and on sub-division consents. However, there can be an indefinite interval between when contributions are collected (e.g. on sub-division) and when effects emerge (on building) and there is no alignment between these RMA provisions and those on building permits under the Building Act.

- Section 32(2)(a) of the RMA allows for the use of local rates as a means of achieving the Acts purposes, which may include special rates or differentials on different types of property or permanent rates relief on properties with heritage values. Since ratepayers cannot avoid rates other than by moving, rates have little incentive effect.

4. Discussion

The sustainable management requirements of the Resource Management Act imply some constraint on the unfettered pursuit of economic activity if it leads to the depletion of environmental stock resources. Land conversion which irreversibly changes the mix of available land within a region has significant intertemporal effects, suggesting an economic case for intervention in containment of urban growth.

Since the cause of environmental externalities is incomplete markets and inadequately defined prices, a prime economic prescription to such problems is to adjust prices to reflect the full marginal social cost of environmental resource use (Bromley). If land is being converted from rural to urban uses too rapidly, a simple solution is to increase the cost of conversion by placing a supplementary charge on such transactions. This however creates a problem in setting the supplementary charge so that the "price" of land conversion responds to changing conditions.

An alternative is to seek the same effect by some non-price measure. Setting physical constraints on environmental use, within which market processes can continue to operate, is one method which should induce market price adjustments to the new conditions. Another is to make resource use conditional upon achieving set performance standards, which indirectly raises the cost (and hence "price") of resource use.

Given the uncertainties surrounding long term environmental effects and future resource needs, such physical constraints and pre-set standards provide more prudent means of containing environmental damage or depletion within limits required to meet foreseeable future needs than relying on unco-ordinated market transactions.

Such a rationale points to a three stage remedy:

(a) address sustainability by slowing down the rate of irreversible conversion of land from rural to urban uses, so as to endow future residents with undiminished range of environmental services. This does not mean that land use patterns remain static, and there will be shifts in relative value between farmland and other lands, but it does imply some constraint on land conversion;

(b) once a quantitative rate of land conversion is set, allocate the limited convertible area so that land flows into its most productive uses. Requiring developers to bid for development rights is a promising means of doing this, but there is currently limited legal scope for doing so;

(c) ensure new developments face the full social and environmental costs they create by adhering to locality-specific and activity-specific standards. This implies areal differentiation which could be implemented through a form of effects based zoning.

The results of comparing the possible options for implementing conversion policy by a set of common criteria are outlined below (Table 1). Economic instruments score well on flexibility and allocative efficiency but, with the exception of tradable quota, not so well on providing certainty of environmental outcomes. Of the other instruments, the standards threshold approach provides low certainty of aggregate environmental outcomes and incurs relatively high monitoring and administration costs. Directives incur a high penalty in all cost categories, but zoning is less extreme in its degree of intervention and in its costs. "Do Nothing" entails high flexibility, but also high allocative and compliance costs, because externalities are not corrected and fall unpredictably on third parties, who directly bear their costs of damage and reparation without being able to control them. Both zoning and tradable quota score high on outcome certainty, provided the zones/quotas are set with reference to full social costs.

Table 1: Comparison of Options for Land Conversion Policy

	Criteria for Comparison								
	Benefits			Costs					
	Outcome certainty	Predict-ability	Flexi-bility	Admini-stration cost	Cost of complying	Allocative cost	Benefit Score	Cost Score	Net Benefits
Economic Instruments									
Individual charge	1	2	3	2	1	1	6	4	2
User group charge	1	2	2	1	1	2	5	4	1
Resource royalty	2	2	2	2	2	1	6	5	1
Tradable quota	3	2	3	2	1	1	8	4	4
Contingent cost	2	1	3	3	2	2	6	7	-1
Other Approaches									
Standards threshold	1	2	3	3	2	2	6	7	-1
Area zoning	3	3	2	2	2	2	8	6	2
Directives	2	2	1	3	2	3	5	8	-3
"Do nothing"	1	1	3	1	3	3	5	7	-2

Key to "scores" 3 = High; 2 = Moderate; 1 = Low

The scoring of benefits and costs is admittedly subjective but the conclusion is clear. Tradable quotas for development land would be most efficient, but they are also the most legally and politically contentious to implement. Individual charging and zoning appear to have similar results overall, and zoning is both more familiar in the public mind and more effective in ensuring environmental outcomes are met.

5. Conclusions

This paper suggests there is an economic case for intervention in the conversion of rural land to urban uses to internalise externalities, both the contemporary environmental effects of development and the intertemporal curtailment of options for future land uses. This could support policies which both influence the rate of land conversion, and also specify standards to control the effects of the change. Further, comparison of the possible measures with which to implement such a policy suggests that there is still a place for zoning, albeit of a less rigidly prescriptive form than commonly used in the past. A quantitative limit on the total area converted over the planning horizon, with zone boundaries aligned with changes in combined financial and environmental cost of developments in specific locations should ensure developments pass a benefit:cost test. The use of economic instruments is constrained by institutional and legal limitations, and the allocative costs of zoning may be a reasonable price to pay for achieving sustainable management, until evidence becomes available that the practical application of other instruments is unambiguously superior.

While New Zealand's Resource Management Act provides for the control of adverse environmental effects, it does not explicitly include resource depletion as such as one of the effects to be managed, but to ignore it with respect to critical natural resource stocks imposes costs on the future, which is of relevance to section 5(2)(a) of the Act. Both forms of intervention are arguably consistent with the sustainable management of the land resource, and can be examined through economic analysis. Similar conclusions are likely in other countries and institutional settings with sustainability aims.

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