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**Efficiency = Equity and Other Musings  
on Economics and Sustainable Development**

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# **Efficiency = Equity And Other Musings On Economics And Sustainable Development**

**By Jim Sinner, Ecologic Foundation, Nelson<sup>1</sup>**

## **Abstract**

Conventional wisdom says that equity concerns are beyond the scope of economic analysis and that achieving equity objectives will often come at a cost in terms of efficiency. Examination of the underlying meaning of efficiency and how it is defined, however, reveals that this tension between efficiency and equity is more apparent than real. The paper also explores the application of other economic concepts to the field of sustainable development, including the use of discounting for present value, Gross Domestic Product as a measure of well-being, and rational utility maximisation vs. bounded rationality as models of human behaviour.

## **Introduction**

This paper examines key concepts underpinning sustainable development in order to assist in the assessment of policy options and proposals, and thereby progress the implementation of sustainable development principles across central and local government. The concepts explored here will inform further work on Ecologic's research programme on Institutions for Sustainable Development. The research involves case studies on resolving the tensions between democracy and sustainability and on integrating the cost of natural resource use into the market economy.

## **What is sustainable development?**

The most commonly used definition of sustainable development is from the Brundtland Commission in 1987:

*Sustainable development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs.*

The New Zealand Government used this definition in its Sustainable Development *Programme of Action* released in January 2003.

While the concept of sustainability has environmental roots, it has a strong ethical (i.e. social) underpinning based on moral obligations to future generations. In the words of the Brundtland Commission, "Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation" (1987, p.43).

Hence, Principle 1 from the Rio Declaration of 1992:

*Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.*

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Before focussing on economic concepts, it is useful to reflect on a systems-based view of sustainable development.

### **A systems view of sustainable development**

Sustainable development can be analysed, described and interpreted in the context of economic systems, ecological systems, and social and cultural systems. A “systems view” acknowledges that each of these systems is no more nor less than a partial representation of the real world through a particular lens. The representations (systems) co-exist and interact; indeed, they are overlapping sub-systems of the same “real system”. The essence of “systems thinking” is an explicit consideration of these relationships and interactions. This is not the same as reducing all dimensions to expressions in a single numeraire.

The challenge in integrative research, therefore, is to reflect these relationships. This necessarily will involve researchers and policy/institutional analysts working across traditional disciplinary and sectoral boundaries. The shift from working in a single dimension (e.g. analysing the economic dimension by itself or the ecological dimension by itself) to working across multiple dimensions requires a fundamental change in how problem identification and institutional design are conceived.

In one-dimensional analysis, problems and needs can be relatively precisely defined, and this leads to the idea of a solution (in this case, an institutional design) that can be evaluated according to a narrow, internally consistent set of disciplinary criteria. In multi-dimensional analysis, the problem situation is more complex. There are multiple needs to be addressed, and this leads to the idea of feasible, desirable changes in institutional design, which then need to be evaluated simultaneously against a wider set of criteria. In shifting from a one-dimensional focus to a multi-dimensional focus in problem understanding and resulting institutional design, there is a fundamental change from the notion of “a problem to be solved” to the notion of “a problem situation to be improved”.

## **Economics and sustainable development**

Sustainable development is concerned with allocating the earth’s resources to meet the needs of present and future generations. The allocation of resources, in terms of production and consumption flows, and with respect to both the present and the future, is a central focus of economics.

### **Efficiency as optimality**

The discipline of economics has adopted economic efficiency as the benchmark against which allocations are considered to be “optimal”. As economists know, but often fail to communicate to the public, economic efficiency properly defined is concerned not only with monetary values. It means maximising the net flow of *all* benefits, or value, derived from a given set of resources over time.<sup>2</sup> This includes market and non-market values, tangible and intangible, quantifiable and non-quantifiable. In its simplest expression, efficiency means that resources are not wasted. “Waste”, however, is defined not in physical terms but economically:

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<sup>2</sup> In some contexts, economic efficiency can also be expressed as achieving a specific outcome at least cost. In the context of sustainable development, however, we generally want to maximise society’s outcomes, i.e. improve the environment, wealth and social well-being as much as possible given the resources (including human resources and knowledge) that are available.

resources have been “wasted” if they could have been used in some other way that generated greater net benefits to society.

Even without efficient use of resources, it might still be possible to “meet the needs of the present without compromising the ability of future generations to meet their own needs”. As a recent essay stated, “Constant consumption at no more than a subsistence level could satisfy this requirement, yet it would surely not be accepted as a reasonable social goal or target for public policy” (Stavins et al, 2002). Major redistribution of wealth could theoretically ensure that basic needs are met, but it is unlikely to happen. Hence, some economic development will be required to raise the well-being of much of the world’s population.

Thus, the more efficient the economic development (and the more it focuses on well-being rather than consumption of material goods), the less strain it will place on the earth’s natural and physical resources as we strive to meet the needs of present and future generations. In other words, efficiency is important.

### **Efficiency as a decision criterion**

Jollands (2003) suggests that economic efficiency should be used as a decision criterion only within a framework that first requires biophysical and social goals to be met. In this interpretation, economic efficiency is only relevant after certain “absolutes” have been met – the “environmental bottom line” interpretation that some have applied to the Resource Management Act 1991 (RMA). Similarly, Bromley (1988) argued that economics should only be concerned with the efficiency of achieving the objectives that society has determined that it desires, rather than questioning the efficiency of the objectives themselves.

The essence of Bromley’s approach was adopted in the RMA. Under s.32, Ministers and councils must carry out an evaluation that “must examine: (a) the extent to which each objective is the most appropriate way to achieve the purpose of this Act; and (b) whether, having regard to their efficiency and effectiveness, the policies, rules, or other methods are the most appropriate for achieving the objectives.” This evaluation must take into account “(a) the benefits and costs of policies, rules, or other methods; and (b) the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the policies, rules, or other methods.”

Although objectives must be “appropriate to achieve the purpose of the Act”, only policies, rules and methods are scrutinised in terms of efficiency and effectiveness. There is a danger of tautology here: i.e. an assumption that whatever objectives the democratic-legal process produces are by definition “sustainable” (and by implication, “optimal”) because they reflect what people want. But are the objectives determined through this process, including with consultation, in fact what “the community” wants? In other words, how robust is the democratic-legal process, and how (if at all) are gains and losses by different groups and individuals summed or weighted to determine the collective interest? Can democratic processes in this area be assisted by use of better analytical tools?

Economists have tended to the view that it is appropriate to assess the economic efficiency of outcomes as well as the efficiency of the means. For some, this reflects a preference for a single decision criterion, together with a degree of optimism that

social and environmental factors can be reduced to a common metric with economic factors. However, the definition of efficiency that is typically employed by economists and policy analysts raises other questions, as do some of the economic methods employed in policy analysis.

### **Pareto efficiency and intra-generational equity**

According to the classical definition of efficiency (known as “Pareto efficiency” after an Italian economist), an allocation of resources is efficient if there is no possible alternative that would leave at least some persons better off and no one worse off. Of course, most policy changes leave some people worse off even if most people are better off, so most economists use the Kaldor-Hicks efficiency criterion, which effectively requires maximising net benefits. Under this criterion, a change is more efficient if it represents a “potential Pareto improvement”, i.e. if the benefits are sufficiently large that the winners *could* compensate the losers and leave no one worse off (Stavins et al, 2002). Under the Kaldor-Hicks definition, such a change is “efficient” whether or not the compensation actually occurs. Decisions about compensation are left to the political process.

Pursuing equity is often seen as competing with efficiency, because distribution of costs and benefits on equity criteria can conflict with distribution criteria, e.g. user pays, that provide incentives for efficient use. In this sense, pursuing equity can compromise economic growth, i.e. equitable outcomes might be seen as “inefficient”.<sup>3</sup>

Hence, there is tension between the concept of efficiency and the broader concept of sustainable development, assuming that the latter requires some cognisance of social equity. Achieving efficiency alone is not sufficient to achieve sustainable development. If 1% of the world’s population held 99% of the wealth, this could hardly be called “sustainable” even if it were “efficient” by the Kaldor-Hicks criterion.

Thus, a more difficult question is “what equity criteria need to be met for an efficient outcome to be considered sustainable?” Or indeed, can in some cases “inefficient” outcomes be considered sustainable?

### **Efficiency = equity?**

The Pareto definition of efficiency arises because economic theory provides no objective basis for comparing the well-being of one person with that of another. Hence, we can only say unambiguously that one situation is better than another (i.e. more efficient because total well-being is greater) if at least one person is better off than before and no person is worse off. In contrast, an outcome is more efficient in Kaldor-Hicks terms if it produces more wealth in total, regardless of who gets it. The Kaldor-Hicks criterion implicitly assumes that all people experience an equivalent change in well-being due to an increase or decrease of one dollar. This allows a change in total wealth to be treated as equivalent to a change in total well-being.

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<sup>3</sup> Such a conclusion would typically rest upon the Kaldor-Hicks criterion rather than Pareto efficiency, because under Pareto’s definition an outcome that leaves some people worse off cannot be deemed to be more efficient than another alternative, even if it results in higher total economic output.

But notions of equity are based at least in part on an understanding that an extra dollar has more value to a poor person than to a rich person, and hence that overall well-being can be increased by transferring wealth from rich to poor. While neither the Pareto definition nor the Kaldor-Hicks definition would recognise such a transfer as an efficiency gain, most citizens in a democratic society would consider that some gain in overall social well-being *is* achieved by such transfers. Thus, at a conceptual level, the conflict between efficiency and equity may be more apparent than real, given that efficiency is fundamentally about maximising total social well-being.

Of course, this does *not* mean that efficiency equals equity – the title was simply to get the reader’s attention! In practice, the tension between efficiency and equity remains real for two related reasons.

First, it is difficult to quantify, either analytically or empirically, how much wealth transfer is required to produce an outcome of “true” efficiency in this sense, especially since equality of income does not necessarily produce equality of opportunity or outcome (on this point see Sen, 1999, chapter 4). Second, wealth transfers tend to cause social externalities that could lead to longer-term effects on society’s overall well-being. These include the creation of poverty traps and dependence and damage to social cohesion caused by favouring particular groups.

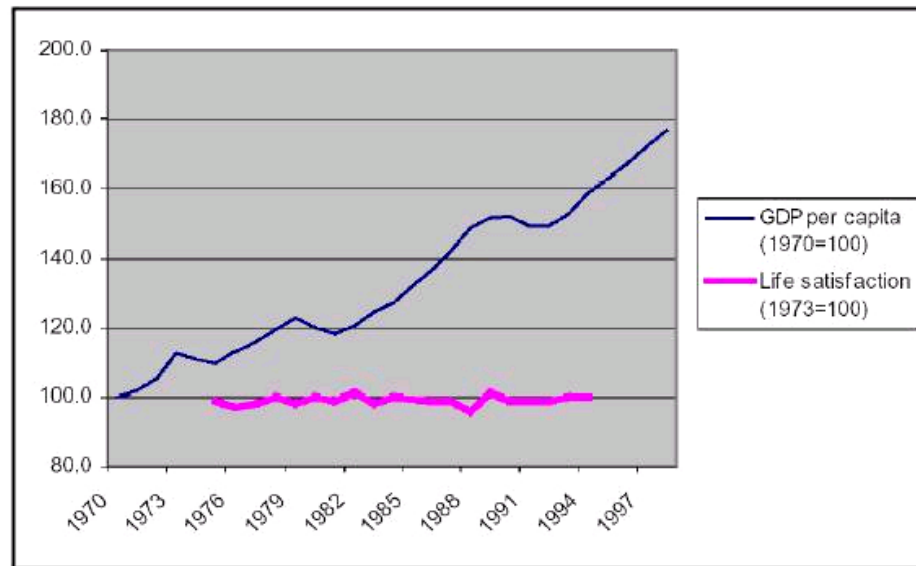
Such considerations serve to emphasize the complexity of social systems that sustainability analysis must seek to grapple with. Nonetheless, the point remains that an increase in equity can result in an increase in total social well-being, i.e. an increase in efficiency broadly defined, even if total output is reduced.

### **GDP as a measure of progress**

A related tension between economics and sustainable development arises because governments tend to measure progress by Gross Domestic Product (GDP) and related measures. In addition to using the Kaldor-Hicks definition of efficiency, GDP accounting treats “bads” (e.g. government expenditure to combat pollution) as though they were “goods”, while many other “goods” (e.g. leisure) and “bads” (e.g. personal harm from crime) are not counted at all. These limitations of GDP are recognised<sup>4</sup>, and governments are now developing and reporting measures of social and ecological well-being to accompany the national income accounts. Still, both politicians and the public tend to assume that an increase in GDP indicates an increase in overall well-being, when in fact it might not. See Figure 1.

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<sup>4</sup> E.g. see Daly and Cobb, 1989, pp. 62-84; Mates, 2004.



**Figure 1. Life satisfaction vs GDP per capita in the UK 1973-1997** (Government Strategy Unit, 2002).

## Concepts of the good

Hatfield-Dodds (1999, p158), examining the philosophical tradition from John Stuart Mill to Rawls and others, raises the further question of whether society should aim to maximise the wealth it passes to the next generation, or to maximise the opportunities for personal liberty:

*The touchstone of liberal social theory is that there are a plurality of equally legitimate conceptions of the good life, implying that society should be structured so that each individual is able to pursue their understanding of the good with the fewest possible impediments. ... This notion of liberty is also strongly associated with ideas of rights and justice. Kant (1785), for example, argues that society should be governed by principles which conform to the moral code revealed by metaphysics, rather than maximising social welfare or some other concept of the good. ... Like Kant, Rawls ... upholds the priority of justice over the calculus of social interest.*

This is a radical challenge to modern economics, which is based on a utilitarian definition of “the good” and implicitly rejects the notion that there are multiple equally legitimate conceptions of the good. Most economists define a public policy problem as one of maximizing the wealth of society. To many *non*-economists, this looks like narrow-mindedness at best and arrogance at worst.

This apparent divide can be bridged with the simple but powerful notion that freedom is both the end and the means of development (Sen, 1999). That is, the objective of development is to increase individual freedoms (i.e. liberty), including freedom from hunger and other deprivations, and the best way to achieve this objective is through increasing economic, political and social freedom. Thus, economic growth and wealth creation are not ends in themselves. Rather, they are means to achieve the objective of individual liberty.

Society should not, Sen argues, try to reduce judgements to a single metric:

*It is not, for example, to the credit of classical utilitarianism that it values only pleasure, without taking any direct interest in freedom, rights, creativity or actual living conditions. To insist on the mechanical comfort of having just one 'good thing' would be to deny our humanity as reasoning creatures" (Sen, 1999, p77).*

Hatfield-Dodds (1999) makes a similar point, but his concept of “person-in-community” also stresses that individual liberty must be balanced against the common good:

*The notion of person-in-community implies that humans are inherently social, that the central characteristic of justice is radical equality of opportunity, and that the deepest sources of well-being relate to issues of purpose and integrity and social standing rather than to income or purchasing power. ... This vision of the good life ... can only be realised through the promotion of personal liberty ... which carefully balances the claims of the individual against the common good ... a theory of 'liberty-in-solidarity' (p 162).*

As economists, we need to acknowledge that equity and efficiency can be mutually consistent rather than competing, that GDP is a poor measure of social progress, and that society's objectives need to be judged against multiple criteria, and we also need to apply these ideas in our work. This would begin to bridge the gap between conventional economics and broader views of sustainable development.

## **Models of human behaviour**

If one accepts that progress towards sustainable development requires changes in current patterns of resource use by individuals and businesses, then it is important to understand what motivates changes in human behaviour. Economics is built on a theory of utility that assumes people derive satisfaction (i.e. “utility”) from a range of goods, services and leisure, and that “more is better”. Utility theory further assumes that people seek to maximise their utility and are rational in their decisions.

For many situations this classical economic model of the rational utility-maximising individual is sufficiently accurate to be analytically valid, but for other problems a more robust theory of human behaviour is required. Daly and Cobb (1989, pp 85ff), for instance, have criticised the classical model for ignoring the fact that a person's perception of well-being is affected by others' consumption as well as their own.

Hatfield-Dodds (1999) notes that the material needs of most persons are met through social systems, and that emotional well-being is shaped by social forces, including perceptions of identity and self-esteem. Hence his view that analysis must focus on the “person-in-community”. Hatfield-Dodds also notes that Adam Smith saw self-interest as only one of three forces driving human behaviour, the others being benevolence and justice:

*Smith held that these different motivational forces all derived from the same aspect of humanity's social nature, the unique human ability of individuals to identify the feelings engendered in others by social interaction. This capacity for sympathy, he argued, underpins all human action and institutions, through the desire for the approbation of others motivating individuals to behave in acceptable ways. ... Smith considered self-interest to be the most powerful of the three motives, at least in unrefined cultures and classes, and thus argued that it should form (and be affirmed as) the organising principle for meeting society's material needs. He believed,*

*however, that the good life can only be achieved through the exercise of all three virtues, and associated progress with the refinement of taste and the cultivation of the nobler virtues.*

Whether a “desire for approbation of others” is simply another manifestation of self-interest is a moot point. Even so, human behaviour cannot be fully understood based on a model of rational maximisation of personal wealth. For example, people often exhibit traits such as generosity and take views on issues of no consequence to themselves (Boudon, 2003).

One response of economics has been the theory of “bounded rationality”, which describes individuals as “fallible learners”:

*Alternatively, one could assume that the individuals who calculate benefits and costs are fallible learners who vary in terms of the number of other persons whose perceived benefits and costs are important to them and in terms of their personal commitment to keeping promises and honoring forms of reciprocity extended to them. Fallible learners can, and often do, make mistakes. Settings differ, however, as to whether the institutional incentives involved encourage people to learn from these mistakes. ...*

*Many of the situations of interest in understanding public choices about common-pool resources...are uncertain, complex, and lack the selective pressure and information-generating capabilities of a competitive market. Therefore, [in place of simple rationality] one can substitute the assumption of bounded rationality—that persons are intendedly rational but only limitedly so.... With incomplete information and imperfect information-processing capabilities, all individuals may make mistakes in choosing strategies designed to realize a set of goals. Over time, however, they can acquire a greater understanding of their situation and adopt strategies that result in higher returns. Reciprocity may develop, rather than strictly narrow, short-term pursuit of self-interest (Ostrom & Ostrom, 2004, pp 118-119).*

Watson (2004) described a similar approach, called social learning theory. This model of behaviour, which can incorporate aspects of rational choice, recognises not only legal and financial sanctions and rewards for behavioural change but also the attitudes of “significant other persons” with whom the individual is associated.

If the parameters are properly defined, both “bounded rationality” and “social learning” offer models of human behaviour that are consistent with economic theory but go beyond a simple view of well-being based on the material wealth that contributes to GDP. There is an extensive literature on human behaviour, ranging across several disciplines. While a comprehensive review of this field is beyond the scope of this project, our research will explore some of the work that is most directly relevant. For example, in commenting on the inadequacy of rational choice theory, Boudon (2003) identifies non-utilitarian elements of human motivation that resonate with the views of Sen (1999) outlined above. These broader models of human motivation and behaviour are likely to be useful in designing institutions for sustainable development that will provide incentives for people to learn from the inevitable mistakes.

## **Economics and Ecology**

### **Discount rates and inter-generational equity**

A further tension between efficiency and sustainability relates to inter-generational equity and the conversion of natural resources into “non-natural” forms of capital, e.g. physical infrastructure or monetary assets.

A key concept used in economics, especially in benefit-cost analysis, is that of “present value” of a flow of costs and benefits over time. Future benefits must be “discounted” by some rate of return (which is often termed the “discount rate”) to be compared in equal value terms.

Although discounting and present value techniques are often criticised, these concepts and criteria aim to maximise benefits to society from a given set of resources. Converting natural capital (e.g. petroleum) to other forms of economic assets directly contributes to wealth and well-being (though pollution and social disruption from these activities can also harm well-being). If we were to reject an “efficient option” (as determined by present value) and instead select an option that was less efficient, the result would be to bequeath to future generations less wealth than we could have bequeathed them.

We might leave more petroleum in the ground for future generations, but if we have estimated the future value of oil using best available information (e.g. the substitute energy sources likely to be available), and taken environmental and social externalities into account, the petroleum will be worth less to future generations than we could have bequeathed to them had we extracted it and used it to build a better society. (Because conversion of natural capital often entails costs that are not considered by private owners who are converting capital, society rightly seeks to impose conditions and constraints on such conversion, and/or to implement policies that “internalise” these costs to the private sector.) There is, of course, the additional question of whether natural resources are in fact used to build a better society, i.e. to add to other forms of capital from which future generations can draw, or are simply consumed by the present generation.

Thus, there is no escaping the fact that the current generation has to make some judgments on behalf of future generations: how much the present generation should consume, and whether to bequeath future generations more natural and social capital or more wealth, recognising that greater wealth will include greater knowledge and technology, but also recognising that value and wealth go beyond tangible goods that can be quantified in monetary terms. The challenge to economics is to use discounting in a way that enhances rather than compromises the ability of future generations to meet their own needs. Where critical natural capital is at risk, it might not be appropriate to use discounting and present value techniques at all.

### **Critical natural capital**

The conventional economic approach of discounting has failed to satisfy many observers in large part because it can be used to justify as “efficient” an option that entails a risk of damage to critical functions of natural systems, e.g. the earth’s climate.

An alternative view asserts that natural resources should only be used at a rate at which they can be recycled or replaced, so as to leave an equal entitlement for future generations.<sup>5</sup> Aspects of this approach have been popularised, e.g. via The Natural Step, and have proved to be an effective motivator of change. However, the conceptual debate has moved on, because it is difficult to defend a complete prohibition on conversion of natural capital. What are agricultural lands, cities and dams if not natural systems that have been converted to deliver a different mix of goods and services? It seems untenable to suggest that such developments cannot be consistent with sustainable development. Nonetheless, some still say that sustainability requires the total stock of natural capital to be maintained (see e.g. Mates, 2004), a position often described as “strong sustainability” or “very strong sustainability”.

Peet (2003, p.12) described a “moderate” version of strong sustainability, where substitutability (i.e. conversion) of natural capital is not seen as proscribed but as “seriously limited by environmental characteristics such as irreversibility, indeterminacy and the existence of ‘critical’ components of natural capital which are not only essential to human welfare, but are also essential to the wider realm of the processes of life on earth.” Indeterminacy can be taken to include the limits to substitution that arise because of the complexity of ecological and human interactions and our inability to predict the consequences of depletion of a resource and its transformation into energy, other resources and waste.

There is an emerging body of work on identifying “critical natural capital”, i.e. the elements of natural capital that need to be maintained at all costs to avoid serious risk to sustainable development (see e.g. Ekins et al, 2003, and Ekins n.d.). According to this concept, there are certain critical resources that should not be converted even if doing so is estimated to generate a net benefit to society, in particular where there is a coincidence of uncertainty, irreversibility and the possibility of very high costs. Where these circumstances prevail, it would be inappropriate to take such risks on behalf of future generations.

While this work has produced some principles for distinguishing between critical and non-critical resources, in practice judgement is still required as to how much of a critical resource is required. As Ekins et al (2003, p. 175) acknowledge “...in many cases, ... what counts as an “unsustainable effect” rather than a sustainable economic cost is a matter of judgement which can only partially be resolved by science.”

### **Environmental bottom lines?**

“When an ecosystem component or process is pushed beyond its natural range of variability, that component or process, as well as others that depend on it, may not be sustained naturally” (Park, 2000). In this view, ecological sustainability is “the ability of an ecosystem to maintain itself undiminished over some time period”.

It is often said, therefore, that one of the mandates implicit in the RMA is to define “environmental bottom lines” representing the thresholds beyond which ecosystem components or processes should not be pushed. Given the complex interactions among ecosystem components, defining such “environmental bottom lines” is neither

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<sup>5</sup> An exception is allowed for energy, since the second law of thermodynamics (entropy) does not allow us to capture and recycle all energy.

as simple nor singular as it sounds. In managing rivers, for example, we prefer now to define “flow regimes” rather than “minimum flows”.

However, others have questioned whether the RMA does in fact imply “environmental bottom lines”. Memon (n.d.), for example, claiming support from New Zealand case law, has argued as follows:

*The application of s.5 involves an overall broad judgment of whether a plan, policy or a development proposal will promote the sustainable management of natural and physical resources. Such a judgment should be based on comparison of conflicting bio-physical, socio-cultural and economic considerations and the scale or degree of them and their relative significance or proportion in the final outcome from intra-generational and inter-generational perspectives.*

I.e. there is no prohibition on conversion of natural capital to a different state if the result improves overall well-being, taking both current and future generations into account. Local authorities or central government might define standards that should not be breached but, in this view, there are not “bottom lines” that can be inferred from s.5 of the RMA.

Ecological sustainability requires integration of human uses of resources with the needs of the ecological systems that created or provides those resources. It recognises that people are a part of New Zealand’s ecosystems, which include production and urban environments as much as the publicly owned conservation environment. However, New Zealand’s most perturbed natural ecosystems are those of the lowlands where the majority of our settlements are and where most intensive production activities occur – hence the loss of lowland forest and wetlands and degradation of lowland streams.

From the perspective of critical natural capital, whether this loss of lowland ecosystems is “unsustainable” depends on the functions that these ecosystems provide and how much needs to be retained to protect long-term human welfare and the wider life support processes of the planet. In the framework proposed by Ekins et al (2003), much would seem to depend on the “information functions” that include aesthetic and amenity values; cultural, historical and spiritual values; and scientific and educational values. Because of the subjectivity of defining how much of these functions needs to be retained as critical natural capital, in practice this approach might not differ significantly from Memon’s overall broad judgement. If, on the other hand, these “information functions” were left out of the “bottom line”, there would be a more objective basis for determining how much of a given ecosystem needs to be protected, though it would still be far from easy to do so.

### **Managed transitions and resilience theory**

An important concept in ecological sustainability is “irreversibility”, e.g. society should be especially careful before causing adverse effects that are likely to be irreversible. This is often referred to as a precautionary approach or the “precautionary principle”.<sup>6</sup> Irreversibility can be defined in absolute terms – e.g.

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<sup>6</sup> One formulation comes from Principle 15 of the Rio Declaration 1992: “In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty

species extinctions – or over realistic time frames – e.g. when degradation will take decades or centuries to remedy and thereby deprive significant numbers of future users for a long time if not forever. This is closely related to issues regarding conversion of natural capital, discussed above.

However, ecological sustainability does not require maintaining ecosystems in their current form. In selected areas, conservation efforts aim to achieve this, or alternatively, to protect ecosystems from anthropogenic influences so that they may continue to evolve ‘naturally’. More generally, however, meeting human needs will continue to involve modification of ecosystems. The inevitability of change means that humankind must attempt to manage, shape and/or adapt to change:

*The hope of the future lies not in curbing the influence of human occupancy – it is already too late for that – but in creating a better understanding of the extent of that influence and a new ethic for its governance. – Aldo Leopold, 1933*

Resilience theory (Gunderson and Holling, 2002) is a developing theory of adaptive change. It suggests that systems as diverse as ecosystems, economic systems and organisations move between a series of stable states. Living systems in particular go through cycles of growth, rigidity, collapse and reorganisation. Even the notion of managing for Maximum Sustainable Yield for particular stocks is seen as flawed because it assumes that one can achieve a stable equilibrium within what is actually a dynamic ecosystem.

Change can be incremental, lurching, or transformational, and abrupt shifts from stable states are common (*ibid.*). The challenge is to manage adaptively for ecological sustainability, and to expect ongoing change. Adaptive management means *learning* - as opposed to *planning* – our way to sustainable futures. Sustainability can be defined as the ability to create, test and maintain adaptive *capability* and development defined as the process of creating, testing and maintaining *opportunity*. According to Gunderson and Holling, key approaches to adaptive management include managing for resilience in ecosystems, flexibility in institutions and incentives in economic systems.

There is no one management approach that is right for all time – adaptive management requires creating the right links at the right time around the right issues. For ecological sustainability, resilience theory suggests that a new ethic for governance should include taking care to avoid causing major changes to ecological systems because of the potential for unpredictable consequences, as well as being prepared to adapt to such changes should they occur.

## Conclusions

The more efficient a society’s economic development, the less strain that society places on the earth’s natural and physical resources as it strives to meet the needs of present and future generations. Efficiency matters.

But conventional usage of economic efficiency as a decision tool can lead to sub-optimal outcomes, because analysts typically employ the Kaldor-Hicks criterion and

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shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”

assume that an increase in aggregate output corresponds to an increase in overall well-being in society. Among other things, this ignores the fact that an extra dollar has more value to a poor person than to a rich person, so distribution of benefits matters critically in determining overall well-being.

Rather than defining “the good” as maximisation of material wealth, economists should consider Sen’s (1999) concept of development as freedom, and seek to maximise freedoms and opportunities of individuals within communities. When efficiency is defined as maximising well-being rather than wealth, improving equity is often complementary to efficiency rather than in competition with it.

Seeing development as freedom also helps to resolve the tensions in policy analysis that arise from discounting to estimate net present value. Discounting future costs is hard to justify when it is used to support a decision that entails a risk of irreversible damage to critical natural capital, e.g. the earth’s climate. While decisions based on comparison of discounted values might maximise expected wealth, this methodology should be used in a way that does not put at risk the freedom and opportunities, i.e. the well-being, of future generations.

From the perspective of critical natural capital, whether a loss of an ecosystem is “unsustainable” depends on the functions that the ecosystem provides and how much needs to be retained to protect long-term human welfare and the wider life support processes of the planet. Much depends on a subjective assessment of how critical the ecosystem is to human welfare in terms of aesthetic and amenity values; cultural, historical and spiritual values; and scientific and educational values, leaving wide scope for debate. The search continues for objective criteria for ecological sustainability.

Ecosystems, economic systems and organisations move between a series of stable states. Change can be incremental, lurching, or transformational, and abrupt shifts from stable states can and do occur. The challenge is to manage adaptively for ecological sustainability, and to expect ongoing change.

There is no one management approach that is right for all time – adaptive management requires learning rather than planning. For sustainability, resilience theory suggests that a new ethic for governance should include taking care to avoid causing major changes to ecological systems because of the potential for unpredictable consequences, as well as being prepared to adapt to such changes should they occur.

## References

- Bromley, D.W. 1988. “Efficiency and equity considerations in environmental policy.” *Property Rights and the Environment: Natural Resources Policy in Transition*. A series of lectures presented by Daniel W. Bromley. Ministry for the Environment, Wellington.
- Brundtland, G.H. et al. 1987. *Our Common Future*. Report of the World Commission on Environment and Development. Oxford University Press.
- Daly, H.E.; Cobb, Jr., J.B. 1989. *For The Common Good*. Beacon Press, Boston.

- Ekins, P.; S. Simon; L. Deutsch; C. Folke; R. deGroot. 2003. "A framework for the practical application of the concepts of critical natural capital and strong sustainability." *Ecological Economics*. 44 (2003) 165-185.
- Ekins, P. n.d. *Sustainability and Critical Natural Capital: Conclusions from the CRITINC Project*. Working Paper 14. EU Environment and Climate RTD Programme, Project No. PL9702076.
- Government Strategy Unit. 2002. *Life Satisfaction: the state of knowledge and implications for government*. London. July.
- Gunderson, L.H., C.S. Holling (eds). 2002. *Panarchy – Understanding Transformations in Human and Natural Systems*. Island Press, Washington DC.
- Hatfield-Dodds, S. 1999. "Consumerism, well-being, and the good society". Paper presented at the ANZSEE Conference. Brisbane, July. Slightly revised version obtained from author.
- Jollands, N. 2003. "Wasting 'efficiency': Sisyphus and the policy analyst." Paper presented at Think Tank on Ecological Economics, Auckland, 16 November.
- Leopold, A. 1933. *Game Management*. Charles Scribner's Sons, New York.
- Mates, W.J. 2004. "Income, investment and sustainability." *Ecological Economics*. 48 (2004) 1-3.
- Memon, P.A. n.d. "Reinstating the Purpose of Planning Within New Zealand's Resource Management Act." Unpublished paper.
- Ostrom, E; Ostrom, V. 2004. "The Quest for Meaning in Public Choice". *American Journal of Economics and Sociology*. 63(1) 105-147.
- Park, G. 2000. "New Zealand as Ecosystems: the Ecosystem Concept as a Tool for Environmental Management and Conservation". Department of Conservation, Wellington.
- Peet, J. 2003. "Sustainability – A Scientific Dilemma." Paper presented at Think Tank on Ecological Economics, Auckland, 16 November.
- Sen, A. 1999. *Development as Freedom*. New York: Anchor Books.
- Stavins, R.; A. F. Wagner; G. Wagner. 2002. "Interpreting Sustainability in Economic Terms: Dynamic Efficiency Plus Intergenerational Equity". Discussion Paper 02-29. Resources for the Future. Washington DC. August.
- Watson, B. 2004. "Factors contributing to unlicensed driving: A comparison of deterrence theory and social learning theory." Paper presented at Persuasive Policy Conference, Wellington. 16 March.