Section 1

Literature review

"The earth belongs in usufruct to the living"

Thomas Jefferson

Chapter 2

Literature review

2.1 Economic Approaches to Environmental Valuation

Attempts to value the environment or ecosystem goods and services, otherwise called ‘intangibles’, ‘non-market goods’, or ‘unpriced goods’ began with the introduction of the systematic analysis procedure known as Cost Benefit Analysis (CBA). CBA was first introduced in the United States Flood Control Act in 1936, although the conceptual framework did not emerge until some 15 years later with publication of the "Green Book" by the US Federal Inter-Agency River Basin Committee (Pearce 1971; Dasgupta and Pearce 1978; Pearce 1983; Hanley and Spash 1993). CBA is grounded in neo-classical welfare economic theory dating from the 19th Century, which set the scene for it to be used almost exclusively for the appraisal of public projects and policy (Pearce 1971; Dasgupta and Pearce 1978; Pearce 1983). The US Budget Circular A-47 in 1952 attempted to formulate procedures for valuing costs and benefits, yet expressed them in terms of the Gross National Product (GNP). In doing so the US Government failed to appreciate or account for the fact that not all social gains and losses are expressed in terms of GNP (Dasgupta and Pearce 1978). Subsequent interest led to development of what became an integrated CBA theory linked to the vast body of welfare theory, with costs and benefits related to welfare losses and gains (Dasgupta and Pearce 1978; Hanley and Spash 1993). Focus began to gradually change, however, with the assessment of benefits of both water quality and quantity leading to evaluation of water-based recreation, and thence air quality, human health, wildlife and aesthetics (Hanley and Spash 1993). However, the death knell for welfare economics had well and truly sounded by the mid 1950s, with scientists asserting that such a normative discipline, which by definition is not testable, is inappropriate and unworkable in a scientific era (Dasgupta and Pearce 1978).

Fundamental to the difficulties faced in appraising public projects and other projects that may have impacted on society and the environment, was the

evaluation of non-market goods and services, so called ‘intangibles’, such as clean air and unpolluted water (Hanley and Spash 1993). Those analysts that attempted to measure them were accused of trying to ‘measure the immeasurable’, castigated for trying to apply a monetary value to everything, and if they did not, lack of rigour in the process (Pearce 1971; Pearce 1983). Placing surrogate or ‘shadow prices’ on the intangibles often marginalised sections of society, where moral and wealth distributional preferences were diverse. Which posed the question: who, or which group of people constituted society? Local, regional, national or global communities could reasonably be expected to have an interest depending on the project or policy, yet in most cases CBA relied on a random or arbitrary sample. Moreover, the wishes of future people were not considered, as their preferences could hardly be known. In both instances democratic decision-making was over-ruled in favour of expediency. Implicitly or explicitly expressed individual preferences were not always in the best interest of society, with the decision-maker taking a paternalistic role (Pearce 1971). Owing to ambiguities about trade-offs among conflicting interests, the theoretical ideal of a single preference was rarely realised in planning, with a demonstrated need for a new paradigm integrating political, social and economic behaviour (Bharadwaj 1982). The application of CBA to environmental issues faced many obstacles, not the least in regard to the “...treatment of long-term effects, irreversabilities, and risk and uncertainty” (Hanley and Spash 1993:6). Accordingly CBA was but one ingredient in the decision-making process, albeit a powerful one, relying on normative judgements and structured on peoples’ preferences (Pearce 1983).

The original aim of CBA was to ensure scarce resources were allocated only to those projects which yielded the greatest gain in net benefit to society, termed the ‘fundamental rule’ (Duhs 1969; Pearce 1971; Schofield 1987:27). Private benefits to the proponent (the objective function to the firm) were not taken into account (Peters 1968; Pearce 1971) and the effect of social utility on private decision-making was relegated to the economic theories of uncertainty, risk and expectations (Peters 1968). Maximisation of net social benefit (NSB) was thus equivalent to maximising social utility or welfare. Lesourne (1975) describes the model as socio-economic, and both micro-

economic (to do with price theory) (Frank 1991), and global (encompassing secondary and flow-on effects). Projects were ranked according to their NSB, and all of those with a positive NSB were deemed feasible. In the absence of any other influence or criticism, and as long as all relevant alternatives were considered, those projects went ahead (Duhs 1969; Pearce 1971; 1983). However, in the original context of the application of CBA, all public expenditures were already assumed to be in the public interest. Socio-economic justification for a project to proceed required a wider evaluation of social costs and benefits, most of which were intangible (Pearce 1971; 1983; Schofield 1987). Duhs (1969:1) defined the aim of CBA as being:

"...to enhance the efficacy of public decisions by providing a rigorous technique of project appraisal which is capable of incorporating those economic effects that escape the market mechanism".

Society can put a monetary value on a non-market good or service under the right experimental conditions. However an implicit value (by virtue of individual behaviour, such as foregoing the extra cost of a taxi rather than travelling by bus) may only indicate a preference, and rarely reflect a conscious valuation (Pearce 1971; 1983). Attempts to value intangibles can be qualified as to the:

- logical possibility of evaluation, the
- empirical possibility of evaluation, and the
- morality of the value (Pearce 1971:12).

Conscious valuations of intangibles can be made by assessing the 'willingness to pay' (WTP) by individual preference (of a representative sample of society as a whole), to avoid the nuisance of a negative external effect (cost) of a project, or 'willingness to accept' (WTA) compensation (benefit) to put up with the nuisance (Pearce 1971; 1983; Schofield 1987). Costs can be treated as negative benefits and benefits treated as negative costs, in order that undue sensitivity is not imparted from the definitions of each. WTP is arbitrary and subject to class bias, and as such the values are not fully reflected in actuality (Pearce 1971; 1983). WTP is more often than not better described as 'ability to pay', owing to income and wealth distribution (Hanley and Spash 1993). Clearly some individuals can and would pay more than others (Pearce 1971; 1983). Moreover, recent studies have shown that

for a range of projects WTA is typically three to ten times WTP, reflecting the higher compensation demanded by people for them to allow environmental degradation (Cummings, Brookshire and Schulze 1986; Diamond and Hausman 1994; Goodstein 1999) (Table 2.1). WTP is bounded by income while WTA is not. In addition the usual Marshallian (uncompensated) demand curve does not reflect the fact that both it and the Hicksian (compensated) demand curves will change by virtue of income changes due to the act of paying or accepting money. The area under the curve will either be larger or smaller than true WTP or WTA respectively (Bishop 1982).

Table 2.1. Disparities between 'willingness to pay' and 'willingness to accept' (in year of study dollars) (Source: modified after Cummings, Brookshire and Schulze 1986 and Goodstein 1999).

STUDY	WTP	WTA
Hammack & Brown (1974)	$247	$1044
Banford *et al*., (1977)	43	120
	22	93
Sinclair (1976)	35	100
Bishop and Heberlein (1979)	21	101
Brookshire *et al*., (1980	43.64	68.2
	54.07	142.60
	32	207.07
Rowe *et al*., (1980)	4.75	24.47
	6.54	71.44
	3.53	46.63
	6.85	113.68
Coursey *et al.,* (1983)	2.50	9.50
	2.75	4.50
Knetsch and Sinden (1983)	1.28	5.18
Brookshire and Coursey (1987)	12.92	95.52

Walshe and Daffern (1990) suggest that while it is well to draw attention to potential inequities, it is not for the CBA practitioner to make 'stereotypical judgements' about an individual's peculiar circumstances or the marginal utility to them of a particular option-choice. A positive WTP response that had the qualifier 'but I cannot afford it' must be treated as genuine zero bid rather than a protest bid, showing in one way how the bid in the market place is unequal (Hanley and Spash 1993). Resource allocation is thus influenced by income distribution, however if the outcome of CBA is regarded as an acceptable guide to policy, then the status quo of current income distribution should be acceptable for decision-makers. WTP can not only rank alternatives but also measure the intensity ($) of preferences, as opposed to political

voting. Money thus becomes a cardinal measure in measuring preferences, which is contradictory to modern welfare economic theory. This again raises issues about the comparability of utility between individuals. CBA treats gains and losses equally, no matter who makes them, but society may prefer the project that benefits a particular sector of society, eg. the poor. Society also may support projects with negative NSB for similar reasons, eg. more equitable income distribution outcomes (Hanley and Spash 1993). Notwithstanding, adjustments at the macroeconomic level, such as taxes, can be assumed to restore the desired income distribution (Walshe and Daffern 1990).

Economists talk in terms of Pareto efficiency of projects. Named after Italian economist Vilfred Pareto, the principle is concerned with the relative equity of people before and after a project (the 'with or without principle') (Duhs 1969; Goodstein 1999). A Pareto improvement is one where some individuals are better off without other individuals being worse off, while a Pareto optimum occurs when some individuals are better off only at the expense of others (Pearce 1971; Schofield 1987). The WTA or compensation principle implies a Pareto optimum condition, however as the losers are compensated it becomes a Pareto improvement. For projects that involve losses to some people, consumer's surpluses and gains are computed and an excess of gains over losses will justify a project (Pearce 1971). The Hicks-Kaldor principle tries to preserve Pareto optimality recognising that in most cases some people will benefit and others lose, by suggesting a test that requires only that the gainers be able to compensate the losers. However, it does not require that actual payment be made (Pearce 1971; Bishop 1982). Layard (1972) claims there is no ethical justification of the Hicks-Kaldor criterion, as there is little possibility of cases where it is possible to compensate everyone. Walshe and Daffern (1990) lay the onus directly on the decision-makers to decide the reasonableness of whether a net gain to one party is as good as a net loss to another. In terms of compensation, WTA varies as to the marginal utility of income therefore some weighting is required. The traditionalist view is that income distribution could change due to the project, and society is unlikely to be indifferent to this. However, most CBAs treat each person's

losses or gains equally and ignore possible differences in the weights. Other arguments claim that:

- changes are negligible but could have significant distributional effects
- Government can do it anyway through fiscal policy
- distribution will be random but only if there are many projects in the sample (Pearce 1971).

Mishan (1972) points out that CBA does not require that everyone is made better off, and in practise, many are worse off. The Pareto improvement test thus ignores the resulting change in the distribution of income, which is regressive, grossly inequitable, and consistent with the 'richer-richer', 'poorer-poorer' syndrome (Mishan 1972). The distribution effect should be explicitly incorporated in the CBA process, particularly in developing countries where there is a significant divergence of income and wealth across class groups. In fact the whole CBA process requires special treatment in developing countries where there are unemployed resources (labour) and constraints on resources (capital) (Pearce 1971). Bromley (1982) claims Paretian value judgements are clearly not culturally neutral, owing to the necessity of establishing property rights as a precursor to the delineation of costs and benefits. Whomsoever has the power to control things deemed valuable, a priori, has the ability to impose costs on others (Bromley 1982).

The relevant price (in monetary terms) of costs and benefits should reflect the sacrifice or opportunity cost, but if monetary valuations do not reflect market prices, and surrogate prices of intangibles do not reflect social valuations, this is due to failure of the market mechanism and external effects (Duhs 1969; Pearce 1971). Market failure is further explained in terms of valuing conservation as being instances where costs and benefits are not borne by the same people (Allison *et al.,* 1996). For example, the costs of conservation in say, Cape York Peninsula, are generally borne by the landholder, while the benefits accrue to people all over Australia and overseas. Profit driven motives will tend to ignore external effects while true social valuations (WTP) will not. Marginal social cost is value, and private cost is not value: with prices

diverging everywhere. There is a disparity due to society's preferences, leading to a partial rejection of the Pareto optimum. This raises the 'second-best problem' (cannot achieve an optimum) with 'first best' defined as 'prices equal to marginal costs everywhere' (Pearce 1971). In essence, the problem is due to external effects not being internalised in the CBA, ie. they are uncompensated (Schofield 1987). Mishan (1967) criticises the obsession with growth at any cost as counterproductive unless external diseconomies can be made to bear the cost of their actions, and doubts the efficacy of CBA as a tool where externalities are important. External effects include all the ecosystem goods and services humankind take for granted such as stabilisation (clean air, water), regeneration (gene pool), production of goods (timber, fibre, medicine) and life-fulfillment services (aesthetics) (Cork and Shelton 2000), and such diverse effects as traffic noise, photochemical smog and the crime rate. Failure to internalise external effects leads to an understatement of the true social benefit (Pearce 1971). Nevertheless many CBA theorists regard the negative external effects as being of little empirical relevance (Pearce 1971), despite the fact that the flow-on effect of some, if not most, negative external effects will exceed the life of most projects. Hufschmidt (1982:2) calls for the:

"…need to ensure that significant natural system concerns are adequately reflected in economic analysis of alternate strategies, plans or projects...and quantified and translated into factors that can be evaluated in the same terms as economic variables".

Methods developed for dealing with externalities or intangibles can involve a survey or questionnaire aimed at finding the WTP for a benefit or WTA for a cost, which will lead to surrogate prices being established. In the absence or failure of accepted markets, no direct mechanism exists to measure or reveal prices, so surrogate or shadow prices are used (Johansson 1993). The selection of a truly representative sample population for such a survey can be critical, and failure to do so result in either responses too subjective or frivolous (Pearce 1971). Observing or recording explicit behaviour can also derive surrogate prices, however such preferences cannot be regarded as conscious, or necessarily project-specific. A contingency approach may also be adopted whereby the intangible non-monetary benefit is derived from the

difference between the cost and the monetary benefit. This approach becomes more difficult to apply when dealing with multiple intangibles (Pearce 1971). Intangibles could also be reflected in real property values, although the same problems exist as for the contingency approach, with a possible multiplicity of intangibles, and difficulty met in separating out the land and the effect. Despite these intangibles being treated as unpriced due to lack of a defined market, the surrogate markets are real due to the influence the intangible has over the established market for the good or service to which it relates, eg. peace and quiet in a housing estate (Pearce 1983). Logic would appear to dictate that if actual and direct market valuations are accepted for one component of a complexity of intangibles and intangibles that form a whole, it is difficult to reject surrogate markets for the other components (Pearce 1983). Peters (1968) warns against too much praise and reliance on CBA in this regard as, in citing Dorfman's edited volume of the proceedings at the Brookings Institution in 1965 (*Measuring Benefits of Government Investments),* some practitioners likened the problem to:

"…appraising the quality of a horse and rabbit stew, the rabbit being those consequences that could be measured and evaluated numerically, and the horse the amalgam of external effects, social, emotional and psychological impacts and historical and aesthetic considerations that can be adjudged only roughly and subjectively. Since the horse was bound to dominate the flavour of the stew, meticulous evaluation of the rabbit would hardly seem worthwhile" (Peters 1968:43).

In practice, WTP is equal to the price paid plus the consumer surplus. There are people who express WTP in excess of what they actually pay, the difference is consumer surplus (Dasgupta and Pearce 1978; Pearce 1983). Consumer surplus is the primary method for estimating benefits for extra-market goods (Halvorsen and Ruby 1981; Bishop 1982; Bromley 1982; Allison *et al.,* 1996). The social cost of these goods or services is the full opportunity cost of the project foregone (Bishop 1982). Likewise for producers (tour providers, nature resorts, service industries), the difference between the minimum they are willing to accept for the good or service, and the cost of providing/producing it, is the producer's surplus (Driml 1996; 2002). Consumer surplus can only be determined by individual preferences, except in the case of explicit behaviour, such as is demonstrated by choice of travel mode.

However, the difference in extra cost of the more expensive mode could represent either consumer surplus, or merely a time-saving and convenience preference, which is difficult if not impossible to separate. WTP surveys are the prime methodology employed in what has become the most highly regarded and commonly used technique to value non-market goods, the contingency valuation method (CVM) (Mitchell and Carson 1989; Bateman and Turner 1995; Johansson 1993; Hanley and Spash 1995; Fisher 1996; Judez *et al.,* 2000). Despite the popularity of CVM it is possibly the least theoretically rigorous of the economic valuation methods (Allison *et al.,* 1996). One reason for its popularity is probably government preference for the democratic choice-making nature of the WTP process. Davis first used CVM in evaluating costs and benefits of big game hunting in a private forest, and by 1989 more than 100 studies based on CVM had been undertaken in the US alone (Mitchell and Carson 1989). By and large it was these studies that formed the basis for Costanza's (1997a) estimate of $US33 trillion for the World's ecosystems. The method was called CVM because the answers to a valuation question were contingent upon the particular hypothetical market described to the respondents (Johansson 1993; Bennett and Carter 1993). CVM underwent empirical and theoretical refinements in 70s and 80s and was described by Hanley and Spash (1993:53) as measuring economic value:

"…in relation to utility functions through the concepts of WTP and WTA...as well as through the related measures of consumer's surplus, compensating variation and equivalent variation…in a carefully structured hypothetical market".

CVM provides four exact welfare measures: ie. the WTP and WTA of the compensating variation of both welfare increases and decreases. CVM, unlike other neo-classical economic valuation techniques allows a value to be put on non-use values, such as existence value. Total economic value (TEV) of a resource was therefore put as being equal to the sum of consumer surplus (use value), option value, existence value and bequest value:

$$TEV = E(CS) + OV + XV + BV. \qquad \text{(Equation 2.1)}$$

Where E(CS) is consumer surplus; OV is option value; XV is existence value, and BV is bequest value (Allison *et al.,* 1996). However, the diversity of peoples' preferences again plays a large role in quantifying these values. According to Cummings *et al.,* (1986) CVM is more efficacious where

respondents have some knowledge, or can readily become familiar with the resource; have some experience in trading it, and believe the hypothetical market to be realistic. Moreover, the credibility of CVM can be supported by statistically testing the repeatability of results, establishing validity of the results, and peer review. Nevertheless, severe biases still exist due to CBA, and logically also CVM, being firmly rooted in neo-classical welfare economics. An evaluation technique based on peoples' preferences backed up by the ability to pay raises profound issues to do with anthropocentrism, information variability within groups, effects of value aggregation across groups and the positivist-rationalist approach (Hanley and Spash 1993). Elberle and Hayden (1991) strongly criticised CVM theory as being impossible to legitimise from a ‘neo-classical, pyschometric or general systems point of view,’ stating further that the approach lacks methodological, theoretical and empirical grounding. Diamond and Hausman (1994) claim that from evidence to date, CVM surveys do not measure the preferences they purport to measure, with little or no possibility of improvement by way of changes in survey technique. Diamond and Hausman (1994) concluded that reliance on this method is basically misguided, and that it is a ‘deeply flawed’ methodology for measuring nonuse values, particularly in the absence of direct market parallels. Moreover Kahneman and Knetsch (1992) argued that what individuals are willing to pay for moral satisfaction should not be confused with the economic value of public goods. On a more positive note, a study by Smith (1996) concluded that simple choices, multivariate models and estimated WTP were consistent and choice-discriminate for public good characteristics, which could, ‘arguably’ include nonuse motivations. Smith’s (1996) findings were not sensitive to model or statistical changes. Crowards (1992) makes a clear distinction between ‘selfish’ and ‘selfless’ altruism as possible motives for attributing nonuse values to the environment, which has crucial implications for economic valuation procedures, and proposes the introduction of safe minimum standards that can accommodate moral and ethical standpoints.

CVM has had widespread application in the USA for many years and more recently in Europe, however application of the CVM to two highly controversial

resource use scenarios in Australia led to much criticism of the method. The controversy around the mining of Coronation Hill located in the conservation zone adjacent to Kakadu National Park, and the logging of Fraser Island, polarised much of Australian society, yet the results of the CVM for each proposed activity were apparently given little weight by decision-makers. Criticisms included the lack of ability to communicate the nature of the hypothetical market, that is:

- were the respondents supposed to be estimating WTP for conservation for the whole of Kakadu and Fraser Island, or just the area impacted;
- was the bid misinterpreted as being one required for a category of environmental bad, rather than a specific scenario (which is known as embedding), ie: *"WTP for a good varies as to whether it is evaluated on its own or as part of a more inclusive category"* (Kahneman and Knetsch 1992:57);
- pro-environmental respondents to the survey were accused of exaggerating their bids as actual payment was not required; and
- validation and theoretical defences of CVM were not well accommodated in the Australian context. (Bennett and Carter 1993).

Imber *et al's.,* (1991) contingent valuation survey of the Kakadu Conservation Zone produced a lowest estimate of annual value of AUD$647 million, based upon a median WTP of AUD$52.80 per annum for ten years based on a survey of a sample 2034 people, and then extrapolated for 12.3 million individual adults in Australia. Interestingly, the median WTP for one quarter of the sample respondents who were resident in the Northern Territory was only AUD$14.50 per annum for ten years.

In CBA it is also necessary to allow for risk and uncertainty. Allowance for risk by way of a risk premium to the discount rate is regarded as a very crude expedient (Pearce 1971), while the preferred method is by way of a sensitivity analysis. Costs and benefits are presented in terms of ranges, classified as pessimistic, optimistic and best (the highest subjective probability) and it can be shown how the overall result responds to changes in assumptions (Pearce 1971). Allowance for uncertainty is slightly more complex allowing for four views:

- maximax (Hurwicz criterion);
- maximin (Wald criterion);
- Laplace criterion; and
- minimax regret (Savage criterion) (Pearce 1971).

Maximax is the optimistic view where the project with the highest NSB is chosen, or probabilities are applied to the best and worst results, the highest result again being chosen. Maximin is the opposite view (pessimistic), with the largest of the worst outcomes being chosen. The Laplace criterion is essentially middle of the road, with equal probabilities placed on each outcome (the principle of insufficient reason - for a difference), and minimax regret is the cautious approach where error is minimised by limiting the probability of not choosing an alternative (Pearce 1971). The third level of imperfect knowledge (after risk and uncertainty) is ignorance (Hanley and Spash 1993). An unrealistic assumption of neoclassical economics (even in developed countries) is that consumers and producers all have perfect knowledge and information about all aspects of the relevant economy. Consumer sovereignty assumes the price a consumer pays will always reflect the benefit or utility they get in the absence of perfect knowledge about all goods and services that they purchase (Perkins 1994).

Much of the early work dealing with environmental goods in CBA was based on the Cartesian paradigm, which posits that there exists a reality driven by immutable laws. Science sought to discover the true nature of this reality by breaking down components of a complex world into discrete parts, analysing them and making predictions about the world on the basis of these results. The ultimate aim was to discover, predict and control natural phenomena. Such science was equated with true knowledge (Pimbert and Pretty 1995). Norgaard (1989) however, rejects this positivist-rationalist approach, and suggests that conventional economics is totally inappropriate when dealing with environmental problems, preferring the holistic approach of ecologists. The very many variables and feedback effects inherent in the natural world obfuscate proper modelling of environmental impacts on ecosystems. The problem becomes even more difficult when links between complex

phenomena and the economy are sought (Hanley and Spash 1993). Norgaard (1989) further criticises neo-classical economics for both methodological monism (seeking single answers/truths), and the atomistic-mechanistic approach (deterministic predictions from individual preferences at the expense of disaggregated collective preferences). Moreover, Norgaard (1989) claims that the reductionist presumptions of CBA that complex ecosystems, no matter how modelled or analysed, can be reduced to a single number, is absurd. The new paradigm of ecological economics considers coevolution of the separate systems, postulating that the two (ecology and economics) are linked by temporal and stochastic feedback mechanisms, which should govern adjustment of the less benign. Environmental constraints are placed on individual behaviour (preferences), in favour of collective preferences, and on physical and technological limits to change. Klaasen and Opschoor (1991:110) decry WTP altogether as a method to value the environment by stating:

"...the value society attaches to natural resources and the environment is not merely the sum of all individual values. Environment is a merit good, not merely to be determined by the aggregation of individual...willingness to pay at any point in time".

Some environmental impacts are, in essence, irreversible, eg. extinctions, conversion of wetlands, and landscape change through quarrying or clear-felling resulting in soil loss and erosion. In cases like these, the benefits of preservation are foregone forever. These foregone benefits can be estimated in physical and monetary terms, leading to the possibility of calculating the value of preserving the site. Moreover, the concept of quasi-option value converts what was regarded as discounted net benefits to expected future benefits with unknown probabilities (society may be prepared to pay a premium to keep their options open as to the probability of environmental degradation). However, this is difficult to estimate and raises issues of information and probability that may negate the value of the concept even though the existence of quasi-option value is admitted (Hanley and Spash 1993).

In addition to institutional and environmental constraints on CBA, anthropocentrism goes to the core of human preferences for all manner of things. Anthopocentrism holds that only humans can have or ascribe intrinsic value, and as such all other features of the environment, whether living or non-living, can only have value through usefulness to humans. It follows that a feature of the environment or an ecosystem service must provide some utility to at least one human entity otherwise it has no economic value (Goodstein 1999). Both information variability and aggregation can have significant effects on the outcome of a WTP survey, where lack of information and consequent aggregation to the detriment of the better informed biases the outcome. Similarly, many preferences for a generalised outcome can outweigh preferences for a particular outcome, irrespective of the significance of the latter. Prior allocation of property rights is paramount to a democratic outcome under these circumstances, however, it can work the other way with society sympathetic to the resource-owners right to act in their own interest, despite the social detriment to many (Hanley and Spash 1993).

Prior to the introduction of CBA, private appraisal methodology was well established with definitive outcomes, although not all techniques were applicable to CBA. Diverse applications led to a divergence from the welfare theory that underpins CBA, with little relationship between theory and practice. Moreover there were no strict guidelines as to what should be included as costs and benefits, procedures were not universal, and bold attempts to value some intangibles had discredited the process (Dasgupta and Pearce 1978). Charges of failing to meet the criteria due to omission of some costs or benefits, were countered by accusations of arbitrariness and being fanciful for including others in a hypothetical economy. CBA is claimed to be riddled with assumptions about unknowns and disputes over discount rates, aggregation of preferences and what are ‘good’ and ‘bad’ effects, such that the process is described by some detractors as somewhat less than rigorous (Dasgupta and Pearce 1978). Unfortunately, similar charges (of arbitrariness and subjectivity) are made of alternatives to CBA, possibly due to the relatively minor and belated role environmental analysis plays in development planning (Dasgupta and Pearce 1978; Hufschmidt 1982).

By taking into account both market and non-market costs and benefits, in other words by including environmental values, a CBA is termed an 'extended CBA' (Hufschmidt 1982; Lockwood and Walpole 2000). Methods such as the 'travel cost approach' and 'hypothetical valuation' are used, and practices adopted to provide for future demands, due to degradation of natural resources or amenities by, say, overcrowding in the case of nature-based tourism (Bishop 1982; Hufschmidt 1982). Distinct variability in property values due to environmental and aesthetic values can be scrutinised by regression or factor analysis. Natural resources can be valued by way of option demand, with 'option value as a risk-premium' (WTP to keep your options open), or, 'quasi-option value' (considering the resistance and resilience of natural environments and the relative reversibility of negative impacts). Harder to assess are 'existence value', a metaphysical manifestation of society's preferences (WTP) with regard to the existence of things, apart from any benefit that may accrue from them, and 'intergenerational equity', evaluation of which would require having some aid akin to a crystal ball. One other remaining option is to modify the decision criteria, by questioning the relative worth of the intangible, as a positive value derived by deducting measurable costs from measurable benefits, otherwise known as the contingency approach (Pearce 1971; Hufschmidt 1982; Hanley and Spash 1993).

Two revealed preference methods used to value non-market goods that appeared to have stood the test of time, despite criticism, are the Travel Cost Method (TCM) and Hedonic Pricing (HP). TCM (first proposed by Hotelling in a letter in 1947) was first used by Clawson in 1959 measuring demand for and value of outdoor recreation (Johansson 1993). The TCM postulates that every user of a recreation site pays a price measured by his/her travel costs, and this is construed to be at least a lower limit to their valuation of that site (Allison *et al.,* 1996). Travel cost is a function of the distance of the traveller's residence from the park (referred to as the distance decay function), and the distance is again relevant to the number of repeat visits (Hanley and Spash 1993; Johansson 1993; Layard and Glaister 1994). Accordingly if travel to a particular forest were to become prohibitive, i.e. consumptive expenditure is

zero, then the marginal utility of the forest is also zero. This is clearly absurd in the context of evaluating environmental goods, and clear evidence that TCM is not designed to estimate non-user values of an environmental good. However, TCM has an application for calculation of changes in consumer surplus that can be incorporated into the CVM for recreational resources, where consumptive expenditure is more than zero (Hanley and Spash 1993; Johansson 1993). However, it could also be construed to be a poor measure of consumer surplus as the method only captures those for whom a visit is financially viable. TCM uses actual behaviour rather than implicit (CVM), but it only captures user values. Some other problems of the method are that it does not capture planned visits or the proposed frequency of them, variations in tastes, incomes, substitutability etc., across the population zones. It is also hard to imagine how TCM can reveal demand for all the goods and services provided by ecosystems (Johansson 1993).

Hedonic Pricing (HP) was developed by Rosen (1974), and uses property values (marketed goods) as a source of information on benefits provided by non-marketed public goods (environmental value), and on measures taken to reduce externalities (Abelson 1979; Hanley and Spash 1993; Johansson 1993). Generally regarded as the most theoretically rigorous of the economic valuation approaches, the method postulates “any differentiated product unit can be viewed as a bundle of characteristics, each with its own implicit, or shadow price” (Allison *et al.,* 1996:11). House prices are assumed to include the “…capitalised value of environmental quality to the home-owner” (Hanley and Spash 1993:75). The most popular approach is to estimate the implicit prices of the characteristics, which differentiate the closely related products eg. houses with and without views, or with and without noise pollution and so forth. If data on characteristics and market prices are available, then the contribution of various factors can be isolated, and using econometric techniques the market price of a private good (house) can be used to estimate the value of a public good (view). The presence or absence of forest or a waterway nearby has been shown to have a large positive impact on house prices (Allison *et al.,* 1996) (Table 2.2)

Table 2.2. Examples of recent HP studies of countryside characteristics on house/property prices (Source: Allison *et al.,* 1996; Pearson *et al.,* 2002).

Countryside Characteristic	Effect	Source
Presence of forestry (20% woodland cover)	>7.1%	Garrod and Willis 1991a; 1991b
Presence of a canal or river	>4.9%	Garrod and Willis 1991b; Willis and Garrod 1993
A glimpse of Noosa National Park	>7%,	Pearson, Tisdell and Lisle (2000)
Proximity to Noosa National Park	0%	Pearson, Tisdell and Lisle (2000)
Properties to the south of Noosa National Park, compared to those to the north.	<15%	Pearson, Tisdell and Lisle (2000)

The method is prone to misinterpretation due to supply demand functions of houses per se, as well as assumptions about inclusions, quality, market segmentation, etc., irrespective of externalities. Nor may it be of any relevance when dealing with many types of public goods (eg. other than views) (Johansson 1993). Moreover, like TCM, HP does not estimate non-user values (option, bequest and existence values) (Hanley and Spash 1993; Allison *et al.,* 1996). The inability to be able to measure non-user values can lead to gross undervaluations of resources by both the TCM and HP method.

Owing to the general lack of confidence in the outcomes of valuations of non-market goods and services in the environment, and uncertainties due to lack of knowledge of the resistance and resilience of ecosystems, a decision-making model that takes into account pecuniary and non-pecuniary quantitative values is needed. Multiple Criteria Analysis (MCA) is one such technique. MCA has the ability to incorporate information about alternatives from a variety of sources, convert it to standard units of measure, weight the data according to magnitude and significance, test for sensitivity, and rank alternative options (Nijkamp 1975; 1988; Paelinck 1976; Voogd 1988; KPMG 2000). Environmental, social and cultural trade-offs become more explicit and can be considered in the process. Data can be collected by routine surveys and on an *ad hoc* basis supported by detailed ecological, cultural, economic, transport and social research (Rivett 2000). Non-market goods and services can be evaluated by way of revealed or expressed preference surveys in accordance with the CVM. Variations of CVM include Contingent Ranking, Contingent Rating and Paired Comparison, all of which require the respondents to rank or rate attributes and their levels relevant to a natural

resource. A more recent methodology within the CVM, is known as Choice Modelling (CM) and is more firmly grounded in economic theory and less prone to the biases and limitations of WTP/WTA surveys. CM is capable of both relative and absolute measures. Levels over which attributes of a resource can vary under different policy options are listed and arranged in a manageable number of choice sets of two plus a no-change scenario. Respondents are asked to choose, and the results are analysed using a conditional multinomial logit regression model. The individual attributes and aggregate values are derived from this model (KPMG 2000). Boxall *et al.,* (1996) undertook both a CVM and CM study of environmental quality change on non-market recreation values and found a considerable difference between them, possibly due to the CVM respondents not considering substitution possibilities. Another stated preference model trialed in Australia in recent years was the 'citizens', or 'values jury', where the participants were able to be given sufficient information to overcome some of the biases of the CVM (Lally 1999; CSIRO 2002).

Recognition of the limits and constraints of the CVM used to estimate the values of environmental attributes is essential for practitioners if the methodology is to be given due weight in decision-making. However, the CVM is a poor substitute for market value, lacking empirical verification (by way of revealed preferences) (Bennett and Carter 1993). Ideally a method that incorporates choice amongst attributes, contingent ranking of attributes and criteria, sensitivity analyses, and empirical verification of preferences is required to overcome the common criticisms of communication (of a hypothetical market), embedding, strategic bias and validation. Unlike real property valuation principles and practise, economic valuation procedures such as TCM, HP and CVM are not subject to judicial sanction or legislative control in Australia (Lally 1998).

Chapter 3
Literature Review

3.1 The Emergence of Environmental and Ecological Economics

The formal field of economics arose from its origins in moral philosophy more than two centuries ago during the transition from an agrarian society to an industrial one. Sir William Petty, who amongst other accomplishments was the Valuer General for Ireland, is credited as the founder of the new science in Britain, then aptly named 'Political Arithmetric' (Murray 1954). The proposition was that material security could help to establish moral progress. If people were able to satisfy their basic needs (food, shelter and clothing), then they could pursue moral and social improvement (Common 1996; Costanza *et al.,* 1997b). However this proposition did not account for individual materialism, which by and large was responsible for the 'tragedy of the commons' (Hardin 1968), described in economic terms by Borcherding (1991) as a misallocation of resources. Adam Smith (1723-1790) was credited with the first 'full scale treatise' on economics in 1776, and coined the metaphor 'the invisible hand' to describe how markets guided individual behaviour to the common good (Common 1996), or as Costanza *et al.,* (1997b:20) put it, to follow "one's own interests might hurt society as a whole". In the context of conservation, a market will be efficient in the sense of maximising welfare, if the price paid for a good or service is an accurate representation of its value to society (Allison *et al.,* 1996).

Due to the reductionist paradigm, early scientific disciplines were divorced from each other, developed their own cultures, language and worldview. Economics became increasingly isolated from the natural resource (land) component of the 'land - labour - capital triad', ie. it developed a growing isolation from the natural sciences. Theory held sway over pragmatism, and economics was modeled on the disciplinary organised model of physics (Costanza *et al.,* 1997b). By the 1970s, economics was highly specialised and divided into two main disciplines: the micro-economics of supply and demand and prices and the study of the behaviour of individuals, and the

macroeconomics of growth in human capital and whole economies (GNP) (Costanza *et al.,* 1997b; Field 1997). Economics was thus abstracted away from earlier connections with the natural environment (Costanza *et al.,* 1997b).

Environmental economics emerged in the 1970s as a response to several stimuli, one of which was the challenge to the classical perspective that the natural environment did not figure at all in the modern analysis of economic growth (Common 1996). The new discipline involved the application of the principles of economics to environmental or natural resource use, development and management, and included the economics of pollution, damage assessment and restoration (Common 1996; Field 1997). Environmental economics is more concerned with normative economics (what 'ought to be' rather than what 'is'), as issues to do with the environment involve value judgements (Field, 1997). However, it soon became apparent that it was not only the growth or profit motive, *per se*, that caused environmental degradation. The collapse of communist regimes in Eastern Europe and the former USSR revealed immense environmental destruction and pollution. Yet this took place in countries whose economic system completely lacked a profit motive (Ponting 1991; Field 1997). Environmental degradation is not solely attributable to unethical or immoral human behaviour, but rather it is due to the way the economic system is arranged with incentives that are not properly structured towards environmental safeguards as a necessary condition for a reasonably progressive economy (Field 1997).

The science of ecology arose mid 20th Century with it's origins in biology and natural history and it had a clear philosophical difference from the science of economics. Ernst Haeckel (1834-1919) had first coined the term 'oecologie' in 1866 and in 1870 the first definition of Haeckel's term was translated (Costanza *et al.,* 1997b:36):

"By ecology we mean the body of knowledge concerning the economy of nature - the investigation of the total relations of the animal both to its inorganic and to its organic environment including above all, its friendly and inimical relations with which it comes directly

or indirectly into contact - in a word, ecology is the study of all of those complex inter-relations referred to by Darwin as the conditions of the struggle for existence".

The prefix *'Eco'* in both economics and ecology comes from the Greek word *'oikos'* meaning household, such that ecology is interpreted as nature's housekeeping, and economy the study of housekeeping in human society (Common 1996). Opposing prescriptions as to how people should interact with the environment distinguished the two disciplines of economics and ecology. Moral, material and scientific belief in industry and technology had moulded economic thought to conclude that the underlying natural laws would be overcome in order to prevail over elements of scarcity in natural resources (Costanza *et al.,* 1997b). Economics and ecology had some common theoretical concepts, however otherwise, in their popular manifestations as economism and environmentalism:

"…these disciplines became juxtaposed secular religions, preventing the collective interpretation and resolution of the numerous problems at the intersection of human and natural systems" (Costanza *et al.,* 1997b:49).

Economics came to be termed the ecology of humans, while ecology became the study of the economy of that part of nature that did not include humans. However, within a decade or so, natural historians and then ecologists had managed to convince some economists that the "evolving, complex and uncertain system", that was the environment (Costanza *et al.,* 1997b:20), was sufficiently important and at risk, for a collaborative approach to be taken (Turner 1995; Costanza *et al.,* 1997b; Hackett 2001). Environmental economics had by no means been the ultimate solution, being described as "a single grandly conceived coherent theory", but as conceptually monolithic as neoclassical economics (Costanza *et al.,* 1997b:20), The main distinguishing feature of environmental economics was how externalities (eg. pollution) were dealt with. In neoclassical economics they were ignored. In environmental economics they were internalised, ie. compensated. That is to say pollution could be accommodated provided the polluter paid (Field 1997).

Eminent classical economists including Adam Smith, Thomas Malthus (1766-1834), David Ricardo (1772-1832) and Stuart Mill (1806-1873) were primarily

responsible for economics becoming known as the 'dismal science', owing to their gloomy outlook on the finite nature of resources (Roll 1961; Common 1996; Costanza *et al.,* 1997b). Models of how agricultural practices were patterned on the land in response to population growth and changes in food prices as devised by Ricardo (1772-1823), and conditions under which either conservation or depletion of a natural resource took place, explained by Hotelling (1895-1973), were critical to our understanding of the complex interrelationship between human survival and ecological life support systems (Hotelling 1931; Costanza *et al.,* 1997b; Hackett 2001) The Ricardian model posited that food production on fertile land produced a margin over production costs, which became known as Ricardian rent, and generally accrued to the landlord. This led to either more intensive practices on the fertile land, or clearing and cultivation extending further into less fertile and previously undisturbed land (Common 1996; Costanza *et al.,* 1997b). A combination of reduced output, and increased labour costs on marginal land led to diminishing returns, which along with the Malthusian interpretation of population growth and food supply helped to explain the pessimistic view of the classical economists. However, Ricardo and Malthus were men of their time and either failed to consider or include in their predictions the possibility of technological innovations, and increased land availability in America, Africa and Australasia by colonisation and migration (Common, 1996).

Meadows *et al.,* (1972) in their book 'Limits to Growth' put forward a similar proposition to the classical economists two hundred years earlier. As natural scientists and systems analysts, they modelled and predicted a future based on the then current trends. The outlook was not good, however the book was not intended to be a harbinger of doom, rather it was about choice and contained a warning (Meadows *et al.,* 1992). In 1972, the book created a furore, and with few exceptions it was denied by economists (Common 1996). Twenty years later the sequel, 'Beyond the Limits' published in 1992 reinforced the warning, natural resource extraction had exceeded the limits, and it appeared that there had been little that economists had been able to do in the intervening period to reverse the trend (Meadows *et al.,* 1992).

While John Stuart Mill (1806-1873) was one of the first to argue for conservation of biodiversity, and against conversion of natural capital to human capital, he was convinced that competitive economics had to be based on the rules of property ownership and use and that competitive markets were essential to freedom (Common 1996; Costanza *et al.,* 1997b). On the other hand Karl Marx (1818-1883) rejected absolutely the concepts of rent and interest as necessary prices and insisted on a labour theory of value that entirely neglected nature's contribution (Common 1996; Costanza *et al.,* 1997b), which led to extraordinary environmental degradation and destruction in communist countries. Unlike Ricardo and Malthus, Mill also believed that technological progress would raise the standard of living to a point where economic progress was no longer necessary, thus obviating concerns about depletion of nature's finite resources (Common 1996; van den Bergh 1996). Moreover, Mill was a rarity in his profession, describing land as having other than pure production or economic value, being important to humans for 'living space', recreation and aesthetics (Common 1996).

Around 1870 classical economics began to evolve into what became known as neoclassical economics, with the Marxist labour theory of value abandoned, and an emphasis put on the relative rather than the absolute scarcity as a measure of a commodity's price, irrespective of the amount of labour required to produce the good. Elementary was the demand for the good relative to supply (Common 1996; van den Bergh 1996; Hackett 2001). The major concern for the new economists switched from continuing long-term economic progress to price determination using marginal analysis and the structure and pattern of economic activity. This new interest was all that is now known as microeconomics. However, shortly after, J. M Keynes (1883-1946) introduced a new school of economics that dealt with broadly defined aggregates of economic activity and input-output modeling rather than the smaller individual situations, and argued that they did not carry over unmodified to the large. This new school was termed macroeconomics. Macroeconomists did not revert to the classical model of growth with its grim prognosis (due to the finite nature of natural resources) instead they totally excluded the natural environment in their analysis of economic growth,

leading to a falsely optimistic view of material progress (Common 1996; van den Bergh 1996). Mainstream economics today argues that environmental problems are a result of the pattern of economic activity and not the overall level, which, as previously stated, was one of the stimuli leading to the emergence of environmental economics (Common, 1996).

During this evolutionary period Harold Hotelling (1895-1973) had argued that depletion of a resource only occurred when it was not generating a flow of income in its natural state at a rate equal to or greater than the rate of interest (Hotelling 1931, Hackett 2001). There is no disputing this argument on purely financial grounds. Investors would clearly benefit by depleting a resource and investing the money in other more attractive investments in the economic system. This argument also raises issues to do with the interest rate. While low interest rates may on the surface appear to encourage conservation, they also increase the competition between projects on a temporal scale, thus long-term projects with rising interest rates will be passed over in favour of short-term projects (Costanza *et al.,* 1997b; Hackett 2001). However, from an intergenerational equity perspective Costanza *et al.,* (1997b) suggested that as much of ecosystem loss is irreversible, in the future the value of ecosystems 'should' be 'deemed' to increase at a rate greater than the cost of money. Young (1993:28) also argued that from the same perspective:

"…if governments want to promote a transition to ecologically sustainable development they would be well advised to consider changing policies that determine the underlying real interest rate in the economy".

Ecological economics emerged during the 1980s in the context of a general discontent of both economists and ecologists with the inability of the ruling paradigm to properly and holistically bring about improvements in environmental policy (Costanza *et al.,* 1997b). Macroeconomics had also ignored the depletion of natural capital (raw materials) in the national accounts (GNP/GDP), yet included the cost of cleanup as a measure of economic progress. Links between the 'old' and the 'new' economics and environmental impact analysis are shown in Figure 3.1. The Elsevier Science Journal 'Ecological Economics' describes the integration of economics and ecology as

necessary due to 'conceptual and professional isolation' which has 'led to economic and environmental policies which are mutually destructive rather than reinforcing in the long term' (Elsevier 2002:1). The journal describes itself as 'transdisciplinary in spirit and methodologically open', and invites contributions for research into (amongst others), 'natural resource valuation, critical assessments of the basic assumptions underlying current economic and ecological paradigms and the implications of alternative assumptions, and alternative principles for valuing natural wealth' (Elsevier 2002:1). Recent papers published in a special issue of the journal in June 2002 exemplify the current diversity of approaches to environmental valuation and are described in Table 3.1.

Table 3.1. Examples of various approaches to environmental valuation published in the June 2002 issue of the journal of Ecological Economics.

Method or proposition	Findings	Reference
Addresses the calls for more deliberative forms of environmental valuation. Group deliberation rather than individual preferences in social isolation regarded as more likely to lead to fair outcomes.	Moves the normative concept of social equity to the forefront, and focuses attention on discourse-based methods.	Wilson and Howarth 2002.
Light energy emissions (at night) by countries were used as a surrogate for economic activity and perceived to be more spatially explicit than GDP. GDP and ecological services product (ESP) using Costanza's (1997a) values were summed to equal the subtotal ecological and economic product (SEP). The ratio of ESP to SEP x 100 = %ESP as a measure of industrialisation, and hence scarcity of ecosystem services.	GDP is concentrated in the northern industrialised countries, and ESP concentrated in wetlands, tropical and coastal regions. The highest SEP was found to be in countries like Chile, Brazil and Russia.	Sutton and Costanza 2002.
Complexities and the non linear dynamics of ecosystems were examined in the light of human pressures on the planet, with a proposed switch from resource choice valuation techniques to cost avoidance of catastrophic ecosystem change.	Economic welfare values were found to be a poor measure of natural values as being vague and temporally inexplicit. Preference given to ecologically-based measures or indicators of condition and scarcity.	Limburg *et al.,* 2002
Ecological pricing (ratios that measure the price of an ecological commodity, eg. solar energy per kilogram of apples) were used to measure use and non-use values (not simply for humans) of biosphere processes.	Primary ecological inputs (services) for the earth in 1994 were estimated to be about US$25 trillion. This shadow price was found to be similar to the price for all marketable goods, except fossil fuel.	Patterson 2002.
Contributions of the originating ecosystem and an analysis of network flows in ecosystems were used to calculate 'captured ecosystem values' resulting in an index for these values being developed.	The values were found to be inconsistent with market (fish catches) and supply-side values (the ecosystem) leading to policy implications for natural resource extraction.	Gustavson *et al.,* 2002.
A global model was developed which included the dynamic feedbacks among human technology, economic production and welfare and ecosystem services on earth. The model (GUMBO) had modules that were linked through 11 biomes to simulate elemental and nutrient fluxes as well as water through the atmosphere, hydrosphere, lithosphere and the biosphere. Social and economic simulations take place in the anthroposphere.	Relative values were assessed on the basis of the contributions of ecosystems to support conventional economic production and human well-being. Global ecosystem services were estimated to be worth about 4.5 times global World Product in the year 2000.	Boumans *et al.,* 2002.

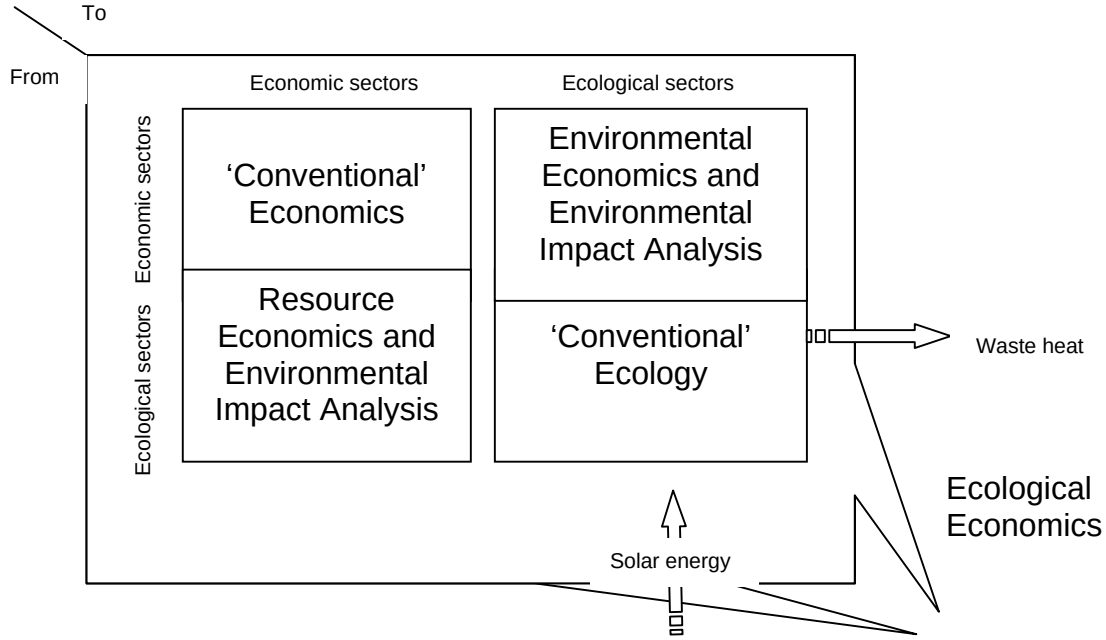

Figure 3.1 Links between the 'old' and the 'new' economics and measures of impact analysis (Source: modified after Costanza, Daly and Bartholomew 1991)

Irrespective of the emergence of this new paradigm, the poor still had little choice but to use whatever they had in an unsustainable way. They were also excluded from productive land and forced to work fragile marginal land that would otherwise be left in its natural state as well as depleting forests for lumber and firewood (Brady 1988; Wilson 1988a; Costanza *et al.,* 1997b). So it is the nature of the global economy and how specific economies interact with nature that dictates who receives the rent from resources, the country of origin or foreign commercial interests. Pigou (1877-1959) was the first to show how costs and benefits not included (when they should be) in market prices affect how people interrelate with their environment (Anderson 1991; Costanza *et al.,* 1997b). Biodiversity is not adequately protected because it is not included in market signals that guide economic decisions of producers and consumers, and in turn the whole economic system (Hanemann 1988; Randall 1988)

Ecological economists also argue that ecosystems are being lost because they do not have prices acting as a negative feedback to keep use in equilibrium with availability. Reserves typically reduce human pressure within

the protected area, but increase them beyond it. Including the value of ecosystems in the price system (market signals) will benefit both every sector of the economy, and ecosystems (Hanemann 1988; Randall 1988). This idea is consistent with the notions of biologists that if the true value of species or biodiversity were understood, it would be conserved. If the true value of species or biodiversity were included in the market system, the markets themselves would assist in conservation (Hanemann 1988; Randall 1988). This is also important for how costs and benefits of development that may impact on ecosystems are valued. Market systems mean every market can and does impact on others, ie. they are all related. A price for any ecosystem is dependent on other ecosystems or substitutes ie. no one ecosystem has a single value, as this concept would refute economic and ecosystem interrelatedness. Environmental valuation can assist in understanding (at least) the minimal importance of ecological services, and conveying this to the public for the common good and for political imperatives (Costanza *et al.,* 1997b; Heal 2000).

Further evidence of the continued development of non-market valuation techniques in Australia, and further refinement of the existing methods is best exemplified by the publication of a 'special issue' of the Journal of the Economic Society of Australia (Queensland) in June 2002. Articles featured in the issue were based on research projects that took place over the last, say, 6 years, and used a variety of the techniques:

- Driml (2002) used the TCM to estimate consumer surplus generated with respect of annual visits by Australian tourists to the WTWHA and addressed criticisms of the TCM as not providing an absolute measure of welfare by using different methods of estimating travel cost, which led to different but statistically acceptable measures of consumer surplus. Driml came up with a figure of $83 to $166 million year^{-1} which translated to about $100 to $200 million year^{-1} in 2002 prices, or $112 to $ 224 ha^{-1} year^{-1}.
- Tisdell and Wilson (2002) attempted to estimate the increased value that World Heritage listing ascribed to sites, and drew on international

visitor time-series data for empirical evidence. Then applying the TCM they estimated the demand curve for visits to a natural area. In so doing they identified a number of limitations or qualifiers to the use of TCM:

1. Travel cost is not a revealed preference method as previously supposed, it is an *anticipated* preference method. Neoclassical welfare economics argues that the before and after demand curve for both should be very similar due to the consumer being assumed to be fully informed. Such is rarely the case in destination travel, as it is essentially a journey of discovery, and considerable potential exists for the before and after demand curve to be substantially different. This experiential issue can lead to either under or over valuing recreation at WH listed sites, and has not been taken into account in any previous studies in Australia.
2. Multi-purpose trips pose a considerable problem where the whole cost of the journey is used to estimate the recreation value of an individual site. Although it has been proposed that this can be overcome by using the recreational point of origin, rather than the home point of origin. The former would obviously lead to an overvaluation and the latter an undervaluation.
3. The spatial extent of and distances between WH listed properties, particularly in Australia. TCM is a site-based technique rather than regional, and very large and diffuse WH listed areas such as the WTWHA, Kakadu and the Great Barrier Reef (GBR) raise considerable difficulties. A visitor from Melbourne accessing the GBR at Bundaberg may have considerably lower costs than one accessing the reef at Cairns.
4. Other problems could involve the economic value of time across individual members of a party travelling together.

- Rolfe and Bennett (2002) used the choice modelling (CM) technique to assess peoples' value preferences for conservation. A random sample of Brisbane residents were asked to reveal their preferences for conservation of rainforests in Queensland, NSW and overseas. To

address the issues of location, features and qualities of the choices, it was found to be important to be able to 'distinguish between different components of value and to prioritise between a set of alternatives'. The respondents chose location as possibly the most important attribute to them, and being Brisbane residents the results showed that they were parochial in ranking the choices as Queensland, then Australia, and overseas.

- Eono and Harrison (2002) worked up a CBA of a rainforest reforestation program in North Queensland with several stated objectives and found it to be marginally justifiable in economic terms. However, some intangible benefits could not be quantified, including the 'social healing' after the local hostility to declaration of the WH listing of the Wet Tropics, and the research value of a wide variety of tropical rainforest timbers in plantations. Surveys were conducted with landholders and local governments and responses to the benefits ranked and scored. Estimates of non-wood benefits were of the same magnitude as wood benefits and carbon sequestration accounted for more than half the non-wood benefits, suggesting the possibility of an early cash flow.
- Duthy (2002) undertook a contingency valuation study to determine community support for dedication of Whian Whian State Forest in northeastern NSW as a new National Park. The two most important uses of the forest were found to be water catchment protection and habitat for endangered species. Respondents placed strongest values on bequest, existence and non-consumptive use values, and weakest on the productive functions of Whian Whian. The mean WTP for the non-consumptive use and non-use values was \$18.89 year^{-1} for three years (median \$10). Response rate for the mail out survey was low (26.5%) however it was supplemented by a telephone survey. The population of the LGAs from which the sample was drawn was 119,148, thus the value of non consumptive uses and non-uses was put at \$1.19 million year^{-1} using the median bid, to \$2.25 million year^{-1} using the mean bid, excluding the recreation value ascribed to potential

visitors from outside the LGAs. Whian Whian comprises 5567 ha of State Forest, so these estimates equate to a range of from $214 to $404 ha^{-1} $year^{-1}$ for non-consumptive uses and non-uses. Duthy says by transferring recreational values estimated for Dorrigo National Park and Gibraltar National Park, also in northern NSW, these could add another $264 to $298 ha^{-1} $year^{-1}$ to the total for Whian Whian.

- Cook and Harrison (2002) discussed the economic modelling of long distance walking track proposals for the Wet Tropics of Queensland and suggested use of a social cost benefit analysis. A walking track is a recreation asset and it can be modelled in a market framework with estimates made for supply and demand, market clearing prices can be determined and implications drawn for introducing user-pays mechanisms. TCM can be used on the basis of benefit transfer from comparable situations, or stated willingness to pay for the proposal. The social cost benefit analysis was seen to be a complex task and would involve estimates of the effect of competition with existing tracks, alternative funding options as a function of supply, and information about efficient pricing.
- Herbohn and Henderson (2002) reported on the current interest in including environmental externalities in conventional financial reporting systems, the potential role of non-market value estimates and examined the feasibility of developing a financial environmental reporting system for an Australian public sector forestry organisation. The applicability of non-market valuation methods was discussed. The flexibility of CVM was seen to be an advantage but may have raised concerns with accountants as to subjectivity. The same criticism applied to TCM, and it was thought to be only useful in limited circumstances relating to outdoor use. While it was found that the development of a system was feasible there was strong stakeholder opposition and some resistance by managers to reporting non-market values due to several factors:
  - the ‘erosion of their lobbying base’;
  - ‘cynicism regarding CBA’;

  - ‘outrage at the quantification of intrinsic, environmental, social and cultural aspects of forests’;
  - ‘potential bias in measurement techniques’;
  - ‘the technocratic and exclusive nature of non-market values’, and
  - ‘the absence of a generally accepted environmental performance index against which to report’, and other philosophical objections (p151).
- Pearson, Tisdell and Lisle (2000) used the HP method to estimate the impact on unimproved land values of housing allotments based on the views of and proximity to the headland section of the Noosa National Park. It was found that a glimpse of the park increased land values by 7%, while proximity had no effect, and properties to the south of the headland were only worth 85% of comparable properties to the north. Land values ascribed to proximity to and views of the ocean far outstripped those of the National Park.
- Harrison (2002) performed an abbreviated study of the ‘visual disamenity cost’ associated with installation of high voltage power lines in the Wet Tropics of Queensland using a variety of approaches: a simplified TCM to estimate disamenity to ecotourism operations, compensation payments to agricultural operations, and a simplified HP approach for residential property values. The initial intention to conclude the study with a CVM did not proceed owing to lack of funding, and the author notes that the results of a CVM would undoubtedly generate negative publicity which would galvanise opposition to the development, hence the funding difficulties. The research was inconclusive.

The most important difference between neoclassical economics and ecological economics is that in the economic triad: allocation, distribution and scale, neoclassical economics ignores scale. Scale is of primary importance to ecological economists, as it describes the throughput of the economy, from low entropy matter and energy to high entropy waste. Scale can be measured as the product of population times per capita resource use, and it is relative to

the natural and sustainable capacity of the earth to provide materials and absorb waste (Turner 1995; Costanza *et al.,* 1997b; Hatch 2001). Common (1996), succinctly puts it, that:

"…continually increasing flows of natural resources into production implied by continuing economic growth cannot be indefinitely sustained".

Thus ecological economics is unashamedly ideological in its pursuit of a 'steady state economy', a concept introduced and described by Daly (1993) as recognising the finite nature of earth's resources, where the economy is a subset of the global ecosystem, and where growth is bounded by a level of sustainable use of nature's resources consistent with maintenance of a steady state. The 'Earth Summit' (United Nations Conference on Environment and Development, UNCED) held in Rio de Janeiro in June 1992 put the concept of sustainability firmly on the agenda (WCED 1987). This led to the creation of a new United Nations agency, the Commission for Sustainable Development, to oversee the implementation of *'Agenda 21'* (Commons 1996). '*Agenda 21'* is an 800 page document aimed at attaining global sustainable development, with over 100 programs, many involving resource transfers from the developed to the developing nations (Commons 1996). Commons (1996) interprets the global interest and outcomes at UNCED to indicate wide acceptance of the need to address economic and environmental problems arising from the juxtaposition of the economy and the environment. While the original concept of sustainability was economic, ESD was soon to be interpreted as environmentally, or ecologically sustainable development. ESD is about conserving a minimum limited amount of resources to pass onto future generations (Costanza *et al.,* 1997b; Hackett 2001). Neoclassical economists chose to ignore the way the initial distribution of resources affects subsequent allocation in markets, which exacerbated the 'richer-richer', 'poorer-poorer' syndrome, and was largely responsible for the increased inequity and environmental destruction in developing countries continuing even now, 50 years after the international development programs were established post WWII (Mishan 1972; Costanza *et al.,* 1997b; Field 1997). However, the concern with equity has Marxian overtones, and perhaps led to the emergence of yet another discipline, 'social and political ecology', where Marxian frameworks of analysis are used in research on "power, poverty and

environmental transformation" (Costanza *et al.,* 1997b:75). The overlap of ecological economists with political ecologists is significant, as is the diversity of patterns of thinking and of the multi-disciplinary roots of current exponents of ecological economics (Costanza *et al.,* 1997b).

CHAPTER 4
LITERATURE REVIEW

4.1 Valuation Theory and Practice

As has been evidenced in the previous two chapters, much controversy surrounds attempts to value the environment, not the least being the odium that attaches to applying a monetary value to nature's beneficience. The term 'value' is judgement-laden, and despite 50 years of development of valuation techniques by the various sub-disciplines of economics, no widely-accepted method appears to exist which unambiguously identifies the value of a whole ecosystem, or a component of it (Lally 1999).

Every use of land has an opportunity cost, that being the existing use or other uses to which the land could be put (the use foregone) (Edwards 1987; McNeeley 1988; Frank 1991). The value of a conservation area should be at least as much as the cost of preserving it, or measured by the cost of the foregone opportunities, as the area cannot be developed or redeveloped (Allison *et al.,* 1996). McNeeley (1988:33) described marginal opportunity cost as a 'very useful tool in making decisions about allocation of resources'. Moreover, McNeeley (1988:33) argued that marginal opportunity cost:

"…can be used as a means by which those who will lose from having restrictions placed on their use of biological resources can be compensated to recover the value of their lost opportunity".

Marginal opportunity cost can be expressed in terms of the annual net revenue foregone, in which case it would be capitalised, resulting in a land value in restricted and unrestricted use (McNeeley 1988). These concepts clearly link the natural production function of land with land valuation procedures. As ecosystem services are the production function of land in its natural state (the *Usus Fructus per annum*), and as ecosystem services are essential for planetary life support, it could be argued that the provision of ecosystem services are the 'highest and best use' of land. It follows that apart from the economic valuation procedures described in chapter 2, the value of non-market environmental attributes can be derived indirectly by using prices from a related market which does exist (Allison *et al.,* 1996). Young (1993:8)

proposed a rule for maintenance of natural capital (allowing for some trading between different forms of natural capital), that being:

"Economic development is consistent with intergenerational equity if and only if opportunities to use, enjoy and consume natural capital are conserved and we do not increase the risk of irreversibly changing essential ecological functions and processes".

The principles of land valuation predate modern economics and consist essentially of precedents in English Common Law. In order to demonstrate this chronology some older authorities have been purposely cited, along with more current ones. In Australia, valuation practice has been greatly elaborated and replaced by legislation, most of which was first enacted in the late 19th and early 20th century (Herps 1942). By far the majority of this legislation is to do with taxing laws (Herps 1942). Current methods of valuation have been derived largely from decisions given by eminent judges of the Supreme Court in various States, the High Court of Australia, and of the Privy Council (Herps 1942; Hyams 1986). These authorities have ruled that the term value means value in the open market, which is then often appealed to a higher court. The precedent followed by all Courts in Australia when dealing with the valuation of land, under the Land Acquisitions Act and pre-dating the Federal Land Tax Act by many years is, Spencer v The Commonwealth in 1907 (5 CLR 418). Griffith C.J. in that case put the test in the words:

"In my judgement the test of value of land is to be determined, not by inquiring what price a man desiring to sell could actually have obtained for it on a given day, i.e. whether there was in fact on that day a willing buyer, but by inquiring what would a man desiring to buy the land have had to pay for it on that day to a vendor willing to sell it for a fair price but not desirous to sell" (5 CLR 418).

The opening words by the Hon Sir John Morris to the first edition of the *Principles and Practice of Valuation* in 1949 still hold true today. Judges and arbitrators are as much valuers as the professional valuer, although:

"…at times in no other respects than that he is unfeed for either side and his opinion is happily un-cross-examinable and unappealable. His whole anxiety is to steer clear of mere owl-like wisdom and reach a conclusion for which he can show satisfactory grounds"

(Murray 1969: Foreword).

Morris continued with the words of Dixon J. in *'The Minister of State for the Navy v Rae':*

"It is necessary or, at all events wise, to pursue as many means of estimation as are open, to compare them and, then, as an exercise of judgement, to fix what upon consideration this process suggests to be fair compensation" (70 CLR 339 at 334).

Morris referred to Murray's own words (1954:70-71) in support of the task of a valuer:

"The task of a valuer is to ascertain values. The value of a property at a particular date is something to be discovered; the steps whereby such value is determined must be logical, and all evidence of value must be sought and carefully weighed. In the final analysis, the competence of the valuer is revealed by the fact that he is able to show, if necessary, to the satisfaction of a court, that he has brought to bear upon the problem an intimate knowledge of all factors pertaining to the value of land, and has reviewed and coordinated them with the degree of skill only to be obtained from a thorough training in his profession."

Land (real property or real estate) has long since been regarded as different from personal property, in that under common law no person can have an absolute title to real property. Theoretically absolute ownership in Australia vests in the Crown, who may resume, provided proper compensation is paid, the land and the wealth upon it (Herps 1942). Land that is divested from the Crown, either freehold or leasehold and subject to local government rates and taxes is described as alienated, ie. alienated from the Crown. The utilisation of land in a way that benefits both the individual owner and society, remains one of the principal problems in the world today, particularly in developing nations where the poor often have little choice but to deplete or degrade natural resources to earn a living (Nations 1988). Public opinion and legislation have worked together in most developed countries to limit misuse of land, however without a practical method to assign value to land in its natural state as being worth at least as much as all the other uses to which land is put, and increasing in value at a rate greater than the rate of interest (Hotelling's rule), it will be converted to other uses (Hackett 2001). Despite this narrow economic reasoning it may be prudent to maintain ecosystem function as an option until further work is done and policy objectives properly defined in regard to the economic foundations (and financing) of nature conservation, particularly on private land (Costanza *et al.,* 1997b).

Nations, states and the local authorities have, from time immemorial, possessed a beneficial interest in all privately owned lands as being the basis of taxation and for local rating purposes (Murray 1954; 1969). The use of the value of land expressed in various forms as the means of collecting revenue is acceptable throughout the civilised world (Inglis 1960). The basis of rating in most states of Australia and most countries of the world is the unimproved capital value of land, or termed 'site value', although previously in some states and currently in Tasmania the Assessed Annual Value (*AAV*) was/is used for some taxes (Blackwell 1994). The *AAV* was defined by Hyams (1983) as 9/10^{ths} of the Fair Average Annual Value or 5% of the unimproved value, whichever is the greater. The definition of unimproved value (*UV*) of land used in the Commonwealth Act and used in connection with and defined by the taxing laws of Australia and the States and New Zealand was:

"…the capital sum which the fee simple of the land might be expected to realise if offered for sale on such reasonable terms and conditions as a bona fide seller would require, assuming that, at the time the value is required to be ascertained for the purpose of this Act, the improvements did not exist" (Lambert 1932:15).

This was not interpreted as 'the original value as if the State had not been developed', nor 'the present value as if all the land in the district had not been developed', but as if 'it, the particular parcel alone, had not been developed', and all the other land in the locality in the condition (improved or unimproved) existing at the time of valuation. That is:

"…the increased value attaching to any particular piece of land which is due to the successful working of other people's land in the district, or the progressive works affected by the State; the general prosperity of the country, all form a portion of the 'unimproved value."

(Lambert 1932:15).

The *UV* is the 'fee simple in possession' of the land, which is the most absolute form of possession that any legal entity can hold under the Crown, limited only by the conditions contained in the original grant from the Crown, and excluding any subsequent restrictions, leases, easements and other charges (Lambert 1932). Herps (1942) described unimproved value as the value of a natural resource or an opportunity. The courts insisted that the improvements on the subject land were to be ignored. However, the courts also insisted that communal effort, the presence of government utilities, such

as transport, water, gas, electricity, and the proximity of a dense population were all to be considered (Herps 1942). More particularly Herps (1942:107) stated that:

"The value of a particular piece of land is the value of civilised government at that spot. It is the value which the presence of the community gives to the land and which the community unconsciously assesses. It is something which is already in existence and must be discovered, not invented... It will be seen, therefore, that unimproved value is in reality the capital value of the economic rent of a piece of vacant land or other natural resources."

This view was supported by a judgment of the Privy Council on Appeal on July 1st 1957 in the matter of Tetzner v. The Colonial Sugar Refining Co. Ltd. The official valuer, Tetzner, had valued the unimproved value of a sugar mill in Lautoka, Fiji on the basis of it being devoid of all improvements but in its existing environment. Sir Garfield Barwick for CSR argued that to value the subject land on the basis of the values of surrounding lands, which were due largely to the existence of the mill, was unfair in that it taxed the company on the basis of values that it had itself created. It was held by the Privy Council that the land was to be valued as situated 'in the community with the amenities which have grown up around it' (Principia 1958).

In Biblical times and ancient Greece and Rome, many parallels can be found that support modern valuation practice. The Mosaic Land Laws were based upon the assumption that the estate in fee simple rested with God, with no permanent ownership ascribed to an individual (Murray 1954, 1969). Perhaps another way of saying that the value of essential life-supporting natural resources such as clean air or water are without monetary consideration (infinity), or are indeed, in the realm of divinity. Greek Consuls were empowered to value property in ancient Greece and invariably took into account the productivity function of land (fertile, rich, well-watered). Diocletian's taxation system in ancient Rome was referred to as 'capitatio', where land and labour were divided into equal units called "capita", although "iugum" was the term for real property that was divided into various classes according to its productivity. One "Iuga" was a yoke of oxen, which together with a certain amount of labour yielded the same productivity from land of

equivalent fertility (Murray 1954; 1969). The Domesday Inquest (ca1080s) had as its underlying intention the equitable taxation of landholders in England based on their ability to pay yet it became the means by which an occasional war tax was levied during the reign of William the Conqueror. The questions were very well designed, one asking ‘if more can be had than is had?’ which is synonymous with the modern valuation principal of ‘highest and best use' (Murray 1954, 1969; Whipple 1962, 1992).

There are three primary methods used to value real property (Motha 1979; Reynolds 1984), all of which are complementary and lead to convergent validity. They are:

- summation;
- capitalisation; and,
- comparable sales.

Summation involves, as the name suggests, addition of the depreciated value of improvements to the unimproved value of the land, or in the case of trying to find unimproved value from comparable sales of improved property, deduction of the value of improvements from the improved value. Care must be exercised as not all ‘improvements’ add to the value, ie. they are economically unsuited to the highest and best use of the land {Herps 1942; Australian Institute of Valuers and Land Economists (AIVLE) 1997}. Extreme circumstances of improvements being unsuited to the highest and best use of the land can actually affect the unimproved value of the land to the extent of the cost of demolition and/or restoration. Other methods include discounted cash flow for investment property, and hypothetical development or residual land value method for development sites (AIVLE 1997).

Capitalisation refers to the application of an interest rate or desired/expected yield to the capital value of the land or improved property to arrive at a rent, or the capitalisation of the rent or net earnings to arrive at a capital value. In the first instance, consideration must be given to the capitalisation rate as reflecting the elements of risk, and the return of capital within the life of the investment. The capitalisation rate is the inverse of the number of years in

which the net rent will buy the investment, eg. a capitalisation rate of 6.5% is equivalent to 15.38 years purchase (AIVLE 1997). The capitalisation rate is never less than the rate of bank interest, or at least comparable with the yield from gilt-edged securities such as long-dated government bonds, however it can only be determined by a study of comparable sales evidence where the passing capitalisation rate can be determined (Lambert 1932; AIVLE 1997). When capitalising the rent or earnings from the land, care must be taken that the rent is not inflated, or less than the market rent, or the net earnings neither more nor less than what would be reasonably expected of the land given its fertility and careful management (Box and Pine 1934). In the case of over-market rents the capitalisation rate must take this into account, and conversely, there is a reversionary interest that must be considered (Murray 1969; AIVLE 1997). Sir William Petty (1623 – 1687) was credited with capitalisation of the *Usus Fructus per annum* or productivity function of the land (Murray 1954, 1969; Roll 1961). The Oxford Dictionary defines *Usufruct* as:

1.Law. "The right of temporary possession, use, or enjoyment of the advantages of property belonging to another, so far as may be had without causing damage or prejudice to this. Usufruct is the power of disposal of the use and fruits, saving the substance of the thing" (Simpson and Weiner 1989).

The Oxford Dictionary also cited Marsh (1864:35) in 'Man in Nature', wherein Marsh stated:

"Man has too long forgotten that the earth was given to him for usufruct alone, not for consumption" (Simpson and Weiner 1989).

The opening quote for this section of the thesis attributed to Thomas Jefferson (1743 - 1826), is described by Page (2002) as not just the use of the fruit of the land, but a legal principle and a good working definition of sustainability. Sir William Petty (Murray 1954, 1969; Roll 1961) believed that capitalisation of all of the profit and benefits produced by land held in the public domain was a logical economic step to take to determine capital value, or vice versa. Current humans are the present tenants of the earth, not the absolute owners, and have no right to impair the substance or productivity, which is preserved for later tenants, ie. future generations (Passmore 1974; Page 2002). Petty was uncertain as to how to determine the rate of return from land other than using

the surplus from production as rent, but came up with an ingenious solution. Petty determined that the rights to land of three generations of humans would be a reasonable estimate, and as 3 life expectancies in England in the 17th Century were 120 years, he computed the value of land at twenty one year's purchase of its annual rent, or in money-capital terms, a capitalisation rate of 4.76% (Roll 1961).

Comparable sales provide the additional evidence upon which buyers, sellers, valuers and the courts rely on to establish a parity or consensus on opinion of value, which can be averaged to ascertain 'the capital sum which similar land might be expected to realise' (Lambert 1932:17; AIVLE 1997). The use of comparable sales data is described as a fundamental activity in valuation work (McNamara 1983). In the Land and Valuation Court in Victoria in 1967 (Block Buildings Ringwood P/L v. the City of Ringwood) it was held that a valuation based on comparable sales but checked by other means was the most preferable method of valuation (The Editor 1967). Further it was held in the Land and Valuation Court in New South Wales in 1962 (Blefari v. The Minister) that the value of land within the green belt for the purposes of compensation for resumption were as indicated by comparable sales of other *en globo* land within the green belt irrespective of the potentiality of release from the green belt (The Editor 1963). Further, Isaacs-Power Rich J. in the Full High Court on Appeal re: MacDonald stated:

"…where the value of a given piece of land is in issue, it is the constant practice to admit evidence of actual sales of similar land where they may be regarded as throwing light on the value of the subject land" (20 CLR 231 cited in Lambert 1932).

Also Lord Watson in Metropolitan Asylum v. Hill held that:

"When the matter has reached the point of a concluded contract, there has been a definite concrete fact established, which not only establishes value, but to some extent helps to create or modify it" (47 LT at p35 cited in Lambert 1932:23).

Valuation practice therefore uses inductive reasoning in applying comparable sales data, with accuracy depending on the degree of comparability (Murray 1936).

Conceptually, market value can be regarded as the equivalent of the current worth of future anticipated benefits (Reynolds 1984). However, there is a distinction between the way a valuer treats 'value-in-use' and 'exchange value'. ‘Value-in-use’, otherwise called ‘special value to owner’ is often higher than exchange value, but exchange value indicates the existence of a market. Market value is a species of exchange value, hence a property that is valued by the summation method less depreciation tends towards a value-in-use, as valuers seeking an exchange value must consider obsolescence. Likewise with the capitalisation method, the correct rate of capitalisation can only be discovered by a study of the market (Ab Initio 1949; Else-Mitchell J. 1963; AIVLE 1997). Rich, J., Dixon, J. and McTiernan, J., in the full High Court of Australia, Deputy-Federal Commissioner of Taxation v Gold Estates of Australia, 1934, stated that:

“…market value is not an absolute, but a relative term, expressing the relationship of value existing at the date of valuation between the land in question and other similar land, with land generally, and further, with all other avenues of investment in the economic system” (51 CLR 509).

To an economist, exchange value is defined as the ability of a thing to command other things in exchange, and the many present and prospective factors that affect exchange value interact. Yet the economist's definition and use of the supply/demand function says nothing about the quantum of exchange value, which is precisely what concerns a valuer. The process then that has narrowed down exchange value to the species 'market value' has been presided over by the judiciary, with considerable emphasis placed upon the use and proper appreciation and application of comparable sales evidence as the best guide to a determination of market value (Ab Initio 1949). The Australian Property Institute, formerly the Australian Institute of Valuers and Land Economists, has adopted The International Assets Valuation Standards Committee definition of market value:

“…the estimated amount for which an asset should exchange on the date of valuation between a willing buyer and a willing seller in an arms length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently, and without compulsion” (AIVLE 1997).

Much difficulty was experienced with the definition of unimproved value (UV). Valuers and judges were required to deduct the cost of improvements from the improved value to arrive at an unimproved value. Improvements included clearing of trees, filling or draining wetlands, and removal of rocks and stones (Inglis 1960; AIVLE 1997). These events may have taken place 50 or more years earlier, and using the common comparison of adjoining fields, one where there was a fair certainty that it was originally treed, and the other not, led to a great deal of confusion and uncertainty. Clearly the fields were now of similar value, however the law required that the formerly treed land have a deduction of the estimated cost of clearing, to arrive at an unimproved value, resulting in a disparity between the value of the fields. The cost of clearing was such that often the remaining value of the formerly treed field was a lot less than its neighbour (Inglis 1960). In the County Court in Victoria in 1959, Norris J. said:

"A witness called as to the cost of clearing in 1958 land containing about two trees to the acre led me to the belief the net cost of clearing this land by contract at present prices would be very high – somewhere between about 35-65 pounds per acre, according to the number of trees I think were on the land originally, after allowing for the sale of the timber. The conclusion would be that in some cases the land uncleared would be practically valueless if the present cost of clearing were deducted. The conclusion would, I think, be quite fallacious."
(Inglis 1960).

This problem was resolved by a new definition of 'site value' requiring a different treatment of improvements, which was contained in the *Valuation of Land Act 1960* (Blackwell 1994):

"Improvements for the purpose of ascertaining the site value of land means all work actually done or material used on and for the benefit of the land, but in so far only as the effect of the work done or material used increases the value of the land and the benefit is unexhausted at the time of valuation, but does not include:

- *(a) work done by or material used for the benefit of the land by the Crown or by any statutory public body; or*
- *(b) improvements comprising:*
    - *the removal or destruction of vegetation or the removal of timber, rocks, stone or earth; or*
    - *the draining or filling of land or any retaining walls or other works, appurtenant to the draining or filling; or*
    - *the arresting or elimination of erosion or the changing or improving of any waterway on or through the land;*

unless those improvements can be shown by the owner or occupier of the land to have been made by that person or at that person's expense within the 15 years before the valuation".

The concept of 'highest and best use' automatically extends to the 'highest and best legal use', that which is legal, for example, compliance with zoning laws and local authority regulations (Whipple 1962; Spencer 1984), and now Federal and State environmental laws (Hemmings 1996). Liability for environmental harm can arise from common law or from statute, and as a valuer has a duty to make all prudent enquiries and take into account all matters that affect value, laws that are designed to protect the environment can have a significant impact. Environmental laws have the potential to make otherwise lawful uses non-profitable and the 'highest and best use' unattainable (Hemmings 1996). On the other hand it could be argued that the provision of ecosystem goods and services as being essential for planetary life support, is the 'highest and best use', in which case environmental laws make this use attainable (Curtis 2002). Putting aside the legal determinants of 'highest and best use', Whipple (1962) suggests that if a development achieves maximum acceptability in the marketplace (such as a National Park), then the land has been put to its 'highest and best use'. If it is valid to equate the concept of 'highest and best use' with maximum acceptability in the market place, it must satisfy human social and economic preferences (microeconomics), and these are manifest in the development and evolution of communities in time and space (Whipple 1962).

Else-Mitchell (1963) in discussing resumption and compensation where there is no or little market evidence, refers to all evidence given by valuers to be evidence of opinion whether or not it is backed up by reference to sales of comparable land. As Isaacs, A.C.J. said in Hazelldell v. The Commonwealth (1924):

"The value of land where there is no market price, is always a matter of opinion…and opinion is largely dependant on the personal equation" (34 CLR 442 at p452).

Moreover, Sugarman, J. observed in Bingham v. Cumberland County Council (1954), that the valuer must:

"…draw on his general knowledge and experience, including perhaps experience in other situations which, although lacking in complete comparability, may yet provide an experienced valuer with guidance and suggestions as to the general approach which may be made and as to considerations which may be relevant" {20 LGR (NSW) 1}.

The valuer is required as an expert witness when the court is unable to reach a decision unaided by expert evidence (Paterson 1984). The role of the valuer is to provide an objective and impartial opinion of the facts as known and value of the relevant property along with the evidence upon which the valuer relied. The weight of the evidence given by the valuer will depend upon the soundness of the inferences drawn from the facts presented. Evidence backed up by comparable sales will carry more weight than one based purely on opinion (Paterson 1984).

Acceptable error in property valuations can be a contentious issue, and there are numerous precedents established that evince a permissible margin of error 10% either side of what can be said to be the real figure, or in exceptional circumstances about 15% (Worthington 1987). It is generally accepted that value ranges are indicative of the inherent uncertainty in valuations, which is reasonable considering valuers may hold divergent views to each other as to value and also to sale price. Boyd and Irons (2001:107) described this as quasi-legitimisation of valuation imprecision, while accepting that assessed market values 'provide a sound proxy for market price'. However, rather than the acceptability of a range of values in common law jurisdictions, courts are now turning to an assessment of the 'duty of reasonable care' as the primary determinant of negligence (Boyd and Irons 2001). Two notable earlier precedents were Singer & Friedlander v. John D. Wood in 1977 in London, where the vagaries of the 'boom and bust' market of the early 70s had resulted in widely varying property values before and after the bust. The measure of excessive value was taken to be the difference between the median value of three valuations made for security purposes, and as the defendant's value was more than 15% above this, the judge found against him (Worthington 1987). In 1985, Clarke J. again found against the valuer in the matter: Trade Credits Ltd v. Baillieu Knight Frank (NSW) Pty Ltd. A number of expert witnesses gave evidence of the acceptable margin for

error ranging from 5-15% either way. The actual difference was 22%, and as this was outside the acceptable margin for error the valuer was found to be guilty of negligence (Worthington 1987).

In discussing the current issues involved with valuation accuracy, uncertainty, error, range and variation, Boyd and Irons (2001) define them as being:

- accuracy: the difference between a determination and a subsequently realised sale price;
- uncertainty: the inability to determine a single point value due to the inherent difficulties in assessing a subject property;
- error: error in any other component of the valuation other than the valuation determination itself;
- range: the estimation of a probable range of values due to uncertainty;
- variation: the measure of differences between determinations by different valuers.

The Mallinson report (cited in Boyd and Irons 2001) postulates that a valuation is simply an expression of expert opinion, and as such the opinions of a number of valuers can be expected to differ. Radcliff (1972:525) stressed that establishing a market value is a prediction of an economic event, and suggests that “no such thing as ‘true’ or ‘real’ value for a property exists”, leading to the practise of establishing a range of values. In order to calculate a range a consideration must be made of how accurately each variable can be determined (Boyd 1990). Several studies have been done in the UK using regression procedures to determine valuation accuracy, resulting in a high level of correlation between valuation and sale price. However, three independent studies concluded that the probability of a valuation lying within the range of +/-10% of the subsequent sale price were 30%, 35% and 53%. This leaves a large proportion of valuations exceeding the desired accuracy rate of +/- 10%, eg. up to 80% (+/- 20%) in one study (Boyd and Irons 2001). Newell and Kishore (1998) conducted a study in Australia that confirmed the often-suspected pattern that valuers tend to undervalue in a bull market and overvalue in a bear market.

A Study by Hager and Lord in 1995 of valuation variation (cited in Boyd and Irons 2001) was criticised due to the small sample size, namely ten independent valuations of each of two different commercial properties, however all but one valuation lay within the 20% range, 85% were less than 10% coefficient of variance, and 45% less than 5%. Later studies evidenced wider variations with only 61% less than 10% coefficient of variance. A study by Brown in 1998 found that valuers have only 20% probability of producing valuations that lie with 10% of the mean of valuations, leading to the conclusion that valuation uncertainty is higher than previously thought due to differing opinions of valuers as to market conditions, ie. valuation error (Boyd and Irons 2001). The judgement of White J., in the matter of Interchase Corporation Ltd v ACN 010087573 Pty Ltd and others is significant in that it concluded that the valuer did not exercise 'reasonable care' as an expert, and further 'experimented' with figures in a spreadsheet format to produce a desirable result. White J (2000:108) stated:

"I have little difficulty in concluding that as a consequence of ….(the valuer's) approach to aspects of the valuation he negligently accepted rentals which were not sustainable and was inappropriately influenced by …(the client) and this ultimately led to too high a valuation figure".

The accuracy and variance of the valuation was brought into question by their being 5 valuations, two in 1988, and three further valuations as a result of these proceedings, however as at the same 1988 date. The earlier valuations were 22% and 20% above the determined figure. However, the variance between the valuations was greatest for the latter valuations between the two lowest and White J. determined the value as being halfway between them. What was significant is that the Judge did not rest on valuation accuracy or variation, but rather the 'reasonable duty of care' proviso and the valuer's performances based on their reports and evidence in court (Boyd and Irons 2001).

The relatively recent requirement that land under roads, and by implication, other land under public utilities or devoted to specialised purposes be included in municipal financial statements (Australian Accounting Standard AAS27), has caused much consternation and led to the need to quickly develop a

practical method to value such land in the absence of a market (Rowles *et al.,* 1998). The requirement is part of a reform process whereby public sector finances are to be managed in an efficient and effective way paying due heed to the scarcity of public resources and also includes AAS29 for government departments. The problems, valuation industry opinions, options and alternatives in valuing these assets, are thoroughly explored in Coleman (1996) and Tamlin (1996). The assets now required to be valued have long since been regarded by the local governments (LGs) and authorities and their accountants as being 'beyond value' due to there not being a ready market. A survey of the 708 LGs in Australia revealed a general misunderstanding about the purpose of public sector accounting and a feeling that the exercise of valuing land under roads (and other utilities) was pointless as this land was not an asset because it had no market value (Rowles *et al.,* 1998). Other land to which the accounting standard could apply includes land under railways, electricity transmission corridors, dams and reservoirs and public reserves. Land under roads continues to have a potential for other uses, and the economic cost to society of dedication to use as a road is the opportunity cost foregone, as is the case for resources generally, and is best measured as 'deprival value'. Deprival value is a concept used in the insurance industry to describe the monetary loss an owner of an asset would suffer if deprived of it (Tamlin 1996). 'The relative scarcity of resources is ranked in the market place by price' (Rowles *et al.,* 1998:261), and in the case of land under roads the relative scarcity has to be determined in an indirect way by use of a surrogate market or 'shadow price'. Valuers have proposed a number of techniques, including comparable sales of adjoining land, rating values of adjoining land and average municipal rateable value (Tamlin 1996). The latter two techniques are regarded as the most suitable to provide a shadow price, due to their ability to rank relative scarcity, and ease of application (Tamlin 1996; Rowles *et al.,* 1998). In addressing valuation of public land, Daines (1982:333) cited H. R. Parker (claiming that the statement gathered respectability with age) as saying in 1965 that:

"The valuation of land reserved for a public purpose is determined as if it had not been reserved but had an alternate or underlying zone",

More recently the Public Sector Accounting Standards Board introduced a new standard referring specifically to 'Revaluation of Non-Current Assets'. Referred to as AASB1041 it applies to reporting periods commencing after July 1, 2000. This standard goes further towards changing the way public assets are valued as it includes definitions, and each State and Territory government have a set of policy guidelines that are prescriptive as to the uses of concepts within AASB1041. Government departments and agencies have to comply with the guidelines and valuers must follow suit when instructed to value government assets for financial reporting purposes. Specific aspects in AASB1041 that must be adhered to are the following definitions of what constitutes 'fair value' (Reed *et al.,* 2003:420):

- where a quoted market price in an active and liquid market is available for an asset, that price must represent the best evidence of an asset's fair value;
- where the quoted market price for an asset in an active and liquid market is not available, the asset's fair value is estimated by reference to the best available market evidence of the price at which the asset could be exchanged between knowledgeable, willing parties in an arm's length transaction. This evidence includes current market prices for assets that are similar in use, type and condition (termed 'similar assets'), and the price of the most recent transaction for the same or a similar asset (assume there was a recent transaction); and
- current market prices for the same or similar assets, which can usually be observed for land. For land and buildings, these prices can also be derived from market evidence.

Valuer-Generals around Australia have, in the past, used *comparable* sales of *adjoining* land on a 'per hectare' basis to derive the value of National Parks, (emphasis added) (Reed *et al.,* 2003). Now, under AASB1041, National Parks:

"…should be valued at fair value having regard to their 'highest and best use' being net of costs to achieve that use",

provided there are:

"…feasible alternative uses in the existing legal, natural and socio-political environment, and these uses are feasible in the near future" (Reed *et al.,* 2003:421).
Where there is no alternative higher and better use, the National Park should be valued at its 'fair value', which implies its restricted use (Reed *et al.,* 2003).

The valuation of a property subject to a private conservation agreement is generally no different from the valuation of one that is not, however in the light of the new environmental awareness, and prevailing market considerations, does the new status of the property as a conservation reserve confer a 'special' value over and above market value? (Lally 1998). Little evidence exists that leads to the ability to support or refute the hypothesis that conservation brings societal benefits (Allison *et al*., 1996) The International Assets Valuation Standards Committee acknowledges that 'specialised' properties may be subject to 'special' value assessment (Lally 1998). Land identified as being of high conservation value may be acquired by conservation agencies, and often these acquisitions do not satisfy the willing buyer/willing seller criteria of market value (Lally 1998). Accordingly it is still uncertain how the value of land included in a conservation zone will be affected, as this can only be determined by a study of comparable sales, of which there are still too few (Vaughan 1999). There is, however, a market belief that conservation can be a constraint, that the term is imprecise and lacks rigour in analysis, yet it can contribute to socio-cultural identity (Allison *et al*., 1996). In the final analysis, investing in conservation involves a high degree of risk and uncertainty.

Valuation standards in Australia are based on the current Australian Property Institute Professional Practice manual and the current Royal Institution of Chartered Surveyors Red Book (Crosby 2000; API 2002). Although there are some common standards throughout the world, some of the inconsistencies that affect perfect comparability and lead to uncertainty lie in terminology and the valuer's approach. For example: the problem of appraising the value of a property to an individual rather than a market (Crosby 2000). Also, The European Mortgage Federation have adopted the concept of 'sustainable value', which refers to a continuum of values through time, although

'sustainable value' is not clearly defined. In the latest draft of the European Valuation Standards 'mortgage lending value' is defined as:

"The mortgage lending value shall mean the value of the property as determined by a valuer making a prudent assessment of the future marketability of the property by taking into account long-term sustainable aspects of the property, the normal and local market conditions, the current use and alternative appropriate uses of the property. Speculative elements shall not be taken into account in the assessment of the mortgage lending value. The mortgage lending value shall be documented in a transparent and clear manner" (Crosby 2000).

Crosby (2000) takes issue with the underlined phrases as suggesting that values can last through time, contrary to most economic concepts of value, and as indicating that this uncertainty may compromise valuers in professional negligence cases. Behavioural valuation research has taken on a new focus since the property crashes in the UK and Australia circa 1988 and 1990. Formalisation of the instruction process is proceeding and much attention is being given to client/valuer liason to minimise the risk of the relationship influencing valuations. Precedents and norms govern rules that set the standards by which valuers must comply if they are to avoid a charge of negligence (Crosby 2000). Other problems such as: valuers according undue weight to their previous valuation in periodic valuations, whereas theoretically they should ignore it; and 'precipitance', where valuers tend to form an opinion early in the process, only lead to reinforce the need for continued research and development of valuation practice (Crosby 2000).

The practice of valuation may never be considered an exact science, yet according to Murray (1936) it is at least as exact as the science of medicine. Methodological procedures, rigorous enquiry, and the competency and industry of a valuer with an unbiased mind are the prerequisites to finding the solution of a problem in valuation within a small margin of error.

"The valuer who has employed scientific method in his endeavour to ascertain the true value of a property will have the satisfaction of having arrived at a figure which represents, as far as it is possible to ascertain, the true value" (Murray 1936:245).

Chapter 5
Literature Review

5.1 The Ecosystem Approach

An ecosystem has been defined as "the set of organisms living in an area, their physical environment, and the interactions between them" (Daily 1997:2). Dickinson and Murphy (1998) claim that ecosystems provide not only the 'best paradigm' for integrating the biotic and abiotic components of the biosphere but also the concept is a useful operating framework for incorporation of the human dimension. The ecosystem concept is crucial to the linking of ecological science with environmental science, and is a robust and adaptable one that is fundamental to the understanding of human impacts on life on earth (Dickinson and Murphy 1998). However, the ecosystem as a fundamental ecological concept is not simple and has a number of dimensions. Pickett and Cadenasso (2002) refer to these multiple dimensions as 'meaning, model and metaphor', the latter referring to the ways in which ecosystems are perceived and the concepts conveyed to scientists and the broader community.

Ecosystems exist throughout the biosphere on a great variety of scales and are bounded by both physical parameters and human criteria (Dickinson and Murphy 1998). As the combinations of species that can perform as an integrated ecosystem change with environmental conditions, Meffe and Carroll (1997) assert that ecosystems can only provide the environmental goods and services upon which human life depends, if a rich variety of well functioning ecosystems are distributed over most of earth's surface. Explicitly characterising a biological community within its physical context began with Forbes' 1887 paper "The Lake as a Microcosm", however, Cowles' work on succession in the Indiana dunes in 1899 was regarded as the beginning of ecosystem ecology (Mooney and Ehrlich 1997). The term 'ecosystem' was first coined by Tansley in 1935, although Lindeman's 1942 paper on a small lake ecosystem was the first in the modern era to explicitly link the food cycle relationships of a biotic community with its abiotic environment, stating that

from henceforth the fundamental unit was the 'ecosystem' (Mooney and Ehrlich 1997). Ecosystems were not recognised for the specific goods and services they provided for planetary life support for more than twenty years, with publications by SCEP (1970), Holden and Ehrlich (1974), Ehrlich et al (1977), Westman (1977) and Ehrlich and Ehrlich (1981) (all cited in Mooney and Ehrlich 1997). Increasing attention was being paid to how the loss of species and biodiversity would affect the level of provision of ecosystem services, and what potential existed for technological substitutes. Despite this, the socio-economic consequences of the loss of genetic diversity could still be enormous (McNeeley 1994; Oldfield 1984). Species diversity was found to be crucial to maintenance of a healthy ecosystem and the provision of ample services to society in the face of potential perturbations, with simple ecosystems (few representatives of major functional groups) most vulnerable (Oldfield 1984, Mooney and Ehrlich 1997). The most important anthropocentric reason for preservation of biodiversity was the role that microorganisms, plants and animals play in the provision of ecosystem services (Ehrlich 1988), which eventually led to the foundation of the field of study known as conservation biology. The Smithsonian Institute of Conservation Biology describes the new field as:

"…blending academic and applied disciplines…….(it) addresses the interface between economics, development, science, and conservation practices"

(Smithsonian Institution 2002:1).

Biodiversity has been defined as:

"the variety of life at all levels of organisation, from the level of genetic variation within and among species to the level of variation within and among ecosystems and biomes" (Tilman 1997:93).

Generally many genetically diverse populations are necessary to ensure persistence of a species in the face of inevitable natural environmental change. Abundant genetic variation in many disjunct populations increases the potential for evolving in response to long-term environmental change (Ehrlich 1988). Tilman (1997) posed three questions to do with biodiversity and ecosystem functioning:

1. Does the productivity of ecosystems depend on their biodiversity?

2. Does ecosystem stability depend on biodiversity? and
3. Does the long term sustainability of ecosystem functioning depend on ecosystem biodiversity?

Many authors have commented on the diversity – productivity hypothesis, including Darwin (1872), suggesting that the more species rich assemblages would provide more alternative pathways for the flows of energy and cycling of nutrients (Tilman 1997). Ecosystem productivity is thought to be higher when more plant species are present due to their peculiar physiologies and morphologies, life histories and adaptations to the environment, that facilitate more extensive resource utilisation. Tilman (1997) put forward two possibilities that may explain the influence biodiversity has on productivity in an ecosystem. The sampling competition effect, where higher diversity enables a greater sampling of the potential of an ecosystem, and competition among species magnifies their differences, such that the increased variety of different resources being used promotes other aspects of ecosystem functioning. And complementary resource use by different species, where different species have different levels of requirement for the available nutrients. Greater diversity in plant species can also host a wider assemblage of decomposer species, thus boosting nutrient cycling (Tilman 1997).

Natural (climate induced) and human disturbance of ecosystems has the potential to greatly decrease the levels of production of ecosystem goods and services. The level to which they are affected depends on their stability, resistance to perturbation and thus resilience. In the face of environmental change, resilience is the key to ecosystem survival, due to major catastrophes occurring when resilience is low bringing about unwanted change (Walker 2001). Moreover, the resilience of ecosystem function is enhanced by functional similarity between dominant and minor species and among minor species (Walker *et al.,* 1999). Elton (1958) postulated that more diverse ecosystems were less prone to long-term fluctuations, were less oscillatory, than less diverse communities. Although mathematical studies that ensued over the next two decades appeared to challenge this assumption, with increasing evidence that as complexity increased individual species dynamics

became increasingly less stable. It was soon realised however, that despite this, the whole ecosystem became more stable (Tilman 1997).

At the lowest level an ecosystem is made up of numbers of individual organisms in a micro-scale abiotic environment, which then increases with complexity and the level of integration as scale increases. Populations of the same or other species and other micro-scale environments form communities, with varying levels of environmental tolerance. Functional groups depend upon a set of environmental pressures within the tolerance range of the species making up the group. Ecosystems are the defined envelope of environment and biota conditions, which when linked together on the basis of shared characteristics, form biomes on the macro-scale (Dickinson and Murphy 1998). Tansley (1935) referred to ecosystems as 'a system in the sense of physics' (cited in Dickinson and Murphy 1998:12), foreshadowing later development of systems theory and analysis in their application in ecology. Systems theory and systems analysis differ as to their philosophical intent, with theory to do with the nature and properties of systems, and analysis the development of practical techniques and applications (Dickinson and Murphy 1998). The structure and energy flow in ecosystems from low entropy food to high entropy heat was first defined by Lindeman (1942) as 'trophic levels', enabling modelling of this ecosystem function from solar input of energy to output of waste heat to the atmosphere. A nutrient cycle parallelling the energy cycle was shown by Odum (1953) to be vital to sustain life on earth, as all organic matter requires a minimum or optimum amount of the essential chemical elements in an available form (cited in Dickinson and Murphy 1998).

Species composition, richness and diversity were used by Spellerberg (1992) to discuss an ecological basis for evaluation and assessment of ecosystems. Species composition refers simply to the species present, while species richness attempts to record total number of species and total number of individuals, most often by using an index, although these do not necessarily provide a measure of diversity. Spellerberg (1992:47) cites two such indices, the first attributable to Margalef (1951) and the second to Menhinick (1964):

$$SR = S\text{-}1/\log N \qquad \text{Equation 5.1, and}$$

$$SR = S/\sqrt{N} \qquad \text{Equation 5.2.}$$

'Where *SR* is the index of species richness, S is the total number of species in the sample or area and *N* is the total number of individuals'. Species diversity is also measured using indices, the most used being Simpson's, Shannon-Weiner's, and the Alpha Diversity Index (Spellerberg 1992:47). The first two of these are attributable to Simpson (1949) and Pielou (1966) respectively (cited in Spellerberg 1992), and both use the sum of the total number of species and the proportion of the *i*th species (*ni/N*). The Alpha Biodiversity Index is attributed to Fisher *et al.,* (1943) and is expressed as follows:

$$S = \acute{\alpha} \, \text{Log}_e (1 + N/\acute{\alpha}) \qquad \text{Equation 5.3.}$$

'Where *S* is the total number of species, *N* is the total number of individuals', and the value ά, is the biodiversity index (Spellerberg 1992). These indices are useful in context, for eg. where minimum and maximum possible values are known, or made relative to land area which has extremely important implications for conservation.

The theory of island biogeography poses similar conditions such as local extinction risk, rate of colonisation and species richness to habitat size (land area) and isolation (MacArthur and Wilson 1967; Dreschler and Watzold 2001). In their theory of island biogeography MacArthur and Wilson (1967) related the species richness of an island or in a habitat patch to the area, in the function:

$$B = S = \alpha \, x \, A^z \qquad \text{Equation 5.4}$$

Where the benefit (*B*) of an ecosystem is measured by the species richness (*S*), which is itself a function of area (*A*), with α some positive constant and the exponent of *A* in the range 0.15 – 0.35, subject to habitat type and taxonomy (MacArthur and Wilson 1967; Dreschler and Watzold 2001).

Decision II/8 of the Convention on Biological Diversity (CBD 2002:1) recognised that the 'ecosystem approach' should be the primary framework of action to be taken under the convention, yet failed to define it. It was later described (in the context of forests) as:

"…a strategy for the integrated management of forests that promotes their conservation and sustainable use in an equitable way. Humans, with their cultural diversity, are an integral component of forest ecosystems. The ecosystem approach requires adaptive management to deal with the complex and dynamic nature of forest ecosystems and the dynamic nature of forest ecosystems and the absence of complete knowledge or understanding of their functioning".

At the fourth meeting of the parties to the convention, decision IV/7 was taken which called for:

"Holistic and inter-sectoral ecosystem approaches that integrate the conservation and sustainable use of biological diversity, taking account of social and cultural and economic considerations" (CBD 2002:1).

Four major management options exist for ecosystems where increased pressures of population growth and resource extraction endanger them, and demand is increasing for environmental services provided by them:

- self-sustaining ecosystem management,
- adaptive management,
- case-by-case resource management, and
- high reliability management.

(Roe and Van Eeton 2001).

However in a heterogenous, dynamic landscape, management options change, and any one management option is inappropriate to ensure ecosystem health and highly reliable flows of ecosystem services. Roe and Van Eeton (2001) advocated a framework of threshold-based resource management, where ecologists determine the limits that define ecosystem health or the boundaries within which ecosystem health is to be achieved (for eg. wetlands connectivity), and engineers provide highly reliable management provided the limits and boundaries set are feasible. Jansson *et al.,* (1999) referred to the need to explicitly address the critical interdependencies between freshwater flows and the capacity of an ecosystem to generate a reliable and continuous flow of services. Thus Jansson *et al.,* (1999:351) advocated:

"…a dynamic eco-hydrological landscape-management approach upstream and downstream in watersheds to reduce unintentional impacts, irreversible change, and further loss of freshwater resources, ecosystem services, and resilience".

Management of human-dominated watersheds and flow regimes thus presents a major challenge for sustainability of ecosystem services while still providing a dependable water supply for towns and rural needs (Strange *et al.,* 1999; Naiman *et al.,* 2002; Nilsson and Svedmark 2002). Modification of natural flow regimes affects the provision of some ecosystem services that depend on the biological niche of some functional groups, by virtue of alteration of their abundance and species composition (Strange *et al.,* 1999). Strange *et al.,* (1999) proposed to predict the ecological consequences of flow manipulations by means of a framework based on the role of hydrology linking population, community and ecosystem function. Moreover, Lundberg and Moberg (2003) identified three main functional categories of organisms that actively moved in the landscape, namely resource, genetic and process linkers, and suggested that it is the diversity of these mobile links that maintain ecosystem resilience and secure the capacity of ecosystems to supply the goods and services essential to society. Human activities and global environment change were altering the capacity and quality of organism-mediated dynamics within and between ecosystems (Lundberg and Moberg 2003).

The World Resources Institute Pilot Analysis of Global Ecosystems (PAGE) examined the temporal degree of human modifications on the spatial extent and structure of forest ecosystems (Mathews *et al.,* 2000), and evaluated the condition of a limited suite of ecosystem services. 'Condition', was defined as 'the current and future capacity of the systems to continue providing the full range of goods and services needed or valued by humans' (this is what they found):

- global forest cover has been reduced by 20-50% since pre-agricultural times;
- nearly all forests in the USA and Europe are under management and support reduced levels of biodiversity;
- losses and degradation of tropical forest is more severe than official estimates imply because zones of mixed forest and agriculture are spreading rapidly at the borders of formerly intact forests;

- these zones may have greatly reduced capacity to provide the full range of ecosystem goods and services;
- the world's growing road network poses a major threat to forest condition due to access for development, hunting and poaching, and so forth, and,
- logging for wood and pulp is growing, and despite the importance of wood plantations, mature natural forest is still being degraded.

(Mathews *et al.,* 2000:1).

On World Environment Day, June 5 2001, the United Nations along with many interested and involved groups of scientists, governments and foundations, announced the launch of the most extensive study yet of the state of the world's ecosystems, and named it the Millennium Ecosystem Analysis (WRI 2001). The study will involve over 1500 natural and social scientists in an assessment of the role that forests, grasslands, rangelands, farmlands, lakes, rivers and oceans play in providing planetary life support, and how their capacity to do so is being affected by current global practices (WRI 2001). The Millennium Ecosystem Assessment (MA) began with a set of 'synthesis questions' in the first draft of the 'Outline of User Needs' (MA 2001:4-9), which provide an appropriate summary of the ecosystem approach taken as 'the lowest common denominator' for study in this thesis. This is also consistent with Lindeman's (1942) conclusion that the ecosystem is the fundamental unit (cited in Mooney and Ehrlich 1997). The set of synthesis questions were:

- *What tools and methodologies can be developed and used in the MA to strengthen capacity to assess: a) ecosystems; b) the goods and services they provide; and, c) the implications of response options?*
- *What ecosystems provide what goods and services (e.g., food, water fibre) and how do these specific goods and services contribute more generally to sustainable development (e.g., through health, security, employment)?*
- *How have ecosystems changed in the past and how has this increased or reduced their capacity to provide goods and services?*
- *What thresholds, non-linearities or irreversible changes have been observed?*
- *What are the costs, benefits, risks and distributional effects of the observed changes in ecosystems?*

- *What are the plausible future changes in ecosystems and in the supply of and demand for goods and services?*
- *Under what circumstances are thresholds, non-linearities or irreversible changes likely to occur?*
- *What are the most critical drivers and factors affecting future changes?*
- *What are the costs, benefits, risks and distributional effects of plausible future changes in ecosystems?*
- *What response options and processes can be used to realise or avoid specific futures?*
- *What are the trade-off implications of the response options?*
- *How does inertia in the social and natural systems impact management decisions?*

Some of these questions are addressed in the Delphi Inquiry and Chapter 13.

The paradox of human life being dependent on ecological systems and biodiversity, while at the same time apparently threatening their survival, remains one of the dilemmas of modern science (Ke Chung and Weaver 1994). In order to conceptualise biodiversity and ecological systems on a landscape scale, Weaver and Ke Chung (1994) proposed a focus that could be termed a broadscale ecosystem approach, or a total diversity approach towards a new paradigm. Human dominion over nature has marginalised nature as an abstraction away from human constructs, where many people live in urban societies with little consciousness of ecological processes. Likewise rural populations may consider nature as a storehouse without due consideration to the limiting factors of biological processes. Many still argue, including scientists, that human ingenuity and capacity to exploit technology will overcome constraints on utilisation of natural resources (Weiner 1990; Weaver and Ke Chung 1994). The crux of the paradox as Weaver and Ke Chung (1994) put it, is the dysfunction of humans and human cognition as a part of nature. People are either hedonistic and myopic or altruistic and non-myopic, and the 'invisible hand' of markets has proven time and again to be not the solution to the problem of over-exploitation (Hardin 1968; Weaver and Ke Chung 1994; Costanza *et al.,* 1997b). A new paradigm using the ecosystem approach as the lowest common denominator requires societal consensus to a range of new institutions, institutional change on the micro and

macro scale, information and education, market-based incentives and regulations and restrictions on some types of human activity, including enforcement, to redress the paradox (Weaver and Ke Chung 1994).

Chapter 6
Literature Review

6.1 Section Summary

6.1.1 Economic Approaches to Environmental Valuation

Cost-benefit analysis is grounded in neo-classical welfare economic theory dating from the 19th Century, which set the scene for it to be used almost exclusively for the appraisal of public projects and policy. The evaluation of non-market goods and services, such as clean air and unpolluted water was fundamental to the difficulties faced in appraising public projects and other projects that may have impacted on society and the environment. The 'willingness to pay' (WTP) by individual preference of society as a whole, to avoid the nuisance of a negative external effect of a project, or 'willingness to accept' (WTA) compensation to put up with the nuisance, was the primary method used to procure conscious valuations of these intangibles or external effects. External effects include all the ecosystem goods and services humankind take for granted such as stabilisation (clean air, water), regeneration (gene pool), production of goods (timber, fibre, medicine) and life-fulfillment services (aesthetics). Failure to internalise external effects in CBA leads to an understatement of the true social cost of development.

Prior to the introduction of CBA, private appraisal methodology was well established with definitive outcomes, although not all techniques were applicable to CBA. Economic measures of value resulted in a supply/demand function, but not a value, which is precisely what valuers are interested in. Diverse applications led to a divergence from the welfare theory that underpins CBA, with little relationship between theory and practice. Moreover there were no strict guidelines as to what should be included as costs and benefits, procedures were not universal, and bold attempts to value some intangibles had discredited the process. Assumptions about unknowns and disputes over discount rates, aggregation of preferences and what are 'good' and 'bad' effects, were endemic to CBA, such that the process was not always rigorous.

WTP surveys were the prime methodology employed in the most highly regarded and commonly used technique to value non-market goods, the contingency valuation method (CVM). The method was called CVM because the answers to a valuation question were contingent upon the particular hypothetical market described to the respondents, however, the efficacy of the method revolved around survey design and how realistically the hypothetical market could be described. CVM was less reliable where respondents had little or no knowledge of, and lacked the ability to become familiar with the resource; and believed the hypothetical market to be unrealistic. Accordingly, severe biases still exist due to CBA, and logically also CVM, being firmly rooted in neo-classical welfare economics. Based on peoples' preferences and backed up by the ability to pay, the technique raises profound issues to do with anthropocentrism, information variability within groups, effects of value aggregation across groups and the positivist-rationalist approach.

6.1.2 The Emergence of Environmental and Ecological Economics

The formal field of economics arose from its origins in moral philosophy more than two centuries ago during the transition from an agrarian society to an industrial one. Material security was regarded as fundamental to moral progress. If people were able to satisfy their basic needs (food, shelter and clothing), then they could pursue moral and social improvement. Early scientific disciplines were divorced from each other and developed their own cultures, language and worldview. Economics became increasingly isolated from the natural resource (land) component of the ‘land - labour - capital triad’, ie. economics developed a growing isolation from the natural sciences. Theory held sway over pragmatism, and the disciplinary organised model of physics was used to model economics. Eminent classical economists including Adam Smith, Thomas Malthus, David Ricardo and Stuart Mill were primarily responsible for economics becoming known as the ‘dismal science’, owing to their gloomy outlook on the finite nature of resources.

Around 1870 classical economics began to evolve into what became known as neoclassical economics, with the Marxist labour theory of value abandoned, and an emphasis put on the relative rather than the absolute

scarcity as a measure of a commodity's price, irrespective of the amount of labour required to produce the good. Long-term economic progress was then modeled on price determination using marginal analysis and the structure and pattern of economic activity (now known as microeconomics). However, Keynes introduced a new school of economics in the early 20th Century that dealt with broadly defined aggregates of economic activity and input-output modeling and argued that the smaller individual situations did not carry over unmodified to the large. This new school was termed macroeconomics. Macroeconomists did not revert to the classical model of growth with its grim prognosis (due to the finite nature of natural resources), instead they totally excluded the natural environment in their analysis of economic growth, leading to a falsely optimistic view of material progress. The depletion of natural capital (raw materials) in the national accounts (GNP/GDP) was also ignored by macroeconomics, yet included the cost of cleanup as a measure of economic progress.

The science of ecology arose mid 20th Century with it's origins in biology and natural history and it had a clear philosophical difference from the science of economics. The juxtaposition between economics and ecology prevented the collective interpretation and resolution of the numerous problems at the intersection of human and natural systems, however they did have some common theoretical concepts. The challenge to the classical perspective that the natural environment did not figure at all in the modern analysis of economic growth was one of several stimuli that led to the emergence of environmental economics in the 1970s. The new discipline involved the application of the principles of economics to environmental or natural resource use, development and management, and included the economics of pollution, damage assessment and restoration. The main distinguishing feature of environmental economics was how externalities (eg. pollution) were dealt with. In neoclassical economics they were ignored. In environmental economics they were internalised, ie. compensated. However, within a decade or so, natural historians and then ecologists had managed to convince some economists that the 'evolving, complex and uncertain system' that was

the environment was sufficiently important and at risk for a collaborative approach to be taken.

Ecological economics emerged during the 1980s in the context of a general discontent of both economists and ecologists with the inability of the ruling paradigm to properly and holistically bring about improvements in environmental policy. The Elsevier Science Journal 'Ecological Economics' describes the integration of economics and ecology as necessary due to conceptual and professional isolation which has led to economic and environmental policies which are mutually destructive rather than reinforcing in the long term. Western neo-classical economists had always accepted the initial allocation of resources as an efficient distribution of resources. With the emergence of ecological economics, there was much more awareness that the equitable distribution of resources and environmental services was vitally important to conservation and sustainability. Prices act as a negative feedback to keep use in equilibrium with availability, and ecological economists argued that as ecosystems were un-priced they were being lost. Therefore by including the value of ecosystems in the price system every sector of the economy and ecosystems would benefit.

In the economic triad: allocation, distribution and scale, neoclassical economics ignores scale. Scale is relative to the natural and sustainable capacity of the earth to provide materials and absorb waste, and is of primary importance to ecological economists as it describes the throughput of the economy, from low entropy matter and energy to high entropy waste. Scale can be measured as the product of population times per capita resource use. Ecological economics is thus unashamedly ideological in its pursuit of a 'steady state economy', where growth is bounded by a level of sustainable use of nature's resources consistent with maintenance of a steady state, although both Hotelling's and Hartwick's rules require an incremental temporal increase. A decade later the concept of sustainability was put firmly on the agenda at the 'Earth Summit' held in Rio de Janeiro in 1992. The penchant of neoclassical economists to ignore the way the initial distribution of resources affected subsequent allocation in markets exacerbated the 'richer-richer',

'poorer-poorer' syndrome, and was largely responsible for the increased inequity and environmental destruction in developing countries. However, the concern with equity had Marxian overtones, and perhaps led to the emergence of yet another discipline, 'social and political ecology', which had a significant overlap with ecological economics.

6.1.3 Valuation Theory and Practice

Every use of land has an opportunity cost, that being the existing use or other uses to which the land could be put (the use foregone). This marginal opportunity cost can be expressed in terms of the annual net revenue foregone, in which case it would be capitalised, resulting in a land value in restricted and unrestricted use. As ecosystem services are the production function of land in its natural state (the *Usus Fructus per annum*), and as ecosystem services are essential for planetary life support, it could be argued that the provision of ecosystem services are the 'highest and best use' of land. These concepts clearly link the natural production function of land with land valuation procedures.

In Biblical times and ancient Greece and Rome, many parallels can be found that support modern valuation practice. However, current methods of valuation have been derived largely from decisions given by eminent judges of the Supreme Court in various States, the High Court of Australia, and of the Privy Council. These authorities have ruled that the term value means value in the open market, which is then often appealed to a higher court. The precedent followed by all Courts in Australia when dealing with the valuation of land, under the Land Acquisitions Act and pre-dating the Federal Land Tax Act by many years is, Spencer v The Commonwealth in 1907. Land has long since been regarded as different from personal property, in that under common law no person can have an absolute title to real property. Theoretically absolute ownership in Australia vests in the Crown, who may resume, provided proper compensation is paid, the land and the wealth upon it. Nations, states and the local authorities have, from time immemorial, possessed a beneficial interest in all privately owned lands as being the basis of taxation and for local rating purposes. The basis of rating in Australia and

most countries of the world is the unimproved value *(UV)* of land. The *UV* is the 'fee simple in possession' of the land, which is the most absolute form of possession that any legal entity can hold under the Crown, limited only by the conditions contained in the original grant from the Crown, and excluding any subsequent restrictions, leases, easements and other charges.

There are three primary methods used to value real property, summation; capitalisation, and comparable sales, all of which are complimentary. Summation involves addition of the depreciated value of improvements to the unimproved value of the land, or in the case of trying to find unimproved value from comparable sales of improved property, deduction of the value of improvements from the improved value. Capitalisation refers to the application of an interest rate or desired/expected yield to the capital value of the land or improved property to arrive at a rent, or the capitalisation of the rent or net earnings to arrive at a capital value. Sir William Petty was credited with capitalisation of the *Usus Fructus per annum* or productivity function of the land. Petty believed that capitalisation of all of the profit and benefits produced by land held in the public domain was a logical economic step to take to determine capital value, or vice versa. Petty had an ingenious solution to determine the capitalisation rate for land when the surplus of production (as rent) was unknown. Petty determined that the rights to land of three generations of humans would be a reasonable estimate, and as 3 life expectancies in England in the 17th Century were 120 years, he computed the value of land at twenty one year's purchase of its annual rent, or in money-capital terms, a capitalisation rate of 4.76%. The practice of capitalisation of the net production function of land is now axiomatic in all financial sensitivities to do with all forms of real property. Comparable sales provide the additional evidence upon which buyers, sellers, valuers and the courts rely on to establish a parity or consensus on opinion of value, which can be averaged to ascertain the capital sum which similar land might be expected to realise.

The concept of 'highest and best use' automatically extends to the 'highest and best legal use', for example compliance with zoning laws and local authority regulations and now federal and state environmental laws. Liability

for environmental harm can arise from common law or from statute, and as a valuer has a duty to make all prudent enquiries and take into account all matters that affect value, laws that are designed to protect the environment can have a significant impact. Putting aside the legal determinants of 'highest and best use', if a development achieves maximum acceptability in the marketplace, then the land has been put to its 'highest and best use'. The validity of this concept relies on the microeconomic principles of human social and economic preferences amid scarcity, and these are manifest in the development and evolution of communities in time and space.

The valuer is required as an expert witness when the court is unable to reach a decision unaided by expert evidence. The role of the valuer is to provide an objective and impartial opinion of the facts as known and value of the relevant property along with the evidence upon which the valuer relied. Acceptable error in property valuations can be a contentious issue, and there are numerous precedents established that evince a permissible margin of error 10% either side of what can be said to be the real figure, or in exceptional circumstances about 15%. More recently the courts have turned to an assessment of the valuers duty of 'reasonable care' in assessing whether or not a valuer has been negligent.

The recent requirement that land under roads be included in municipal financial statements (Australian Accounting Standard AAS 27), and the 'valuation of non-current assets' (AASB1041) has led to the need to quickly develop a practical method to value such land in the absence of a market. The requirement is part of a reform process whereby public sector finances are to be managed in an efficient and effective way paying due heed to the scarcity of public resources. Local governments and authorities and their accountants have long since regarded land under public utilities as being 'beyond value' due to there not being a ready market. Other land to which the accounting standard could apply includes land under railways, electricity transmission corridors, dams and reservoirs and public reserves. The economic cost to society of dedication of land to use as a road is the opportunity cost foregone, as land under roads continues to have a potential for other uses, as is the

case for resources generally. The relative scarcity of resources is ranked in the market place by price and in the case of land under roads the relative scarcity has to be determined in an indirect way by use of a surrogate market or 'shadow price'. A number of techniques have been proposed, including the use of comparable sales of adjoining land, rating values of adjoining land and average municipal rateable value. The latter two techniques are regarded as the most suitable to provide a shadow price, due to their ability to rank relative scarcity, and ease of application.

The theory of valuation stands in the forefront of the social sciences, being a branch of applied economics principally to do with all of the ramifications of land utilisation and commerce, and employing the scientific method where hypotheses are tested by both empirical means and convergent validity. Methodological procedures, rigorous enquiry, and the competency and industry of a valuer or researcher with an unbiased mind are therefore the prerequisites to finding the solution of a problem in valuation within a small margin of error.

6.1.4 The Ecosystem Approach

Ecosystems provide the 'best paradigm' for integrating the biotic and abiotic components of the biosphere and are a useful operating framework for incorporation of the human dimension. Ecosystems can provide the environmental goods and services upon which human life depends only if well functioning systems are distributed over most of earth's surface. This requires a rich variety of ecosystems because the combinations of species that can perform as an integrated ecosystem change with environmental conditions.

Species diversity is crucial to maintenance of a healthy ecosystem and the provision of ample services to society in the face of potential perturbations, with simple ecosystems (few representatives of major functional groups) most vulnerable. The most important anthropocentric reason for preservation of biodiversity is the role that microorganisms, plants and animals play in the provision of ecosystem services, which led to the foundation of the field of study known as conservation biology. Generally many genetically diverse

populations are necessary to ensure persistence of a species in the face of inevitable natural environmental change. Abundant genetic variation in many disjunct populations increases the potential for evolving in response to long-term environmental change.

Ecosystem productivity is thought to be higher when more plant species are present due to their peculiar physiologies and morphologies, life histories and adaptations to the environment, that facilitate more extensive resource utilisation. Natural (climate induced) and human disturbance of ecosystems have the potential to greatly decrease the levels of production of ecosystem goods and services. The level to which they are affected depends on their stability, resistance to perturbation and resilience. At the lowest level an ecosystem is made up of numbers of individual organisms in a micro-scale abiotic environment, which then increases with complexity and the level of integration as scale increases. Ecosystems are the defined envelope of environment and biota conditions, which when linked together on the basis of shared characteristics, form biomes on the macro-scale.

Species composition, richness and diversity have been used as an ecological basis for evaluation and assessment of ecosystems. While species composition refers simply to the species present, species richness attempts to record total number of species and total number of individuals, most often by using an index linked to the sample or area. Species diversity is also measured using indices, the most used being Simpson's, Shannon-Weiner's, and the Alpha Diversity Index These indices are useful in context, for eg. where minimum and maximum possible values are known, or made relative to land area which has extremely important implications for conservation. The theory of island biogeography is also directly related to habitat size (land area) and poses similar conditions such as local extinction risk due to isolation, rate of colonisation and species richness.

One of the dilemmas of modern science is the paradox of human life being dependent on ecological systems and biodiversity, while at the same time apparently threatening their survival. In order to conceptualise biodiversity and

ecological systems on a landscape scale a broadscale ecosystem approach or a total diversity approach should be adopted. The crux of the paradox is the dysfunction of humans and human cognition as being a part of nature. A new paradigm using the ecosystem approach as the lowest common denominator requires societal consensus to a range of new institutions, institutional change on the micro and macro scale, information and education, market-based incentives and regulations and restrictions on some types of human activity, including enforcement, to redress the paradox.