ECONOMICS AND THE COMPREHENSIVE REGIONAL ASSESSMENT OF FOREST RESERVES[1]

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1 Introduction

The objective of this paper is to review the role and current use of economic analysis in the Comprehensive Regional Assessment (CRA) of forest areas in Australia, in preparation for a CRA in the South-East bio-geographic zone of Queensland. By placing economic analysis applying to CRA in the context of social expectations, conceptual issues and analytical methodology, it is hoped to give an indication of its strengths and limitations.

First an historical backdrop is presented of the concept of forest reserves with some of the important requirements for their implementation. An introduction describing the locations of CRAs is followed by a section on alternative philosophical paradigms in approaching ecology/economy conflicts. Next is a broad classification of basic analytical approaches used for decision support in ecology/economy conflicts. Economic assessments actually carried out in Australia are then reviewed from the points of view of their scope and integration into the decision-making process, followed by sections of the proposed Queensland method and alternative approaches. Finally, some conclusions are offered.

2 Regional Forest Agreements in Australia

2.1 The origins

Forests have been the rallying point for the conservation movement worldwide. In Australia, continuous attention to forest management by conservation groups ensured that it has enjoyed specific attention among resource-management issues at the national level.

Given the electoral policies of the Hawke/Keating Commonwealth Governments (1983-96), decisions about forest management were specifically aimed at securing the conservation vote (Hayden 1996 p.476). The acrimonious debate over woodchip exports is said to have particularly contributed to the Commonwealth Government's intention to establish a "comprehensive, adequate and representative" (CAR) forest-reserve system, in addition to existing conservation areas (Commonwealth of Australia 1992 p.9). Logging and other forest use would continue in areas not required for the reserves, regulated by codes of practice compatible with the precautionary principle, outlined in Regional Forest Agreements (RFAs) between the Commonwealth and the appropriate state. Without an RFA in their region, the Commonwealth would not issue woodchip licences to companies after the year 2000.

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[1] Paper presented at the 41st Annual Conference of the Australian Agricultural and Resource Economics Conference, 23-25 January, Gold Coast.

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The contribution of colleagues to improving this paper is gratefully acknowledged, while all remaining errors are the author's own.

The views expressed in this paper are those of the author only and do not reflect Queensland Government policy.

The process for identifying CAR reserves was to be CRA. Reserve criteria were to be developed by a Technical Working Group (JANIS) comprising scientists and planners from all State and Territory forestry and conservation agencies and from CSIRO.

The Commonwealth's preferred reserve criteria (Commonwealth of Australia 1995) were conservation oriented. Delineation of reserves imposes physical limits on economic use, effectively deciding on the use of all forests. Still, the maximization of social welfare from all of its sources was not among the objectives declared by the Commonwealth. Rather, the achievement of specific conservation objectives was prescribed, including the much-publicized position that 15% of pre-1750 forest communities should be preserved. There were no economic and social criteria, and the consideration of economic and social issues was limited to suggesting the selection of the least-cost reserve option, once conservation criteria are satisfied.

Subsequent iterations in further developing the criteria, to become known as the JANIS criteria (e.g., JANIS 1996), have paid more attention to socio-economic aspects. It was conceded that potential socio-economic consequences may limit the achievement of the 15% target in some cases (and that conservation objectives may be satisfied at "a lower level of reservation (e.g., 10%)" in other cases). However, otherwise there has been no departure from the 1995 Commonwealth criteria on the points above. Moreover, as the specific targets are still included and their achievement is to be monitored, they constitute an anchor in any negotiating process.

2.2 RFAs around Australia

An interim agreement on deferring the consumptive use of certain forest areas, pending the RFA process proper, was reached in NSW in 1996. It is known as the Deferred Forest Agreement (DFA). The NSW DFA process was similar in its objectives, methods and scope to those likely to be followed for RFAs.

CRA processes are under way in Tasmania (for that state as a whole), in Victoria (East Gippsland and Central Highlands, the former being more advanced), Western Australia and Queensland (for the South-East Queensland bio-geographic zone). The locations of these RFA regions, and others planned to be carried out in the future, are shown on Figure 1.

The NSW DFA has already resulted in an agreement. CRAs have been carried out in Tasmania and East Gippsland, with the reserve designs approaching completion. CRA has officially started in WA. While much preparatory work has been done in Queensland, the CRA process has not yet formally started for lack of a signed Scoping Agreement between the State and the Commonwealth. Also in Queensland, an Interim Management Arrangement (IMA) is being finalized to keep conservation options open for the CRA process.

3 Nature-Economy Conflicts

3.1 Philosophical issues

Fundamental philosophical differences lie at the root of divergent analytical preferences for representing conflicts in resource use. Roughly, the pure anthropocentric paradigm considers the ecosystem as subordinate to human society, while the pure ecological paradigm holds the opposite view. Hence, as a matter of principle, trading off vital ecological interests for human objectives is acceptable to anthropocentric analysts and unacceptable to ecologists.

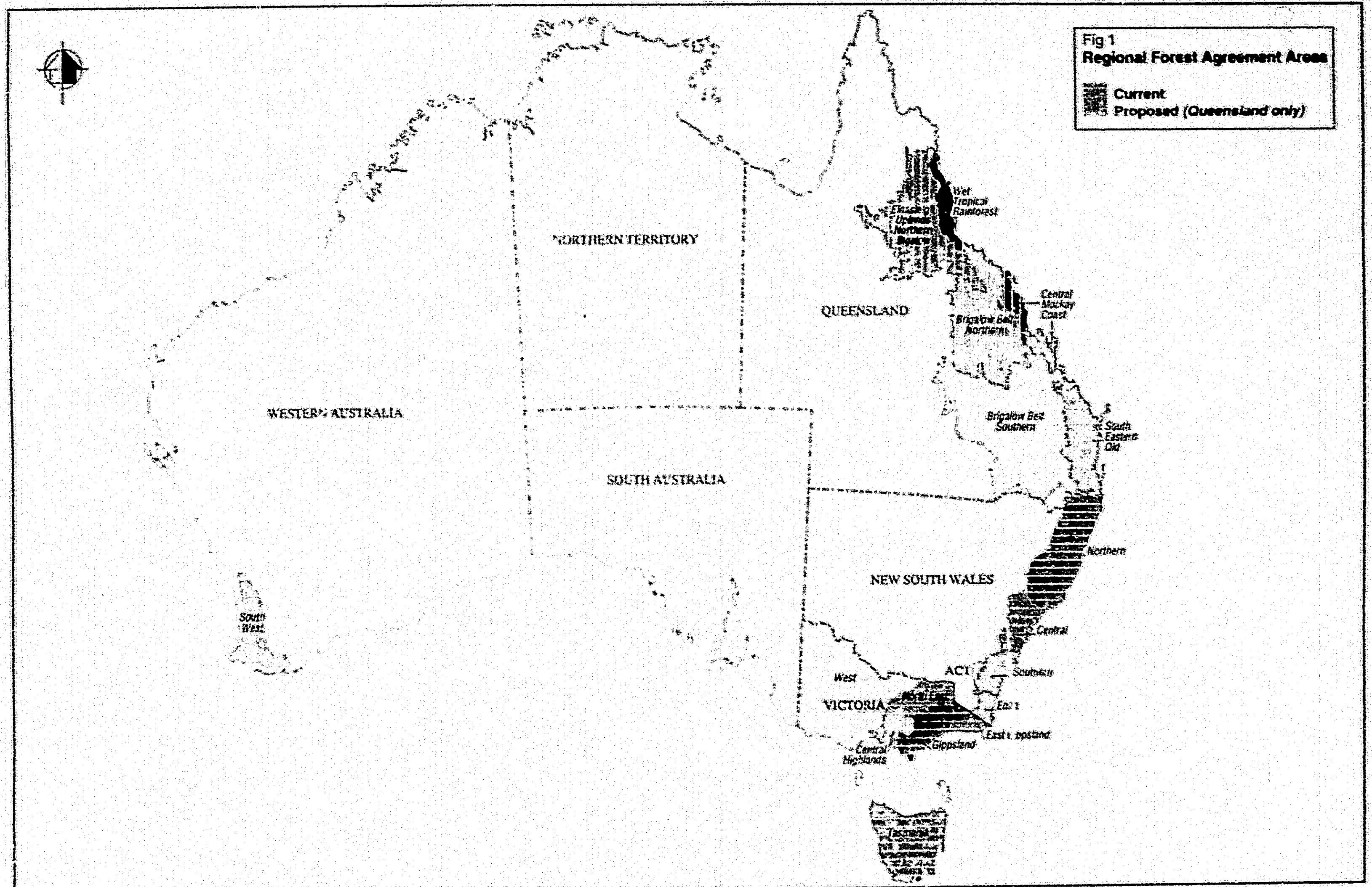

Fig 1
Regional Forest Agreement Areas

The use of the precautionary principle[3] is central in conservation-oriented analysis (Jacobs 1993 pp.8-9). The absence or presence of the precautionary principle dinstinguishes 'weak' and 'strong sustainable development'. The notion of trading off conservation and consumption belongs to the former, introducing absolute ecological limits or constraints on human activity to the latter. 'Weak' cost-benefit analysis has its 'strong' counterpart in constrained policy assessment. Jacobs (1993) compares the application of the precautionary principle to engineering where cost and aesthetic attributes of a design are only applied once compulsory safety requirements are satisfied.[4] He is among those advocating such constraints for decisions affecting the environment.

The JANIS criteria for the CRA process clearly reflect the ecological paradigm, complete with the prescription of specific constraints.

3.2 Conceptual considerations

In a basic representation of forest use, conservation and consumption can be viewed as two independent, alternative 'products'.[5] Figure 2 illustrates the 'production' and 'consumption' of the two 'products'.

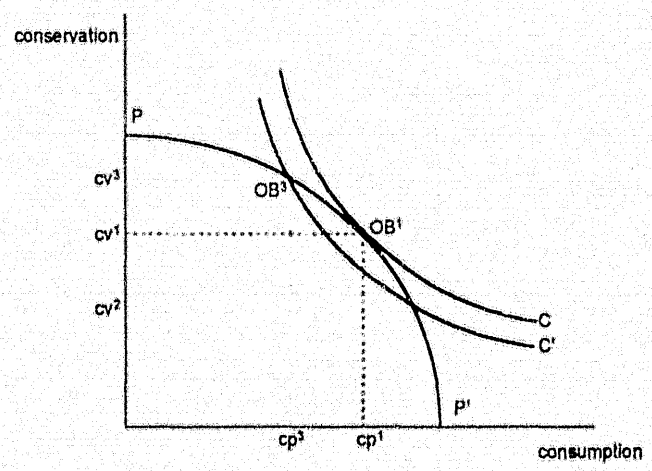

Fig 2 Basic Representation of Consumption/Conservation Alternatives

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[3] The precautionary principle (Young 1993 pp.12-17) has been accepted by the Inter-Governmental Agreement on the Environment, committing all levels of Australian governments to apply it in in their decisions. The definition used is: "where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public decisions should be guided by: (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and (ii) an assessment of the risk-weighted consequences of various options."

Note that there is no such principle applied to the opportunity cost of foregone material gain, on grounds that human-made capital is "easily replicated" (p.14). At the level of individual capital items this approach is quite acceptable. However, the experience of social experimentation has showed that the economic, and social, cost of consistently biased political decisions can be very large in the long run.

[4] Ironically, even the engineering safety standards thus held up as absolute are far from that. A case in point is the debate on 'affordable safety' in Australian civil aviation during the early 1990s.

[5] Forests being a renewable resource, consumption means the final loss of individual trees but not of the forest. At a certain intensity of consumptive use, regrowth is sufficient to make consumption sustainable in the long run. However, sustainability has different levels and interpretations, depending on the conservation objectives included. For example, sustainability from a timber-production point of view may not be sufficient for the sustainability of biodiversity in the forest.

The production possibilities curve PP' borders the feasible bundles of consumption and conservation. A notional social indifference curve is represented by curve C. Unrestricted, the socially optimal output bundle of consumption and conservation is at point OB^1, allowing conservation at level cv^1 and consumption at level cp^1. Placing a minimum restriction on conservation at level cv^2 does not restrict consumption sufficiently to prevent the achievement of the optimum output bundle. However, setting the minimum conservation at level cv^3 restricts consumption to cp^3, and forces society to make do with output bundle OB^3 that lies on indifference curve C', representing a lower level of social welfare. Placing minimum restrictions on consumption would have similar possible outcomes. The JANIS criteria constitute minimum required levels of conservation, but JANIS (1996) does not even consider whether they may force suboptimal outcomes from the point of view of total social welfare.

The maximization of total welfare from merely two attributes does not require sophisticated analytical techniques. Even if the units are different, tradeoffs between two attributes can be easily conceptualized.

A more general representation of the values associated with forests would require the formal treatment of a range of use- and non-use values [6]. Total social welfare from forest 'use', also called total economic value (TEV) (Dann, Hennery and Stephens 1996), would thus be a function of welfare gained from each 'use' attribute.

$$TSW = f(u,n) \qquad 1$$

Where: TSW = total social welfare,

u = represents social welfare gained from the consumption of use attributes, and

n = represents social welfare gained from the 'consumption' of non-use attributes

Maximum TSW is then achieved at those levels of 'use' in the individual attributes where marginal welfare gain from all attributes is the same. To analyse such multi-dimensional optimization problems, formal analytical techniques are necessary. These techniques range in complexity from simple checklists or scoring models to complex models implemented as systems simulation or mathematical programming (Antony and Hardaker 1991). Most analytical techniques are limited to the diagnostic analysis of a predetermined system and the passive measurement of its performance. Only mathematical programming is suitable for the optimization of the system, as well as providing performance measures.

The main conceptual obstacle in the way of assessing tradeoffs and maximizing social benefits in conservation decisions that have economic implications is the impossibility of the social welfare function (Arrow 1963). The practical way around this problem is to use proxies representing the interests of as much of society as feasible. This includes consulting stakeholder organizations, conducting stratified surveys, and entrusting select decision-makers to nominate a social welfare function. In most political processes, there is only an implied welfare function, created through the interaction of stakeholders.

However, the more formal the analysis the less scope there is for avoiding the explicit specification of a welfare function. This is particularly so if data for the various attributes are used in their 'native' units. At the stage of integrating economic values with those for other attributes, a summary function needs to be generated that includes formal weights on each attribute indicating their relative worth. One emerging way around this is to measure even the

[6] See DEST/DF/RAC (1995) for a classification of non-use values of the natural environment.

attributes associated with non-consumptive use with the same unit as the consumption attributes, most likely money value, via non-market valuation (DEST/DF/RAC 1995) While for most conservation attributes this requires an additional round of data collection, the compilation of survey results provides scope for the combination of the respondents' revealed welfare functions.

4 Decision-Making Approaches for Australian Forest Reserves

4.1 Economic assessments and their use - the status quo

Reports are available on the NSW DFA (RCAC 1996), and the Tasmanian (TPLUC 1996) and East-Gippsland (CVRFASC 1996) CRA processes [7] Logging, understandably, was foremost among the economic activities in forest assessment, while other economic activities considered were mining, forest grazing, apiculture, minor forest products, and tourism and recreation Economic implications of potentially changed water quality were also investigated. For logging, involved studies were carried out on general resource availability and log yields under various management regimes, as well as on the industry's structure, product range, costs and margins, current and prospective market situation and development options.

The 'strong sustainable development' approach has been observable in DFA/RFA processes in Australia. One way or another, conservation objectives are used for 'seeding' the reserve design, thus introducing the conservation limits or constraints on consumptive activities advocated by ecologists The NSW DFA process employed the most formal method for compiling, developing and presenting the conservation criteria aided by the Irreplaceability software, a geographic information system (GIS) implementation of conservation rules (Pressey et al 1995). Tasmanian and Victorian CRA processes were less formal in their generation of the conservation boundaries.

As prescribed by the Commonwealth Government, economic and social criteria were applied in a cost-minimizing fashion to select between reserve design options generated by conservation criteria. The processes for integrating conservation criteria with economic and social aspects of the decision problem varies between the states.

In NSW, the vehicle was a conference of stakeholders' focus group, dealing with the main regions separetely. Starting with the reserve priorities suggested by the computer runs of Irreplaceability, contentious forest areas were individually negotiated over by representatives of the conservation movement and the forestry industry. This approach reduced the decision problem to the two-product model shown in Figure 2. During negotiations, reserve designs representing four scenarios (Crown sawlog allocations at 30%, 50% and 70% of 1995 levels, and the satisfaction of conservation criteria) were benchmarked in their satisfaction of the targets for conservation and sustainable yield. Tradeoffs were considered informally over the process of 'rolling out' reserve area to meet conservation objectives and 'scaling it back' to satisfy industry requirements.

The Tasmanian Public Land Use Commission was given the task of conducting the CRA in that state, and it was this body which is to carry out the integration with public consultation, using a process as yet unpublished. For East Gippsland integration was done by the Department of Natural Resources and Environment, again with stakeholder consultation. It would appear that integration in East Gippsland was essentially a manual, GIS-based process.

[7] Note that published material on Australian RFAs is available on the World-Wide Web at http://www.crin.gov.au/land/forests/rfa.html .

In all three states, draft reserve boundaries reflecting conservation objectives were handed over for economic analysis. The resource left outside the reserve was quantified, primarily from the timber-production viewpoint, and the economic impact of the option was calculated. In addition to the awareness of negotiating timber-industry representatives of their industry interests, regional economic impact was estimated in NSW using input-output models of the timber industry (Margules Groome Pöyry 1995). In the Tasmanian and East-Gippsland CRAs, the structure of the timber industry was analysed using ABARE's FORUM model (Hansard et al. 1996) within specific resource and regulatory scenarios and regional economic impacts were calculated using general-equilibrium models.

Although not a CRA study itself, a relevant analysis of Australian forest management was that by the Resource Assessment Commission (RAC 1995). It was aimed at investigating, at the macro level, the feasibility of simultaneously satisfying both conservation and consumption objectives in forest use. The conclusion was that there is little scope for 'win-win' solutions.

The CSIRO's framework for developing land-use options, LUPIS, must be mentioned (Ive 1992). Essentially a computerized implementation of a scoring-model, it is the method considered in detail by the Commonwealth for integrating conservation and consumption data layers in the forthcoming CRA processes. It is understandable that scoring models would be seen as the reasonable compromise between cheap but totally informal methods on the one hand, and sophisticated methods that are expensive due to their demand for detailed data on the other hand. However, it must be kept in mind that, despite their seeming systematic nature, scoring models still rely on subjective scores derived by experts. This aspect makes it likely that scoring models used in integration would not satisfy the Commonwealth's earlier requirement (Commonwealth of Australia 1995) that the process should be repeatable. Perhaps this realization caused the requirement to be dropped by the time of JANIS (1996).

4.2 Economics in the Queensland CRA

It is likely that the Queensland CRA will differ from those in other states in emphasis, rather than constituting a radical departure. The state government has indicated its intention to attach equal importance to all attributes and not to be held to "arbitrary" numerical constraints.

The proposed economic analysis assumes that the Queensland CRA will still retain the basic approach of socio-economic cost minimization within limits set by conservation criteria. The method and procedure for the integration of environmental, heritage, economic and social data layers are under development (Ward, Burgess and Said 1996). The chosen integration framework will have implications for the way economic data are used. There may be scope for the optimization of some subsystems, but an all-inclusive optimization of conservation and consumption uses is not likely to be carried out. It is expected that two types of economic data will be needed in two distinct types of economic analysis:

- data covering the whole CRA region, for the valuation of the total opportunity costs of alternative reserve designs, of medium resolution and precision for cost reasons, and
- data for the in-depth analysis of the socio-economic parameters of a small number of specific areas of resource-use conflict, of high resolution and precision.

Medium-resolution data will have to be available before the integration of the conservation and consumption layers, while high-resolution data will be collected once the areas of resource-use conflict become evident.

The intention is to provide a full regional set of GIS-based economic values for the main activities generating use values: timber production, grazing, apiculture, mining. For timber production, forestry resource data will be used as the base of valuation. Quantitative specifications in grazing and apiary permits will be the basis of valuing resources for these industries that are relatively more important in Queensland forest use than in other states. Resource endowment is indicated by carrying-capacity figures in grazing permits and the number of apiary permits in individual forests. With further refinement, these will be sufficient to estimate productivity and thus distinguish resource values for areas within the bio-geographic region. Mining and tourism potential are less certain, but it may be possible to generate similar information sets for these forest uses.

It is intended to estimate the expected net opportunity cost of CAR reserves. Although impacts on industry attributable to causes other than the reserve system should not be held against the reserve system, it is not clear if such a distinction has been made in other states. Specifically, by all indications, the logging of native forests would decline in the future even without locking up any more forests. This will be included in a formal 'without-CRA' scenario, or 'base-case' scenario, of the potential use value of forests.

In analysing specific areas of resource-use conflict, consideration will be given to the economic valuation of conservation attributes to allow a precise measurement of potential tradeoffs. On such a smaller scale, relevant conservation issues are identifiable and of a small number. Data connection on them may thus be possible to accommodate within the resource limits of the CRA analysis, so that a general welfare measure, something approaching TEV, can be estimated.

4.3 The alternatives

The CRA processes carried out in Australia to this date have been manifestations of the ecological approach to forest management, by virtue of using socio-economic criteria after, and within the constraints determined by, conservation objectives. It appears that no coherent alternative process has been outlined that would satisfy the anthropocentric paradigm and the small-area decision focus of CRA at the same time. There is a number of likely reasons for this.

The direct calculation of tradeoffs would require all attributes measured in the same unit, while optimization would necessitate the use of a sophisticated formal model, most likely mathematical programming, and a social welfare function. Even if a complete list of all environmental and heritage attributes could be generated for an area as large as those of CRAs, their uniform economic valuation would be prohibitively expensive via the state-of-the-art method, non-market valuation (Bennett 1996). Advance in computer technology has removed the technical limitations of using large programming models. However, the application of such highly automated systems in political decision-making has its dangers, i.e., their perception by stakeholders as 'black boxes' hinders the general acceptance of the decisions thus prepared.

Nevertheless, these problems are likely to constitute only a short-to-medium-term hindrance. In the long run, further advance in ecological/environmental/resource economics will overcome the problems. In particular, modified national accounting (measurement of the 'Green GDP' concept compatible with TEV) will provide a unified framework for the assessment of conservation and consumption outcomes simultaneously (Kulshreshtha 1994).

Even though the overall optimization of micro-level land use over large regions appears infeasible using current economic methodology, there are other short-term applications for it.

Specifically, the valuation of conservation and consumption attributes with the same unit of measure, as well as the quantification of conservation/consumption tradeoffs, is possible via non-market valuation where the set of attributes is small. CRA processes should make use of this and include the estimation of social welfare, or TEV, for specific smaller locations or, as advocated by Bennett (1996 p.31), at an aggregate level within a cost-benefit analysis framework. Doing so would initiate the accumulation of information on the net social-welfare implications of RFAs and contribute to their socio-economic validation. Initially used in a diagnostic way, it would prepare the scene for the gradual extension of the method and its eventual interface with modified national accounting.

5 Conclusions

The process currently used in Australian CRAs cannot guarantee socially optimal forest use. While much effort is put into assessing conservation and consumption values, the integration process remains the weak point. There is no single, overarching objective in the process, such as maximum social welfare, whose achievement might be measured. This impedes the formal reconciliation of the interest of society vis-a-vis the environment, and of groups in society vis-a-vis each other, in a systematic and transparent way. Instead, reconciliation relies on political processes that are necessarily ad hoc and reflect lobbying power.

The up side of the ad-hoc element of the political process is that extensive client consultation does provide the opportunity for stakeholder groups to participate in the decision making. This ensures that the decisions are not arrived at by government officials talking to academics. In particular, the decision criteria can be dynamically tested, and even adjusted, for social interests that may have previously been insufficiently accounted for.

While the criteria put forward in the CRA process are not conducive for a general optimization of social welfare, neither are there off-the-shelf methods that could be easily applied to this task. The fact that the extent of departure from socio-economic optimum in the CRA process is not measurable without substantial further analysis reflects the limited alternatives that economics can offer for handling such political decision problems, in their full complexity, at this stage.

By the time the current round of RFAs comes up for renewal, economic theory and practice may well have progressed to providing a unified framework for the measurement of conservation and consumption alternatives. Until then, applications of non-market valuation to small areas and/or small sets of attributes would give useful indications of net social-welfare effects of RFAs and help the extension of the method.

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