Institute of Foresters of Australia (IFA) submission to the Garnaut review

Issues Paper 1: Climate Change: Land use – Agriculture and Forestry

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1 Introduction

The Institute of Foresters of Australia (IFA) is a professional organisation with 1300 members engaged in all branches of forest management and conservation in Australia. The Institute is strongly committed to the principles of sustainable forest management and the processes and practices which translate these principles into outcomes.

The membership represents all segments of the forestry profession, including public and private practitioners engaged in many aspects of forestry, nature conservation, resource and land management, research, administration and education.

The IFA appreciates the opportunity to make this submission to the Garnaut review, Issues Paper 1: Climate Change: Land use – Agriculture and Forestry.

This response is structured to respond directly to the key components of the issues paper. Specific responses to items discussed in the issues paper are outlined in section 2, and responses to some of the 'questions for consideration' raised in the issues paper are provided in section 3. Some additional science regarding adaptation in forestry is discussed in section 4 and mitigation in section 5. In accordance with the objectives of the IFA, this paper responds to issues related to forestry and forest management in Australia, or the interaction between forestry and agriculture. It does not attempt to comment on the agricultural issues raised in the paper.

2 Specific comments on the issues paper

The IFA would like to make the following comments in relation to specific items within the issues paper.

- Box 3.1 – Improved fire management and preventative measures are one of the most effective and arguably cheapest ways to reduce emissions for forestry sector;
- P 4 – The reference to 'diffuse sinks and sources' and 'measurement difficulties' are not necessarily applicable to the forestry sector. Indeed throughout the paper, many of the references to agriculture do not pertain to forestry. Australia's forestry sector is concentrated within a few key regions, along the east coast, in the 'Green Triangle' of Victoria and South Australia; Western Victoria; and south-west WA. Some of the large plantation companies own significant areas of land, and many of these are already estimating the amount of carbon in their forests. Estimation of forest carbon, while complex, is not subject to the same estimation difficulties as agriculture. Most forestry companies measure volume of their forests as a routine business activity, and estimates of volume can readily be converted to carbon;

- P 5 – The reference to 'high diversity of entities' is not quite as applicable to the forestry sector as it is for agriculture. The forestry sector is more consolidated within a relatively constrained area;
- P 5 – The reference to 'high diversity of emissions' is not necessarily applicable to the forestry sector. Most emissions are carbon (CO_2) related;
- P 5 – Trade exposed industries. If Australia's forestry industry does not receive a price for forest carbon while its competitors do, this may give our competitors a price advantage. This is already likely to be the case, as New Zealand's plantation owners will receive a 'price of carbon' from 1 January 2008 (ie: allocation of New Zealand Units), for all forests established after 1990.
- P 5/6 – Acceptances of liabilities for inclusion of forestry within an ETS. Current carbon accounting rules under the Kyoto Protocol and the AGO Greenhouse Friendly scheme assume that all carbon sequestration is emitted in the year of harvest. This presents a significant limitation for commercial forest owners, as carbon stock changes must be aggregated at the estate level, or reported in accordance with fluctuations in the harvest cycle. The current approach also dis-incentivises small forest growers, as they are less able to buffer emissions across an entire estate. A long term averaging approach might be less cumbersome, more inclusive of a range of forest owners, and more representative of long term carbon sequestration in forests.
- P 6. – The IFA agrees that production of biomass energy from forest residues provides good climate change mitigation strategy. However biomass energy policies should be carefully created to avoid perverse incentives. The IFA considers that biomass energy should only be produced as a bio-product from native forest harvesting, not a primary product. For plantations, full life cycle carbon accounting should be undertaken to calculate the net climatic benefits of plantations grown specifically for production of biomass energy.
- P 7 – Point of obligation. As per the comment for acceptance of liabilities, the IFA supports the adoption of a long term averaging approach to forest carbon accounting. In this way, land-holders would only be liable for emissions if they exceeded the long-term average scenario.
- P 7 – Monitoring and verification of emissions. Monitoring and verification of forests is regularly undertaken as a routine part of business for forest managers in Australia. Many forests now have been verified and certified under independent forest certification programs (under the Australian Forestry Standard [AFS] or the Forest Stewardship Council [FSC]); and are also managed under State based codes of practice, which in some cases, have legislative backing. Therefore forestry has much better internal control procedures than agriculture in Australia, and many of the monitoring and control issues mentioned for agriculture do not pertain to forestry.

- P 7 - Models such as the Australian Greenhouse Office *FullCAM* model simplify forest carbon estimation procedures. Such models should be used by trained operators, and be accompanied by forest inventory measurements to ensure model estimates are reflective of reality. The presence of such a model implies that Australia's forestry sector currently has the tools to accurately estimate changes in forest carbon stock, and therefore participate in an ETS.
- P 7. The use of satellite imagery for monitoring and verification is not reliable on its own. For example, areas which have been harvested, but are intended for reforestation will temporarily show up in satellite imagery as having been cleared, until vegetation cover has re-established. Also satellite imagery will not necessarily be useful in judging whether reforestation has been successful. Independent auditing and verification of reforestation success will be important. Current forest certification systems (AFS and FSC) provide suitable mechanisms to address this issue. In addition Codes of Practice such as the Tasmanian Forest Practices Code (2000) require reforestation is successfully completed before a Forest Practices Plan can be certified as complete. Such mechanisms should be incorporated in monitoring and verification systems.
- P 9 – The IFA supports the recommendations of the Prime Ministerial Task Force on Climate Change, in identifying the "recognition of avoided deforestation and the development of rigorous methodologies … (to) account for harvested wood products, as key areas for development."
- P 10 – Compatibility with international frameworks. The IFA notes that a number of deficiencies have been identified in relation to the requirement for 'additionality' under the JI and CDM. This includes the difficulty of proving additionality for biodiversity enhancement projects and difficulty in verification of hypothetical baseline scenarios. To streamline the verification process, the IFA suggests that particular types of forest carbon projects (such as biodiversity plantings; or plantings in specified areas considered 'non-commercial' for traditional forestry) could be pre-approved to meet the additionality clause.

3 Responses to questions for consideration

This section responds to specific 'questions for consideration' raised in the issues paper.

3.1 Adaptation:

1. How might these adaptation challenges be addressed?

There are a number of options available to plantation industries to adapt to climate change. These include:

- Facilitated migration (shifting species to regions where they are more suited to the climate);
- Choosing drought resistant species;
- Thinning during drought periods and wider initial spacing to spread water supplies among fewer stems;
- Genetic improvement and breeding for drought/climatic resilience;
- Improved site selection;
- Estate diversification (planting across a range of species and areas to spread risk); and
- Use of water-holding gels and protective seed-beds to assist in seedling establishment.

In the context of native forests many of the above strategies are partially achievable but would be almost impossible to implement on a broad landscape scale. In addition, there would likely be public opposition to any significant intervention in natural systems without robust scientific justification.

<u>IFA Position:</u>
The IFA advocates the development of science-based responses coupled with an extensive education program to assist Australia's forestry industry and stakeholders to adapt to climate change.

The IFA suggests that following issues should be considered in developing and implementing climate change adaptation policies and programs:

- Rates of climate change are generally considered to exceed the rate at which forests can adapt to these new conditions. Significant and unprecedented anthropogenic interventions will almost certainly be required to maintain biodiversity and supply of forestry and forest products;
- Australia's forests will need to adapt not only to the direct effects of climate change (temperature, rainfall and evapotranspiration); but equally importantly the secondary effects of climate change, such as changes in the frequency of fires, storms; pests and diseases;
- The long term planning horizons for the industry, particularly for native forests, should be considered in prioritising efforts for adaptation to climate change. Harvest cycles of sixty years or more are not uncommon, and therefore the species that are planted or re-established today may not be best suited to optimal climate for forest growth;
- It is likely that regional climate change forecasts will need to improve significantly before plantation owners are likely to reconsider their current commercially favoured species and management techniques;

- There are significant ethical concerns regarding the extent to which anthropogenic interventions can be used help native ecosystems adapt to a highly modified environment, as predicted under climate change. This is likely to raise significant political issues, which may constrain the adaptive capacity of Australia's forestry sector. For example, breeding or genetic improvement for drought/climatic resilience is likely to be opposed by some sectors of society. Likewise, the utilisation of non-indigenous species for regeneration of native forests is also likely to be controversial. There may be implications for Australia's biosecurity policies;
- Strategies to spread risk across different species and geographic locations are likely to be constrained by the necessity of plantation owners to achieve economies of scale (ie: single or few species) with established or emerging markets; and to be located within close proximity to ports or manufacturing facilities;
- There is significant potential for the forestry sector to assist the agricultural sector in adaptation to climate change. The use of trees as shelter for livestock, crops and pasture has been shown to reduce heat stress and improve productivity.
- Biodiversity, water supply, cultural values and socio-economic aspects are important in consideration of the role of forests in adaptation to climate change. They should not be viewed in isolation in the development of ETS (see Jackson 2007).

The IFA supports and encourages:

- Research and development on appropriate adaptive responses for the forestry sector. Implementation of field trials to assess climatic resilience of different species and forest management techniques should be prioritised in government funding programs and the results should be used in a scientifically rigorous manner;
- Taking a long-term view and maintaining as many options as possible for developing future forest values;
- Development of forest valuation systems which take into account biodiversity, water and cultural values as well as the commercial value of forest produce (timber and non-timber forest products) and carbon;
- Improvement of regional climate change prediction models which are scientifically robust;
- Integration of forestry into agricultural activities using species and silviculture that complements farm management and results in increased biodiversity, improved water quality and carbon sequestration;

- Development of insurance products that can insure against forest loss from the increased incidence of disturbance events or difficulties in re-establishment that might be expected under climate change; and
- Education programs to promote collaborative adaptive measures between the agriculture and forestry sectors.

The IFA considers that:

- Measures to assist the forestry sector to adapt to climate change should promote sustainable forest management practices;
- Implementation of adaptive measures in forestry will likely require extensive public consultation and education campaigns; and

The need for caution in implementation of adaptive strategies should be balanced against the urgency for implementation of such adaptive strategies. Well-supported field trials with long term funding provide an appropriate way to test adaptive strategies prior to widespread implementation.

3.2 Mitigation:

1. What incentives, policy innovations and/or market-based mechanisms would guarantee an optimal contribution to the national mitigation effort?
   - The IFA supports an ETS, alongside complementary policy measures such as favourable tax treatment for investment in forest carbon plantations to encourage mitigation in the forestry sector.
   - The IFA supports the recognition of the carbon storage within wood products within emerging green building codes and standards. This would require building codes to account for the embodied energy of all building materials.

2. What is the best way to deal with trade exposure if policy measures are implemented to reduce emissions from the agriculture and forestry sectors?
   - The Australian forestry sector risks being out-competed in domestic and export markets, if our key competitors benefit from supplementary revenues due to carbon and we do not. This is currently the case with New Zealand. As of 1 January 2008, New Zealand forest managers can receive revenue from the sale of carbon (NZUs) from all forests planted after 1990. The best way to manage this trade exposure is to similarly include Australia's forestry sector within a domestic ETS.

3. Accepting existing practical limitations, is direct inclusion in an ETS the most appropriate mechanism for encouraging mitigation in the agriculture and forestry sectors?

- The IFA supports the inclusion of forestry offsets within an ETS.
- The IFA supports the recognition of carbon stored in wood products within an ETS, while recognising that data on the full life cycle of wood products may not be available in the first instance.
- The IFA supports the recognition of bioenergy produced from sustainably managed forests as 'carbon-neutral' within an ETS.

IFA Position:

The IFA advocates the development of science-based market and fund based mechanisms that enhance the potential contribution of forests to climate change mitigation.

The IFA suggests that following issues should be considered in quantifying and trading forest carbon in an ETS for climate change mitigation purposes:

- Carbon accounting must be undertaken in accordance with agreed standards and independently verified. It should include potential losses and gains in all pools including: living tree biomass, understorey, litter, soils and dead wood pools, unless those pools can be demonstrated they are not a source of emissions;
- Net changes in forest carbon stock can either be positive (when the forest is growing) or negative (due to emissions from soil disturbance and biomass losses from fire or disease). Risk management procedures need to be adopted to account for unanticipated losses. This might include retaining of a portion of carbon in a reserve pool, or spreading risk across a diverse range of forestry offset projects;
- Estimates of change in carbon stocks can have large statistical errors due to the high variability in carbon density in different pools. Producing estimates of carbon stock change with low error can require many samples and this can be costly, particularly for small forest holdings.
- Models such as the Australian Greenhouse Office *FullCAM* model have been developed to simplify forest carbon estimation procedures. Such models should be used by trained operators, and be accompanied by forest inventory measurements to ensure model estimates are reflective of reality.
- ETS need to recognise the requirement for active silvicultural management, especially in native forests, which may be required to maintain ecosystem health (eg thinning to reduce water demand, control burning to reduce fire risk etc).
- Other forest values such as biodiversity, water and cultural values should not be considered in isolation.
- The role of forests in producing goods and services which contribute to economic well-being regional and rural Australia should also be considered. Forest policy must balance the needs of conservation, carbon sequestration and production.

The IFA supports and encourages:

- Incentives for the full range of activities and processes through which forests can mitigate climate change, including sequestration, reduced emissions from deforestation and degradation; biomass energy and product substitution; in a domestic emissions trading scheme, as well as schemes in both developed and developing countries.
- International cooperative efforts to reduce greenhouse gas emissions, incorporating quantitative commitments for emission reduction particularly in developed countries;
- International collaborative efforts to reduce deforestation, especially in tropical rainforests of developing countries;
- Capacity building within developing countries to enable implementation of professional and sustainable forest management integrated with sustainable agricultural practices and economic development for impoverished communities;
- Development and implementation of national and sub-national greenhouse strategies which recognise the carbon sequestration and storage role of forests;
- The ongoing development of scientifically defensible and operationally practical methods for accounting for both carbon storage and carbon fluxes in forests and forest products;
- Development of opportunities for trading of carbon sequestration and storage benefits in both formal compliance and informal voluntary schemes, subject to measurement and application being based on scientific principles, and full disclosure of the accounting methodologies and temporal characteristics of the carbon product; and
- Examination of options to reduce greenhouse emissions produced during the harvesting and wood and paper production processes. This includes adoption of reduced impact logging techniques; optimisation of haulage routes; and use of forest and mill residues to substitute for fossil fuels as an energy source.

The IFA considers that:

- Implementation of forest carbon projects should promote sustainable forest management practices;
- Forest carbon offsets should be used to supplement efforts to reduce greenhouse gas emissions from burning of fossil fuels, as well as investment in renewable energy sources;
- Increased use of wood products is a legitimate means to mitigate climate change. Agreed standards for monitoring carbon storage in the wood products pool are

under development, and these should be recognised in future carbon trading schemes;
- Efforts should be made to maximise the longevity of forest carbon sequestration and emission avoidance projects. However it should be recognised that even temporary emission reductions are of significant value, as they allow time for investment and development in renewable energy sources and low-emission technology; and
- Learning from the development and operation of forest carbon trading markets may assist with developing markets for other forest services such as biodiversity conservation, water quality and quantity, cultural values and recreation.

3.3 Inclusion of forestry within an ETS:

1. Do the economic efficiency gains from including small emitters in an ETS justify the costs of compliance? How could transaction costs be minimised?
   - Carbon pooling arrangements are emerging to allow inclusion of small-scale forestry offset providers to achieve economies of scale in measurement, monitoring and marketing costs.
2. Should a threshold for liability be applied, and how should it be defined?
   - The IFA considers that forest managers should not be liable to ‘refund’ offsets due to fluctuations in the harvest cycle. Recognition of carbon storage in wood products would address this issue. At the very least, a stand-level average carbon accounting approach would be more appropriate than current conventions that necessitate estate level average and thereby preclude small growers from participation.

3.4 Recognition of carbon offsets and sinks:

1. What types of carbon sink and mitigation measures should be included as offsets or within an ETS?
   - Land use change from forestry to non-forestry should be discouraged in an ETS unless suitable offsets can be achieved. These offsets should encourage like-for-like (eg tropical rainforest deforestation should not be traded for dryland forest afforestation). The IFA encourages better public understanding of the cycle of harvesting, regeneration and growth of natural forests through education programs.
   - Active forest management, which may include periodic forest removal by harvesting, followed by reforestation, should not be penalised under ETS. However, there should be some mechanism to ensure commitments to reforestation are met. The particular danger lies in changes of ownership between harvesting and reforestation.

- IFA supports an ETS, which fosters improved forest management and ensures reforestation is successful according to established forest practices and standards.
- Plantation forestry is suited to inclusion in ETS as there are defined rotations (varying from about 7 to 30 years) and ownership and management boundaries are easily defined.
- Native forests are more difficult to include in ETS due to complexity in structure, management and adjoining tenures with different management objectives (eg one forest area may encompass multiple State agencies, Federal and private ownership tenure). The long-term nature of native forest management with rotation lengths measured in decades and often centuries brings unique problems, especially for small-scale landowners who cannot manage their individual estates according to principles of sustainable yield, although this management may still meet principles of SFM when taken into the context of the national forest estate.
- Native forests are also exposed to catastrophic fires at very large scale (eg recent large fires in WA, Vic, NSW, Tas and NT). The loss of stored carbon from such events could not be compensated in financial terms without severe economic impact to the owner of that carbon.
- The IFA also supports an ETS that recognises the diverse values of native forests in providing biodiversity, water, cultural amenity and recreation as outlined in this submission.

4 Adaptation in forestry

General Discussion

The biophysical impacts of climate change on forests will depend on the particular tolerance range or ‘climate envelope’ of the forest species. Jovanovic and Booth (2002) have documented the climatic requirements (including temperature and rainfall) of a number of major native and plantation species in Australia. This provides a useful resource to identify forests that are mostly likely pushed to the edge of their climatic tolerance range due to climate change, and may therefore be most vulnerable to climate change.

Preston and Jones (2006) suggest that in Australia, water availability rather than temperature mainly limit forest productivity. It is suggested that regions where precipitation is expected to increase, up to a 1 C^o increase in temperature may actually increase forest yields. Where precipitation decreases under climate change, forest yields are expected to decline with increasing temperature.

Landsberg (1986) categorised the general response of trees to water stress according to short, long and severe impacts. Short-term (hourly) exposure to water stress, the plant hormone Abscisic Acid (ABA) is produced and transported to the leaves (Salisbury and Ross 1992). This, along with loss of pressure of the stomatal cells, results in stomatal closure thereby preserving water by reducing the rate of transpiration. As a result of this water conservation strategy, gaseous exchange between the leaf and atmosphere is limited, resulting in a reduced rate of photosynthesis, and consequently reduced growth. Similarly, long term water stress will again result in reduced photosynthesis and growth. This is due to a reduction in the translocation of sugars, causing reduced cellular growth (Salisbury and Ross 1992). Under severe water stress, trees will commence leaf shedding in order to reduce water loss via transpiration (Landsberg 1986). Again, this response will further reduce the rate of photosynthesis and growth. An increase in allocation of biomass to roots has also been observed in drought-stressed trees.

The timing of these individual responses will vary between species, and also depending on whether the trees were subject to gradual or sudden water stress. Trees that have been subject to gradual or historical drought exhibit drought acclimation characteristics, and are able to adjust the osmotic potential of their leaves to maintain transpiration at lower leaf water potential (Landsberg 1986).

4.1.1 Response of native forests to climate change

Most native forest species have a relatively narrow climatic envelope and therefore are predicted to have a poor adaptive capacity to climate change (Allen Consulting 2005). Preston and Jones (2006) suggest that warming of 1°C is expected to exceed the core habitat (climatic envelope) of 25% of Eucalyptus species. Established native forests may have a natural resilience to the effects of climate change, as they may be able to create their own 'micro-climate', however more research is needed in this area. It is generally agreed that seedlings are likely to be more vulnerable to climate change than mature, established native forests.

If current drying trends in the wet forest regions of south western Western Australia and south-eastern Australia (particularly southern NSW, Victoria and Tasmania) continue, there is likely to be widespread decline in health and growth of the predominant eucalypt overstory and a retreat of temperate rainforest species to smaller geographic distribution. This decline will also result in increased fire risk due to high fuel loads and a drier environment. Increased fire frequency places pressure on natural ecosystems to regenerate. Some species may be lost if fire frequency exceeds the time for trees or shrubs to each sexual maturity to provide seed for regeneration. A recent example is the alpine ash (*E. delegatensis)* forest of the Victorian highlands which were burnt in 2003 and again in 2006.

The role of human intervention in assisting regeneration through artificial seeding or planting needs careful consideration and research. The restoration of a sustainable ecological system in the face of changing climate is uncertain.

4.1.2 Response of plantations to climate change

Almost 70% of Australian plantations are comprised of just two species: radiata pine (*Pinus radiata)* and blue gum *(Eucalyptus globulus*) (AFFA 2004). The responses of these two species to climate change are discussed below.

A study conducted by Snowdon and Waring (1991) investigated the impact of artificial drought, 'normal' rainfall and irrigation on radiata pine grown near Canberra. It was found that there were five main physiological impacts of drought on Radiata pine: 1) a reduced rate of survival, compared with the irrigated stands; 2) shoot die-back, leading to multiple leaders and therefore reduced wood quality; 3) a 'drought-hardening' process, resulting in less deaths during drought than the irrigated and 'normal' rainfall stands; 4) a reduction in biomass allocation to foliage, but an increase in allocation to roots; and 5) a reduced growth response after rain (i.e.: droughted trees exhibited a type of cautious 'drought memory').

Blue gums show a number of adaptations for drought tolerance (Honeysett *et al.* 1996). For example, White *et al.* 1996 found that the elasticity of blue gum cells enable it to maintain cell turgor during drought periods. It was also found that blue gum recovers to normal rates of stomatal conductance within days following drought stress. These drought adaptations enable blue gum to maintain a high water use efficiency, allowing continued growth, even during drought periods (Honeysett *et al.* 1996). A side effect of drought stress in blue gum has been the observation that water limitation increases wood density (Searson *et al.* 2002). It is hypothesized that exposure to drought caused plants to thicken xylem cells, thereby adapting to the higher tensile strength required to transpire in low moisture.
Annual increment (MAI) of 4 year old *E. globulus* stands were observed up to 40 m^3 ha^{-1} yr^{-1} on sites with ground water access, compared with similar sites with no ground water access, MAI 20-31 m^3 ha^{-1} yr^{-1} (Feikema *et al.* 2002).

Studies investigating drought mortality of *E. globulus* plantations in both W.A. and Vic./S.A have shown that survival of *E. globulus* during drought is highly sensitive to water availability, as determined not only by rainfall, but also evaporation and soil depth (Crombie and McGrath 1999; Feikema *et al.* 2002). A study conducted by Crombie and McGrath (1999) examined growth of *E. globulus* along a rainfall/evaporation gradient in south-west W.A. An interaction between the importance of rainfall and soil depth was observed; the higher the rainfall, the lesser the reliance on soil water. Harper et al. (2002) found that *E. globulus* plantations on soils greater than 2 m deep experienced significantly fewer drought deaths (22%) than on soils less than 2 m deep (79%). (Smith 1999) suggests that the most important site factors determining drought vulnerability of *E. globulus* are climate, soil depth followed by salinity.

5 Mitigation options for forestry

Forests play a critical role in regulating concentrations of greenhouse gases in four main ways: by removing ('sequestering') CO_2 from the atmosphere through the process of photosynthesis; by acting as a store ('reservoir') of carbon much like fossil fuel deposits; by providing low emission biomass as an energy source; and by reducing emissions through substitution in place of more fossil fuel intensive alternatives such as concrete, aluminium and steel.

All plants capture CO_2 from the atmosphere via photosynthesis and convert this to carbohydrates captured in the biomass. Compared to most other plants, trees store much of this biomass carbon for comparatively long periods.

Forest carbon mitigation ('offset') projects differ from conventional greenhouse gas abatement projects in a number of ways. Forestry offset projects can both sequester and avoid emissions. Carbon storage in forests is potentially 'reversible' if the forest is burned, harvested or damaged by pests or disease. Forestry offset projects can result in either gradual accumulation of carbon over long periods of time (in the case of afforestation or reforestation), or can provide large quantities of almost immediate carbon offsets (in the case of avoided deforestation projects).

To facilitate trade of forest carbon, a complex array of policies and measurement procedures has been developed to cater for the unique properties of forest carbon offset projects. Implementation and development of forest carbon offset projects requires the integrated knowledge and skills from a variety of disciplines including; forest inventory and carbon modelling, remote sensing, policy related to climate change and emissions trade, future and current markets for carbon offsets; as well the economic aspects of forest management for carbon alongside a multitude of other products. Professional foresters are well positioned to advise on these issues.

The Institute of Foresters of Australia would be pleased to clarify any forestry or forestry related issues raised by the Review and thank the Review for the opportunity to make this submission.

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