INQUIRY INTO REGULATORY ARRANGEMENTS FOR TRADING IN GREENHOUSE GAS EMISSIONS

Submission by Roger Holloway, Director, TreeBank Carbon Services

66 Yarra St, Williamstown, Vic. 3016 (03) 9399 1275 Email <TreeBank@bigpond.com>

FOCUS OF THIS SUBMISSION

Vegetation carbon sinks as an offset for greenhouse gas emissions.

PRESUMPTIONS:

General

1 Government will act to ensure that Australia meets targets for greenhouse gas (GHG) reduction.

2 A system will be needed to enable accountability of emissions and to set industry or sectoral targets for GHG reductions (or reduced rates of increase) over time.

3 The system need not in the first instance, be accompanied by government-imposed regulations or carbon taxes (but the infrastructure would be in place in the event that further intervention becomes necessary).

4 Government will continue to favour and support the signing of voluntary, cooperative agreements through the Greenhouse Challenge Office (GCO) and to monitor the reductions achieved through this approach.

Vegetation sinks: general points

1 Australia advocated the inclusion of land use change and forestry to be counted as part of national carbon accounting and reporting on targets at the Kyoto Conference, notwithstanding opposition from several other countries.

2 Australia should be willing to be proactive on this issue and take a leadership role in establishing workable, scientifically-based processes for carbon accounting in vegetation sinks and their use nationally and internationally as (tradeable) offsets to GHG emissions.

3 Australia stands to benefit significantly from these initiatives, as a trading system *at least* in respect of vegetation carbon sink offsets of emissions will result in increased investment in plantations, agroforestry, environmental and land rehabilitation plantings. These will not only reduce net carbon emissions, contributing to national targets, they will also provide economic, social and environmental benefits in their own right.

4 Trading will take place, at least between sink providers and emitters who are serious about achieving reduction targets, whether or not the government takes a role, and such trade will continue unless it is specifically proscribed by legislation.

5 The House of Representatives is congratulated for this timely Inquiry and is urged to endorse measures to set a sound and practical framework for emissions trading which comprises or at least includes (vegetation-related) carbon sinks.

EMISSION RETURNS SYSTEM

A system of (carbon) Emission Returns, similar to a tax return is needed in order to track emissions and changes, *even if there is no tax or regulation* attaching to the return in the first instance.

In the absence of a returns-based system, it is not clear to the submitter how a Government might enable itself (should it need to in future) to develop and equitably apply policy 'levers' in order to achieve GHG reduction targets in the event of the failure of voluntary and cooperative programs.

The preparation of Emission Returns is a process that will take a few years to develop and become common practice within the accountability and target-setting framework of businesses and other relevant organisations. Once it is 'internalised' it will be possible for management to treat emission targets seriously, as part of their *core* considerations rather than as a peripheral issue, to be regarded negatively by some as a 'nuisance' or more positively by others as 'good public relations posture'.

This Inquiry can (and should) set the wheels in motion to require emitters above a (regulated) threshold quantity of emissions, *including those who are claiming 'sinks'*, to lodge Emission Returns. It should also propose a process to decide issues such as the thresholds, form, boundaries, content and frequency of those returns. (For example, it would seem reasonable that a sink claimant should furnish a return once every 5 years and in any year that a carbon credit claim or sale is made against the plantation.)
Substantial support, including default values, simple calculation protocols and provision of free computer programs that can use existing business accounting records to generate an emissions statement will be important.

Recommendation:

That this Inquiry initiate the *development* of an Emission Returns system covering the 6 greenhouse gases agreed through UNFCCC to be counted towards national targets. And that the system be introduced gradually, with supporting resources.

TRADING

Should sectoral or industry-by-industry regulations, licences or *allocations* of annual or moving average GHG emissions be introduced, and if a business can bank **'emission credits'** from instituting actions which bring its emissions below the allocated level, there can be a system of trading in emission permits or 'rights'. This submission is silent on how such arrangements might be established, allocated or monitored save to suggest:

1. A **right to emit** within a capped or regulated level of emissions of GHG will need to be expressed in (or readily converted into) **emission units** that are nationally and internationally acceptable.

2. A claim to *offset* GHG emissions by the provision of *carbon sinks* will also need to be expressed in (or readily converted into) these same units.

This submission is also silent on the regulatory arrangements that might be required that facilitates or limits the trading in 'rights' to emit. On the face of it, it would seem 'reasonable' that as a minimum, an **Australian 'right to emit'** should be required for any firm wishing to do business in Australia and include those figures within their Emissions Return. In this way, the allocation of (tradeable) emission rights will not lose their benefit to national greenhouse targets.

In practice the future trading of emission units will be driven by:

1. trading in ***Emission Rights*** (made possible by a system of allocation and a concomitant policy controlling or limiting their availability), largely taking place between emitters (on the one hand),

   - The seller of an emission right will be a government (which provides them) or a firm with a permit to emit more GHG than it needs by virtue of changes to production processes.
   - The buyer of an emission right is a firm that needs to emit more GHG than it is permitted to do by regulation, is liable to be penalised for by tax or fine, or undertakes to do for reasons of corporate citizenship, public relations or voluntary agreement.

2. trading in ***Emission Offsets*** (made possible by the desire of an emitter to reduce emissions and the availability of a suitably specified carbon sink) taking place between emitters and sink providers.

   - The seller of an emission offset will normally be a sink provider.
   - The buyer of an emission offset will be a firm wishing to report lower net emissions, (or wishing to prevent an increase in net emissions) and motivated by the same considerations as the buyer of an emission right.

EMISSION RIGHTS AND OFFSETS COMPARED

Note that the difference between an emission right and an emission offset is in their *actual greenhouse implications.*

A right to emit is policy tool and book entry that results in an emission within a (government-controlled) acceptability framework relating to its national emissions target (currently Australia's target is: 8% above 1990 emissions at 2012). An 'Australian right to emit' is needed in Australia in order to make the policy contribute to Australian targets. Regulations will be required that address these issues.

An emission offset arises by virtue of actions taken directly or indirectly to *reduce* greenhouse gases in the atmosphere. Provided it is properly specified the reduction (or 'sink') can, in principle, be transferred or sold between parties and between nations because climate change is a global issue.

In practice, there is no need to 'control' the sale of Australian sinks, either within Australia or overseas. If the Government considers that the 'export' of emission offsets arising through private sales is acting against the achievement of Australia's targets it can:

- tighten the allocations to emitter firms in the domestic market to more accurately reflect the emission target;
- enter the market itself as a purchaser of offsets (or rights);
- become an inventory claimant; or
- sell emission rights only against credits in its own inventory.

Recommendation:
Whether or not there is trading in GHG Emission Rights, it is recommended that:
- a **GHG emission offset unit** be specified for relevant sinks that is equal and opposite in value to a GHG Emission Unit;
- there should be an ability to trade an Offset Unit with an Emission Unit, thereby *cancelling* the Emission Unit for the reporting (and liability) purposes of the purchaser.
- the trading of emission offsets should be unrestricted nationally and internationally
- agreements will be needed between nations on technical matters, especially the specification of units, monitoring and verification standards and the obligations of parties to the transaction.

SPECIFICATION OF UNITS

It is important that the units (Emission Units and Offset Units) be determined and expressed in relation to the Global Warming Potential of carbon dioxide, even though this unit was originally developed by IPCC for other reasons. [This would make the units consistent with internationally agreed measures established through UNFCCC's IPCC and applied by NGGIC.]

However, it is also necessary **to select *one* time frame** against which the *biomass carbon offsets* will be determined. In this submission *100 years is the suggested time frame*, although it really does not appear to matter much whether it is '100 year tonnes carbon', 'tonnes carbon per year' (1 year tonnes carbon), or something in between (say 25 or 50 years). The time frame will need to be *set by convention and agreed* within the international community concerned with biomass carbon as emission offsets.

Provided that emission units and offsets are sensibly specified as equal and opposite in terms of their greenhouse implications, carbon sinks may be traded in their own right and will be seamlessly integrated with emissions whether for trading, asset assessment, reporting or national statistical purposes.

RELATING CARBON IN BIOMASS TO CO2 EMISSIONS

1 Equivalence issues

There appear to be some difficulties in relating carbon in the form of complex carbohydrates in vegetation (lignin and cellulose) to gaseous carbon dioxide. The critical issue appears to be the radiative forcing resulting from CO2 (and other GHG) in the atmosphere over time. The IPCC unit of Global Warming Potential based on CO2, is the radiative forcing resulting from 1 unit mass of CO2 injected into the atmosphere at the commencement of a *chosen time horizon*. There is an exponential **decay function** associated with the CO2 in the atmosphere such that if 100 years is the chosen time horizon there is *less than half* the original mass of CO2 remaining

and the **average** amount of CO2 present over the whole of the 100 year period is, we believe, *about one half the original mass* of CO2. This suggests that, on the face of it, the sequestration of **one half a tonne CO2** as carbon in plant tissues for 100 years will offset the Global Warming Potential of 1 tonne CO2 gas emitted in year 1.

If this argument is correct it would penalise carbon in vegetation if a 1:1 equivalence were to be assumed between carbon in CO2 and carbon in biomass carbohydrates if the offset unit is defined as 100 year tonnes carbon.

It is requested that the Inquiry seek clarification on this point to ensure the emission offset arising from holding carbon in biomass form over time is not penalised. This has the **potential to halve** the time needed to hold a given amount of biomass carbon to achieve a specified emission offset, or double the effectiveness of vegetation carbon measured on the assumption of a simple 1:1 relationship.

2 Relating 'uptake' and 'storage'

Current workbooks on carbon in vegetation focus on *growth* quantification issues (NGGIC Workbook 4.2, 1997; GCO Draft Sinks Workbook, in prep.). Little attention is given to the equally important *time* factor. For this reason additional discussion is warranted here.

It is commonly understood that a *growing* plant or forest acts as a sink to reduce atmospheric CO2, thus ameliorating the enhanced greenhouse effect. It is less commonly understood that storage of carbon, including the retention of a remnant forest in 'steady state' (that is, in balance between incremental growth and decay) also benefits the greenhouse effect by avoiding an emission and by incremental uptake of carbon that replaces decaying biomass. [A good analogy is a drainage system with a retarding basin: the drains provide a service by removing surplus water from land; the retarding basin provides a service by preventing land from being flooded.]

Another useful analogy is to see the growth as *income* and the retained biomass as *capital*. For greenhouse purposes the aim is to convert as much biomass growth 'income' into retained biomass 'capital' as possible over each measurement period of 100 years. There in not much point growing trees quickly if we are not also taking measures to retain the grown biomass.

Importance:

Deforestation or land clearing constitutes a reduction of biomass carbon in storage. Clearing rates are in the order of 470,000 ha per year in Australia, hence this constitutes a significant emission. [1990 figures reported by NGGIC provided a 'best guess' of 152 Mt CO2 emissions* resulting from land clearing. This represented **27%** of the total reported emissions for Australia that year, and was about twice the reported removals through forestry and other woody biomass growth (75 Mt CO2)] [*Note: Revised methods result in a figure of 122.6 Mt CO2 equivalent. (NGGIC, LUC&F, 1997, pxx)]

Given the relative importance of the *storage* role of vegetation, it is essential that careful consideration is given by this Inquiry and other policy bodies to identifying both 'carrots and sticks', including a market-related price mechanism to help achieve the desired retention of vegetation.

Policy responses:
It is perhaps easy to envisage a *penalty* for clearing. This might be imposed either through regulation or taxation. A more robust system will be one that includes a *financial incentive* to retain (and manage) existing forests and plantations for their carbon storage benefits. [Note that this will also encourage the growing of timber for durable products rather than pulp and firewood]

The question arises on how to provide a framework for price-driven market incentives for existing biomass in (say) a remnant forest, woodland, scrubland or mature plantation where the greenhouse benefits in the forthcoming time horizon (say 100 years) relates, at least in part, to the biomass (duration of carbon storage) arising in a previous period.

An approach to this issue is to *set a convention on greenhouse neutral decay and hypothetical growth post 1990*, using linear functions for ease of calculation. This model can then be used to calculate the greenhouse benefits of carbon storage. The model is illustrated in **Attachment 1.** The model effectively proposes that the greenhouse benefit of carbon in storage, using a 100 year time frame, is half of one percent per annum of the 'steady state' carbon in biomass from 1990 until 2090.(The steady state biomass would be subject to periodic monitoring, say once every 5 years, reducable to 1/10 in the event of no substantive changes, loss events and compliance with variance limits set by regulation or guidelines).

SIMPLICITY AND CONVENTIONAL PRACTICES WHEREVER POSSIBLE
Notwithstanding the complexities of calibrating the relationship between CO2 and carbon in biomass, it is strongly urged that simple field measures, protocols, calculation factors and default values be developed so that a sensible, conservative result is achieved in calculating GHG Emission Offsets arising in any vegetation regime.

The Inquiry should set (or recommend the setting of) agreed:
- field measurement techniques, practices and frequencies
- framework, protocols and relationships
- inclusions and exclusions
- calculations, factors and default values

for the purposes of:
- recording and reporting
- monitoring
- verification and auditing
- claiming of carbon sink assets
- sale or transfer of offsets

ELIGIBLE VEGETATION
Regulatory arrangements resulting from this Inquiry will need to specify the components of vegetation biomass that are eligible for assessment of 'carbon credits'.

Carbon in biomass can 'offset' the global warming effect of CO2 in 2 ways:

- **plant growth**, which involves a *net uptake* of CO2 from the atmosphere and its sequestration in the form of plant tissues, lignin and cellulose.
- **carbon storage**, the *time* that plants or plant products hold carbon out of the atmospheric cycle. This can be considered as deferring or avoiding the emission of CO2, and as offsetting a *time-defined emission*.

Both these aspects need to be considered as *positive contributors* to national targets and to reducing the level of greenhouse gases in the atmosphere.

1 Plant growth

It is proposed that the following components of *vegetation growth* be considered as 'eligible' for counting towards 'carbon credits':

Uptake between 1990 and current date [Retrospective uptake]

1.1 *Net carbon* additions achieved up to date of measurement due to *vegetation biomass* in the *current rotation* planted since 1990. [Figure 1.1]

Meaning of terms:

Net carbon: Carbon content of vegetative matter after subtraction of an agreed baseline, and project emissions.

Vegetation biomass: Plant tissues including foliage, bark and wood above and below ground.

Current rotation: An existing plantation or stand of vegetation whenever and however established and whatever interventions (deliberate or otherwise) may have occurred in the past.

1.2 Net carbon additions achieved up to date of measurement due to vegetation biomass in the current rotation planted before 1990, but excluding *biomass at 1990.* [Figure 1.2]

Biomass at 1990: A measured, assessed or default quantity of biomass in a plantation as at 1990. [1990 is the agreed base year for assessing national emissions]

Prospective uptake:

1.3 *Projection assessment* of net carbon addition in vegetation biomass in the current rotation, discounted by applying *prospective carbon discount factors.* [Figure 1.3]

(Please note: Figures have been forwarded by conventional mail)

Projection assessment: An assessment of the future uptake of carbon into biomass storage that will be achieved by the subject planting.

Prospective carbon discount factors: A set of time-risk discount factors to convert future carbon uptake forecasts to present value carbon credits.

Note: If prospective uptake is accepted, there will be a 'residual obligation' on the claimant of carbon credits to demonstrate, at specified points in the future, that realised uptakes meet or exceed the amount claimed, transferred or sold.

Future rotations

The question as to whether a present value should be ascribed to prospective carbon uptake in (contracted) future rotations is open to discussion. This submission takes no strong position as to its inclusion other than to note that some innovative greenhouse mitigation schemes (eg Foster Foundation's 'Greenfleet' project) already appear to be relying on it, at least in part, to make their case to contributors (purchasers of carbon credits). In these circumstances, the eligibility of this category must be carefully addressed by the Inquiry. The proposed schedule of prospective carbon discount factors (to be set by government authority) can readily be expanded to cover time frames that encompass future rotations.

Expressed in the form used above, the proposal would be to include:

1.4 Projection assessment of carbon uptake in *future rotations* subject to a *complying legal contract* and prospective carbon discount factors.

[Figure 1.4]

Future rotations: Replanting or coppicing following harvesting of the current rotation.
Complying legal contract: A Forest Property Agreement (Forestry Rights Act 1996 Vic) or common law contract which obliges one of the parties to replant an area where the vegetation has been removed (whether by harvesting or specified loss) and includes an indemnification clause at least to the extent of replacing the claimable carbon credits. The contract must also include (standard) minimum requirements for monitoring, measurement and revision of projected carbon uptake.

2 Carbon storage

This submission proposes that existing vegetation be declared as an eligible category for carbon credits calculation purposes as follows:

2.1 *Unprotected or protected vegetation* comprising existing remnants and other mature vegetation

Unprotected vegetation: Vegetation existing on private or public property where no specific legal measure has been taken to protect or control its removal.

Protected vegetation: Action that legally prevents or directly controls the removal of vegetation.

[This may, for example, be demonstrated by one of:

- ◊ The gift or sale of the land to another party where the receiving party contracts to protect the vegetation using a complying legal contract.
- ◊ The signing of a Forest Property Agreement or common law agreement that constitutes a complying legal contract and that contract protects the vegetation.
- ◊ The signing of a Conservation Covenant (such as available through the Trust for Nature (Vic) adapted to be a complying legal contract protecting the vegetation.
- ◊ Addition of private forest to a Reserve or Park where it is protected by legislation.
- ◊ Amendment of Planning Scheme (Vic.) prohibiting removal of specified vegetation.]

Implications for government support of a vegetation carbon credit system

Regulatory and related support measures needed to make the above system work include:

1 Declaration of eligible classes of vegetation additions and storages
2 Definition of terms
3 Declare a 'convention' for calculating carbon credits from existing vegetation, covering cases of protected and unprotected vegetation.
4 Provide a model insert for use in a Complying Legal Contract.
5 Setting schedules of prospective carbon discount factors, or publish guidelines and require sink providers to *declare* the factors they have used.
6 Set requirements for claimants of prospective uptake to demonstrate achievement and the manner of confirmation. (Penalties needed in default).

OTHER TECHNICAL ISSUES IN DETERMINING GHG EMISSION OFFSETS

Regulatory arrangements resulting from this Inquiry will need to specify *complying methods and protocols* by which carbon in biomass can be measured, monitored for retrospective uptake and storage, assessed for projected uptake, and verified or audited. The following suggestions are made:

- **Field measurements should rely on standard forestry practice** and be readily related to existing normal growth measures such as merchantable wood volumes (m3 and m3 /ha) and mean annual increments (m3 /ha /y). The less change needed from conventional practice the more accessible and understandable the system will be.

- An **expansion factor** is needed to estimate the total vegetative biomass from the initial merchantable wood volumes. Workbook 4.2 uses a factor of 1.9 with no explanation and defines it as not including roots. This suggests that an expansion factor inclusive of roots will be more than 2.0! An alternative, suitable for commercial plantations, proposed in the Draft Greenhouse Challenge Sinks Workbook is to combine a **harvest index** and **a root: shoot ratio**. This needs to be clarified and a default value (or set of values for different circumstances) should be set by an Authority and applied under subsequent regulatory or guideline arrangements.

- **Standard carbon densities** need to be set under which different plantations and vegetation stands can be assessed. This should take into account species, ages and floristic compositions (proportions) and be based on exemplar plantations and published values for Broad Vegetation Types *by a central agency* (rather than by sampling assessment of each project by service providers). The Inquiry should recommend that default values be set on the conservative side for ease of application and lower cost. The extra cost of proving up more accurate figures is not worth it in carbon Emission Offsets.

- **Baselines** need to be set and monitored. The approach proposed in the Draft Greenhouse Challenge Sinks Workbook is generally supported, except that the

cases of retained remnant vegetation and post 1990 rotations of plantations should be treated differently.

- **Project emissions** need to be monitored or set and subtracted. Emissions associated with the *production process and management* of the plantation or vegetation project need to be subtracted from uptake figures to give a net uptake figure. The calculation of these on a project basis will be expensive and impractical, hence some default values should be set for a range of different plantation and vegetation management regimes. The GCO Draft Workbook does not address this issue adequately.

- **Emissions at harvest or as a result of unintended loss must be counted**.

The Greenhouse Challenge Sinks Workbook recommends these be subtracted from the 'Trees and roots' pool as they happen, and harvest debris is assumed to decay linearly over the next 10 years. This approach is supported. Harvested timber is then counted as *sequestered carbon in a 'Wood products' pool* and project emissions (manufacturing into other products) are subtracted. Sale of the products to another party is not proposed to be counted as an emission (but will need to be considered by the purchaser).

- **Rotation length and time horizons** are critical to the determination of a GHG Emission Offsets from a particular plantation. The point has already been made that carbon in biomass needs to be related to a specified time frame (eg 100 years) over which CO2's GWP is expressed, so it is possible to relate the (average) carbon uptake and storage in any known rotation to an imputed mean over the specified time horizon. Questions arise in relation to environmental plantings for which the time horizon is indefinite and for plantations intended for harvest where there is a departure, intended or otherwise, from the nominated rotation length.

  ◊ **Environmental plantings:** Where a complying legal contract is made (and the time horizon is specified, and the contracting party is indemnified at least in relation to carbon), this is sufficient as a basis for calculating a carbon credit and its sale as an Emission Offset provided that the prospective carbon discount factors are used. Where there is no contractual arrangement it is important that the Inquiry recommends that default time horizons be set for different circumstances, which tie in to the minimum requirements for monitoring, measurement and revision.

  For example, it is suggested that a default value for revegetation of a nature reserve, or land subject to a Conservation Covenant might be acceptable as 100 years, but that for land not so committed, a normal maximum be (say) 67 years. A residual obligation remains for the claimant or seller to demonstrate achievement or make good the shortfall. This requires indemnification. In situations (to be specified) where longevity of the planting is under greater threat, perhaps 50 or even 33 years is a reasonable default time horizon. [Note that a planting that exceeds its default or specified time horizon accrues additional Emission Offsets, and may be eligible for a 'second payment' at this time. Alternatively, a planting that fails to reach its target will incur penalties, if only to the extent of buying back carbon credits from the market.]

◊ **Early harvesting or untimely loss such as fire damage:** In these situations it is easy to make an adjustment to the carbon Emission Offset unit balance held by a sink owner. In the event that a negative balance is not made up by eligible Emission Offset assessments (by replanting, or other credits in measurable plantations) it should be mandatory for the sink owner to purchase Emission Offset units sufficient to make up the deficit balance. This requires indemnification at the time of claiming or sale of offset units unless the claims are made only on *retrospective* growth and storage.

The Inquiry will need to set guidelines for the 'making good' of negative carbon unit balances, and have some method of accounting for performance and penalties for failure to comply. This implies a *registration system* for all plantings that intend to claim carbon credits.

- **Projection assessment** (future carbon uptake): This Inquiry should recommend the setting out of guidelines, procedures and requirements for projection assessment of carbon uptake potentials in current and future vegetation plantings, including the eligibility criteria.

CERTIFIED AND CERTIFIABLE UNITS

One option worth considering is to have two types of offset units:

A **'Certified'** offset unit would relate only to eligible *retrospective carbon growth and storage*, and is already verified prior to sale according to a set of nationally and internationally agreed rules. No prospective sequestration component is included. No residual obligation attaches to the unit. The equivalent in the conventional market is the trading of a physical commodity.

A **'Certifiable'** unit is one that sets a price at the time of transaction for delivery of a Certified Unit at an agreed future date, (say) 2, 5, and 10 (+ 20?) years hence. The market rules will need to be set to ensure that the purchaser has confidence in the 'quality' of what is being purchased. This goes to the necessary conditions for specification, measurement and verification of the Certified Unit.

The seller of a *Certifiable unit* may take into account estimates of retrospective growth and storage benefits and prospective carbon that is *capable of being certified prior to the specified contract delivery date.*

This unit carries:

- a contractual obligation by the sink provider (or seller) to verify the net carbon offset at some agreed point in the future. (This obligation may be satisfied by the direct provision of eligible sinks, or the purchase of a Certified unit.) and
- an indemnification requirement. (This can be handled in the normal manner under 'Client agreements' with a broker, although there may be a role for the Authority to check adequacy and provide guidelines).

The equivalent in the conventional market is a futures contract.

Different prices will be offered for **certified** offset units and **certifiable** offset units. Certifiable offset units with different delivery dates will also realise different prices.

MONITORING, VERIFICATION AND AUDITING

The traded value of carbon (or a rate set by carbon tax policies) will determine the level of accuracy adopted in measuring and verifying carbon inventories. [A price of $100 /100ytC will enable (and ensure) greater accuracy than would result if the price were $20 /100ytC or less.]

Kenneth MacDicken (1996) estimates that inventory techniques increasing from 'basic' through 'moderate' to 'high' should result in increases in accuracy of 10% and 5% to 10% respectively. [That is, an overall improvement of 15% to 20% by going from a basic measuring system to a highly intensive sampling and monitoring system].

Using these figures TreeBank Carbon Services estimates that for normal plantation regimes and well favoured environmental plantings, and a carbon value of $100 /100ytC this would need to cost less than about $400 and $300 respectively to be worthwhile. This means monitoring, verification and auditing **marginal costs** of $700 overall (or $7 /100ytC per year) to increase the accuracy from 'basic' to 'high'. On the face of it this appears to be a 'tough ask' even at these prices for smaller scale and high variance plantations. Lower prices will make careful measurement less worthwhile and even with the best available technologies (such as laser digital triangulation, point sampling and global positioning systems) there will certainly be a tension in self-monitoring and independent auditing services. An incentive will exist to claim the maximum carbon offset for the minimum outlay and the minimum intensity of inventory measurement.

This suggests that it will be unrealistic to expect every vegetation sink project to be assessed with the level of intensity and consistency needed to achieve better than 90% accuracy, even using accredited plantation and vegetation surveyors unless there is a *technical support system* in place providing sound but conservative default figures and calculation protocols that have national and international credibility.

The recommended approach is to base the whole vegetation carbon accounting and trading system, and the unit verification arrangements, on a set of published protocols for monitoring and calculation supported by default values, and to provide for the review, upgrading and elaboration of these over time.

There would be an important role for an 'authority' in **building up** (by research sampling) the scope and accuracy of default values, applying these to different 'land systems' (soil / climate / hydrogeology) or 'biological systems' (Broad Vegetation Types / Ecological Vegetation Classes / Bio-regional units).

The 'authority' would also need to set the figures in an internationally acceptable framework, and in the absence of such a framework or forum, to initiate one.

ACCREDITATION OF SERVICE PROVIDERS IN EMISSION OFFSETS

Rather than require an Authority to handle all the issues of carbon banking, accounting and trading, monitoring and verification it is strongly urged that the

Inquiry support the notion of accreditation of professional service providers, enabling the broadly-based certification of (vegetation-related) GHG Emission Offset Units (whether for annual returns, taxation, regulatory, statistical reporting, transfer, sale, asset valuations or any other purposes.) Given that there will be a number of possible purposes, there is an important coordination role for a government authority here.

Accreditation takes the service close to the people. It is a devolution of responsibility that will aid the development of markets, and participation rates of sink providers. Given the case (we make) that vegetation is a low-cost sink option because of the substantial prospect of cost-sharing partnerships, accredited services will also boost participation rates of emitters under voluntary emission reduction plans such as those offered by GCO.

OWNERSHIP AND LEGAL ISSUES

This is another area where there is clearly a role for a government Authority. TreeBank Carbon Services supports the submission by Landcare (Landcare Foundation Victoria) which addresses these issues in detail.

CONCLUSION

Trading in Greenhouse Gas Emissions which includes carefully specified emission offsets from vegetation carbon sinks has the potential to be of enormous benefit to rural Australia, providing new opportunities for viable timber production, retention of native vegetation and land rehabilitation works involving vegetation plantations to combat erosion, salinity, soil acidification, declining water quality and habitat problems.

Positive community response will ensure that rural Australia plays its part in reducing national (and global) emissions of greenhouse gases and will boost the achievement of other national objectives in sustainable land management, biodiversity and the expansion of private plantations.

Government should take a positive and proactive role in developing a sound and reliable market in carbon credits (which will include, but not be dominated by regulations) so that the potential of these substantial environmental, economic and social returns will be realised. Australia can and should be the international leader in this field.

It is good news in every way! It is not just ‘win-win’, it is multiple wins:

- Good for offsetting global warming
- Good for the achievement of national greenhouse targets
- Good for the care and repair of land and water
- Good for encouraging economic development in timber plantations
- Good for the viability of rural enterprises, businesses and communities
- Good for natural heritage, biodiversity and habitats for plants and animals
- Good for sustainability objectives
- Good for joint venturing, partnerships, community motivation and pride
- Good for building a positive relationship between Canberra and rural Australia.

REFERENCES

Greenhouse Challenge Office (March 1998), *Greenhouse Challenge Sinks Workbook* Draft for comment (AACM International Pty Limited).

MacDicken K G (1996), *Monitoring Carbon Changes in Forestry Projects* (Winrock Institute for Agricultural Development).

ATTACHMENT 1

PROPOSAL: Existing Vegetation Carbon Storage Benefits Model

An approach to calculating the greenhouse benefits of carbon storage after 1990 is to establish a **'convention' or default model** for existing and steady state biomass.

It starts with the assumption that biomass in a 'steady state' remnant woodland or forest grown prior to 1990 (the base date for calculating credits) is a *greenhouse neutral emission over the 100 years following its uptake*. It is not counted as an *actual* emission because it still exists, but would be counted in the event of harvest, fire or other loss.

To determine the greenhouse benefits arising from *continuing storage* of vegetation biomass the model *hypothetically regrows* the same forest over the same period and at the same rate. **Figure 1** illustrates how this applies to the remnant vegetation case.

(Figure 1 has been sent by normal post)

Figure 1: Existing Vegetation Carbon Storage Benefits Model: Greenhouse neutral decay and hypothetical growth post 1990 in remnant vegetation.
Rd = Remnant vegetation (greenhouse neutral) decay function
Rg = Remnant vegetation growth function;

The retrospective greenhouse benefits of retention under this model would be calculated as:

Carbon Credit (tCyears) = Yn (no. of years since 1990) * steady state carbon in biomass (tC) / 200

Example: The retrospective Carbon Credit in 2020 for a remnant forest comprising 220 tC /ha would be:

CCr = 30 * 220 / 200 = 33 tCyears /ha.

There is a case also for *prospective* claiming of carbon credits *by owners of protected vegetation* if a prospective carbon discount factor is applied and is backed up by regulations to verify performance or make good any shortfalls.

The decay function (Rd) would come into the calculations in the event that the forest was cleared or burnt out. For example, if burnt out in 2040, the emission to be brought to account would be 55 tC. The site would then commence regrowing at 1% pa.

By phasing out the pre-1990 biomass carbon over a period of 100 years it can be regarded as greenhouse *neutral* and need not be subtracted from the post 1990 claim. [This arises because the proportionate growth of biomass between 1890 and 1900 will be deemed under the 'convention' to have fulfilled its 'global warming offset' by 2000. The carbon taken up in 1989 and 1990 will have completed its offset service by 2089 and 2090 respectively. From 2090 onwards, all of the carbon in the remnant forest will, under this model, be offsetting post-1990 global warming.]

In practice, carbon credits would be calculated on *monitored total biomass* from the subject sites. This enables other factors such as improved management to be taken into account, together with reductions due to fire, drought, severe disease attack and other losses.

Unprotected stands of remnant vegetation would only qualify for *retrospective* analysis of the hypothetical regrowth under the model. Eligible *protected stands* could also be able to claim *prospective* carbon storage benefits by applying *prospective carbon discount factors.*

Adding storage benefits to annual growth increments

The above storage benefits model can also be applied to the *plantations case* (and hence modifies the growth shown in the text at Fig.1.2) as illustrated in **Figure 2** below.

(Figure 2 has been sent by normal post)

Figure 2: Plantations case: Growth and storage benefits after 1990 for plantations commenced prior to 1990.

Figure 2 shows a plantation commenced in mid 1968, growing at an average rate of 10 tC /ha /y and due for harvest, at age 30 years, in mid 1998.

From 1990 the pre 1990 biomass carbon (220 tC /ha) commences a greenhouse neutral decay under the model by 1% pa. When harvested in 1998 the residual emissions are realised as follows:

Post 1990 *growth* component = 8 * 10 / 2 = 40 tCyears /ha
Add post 1990 *storage* component = 8 * 220 / 200 = 8.8 tCy /ha
Total post 1990 uptake and storage = 48.8 tCyears /ha

Emissions to be counted after harvest in 1998 comprises:
220 tC /ha - 8% of 220 tC in GH neutral emissions (= 17.6 tCy /ha) / 2
= 220 - 17.6 / 2 = 101.2 tCyears /ha

Net emissions to be brought to account against the next rotation:
= 101.2 - 48.8 = 52.4 tCy /ha

[Note: The assumption of linear uptake enables easy calculation and checking against the average storage of carbon over the 30 year rotation:
Average carbon in storage = 30 * 10 / 2 = 150 tC /ha
Check against example: 101.2 (emissions) + 48.8 (uptake) = 150 tC /ha]