**Viability of Disturbed Eco-systems**

# Conservation/rehabilitation of wetlands and riparian and other forest in a tropical agricultural setting

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**Introduction.**

The issues discussed in this paper are :

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- The benefits and disadvantages of these to the landholder and to the environment.
- Counterproductive aspects of some regulations designed to conserve wildlife.

## Creation of lagoons or wetlands

Issues addressed:

- **Excavated (created ) wetlands versus impoundments.**
- **Created versus natural wetlands.** How they can compare in some instances.
- **Possible adverse environmental impacts.**
- **Environmental benefits.**
- **Some lagoon construction techniques.**
- **Desirable features for inclusion in a created lagoon.**
- **Economic benefits to the landholder.** How some created lagoons can pay for themselves.
- **Justification for 150% tax deductibility.** How the tax office could recoup its investment ( rapidly, in some instances. )
- **Regulatory suggestion designed to conserve, rehabilitate or create wetlands,** but avoiding the knee-jerk reaction from farmers of increased drain digging activity, which would lead to the further destruction of wetlands.

Like many other canegrowers up and down the east coast of Australia, I've undertaken drainage and land levelling to increase my production. However, as a recreational fisherman I came to realize that these works were having a deleterious effect on wetlands on the Tully-Murray floodplain, which are vital nursery areas for barramundi, perhaps northern Australia's most sought after recreational fish species. Similar adverse impacts have occurred in many agricultural ( and some pastoral ) areas throughout Australia.

To compensate in a small way for this, I decided to excavate a lagoon. Excavation was undertaken in December 1990. The lagoon measures 152 metres in length, 35 metres max. width and 3.5 metres max depth of excavation. Cost - $14,000 excluding tree planting around the perimeter. Perhaps surprisingly, this lagoon paid for itself in only 3 - 4 years.

**Excavated (created) wetlands versus impoundments.**

From an environmental perspective, there are major differences between excavated lagoons and impoundments. In the case of impoundments for example, the dam wall restricts native fish access. No such restriction exists in the case of an excavated lagoon provided the spoil is spread over adjoining land and is not used to create an embankment. Impoundments require surface run-off from a catchment. Excavated lagoons in this instance, are "window" lagoons, ie they are excavated into the existing watertable. Excavated lagoons are generally monumentally more expensive to create than impoundments of similar volumetric capacity.

**Created versus natural wetland** - How they can compare in some instances.

Like natural lagoons on the floodplain, my lagoon is inundated at least once every year, and aquatic life is free to come and go as it wishes. Qld Dept of Primary Industry-Resource Management fisheries biologists have electro-fished the lagoon and as of January 1995, had identified 14 species of native fish which had taken up residence. In an Environmental Assessment Study of the floodplain undertaken in 1994, the largest number of fish species found in any one natural lagoon was 17. In 8 days of surveying, the biologists found 39 fish species in the freshwater areas of the Tully and Murray rivers and the associated floodplain.

Due to any one of a number of factors ( both natural and man-made ) reduced oxygen levels were present in some of the larger natural lagoons. In one case the

oxygen content was only 0.2 mg/l (ppm) less than 30 cms from the surface. Three of these larger lagoons were found to support only 6 or 7 species.

Perhaps surprisingly, the dissolved oxygen content of my lagoon ( 7.8 mg/l ), compared more than favourably. The highest recorded in a natural, at that time, was 5.5 mg/l. In other water quality tests, ph, conductivity etc, the created lagoon was comparable with the natural.

The foregoing indicates that widespread adoption of the "created" lagoon concept could go some way towards ensuring the biological diversity of floodplains, which are under continuing developmental pressures.

150% tax deductibility for such works, ( dependant upon certain environmental criteria being met ) would not only be a major incentive for farmers, but is a means of ensuring possible adverse environmental impacts are avoided.

**Possible adverse environmental impacts include :**

- Excavated soil being spread over ( and consequently destroying ) adjoining, still viable, shallow wetlands.
- Excavation of acid sulphate soil - although exposed acidic soil can be treated with lime.
- Provides additional areas for propagation of exotic weeds and pests, if not adequately monitored.
- Adverse impact on shallow aquifer - if excavator digs through a clay layer which had been acting as a seal, preventing groundwater from draining away.

**Environmental benefits include:**

- Provides habitat for aquatic and terrestrial wildlife.
- Excavated soil can be used to build up low-lying agricultural land, thus reducing the need for such deep drains. Shallower drains should reduce the adverse impact of farm drainage on neighbouring wetlands. By lowering the watertable, deep drains may actually expose far more acid sulphate soil to oxygen - with subsequent release of sulphuric acid into waterways - than that excavated for a lagoon.
- Created lagoons may be of assistance in recharging the aquifer.
- Lagoons created on farm drainage systems can act as silt traps, thus improving downstream water quality.
- Any chemicals contained in farm run-off should be most concentrated in the on-farm lagoon, therefore they may act as early warning indicators of the appropriateness or otherwise of farming operations.
- If a downstream fish kill does occur due to farm chemicals, it would be easier for the appropriate authorities to ascertain the source.
- Most farmers are likely to become attached to a lagoon they themselves have created, and are therefore more likely to ensure their operations do not adversely impact upon it.

**Some lagoon construction techniques.**

A detailed look at what was involved in my lagoon construction may be useful :- Some 20 years previously during a dry spell, we had removed about 30-40 centimetres of topsoil from a low-lying area of the farm. Since then the area had grown only grass and rats. It used to bug me every time I drove past on a tractor. I'd decided to build a lagoon there as soon as finances permitted. In December 1990, after an exceptionally dry period, a contractor with a scraper commenced removing the top 1.5 metres of soil from an area of approximately 0.6 hectare.

As the soil became moist, and to expedite filling, a 4WD tractor was used to push the scraper. All the soil removed in this manner was used to build up adjoining low-lying paddocks. As a result, I have brought into production approximately 5 hectares of additional cane land which previously would have been only marginal. The cost to that point has been offset by this additional land becoming available.

I wanted to **ensure that the lagoon carried sufficient water during the driest conceivable year to ensure any resident fish would survive**. With the soil becoming too wet for the scraper, an excavator and swamp dozer commenced operation. The excavator dug to a final maximum depth of 3.5 metres - average depth would probably be in the vicinity of 2.5-3 metres - and the swamp dozer pushed this soil away.

Much of this soil was simply pushed to the perimeter of the lagoon to reinstate the level to that which existed prior to the scraper's work. - If the soil is sufficiently dry, and the site chosen to be built up is some distance from the lagoon site, it is possible for the excavator to load soil directly into trucks. Obviously soil excavated below the water table level would stick to the truck bodies, and such soil could be used to reinstate the perimeter of the lagoon as described above.

The finished lagoon has a surface area of approx. 0.4 hectare. Some of the excess soil was spread over some

still low-lying areas, while the remainder was utilized by neighbours to build mounds for sheds on the floodplain etc. Although they did not pay for this soil, it did result in my not having to pay for its haulage to more distant low-lying areas of my farm, the cost of which would have been exorbitant, and not justified on a cost / benefit basis. I was also a little dubious about spreading this deep clay too heavily on surrounding paddocks.

In September 1991, approx. 500 trees were planted around the perimeter, by twenty volunteers from community groups interested in conservation. This demonstrates the public relations value of such works.

Lagoons such as these, apart from providing immediate vital habitat for wildlife, would also act as silt traps, trapping soil lost from farmland before it finds its way into rivers and perhaps reducing concerns regarding the effects of agriculture on the Great Barrier Reef.

**Overcoming problems associated with excavation below the existing watertable.**

When my lagoon was excavated, water tables were exceptionally low and the soil so dry that water could not seep into the excavation hole as quickly as soil was being removed. This was despite the watertable actually being 2 metres above the lagoon bottom. The excavator operator could therefore see exactly what he was doing and consequently was able to do an excellent job. The lack of moisture also significantly reduced the effort required for the swamp dozer to push away and spread the excavated soil.

When the Cardwell Shire Landcare lagoon was excavated, in November 1993, a high water table existed. A significant depth of water, which obviously became very muddy, was present in the hole. This resulted in the operator basically "driving blind", and a few weeks later when the water table did drop, numerous outcrops of soil protruded above the surface of the lagoon. These outcrops detracted from the appearance, but more importantly, para grass could've become established there. Eventually, a mat of grass may have choked the waterhole. As soon as conditions permitted, a dragline was used to remove these outcrops. This resulted in additional expense.

To avoid this situation in future a flood lifter or irrigation pump could be utilized to keep the water level to a minimum. Since such lagoon construction is likely to take place somewhere along the course of a drain, it would be easy to temporarily block the drain where it exits the lagoon site, and pump water over the block (dam) so the drain can be utilized to carry water away.

Of course, this would result in a short term increase in turbidity in streams into which the drain flowed, however it may be possible to construct small silt traps in the drain itself, or perhaps the outflow could first discharge onto nearby vegetated areas. In drier periods, it may be feasible to block any incoming drainage channel to the lagoon, and utilize this channel as a settling pond. If a greater number of excavators were engaged in the task, the lagoon would be constructed more quickly, and the duration and extent of discharge of silt laden waters through the floodlifters would be significantly reduced.

Soil testing, either by core sampling or excavation of a pilot hole should be undertaken prior to commencement of works to ascertain the suitability of the site for such an excavation.

It is important to ensure that any acid sulphate soils exposed through these works are neutralized by applying lime. Failure to do this can result in sulphuric acid and aluminium leaching into our river systems, which can lead to major fish kills and loss of a myriad of other aquatic life. Lack of lime would obviously also adversely affect production on farmland on which such soils have been spread.

It is vital that indiscriminate such works do not lead to the destruction of further vital habitat through soil being used to build up areas which would otherwise have remained as shallow wetlands. Farmers with no environmental awareness would be inclined to spread the excavated soil on the nearest low-lying land irrespective of its ecological values. Since it is obviously more costly to transport soil further away from the excavation site, assistance ( perhaps in the form of subsidies, but at least in the form of generous tax deductions ) would offset some of the increased costs associated with an environmentally beneficial work.

Indiscriminate works should not qualify for any attractive tax concessions which may be introduced to encourage landholders to undertake more lagoon constructions.

**Desirable features for inclusion in a created lagoon.**

To ensure my lagoon would not just be a sterile hole in the ground, and to decrease the time it would take to become a biologically rich habitat, stockpiled topsoil was spread along some of the banks ( since these banks now consisted of clay excavated from as deep as 3.5 metres ) and over the bottom of the excavation. A lightly built bitumen road prevented my topsoiling one side of the lagoon, and the extra

effort involved in establishing trees there, together with their lack of growth, has been a source of continuing aggravation.

Some 8-10 large trees, which had to be removed from the area where excavated soil was being deposited, were dug out by the excavator and replanted along the banks of the lagoon. They were replanted so as to give the impression of having fallen over into the water, thereby creating habitat for fish and roosting areas for birdlife. Unfortunately, prolonged flooding immediately after completion of the work proved too much for the trees and none survived the shock of the transplant. However the trunks remain and still provide much of the required habitat, while also adding aesthetically to the lagoon.

In June 1991 a black duck with 7 ducklings was seen paddling among the water lilies. Due to this being a relatively deep water lagoon it is frequented more by species such as whistling ducks, pygmy geese, darters and cormorants, with the odd egret and numerous other species on occasion. I think I got value for money and now look forward to driving past that site.

Provision should perhaps have been made for a slightly larger area of shallows, which are utilized by wading bird species, although most lagoons silt up over time and will eventually become shallow wetlands.

**To ensure maximum environmental benefit accrues from created lagoons, the following is desirable:**

- **Surface area should be as large as possible, and preferably no smaller than 0.3 hectare.** This reduces the chances of aquatic weeds overgrowing and choking the waterhole. It should be borne in mind that significant quantities of soil will have to be disposed of, and this alone is a limiting factor on lagoon size. Costs involved in transporting soil to more remote low-lying farm land may be prohibitive in many instances.
- **Orientation of the lagoon such that the prevailing wind may blow along it** - assists oxygenation of the water.
- **Inclusion of an area with a minimum water depth, even during the driest times, of 3 to 4 metres** ( ideally 5 metres ) ensures at least some open water should remain at all times. This is particularly important in view of the ability of ponded pasture grasses, such as *hymenachne amplexicaulis*, to grow from up to 2.5 metres under water ( G. Lukacs pers. comm.).
- This deep water assists in maintaining a quality environment for aquatic life and may ensure that fish do not become stressed or die due to excessively high water temperatures.
- **Inclusion of an island** - provides waterfowl with a nesting site, free of predation by cats or disturbance from human activity. Islands also make lagoons more aesthetically appealing and interesting, since the whole lagoon may be impossible to see from one location.
- **Spread a layer of topsoil** ( stockpiled at the commencement of excavation ) **around the shallow perimeter of the lagoon** - assists establishment of sedges and reeds, and biological processes.

**A buffer of trees:**

- provides berries and insects etc. - food for birds and fish.
- should perhaps **not** be established at south-east end if prevailing wind is a south-easterly. This ensures maximum aeration. ( However in some areas, cold winds at night may cool surface waters to such an extent that an inversion occurs. As the cooler, more dense, surface water sinks to the lagoon bottom it displaces the deeper, oxygen deficient water. The end result can be a body of water with critically low oxygen levels. In such cases, a continuous buffer of trees provides some protection.)
- provides shade which restricts weed growth and reduces water temperatures.
- reduces disturbance of waterfowl - although can render smaller lagoons unavailable to birds such as swans and pelicans which require some distance to attain flight speed..
- provides habitat for other birds and wildlife.

**The perimeter of the lagoon should include:**

- **deep water shaded by overhanging trees** - provides additional relief for larger fish in exceptionally hot weather. Although water temperatures fall as depth increases, so usually does oxygen content. In some of the natural tropical lagoons, the dissolved oxygen reading at 2metres was zero. On 1-2-95,in one instance, the surface water temperatures reading was 34° C at 4pm, and oxygen concentration 30 cms from the surface was 7 mg/l. At a 3 metre depth, the temperature was 28.2°C but oxygen concentration was zero. One has a mental picture of fish repeatedly rising to near the surface for oxygen and then returning to the depths for comfort.

- **shallows** - preferred by many waterfowl and baitfish.
- **snags** - provide roosting areas for birds & tortoises, habitat for fish, and add aesthetically to the lagoon.

**Economic benefit to the landholder.**

To encourage farmers to undertake lagoon constructions, I emphasize the benefits in terms of increased production on surrounding land.

As a result of raising land surrounding my lagoon, I have an additional 5 hectares growing cane. This has increased my production by approx. 600 tonnes per year. From those figures, it is easy to accept the statement that the cost will be recouped in no more than four years from the date of construction.

When considering whether to provide the 150 % tax deduction mentioned earlier, it should be borne in mind that in many cases, the monies immediately foregone by the tax office in this manner will be more than recouped over the forthcoming years. Consider the following :

( i ) the contractors undertaking the excavation will no doubt be paying tax on the income derived from such works.

( ii ) tax will be payable on the farmer's income derived from increased production on surrounding land.

An indication of how quickly the tax office could recoup its investment may be ascertained from the following production figures of a block on just one side of the lagoon, which also show that such activity may eventually be at no cost to the landholder.

Tonnes harvested from block 14.
( Prior to lagoon construction )

| Year | Hectares | Ratoon | Production |
|---|---|---|---|
| 1990 | 0.5 | 1R | 61.60 |
| 1991 | 0.5 | 2R | 37.47 |

After lagoon construction
( .5 replant - 2.27 new land )

| | | | |
|---|---|---|---|
| 1992 | 2.77 | RP | 366.57 |
| 1993 | 2.77 | R1R | 360.85 |
| 1994 | 2.77 | R2R | 349.44 |
| 1995 | 2.77 | R3R | 363.08 |

**NB: An equivalent area was brought into production on another side of the lagoon, with a similar production increase.**

In 1993 I harvested these blocks ( which were once the lowest on my farm ) only a couple of days after our co-operative's full track harvester, tracked infield transporter and high flotation, 6 wheeled cane haul-out transporters were bogging on a neighbouring farm, where they were making ruts a couple of feet deep. My blocks were unmarked, and many more years of ratoons will be possible.

I'm aware of farms where even greater benefit will accrue. However increases in production of this magnitude will not be achieved in all instances, and in some cases little or no economic benefit will accrue to the landholder. Hence the need for attractive tax concessions to stimulate such activity. This should be seen by those in the conservation movement as a positive step in the right direction, and follows many years where environmental devastation has been exacerbated by inappropriate tax incentives.

**Economic justification for 150 % deductibility.**

The production figures show that as a result of my lagoon construction, over the past four years I have produced an additional 600 tonnes of cane per year on land which was previously unproductive due to its low-lying nature. The income derived would be additional income, likely to be taxed at relatively high rates. Assume a tax rate of 33.3%.

Since the lagoon cost $14,000, a 150 % tax deduction would mean the Tax Office foregoing $7,000.

Taxable income on a sugar cane crop of 600 tonnes varies considerably from area to area, and from farm to farm. At market prices of the early 1990's, a pre-tax profit of $10 - $15 dollars per tonne is realistic. Therefore taxable income on that additional 600 tonnes can range from $6,000 - $9,000. At a 33.3% tax rate, the tax office would receive $2,000 - $3,000 per year, leaving the farmer with an additional $4,000 - $6,000.

Over the 4 years of production for which I have records, the Tax Office would receive $8,000 - $12,000. It had originally only foregone $7,000. I have ignored the interest factor in this scenario, but it should be obvious that the Tax Office soon more than recoups its "investment". It will continue to receive that additional tax income for as long as production continues on the said land.

Over the same 4 years the farmer receives $16,000 - $24,000. Since interest rates can vary considerably, I've not done an exact calculation, but it should be obvious that he soon more than recoups the cost of establishing the lagoon.

Most importantly, a wetland is constructed.

Who loses? This seems like a win, win, win proposal.

If 150% deductibility applies to expenditure related to rehabilitation of degraded mine sites, ( in the end, all that results is a rehabilitated environment - which I'm not knocking ); surely there is even more justification for a similar deduction in the case of expenditure related to rehabilitation of degraded agricultural land when, as the above figures indicate, there will be ongoing economic benefit.

150% deductibility should be dependent upon meeting DPI Resource Management or DEH approval, so would ensure a truly environmentally viable wetland is established.

As pointed out earlier, in some cases there will be greater economic benefit than that described, but there will also be instances where economic benefit will be negligible. Overall however, the end result should be the restoration or establishment of numerous lagoons at minimal cost to the nation, and quite possibly even at a profit.

An environmentally responsible government would put mechanisms in place which minimise environmental degradation, and do something positive to rehabilitate that which has already occurred.

Do we have environmentally responsible governments, or simply environmentally opportunistic governments?

I almost overlooked mentioning the introduction of attractive tax deductions for donations by the general public towards lagoon constructions.

Additional funds for a Cardwell Shire Landcare lagoon construction, in November 1993, were derived from generous donations by Andrews' Fiveway Motors ( now Andrews' Agricultural Services ), the Mission Beach Game Fishing Club, myself, Mort Johnston and Father John O'Connor. One individual contributed $3500.

It is possible to receive a 50% deduction for donations towards Landcare approved projects. Unfortunately this tax deduction was introduced subsequent to the Landcare lagoon's original excavation. I doubt that 50% is going to create an avalanche of donations however.

Andrews' Agricultural Services' Jeff Andrews has since told me that if a more attractive tax deduction is made available, they would be prepared to contribute towards ( and thus stimulate ) further lagoon constructions on a regular basis. The same applies to the likes of fishing clubs and other individuals. Surely a generous tax deduction should also be available to such contributors.

There is really no valid reason why a lagoon should not be required to be established on every drain to compensate in some way for the adverse effect such drains have had on our wetlands. Since any farm which has undertaken drainage works, or even levelled land, may have contributed to the loss of wetlands and lowering of watertables, every such farm should be required to contribute to a fund for compensatory works.

It should not be difficult to come up with a suitable ratio of artificial lagoon area per hectare of drained land. Such a proposal, if applied to existing as well as new landholders, discriminates against no one.

**Regulatory suggestion designed to conserve, rehabilitate or create wetlands.**

There is concern that any suggestion of controls over drainage will lead to the knee-jerk reaction of increased drain-digging activity prior to the implementation of such controls.

The following proposal, which aims to reconstruct wetlands and lagoons which have degraded or ceased to exist due to agricultural drainage, while not being popular with some elements of the farming community, could be implemented swiftly with no knee-jerk reaction likely.

The **proposal consists** of :

(1) **licensing all drains** - existing and future

(2) as a **condition of that licence, a lagoon or wetland be re-established** or constructed - by the drain owner / owners on a suitable site.

This would at first appear to be a costly imposition on the farming sector, but more thorough consideration would reveal: (a) costs associated with such works can be tax deductible. - The Cardwell Shire Catchment Co-ordinating Committee, the Community for Coastal & Cassowary Conservation and the Wildlife Preservation Society of Queensland have since made representations to the various political parties requesting that such expenditure, or any expenditure aimed at rehabilitating the environment, be 100% deductible in the year of expenditure.

(b) the excavated soil has to be dumped somewhere, and the most logical site would be nearby low-lying agricultural land. By raising low lying land in this manner, the need for excessively deep drains is eliminated, and this alone will be of major benefit to natural wetlands. ( It would be essential that any lagoon site be investigated to ensure that further vital wetland is not destroyed by indiscriminate such works. )

To ensure these excavations are environmentally sound and not just holes in the ground with water in them, any attractive tax concession, could be dependent upon certain criteria being met. A 150 % deduction such as that available in the case of rehabilitation of degraded mine sites, would ensure landholders did their utmost to qualify.

It should be immediately obvious that, far from being a costly imposition, this proposal not only reconstructs lagoons etc. but could enable a landholder to improve some less productive land while obtaining considerable tax benefits.

150% deductibility should only be applicable if the extra effort, and hence increased cost, required to meet these criteria is undertaken by the landholder.

In the case of community drains, a number of suitably low-lying areas could become lagoons, - it should be less costly to make smaller lagoons - preferably a minimum of 0.3 hectare - since excavated soil does not have to be moved so far.

Alternatively, a single large lagoon could be constructed by the community-drain members on a particularly suitable site, although obviously there would be problems associated with costs & benefits, since the landholder immediately adjacent to the lagoon site would benefit greatly from the soil deposited on his land.

In the case of community drainage works, a benefited area is identified and costs distributed accordingly. A similar process could be utilized to finance lagoon construction.

In cases where there is danger of an excavation having adverse effects on the water table, ( perhaps by digging through a clay layer and effectively "pulling the plug" ) a shallow wetland could be established. Alternatively, landholders in such areas could assist in the construction of more / larger lagoons in more suitable areas.

Since some farmers may not presently be in a financial position to undertake a lagoon construction, a suitable time limit could be imposed. Perhaps ten years would be sufficient. Most farmers should have a high income at least once during that period, at which time favourable tax deductions applying to such works would be no great burden to bear.

**Problems associated with this suggested regulation:**

- Retrospectivity - landholders who've got away with adversely affecting wetlands in the past are likely to scream like stuck pigs if they are asked to compensate for some of the damage they've done.

**Justification for retrospectivity:**

- Landholders who've adversely impacted on wetlands years ago, have had years of production and additional income as a result, which should place them in a better position financially to undertake compensatory works.

- If these landholders are not required to undertake compensatory works, it makes it extremely difficult to expect landholders presently developing their properties, to undertake significant environmentally sensitive works. ( Although, since industry representatives constantly tell us that **all** farmers are conservationists, it's always possible I could be wrong.)

DPI Fisheries staff at Walkamin Research Station on the Atherton Tableland - contact Alf Hogan ph. 070 933834 fax 070 933903 - are currently assessing the ideal design for artificial lagoons. This may take some time, but I've included their suggestions that :

- Lagoons be orientated so that the prevailing wind can blow along the body of water, thus creating ripples which contribute to the raising of oxygen levels.

- Trees should ideally be planted along the sides so as not to interfere with the prevailing wind, while providing shade which reduces both water temperatures, and excessive weed growth in the lagoon.

# Stabilization of eroding riverbanks in tropical Nth.Qld.

Issues addressed:

- **Erosion - a natural process or due to human activity?** Who or what is really to blame.
- Value of trees in preventing erosion.
- **Methods of riverbank stabilization** eg:
  - Rock stabilization.
  - Tree planting.
  - Car bodies - ??!!
  - Bulldozing sandbars across the river to the base of an eroding bank - ??!!
- **The success or failure of these methods.**
- **Environmental benefits that can accrue from appropriate works.**
- **Adverse environmental impacts of works.**
- **Letting nature take its course.**
- **Who should pay for stabilization works.**

## Erosion - a natural process or due to human activity? Who or what is really to blame?

When discussing river bank erosion, the following comments are frequently heard :

- " If the farmers hadn't crashed all the trees on their banks they wouldn't have an erosion problem."
- " Erosion is a natural process, therefore we should do nothing and let nature take its course."
- " It's too expensive to undertake an effective stabilization program."

Even a cursory examination of the foregoing statements reveals that some are contradictory. Perhaps we should look in greater detail at the logic involved in those statements. We may even find that it is **more** expensive **not** to undertake an expensive stabilization program.

**It can not be denied that erosion is a natural process.** Rivers owe their very existence to erosion. To say otherwise demonstrates a remarkable lack of understanding of the forces of nature.

If one cares to take the time to look, **evidence of massive erosion, prior to the coming of Europeans,** can be readily seen in a simple boat trip down the Tully River. The trunks of large trees can be seen protruding from the base of a number of banks. A closer look reveals that it is the butt of the tree which protrudes; the head and branches remain smothered under 6 metres of soil - the result of silt build-up over the centuries.

Further evidence of ancient erosion can be seen in the composition of some of the banks now being eroded. In some cases the base of a bank on the outside of a riverbend is sand, with soil ( silt build-up over the years ) above this. Sand carried downstream by the current settles out in areas of little current flow e.g. on the inside curve of a river bend. Hence the existence of numerous such sandbars located along a river. The fact that a sandbar exists, and is now being eroded, on the outside curve of a river bend indicates how a river's course is constantly changing. Apparently, the Hull and possibly the Murray (NQ) river estuaries have been the mouth of the Tully over the centuries. The river is now simply eroding through a sandbar which had been laid down by the river itself perhaps many hundreds of years ago. It would follow therefore that significant erosion took place even though the surrounding lands were covered with rainforest.

Despite this evidence, some people still seem determined to believe that farmers are the " root of all evil " when it comes to erosion. Such prejudice does nothing to alleviate a major problem. Perhaps the following extract from a letter I wrote to the " Australian Canegrower " may lead to a better understanding of the situation. Quote : " In over 30 years of fishing the Tully River I have seen dozers with their tracks right to the lip of the bank, with the blade reaching out to knock down the last possible tree. Such farmers have indeed been stupid. Some banana growers for instance, don't like trees shading their bananas. Canefarmers are also far from blameless in this regard.

However, **I've also seen banks, on which some farmers have left 10, 15 and even 20 metres of trees, erode over the years to the point where no trees now remain.** The one trip expert,( ie someone with no long term experience of rivers ), choosing not to let the facts interfere with a good prejudice, still points to these banks and says " If that farmer had left a buffer of trees he wouldn't have an erosion problem."

The fact is that rivers are formed through erosion and erosion just continues, trees or no trees. However in the past when rainforest stretched for miles on either side of the Tully, erosion was a reasonably slow process, and **the constantly undermined trees which fell into the river provided ideal habitat for**

**many of our most sought after fish species**. With many of the eroding banks now devoid of trees, no fresh snags will become available as fish habitat to replace those which are weathering away.

## Value of trees in reducing erosion.

Some people point to riverbanks covered with trees and claim this proves that trees prevent erosion. An analogy can be drawn with the old " Which came first, the chicken or the egg."

Some years ago I asked Hamar Midgeley, ( honorary Dr. of Science for his research into the ecology and biology of freshwater fishes ) how thick a riparian corridor he thought would be required to ensure erosion did not leave only bare banks. His response was " 5 miles! " . He may have been exaggerating slightly to make his point, but the concept is correct.)

If all landholders had left 20 metres of trees along their river frontage, unless they were lucky enough to have an exceptionally hard clay riverbank, natural erosion would eventually ensure the total loss of vegetation on the outside bank of most riverbends where current flow is greatest.

Once again a simple boat trip down the Tully with both eyes and mind open would reveal that in most cases **those riverbanks still fringed with trees are** :

- on the inside curve of a riverbend where there is no significant current flow impacting on the bank.
- on the sides of river straights where current flow is mostly parallel to, but not directed onto, the riverbank.
- on the outside curve of a riverbend only where:

**(i)** the bank consists of an erosion resistant hard clay - or
**(ii)** the joining of a river tributary results in current flow from the tributary deflecting the main river's flow from impacting directly onto a usually easily erosive soil type.

The " chicken or egg " question is more easily answered in this analogy. Obviously **trees give the impression of having prevented erosion simply because they remain on banks where erosion was far less likely to be a problem** due to any one, or a combination, of the factors outlined above.

**It does not follow that trees do not perform a useful function in slowing down the rate of erosion.**

Comments on trees, and their value in riverbank stabilization, include some directly opposing viewpoints. Such as " When trees fall into the river they take a large chunk of the bank with them - they actually cause more erosion."

This view is usually the result, once again, of not looking at all the circumstances.

In the natural scheme of things, with continuous tracts of rainforest fringing the river, there was much inter-twining of the root systems of the many trees. When a tree was undermined and did fall into the stream, this interlocked root system often prevented its being swept away. The pressure of the current swung the trunk down along the bank where it performed the useful function of deflecting current off the bank. Seeds from overhanging trees quickly germinated in the disturbed soil where the dislodged tree had stood, and a natural healing process commenced. Although massive erosion could still occur in exceptional weather conditions, it is easy to understand from the above why erosion in the past was a relatively slow process.

With, in many cases, only individual trees, isolated stands or a thin veneer of trees now fringing the river, the situation has altered significantly. In the case of individual trees, there is obviously no inter-twining of root systems. Consequently when such a tree is undermined a more dramatic dislodgement occurs, with soil held by the root system being lost almost completely from the riverbank.

**Isolated stands of trees may exist midway along a rapidly eroding bank. In this case erosion can appear to be aggravated where the trees commence.**

The reason for this is that in a fully vegetated situation, undermined trees would have been swung down along the bank and commenced their deflecting action at the upstream point of erosion. As the point of impact of the current on the bank moved down along the bank - the usual, but not mandatory, result of erosion taking place on banks further upstream altering the angle of deflection of the current, and hence its point of impact - additional trees would have been undermined. The end result was a series of overlapping tree trunks, along the bank, performing the deflecting function described earlier. The base of these tree trunks were usually protected from the worst of the current by the trunk immediately upstream.

In the case of a stand of trees occurring midway along a rapidly eroding bank, no overlapping of tree trunks exists to protect any undermined tree from the worst of the current. Hence, the current impacts directly onto the base of such trees and is often deflected to either side of the butt, i.e. on one side, directly onto what is an already eroding riverbank. More erosion consequently takes place.

## Methods of riverbank stabilization.

### Tree planting.

**Riparian "re"-vegetation benefits:**

- Root systems assist in stabilizing bank.
- Provides shade which inhibits growth and spread of exotic/pest plants.
- Silt loads in the river decrease.
- Assists in maintaining a clearer, deeper stream, with pools and riffles instead of just a featureless drainage channel.
- Provides nutrients for fish and other aquatic life.
- As mature trees fall into the river, additional fish habitat is created.
- Provides habitat for wildlife.
- Provides corridors by which wildlife, such as the endangered cassowary, may access isolated remnant forest areas.
- Aesthetically appealing.
- Provides a valuable recreational asset for locals and for eco-tourists.
- Ensures farm machinery will not be inadvertently driven over river and creek banks, with consequent possible loss of life.
- Reduces rate of outflow of floodwaters from rivers over adjacent agricultural land, thereby alleviating erosion to some extent.
- Improves drainage ability of natural watercourses through shade reducing growth of exotic grasses which would otherwise be capable of "choking" small streams and channels.
- Should be encouraged in lieu of levee banks, which may benefit one area, but aggravate flooding elsewhere.

**Revegetation disadvantages:**

- Does not provide protection from erosion of the toe ( underwater section of the riverbank ), therefore trees on erosion-prone banks will eventually be lost as the bank is gradually undercut.
- Demoralizing for those involved in revegetation works to see their effort wasted, ( if the above does occur.)
- A waste of time and money in erosion-prone areas of fast flowing perennial rivers and streams, unless the toe is first stabilized with rock.
- Attracts farm pests ( such as sulphur crested cockatoos, which can eat considerable quantities of sugar cane. I've personally lost 200 tonnes in one season due to lack of surveillance while away on holidays.)

Despite the abovementioned easily observable facts, there are moves in some areas to undertake large scale tree plantings in an attempt to stabilize eroding riverbanks. Although tree planting may be helpful in some situations, where erosion is of **real** concern along the Tully River, it is really a waste of time unless at least the toe of the bank is first stabilized with rock.

If mature rainforest is failing, or has failed, to prevent erosion, it is difficult to see how young plants could possibly be more successful. The bank will simply continue to erode, and the painstakingly planted young trees, and a considerable sum of scarce funds, will have been wasted.

### Cost of tree planting

It is difficult to obtain a clearcut figure on the cost of tree planting. The Wet Tropics Tree Planting Service plants between 5000 and 10000 young trees per hectare depending on the situation. In the early 1990's, a rough estimated cost was $2 per tree to the out of hand stage. The April 1992 BP Landcare Challenge magazine mentioned a figure of $4-$5 a tree, although this included fencing to ensure no damage from stock. Cost per hectare would thus range from a low of $10,000 to a high of $50,000. A T.V. program on the subject gave a figure of $30,000 / hectare, which would appear to be a useful average figure. Based on the $30,000 figure, the cost of establishing young trees in a 20 metre wide corridor along a kilometre of riverbank is $60,000.

It would appear sensible to ensure that funds of this magnitude are not wasted.

## Rock stabilization.

**Benefits:**

- Provides long term stabilization of the critical underwater ( toe ) section of the riverbank ( if done correctly.).
- Provides habitat for fish.
- Provides numerous protected nooks and crannies where silt can settle out along with

seeds, from upstream forested area, which germinate and further stabilize the bank.
- Provides a solid base which ensures that any trees which are planted or otherwise become established, are not lost to erosion.
- **Ensures all the benefits attributable to tree planting endure.**
- In tropical areas, after a relatively short period of time, the bank returns to a near natural condition.
- Silt loads will decrease significantly.
- Aesthetically appealing ( if done in the right way. )

**Disadvantages:**
- If blasted rock is used, jagged edges may be hazardous for those negotiating the riverbank, unless top-dressed with soil..
- Expensive initially.
- Difficult to implement on eroding banks which still have significant tree cover.
- No new ox-bows ( billabongs ) will be created as meandering by the river should be eliminated, in all but exceptional circumstances. ( Assumes rock stabilization is undertaken in a co-ordinated and correct manner. ) However, most landholders will take some sort of action which prevent such ox-bows from forming in future anyway.
- Silt loads will decrease with perhaps a reduction in silt deposition on agricultural land on the floodplain. However, due to above natural silt loads, in run-off from developed areas, and continued agricultural activity in the catchment, more than sufficient silt should still be available to eliminate any concerns that may be expressed in this regard.
- Can be less than aesthetically pleasing if not done correctly. ( If bare rock alone is placed right to the very top of the bank along extensive reaches of the river, for example. )

## Examples of rock stabilization.

**Re-active rock stabilization.**

I've rock stabilized 3 relatively small sites along my one kilometre Tully River frontage. The first occasion was in 1972. Here, at low-flow height, the river is 3 metres deep with the top of the bank 8.5 metres above the waterlevel. Initially, large rocks ( natural unblasted rocks, which were leftovers from quarrying operations for red soil in the shire ) were dumped onto the clay base of the river bed until they began to appear above the water. Then progressively smaller rocks mixed with soil were utilized. The larger of these rocks found their way towards the lower levels of the bank, and the soil/rock mix gradually became more soil towards to upper bank. This soil proved ideal for the establishment of trees. Seeds from upstream areas, which deposited on the bank and germinated, were able to colonise the now stable bank with no assistance from myself. Those trees are now 12 - 15 metres high, and look as though they've always been there. Leaf mulch etc has further built up the bank, and it is now extremely difficult to see any rocks above water level.

The work has stood the test of time despite being on one of the sharpest bends on the river, and thus subject to very high erosive forces.

If further meanering of the river is prevented, and it is restricted to its present course, continual vertical erosion ( ie scouring of the river bed, ) may lead to eventual undermining of protection works.

While using large quantities of rock, the stabilization method undertaken long my river frontage results in a massive but still flexible, underwater base, which is able to cater for any further, foreseeable scouring of the river bottom. That base is also full of nooks and crannies which provide the cover fish previously found in snags and fallen trees.

Some eroding banks are devoid of any cover - virtually sterile. Although a good number of banks still provide cover for numerous fish, the trend is rapidly downhill. At my bank, barramundi, mangrove jack and jungle perch, ( as well as the more common species which can live just about anywhere, and are therefore not a good test of the habitability of a site ) have been seen among the new boulders.

**Ensuring a healthy aquatic habitat should be a high priority of any stabilization program.** Failure to provide for this aspect will result in those responsible suffering due ridicule from not only the present generation. It doesn't cost a great deal more to do it right the first time.

The cost seems insignificant now, and I obtain considerable enjoyment from looking at the fish that take up residence. In fact, I plan to undertake similar works just to provide further fish habitat.

I've deliberately avoided applying for subsidies for stabilization of my riverbank for a couple of reasons.

Among these is that:
- As a longtime advocate for greater assistance being made available for river bank stabilization, to retain credibility, it is vital that I not be seen to be deriving any benefit.

- back in 1972, when Water Resources Commission officers were invited to give their advice on the eroding bank, they suggested making concrete blocks utilizing sand from our sandbank. ( This wouldn't have been very aesthetically appealing. )
- I've been less than impressed with some other engineers' suggestions. ( Particularly when they advocate bulldozing sandbars across the river. see page 16. ) However, DPI-Resource Management which now has jurisdiction over river stabilization works, appears to be taking a more environmentally sensitive approach. ( Although sandbar bulldozing does not appear to have been ruled out, yet.)

**Pro-active rock stabilization.**

My first site was eroding badly and was also in a strategic area. ( If it had not been stabilized immediately, a serious threat to my property may have developed. A stitch in time saves nine. ) Much of the rest of my river frontage consists of an erosion resistant hard clay. However at the downstream end of this hard clay, where the soil changed again to an easily erosive type, very minor erosion of the upper bank was becoming apparent. A sandbar still existed at the toe of this bank, and no major erosion threat was likely to develop for perhaps a number of decades, although due to lack of consistency of weather conditions and hence rates of erosion ,one can never be sure.

Observations of the meanderings of the river over my lifetime led me to believe that it was inevitable that eventually this site would be subject to the full force of the current. In fact, the 80 metres of bank stabilized in 1972, is no longer subject to erosive forces. Due to extensive erosion on a property situated across the river and slightly upstream, the point of impact of the current onto my bank has altered significantly. The impact point has moved downstream 80 metres over the past 24 years. At that rate, it would be impacting directly at the second vulnerable site in about a century. However significant erosion may occur well before actual direct impact. Were erosion to scour through the vulnerable site, it would destroy up to 2 hectares of riparian habitat, plus about 2 hectares of Community Rainforest Reafforestation Program timber trees. Some of those timber trees will take at least 70 years to attain millable size. It would be pointless to go to the trouble of establishing such plots only to see them lost to erosion.

A similar stabilization technique was used here as with the previous site, ie simply dumping rock from the back of trucks, or pushing them over the bank with machinery. The major difference here was that at the base of the bank was a sandbar. Over the years, this sandbar has been slowly moving downstream. Eventually, as the impact of the current onto the bank becomes more direct, this sand will be completely scoured from the base of the bank, and the clay bed of the river exposed.

It was therefore vital to dump sufficient rock to ensure a solid base in the inevitable event of subsidence. The unfortunate aspect of this, is that a considerable quantity of rock is evident for half the height of the exposed bank. In the short term, trees planted there will reduce the starkness of the rock. Scouring away of the sand toe will ensure the rock mass falls to the bed of the river where it will perform its intended function. In the meantime, I can continue with my establishment of a continuous 20 metre wide riparian tree corridor, secure in the knowledge that it will endure, and not be lost to erosion, or have to be destroyed to access the river to combat erosion.

At this second site, the easily erosive bank actually commenced 40 metres upstream from where open access to the river was available. To retain the existing riparian vegetation on that 40 metres, an excavator was used to transport rock from the dump site, and to place it at the base of the still forested bank. This was possible at the time, due to the fact that the sandbar was still in place. Had I waited until major erosion was occurring, this option would not have been available, as the clay bed is over 2 metres below the water level at this site. As it was, the excavator operated in almost a metre of water.

A large dead tree which was on the sandbar, was dragged to the base of the rocked bank and secured in place with rocks. This will provide habitat for fish.

At the third site, erosion was in the form of a slump, due to an outflow of groundwater from the lower bank. Once again, the same rock dumping technique technique was used. The relatively massive rock base has once again provided the required stabilization, and has once again provided the significant additional side-benefit of good fish habitat.

**Rock stabilization utilizing excavators.**

Some other banks in the Tully River have been stabilized by carefully placing a veneer of rock with excavators. While obviously using smaller quantities of rock, this method is usually only marginally less expensive due to the cost of the excavators. Care is taken to ensure a smooth flow of water so the veneer of rock is not dislodged by turbulence or eddies.

Banks stabilized in this manner may not provide as good a habitat for fish as the dumped rock method. There may also be insufficient rock in place at the bank toe to cater for any further scouring of the river bed.

**Is rock stabilization too expensive?**
Despite the obvious success of rock stabilization, there remains an incredible reluctance to undertake works of this nature.

In fact, it is almost amusing to hear someone, ( who has attempted riverbank stabilization utilizing some of the less than successful methods described in the following pages, at considerable expense, and to no avail, ) make statements such as "Rock stabilization is too expensive!!"

**Which is more expensive?** To expend funds on short term or futile attempts at erosion control, and have nothing to show for it, or to undertake a systematic rock stabilization program which will endure?

## Agreed " only practical way to stop erosion ."

- **Rock stabilization of the toe of the bank, followed by tree planting to further stabilize the bank.**

Following an inspection of erosion problems on the Tully River, officers of the Water Resources Commission, Dept. of Primary Industries ( Land Utilization and Soil Conservation Section ), C.S.I.R.O. and Bureau of Sugar Experiment Stations **agreed " that the only practical way to stop an already eroding bank was by rock protection, especially the establishment of a stable rock toe.** Once this was established it was then possible for suitable tree species to become established which could further protect the river bank by the formation of the big root mat necessary to hold the tree."

An **example of tree planting suggested by Mr. Geoff Tracey, then of C.S.I.R.O..** Quote "Partial rock fill at foot of bank making sure rocks are in stream to avoid further undercuts. Between rocks and top of bank and on foot of collapsing bank, plant trees." Recommended native tree species were then listed.

**It was also pointed out that " tree planting in some situations would not immediately arrest erosion. These sites had an option of " do nothing " and let nature take its course or rock fill with additional trees either through natural regeneration or tree planting." End quote.**

This would seem to be an appropriate time to address the " let nature take its course " option.

## Letting nature take its course.

**Benefits:**

- No immediate capital outlay.
- Continued meandering of the river and natural truncations will create ox-bows ( billabongs ) which provide valuable aquatic habitat.

**Disadvantages:**

- Loss of prime agricultural land will occur.
- Continued erosion will lead to eventual loss of much riparian forest. This forest is particularly valuable for wildlife..
- As erosion continues into cleared agricultural land, no further snags will become available to provide habitat for fish.
- A valuable recreational and tourist asset will be further degraded.
- Loss of expensive infrastructure, such as roads, railways, bridges, houses etc may occur.
- Additional expensive infrastructure may have to be built. eg perhaps a new bridge over a new river channel.
- Expensive rock stabilization works undertaken by individual landholders will be to no avail, due to the river's continued meandering in other areas. those works may no longer be at the point of impact of the current.

Perusal of the attached diagrams explaining why government involvement in riverbank erosion control is necessary, quickly illustrates why it is vital that a properly co-ordinated rock stabilization program is undertaken. This should commence at the erosion prone bank nearest the river's source and work downstream from there. As briefly mentioned earlier, as a riverbank erodes, the angle at which the current leaves that bank alters. This results in a change in the point of impact of that current on the next erosion prone bank downstream. An analogy could be drawn with the ricochet of a bullet. By commencing stabilization at the erosion prone bank nearest the river's source, the angle of deflection remains constant.

A haphazard stabilization program would result in earlier rock stabilized areas eventually no longer being located at the point of impact, and the funds used in stabilizing those banks will have been wasted. **This, together with a predilection to use inadequate quantities of rock in the toe area, is a prime causative factor in those cases where rock stabilization appears to have failed.**

IInstances have already occurred where an individual has undertaken costly protection of his eroding river frontage only to find his labours are undermined by the refusal of his upstream neighbour to do similar works.

Thus if one farmer decides to " let nature take its course " , the adverse effects can be even more serious for other landholders.

Perhaps we should consider who loses, who benefits and who should pay.

## Who should pay for stabilization works?

- The relevant riparian landholder alone?
- The government?
- The relevant riparian landholder with a little government assistance?
- The relevant riparian landholder with generous government assistance?

A detailed study could be undertaken to understand as exactly as possible, the meanderings of the river over the centuries. This study would, in all probability, reveal that many areas, both on the floodplain and adjacent to the river's present course, have at some time actually been the bed of the river. It follows that if " nature takes it course " the river will continue to meander over these areas in the decades and centuries to come, but in a manner that has been described as " thrashing around shuddering like a dying snake." i.e. at a much increased rate.

Who loses? **Everybody loses!** The river will become increasingly less attractive for recreational purposes, and any structure on the floodplain, or adjacent to the river's present course, could be at threat at some time. That includes houses, sheds, railway lines, roads and bridges.

### Example of existing erosion situation.

Perhaps the best means of illustrating this would be to describe the situation as it exists at Warren Mitchell's property on Davidson Road, on the Tully River. If Mr. Mitchell decides that it is not worth spending $200,000 to save perhaps 2 hectares of his river frontage, erosion will continue. Eventually the following things will occur :-

- Erosion will continue to take its toll of Mr. Mitchell's farmland
- Further erosion would result in the loss of the Kinjun family's home
- The Jenkins' family home and large shed would soon suffer the same fate.
- Erosion would threaten the Tully Mill railway line, perhaps requiring the construction of a railway bridge, but at the very least requiring the rock stabilization of the Tully River's bank to prevent loss of the railway line.
- Erosion would threaten Davidson Road, perhaps requiring the construction of another bridge across the Tully River, but at the very least requiring the rock stabilization of the Tully River's bank to prevent a breach of what is a secondary main road.
- If no rock stabilization is undertaken, and a major change in the river's course does occur with consequent breach of Davidson Road, a bridge may not only be required in this area. The river could very easily change its course to such an extent that it could link up with the Murray River, requiring the construction of another bridge on the Bruce Highway where it crosses what is now considered the Murray River floodplain.

While some of the above may seem alarmist to those not familiar with the river, further study of the situation would reveal :

- Approx. 4 kilometres upstream from Mitchell's, erosion of a property now owned by G. Borgna has resulted in the river's course altering to such an extent over the past 40-50 years that what would have been Mr. Borgna's original riparian boundary is now situated on the sandbar on the opposite side of the river. A similar loss of bank at Mitchell's would result in the occurrences described earlier, with consequent major expenditure.
- While Mitchell's bank consists of a slightly less easily erosive soil type than Borgna's, erosion at Mitchell's is still a major problem. Firstly, it has a more severe bend and is thus subject to greater erosive forces. It is also not known just how much of the heavier soil remains to be eroded before a softer soil type is exposed.
- On-site inspection or perusal of the recent aerial photographs taken for the Cardwell Shire River Improvement Trust, would reveal

hat a number of old watercourses meander through Mitchell's property. It is not difficult to imagine a flooded Tully River scouring these out on its way to the Murray floodplain.

It is pretty obvious from the foregoing that **everyone loses if we " let nature take its course."**

It is also pretty obvious that everyone benefits if Mitchell's riverbank is stabilized.

It is also pretty obvious that everyone is sitting back waiting for Mr. Mitchell to spend the required $200,000 - i.e. quite happy to bludge off him.

Mr. Mitchell is 46 years old. Erosion was occurring before he appeared on the scene. It will continue to be a problem long after he has gone, if nothing is done to stabilize the situation. If the situation is stabilized, **everyone** - e.g. tax-payers pay for Main Roads and bridges, - **including all future generations will benefit. Is it fair that such a cost be borne by just one individual?**

Mitchell's bank is obviously going to have to be stabilized eventually, and the longer it is put off the more expensive the job will be. Surely it would make more sense to stabilize the bank prior to the loss of the farmland.

Having pushed the case for Mitchell's bank, let's look at those not fortunate enough to have a road or railway line threatened if erosion of their river frontage continues.

Let's assume that Mitchell's bank is stabilized by the appropriate authorities due to the points raised above. This would ensure that the next erosion prone bank downstream is subject to continuing erosive forces. Forces which would have ceased eventually had the river simply been allowed to erode through Mitchell's, the rail and road ways. This process could go on ad infinitum.

**It is pretty obvious that a properly co-ordinated riverbank rock stabilization program, with greater government funding, is necessary.**

## The success or failure of other attempts at erosion control.

There have been any number of **less than successful and successful**, but only in the short term, methods of arresting erosion undertaken in the Tully River.

### Car bodies.

**Benefits:**

- Do provide short term stabilization in some instances.
- Provide numerous protected nooks and crannies where silt can settle out along with seeds, from upstream forested area, which germinate and further stabilize the bank. In tropical areas, after 10 - 20 years, the car bodies become difficult to discern amongst the trees, and ( from a distance ) the bank can appear to have returned to a near natural condition.
- Car bodies in the water provide similar functional fish habitat to that of snags.

**Disadvantages of car bodies:**

- Provide only relatively short term protection, as they eventually rust away. When erosion of the toe recommences, the trees will eventually be undermined.
- Require almost as much effort, expense and machinery to transport as rock which will endure and can provide all of the above-mentioned benefits.
- Pollution from oil in engines, gearboxes etc ( if not first adequately drained and flushed.)
- Hazardous for anyone or thing negotiating the bank.
- Due to low weight/surface area, can be swept away by the current from point of deposition to become a hazard for unsuspecting boats.
- Aesthetically unappealing.

Having inherited a relatively pristine river, surely there is some responsibility to ensure that such a river endures for the enjoyment of future generations.

**Fortunately, under the Qld. Gov. Water Resources Act 1994, it is now illegal to dump car bodies or any scrap metal over a riverbank.**

### Bamboo.

**Benefits:**

- Relatively easy to establish as it out-competes most other grasses.
- Unlike revegetation with trees, it requires minimal maintenance.
- When undermined, clumps that fall into the river provide valuable, though short term fish habitat.
- Ensures farm machinery will not be inadvertently driven over river and creek banks, with consequent possible loss of life.

**Disadvantages:**

- Provides little or no bank stabilization due to its shallow root system.
- Can actually lead to greater erosion - due to its shade reducing the establishment, and growth, of other plants which grow closer to the low-flow water level.
- May have similar adverse effects to levees on river flows and heights ( due to the impenetrable nature of bamboo thicket.)
- Is promoted, in preference to native trees, usually by landbased observers who are deceived by the thick, luxuriant growth at the top of the bank.
- Provides little or no "real" habitat for native wildlife.

## Tyre mats:

Tyre mats have been tried unsuccessfully on what was Jack Flegler's bank. Once again, nothing was done to stabilize the real problem area , ie the toe of the bank. and although staked into the bank, the fast current in the Tully soon destroyed this effort. Such mats are also not aesthetically pleasing.

## Groynes.

**Benefits/Disadvantages:**

A number of different types of groynes have been tried. Jack Flegler constructed three in late 1972 or '73. These were simply numerous loads of rock dumped at intervals along the riverbank. Perhaps these were too far apart, for although on a relatively mild river bend, continuing erosion has resulted in the river cutting in behind the most downstream of the groynes, which is now some 6 metres away from the present river bank. This may also have been a consequence of a change in the currents angle of impact onto Flegler's bank, due to erosion occurring upstream on the other side of the river. This groyne may now constitute a boating hazard. Trees have colonised the remaining two groynes, and they provide welcome relief along an otherwise featureless eroding bank. They also provide some fish and wildlife habitat, but in some cases, this may be only transitory. The base of the topmost of the original three groynes has since been covered by a sandbar which has been steadily moving downstream.

A **recent groyne construction** took place in the Murray River (NQ) to protect the river frontage of por. 39v. This involved driving railway lines in pairs approx. 45 cms apart, vertically into the river bed. Old bridge timbers or logs were stacked between the railway line "piles". Perhaps the angle of deflection was greater than anticipated, but for some reason erosion occurred downstream of a section of rocked riverbank which could best be described as now being in the lee of the groynes. Had the funds expended in the construction of the groynes been instead utilized in dumping greater quantities of rock, the resultant rocked bank would have coped easily with any conceivable current. **- Such groynes are also hardly aesthetically pleasing, and are likely to endure only until such time as the lines or fastenings rust out**. These Murray groynes have already largely disintegrated, and the remaining rail lines could be hazardous to those utilizing the river for recreational purposes. **No consideration seems to have been given to ensuring that the riverbend in question remained a healthy habitat for fish,** which was particularly disappointing.

Despite the above, aesthetically appealing groynes may have a role to play in some cases. eg in relatively low-impact sites, where water depth is shallow, and remaining riparian forest prevents rock placement.

## **Bulldozing of sandbars** across the river against an eroding bank.

**Benefits:**

- Provides employment to bulldozer and excavator operators.
- Sand swept away settles out in low flow areas downstream, and may "recharge" nearly exhausted sand-extraction pits.
- Replenishes the beaches??!!

**Disadvantages:**

- Provides only very short term protection in most instances. ( Sometimes only lasting a few days.)
- Deep holes and snags, essential for fish, adjacent to the eroding bank are smothered as sand is bulldozed across.
- Sand swept away in floodwaters further increases erosive ability of the current. ( It adds an abrasive element.)
- Sand swept away can silt up deep holes and destroy aquatic habitat downstream. ( If the river's current is sufficiently strong, this may be only temporary, as the sand may be swept further downstream in subsequent floods. )

This has been tried a number of times in the Tully River. It has always proved unsuccessful in the long term, and in some instances has lasted for only a few days. The disturbed sand, when swept away by floodwaters, **aggravates erosion on other**

**riverbanks downstream - it adds an abrasive element to the already effective erosive force of the current - and also smothers fish habitat and other aquatic life.**

**Replenishes the beaches?**

During a conversation with an engineer on the benefits or otherwise of sandbar dozing, he was becoming somewhat desperate in his attempts to justify what had been done. Finally he said," You know, when we bulldoze those sandbars across the river we don't expect them to stay there. The Beach Protection Authority want us to disturb the sand so it can be carried downstream to replenish the beaches."??!!

It may very well do just that. Have the landholders, who have spent tens of thousands of dollars in some cases, under the illusion that they are going to stabilize their riverbanks, been made aware that is the intention?

The following extracts from a letter to a River Improvement Trust of that time goes into the adverse impacts in some detail. ( **The present day River Trust has a far more enlightened attitude.** )

Quote:

" With reference to my statement in an above paragraph regarding the failure of sandbar dozing to have any lasting benefit, some people are under the impression that similar work carried out in February 1982 ( in an attempt to arrest erosion occurring to land now owned by Pennisi, Borgna and Jones ) was a success.

I'm the first to concede that little erosion took place on that bank for a number of years thereafter. Does that make the work a success? Incorrect conclusions can be arrived at from looking at one bank in isolation. As a frequent traveller on the Tully River, I'm perhaps more aware than most of what is occurring to the river as a whole. Some of my observations are :

- Although there have been isolated, short duration big flood events, due to lack of continuous severe flooding in the Tully River in the years subsequent to February 1982, erosion took place on only the most erosion prone banks. Banks which had no erosion control works, but of a similar soil type to the Pennisi, Borgna, Jones (PBJ) bank, also suffered little erosion during those years.

- The degree of sharpness of the bend is a factor to take into consideration. A quick look at a map shows the PBJ bank is on the outside of a relatively gentle bend. Similar soil type banks on sharper bends have naturally eroded more, since greater pressure is borne by them.

- Despite the gentle bend of the PBJ bank, photographs and videotape taken in February 1982 show that the artificial sandbar is now only a tiny fraction of its original size. ( Where the sand remains, the bend is so gentle that if it was any more gentle it would be classified as a straight. )

- Only photographs and videotapes remain to show that in 1984, the Trust bulldozed a kilometre long sandbar across the river in a futile attempt to arrest erosion occurring to a river bank bordering the property of W. Mitchell.

- The original sandbars are rapidly reformed by sand, carried downstream by the current, naturally settling out in areas of little current flow. Another natural sandbar was formed in only six months after the Trust's sandbar dozing effort, in December '88, to attempt to arrest erosion occurring to land owned by Mackay's. Similarly, another sandbar was naturally reformed to replace the one so painstakingly dozed away by the Trust at Mitchell's.

- Major loss of fish habitat results from snags and deep holes being destroyed or filled in by the sandbar dozing.

- Water, alone, erodes river banks quite efficiently. The loose sand carried downstream adds an abrasive element which aggravates erosion. A hard clay river bank on my property which normally has a layer of moss was almost glaringly white after being " sandblasted " in floods following the Mitchell sandbar dozing episode.

The huge volumes of loose sand (resulting from sandbar dozing ) when carried downstream by floodwaters, have the following adverse effects :-

(1) Silting up of deep holes essential for fish - particularly in drier times. Sometimes this is only temporary, sometimes not. A river hole near my property, normally about 3 metres deep and covering approx. a hectare, was only knee deep for a time after sand was carried downstream from the Mitchell

sandbar dozing. The Tully River's high rate of flow eventually carried this sand further downstream. What damage was done to aquatic life in the meantime?

(2) Snags and other habitat become smothered - as above.

(4) One property owner in the Lower Tully area had considerable quantities of sand deposited on his pasture after the river flooded.

(5) The loose sand carried downstream, while on its slow journey to the sea, usually eventually settles out on the inside of river bends where sandbars already exist. If, as the engineers claim, sandbars increasing in size are forcing the current over to the outside of river bends thus causing erosion, surely they are simply aggravating the erosion situation further downstream by causing sandbars there to increase in size more rapidly than would normally be the case."

The engineers may be **partially** right, although increasing sandbar size is a minor causative factor in most of the erosion occurring in the Tully River.

Many landholders see their riverbank eroding, and notice the sandbar across the river is increasing in size. They conclude that it is the increasing size of the sandbar which is causing their erosion. Once again it is important to consider "Which came first, the chicken or the egg."

Anyone with a grain of understanding of river dynamics would understand that the current, ( **whose course has been set largely by its angle of deflection off the outside bend of an upstream riverbank.**) impacting on the outside bend of a river erodes that bank. As that bank recedes, pressure on the inside of the riverbend decreases. This decrease in pressure allows more sand to settle out, and the sandbar increases in size. However, the width of the river between sandbar and eroding bank usually remains relatively constant. Therefore it should be obvious that the sandbar is only taking up the space vacated by the eroding bank on the other side of the river. The landholders' perceptions are back to front, but unfortunately, such perceptions have led to many inappropriate river works.

So much of what was considered "farsighted" and "progressive" a decade or more ago is now seen as disastrous and motivated by greed and/or ignorance. Truncations of river bends and dozing sandbars across rivers, do not seem to take into account any adverse effect on fish habitat. Do engineers see rivers as nothing more than inefficient drains?

Far greater regard needs to be given to input by biologists and concerned members of the public.

The Water Resources booklet "River Improvement Trusts in Queensland" outlines the role of a Trust quite clearly. The following quotes are from that booklet :-

" These improvements, when carried out in **harmony** with the river environment, create efficient waterways of benefit to the **whole** community."

" This is invaluable information for those concerned about the **conservation** and maintenance of our waterways and their **surrounding environment.**"

"**study** their behaviour "

"foster and assist in programs of **community awareness** "
" **repair** and **prevent** damage to the bed and banks of rivers"

"Each **Trust** is a body corporate, **capable of suing** and **being sued,** "

"Common to all Trusts is the need to act to **prevent** as much as possible the **degrading** of streams and streambanks, to plan remedial and improvement works and to foster and assist in programmes of community awareness. "

" Trusts are encouraged and assisted to take the **widest view** of problems associated with inhabited floodplains, to seek not only structural solutions "

"Probably the **greatest assets** a river could have are **stable, naturally vegetated** river banks. The Act allows Trusts to protect river banks from damage. "

"All work proposed by a Trust is subject to ( the Commissioner of Water Resources ) approval prior to execution. "

When taking the **widest view** of river problems and seeking to undertake works in **harmony** with the river environment and of benefit to the **whole** community, the observations noted in this paper are worth consideration.

I'm surely not alone in seeing many works undertaken by "River Trusts" as nothing more than thoughtless vandalism which renders destructive acts by some younger members of the community insignificant by comparison.

Such apparent disregard for the environment by "Trusts", usually at the behest of only a small percentage of the farming community, results in a lack of credibility of statements by farming organisations that "all farmers are concerned about the environment."

Most communities are based on or near a river, however in most cases these watercourses are in despairingly poor condition. River rehabilitation works have been undertaken in British Columbia as a result of a comprehensive study of the economic value of sportfish to that state. If we don't damage our rivers even more by ill-considered works, the costs of rehabilitation may be much less than those in British Columbia.

River Trusts would be doing local economies a favour if they adhered to the role which most in the community imagine they perform i.e. maintaining healthy rivers in trust for us and future generations.

## On farm re-afforestation

Re-afforestation has a ( relatively well known ) role to play in :

- Lowering groundwater levels, thereby reducing the area of land lost to salination.
- Reducing soil loss through wind erosion.
- Reducing soil loss through water erosion.

Trees, additionally :

- May provide a source of income in the future, if suitable timber tree species are utilized. ( Could be seen as a form of superannuation by the property owner. )
- Reduce harbourage areas for some farm pests. ( eg sugarcane rat.)
- Make a property a far more pleasant place on which to work, ( although they may actually make farming operations more difficult through trees interfering with machinery )

( Plus, as listed on page 10 under "**Riparian "re"-vegetation benefits"**)

- Root systems assist in stabilizing riverbanks.
- Provides shade which inhibits growth and spread of exotic/pest plants.
- Silt loads in the river decrease.
- Assists in maintaining a clearer, deeper stream, with pools and riffles instead of just a featureless drainage channel.
- Provides nutrients for fish and other aquatic and terrestrial wildlife.
- As mature trees fall into the river, additional fish habitat is created.
- Provides habitat for wildlife.
- Provides corridors by which wildlife, such as the endangered cassowary, may access isolated remnant forest areas.
- Aesthetically appealing.
- Provides a valuable recreational asset for locals and for eco-tourists.
- Ensures farm machinery will not be inadvertently driven over river and creek banks, with consequent possible loss of life.
- Reduces rate of outflow of floodwaters from rivers over adjacent agricultural land, thereby alleviating erosion to some extent.
- Improves drainage ability of natural watercourses through shade reducing growth of exotic grasses which would otherwise be capable of "choking" small streams and channels.
- Should be encouraged in lieu of levee banks, which may benefit one area, but aggravate flooding elsewhere.

**Riparian revegetation disadvantages:**

- Does not provide protection from erosion of the toe ( underwater section of the riverbank ), therefore trees on erosion-prone banks will eventually be lost as the bank is gradually undercut.
- Demoralizing for those involved in revegetation works to see their effort wasted, ( if the above does occur.)
- A waste of time and money in erosion-prone areas of fast flowing perennial rivers and streams, unless the toe is first stabilized with rock.
- May attract farm pests, such as sulphur crested cockatoos which can eat considerable quantities of sugar cane, for example. I've personally lost 200 tonnes in one season due to lack of surveillance while away on holidays.)

**Additional disadvantages of trees from a farmer's perspective and personal experience:**

In my area, farmers are being asked to establish tree corridors adjacent to watercourses through their properties for environmental reasons.

As a sugarcane farmer ( on the wet tropical coast of North Queensland, ) who has undertaken tree planting activities in addition to leaving a significant area of forest in its natural state, I'm aware of most of the benefits and disadvantages that accrue from the establishment of trees in this area.

Reluctance by farmers to establish tree corridors stems from the following facts. Trees do interfere with the operation of farm machinery, and greater concentration is required at all times when turning at the end of rows when trees are present. Concentration levels fall as one becomes tired, and wide or long implements, or high harvesting machinery can be damaged after coming in contact with trees at the end of paddocks.

Trees do fall over from time to time; usually into the adjoining paddock since trees have a tendency to lean out from the forest in an effort to obtain as much light as possible. This requires the expenditure of more time and effort in their removal. I have a three kilometre frontage to an environmental park ( once our property ), along which there were many trees on the verge of falling into my paddocks.

I approached DEH to see if it would be alright to use an excavator to push the offending trees back into the park. This would involve only a fraction of the effort required to remove them once fallen. DEH agreed, but it took 2days with the excavator to work along the 3 kilometre frontage. (Excavator hire plus labour would be in the vicinity of $2000. There is also considerable risk involved in this operation, since excavators are not equipped with heavy protective bars to protect from falling trees or limbs.)

It is very easy to say " Farmers should simply move their paddocks further back from the forest,." However, if the aim is to encourage farmers to plant trees, that statement is certain to discourage them. Most farms in this area consist of only relatively small paddocks, and relinquishing even a small margin of land at one or perhaps both ends of a paddock can result in a considerable loss of area. Also, forests in this area can rapidly expand, and if efforts are not made to prune them, many paddocks would simply become totally colonized by trees over time. Obviously that is not acceptable to the farming community, which still does produce a significant percentage of this nations export income.

Despite being aware of these and other drawbacks, I have been undertaking further tree planting on my farm, and eventually will have between 5 and 6 kilometres of forest adjoining my paddocks. My farm has only 94 hectares of productive land, and these additional forest areas will lead to the loss of some of that, with subsequent loss in income.

I'm currently re-afforesting a watercourse through my property. This watercourse will provide a vegetated corridor from the aforementioned environmental park to the Tully River. Prior to the re-afforestation, sugarcane was grown much closer to the creek banks, with only a narrow area ( a headland), between the cropped area and the creek, left vacant for the purpose of turning machinery. Large implements attached to the back of a tractor do not present any difficulty when turning in such circumstances. They are suspended out over the creek during the turn, and the headland only has to be wide enough to accommodate the tractor itself.

Once trees are planted, the headland has to be wide enough to accommodate the combined length of tractor and implement. This obviously renders more land unavailable to cropping. For example: In the case of my watercourse, which is 500 metres long, loss of a 5 metre strip either side renders 0.5 hectare unavailable for cropping. That represents a loss of approximately 50 tonnes of cane annually. With a pre-tax profit of say $10-$15/tonne, that represents a reduction in income of from $500-$750 annually. A tree corridor I'm establishing along my one kilometre frontage to the Tully River will result in a loss of a further $1000-$1500 annually.

From a farmers point of view, it can be appreciated from the above that re-afforestation has its costs.

## What benefits offset these costs?

**Re-afforestation:**

- **Reduces rate of outflow of floodwaters from rivers over adjacent agricultural land, thereby alleviating erosion to some extent.**

Water flowing through a sufficiently wide corridor of trees obviously has its rate of flow reduced. The tree corridor I'm establishing along my frontage to the Tully River should lead to a reduction in surface erosion on adjacent paddocks. In my own farming history, significant surface erosion has occurred on only one occasion, i.e. when a legume crop in a fallow paddock had not had time to become fully established before the onset of an early flood. However it is a factor which must be considered every year, when undertaking farming operations, since a large flood is always a possibility.

- **Reduces harbourage areas for some farm pests.**

The Qld Dept of Environment & Heritage ( QDEH ) and the Bureau of Sugar Experiment Stations ( BSES ) have been co-operating in a study of the re-afforestation benefits of the aforementioned watercourse through my property. The purpose of the study is to ascertain the extent to which conversion of

grassed areas ( adjacent to sugarcane ) to forest, can reduce rat numbers and consequent rat damage to sugarcane. Results so far have been very encouraging, with few if any rats being trapped in, or adjacent to, the forested areas. Rat numbers, in the section of the watercourse still choked with grasses, are significantly higher. The BSES is now encouraging farmers to re-afforest grassed areas on their farm.

Re-afforestation:

- **Improves drainage ability of natural watercourses through shade reducing growth of exotic grasses which would otherwise be capable of "choking" small streams and channels/drains.**

This may reduce the need for chemical controls in maintaining effective drainage of agricultural land.

- **Ensures farm machinery will not be inadvertently driven over river and creek banks, with consequent possible loss of life.**

In the 1950`s, my father was trapped under a tractor he had inadvertently driven over the bank of the watercourse already mentioned. He was lucky, and escaped relatively unscathed. On a neighbouring farm, in the 1970`s, a tractor driver died ( his skull crushed ), and the tractor damaged after a similar incident.

In the sixties, I came very close to putting a new tractor over a bank into the Tully River. One front tyre actually went over the vertical bank which was 8.5 metes above a 3 metre deep riverbend. Similar incidents are a too common occurrence on farms generally.

Obviously, if a tree corridor is established along stream banks, such incidents are an unlikely occurrence.

A fatality, or major tractor damage, from one such incident would more than offset any economic advantage gained through cropping of the relatively small area of land that would be lost through the establishment of a riparian tree corridor.

Machinery damage would be limited to radiators or panels, and human injury perhaps limited to the odd black eye, or smack in the mouth, from tree branches protruding over headlands.

These trees will however provide access routes and valuable habitat for many species of wildlife.

## Cockatoo damage to crops.

Among those species provided with habitat is the sulphur-crested cockatoo. This bird is attracted to the aforementioned environmental park adjoining my property, by the huge number of palm berries. After their main course of berries, the birds have a dessert of sugarcane. When the berries cease, sugarcane becomes the main meal, and considerable damage can result.

I have had about 2 hectares destroyed by huge flocks in one season. I've tried using scarecrows, and have had up to 24 along the 3 kilometre frontage of my property with the environmental park. In areas subject to severe damage, I've tried planting varieties of cane which have a harder sheath, which is less palatable to cockatoos. However these varieties ( eg Q113 ) may have a low sugar content, be difficult to harvest, or have other characteristics which make them unsuitable for the particular soil type or location. I've tried "case-hardening" other varieties by planting the ends of paddocks, or a few rows on the outside, with Q113. However, this idea was dropped when it was found that cockatoos had been eating more palatable cane behind the veneer of Q113.

Cockatoos become used to gas ( scare ) guns which emit a loud explosion at regular intervals, and eventually go on eating after only a brief interruption. I've tried harassing them with radio control aircraft, but when the area to be patrolled is so long, these are not practical. I have tried constantly patrolling my property, up to three times a day, to keep them on the move. The cockatoos simply fly up into the trees ( or away to another paddock ) and recommence eating on my departure. The only way to have cockatoos take a farmer seriously is for him to actually shoot about 10% of their number.

A simple means of avoiding cockatoo damage would have been to have clear felled the forest which attracts them to the area in the first place. But I thought that was a pretty drastic solution and opted instead to have the area become an environmental park. It seems that farmers who wish to ensure a healthy environment are penalized for doing so. The birds frequent forested farms so that at least one cockatoo can remain perched in high trees nearby, on lookout ( for irate farmers, ) while the rest of the flock eats uninterrupted.

Farms with no trees usually suffer no damage, unless an adjoining farm has trees, in which case ill feeling between neighbours can arise. ( The farmer with trees is blamed for any cockatoo damage suffered by his neighbours. )

Shooting cockatoos without a permit results in a fine of $1000 per bird. While still being issued at present, permits are becoming increasingly difficult to obtain. Previously, any farmer who knew he would suffer cockatoo damage, would apply for a permit prior to suffering actual damage. As soon as cockatoos commenced eating his crop, the farmer would begin shooting. Since the cockatoos had not, by that stage, acquired a real taste for sugarcane ( or got into the habit of eating it, ) they were relatively easy to convince to cease eating it. ie Only a relatively small number needed to be shot to convince them to cease their destructive activities.

However, before permits are issued now, an officer must inspect the property to ascertain the extent of cockatoo damage. The farmer cannot, therefore, apply for a permit until damage has actually commenced. Inevitably, there are time delays between applying for a permit, inspection taking place, a permit being issued, and the farmer taking action. During this time, the cockatoos acquire a taste for the cane ( or get into the habit of eating it,) and are much more difficult to dissuade. Consequently, greater numbers usually have to shot to convince them to cease. This is a prime example of regulation, introduced to protect our wildlife, proving to be counterproductive.

Should permits not be available, I would suffer considerable economic loss, and would have to seriously reconsider proceeding with further tree planting on my property. I would also have to consider if I could afford to retain the tree corridors already established. These provide habitat for a wide range of other species, including the endangered cassowary, which can also utilize the corridors as access routes to isolated remnant forest areas.

- It can be seen that cockatoo damage is a major disincentive to farmers establishing trees on their properties.
- At the moment, cockatoos are dying from being shot while eating a farmers crop.
- They are also dying while being smuggled overseas where they fetch high prices.

I'm told that a lottery in Florida, USA, had a pair of sulphur-crested cockatoos as first prize. Second prize was a car. *The Bulletin* magazine - June 4, 1991, featured an article "Snaring the bird killers" ( pages 92 & 93 ) in which it is stated that sulphur-crested cockatoos are fetching $25,000 a pair overseas. While seen as being of such high value, illegal trafficking in the birds is likely to continue.

A suggestion which I believe has considerable merit, is that a number be trapped, and sold overseas to satisfy that export market. That would immediately make the smuggling operation non-viable, and no further deaths should occur in that area.

Funds derived from the legal sale of the birds ( 1000 birds = $12,500,000 ) could be utilized for environmentally beneficial purposes.

A percentage of these funds could be put into a fund dedicated to reimbursing farmers for losses resulting from cockatoo damage. If a farmer was going to be reimbursed for such loss, he would be likely to allow the cockatoos to continue eating uninterrupted. There should be no further deaths, or at least a substantial reduction in deaths, from farmers protecting their crops.

This may have some advantages for cane-farmers generally, since it is thought, though not proven, that cockatoos may spread Ratoon Stunting Disease which causes considerable production decreases. ( It has been proven that rats and guinea pigs have spread the bacterium *Clavibacter xyli* sub sp. *xyli*. which is responsible for RSD.) This seems logical, since there is little difference between a cockatoo's beak and a caneknife or harvester basecutter. When the latter two come in contact with an RSD infected plant they can then go on to infect many hectares of additional crop. Sterilization of cane harvesters between paddocks and farms is a practice that is recommended. If, instead of being disturbed, cockatoos are allowed to continue eating uninterrupted in a few areas, there is less chance of spread of this disease.

The end result is that there should be more cockatoos, and a major disincentive to canefarmers re-afforesting their properties will have been removed.

If the overseas' market for sulphur-crested cockatoos does become saturated, obviously the source of funds for compensation to farmers would cease to exist, but at least the illegal trade in the birds would also cease.

Some will no doubt argue against this proposal on the grounds that we should not be trading in native wildlife, and that the keeping of wild birds in cages is unacceptable. ( Although one would imagine that a person prepared to pay $12,500 for a bird would also be prepared to pay for a fair sized enclosure. ) It may be unpleasant, but surely much less so than the attendant severe stresses, suffering and deaths associated with illegal trafficking in the birds. The cessation of smuggling together with the increased area of on-farm habitat likely to be created, following removal of one of the major disincentives, should be

seen by most rational people as a preferable alternative to that which presently exists.

**N.B.** Over the years, tens of millions of dollars worth of cockatoos have been shot and simply rotted away, serving no useful purpose.

## Side benefits of re-afforestation programs.

Two government funded tree planting programs presently existing in north-east Queensland are the Community Rainforest Re-afforestation Program ( CRRP ) and the Wet Tropics Tree Planting Scheme ( WTTPS ).

The CRRP is aimed primarily at establishing native timber trees, although a percentage of habitat planting is also undertaken. ( Of course all the trees will provide some habitat value. )

The WTTPS is primarily involved in habitat plantings, particularly the creation of riparian tree corridors.

Both utilize numbers of unemployed who are presently paid marginally more than the dole to undertake what is really quite valuable work.

A side benefit of these schemes is the role they can play in the control of noxious plants. In 1994, Siam Weed, rated as the world's second most noxious weed, was discovered to be growing along the banks of the Tully River.

In an effort to eradicate the weed, an intensive spraying program has been undertaken by the Lands Dept.. Due to the prolific seeding nature of the weed, and the presence of large exotic grasses such as Hamil and Guinea ( *panicum maximum* ) etc., detection of all the young plants is extremely difficult.

When the WTTPS establishes a habitat plot, the whole area is first sprayed with glyphosate. To enable the young trees to become established without suffering from competition from rapidly growing tropical grasses, a regular spraying program is undertaken. Consequently, the likelihood of Siam Weed becoming established in these habitat areas is remote. Eventually the closely planted native trees will shade out the weed from all but the fringing areas.

Riparian WTTPS plantings thus reduce the area which Lands Dept. officers must investigate, allowing them to concentrate more thoroughly on other sites.

In the end, the WTTPS plantings will not only have played a valuable role in controlling a major pest but, should the scheme continue, the river itself will have been significantly rehabilitated.

The increase in self-esteem of the young people involved in the CRRP and WTTPS. ( as a result of seeing the fruits of their labours, ) together with the benefits briefly outlined above, justifies continuing financial support for these programs from all levels of government.