



LAND, SOIL AND BIODIVERSITY

Fresh erosion – and new rules to deal with it

If people of Gisborne District had forgotten that we live in an area of “soft rocks and steep hills”, prone to extreme and often unpredictable weather, the middle months of both 2005 and 2006 provided an overt reminder.

Spring 2005 will be remembered for two substantial flood events, while in 2006 seemingly endless wet days and few drying days combined to saturate soils to great depth.

As a result, land and soil started to move. While superficial soil-slip was evident in some locations, several significant big slips and slumps occurred. The weight of saturated soil on some slopes lead to failure at a depth below the reach of tree roots – thus even some densely vegetated areas slipped. The last time staff remember deep-seated erosion forms moving to such an extent was 25 years ago.

Roads, in general, traverse the more stable country, but because the cuts and fills create inherent instability, damage to the district’s roads gives a realistic indication of the extent of soil erosion across Gisborne District as a whole.

Of this we can be certain: the damage could have been worse, were it not for conservation trees established on many of the District’s farms.

Also glaringly obvious was the fact that many areas are still crying out for tree-cover.



Above: Damage to Pakowhai Road, Muriwai, after the 2005 floods.

of riverbed aggradation since Bola, the 2005 flood would have been 79cm below Bola, had the river bed remained unchanged). This ranks the Labour weekend flood in the Waipaoa as a ‘one-in-forty-year’ event, as measured at Kanakanaia.

Serious damage, in the form of dropouts, occurred on several roads. A section of Waiomatatini Road was completely taken out by the Waiapu River. All roads were re-opened to at least light vehicles by the Thursday following Labour weekend, although one or two had marginal/4WD-only sections.

Structural damage was surprisingly minimal. No bridges were lost or had major damage, although many received damage to railings and captured large amounts of debris.

Principal findings

- There were two significant flood events in spring of 2005
- Winter 2006 was very wet, with few drying days, and significant soil erosion occurred
- The cost of emergency reinstatement of the District’s roads exceeded all previous records
- By the end of 2006, fifteen new farm poplar nurseries were established
- Tree planting is to be a requirement on Overlay 3A erosion-prone land, under Plan Variation 176, notified in December 2006
- Exotic forestry harvesting showed a dramatic eight-fold increase in 2006 over 2005, meanwhile consent applications from farmers declined in the same period
- Biodiversity conservation received a boost with grants over \$280,000 obtained by local landowners.

Floods of 2005 – a double whammy

The first of two significant rainstorms drenched Gisborne District in October of 2005, resulting in power outages, localised areas of soil slip, over 40 road closures and severe damage to crops from ponded water and silt.

The Labour Weekend flood was, in fact, the second highest on record for the Te Karaka and Waipaoa River Flood Control Schemes.

At the Waipaoa River gauge at Kanakanaia (Te Karaka), the Labour Weekend peak measured 10.55m, only 56cm below the 1988 Cyclone Bola peak (although, after taking account



Above: Flooded land around Patutahi following the October 2005 storm event.

November storm event 2005

The storm event of November the 28th resulted in a significantly lower flood-peak, reaching 8.4m at Kanakanaia, ranking it as a 'one-in-ten-year' event.

However, the timing of this event could not have been worse, because the soil was still waterlogged. In many instances damage from this second deluge was even worse than the (larger) Labour Weekend event.

A considerable amount of spoil, silt and debris that had been removed following the Labour weekend event was re-deposited. A number of existing slips moved further, and many new ones appeared.

The western area (hill country inland of Gisborne and the Poverty Bay flats) was hardest hit, with the northern area (the East Coast) mainly requiring mopping up, although further damage was inflicted by the Waiapu River at Waiomatatini Road.

Because of the repeat damage, and the saturated nature of the ground, some sections of road were opened to single-lane traffic and left until summer to dry out before further repair.

For instance, on the 'Doonholm hill' stretch of Tauwhareparae Road, very major earth movements extended to the ridgeline, and continued removal of deposited material off the road would only have further destabilised what was virtually a 'river' of mud and debris.

Crop losses on the Poverty Bay flats

Large areas of emerging annual plants were destroyed in the Labour Weekend floods, by either being washed away,

Grower estimates of total crop losses in 2005 floods	
Squash	686 ha
Maize	491 ha
Sweet corn	472 ha
Broccoli	75 ha
Tomatoes	39 ha
Brassicas	10 ha
Peas	7 ha
Melons	4 ha
Total area	1,784 ha

or buried in silt. Many growers immediately replanted after the flood-waters had subsided, only to incur repeat losses in the November deluge. By this stage it was too late, in many instances, and too expensive, to replant a third time. The total farm-gate value of crop losses was estimated to be \$8.4 million.

Wet autumn and winter 2006 – and the slips that came down

Heavy rainfall events in April and May almost duplicated the effect of the 2005 storms. Once again, several high-intensity events followed one another, compounding damage.

Hardest hit were western areas including Tiniroto, Pehiri, Te Karaka, Otoko, and the East Coast, particularly around Ruatoria.

Autumn set the pattern for winter: rain continued to fall at frequent intervals giving little opportunity for soils to dry out. As a result, many unstable hill slopes gave way. In some instances dramatic large slips and slumps moved.

Damage to East Coast bridges

At Ruatoria, March-to-July rainfall in 2006 was 150% of normal. Severe gravel aggradation occurred in several streams, compounded by forestry slash (branches, off-cuts and tree stumps) clogging bridges, watertables and culverts.

Two bridges on Poroporo Road captured a huge accumulation of debris that sent the creek over the road on each side. Only the fact that these are low-level bridges prevented greater damage.

Removal of slash, and the silt that it traps, is very costly, and it was decided that only the material immediately above the bridge would be removed. Apart from cost-saving, in another flood event there will simply be more slash coming downstream.

Gravel accumulated to within a metre of the upstream girders of the bridge over the Mangaharei Stream (on the main road to Ruatoria), and was deposited over adjacent farmland.

Cross-sectional surveys of the river (upstream of the bridge) began in 1979, and revealed that in the 21 years from 1982 to 2003, mean bed level in the stream actually fell by 1.94m. However, the most recent survey (September 2006) confirmed that gravel had built up again to the second-highest recorded level.

Soil Conservation staff deduced the aggraded material had originated from down-cutting and lateral erosion of upper channel areas, and had not been a result of removal of pine trees in the catchment. They concluded that Mangaharei (and Manutahi) Streams experience cyclical aggradation and down-cutting, dependent on the intensity and frequency of rainfall within the catchment.

To address the reduced capacity for water to flow under the Mangaharei Bridge, it was decided to excavate a channel below the bridge and for a distance downstream, with the intention of initiating bed degradation.



Above: Flood waters in Ormond Valley reached a depth where posts supporting grape vines were over-topped.



Above: Bank slumping along the Waikohu Stream following the Labour Weekend flood. Emergent maize seedlings in the paddock beyond were buried in silt and did not survive.



Dymocks hill slip

On June the 25th, 2006, State Highway 2 between Te Karaka and Otoko was closed by around 2,000 cubic metres of material that slid dramatically down-slope taking 15-year-old closely spaced pine trees with it.

Geotechnical experts discovered water coming from springs within the slipped area had concentrated at a particular depth. The slope had become unstable, despite the cover of trees.

The slip continued to move slowly over several days, accompanied by the sound of breaking stems and snapping roots, while material continued to collapse in at the top. Meanwhile, Transit NZ was forced to spend several days constructing a road in an adjacent paddock, around the toe of the slip.

Waitangi Terraces slip

On the night of July the 20th, 2006, a huge slip on Waitangi Terraces Station completely blocked the Waingaromia River, initiating the formation of a large temporary 'lake' upstream of the slip.

The Council has a river level recorder only 300m upstream of where the blockage occurred, enabling events of the night to be accurately reconstructed. Prior to the slip, the river level was 1.45m. Seven hours later the blocked river recorded a peak level of 8.45m.

An estimated 370,000m³ of water was impounded, ultimately escaping by carving a new channel around the toe of the slip through which a controlled release of water occurred at a rate of around 100 cumecs. This produced just a small 'blip' at the Kakanai river level recorder, 38km downstream, three and a half hours later.

Road repairs - ongoing

The enormous task of reinstating roads after the 2005 events had been, up to late April 2006, proceeding well.

However, the return of wet weather aggravated problems on a number of roads and in fact largely undid many repairs achieved over the previous summer. Continuity of access along Tauwhareparae Road at Doonholm hill and Waiomatatini, especially, continued to be precarious.

For the former, access was strongly advised against throughout winter 2006, and prohibited for heavy and non-4WD vehicles.

Ongoing reinstatement was plainly going to be futile for some roads. It was decided to provide only a basic standard of access over some sections, at least in the short term.

Further heavy rain in early August, particularly around north/East Cape, caused further damage, closing several



Above: Tauwhareparae Road was blocked by oozing slips for weeks in the spring of 2006.

more roads and producing around twenty additional badly damaged or actively moving sites.

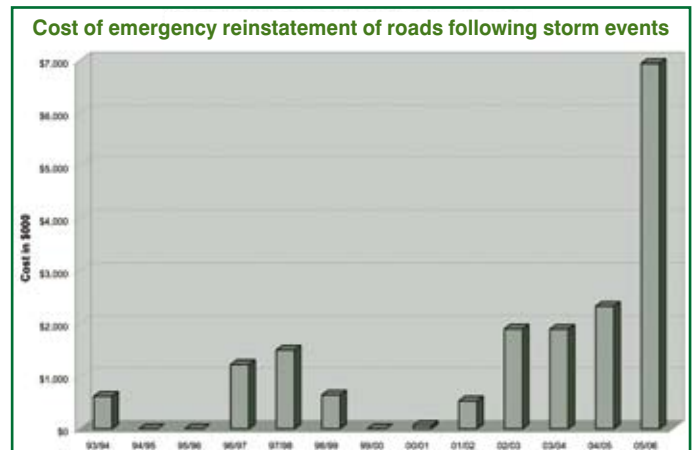
At last: drier conditions

Much-needed drier conditions prevailed after August, enabling long-term repairs to at last proceed, and by the end of 2006, the unsealed road network was fully reinstated, barring several major sites that still required substantial works.

Enormous cost to road network

The cost of repairs to the road network was enormous, out of all proportion to previous years, and certainly the largest bill since Cyclone Bola (1988).

Since 1992/93, emergency repairs to the District's road network had hovered around \$600,000 to \$1.5 million, with several years incurring no storm damage at all. The three years from 2002 to 2005 saw wetter conditions, and repairs increased to an average of just over \$2 million. For the 2005/06 financial year, during which most of the severe weather occurred, the bill exceeded 6.9 million. This dramatic upsurge is illustrated in the chart below.



Hill country farming

Sheep and beef farming remains the predominant land use in Gisborne district. Most farms are owner-occupied and some have been in the same family for 5 or 6 generations. Once very large, they were divided into smaller farms over the generations. The average farm size is approximately 435 ha with stocking rates of 10su/ha. The current trend is for farm sizes to increase. Landowners frequently buy adjacent properties when the opportunity arises, in order to remain viable businesses.

The remaining large stations (over 800ha) comprise rolling land through to steep erosion-prone slopes reverting to native bush. Regionally around 40% of these properties are Maori-owned and run by managers. The average size of the large stations is 1,500 ha with a stocking rate of 7.75 su/ha.



Above: The Waingaromia River flows in its newly-cut channel around the toe of the huge slip, that completely blocked the former channel.



Above: Tauwhareparae Road - severely threatened at Doonholm hill, 2006.
Below: Drop out on Mangatu Road.



Above: Slumping threatening Shark Bay Road (Anaura Bay).
Below: Hore Hore Road completely obliterated by a rock fall. The road was permanently closed.



Tairawhiti Rural Environmental Award 2005

Graeme and Seanne Williams of Mangaroa Station were the 2005 winners of this biennial award, the purpose of which is to promote and recognise excellence in sustainable land-use practices.

Graeme's father, Ralph, purchased Mangaroa, north of Tolaga Bay, in 1962. Since then, an ongoing programme of planting conservation trees has established over 50,000 willows and poplars, most grown in Mangaroa's own nursery and planted by the family with the help of some casual labour.

Trees established in the twenty years prior to Cyclone Bola clearly reduced the damage sustained, which could have been far worse had gullies, in particular, remained un-planted.

Gully and slip planting is comprehensive, on an extensive scale, and very pleasing to the eye. In addition, the trees can be topped to provide stock fodder when needed.

Graeme is involved with large-scale goat mustering, not only on his own property but also throughout the district. Together with a partner he has mustered in excess of 30,000 goats from Wairoa to East Cape.

The judges commended Mangaroa station as a wonderful example of an environmentally and financially sustainable property, where the welfare and condition of stock are enhanced by the provision of shade and shelter trees.

The winners of the award receive a trophy and prize package, and host a field day on their property. Winners and runners-up are featured in the Council's quarterly publication Conservation Quorum.

The poplar pole nursery project

Poplar poles (along with willows) have long been the mainstay of soil conservation planting on farms in Gisborne District, due to their ability to establish from a large cutting (a pole), protected from sheep and cattle by a plastic sleeve. The cuttings have enough 'reserves' in the stem to allow the roots to establish during the first year in the ground.

Currently, demand for planting material vastly outstrips supply. The Council's own nursery at Waerenga-a-Kuri can produce up to 9,000 poles a year, but landowners require in excess of 50,000 poles per year, and limited numbers are available outside the district. Pole requirements are set to increase further, as poles are now eligible for East Coast Forestry Project funding. In addition, new rules requiring tree cover on erosion-prone land will start to come into effect.

The Soil Conservation section of the Council, with funding from MAF's Sustainable Farming Fund, initiated a project in 2005 to encourage more farmers to establish on-farm nurseries. The aim: for farms to become self-sufficient in their own supply of poles.

Farmer interest has been excellent: by the end of 2006, there were 15 new nurseries, with weed control completed and stool material in the ground (stools are the stumps from which the poles can be repeatedly harvested). New stools are planted as 0.5 or 1m 'stakes', and this accounts for the big increase in use of this grade of material, seen in the graph on the back page.

It is planned to set up a trust to assume funding for the project once the three-year SFF funding is exhausted. Each of the new nurseries is to provide 10% of their pole crop to a general pool to be sold, with the money going back into the project via the trust. It is hoped once the project is self-sustaining in this way it can be opened up to more applicants.

The predominant poplar varieties chosen are Crow's Nest and Veronese, both of which have a proven track record in Gisborne District.



Above: Poplar poles growing from a nursery stool.

Gisborne District livestock numbers

	Total beef cattle	% change*	Ewes/hoggets put to ram	% change	Total sheep	% change	Dairy cattle**	% change	Total Deer	% change
1994	351,000				2,089,000		6,000			
2002	313,000	-11	1,097,040		1,679,377	-20	12,533	+109	25,752	
2003	350,000	+14	1,333,000	+21	1,870,000	+11	7,000	-56	..s	
2004	342,000	-2	1,345,000	+1	1,848,000	-1	..s		38,000	
2005	301,000	-12	1,275,000	-5	1,717,000	-7	..s		30,000	-21

* Compared with the previous survey ** There are only three dairy farms on the Poverty Bay Flats, as at 2006, therefore dairy cattle figures mainly represent dry cows grazed in Gisborne District. ..s suppressed

Source of data: Statistics New Zealand Agricultural Production Surveys, 2003, 2004, 2005.

Biodiversity grant successes in 2005 and 2006

Conservation on private land received another big boost following the 2005 and 2006 rounds of applications to the Biodiversity Condition and Advice Funds, and Nga Whenua Rahui.

These contestable funds provide support for protection of biodiversity on private land as part of the Government's commitment to the New Zealand Biodiversity Strategy (2000). Nga Whenua Rahui is specifically available to owners of Maori land.

Their aims are to improve and maintain the condition of areas of indigenous vegetation, species and habitats, for example through stock-exclusion fencing and provision of

Successful grant applications for voluntary conservation projects 2005-06

Property/project	Works	Grant
Biodiversity Condition Fund (May 2006 applications)		
Alacam Estate wetland, Ormond	Planting with flax, kowhai and Cordylines to restore 3ha of proposed 4.27ha QEII Covenant	\$1,450
Nga Whenua Rahui (March and August 2006 applications)		
Anaura Block	Fencing of four indigenous bush remnants	\$78,165
Anaura Block	Fencing of kahikatea forest remnant, Mahanga River	\$25,000
Tikitiki D8	Fencing of a 15.3ha indigenous forest remnant.	\$13,175
Biodiversity Advice & Condition Funds (November '05 applications)		
Glendhu Station, Muriwai	Development of an Ecosystem Restoration Management Plan for Te Wherowhero Lagoon	\$5,000
Longbush Reserve	Ecosystem Restoration Project: planting at Pa Hill	\$10,000
Motu Kiwi Restoration Project	Predator exclusion fence for 1.4ha for NI Brown kiwi "crèche" at Motu	\$12,625
Mahaanui Station native bush retirement project, Tiniroto	1,300m fence to protect 15ha of kahikatea, kanuka and other indigenous vegetation	\$13,650
Warwick Hills restoration project, Faulkner Road	980m fence to protect two areas of indigenous bush on river terrace, bluffs and hillside	\$7,870
Raukura Station	Fencing (part 2) of 100ha QEII Covenant wildlife corridor on Hangaroa River	(\$30,000)
<i>Note - above grant not disbursed: Applicants did not proceed with project</i>		
Poututu Station	Fencing (3,000m) of 18ha QEII Covenant comprising kahikatea, matai, totara, rewarewa, tawa	\$23,100
Biodiversity Condition Fund (April 2005 applications)		
Te Aroha Station, Pehiri	350m fence to protect 49.3ha indigenous vegetation, pest and weed control	\$3,850
Linburn Station, Tiritiri,	2,994m fence to protect 68.82ha	\$33,074
Waimata	addition to QEII Covenant; also pest control	
Kowhai-Nui Station, Te Karaka	2,646m fence to protect 15.23ha indigenous bush (proposed QEII Covenant); also pest control	\$27,783
Maharahara Station, Te Karaka	2,360m fence to protect 17ha indigenous bush (proposed QEII Covenant), plus pest control	\$27,140
Total grant amounts paid for 2005/06		\$281,882

expert advice to land managers and community groups.

In 2005-2006, fourteen Gisborne applicants were successful in securing over \$280,000 towards the conservation projects outlined in the table, below left. It would not have been possible to fund this conservation work locally, however by accessing central government funding these very worthy biodiversity projects have been possible.

Consent activity

Exotic forestry harvesting showed a dramatic eight-fold increase in 2006 over 2005. This in part reflects the age structure of some East Coast forests, with harvest-age trees coming on-stream, coupled with an improvement in prices for timber leading to a re-commencement of harvesting in areas where it had been put on hold.

Consents issued for scrub-clearance for farming showed, unsurprisingly, the reverse trend, with a substantial decrease in 2006. This reflects a reduction in farm incomes over the period.

Consent Activity

Category	Activity	Area/length	
		2005	2006
Exotic forestry	Scrub clearing	9 ha	0 ha
	Harvesting	398.3 ha	3,236.4 ha
	New road formation	44.1 km	64.2 km
	New track formation	4.2 km	3.9 km
Indigenous vegetation	Harvesting	0 ha	0 ha
Quarrying	Earthworks	8.5 ha	2.6 ha
	New road formation	0.2 km	0.4 km
Residential/housing	New access road	2 km	0.4 km
	New track formation	0.4 km	1.6 km
	Earthworks	2.68 ha	3.53 ha
	Vegetation removal	0.1 ha	0.01 ha
Farming	Scrub clearing	1,410.8 ha	220.9 ha
	New road formation	0.4 km	2 km
	New track formation	54.9 km	31.4 km
	Earthworks	6 ha	11.5 ha
Council/ public works	New road formation	21.2 km	0.7 km
	New track formation	0	5.7
	Earthworks	3.9 ha	17.52 ha
Total	Vegetation removal	1,818.2 ha	3,457.3 ha
Total	New road & tracks	127.4 km	110.3 km
Total	Earthworks	23.9 ha	37.05 ha

QEII National Trust Open Space Covenants

Covenants are a way to legally protect a natural area on privately owned land while still retaining ownership. Many recently approved covenants received funds for fencing through the biodiversity Condition Fund.

An application for an Open Space Covenant is first put before the QEII Trust board for approval. The next stage involves the survey, stock-exclusion fencing, and the area is registered on the land title; a process normally completed within two years.

	Area of covenants registered	Approved awaiting registration	Total area covenanted	Largest covenant	Average covenant size
2005	41 ha	14 ha			
2006	161 ha	148 ha	3,584 ha	1,104 ha	31.4 ha

East Coast Forestry Project

The East Coast Forestry Project, a major government initiative, is unique to Gisborne District, and aims to encourage afforestation of steep and erosion-prone land.

The ECFP began in 1992 and did indeed herald significant changes in land use from pastoral farming to closed-canopy *Pinus radiata* forestry on 'target' and 'eligible' land. Landholders, through a tender process, could apply for grants to plant trees on land where pastoral farming was no longer a sustainable option.

The 'target' land was severely erodible, but other 'eligible' not-so-steep land could be included within the forest boundary, to make the blocks of practical size.

This meant that in some cases whole farms were planted, boundary-to-boundary. While this resulted in forests of economic (even extensive) size, 'good' farmland was often lost. In addition, some, landowners balked at *pinus radiata* being the only option, and so did not apply for grants, even when they had severely eroding land on their properties.

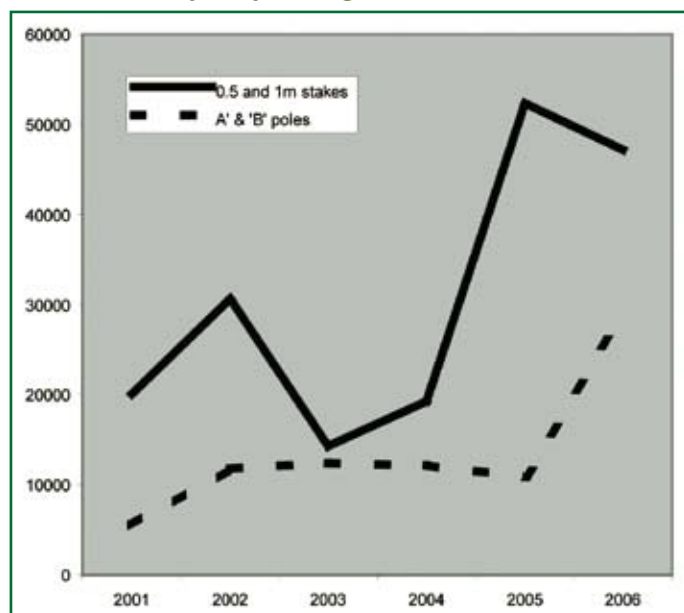
Fluctuations in the economics of forestry and farming have over the years significantly affected forest planting. Whenever forestry experienced a downturn, landholders tended to put off planting trees and continue with farming, and vice-versa.

In 2001 the project criteria were broadened to include 'alternative treatment' on land where other species at various planting densities would be able to halt erosion. Fencing to allow reversion to indigenous vegetation on erosion-prone

	Gisborne production forest (ha)	% change
1994	89,000	
2002	146,000	+64
2003	157,000	+7.5
2004	160,000	+1.9
2005	150,777	-6.7

Source: National Exotic Forest Description, MAF, 2003,2004, 2005

Conservation pole planting trends



Estimated net planted horticultural areas

	Pipfruit (ha)	% change	Kiwifruit (ha)	% change	Citrus (ha)	% change	Avocados (ha)	% change	Wine grapes (ha)	% change	Tomatoes outdoor (ha)	% change	Squash (ha)	% change	Persimmons (ha)
1994	200		300		n/a		-		1,200		1,600		1,600		
1995	329*	+65	286*	-4.6	570*		-		1,430*	+19	2,061*	+29	1,633*	+2	
2002	300	-9	300	+5	695*	+22	57*		1,700	+19	c	c	2,427*	+48	n/a
2003	260*	-13	268*	-10.6	n/a		61*	+7	1,595*	-6	c	c	2,447*	+0.8	
2005	260**	-	270	+0.7	n/a		.s	n/a	n/a		c	c	n/a		
2006	170***	-33	295	+9	800	+15	n/a		1,913	+20	300*	-85	2,884	+18	60*

C confidential, - nil or zero, n/a not available, ..s suppressed data. * Source of data: Gavin Loudon, MAF Policy (Gisborne), ** figure refers to apples only – no separate 2005 data available for pears. *** 2006 pipfruit figure is an estimate. Remainder of data: Statistics New Zealand Agricultural Production Census, 1994, 2004,2005.

land with scattered scrub became another possible option.

At the most recent 2005 review of the ECFP, it was decided that uptake of grant money had been far too erratic and slow, and it was time for the 'carrot and stick' approach. This would involve inserting a rule into the District Plan to require suitable treatment of severely erodible land, and the ECFP would provide the subsidy.

The Sustainable Hill Country Project

The Gisborne District Council has developed a proposed rule, District Plan Variation 176, requiring land owners/mangers of the most erosion-prone land to establish trees or shrubs at the appropriate density, and to maintain tree cover already present on such land.

Gisborne District's most erosion-prone land has now been defined on maps. The project to finalise the maps spanned 2004 to 2006. These were produced by amalgamating pre-existing farm plans and catchment schemes, high-resolution aerial photography, followed up with filling-in gaps and field checking.

The final third of the district not previously captured in high-resolution digital ortho-photos was acquired in 2005, allowing data for the entire district to be stored in the Council's GIS (geographical information system).

Landowners will have until 2011 to either establish the required vegetation, or develop a works plan outlining the stages of planting that will be undertaken. Planting outlined in the works plan must be completed by 2021.

Plan Variation 176 was notified in December 2006. It contains the rule defining "Overlay 3A land" and the maps showing where this land is.

The land mapped as Overlay 3A is also "target" land under the East Coast Forestry Project.

For some larger gullies with little or no topsoil, *Pinus radiata* is still considered the best treatment, but there are other options for other target land including a fencing and indigenous-reversion option, poplar and willow pole planting, or treatment may comprise a mixture of species/treatments.

For some gullies and earthflows, land falling outside of the Overlay 3A boundaries may also need to be planted to ensure effective treatment.

The Poverty Bat flats

The highly productive and versatile soils of the Poverty Bay and Tolaga Bay flats are derived from river-deposited sediments, originating in the hill-country, mixed with volcanic ash.

The types of crops grown on the flat land of the district have varied significantly over time. An understanding of present land use and likely future trends is important to Council to assess future irrigation demand. Both surface water (mainly the Waipaoa River) and groundwater are abstracted for irrigation. It is important these resources are used sustainably. Due to the limited publicly available land-use information, Council is investigating carrying out its own land-use assessment on the Poverty Bay flats.