Earthquakes 2009

The recent 8.8 earthquake in Chile reminds us how volatile the planet we live on is and it highlights how earthquakes have shaped a large part of country we farm today.

The shear magnitude of the Chilean earthquake moved the city of Conception up to 3 metres to the west, along with other cities such as Buenos Aries to a lesser extent. It also altered the earth's rotational axis by about 10 metres which has given the earths rotation a bit more of a wobble. The direct result is that days are now about 2 milliseconds shorter.

New Zealand has its share of tectonic activity but nothing yet to the same magnitude of the Chilean big rock. The biggest earthquake recorded in New Zealand was the Wairapapa earthquake back in 1855 which had a magnitude of 8.2 on the Richter scale. The Richter scale is logarithmic and hence the Chilean quake was 60 times bigger that the 1855 Wairarapa shake.

The most recent big shake in New Zealand was the 7.8 magnitude that hit Fiordland in July last year. This was centred near Dusky Sound and was about 12 km deep. The affect of this quake lifted a large area of land around the epicentre approximately one metre. The reported energy release was compared to 500 million tonnes of TNT or 25,000 times more powerful than the atomic bomb dropped on Nagasaki (without the radiation). The quake twisted the south island with Puysegur Point on the south-western tip moving 30 cm closer to Australia. This is ironic since New Zealand split away from Australia some 65-85 million years ago. To keep the Fiordland quake in perspective, it was approximately 100 times smaller on the Richter scale than the recent Chilean quake.

About 14,000 earthquakes are recorded in New Zealand annually. Most occur along the main ranges running from Fiordland in the Southwest to the East Cape in the Northeast. This axis follows the boundary between the Indo-Australian and Pacific plates. Large quakes are most common on areas of subduction zones – ie where the Pacific Plate is being forced under the Indo Australian Plate. Often these areas result in volcanism. Large quakes are less common along the central Alpine Fault of the South Island where the plates are not subducting and the forces are accommodated in different ways.

Many hill country properties throughout the country have evidence of earthquakes or tectonic activity. The most simplistic examples can be shown in cuttings of farm tracks where the exposed geological horizons or layers are not horizontal but tilted on one direction. This is evidence of geological tilting as a direct result of tectonic activity. Often the farming implications of this are that slopes are often steeper on the up side of the tilt and erosion is mostly soil slip. The soils can also be generally drier. Conversely, the slopes on the down tilt side are often shallower in angle, springs are more common, and the erosion types are generally flows (earthflows) rather than slides (soil slips).

Occasionally on farm track cuttings you come across geological horizons that stop abruptly and the same geological layer is continued some feet above or below the original layer. This is the direct result of tectonic activity and an earthquake at some stage has caused that particular part of the landscape to fall or rise compared with the adjacent bit.

Although history shows that the big quakes in New Zealand are mostly in the low to mid sevens on the Richter Scale, it is the cumulative affect of the small quakes that have played a large role in shaping our hill country landscape. A classic example is the Wanganui hill country where approximately two million years ago the coast line was between Ohakune and Raetihi. As a result of tectonic activity the sedimentary hill country between Wanganui and Raetihi is rising, on average, between 1 and 3 mm per year. This does not seem much but in geological terms it is a very rapid rate of uplift. A direct consequence of this is that the gully systems are cutting down at the same rate so as to maintain their natural bed slope. This down cutting causes over steepened slope toes resulting in erosion of the adjacent hill slopes.

Unfortunately tectonic activity or earthquakes is some thing that humans can not control. They can however control, to a large extent, the on-flow affects of earthquakes with respect to soil erosion. They can also, through understanding the land forming processes, have a better understanding of their land resources and how to optimise these resources.