OK TEDI MINING LIMITED

ENVIRONMENT DEPARTMENT

LOWER OK TEDI AND MIDDLE FLY

VEGETATION DIEBACK MONITORING

2004-2005

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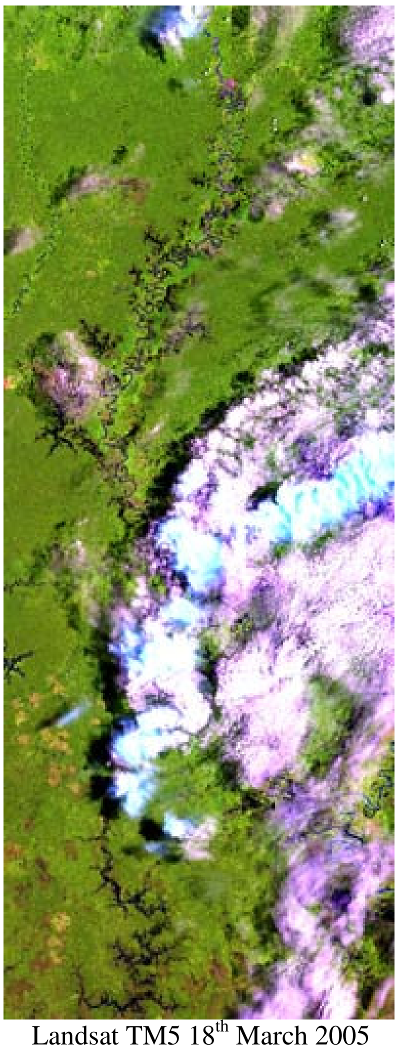
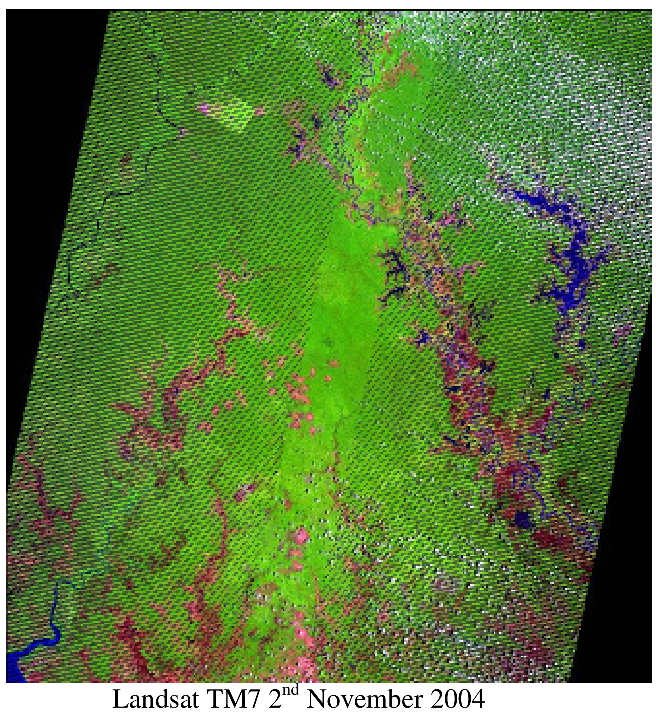
EXECUTIVE SUMMARY

This report details the results of a vegetation dieback mapping program over the Ok Tedi and Middle Fly floodplains of the Western Province of Papua New Guinea. The investigation was undertaken in order to determine the magnitude and spatial extent of vegetation impact for the period to 30th June 2005. Imagery was acquired on the 18th March 2005 from the Landsat 5 TM satellite and on the 2nd November 2004 from the Landsat TM 7 satellite. The imagery was to be analysed and radiometric response classified in order to determine vegetation status. Both data sets had radiometric limitations; the Landsat TM5 due to excessive cloud cover in the lower reaches of the system and the Landsat TM 7 due to technical failures in the satellite sensor and data processor. Despite isolated cloud in the Upper Fly and west of Mabaduam as well as systematic image voids between Manda and Everill Junction the extraction of vegetation impact was undertaken effectively.

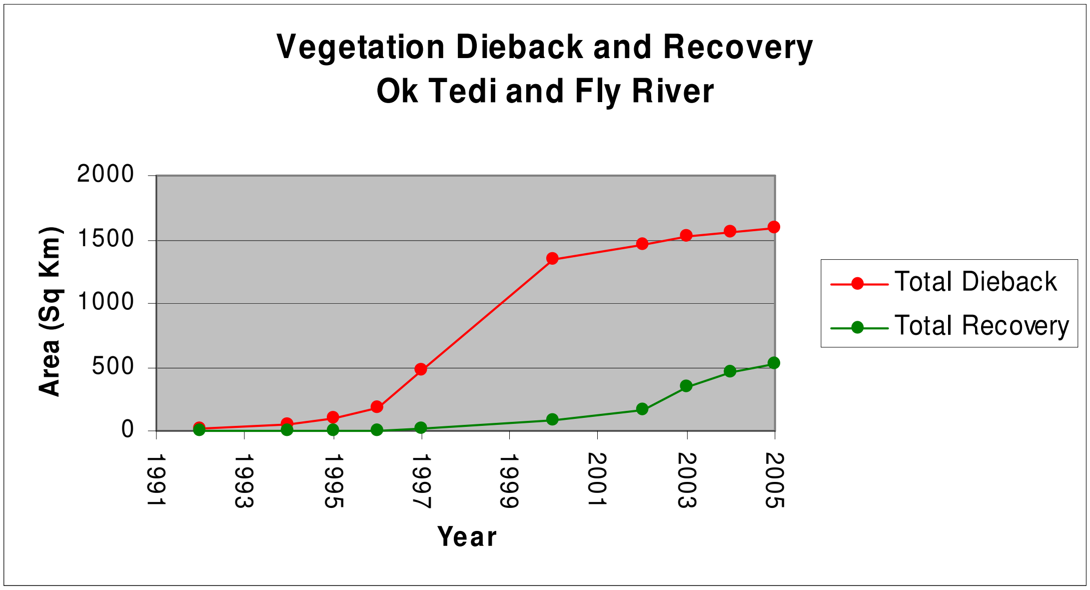




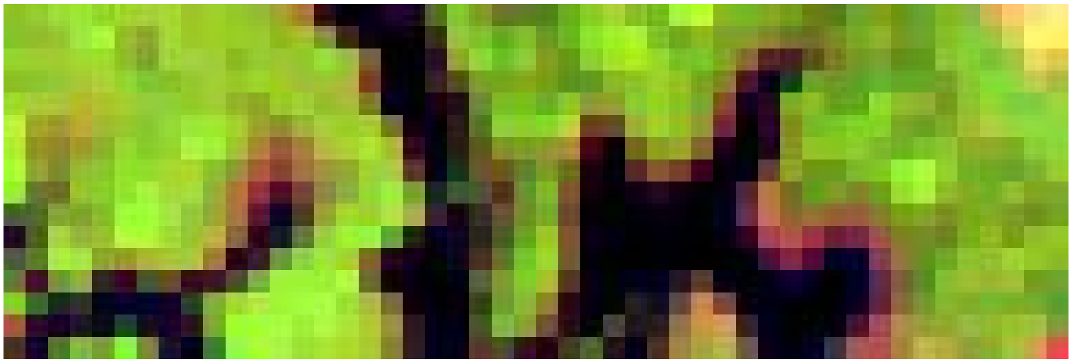
Landsat TM5 18th March 2005 Landsat TM7 2nd November 2004

<u>Estimated vegetation dieback extent totalled 1,588 square kilometres with 527 square kilometres of vegetation recovery included in this estimate. These figures represented a 2% increase in total area and a 15% increase in recovery area with respect to the 2004 epoch of monitoring.</u>

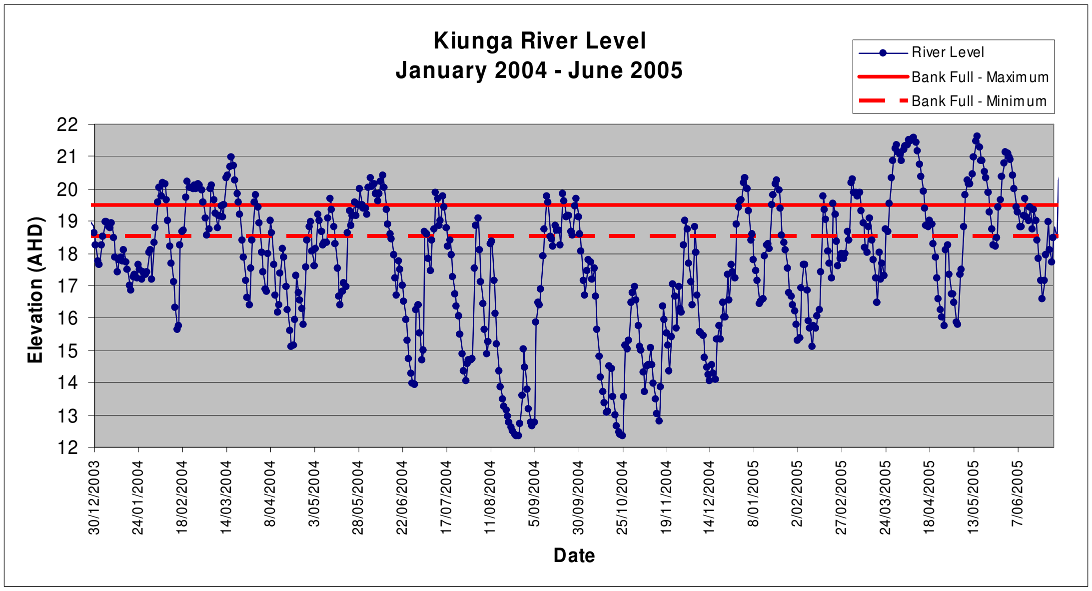
The following figure shows the dieback and recovery estimates for the Ok Tedi and Middle Fly systems.

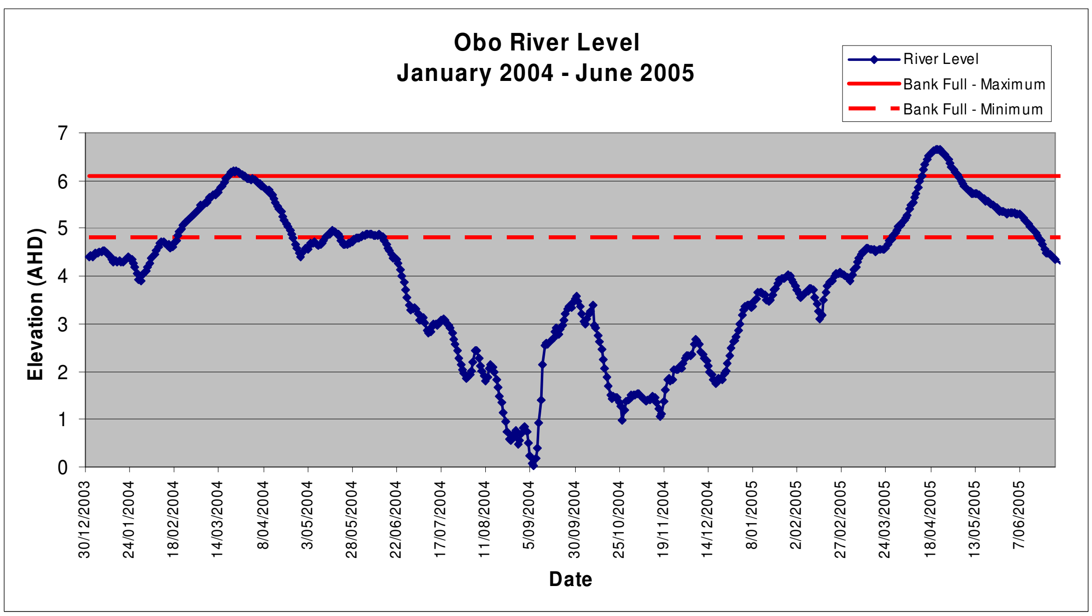


Ground truthing of the satellite imagery, in the form of airborne digital video, was acquired over five transects between Konkonda and Bosset. This acquisition was for the purposes of verifying the dieback and recovery estimates. The imagery was acquired on the 24th April 2005 and 6th June 2005. The digital video imagery was mosaiced and georeferenced, with a resulting orthophoto image resolution of 1.0 metres. From this high resolution data, classification training was undertaken on the 30 metre resolution satellite imagery.



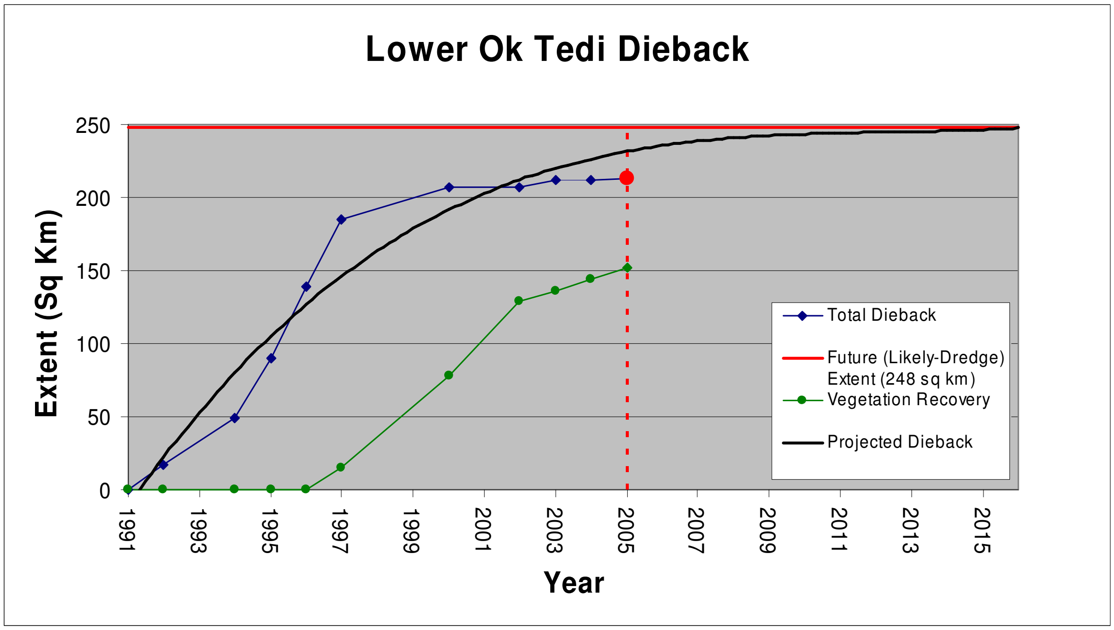
Fly River water levels between June 2004 and July 2005 were lower than average, with an overbank flooding frequency throughout the Fly River floodplain of only 15 - 20%. Flooding duration in the upper catchment was low with an average duration of 5 to 10 days. Flooding duration in the lower catchment was longer with an extended 3½ month flood in early 2004 and a 2½ month flood in early 2005. For approximately 8 months between these events the floodplain was dry or was draining. River levels in 2004, while similar to the 2003 epoch, were lower than the latter epoch and had similarly lower floodplain flooding frequency and duration. Both epochs had flooding characteristics that were significantly lower than the La Nina period of 1999 to 2000.

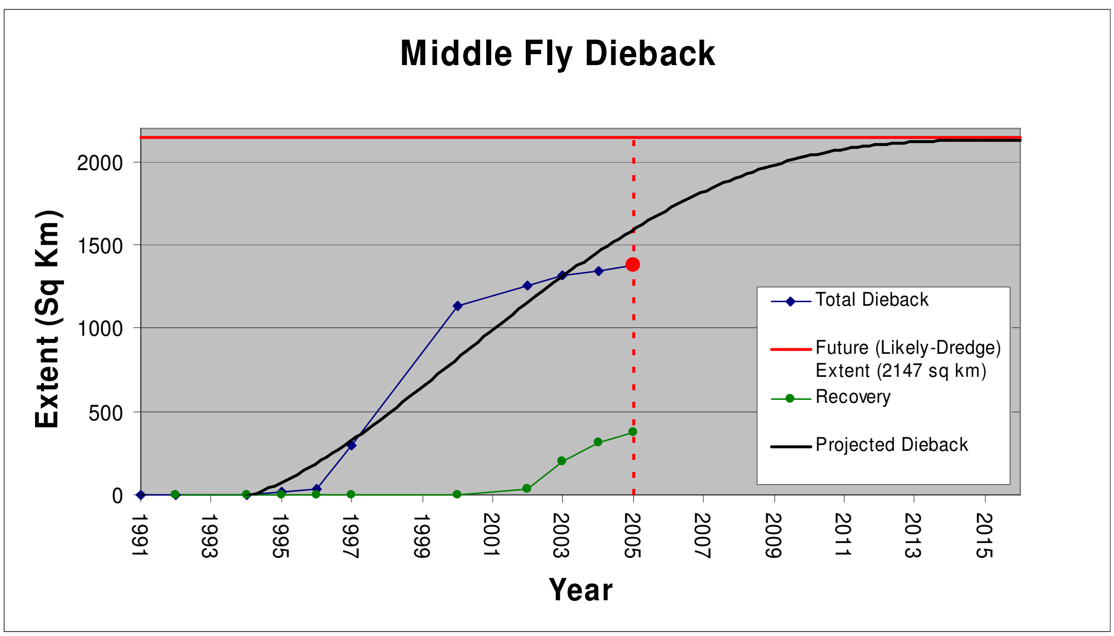




The rate of increase in vegetation dieback has remained relatively constant since 2001, a rate that is significantly lower than that of the 1996 to 2000 period. Climatic conditions similar to those of the 1999 to 2000 La Nina could readily increase the extent of vegetation dieback, decrease the extent of dieback recovery and possibly convert recovered areas back into dieback or stress conditions.

It is evident that in the Lower Ok Tedi the maximum extent of dieback is being approached; with only minimal net increase in area over the past 5 years. The future maximum extent of 248 km^2 is a conservative estimate for this zone. In the Middle Fly the measured dieback extent is following the general trend considering the dryer than average conditions over the past two years. The maximum extent predictions allow for future La Nina events and the progression of dieback into the fringes of the floodplain. Based on the results of the 2004-2005 monitoring epoch the total maximum dieback extent of 2,395 km^2 is believed to be a conservative estimate. The following figures show the relationship between observed dieback and predicted maximum extents for both the Ok Tedi and the Middle Fly.





Recovery rates in both the Lower Ok Tedi and Middle Fly are consistent with those from the 2003-2004 period. In the Lower Ok Tedi the extent of recovery is limited by the dieback in the backwater zones, where the surrounding floodplain has built up and effectively blocked the drainage channels. It is probable that these zones will remain as swamp land or transitional aquatic zones. While there has been some vegetation recovery in the very upper (Upper Fly) and lower (Manda to Everill Junction) reaches the majority of recovery has been in the forested zone of the Middle Fly (D'Albertis Junction to Manda). This is directly related to the lower than average flooding frequency and flooding duration during 2004-2005 where some stressed vegetation has undergone full or partial recovery. There has only been limited recovery of dieback zones anywhere in the floodplain

The general dieback and recovery trends observed during 2004–2005 are similar, both in terms of magnitude and pattern, to those of the 2003–2004 epoch. This is due to the similar climatic and subsequent river conditions between the two epochs and is not unexpected.

- The majority of the Ok Tedi floodplain is under some form of recovery although the backwater zones are still subject to severe dieback. Approximately 70% of the Ok Tedi floodplain is in a recovery phase. The minimal increase in recovery extent in this zone indicates that it has stabilised and the backwater zones will not recover quickly. The vegetation on the floodplain in the immediate vicinity of D'Albertis Junction is still subject to severe dieback as floodplain flooding characteristics are linked to backwater impacts rather than catchment rainfall and related river level.
- Vegetation dieback is extensive in the lower reaches of the Upper Fly, particularly in the vicinity of D'Albertis Junction. Backwater effects at the junction of the Ok Tedi and Fly River are causing significant overbank flooding, irrespective of catchment rainfall and related river levels. Vegetation recovery is primarily in the upper reaches of the zone and recovery accounts for 60% of the total impacted area. Vegetation recovery in this zone will readily convert to a dieback or stress state should extended wetter than average climatic conditions become evident and the backwater effects of the Ok Tedi and Fly River Junction become more dominant. Recovery in upper Fly zone is seen as being at the highest risk of conversion back to dieback or stress when wetter than average climatic conditions prevail.
- Approximately 12% of the fringe dieback and stress has recovered, however much of the forested vegetation along the edges of the lake system has totally died out and the physical evidence of dieback no longer exists. In these cases a conversion process has been completed with the forested rim being converted into an aquatic zone with a swamp / grassland border. Despite the conversion and the lack of physical evidence of vegetation dieback these zones are still classified as impacted based on change from the original state.
- There has only been limited vegetation state change in the Manda to Everill Junction reach with the total area of dieback remaining largely unchanged compared to 2003-2004. Backwater impacts from the Strickland River have contributed to periods of extended flooding on the floodplain in this zone, and although there have been periods of extended dry, the flooded periods have limited the potential for recovery. Recovery during the dry has primarily been with the grasses, where extensive areas of swamp and semi-aquatic areas have been colonised by floodplain grasses. Smaller forest vegetation communities along the river levees and scattered throughout the floodplain have thinned to selected highly flood tolerant species or have converted to grass or swamp vegetation regimes. As with the fringe dieback conversion there is now limited evidence that vegetation dieback was evident in these areas.