Empirically-based Sediment Budget for the Normanby Basin

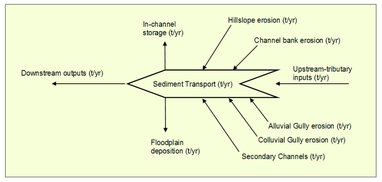
A new understanding of country

What's in a model?

Making good management decisions begins with an understanding of how the country works. The only way to gain that knowledge is by spending time on country. Once we begin to see how things fit together, we can describes how different processes interact.

Here's a simple example. A careful observer will see that the amount of ground cover has an effect on how much soil gets carried away in a heavy wet. So we can make an equation that predicts the amount of erosion if we know (a) the rainfall; (b) the amount of pasture cover; and c) and some details about the slope and soil conditions.

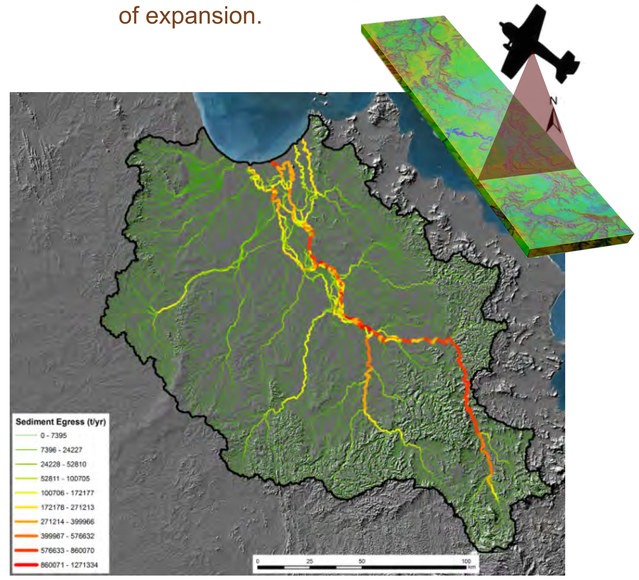
Models are conceptualisations wrapped up as equations. They are never as complete as the real thing and always contain assumptions. To be useful, models must be built upon field measurments and observations on country.



The bare bones of a "sediment budget"

We sampled river water to gather extensive geochemistry data and sediment load data. The load data showed us the concentration of sediment in the water at range of river heights.

Historical airphotos, GoogleEarth imagery, and high-resolution LiDAR data were combined to develop new data on gully distribution and rates of expansion.



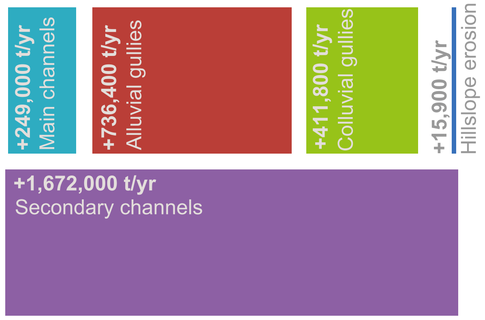
Much of the basin is relatively flat country. The meandering creeklines provide thousands of kilometres of exposed banks. The banks of these small creeks are more easily eroded than the banks of the main rivers. Since they don't have permanent flow they tend to have less riparian vegetation to protect them.

Floodplain deposition

Deposition happens when suspended clay and silt settle out of the stream. The Normanby's broad floodplain country absorbs a huge percentage of the sediment coming down from the upper catchment. Once sediment is deposited on a floodplain it can stay there for thousands of years. Bank and gully erosion, however, will re-mobilise the sediment, allowing it to continue its journey to the Bay

Net input to the stream network

The *stream network* is all the modelled rivers and creeks, divided into "segments" (to make them easier to study). Erosion adds sediment to each stream segment. Some of this material settles out, and some continues on downstream. This map shows how much sediment leaves each stream segment and flows to the next. Red lines show the heaviest sediment loads leaving a stream segment.



Net sediment out to the Bay*

+1,392,000 t/yr

Suspended sediment: clay and silt

Storage

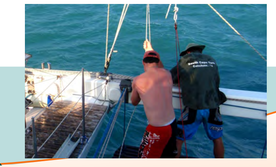
-1,694,000 t/yr

-424,000 t/yr
In-channel Benches

-1,270,000 t/yr
Floodplain Deposition

Great BarrierReef

Coastal plain



Core samples were taken in PCB to test where sediment on the bottom came from.

* Not including Coastal plain sources
+4,000,000 t/yr (esitmated average)

Stripping the Coastal plain

Our research shows that there is a major source of sediments to PCB that has not been accounted for previously. Much more research is needed to understand it properly. Our best estimate is that this source is contributing *at least* 4Mt/yr on average.

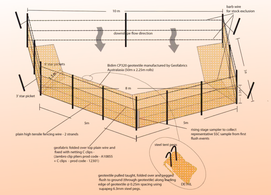
Inputs (t/yr)	**New Budget**	1 StDev
Hillslope (delivered to stream network)	15,900	n/a
Alluvial Gully	736,400	n/a
Colluvial Gully	411,800	n/a
Secondary Channel	1,672,000	n/a
Main Channel Bank Erosion	249,900	204,900
Total Inputs	3,086,000	204,900
Storage (t/yr)	**New Budget**	1 StDev
In-channel Benches	424,000	400
Floodplain Deposition	1,270,000	17,200
Total Storage	1,694,000	17,600
Net Output from Upper Catchment	**1,392,000**	222,500
Coastal Plain Sources**	4,000,000	1,880,500
Total Input to PCB (Annual Load (t/yr))	**5,392,000**	**2,103,000**

Sediment balance sheet

In-channel benches

Eroded sediment transported downstream by the river can be deposited along the sides of the channel. As these deposits build up, they are called in-channel benches. It is important to protect benches. Stable riparian vegetation on these benches can help prevent them from becoming an erosion hazard in the future.

Upper catchment



We used Hillslope Traps to measure the amount of clay and silt coming off slopes with different geologies and soil types.

Using optically simulated luminescence (OSL) dating we determined the depositional age of sediments at gully, in-channel bench, and floodplain sites throughout the basin.

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