Tools for Designing Postmining Landscapes with Acceptable Erosion Risk and Discharges on the Receiving Environment

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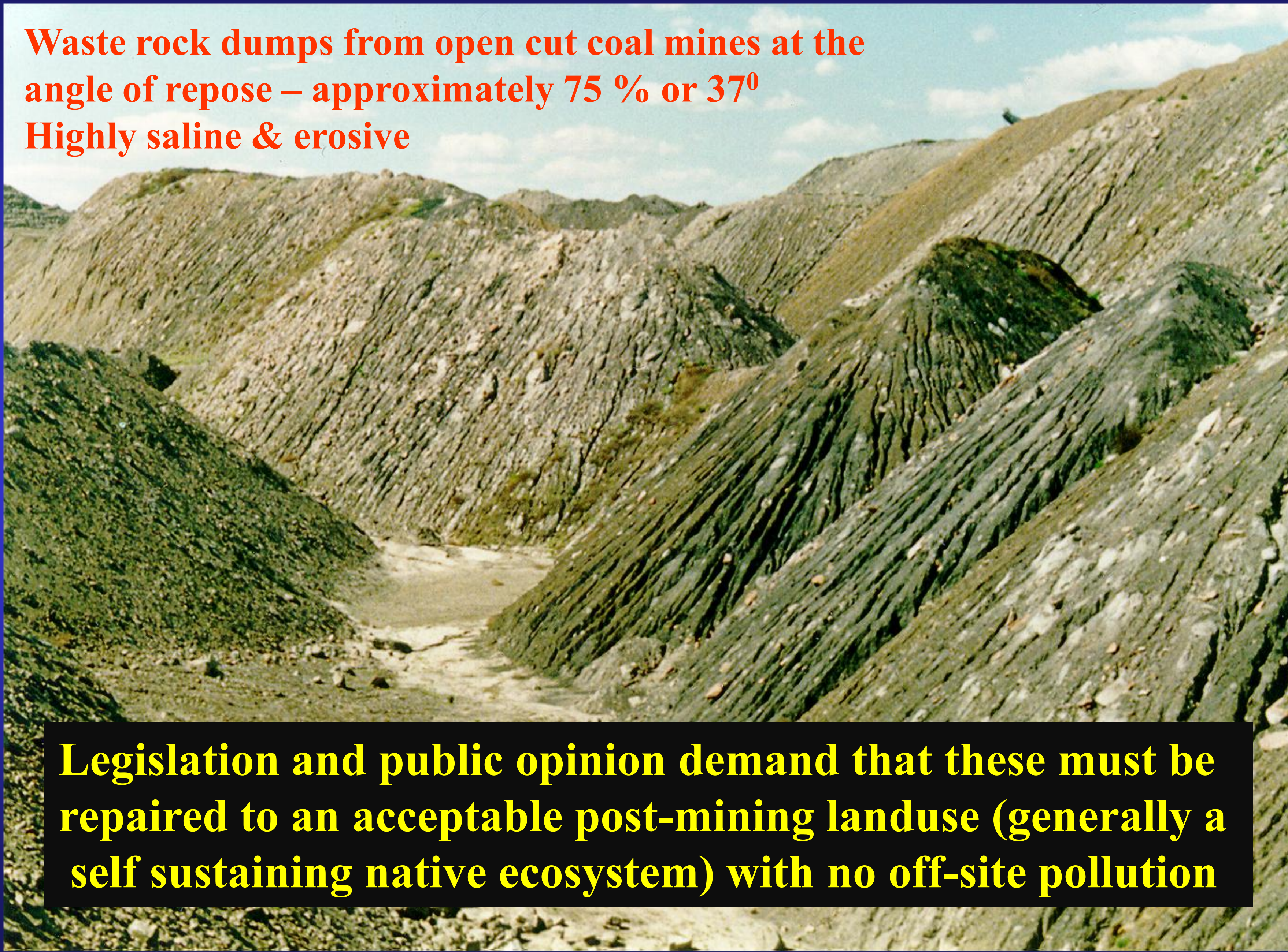
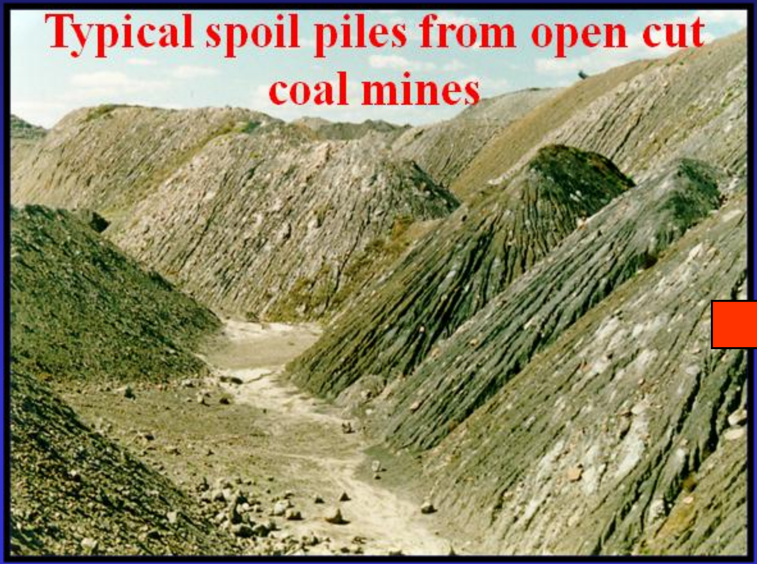
Close-up of a typical spoil piles that needs to be rehabilitated:

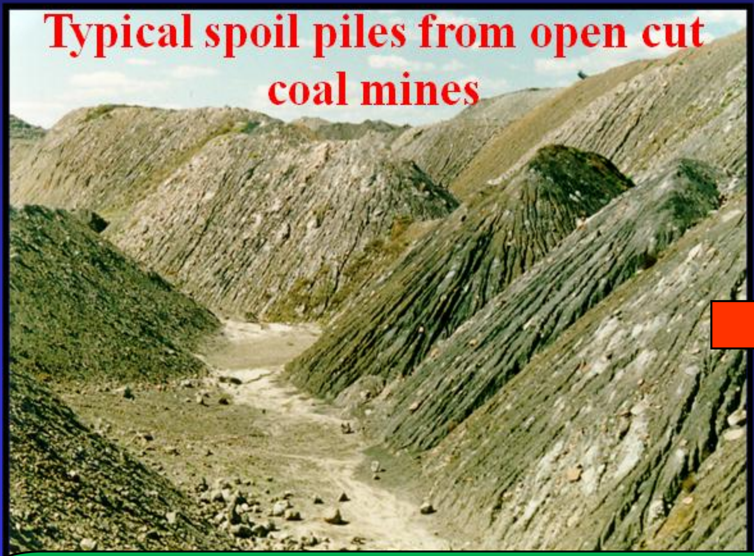


Background: The general Sequence of Rehabilitation is:



- Currently > 50,000 ha in Queensland
- > Ave cost > $ 22,000/ha
- Thus : Large cost to industry

Background: The Sequence of Rehabilitation



- But: Soil and overburden varies greatly in their erodibilities
- Thus Minesites need accurate , cost-effective & user friendly methods to

  (1) determine suitable combinations slope, length & vegetation cover that will result in acceptable rates of erosion for input into their Landscape Design Models and

  (2) determine the potential erosion rates from the Landscapes that they are likely to design and construct.

So we measured erosion at different scales and cost.

(Acarp 1629 & 4011: 1992-1998)

Experimental scale		Experimental - Real world scale	
Lab Rainfall Simulation	**Field Rainfall Simulation**	**Field Plots**	**Field Catchments**
			
Plot 3m x 0.8 m	**12m x 1.5 m** **4m x 1.5 m**	**20m x 5 m**	**Up to 2.5 ha**

Inexpensive
rapid, independent
of climatic conditions
(few weeks)

Expensive, slow
few plots/catchments,
data collection depends
on climatic conditions
(minimum 5 years)

Erosion was measured at different scales and cost.

(Acarp 1629 & 4011: 1992-1998)

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To meet industry requirements, the relevant question is:
Can laboratory scale measurements be used to predict field scale erosion ? (either annual or individual storm events)

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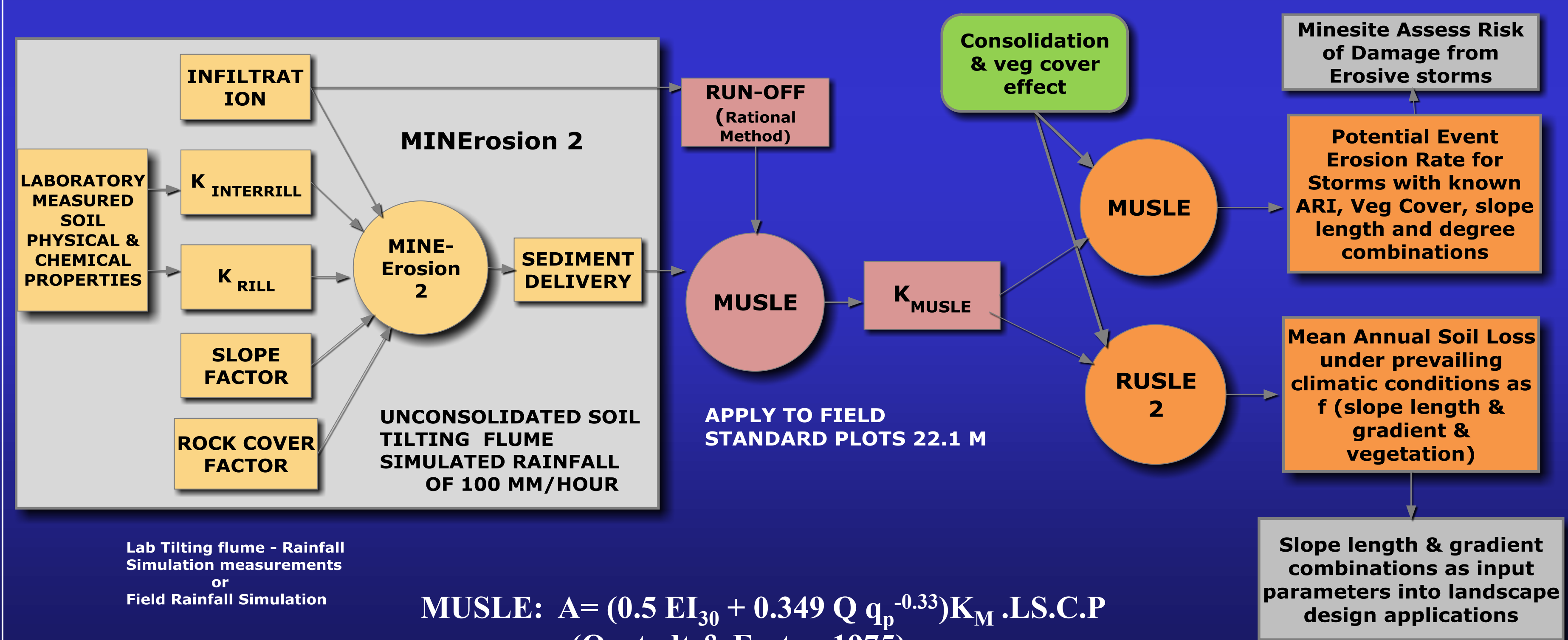
MINErosion 3: a user-friendly hillslope model to predict annual & potential rainstorm erosion rates and to design post-mining landscapes (slope length & gradient)

MINErosion 2: simulates sediment delivery from unconsolidated plots of any slope length and gradient based on rill and interrill erodibility measurements

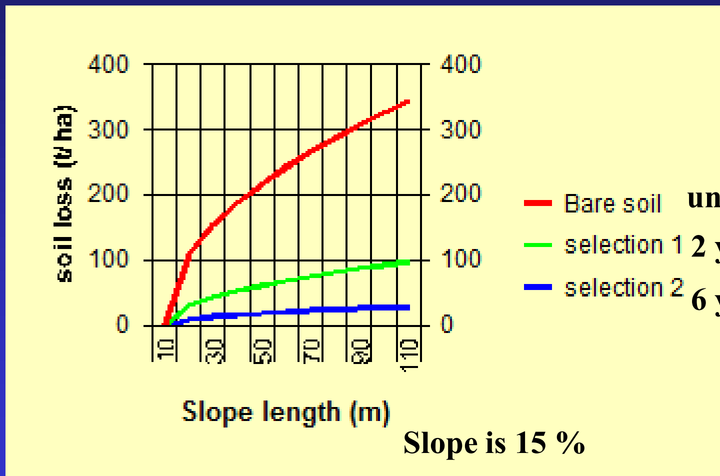
MINErosion 3: rill and interrill erodibilities are combined into a MUSLE erodibility to predict annual and potential rainstorm erosion events (of known annual recurrence). A consolidation and (above ground) veg cover is introduced.



MUSLE: $A = (0.5\ EI_{30} + 0.349\ Q\ q_p^{-0.33}) K_M .LS.C.P$

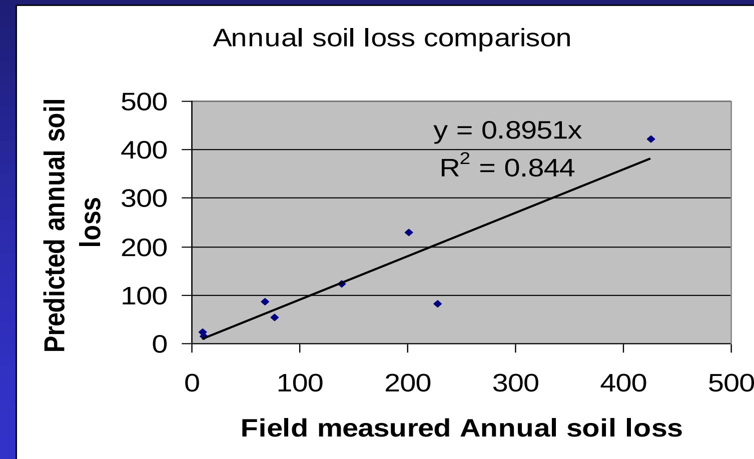
(Onstadt & Foster, 1975)

Outputs:
Annual erosion rates

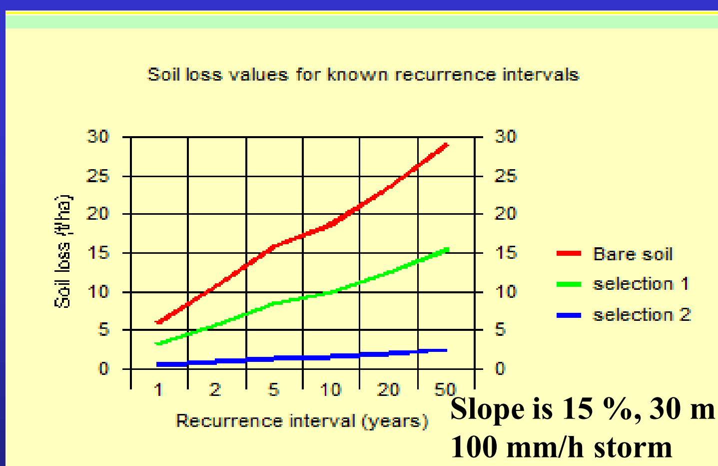


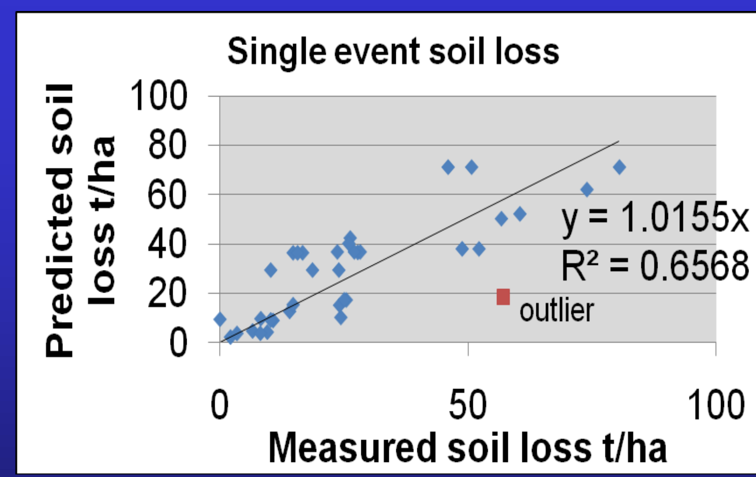
unconsolidated
2 years, 20% cover
6 years, 50 % cover

Validation



Single event soil loss





Although MINErosion 3 can be used to derive suitable combinations of slope length and gradient, it cannot be used to assess erosion from landscapes. Need to combine it with GIS to assess erosion from catchments/landscapes.

MINErosion 4.1: Linking MINErosion 3.3 with ArcGIS

DEM
of catchment or
landscape -
divide into raster of
grid cells

ArcGIS used to tag
gridcells with
-Surface hydr char
- soil & env char
- storm char

MINErosion 3.3
applied to each
gridcell in sequence
with sedimentation
subroutine

ArcGIS used to
express outputs
as
Maps and files

The outputs were validated against annual and storm events collected from 9 years of data collected from the catchments with very good results (Fig 5 in paper).

Thank you.

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