VERIFICATION OF LFA SOIL SURFACE ASSESSMENT (SSA) INDICES

To be meaningful, the generated LFA indices of stability, infiltration and nutrient cycling need to be verified against established scientific measurements. This verification has been done at a number of sites in both the rangelands and on mine sites. Although a limited number of regressions are presented here to illustrate the validity of the LFA procedure to provide reliable and useful science-based indicators, further data are available in reports available from dtongway@iinet.net.au. In each case, we selected the widest range of field functional states as was available. SSA indices do not claim to be precise estimates within a narrow range of soil surface functional states.

LFA verification measurements on infiltration and soil respiration were conducted in the field and soil samples were also collected for soil stability analyses conducted in the laboratory. These measurements and samples were undertaken at field sites where soil surface assessment (SSA) data were collected using visual procedures to assess 11 LFA indicators (see SSA-Proc.pdf).

Stability

To measure soil stability, intact soil cores, in metal rings, were collected in the field. At the laboratory the soil was expressed from the ring in layers of 0 to10 mm and 10 to 30 mm. A weighed sample was then wet-sieved through a nest of sieves, as described in Chaney and Swift (1984), to derive a mean weight diameter measure of the stability of soil aggregates. The derived LFA stability index data (y) were then related to this laboratory measure (x; Fig. 1). The linear regressions were highly significant ($P < 0.0005$).

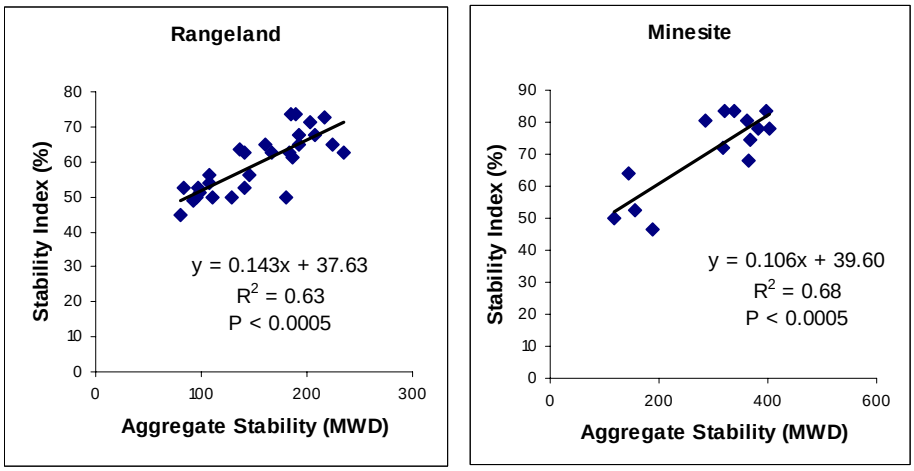

Figure 1. For rangelands and a rehabilitated minesite, the linear relationship between the field assessed LFA stability index and the laboratory measured soil aggregate stability (mean weight diameter; MWD).

Infiltration

Infiltration rates were measured in the field using a disk permeameter, in the saturated flow mode, as described by Perroux and White (1988). Measurements were continued until a steady infiltration rate was maintained over several minutes. The field assessed LFA infiltration index (y) data were then related to these disk permeameter infiltration measurements (x), and found to be highly significant (Fig. 2).

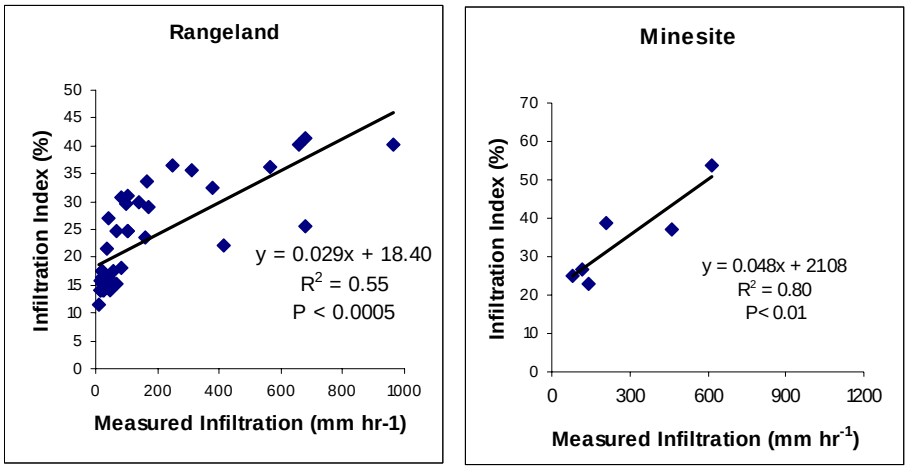

Figure 2. For rangelands and a rehabilitated mine site, the relationship between the field assessed LFA infiltration index and the field measured saturated infiltration rate (mm/hr).

Nutrient Cycling

Two procedures were used to verify the LFA nutrient cycling index:

(i) Soil respiration, which reflects biological activity in the soil, was measured by collecting the evolved CO_2 in the field over a 24-hr period (Hartigan 1980). LFA nutrient cycling index (y) data were related to these soil respiration data (x), and found to be highly significant (Fig. 3).

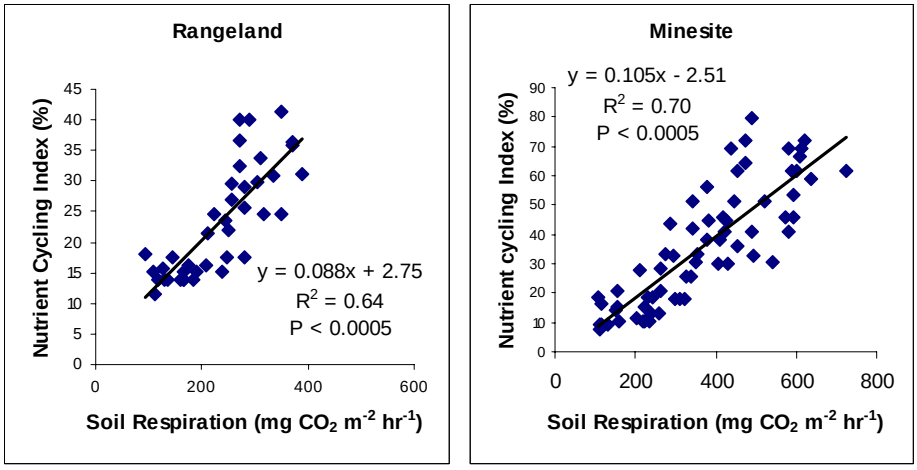

Figure 3. For a rangeland and a rehabilitated mine site, the relationship between field assessed LFA nutrient cycling index data and field measured soil respiration rate data (mg $CO_2/m^2/hr$).

(ii) The size of the nutrient pool of the biological acquired soil nutrients, which included total nitrogen and carbon (Leco 2000) and mineraliseable (available) nitrogen (Gianello and Bremner (1986). LFA nutrient cycling data (y) were also related to these nutrient pool (x) data, and these relationships were highly significant (Fig. 4).

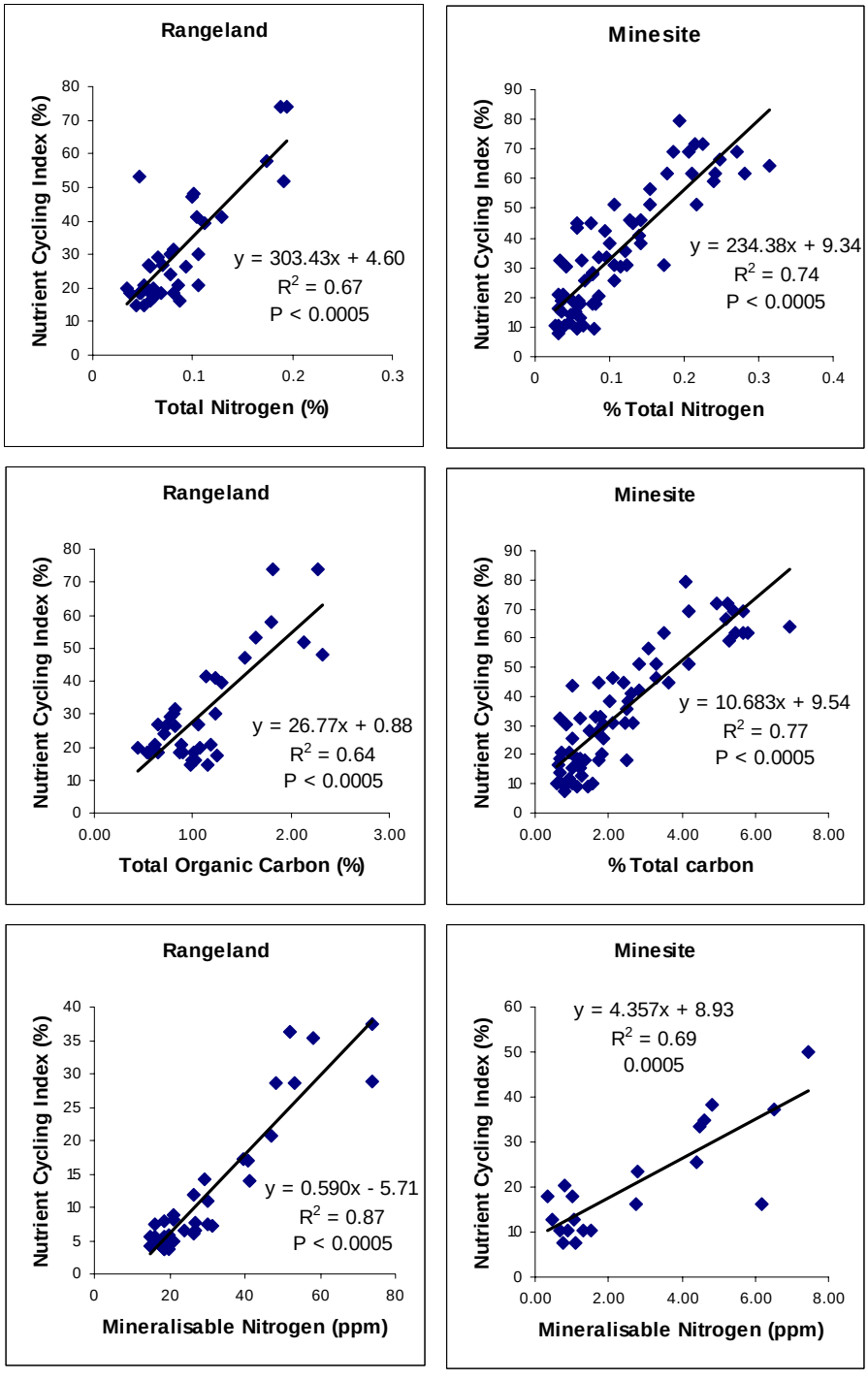

Figure 4. For rangelands and a rehabilitated mine site, the relationship between the field assessed LFA nutrient cycling index and laboratory measured nutrient pool sizes for total carbon (%), total nitrogen (%) and mineralisable nitrogen (part per million, ppm).

References

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Hartigan, R. J. 1980. Soil respiration as an index of forest floor metabolism. PhD thesis, University of New England, Armidale, Australia.

Perroux, K.M. and White, I. (1988). Designs for disc permeameters. Soil Science Society of America Journal. 52:1205-1215.