



Designing growth medium based on hydrological principles to improve seedling emergence

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Topsoil in post mining restoration is vital not only to provide seed diversity and density required for restoration, but also to provide a suitable growth medium for seed germination, seedling emergence and vegetation establishment. However, the deficit of topsoil in post-mining restoration is remarkably common across many restoration projects. This situation encourages research to identify alternative growth media and developments in seed collection. In this study, we hypothesized that the addition of waste-rock to topsoil improves its physical and hydrological properties as a growth medium. Explicitly, we hypothesize that: 1) the addition of waste-rock enhances infiltration and rainfall effectiveness, 2) there is an interaction between rock content and soil texture that modifies water availability and soil temperature with consequences for germination and emergence, 3) soil surface crust decreases seedling emergence and is related to finer soil textures, and 4) landscape position (flats vs. slope) affects water availability and surface crust and, as a consequence, seedling emergence. An experiment was set up with five soil covers with different textures and waste-rock content in two landscape positions: slope and flat. The soil covers were: topsoil, topsoil mixed with waste-rock, waste-fines obtained from the crusher, waste-fines mixed with waste-rock and waste-rock. Four native species were seeded in four plots. In addition, four control plots were also set up to measure seedling emergence. To describe the physical and hydrological traits of the different covers we installed runoff plots, performed rainfall simulations and measured soil surface crust, infiltration rates, soil moisture and temperature and soil physical and chemical properties. To describe the vegetation responses to soil traits we measured seedling emergence. Topsoil cover was found to show more favourable soil conditions (physical and hydrological) that enhanced seedling emergence. The addition of waste-rock to topsoil cover did not show significant effects in physical and hydrological behaviour of the soil covers. Since similar traits and emergence results were found, the addition of waste-rock to topsoil is suggested as a useful practice to increase the area where topsoil (mixed with waste-rock) could be spread.