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Novel ideas for maximising dew collection to aid plant establishment to combat desertification and restore degraded dry and arid lands

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This paper focuses on the potential of dew to provide water to plants and potentially to people as well in remote and difficult to reach areas where rainfall and underground water cannot be harvested.

The combat of desertification and the restoration of degraded and desertified dry and arid lands has never been more urgent. A key practical component of this strategy is the restoration of habitat with planting. But for habitat and planting to survive there needs to be an adequate supply of water. In most cases providing water to the plant's roots is vital. In some areas where habitats have been destroyed, sufficient water is immediately available, for example through seasonal rainfall, or it can be harvested to concentrate adequate supplies of water to the roots. However, in arid and hyper arid areas, as well as in some dryland areas, a consistent and adequate supply of water cannot be provided by any conventional proven method. Thus, as the need to combat desertification and to restore desertified dry and arid land increases, so the need to find novel methods of establishing and maintaining planting and thus habitat increases. In more traditional land management scenarios this can be achieved through manipulating landform on a micro and macro scale, for example, by creating catchments, thereby collecting precipitation and directing it to the plants. Where this cannot be done, other means of water supply are usually required. Bainbridge (2007) and others have shown that supplying water to plants is possible through a number of traditional methods, for example, using clay pots. But most of these techniques require an introduced source of water, for example, obtained through water harvesting methods or by delivering water to site in tanks and by water bowser. This can work but requires continuous manpower. It is expensive and can be physically prohibitive in areas where access is difficult and/or remote.

The concept of using dew to supply water in drylands is not new and numerous studies have been undertaken to investigate past so-called dew collectors and to research the possibilities of using new ones. Most of the historical dew collectors have been disputed as dew collection devices. (Beysens et al 2006, Beysens et al in Kogan and Trahtman 2006, Graf et al 2008.) However, contemporary dew collection has proven possible in those areas that have dew fall. It is generally agreed by researchers, such as Sharan and Beysens in 2007 and Jacobs et al in 2008 after Monteith (1957) that the theoretical maximum dew yield is in the order of 0.8 l/m2/day. Although the exact maximum has never been defined the amounts can yet be significant. However, In most cases the investigations of dew supply in areas where dew is known to precipitate has been undertaken with inclined roof like planar surfaces. However, erecting these planes in remote areas and within difficult terrain makes this kind of collector impractical. Additionally such planar surfaces demand space on the ground which then diminishes the areas of restoration and large collectors require additional plumbing to distribute water to the plants themselves. Thus in order to better supply dew to plants other forms are required. This paper discusses the various ideas and concepts that have been developed for dew collection that have emerged on the market and the novel ideas that have been initiated by the author.

The research undertaken investigates biomimetic forms which emulate plant forms such as various cacti and succulents investigating their ability to increase surface area as well as releasing heat like a radiator. Additionally other spiky, needle like forms are investigated as well as animal forms, such as the surface of the Stenocara gracilipes Namibian beetle which collects fog. The research initiated a new strategy for dew collection dividing dew collectors into two types: 1) Passive dew collectors, where nightly collection and delivery is achieved without people, and 2) Semi-passive dew collectors, which require people to collect the dew after it has formed on the dew collector.

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