theory which will prevent humanity, in its present mindlessness, from developing into the final disturbance which the Earth cannot tolerate.

Permaculture has a strong ethical basis which lies at the root of its discipline. The ethical dimension of permaculture can be summarized by three guiding principles:

1 Care of the Earth by providing conditions for all life systems to continue and multiply.
2 Care of people by providing access for them to those resources necessary for human existence.
3 Setting limits to population and consumption in order to be in a position to set aside resources to further the above principles (paraphrased from Mollinson, 1992).

Permaculture is about adopting the mechanisms of a mature ethical behaviour for ensuring the survival of the Earth as a life-sustaining planet. Central to this ethical position is the conservation of energy and resources, the re-use of waste and the consequent reduction of pollution. The chief characteristic of permaculture is the design of a system where its energy needs are provided by the system itself. While modern crop agriculture is totally dependent on external inputs of energy, the Tropical Rain Forest, in contrast, creates its own energy. Consequently it is the model, par excellence, for a system of permaculture. It is self-sufficient and self-sustaining; it is, therefore, a powerful model also for the sustainable city (Figures 5.5 and 5.6).

Energy can be transferred from one form to another but it cannot disappear, or be created, or be destroyed. While the total energy in the Universe is constant the total entropy is increasing. Entropy is that energy which has been dissipated and is unavailable for work: it is no longer useful energy. When we put petrol into the car it has potential but when the potential is realized as movement the energy is dissipated as heat, noise and exhaust fumes. The question for the urban designer is: how best can the available energy be used before it passes from the site or from the city? The aim for urban design then becomes to trap, store and re-use as much energy as possible on its path to increasing entropy.

Permaculture has a number of broad implications for urban design and settlement planning. Primarily, it means creating regions with stable populations where cities, homes and gardens feed and shelter the population. It is a question of getting our 'own house in order' so that it supports us and our daily needs. For Mollinson (1992) this is a process empowering the powerless to create 'a million villages' to replace the nation state: he sees this as the only safe route to ensuring the preservation of the biosphere.[12] While not wishing to be drawn into this large geo-political debate, it does seem sensible to organize city regions so that they are capable of both feeding the population and dealing with organic waste. The cities of today return little energy to the systems which supply them. They pass on wastes as pollutants to the sea and to the land, having developed a one-way trade with respect to their food supplies. For this to change, the city has to be planned as a self-governing and self-managing garden. One important objective for each development project within such a garden city is to maximize its food-producing capacity and have clear links with a local system for recycling organic waste.

The use of energy in city construction has been explained in *Urban Design: Green Dimensions*.[13] In summary, the practical design considerations are to construct systems which last as long as possible; to repair and renew systems rather than replace them; to construct buildings fuelled where possible by the sun; to design transport regions where the need for mobility is minimized and, where necessary, movements are largely by foot, bicycle and public transport. It requires that urban governance be conducted in a manner which emphasizes public participation in planning, design, system construction and environmental management. The basic components of such a sustainable city region are the