Human, environmental, and economic interrelationships in a sustainable landscape.

who had no outside view or could see only manmade elements (Kaplan et. al, 1988).

Because much of our work is mechanized and we spend our days at computer keyboards or behind desks reading and signing papers, we have to seek ways to use our muscles, ways to relax, and ways to relieve our stress. One of the most common ways is through gardening. Working in the landscape can provide the physical and emotional release we need after a day at the office. If the landscape does not provide human benefits, it is not sustainable simply because we will not continue to maintain and improve it.

A sustainable environment is one that can function in the environment in which it is planted and provides real or perceived economic benefit and emotional and physical benefit to the individual or community. There are several factors that can contribute to the creation of sustainable landscapes. One is developing a regional landscape style. This can be unique and appealing and give special character to the area that local people and visitors treasure. It translates into communities that attract industry, increased tourism, and other benefits of landscaping.

The realization that perceived value and therefore real value of industrial parks, subdivisions, apartment complexes, public buildings, and streetscapes can be increased by landscaping will help ensure that plants continue to be an important part of our cities. The fact that landscaping provides the highest return of any home improvement and that it can reduce crime and vandalism if properly presented and installed upholds the concept that landscaping is not just something extra for the rich. Landscaping is an integral part of the

continued prosperity of our country.

Most definitions of sustainability include human factors, although in production agriculture they are generally called sociological factors. Horticulture and production agriculture affect the sociology of a community and the psychology of those engaged in the practice, although psychological factors have been studied more thoroughly in ornamental horticulture (see Figure). Even in ornamental horticulture, however, we have barely scratched the surface.

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The Greenhouse Wastestream

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The 1990s have emerged as a decade of the environment. An important dimension of this is a societal focus on reducing the volume of materials that are landfilled.

The initial focus of the regulatory community was to reduce the volume of solid wastes generated by large firms. The present focus is community-based, with many local units of government developing recycling and other programs to reduce the volume of household wastes. These efforts will be followed by greater governmental focus on wastes generated by small businesses, including the greenhouse industry.

The significance of this societal focus is that many communities are developing recycling alternatives for several components of the household wastestream that are also present in the greenhouse wastestream. The composition of the United States household wastestream is illustrated in Fig. 1. In contrast, a year-long survey including predisposal visits to greenhouse waste containers in western Michigan revealed the wastestream composition illustrated in Fig. 2. Clearly, several smaller-volume greenhouse waste components such as metal, wood, and scrap paper may be recycled through a community-based option.

The big four

That which remains in the greenhouse wastestream are four materials representing 85% of the total waste volume. Greenhouse growers who want to reduce the volume of their wastestream and their disposal costs should develop a recycling program for hard plastic, plastic sheets, organic materials, and cardboard.

HARD PLASTICS. Most hard plastics that are used to make plug trays, flats, pots, and hanging baskets are either no. 6 polystyrene or no. 2 high-density polyethylene. This distinction is important to some recyclers. Another option that may be available to some growers is to incinerate these plastics in a waste-to-energy facility or sterilize and reuse the growing containers.

SHEET PLASTIC. Many recyclers will require that sheet plastic be cleaned, which requires that it be cut above the ground level. An obvious way to reduce the volume of sheet plastic in the wastestream is to use multi-year, ultraviolet-stabilized

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Fig. 1. The composition of the United States household wastestream.

films for greenhouse covers. Some small growers have given away small quantities of used material as paint sheets, firewood covers, or other household uses within their community. Bailed plastic sheets can create damaging hot-spots if incinerated in waste-to-energy facilities because sheet plastic generates 18,000 BTUs/lb, which is close to the heating value of coal.

MEDIA AND PLANTS. Organic materials represent 17% of the greenhouse wastestream. Almost 90% of this is generated in a 3-month window near the end and immediately following the primary sales season. This suggests that plants and media from the remainder of the wastestream may be separated during this time. Smaller growers may choose to supply these materials to a community-based composting program, whereas larger growers could either establish an in-house composting program or dispose of the organic materials that they generate in a surface-land system.

CARDBOARD. This is one of the easiest components of the greenhouse wastestream to recycle, because many waste haulers and communities have established cardboard recycling programs. If these options are not available, greenhouse growers may be able to drop off clean cardboard at a major retailer in their community. Since up to 60% of a retail sales firm's solid waste is cardboard, many of them collect or bail cardboard for recycling. Cardboard recyclers want clean stock that is free of waxed or wet cardboard and other types of paper.

Getting started

Growers should adopt a waste reduction way of thinking for several reasons, most important of which is because resolving the industry's solid-waste problem is an environmentally sound response to society's concern. Beyond this, voluntary programs put in place now may diminish the attention that the greenhouse industry will receive by the public sector's regulatory community when small and medium firms become the focus of environmental policy.

Growers also should be aware that disposal costs money. Waste-hauler tipping fees are increasing rapidly as the number of landfills declines and establishing new sites becomes a more politically difficult process. I estimate that western Michigan growers spent about \$550/acre of greenhouse space to dispose of their business' solid wastes. This is not a large expenditure, but it can be reduced by putting an effective waste-reduction program in place.

The following six steps are offered to growers who wish to begin a waste-reduction program for their business:

- Set achievable goals.
- Target one or two materials for reduction when getting started.
- Segregate targeted waste streams to avoid contaminating the recycled ingredients.
- Work with neighboring businesses to share balers or dumpsters and storage or collection containers.
- Initially focus on waste-reduction ideas that require minimal capital investment.
- Involve employees in planning and implementation. They are keys to making recycling a success.

Focus on local opportunities to reduce your contribution to the solid wastestream, including waste-exchange networks and processing recycled products. Now is the greenhouse industry's opportunity to establish appropriate environmental practices to be viewed as an industry that produces a product that significantly improves the quality of life while minimizing unwanted environmental impacts.

Fig. 2. The wastestream composition of greenhouse waste containers in western Michigan.