THE RESPONSIBILITY OF THE PLANT PROPAGATOR IN ENVIRONMENTAL MANAGEMENT

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One of the problems which faced the Department of the Environment and Conservation on its inception in December, 1972, was to establish the "metes and bounds" of its responsibility.

The term "conservation," defined to include the protection of soil, water, plants and animals presented few problems, however the term "environment" raised, and continues to raise, difficulties. Many people equate environmental care with pollution control, rejecting the broader concept. It is the view of Dr. Moss Cass, the Minister for Environment and Conservation, that the term environment must be considered in the widest sense to cover all social, physical and biological aspects of man and his surroundings.

This view is also taken here in discussing the responsibility of the plant propagator in environmental management. Similarly plant propagation is considered broadly to cover the collection, dissemination and cultivation of all forms of plant life, either for commercial use or creative pleasure.

Man propagates plants for four main reasons: to provide himself with food, shelter and sometimes clothing, to produce food for domestic stock which, in turn, may be killed and eaten or used in the manufacture of clothing and other products useful to man, for medicinal and pharmaceutical purposes, and lastly for aesthetic and cultural values.

At what time and by what means man first began to cultivate plants as distinct from merely gathering their products is not known. It is clear however that the lives of most people depend upon the existence of cultivated plants. If men were still dependent upon hunting and foraging for food it is estimated that the earth could not support more than 30 million people instead of the present 3,500 million, (14). Man's survival depends on his ability to continue to propagate plants which form the basis of his diet.

In addition to providing food, cultivation of plants has facilitated the division of labour and has given man a certain amount of leisure, both of which are important prerequisites for the growth of science and technology.

The discoveries of plants and their uses probably began in the Stone Age. The starchy foods, then, as now, undoubtedly made up

a large part of the diet. Wheat, rye, barley, rice and oats were the cereals chiefly grown in the old world, and maize in the new world. The inhabitants of Switzerland as early as the neolothic period, cultivated three kinds of barley and at least five kinds of wheat, four of which might be regarded as distinct species. The high value placed upon wheat by the more progressive races and the ease with which it could be carried on their migrations may account for the wide distribution of the plant (3).

Legumes have also been cultivated for a long time by the people of all continents. Peas and beans are not only edible when green, but the dried seeds contain a maximum of nourishment in a small quantity. The vines and husks can also be used as fodder for domesticated animals.

Historical records indicate that agriculture developed early in Assyria and was successfully carried out for many centuries. It was not confined to crop plants but included cultivated fruits, vines and crop plants and even cedars.

The date palm was one of the most important trees, the fruit could be eaten fresh or dried, it yielded sugar, and the sap could be fermented to a wine. Its trunk was used for the columns and roofing beams of temples and houses, its fibres were twisted into ropes, its leaves woven into baskets; and the tender tips were eaten as a vegetable. Sculptures show that the Assyrians were probably responsible for the first attempts at artificial pollination by dusting the pollen-bearing catkins of dates onto the spathes of the pistillate trees.

Men of those remote ages knew that certain plants had medicinal properties. Steeps and brews of leaves, roots of bark were administered for diseases of children and their parents. Seeds of some plants had purgative properties, or power to allay pain or to induce sleep. All herbal lore was not valid, however, as not every plant whose leave had the shape of a hound's tongue would heal a dog bite, neither could every leaf shaped like a heart, cure cardiac conditions.

The discovery and utilisation of papyrus was one of the great biological accomplishments of the Egyptians for it resulted in the manufacture of paper which facilitated the communication of ideas and the development of a culture which has been admired for thousands of years.

Whilst the antiquity of cultivation is well established unfortunately the adverse affects of unwise or unthinking land use practices are also not new.

The Mayas for instance were forced to abandon their cities after short stays because the available land nearby for agriculture

became exhausted. Farmers were forced to move further and further from the cities it was their duty to nourish. Cities finally collapsed as they became surrounded by a wide belt of burned and worn out steppe and the Mayas were forced to migrate (1).

It is not possible to trace fully the history of plant propagation here, and these early references are given largely to establish the antiquity of plant cultivation and to emphasise the significance it has had in the development of present civilisation.

I would now like to refer to four aspects of the activities of plant propagators which are of significance to recent and contemporary environmental management.

The introduction and spread of new plants. The great benefits to mankind which have come about from the introduction of new plants have been referred to above. Crop plants such as cereals and vegetables, fruits and vines, trees for timber, shade and shelter and shrubs and herbaceous plants for beauty and aesthetic satisfaction are but a few examples.

At the same time, serious economic and ecological problems have arisen through unplanned and even illicit introductions. Probably the most spectacular examples of this in the Australian context are the introduction of prickly pear and lantana.

The arrival of the pest species of prickly pear cannot be dated but the first definite record concerned a plant carried in a pot from Sydney to Scone, N.S.W. about 1839. Between 1840 and 1850 many cuttings were taken and planted to form hedges around outlying properties.

The practice of planting hedges was common before the introduction of netting fences to contain stock. By 1884 the occurrence of prickly pear on the Darling Downs was causing concern, by 1900 an estimated 4,000,000 hectares were covered by the pest and by 1925 some 26,000,000 hectares were infested. The remarkable and extremely fortunate control achieved by using the insect *Cactoblastis* is well documented and represents one of the spectacular successes with biological control. It should not be assumed however that every plant pest might be dealt with so effectively.

Some Australian species have become a problem when introduced to other countries. *Hakea* has developed to weed proportions in South Africa, and Eucalypts have spread rapidly and added to the existing severe bushfire hazard in southern California. *Casuarina*, commonly called 'Australian pine', was introduced to southern Florida as a windbreak species to protect valuable vegetable crops. Unfortunately it has successfully spread beyond agricultural lands to the coast in the Everglades National

Park where its ability to colonise sandy beaches has resulted in depletion of turtle nesting areas. In fact the 'Australian pine' in Florida carries the same degree of disapprobation in the minds of some conservationists as the Monterey pine does in Australia, where it is already successfully invading some native bushland.

In addition to possible ecological damage resulting from plant introductions there is the risk of introducing the insect and fungal pests unless adequate plant quarantine is observed and respected by the plant propagator. The harmful effects experienced overseas by "fire blight", Pierce's disease, and a wide variety of rusts are adequate warnings of possible dire consequences of uncontrolled and irresponsible introductions.

Domestication of wild species. Domestication of wild species generally involves selection and breeding for characteristics of benefit to man. These include fruit size, wood quality, frost or drought hardiness and flower size and colour.

In selecting for desirable characteristics, however, there is the risk that others, less obvious but nevertheless essential for species survival, might be overlooked. Possibly the most frequent in this regard is selection for "double flowers", most of which are sterile thus necessitating the development of vegetative propagation techniques if the individual is to be perpetuated.

There are obvious economic advantages in having crops in which fruits of all individuals ripen at the same time thus facilitating harvesting; however, uniformity can have major disadvantages in giving uniform susceptibility to disease or insect attack.

The domestication of Australian native flora is just beginning as people realise the great diversity of material with horticultural potential which is available. It is hoped that the process of domestication will not result in undue emphasis being placed on the spectacular, but will recognize that much of the charm and beauty of many Australian species lies in their simplicity.

Propagation of endangered or threatened species. The Australian flora contains perhaps 15,000 species of vascular plants belonging to some 1,700 genera. Approximately 85% of the species and 33% of the genera are endemic. Considering Australia as a whole, the flora has not been substantially changed except by the introduction of exotic species, many of which have now become completely naturalised (2). However regionally and locally, substantial changes have occurred. For instance, Willis in examining the Victorian flora (see Frankenberg, 1971) has listed fourteen species presumed extinct and 275 species very rare or localised.

The details for other States are summarised in Table 1 taken from Specht, Roe and Broughton (5).

Table 1. Numbers of Rare and Endangered Species in each State of Australia.

State or Territory	Probably extinct	Endanger-ed	Rare	Deplet-ed	Known only from original collec-tion	Geograph-ically important
N.S.W.	9	27	122	12	14	21
N.T.	—	17	97	5	54	68
Qld.	1	21	42	6	34	39
S.A.	42	290	657	152	30	119
Tasmania	—	—	69	—	11	296*
Victoria	14	242‡		26	33†	17
W.A.	6	43	41	13	299	38

* Including 246 species endemic to Tasmania.
† Including a few rare species
‡ Endangered and rare species are not separated.

The knowledge of the flora from each State varies in detail, and thus also the knowledge of species status. State boundaries rarely coincide with biogeographical ones and some State lists, presented in the table, may include a number of rare species which are extensively distributed in adjucent States. Nevertheless the number of species under threat is considerable and many may need to be brought into cultivation to ensure their survival. Whilst some may be easy to propagate either from seed or vegetatively, others are difficult and represent a challenge to the professional plant propagator.

The Australian flora includes many species containing alkaloids and other physiologically active chemicals. Some of these species are now grown as a major source of drugs (e.g. *Duboisia* spp for hyocyamine and hyoscine); others contain compounds with potential in the treatment of human diseases such as cancer.

The flora also contains primitive relatives of crop plants such as native wheats, sorghums, panics, rices, cottons and tobaccos — to which plant breeders are likely to look increasingly for disease resistant genes for use in breeding programmes. The native species of cotton (*Gossypium*) are being systematically collected for cotton breeding programmes in the U.S.S.R. (2).

No discussion of the Australian flora should overlook the eucalypts. Their value for timber, pulp, shelter, essential oil production and ornamental planting is well documented and needs no elaboration. It is less well known however that many species possess ecotypes with particular characteristics not necessarily present in all members of the species. Thus it has been shown experimentally that there are certain forms of snow gum (*Eucalyptus*

pauciflora) occurring in restricted localities, which have a particular weeping form of horticultural merit. Fortunately some of the limited occurrences of this form are protected in national parks and reserves, but there are undoubtedly other species of eucalypts which are not endangered as species, but in which particular ecotypes are threatened, and may depend for continued survival on development of successful vegetative techniques and the establishment of "seed orchards".

Whilst the undoubted value of propagating rare and endangered species cannot be questioned, care must be exercised in collecting propagating stock to ensure that the amount of material removed and disturbance to surrounds, do not accelerate the decline of the species.

Enhancement of the "quality of life". The term "quality of life" has become part of the language and something of a cliche. It is almost like heaven — all people believe it to be a good thing, most hope to experience it, but few can really describe it. One of the tasks given to the Department of the Environment and Conservation was to provide a better measure of society's well-being than the conventional Gross National Product (G.N.P.) and terms such as "human progress index" and "social welfare index" have been suggested.

Even though quality of life cannot be clearly defined most people accept that sufficient nutritious food, satisfying work opportunities, aesthetically pleasant surroundings free of severe pollution and the opportunity for creative leisure are basic requirements to a high quality of life.

As mentioned above, the skills of the plant propagator have been partly responsible for increasing the amount of food produced, and thus the world human population. However it must be accepted that a large proportion of the world's population is undernourished and the spectre of famine is never far away from some people. In fact the shortage of food is probably a far greater threat to world survival than nuclear warfare.

It is natural that aesthetics and pleasant surroundings have little significance unless people are fed, housed and employed and it must be accepted that these goals should always take priority in a democratic society. Nevertheless a clear case can be made to establish the benefits of tree plantings in cities and industrial areas to help increase oxygen levels. Similarly the psychological values of parks and gardens might well be reflected in greater work productivity and less mental and social stress if we can only devise techniques to quantify the benefits.

Canberra is a good example of the value to be gained from the plant propagator's art and foresight. Perhaps the first tree planter in the region was the Reverend Pierce Gaillard Smith, rector of St.

John's Church of England from 1855-1906. Smith, a lover of trees, carried in his saddle bags cuttings and young trees of willows, elms and oaks to many settlers' homes on his pastoral round.

Walter Burley Griffin, the designer of Canberra, also recognised the importance of tree planting in enhancing the site of the national capital. With the able assistance of Charles Weston, appointed Officer in Charge of Afforestation in 1913, more than 2000 acres were planted or regenerated and a flourishing nursery was established by 1921 despite the shortage of labour and finance during the wartime period. Weston not only implemented practical afforestation but, with the help of J.H. Maiden, N.S.W. Government Botanist, conducted major scientific experiments, including the first controlled hybridisation of *Eucalyptus*.

Weston has been followed by a number of prominent tree planters, not the least of whom is the Chairman of this meeting, Professor Lindsay Pryor, whose earnest endeavours have made the city renowned for its trees and gardens; "trees have given grace and shelter where otherwise would have been an almost barren landscape . . . they have grown to a peaceful army which today protects and blends with the garden city". (6)

Attempts have been made in Canberra to strike a balance between exotic species introduced from overseas countries and native Australian species. This has been done partly because the natural vegetation fails to provide species with the range of characteristics adequate for city planting, but also because there has been so little improvement of native species for ornamental planting to meet the rigorous environmental conditions occurring in the city and urban areas.

The Australian Government, aware of the need to improve the urban environment of Australian cities has incorporated tree planting programs in its areas improvement schemes and last year $315,000 was provided for tree planting in the western suburbs of Sydney and Melbourne.

Studies have also been funded to examine the effects of urbanisation on trees and the report of the first of these for Victoria is expected shortly.

Finally, I would like to refer to the close relationship between plants and leisure. Despite our own personal experiences, which we might think contradict the statement it is a fact that most people are experiencing greater amounts of leisure than they have in the past. Much of this free time is being spent out of doors in parks and reserves where trees, shrubs, and grasses are significant in providing pleasant areas for relaxation. Recreation preference studies in the Australian Capital Territory (A.C.T.), have shown that adequate shade and mown grass are important factors in people's minds when deciding on places to visit. In fact a survey

of campers showed that the presence of "shady trees" was rated "very important" in selecting a campsite by more than 66 per cent of groups surveyed.

Whilst there are many people who wish to enjoy passively the benefits of the plant propagator's handiwork there are many others who regard gardening as a most creative use of leisure, and a means of gaining a sense of personal achievement which is often difficult in the anonymity of routine occupations.

Plant propagators have not only a responsibility but also a great opportunity, to provide the basic material for man's physical and aesthetic well being, and to help in achieving the indefinable and yet very real goal of a better "quality of life".

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