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Weed flora of South Africa 3: more power shifts in the veld

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ABSTRACT

This paper deals with shifts towards plants with particular life cycles, growth forms, or from particular geographic areas.

Exotics probably have their greatest impact in the aquatic habitat where they almost equal in number of species (the ratio is 3:5) and out-perform the indigenous aquatic flora. In the streambank habitat exotic weed species, mostly trees, outnumber indigenous weed species by more than 3 to 1. They are completely replacing indigenous streambank communities in many places. An investigation of their effect on stream flow and water loss is urgently required.

The problems of the winter rainfall area are highlighted by the fact that it has 300% more indigenous species and 109% more weed species per unit area than the summer and all year rainfall areas. In the veld as a whole there is a significant and so far unremarked invasion by exotic annuals.

The major invasive weed groupings are herbs from Europe and Asia and trees from Australia but South America probably has the greatest potential to provide us with new and dangerous weeds. A comparison of the weed floras of the southern continents could contribute much to an understanding of our own weed flora.

RÉSUMÉ

LA FLORE DES PLANTES NUISIBLES D'AFRIQUE DU SUD 3: AUGMENTATION DE LEUR AGRESSIVITE DANS LE VELD

Ce document traite des changements floristiques affectant les plantes à cycles de vie, formes biologiques ou distributions particulières.

Les exotiques ont probablement le plus puissant impact dans l'habitat aquatique où elles sont presqu',égales en nombre d'espèces (le rapport est de 3:5) et où elles ont un meilleur développement que la flore aquatique indigène. Dans l'habitat des berges les espèces exotiques les plantes nuisibles, pour la plupart des arbres, sont plus nombreuses que les espèces indigènes de plantes nuisibles dans un rapport superieur à 3:1. Dans beaucoup d'endroits elles remplacent complètement les communautés indigènes des berges. Une investigation de leur effet sur le courant et sur la perte en eau est, requise de toute urgence.

Les problèmes de la région à chutes de pluies hivernales sont mis en lumière par le fait qu'elle a 300 % en plus d'espèces indigènes et 109% en plus d'espéces de plantes nuisibles par unité de surface que les régions à pluies d'été ou celles à régime de pluies durant toute l'année. Dans le veld dans son ensemble, il y a une invasion significative et jusqu'à présent non remarquée d'annuelles exotiques.

Les groupes majeurs de plantes nuisibles envahissantes sont des herbes d'Europe et d'Asie et des arbres d'Australie, mais l'Amérique du Sud a probablement la plus grande potentialité de nous fournir de nouvelles et dangereuses plantes nuisibles. Une comparaison des flores de plantes nuisibles des continents du Sud pourrait contribuer beaucoup à une compréhension de notre prope flore de plantes nuisibles.

1 INTRODUCTION

If it is true to say that scientists need to be as international as the material on which they work, then weed scientists should be the wandering Jews (or Arabs) of the science world. Certainly, it is impossible to work on South African veld weeds without becoming acutely aware of what is indigenous and what exotic. This harping on what is one's own and what is not, may seem strange to botanists from Europe where wave after wave of invading peoples and thousands of years of cultivation have mixed and blended, leaving an international flora. But the kingdoms of the south, the floras of Africa, America and Australia have evolved in isolation from one another, and from the great temperate plant reservoir of the northern hemisphere. These floras have unique characteristics and it is only in the last few hundred years that they have been brought together here at the southern tip of Africa. When they meet, it does not take a botanist or a poet to see them as green armies doing battle — that is exactly what they are.

With the battle-lines so clearly drawn, with our own flora one of the richest and most vulnerable in the world (Oliver, 1978) and with a fighting chance to save it, there is some justification for our preoccupation.

This paper deals with various habitats in the veld and with shifts towards plants with particular life cycles, growth forms, or from particular geographic areas. The weeds referred to are all in the National Weed List (Balsinhas *et al*, 1982).

2 LIFE CYCLES

The 966 exotic and indigenous weeds of the veld have been classified according to life cycle (Table 1).

The great majority of our weeds of the veld (particularly the indigenous ones) are perennials. The lack of indigenous annual weeds may be a real

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TABLE 1.—Life cycles of indigenous and exotic weeds of the veld

Life cycle	Flora and natural pasture weed species					
	Indigenous		Exotic		Total	
Annual	38	8%	152	32%	190	20%
Biennial/uncertain	17	3%	24	5%	41	4%
Perennial	430	89%	303	63%	733	76%
Total	485	100%	481	100%	966	100%

phenomenon or may reflect unintentional selectivity on our part i.e. that small annual indigenous species tend to be overlooked or are not considered important enough to be called weeds. Be this as it may, a significant invasion of the veld by exotic annuals is taking place. This invasion has gone almost unremarked and the roll of this new component in our veld needs to be investigated. It seems to be linked to bush encroachment, with exotic annuals colonizing the areas beneath invading trees.

3 HABITAT AND GROWTH FORM

The 1 003 exotic and indigenous species that are weeds in the veld and in water bodies have been classified according to habitat and growth form (Table 2). A number of them occur in several habitats, giving a total of 1 334 species for all habitats.

3.1 *Aquatic habitats*

The scarcity of water is the greatest limiting factor in the development of vast areas of South Africa. It is so valuable and large water-bodies suitable for recreation are so few that almost all plants growing in water are somewhere regarded as weeds. The 25 indigenous water weed species listed constitute almost our total indigenous aquatic vascular plant flora. They are mostly rooted species adapted to running water or to shallow waters of vleis and pans.

In terms of their percentage contribution to the flora of the habitat exotics probably have their greatest impact in the aquatic habitat, where there are almost as many exotic as indigenous species (the ratio is 3:5). However they do not always compete directly with indigenous species, and few indigenous aquatic species are endangered. This is because most of the exotics flourish best in standing and deep water situations, including man-made dams and canals.

3.2 *Streambank habitats*

The next greatest area of impact of exotics is probably the streambank-habitat, where exotic weed species outnumber their indigenous counterparts by more than 3 to 1 (Table 2). Most of these exotic invaders are woody trees and shrubs — growth

TABLE 2.—Growth forms of exotic and indigenous weeds in veld and water

Habitat	Growth forms	Number and %* of weed species					
		A Indigenous		B Exotic		C Total	
Aquatic	Hemi-crypt and floating	25	100%	15	100%	40	3%
Streambank	Trees & shrubs	8	27%	47	47%		
	Dwarf-shrubs & climbers	4	13%	10	10%		
	Hemi-cryptophytes	18	60%	44	43%		
	Streambank total	30	100%	101	100%	130	10%
Terrestrial Winter Rainfall	Trees & shrubs	30	23%	37	34%		
	Dwarf-shrubs & climbers	27	21%	4	4%		
	Hemi-cryptophytes	73	56%	68	62%		
	Terrest. W/R total	130	100%	109	100%	239	18%
Terrestrial Summer & All Year Rainfall	Trees & shrubs	127	27%	145	31%		
	Dwarf-shrubs & climbers	77	17%	21	5%		
	Hemi-cryptophytes	261	56%	294	64%		
	Terr. All & S/R total	465	100%	460	100%	925	69%
All habitats total		649		685		1334	100%

* In columns A and B 100% = total species in each habitat; in column C 100% = total species in all habitats.

forms that have a maximal effect on their neighbours, on lower strata and the habitat as a whole. Indigenous streambank communities are being completely replaced in some parts (Wells *et al.*, 1980) and there is an urgent need to establish what effect the new exotic communities are having on water loss and water flow.

The aquatic and streambank habitats occupy only about 1% of the area of the country but they are key areas where weeds have a high impact.

3.3 *Terrestrial habitats*

The terrestrial habitats that occupy 99% of the country are split as follows:
— the winter rainfall area covers about 11%, houses about 30% of our indigenous species, and about 18% of our weed species (both indigenous and exotic)

— the summer and all year rainfall area covers about 88% of the country, houses about 60% of our indigenous species and about 69% of our weed species.

The winter rainfall area has about 109% more weed species and 300% more indigenous species of all kinds per unit area than has the summer and all year rainfall area. If one realizes that most of the winter rainfall area has been drastically changed as a result of agriculture and urbanization etc., and that the rich Cape flora is concentrated in relic patches totalling 1,8 million ha (Hall *et al.*, 1980); that over 90% of these species are endemic (Oliver, 1977); and that they include the highest concentration of threatened species in the country, then the flora weed problem of the area is put into frightening perspective.

Terrestrial weeds are very evenly divided between exotic and indigenous species in both the winter and summer rainfall areas. The ratio of different growth forms also varies little with a lower percentage of dwarf shrubs and climbers and a higher percentage of trees and shrubs amongst the exotics. It is the exotic trees, particularly *Hakea, Acacia* and *Pinus* species, that have wrecked havoc in the Cape fynbos where a natural tree layer is lacking (Oliver, 1977; Hall *et al.*, 1980).

4 REGION OF ORIGIN

The region of origin of the 481 naturalized exotic weeds (flora weeds) and of the 16 exotic water weeds is shown in Table 3. A number of them occur in several habitats, giving a total of 685 species for all habitats.

Europe and Asia supply the largest number of flora weeds (40% of the total for all habitats). Of these 73% are hemi-cryptophytes or floating species and the region supplies 47% of all our flora weeds in this growth form category.

South America is the second largest contributor of flora weeds overall. Its species are well represented in all habitat and growth form categories and it contributes by far the most (60%) of the climbing and dwarf-shrub species, as well as the most water weeds.

Africa (and other) supplies mainly hemi-cryptophytes and water weeds of the summer rainfall area.

Australasia supplies only 11% of our flora weed species but of these a remarkably high proportion

TABLE 3.—Regions of origin of flora weeds of various growth forms and habitats

		Number and % of flora weed species									
		Region of origin									
Habitat	Growth Forms	Europe & Asia		Australasia		South America		Central & N.Am.		Africa & Other	
Aquatic	Hemi-cryptophytes & floating	3	20%	0	0%	6	40%	1	7%	5	33%
Streambank	Trees & shrubs	13	27%	13	27%	12	26%	5	11%	4	9%
	Dwarf-shrubs & climbers	1	10%	0	0%	9	90%	0	0%	0	0%
	Hemi-cryptophytes	21	50%	1	3%	6	14%	6	14%	10	19%
	Streambank total	35	34%	14	15%	27	28%	11	11%	14	12%
Terrestrial Winter Rainfall	Trees & shrubs	9	24%	22	59%	5	14%	1	3%	0	0%
	Dwarf-shrubs & climbers	1	25%	1	25%	2	50%	0	0%	0	0%
	Hemi-cryptophytes	43	63%	2	3%	9	13%	3	4%	11	16%
	Terrest. W/R total	53	49%	25	23%	16	15%	4	4%	11	10%
Terrestrial Summer & All Year Rainfall	Trees & shrubs	46	32%	26	18%	41	28%	21	14%	11	8%
	Dwarf shrubs & climbers	4	19%	2	9%	10	48%	0	0%	5	24%
	Hemi-cryptophytes	132	45%	8	3%	61	21%	34	11%	59	20%
	Terrest. All & S/R total	182	40%	36	8%	112	24%	55	12%	75	16%
Total all habitats:	685 (100%)*	273	40%	75	11%	161	24%	71	10%	105	15%

* For total flora weeds = 100% in each growth form category see Column B of Table 2.

(81%) are trees or shrubs. They are particularly important in the winter rainfall area but many of the species are invasive in all three non-aquatic habitats.

Central and North America is the least well represented region supplying mainly hemicrytophytes of the summer rainfall area.

At present it is not easy to know to what extent these patterns reflect the aggressive potentials of the other floras now interacting with our own. We have already suffered from the great influx of herbs from Europe and Asia, and of woody species from Australia. Our impression is that the greatest potential for future weed invasion is South America which has many hardy grasses like the Stipas, shrubs like *Larrea* and trees like *Prosopis* that have yet to penetrate to South Africa.

A comparison of the weed floras of the southern continents could contribute much to an understanding of our own weed flora and the hazards that await us in the form of new introductions.

5 CONCLUSIONS

Exotics probably have their greatest impact in the aquatic habitat where they almost equal in number of species (the ratio is 3:5) and out-perform the indigenous aquatic flora. In the streambank habitat exotic weed species, mostly trees, outnumber indigenous weed species by more than 3 to 1. They are completely replacing indigenous streambank communities in many places. An investigation of their effect on stream flow and water loss is urgently required.

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