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Assessment of Aquatic Weed Problems

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ABSTRACT

Aquatic weed problems are often inadequately assessed, particularly in developing countries. A proper assessment should include evaluation of ecological and economic factors, preferably on a quantitative basis, and should indicate likely future developments, including potential problems resulting from aquatic weed growth. Data should be collected systematically in a form which is suitable for computer

storage and analysis. An assessment procedure has been designed to take account of these objectives. It requires information to be recorded which will characterize the site, identify the weeds, assess their nuisance status, and appraise the potential of the environment to promote or inhibit the problem.

INTRODUCTION

In many cases, the size of a weed population is taken as the main criterion of the extent of the problem. It is unusual for a full evaluation of the situation to be carried out systematically and objectively, particularly in developing countries. There are three main reasons for this. First, the problem is often only recognised at a late stage when its nature and consequences are obvious and require urgent control. If control measures are successful, the causes of the problem may then be considered to be irrelevant and control procedures tend to be repeated whenever necessary, unless adverse effects become obvious. Second, there is a lack of knowledge about which factors should be considered in addition to population size. Third, there are no generally established standard procedures for assessing water weed problems and predicting their seriousness. Uniform assessment procedures would also be valuable for monitoring potential problems.

Studies of the ecology of aquatic weeds, their role in the ecosystem, and the factors that influence their population growth reveal that a full evaluation of the causes and nature of a water weed problem would need to take account of many variables (3). Stability of the hydrological regime, nutrient status, climatic conditions, growth and reproductive potential of the weed plants, their effects on physicochemical and biotic factors in the environment, and whether they are alien species all need to be considered.

A field assessment form has been designed to assess potential and current weed problems (Table 1). All important factors are included in such a way that most can be quantitatively evaluated and the data can be readily transcribed for computer storage and analysis.

TABLE 1. ASSESSMENT FORM FOR WATER WEEDS

Assessment Number |_|_|_|_|_|_| Completed by |_|_|_|_|_|_|_|_|
Date |_|_|_|_|_|_|_|

SITE IDENTIFICATION AND DESCRIPTION

1.1 Longitude |_|_|_|_|_|_| 1.2 Latitude |_|_|_|_|_|
1.3 Locality Code (consistent for an area characterised by the same compass bearings). |_|_|_|_|_|_|_|_|_|_|
1.4 Visit Number |_|_|
1.5 Locality (describe in sufficient detail to allow a subsequent worker to find the site.) |_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_
|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_

WEED IDENTIFICATION AND OCCURRENCE

2. Names of six most important plants contributing directly to the problem in approximate order of biomass. If alien, mark 1 in the last space for each name, if native, mark 2, if origin unknown, leave blank.
2.1 |_|_|_|_|_|_|_| 2.2 |_|_|_|_|_|_|_| 2.3 |_|_|_|_|_|_|_|
2.4 |_|_|_|_|_|_|_| 2.5 |_|_|_|_|_|_|_| 2.6 |_|_|_|_|_|_|_|

NUISANCE STATUS

3. Purpose of water body (in order of importance)*	4. Related annual value (in usual money units x 100)	5. Estimated annual loss due to weeds (as for 4.)
3.1 |_|	4.1 |_|_|_|_|_|	5.1 |_|_|_|_|_|
3.2 |_|	4.2 |_|_|_|_|_|	5.2 |_|_|_|_|_|
3.3 |_|	4.3 |_|_|_|_|_|	5.3 |_|_|_|_|_|
3.4 |_|	4.4 |_|_|_|_|_|	5.4 |_|_|_|_|_|
3.5 |_|	4.5 |_|_|_|_|_|	5.5 |_|_|_|_|_|

* Irrigation = 1, stock = 2, domestic = 3, industrial = 4, hydroelectricity = 5, recreation = 6, waste disposal = 7, etc.

ENVIRONMENTAL STATUS

6. Age of water body (in years : if greater than 98 enter 99). _._.
7. Type of water body** |_|_|

** Spring = 01, stream = 02, river = 03, ditch = 04, irrigation canal = 05, irrigation drain = 06, pond (less than 2 ha) = 07, lake (larger than 2 ha) = 08, small dam (man-made lake less than 2 ha) = 09, man-made lake larger than 2 ha = 10, swamp = 11, paddyfield = 12, etc.

8. Stability of hydrological regime for weed growth: rate from 1 (very unstable) to 5 (very stable) |_|
9. Light penetration into water: rate from 1 (very poor) to 5 (very good) |_|
10. Monthly mean screen temperatures (°C):
 10.1 Mean daily maximum for warmest summer month |_|_|
 10.2 Mean daily minimum for coldest winter month |_|_|
11. Average days of frost per year |_|_|_|
12. Nutrient status: rate from 1 (low) to 5 (high) |_|

PLANT STATUS

Assess main plants only; separate forms may be necessary when more than one weed species is present.

13. Period of infestation (record recent infestations in months with the prefix 1; periods longer than 2 years in years with the prefix 2, periods longer than 99 years are recorded as 300). |_|_|_|
14. Probable agency for introduction (and dispersal)*** |_|

*** Unknown = 1, water = 2, wind = 3, birds = 4, garden/aquarium escape = 5, other (specify under other notes) = 6.

15. Area of infestation (ha): 15.1 total |_|_|_|_|_|_|
 15.2 % suitable habitat |_|_|_| 15.3 % of water body |_|_|_|
16. Growth rate (as doubling time in days).
 16.1 summer |_|_|_| 16.2 winter |_|_|_|
17. Vigour (see text). Assess on basis of sub-samples; when material is uniform, 10 sub-samples should be sufficient; when it is variable up to 30 may be required.
 17.1 size of plants or of population, as appropriate.
 mean |_|_|_| range |_|_|_| to |_|_|_|
 17.2 health: rate from 5 (no evidence of disease/deficiency) to 1 (all plant diseased/dificient) |_|
18. Growth form:
 18.1 differences present (=2) or absent (=1) |_|

If present, proportion (as %) which is:
 18.2 mature/crowded |_|_|_| 18.3 intermediate |_|_|_|
 18.4 young/invading |_|_|_|
19. Reproduction: 19.1 vegetative without specialised propagules: yes (=2) or no (=1) |_|
 19.2 Seeds: absent (=1), scarce (=2), common (=3), abundant (=4) |_|
 19.3 other resistant propagules: (assess as for 19.2) |_|
20. Risk of reinfestation from outside water body: rate from 5 (high) to 1 (nil) |_|

PLACE IN ECOSYSTEM

Rate from 5 (large or important) to 1 (small or unimportant).

21. Primary production |_|
22. Direct food source |_|
23. Invertebrate habitat |_|
24. Substrate for epiphytes |_|
25. Shelter for vertebrates |_|
26. Competition with other non-weed plants |_|

OTHER NOTES

27. |_|_|_| Where necessary supply notes to explain or amplify answers and/or to draw attention to important factors (continue overleaf if necessary). These will not be stored in the computer, but enter 999 above if the assessment cannot be interpreted without reference to these notes.

FIELD ASSESSMENT FORM

Space for an assessment number and an appropriate locality code have been provided to assist in retrieval of data from the computer. Also, the spaces on the form have been arranged to take account of the 80 spaces on a computer punch card, the answers as far as question 1.5 being recorded on the first card, from 2 to 5 on the second, and the rest on the third.

Data should be abbreviated where necessary to fit the form and the same abbreviations used thereafter. Plant names should be shortened to the first two and three letters of generic and specific names respectively. Thus waterhyacinth (*Eichhornia crassipes* (Mart.) Solms-Laub.) would be entered as EICRA. Coding will have to be employed for data such as the type of water body, the purpose for which it is used, the method of introduction of the weed, etc., as indicated in Table 1. For numeral entries, the right hand space is intended for units, the space before it for tens, and so on. Detailed instructions for the completion of the assessment form are available from the author on request.

DISCUSSION

It is not possible to design a single form that is equally applicable to every situation and users will have to judge the relevance of the data to the particular situation they are assessing. However, the suggested form encompasses the main types of data that experience has shown are likely to be important for a full evaluation of a problem. It is desirable that as much data as possible should be collected, especially when the form is used as a means of monitoring a situation.

Economic loss consequent on the presence of the weeds could be assessed in two ways. Estimated potential loss may be more relevant in some cases than actual loss at the time of assessment. Both are likely to be required for cost benefit analysis of proposed management programs (4). For the most part, actual costs should be determined and potential costs estimated separately when required for a particular purpose.

An essential requirement for predicting increase in size of weed populations is an estimate of the growth rate of the plant in the conditions present at the site of the infestation. The potential rates of growth are known for certain species, such as salvinia (*Salvinia molesta* D. S. Mitchell) and waterhyacinth but these are very variable as they depend primarily on quantity of nutrients present, availability of space, and ambient temperatures (1, 2, 5). Usually therefore, it will be necessary to estimate the growth rate in each situation (3). Furthermore, since temperature and possibly the availability of nutrients vary seasonally, it will be desirable to measure growth rates, at least at the most favorable and unfavorable seasons.

Plant vigour, as indicated by health and size, is an obvious indication of the suitability of a site for a plant and therefore of its potential for further increase. Health can be assessed in terms of evidence of disease or nutrient deficiency while, for size, any appropriate measure could be used. For most plants this would be height or length of vegetative parts, but biomass per unit area could also be suitable. The data should be recorded in practicable units to fit the three spaces provided. The parameter measured and the units used must be recorded on the form but these will not be stored in the computer. The same parameter and unit of measurement should be used for all subsequent visits to the same site.

Certain plants such as waterhyacinth and salvinia exhibit different growth-forms in different situations. These growth-forms can be a good indication of the stage of colonization of a habitat and thus can assist in predicting likely future developments. Differences can usually be detected by comparing the plants in the middle of a crowded population with those growing on the margins or in isolated, uncrowded conditions.

Except for the section related to the plant's role in the ecosystem, it is proposed that data be coded so that higher numbers are applied to conditions most likely to promote the problem. Even so it may not always be possible to assess every factor and it would therefore be incorrect to rate the gravity of each weed problem in terms of the total of all such assessments on the form. Also some factors could be inappropriate in certain situations and thus safely omitted, while others could have a dominating effect. Nevertheless, those problems in which the assessment consistently records high ratings for relevent factors should be regarded with concern, if the plant population can be shown to interfere with water use.

Experienced weed scientists will probably find little advantage in the use of the field assessment form. However, assessors are not always experienced, and management decisions may require that situations be monitored by means of repetitive, objective assessment procedures. The field assessment form presented in Table 1 has been designed for use in these situations as well as to direct assessors to the nature of the data required to reach a balanced evaluation on which a rational program of weed management can be based.

LITERATURE CITED

1. Bagnall, L. O., T. de S. Furman, J. F. Hentges, W. J. Nolan, and R. L. Shirley. 1974. Feed and fiber from effluent-grown waterhyacinth. In: Wastewater use in the production of food and fiber. EPA-660/2-74-041. Environmental Protection Agency, USA.
2. Bock, J. H. 1969. Productivity of the waterhyacinth, *Eichhornia crassipes* (Mart.) Solms. Ecology, 50:460-464.
3. Mitchell, D. S. (Ed.) 1974. Aquatic vegetation and its use and control. Unesco, Paris.
4. Mitchell, D. S. 1978. Formulating aquatic weed management programs. J. Aquat. Plant Manage. 17:22-24.
5. Mitchell, D. S. and N. M. Tur. 1975. The rate of growth of *Salvinia molesta* (*S. auriculata* Auct.) in laboratory and natural conditions. J. Appl. Ecol. 12:213-225.