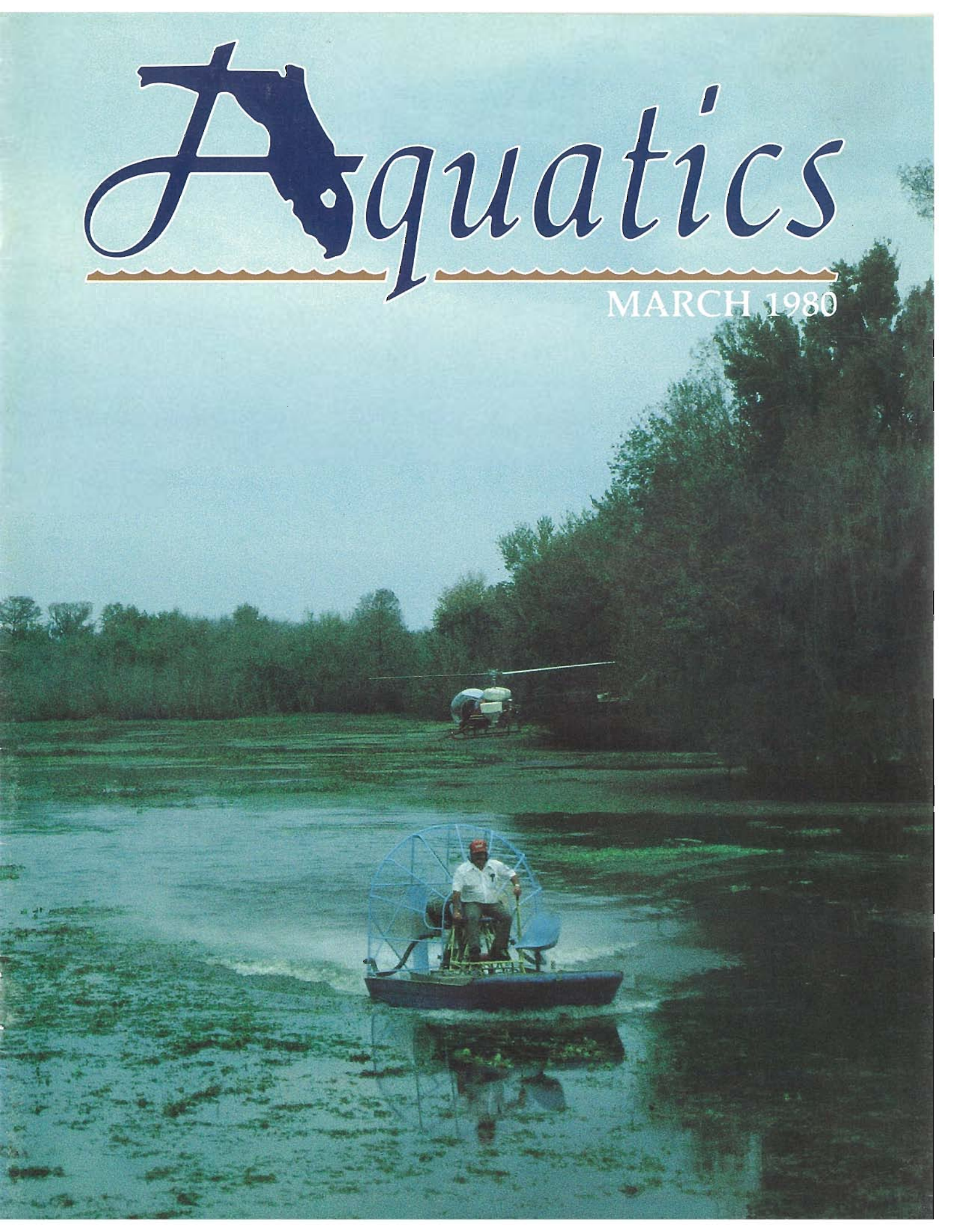
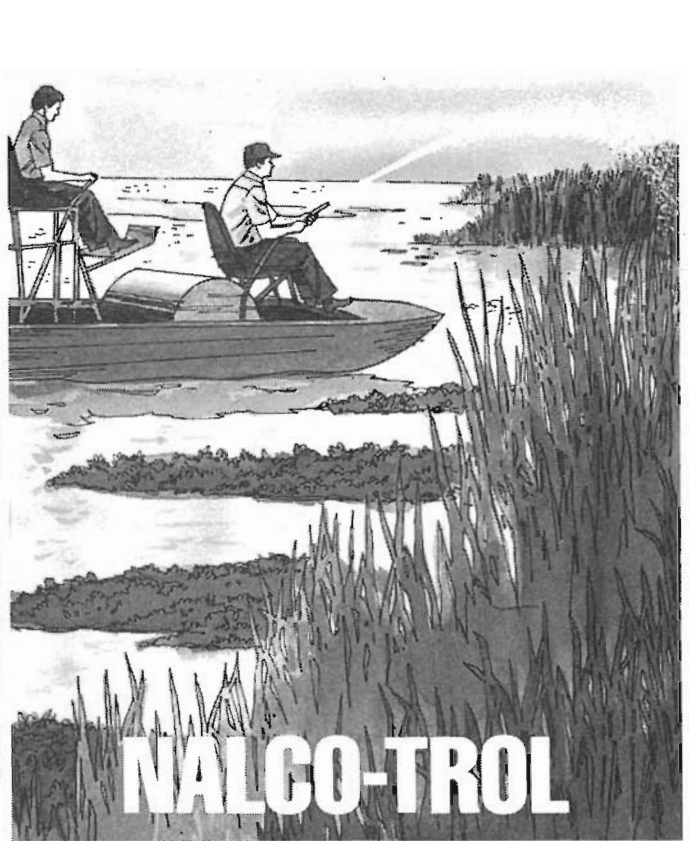
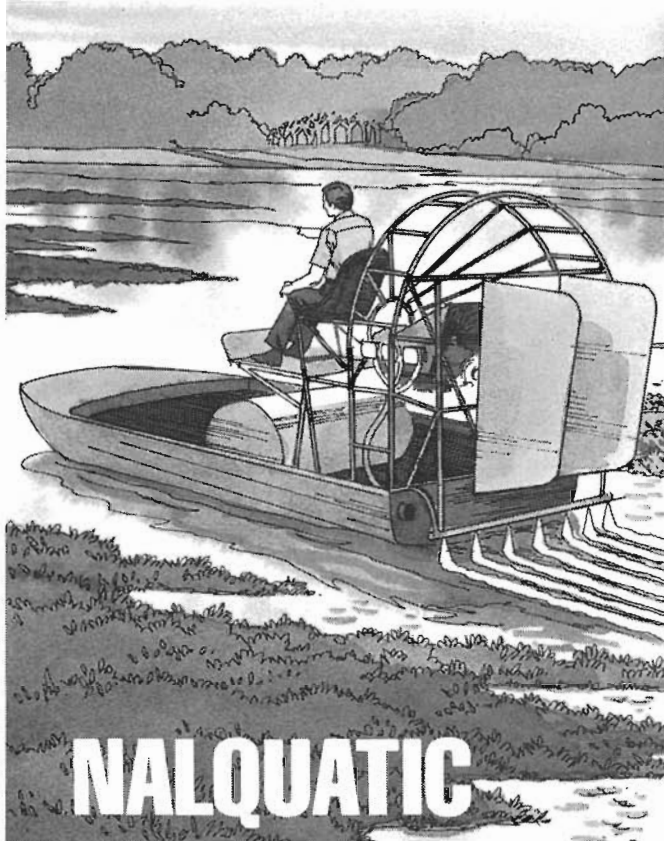


Aquatics

MARCH 1980



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EDITORIAL

By
Dr. William Haller, President

The Board of Directors meeting in January was certainly a milestone in Florida Aquatic Plant Management Society history. Dr. Elton J. Gissendanner, director of the Department of Natural Resources, and Col. Robert Brantley, director of the Florida Game and Fresh Water Fish Commission, met with and answered questions concerning the Department of Natural Resources and the Florida Game and Fresh Water Fish Commission's aquatic weed control agreement. The agreement generally follows the guidelines set forth by the American Assembly Conference which convened last September in Tallahassee. Society directors stressed the importance of establishing a strong, independent Department of Natural Resources Advisory Council, and also wanted all assurances possible that the Game and Fresh Water Fish Commission aquatic weed control personnel would not be without a job as a result of the transfer process. The agreement specifies the establishment of an 11-member Advisory Council, and Col. Brantley assured the Board of Directors that aquatic weed personnel would be offered employment opportunities wherever possible.

Personally, I feel that the aquatic plant management industry and the State of Florida is being well served by these agreements. Aquatic weed control is more dependent on state agency involvement than anytime in the past. The directors of the two most affected agencies should be commended for their professional dedication to serving the needs of the state in the growing and more complex arena of aquatic plant management.

An article will soon appear in "Aquatics" dealing with the research needs of aquatic plant control operations. The one thing this industry does not have is a cookbook type publication which informs new applicators on "how to do it." All operations programs are different from one another due to the fact that there is no best way to control aquatic vegetation; each site or problem area has a specific solution that works best. Also I believe that research organizations have not effectively dealt with problems common to everyday operational programs. Federal and state appropriations are being increased for research in aquatic plant management. If you have ideas on operations problems, respond to the article as it appears in this or the next issue of "Aquatics."

This issue marks the beginning of our second year in publication. Bill Maier is evidence of volunteer duty above and beyond the call. Bill has found time between duck hunting trips to coordinate the many details of putting "Aquatics" together every three months. We owe Bill a hearty "thanks and a hang in there" for doing such a fine job!

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Aquatics

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CORRESPONDENCE: Address all correspondence regarding editorial matter to William L. Maier, Editor, AQUATICS Magazine, Dept. of Natural Resources, Crown Bldg., 202 Blount St., Tallahassee, Fla. 32304.

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COVER

Southwest Water Management District personnel apply chemical treatment to hydrilla by air and boat during early fall on the Withlacoochee River. (Photo by David P. Tarver.)

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CALENDAR NOTES

July 13-16 The Aquatic Plant Management Society's Annual Meeting, Hyatt House, Sarasota

"PEOPLE ON THE MOVE"

Miss Mary Harris has accepted a position with Louisiana State University. Miss Harris formerly served as chief of the feed, seed, fertilizer and pesticide bureau of the Florida Department of Agriculture and Consumer Services.

Mike Dupes has joined the U. S. Army Corps of Engineers' aquatic plant control staff. Mike is working at the Jacksonville office on the Corps' aquatic plant control funding program.

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LIMNOPHILA — A NEW EXOTIC PEST

By
Michael J. Mahler*



Limnophila plant showing submersed and emerged leaves.

INTRODUCTION

Recently a new exotic aquatic plant has begun to flourish in Florida's waters. *Limnophila sessiliflora* Blume has the potential to become a severe pest plant.

Limnophila, also known as "Ambulia," was first brought into Florida by the Aquarium Industry as a decorative plant for home aquariums. This species is native to Asia in the areas of India, Ceylon, and the Philippines where it is often reported as a pest plant in rice fields. Accidental releases and deliberate plantings by aquatic plant dealers have enabled this plant to become established in several lakes and rivers in Florida. *Limnophila* was first reported growing wild in Glades County by Long and Lakela in *A Flora of Tropical Florida*, 1971. It is now established in isolated areas from Dead Lakes in Northwest Florida to canals in Dade County. Within the last year this plant has been observed to out-compete hydrilla and other species of native vegetation in several areas. Another concern with this species is the plant's resistance to generally accepted control measures. Almost all chemicals registered for aquatic plant control have been used with very limited success. One unconfirmed report states desirable control was achieved after a treatment with 2-4,D at a high rate.

The use of water level fluctuation

to control *Limnophila* may possibly compound the problem. It appears as though this species becomes established and thrives in a bog type environment. Viable, minute seeds are believed to germinate readily in moist soil. Knowledge of submersed seed germination is lacking.

Effective biological control for this species is also a new area. There exists some doubt as to whether herbivorous fish will eat *Limnophila* due to a toxin present in the stem tissue. Literature mentions toxicity in reference to crushed stems in aquaria producing a fish kill.

DESCRIPTION

Limnophila sessiliflora is a member of the Figwort Family, Scrophulariaceae, which consists typically of bog type plants inhabiting swamps, marshes and ditches. *Limnophila* resembles cabomba in appearance and is usually misidentified as such. This plant has both submersed and emerged leaves. Submersed leaves are usually in whorls of 3 to 16, bright pale green and up to 4 cm long. Individual submersed leaves are finely divided with each segment repeatedly branched. These dichotomous divisions are flattened and spatulate.

Cabomba's leaf form, a submersed fan-shaped leaf, differs from the submersed leaf of *Limnophila* in that it arises from one central stalk and branches into five divisions initially.

Limnophila's emerged leaves are opposite or in whorls of up to nine. They are dark green, rigid and serrated to deeply lobed.

These emerged leaves appear on an upright stem usually 2-15 cm above the water's surface. The submersed stem is up to several meters long, occasionally branching and slightly pubescent. This plant also has an extensive root system which may attain a length of 1 m. In the fall this species produces numerous flowers which are purple to lavender in coloration

and are attached directly to the stem. Another related species, *Limnophila indica*, is currently being sold by the aquarium industry. It differs from *L. sessiliflora* in that its flowers arise on a long pedicle. *L. indica* has not been reported to be growing wild in Florida.

Reproduction of *Limnophila* occurs by fragmentation and seeds. Seeds are produced in capsules and are extremely small. Each capsule may hold up to 150 seeds. The seeds are known to be viable; however, percent germination has not been determined. In late fall, after seed production, large mats of vegetation have been observed to release from the hydrosol and float throughout the lake or river thus spreading thousands of seeds. Like hydrilla, it appears only a small portion of the plant carried by currents or boats and boat trailers may be necessary to infest a new area.

cont. on page 7



Limnophila sessiliflora in the Little Withlacoochee River.

*Biologist, Bureau of Aquatic Plant Research and Control
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COPPER HERBICIDES vs. SNAILS?

by
Gordon Baker*

May 10, 1978 — a date that various agencies in Florida should remember as the beginning of the "great copper controversy." What events led to this meeting? What is the truth about copper in the environment? And, what impact has this meeting had on the aquatic applicator, aquatic manager, and the aquatic researcher? This article will provide insight into these questions and attempt to point to additional areas of research that should be accomplished.

Just prior to May 10, 1978, the United States Department of the Interior (USDI) raised questions concerning the impacts of the South Florida Water Management District's weed control operations on the Everglades Kite in Water Conservation Area #1 (WCA #1). This area, located just west of Delray Beach, contains about 7500 acres, is bordered by canals and levees of the South Florida Flood Control Project, and is regulated, operated and maintained by the Corps of Engineers, U.S. Fish & Wildlife Service and the South Florida Water Management District (WMD). This area is a classic example of overlapping agency responsibility. The Corps of Engineers (COE) regulates the water levels, the Fish & Wildlife Service of the USDI manages part of this area for wildlife sanctuary and the WMD maintains the bordering canals and levees for the proper operation of WCA #1 as part of the integrated water control and supply system for South Florida.

Specific concerns were expressed regarding the need for controlling vegetation in the canals supplying water to Water Conservation Area #1 and the use of copper in combination with Diquat to control submersed weeds. These concerns were expressed because copper "has the potential for causing substantial in-

direct damage to the endangered Everglades Kite by affecting its sole food organism, the apple snail. Additionally, the plant pests which are being controlled have definite biological value to migratory water fowl and offer excellent habitat to a wide variety of fishes." Therefore a meeting to discuss these matters was set up for May 10, 1978.

On the morning of May 10, the Palm Beach Post newspaper carried a front-page story entitled "Snail Scarcity Prompts Call for Herbicide Ban" in which the USDI refuge manager said he wanted to make officials "aware of years of research" indicating that the apple snail populations have decreased as a result of the continued use of copper-based herbicides to control aquatic weeds. As it turned out, the research consisted of two observations which contributed only "circumstantial evidence of the possibility of copper being a causitive agent," and a snail population index taken from some research pools adjacent to, but outside, the limits of the primary water supply system which encompasses WCA #1.

The meeting was well attended by representatives of USDI, Florida's Game and Fresh Water Fish Commission (GFC), EPA, COE, Florida's Department of Natural Resources (DNR), SFWMD, University of Florida, Florida's Department of Environmental Regulation (DER), Chevron Chemical Company, Sandoz, Applied Biochemists, news media, and at least one "private citizen" who revealed a close personal relationship with several sports writers for various newspapers. The manager of the Loxahatchee National Wildlife Refuge opened the meeting by passing around copies of proposed research, and by stating that there was no definite proof that copper is the causative agent for the decline in the apple snail populations in the water conservation area. He also mentioned that the snail productivity index was not necessarily an accurate description of the actual snail population dynamics. In the introduction to the research he also mentioned four factors which affect Everglades Kite habitat productivity: drought, lowering of water levels, residential developments, and invasions by floating aquatic plants. None of these factors have any bearing on the use or non-use of copper-based herbicides since these herbicides are used for the treatment of submersed vege-

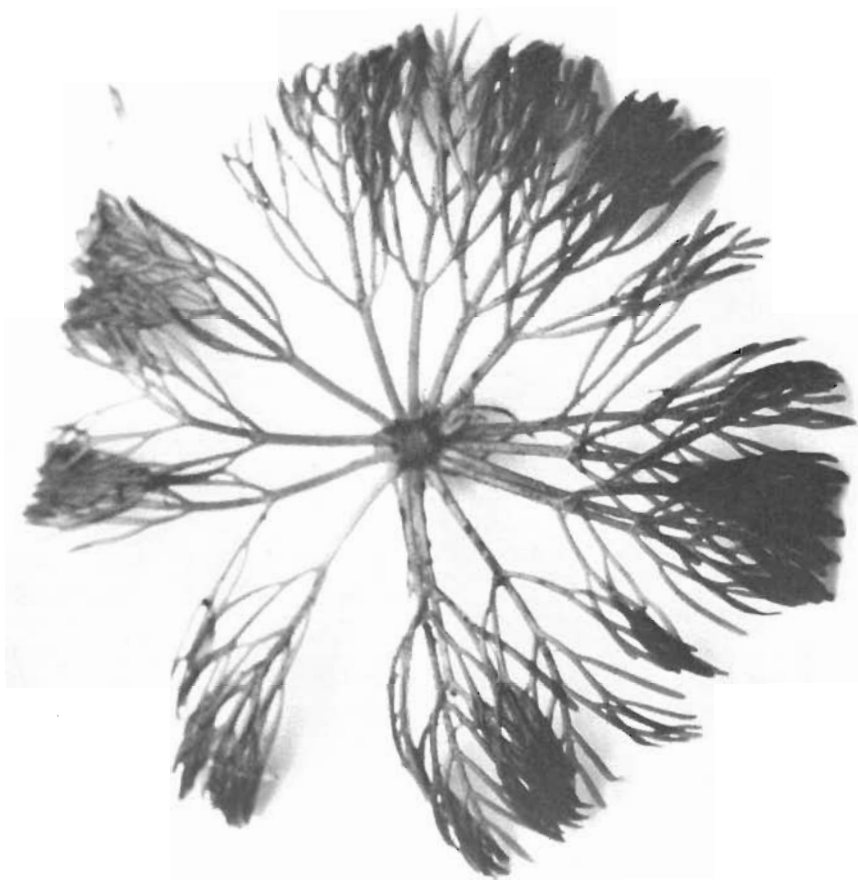
tation only. However, a GFC representative pointed out that the apple snail is a detritus feeder spending up to 1/3 of its time in that activity. Therefore, there is a possibility that copper could be ingested by the snail through its feeding upon decaying submersed plants, providing that the copper is in such form that the snail could separate and absorb it from the detritus.

As a result of this meeting, a committee was established to direct a certain amount of research to determine what, if any, effect copper, in formulations such as Komeen or Cutrine Plus, has on apple snails. After numerous discussions it was decided that the first order of business would be a preliminary toxicology study to see if the snail could survive exposure to copper in solution. This study is now nearing completion and is being performed by Dr. Thomas C. Cheng, Professor and Director of the Institute for Pathobiology, Lehigh University in Bethlehem, Pennsylvania. Those individuals who attended the annual meeting of the Florida Aquatic Plant Management Society, Inc., in Orlando in October 1979 may recall that Dr. Cheng presented some preliminary research data as a result of his initial toxicology study. To summarize his presentation:

- (a) Snails can be grouped together based upon "blood-type" and the "blood-type" will determine the toxic response of the snail to copper. Specifically the apple snail belongs to the "blood-type" group which shows much less toxic response to dissolved copper.
- (b) The apple snail survived in solutions which contained many times more copper than would be used in normal aquatic weed control operations.

These preliminary indications show that copper may be used (in accordance with label statements, of course) without fear in aquatic ecosystems. *BUT*, before such practices and attitudes can be made a part of an aquatics management system, much more information and data must be obtained and thoroughly analyzed. This is especially true when dealing with endangered species. Other studies which need to be done are laboratory and in-field habitat studies of the snails. Also extensive research needs to be done on

*Biologist, South Florida Water Management District



Whorl of submersed leaves.

cont. from page 4

HABITAT AND DISTRIBUTION

Limnophila is found in lakes, streams, canals, marshes, and intermittent creeks. It appears to prefer

organically stained waters that are slightly acidic, but will grow in clear, slightly alkaline water. This species will thrive submersed or on moist

soil. It has been observed growing to a depth of 2-3 meters. Currently it has been detected in Dead Lakes, East Lake Tohopekaliga and Boggy Creek, Lake Pierce, Lake Weohyakapka, Fisheating Creek, Loxahatchee River, Alafia River, Little Withlacoochee River, C-1-North and C-100 canals in Dade County.

In its native range *Limnophila* is reported to be a pest plant in rice fields and irrigation ditches. Due to its tolerance of low temperatures and resistance to chemicals it may become a very aggressive, uncontrollable species.

SUMMARY

Limnophila sessiliflora is rapidly becoming a plant of concern to all aquatic plant managers in Florida. The Florida Department of Natural Resources is in the process of revising Rule 16C-19, F.A.C., to include *Limnophila sessiliflora* on the list of prohibited aquatic plants. This would make it illegal for anyone to import, transport, or cultivate this species except for scientific research and collection.

Studies of control methods for *Limnophila* are now being initiated by the Department of Natural Resources', Bureau of Aquatic Plant Research and Control, as well as life cycle, seed germination and fish toxicity studies.

This species has the potential to become a severe pest plant in Florida and hopefully with an early detection and eradication program we may be able to stop the further spread of *Limnophila sessiliflora*. ▼



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DETERMINING PESTICIDE EXPOSURE

By

Sarah Bausch*

Today, everything you taste, touch or smell poses a potential health hazard. It may not as yet be specifically recognized but the list is growing daily.

This past winter the newspapers in Milwaukee reported that nitrosamines had been found in beer. The Beer City and its following did not even hesitate before setting up the next round.

This reaction or lack thereof is both good and bad. On one hand, people are becoming desensitized by the multitude of cancer scares. On the other hand, some people are beginning to acknowledge the fact that a certain degree of risk is simply unavoidable and that zero risk levels are impractical. We who are involved in the development, manufacture, regulation and use of pesticides must work toward determining the potential risks and keeping these risks to a minimum. To this end, the ability to determine actual human exposure is becoming more and more important — a critical factor in identifying the

real hazard potential of a pesticide.

EXPOSURE is the key word here. Most people immediately think of exposure to pesticides in terms of either the environment or the food we eat. These residues are from the start strictly regulated. However, of equal significance is exposure directly to the concentrated pesticide. This is particularly relevant to the pesticide applicator to whom exposure is an inherent risk of his occupation.

Some of the most common situations associated with pesticide poisonings are:¹

1. Early in the season when inexperienced personnel are handling the chemicals;
2. When a new pesticide is brought onto the market;
3. During long hot spells which tempt applicators to remove

*APPLIED BIOCHEMISTS, INC.
A Presentation Given at the 19th Annual Meeting of the
Aquatic Plant Management Society, Chattanooga, Ten-
nessee, July 15-18, 1979

some of their protective clothing or respirators;

4. Late in the season when cumulative effects suddenly appear as the result of repeated low level exposures.

Exposure can be *acute*, one time exposure, or *chronic*, longer time, lower levels of exposure. Exposure occurs in one of three ways: Oral, dermal, inhalation.

I don't want to spend too much time and go into too deep of a safety lecture. Hopefully, most of you here involved with the use of pesticides have taken advantage of your state's pesticide certification program. Of course, you now think you know everything. You could be wrong. Many accidents are the result of just plain carelessness. We all know that we are supposed to wash our hands before eating, but just as I was writing this talk, our manager of field operations — confined to his desk for the day because of paperwork — complained that his lunch did not taste right; it lacked that added chemical flavoring. Wash your hands and keep your lunch away from pesticides. It is a good idea to have a bar of soap handy not only for use before shore lunches but also for chemical splashes which really deserve more than just a good rinse.

Now, I know most of you are aware of the precautions, but just as a reminder:

1. Don't blow out a clogged nozzle with your mouth.
2. Plastic boat cushions are to be preferred over canvas. If you sit on a canvas cushion soaked with a pesticide, you will need more than a good back rub at the end of the day.
3. Often chemicals get splashed onto the floor of the boat. Not only should you be wary of boots soaked with chemical, but if your cap falls into a chemical puddle, don't put it back on!
4. Wear a rubber glove at least on the hand most likely to come in contact with the chemicals — your spraying hand. Protective clothing is important but don't overdo it. People die of heat exhaustion every year.
5. Sometimes applicators manage



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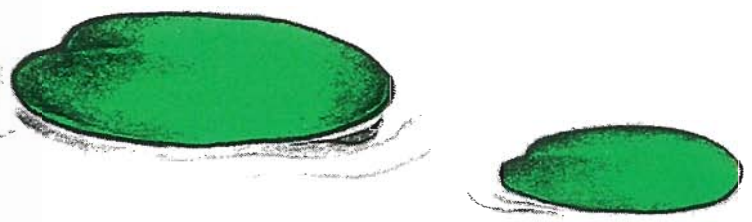
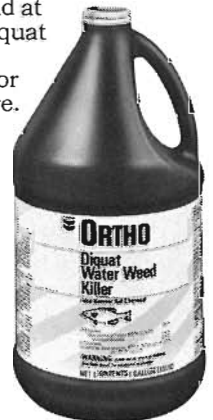
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to get chemical on themselves without realizing it. Often you do not know you have endo-thall on you until the blisters start appearing and then they really hurt. Some pesticides stain so you know they are there. Others can be detected by their characteristic odors.

Let's get back to the original subject: Determining Pesticide Exposure. Be it oral, dermal or by inhalation.

ORAL EXPOSURE

Acute oral toxicity is expressed in terms of LD₅₀, the result of a short-term one time exposure to the minimum amount of chemical which will result in the death of 50% of the test animals. If you know the LD₅₀ of a chemical, you can estimate the amount of pesticide likely to cause death by means of the following simple formula:¹

$$LD_{50} \text{ in mg/Kg} \times .0016 \times \frac{\text{Body Wt (lbs)}}{100}$$

=lethal ounces of pesticide

This is for the concentrated pesticide. Determining exposure through the treated environment requires the consideration of many other factors including the rate of ap-

plication, persistence in the environment, what form or state it is found in the environment and the ability or inability to bioaccumulate. All are of particular importance in the establishment of aquatic tolerances. We are speaking of longer term exposure now, which involves considerably more work and includes many assumptions.

To look at a few of the considerations and assumptions:²

- EDE Estimated Daily Exposure
- ADI Acceptable Daily Intake
- TMRC Theoretical Maximum Residue Contribution
- TDI Theoretical Daily Intake
- NOEL No Observable Effect Level

The NOEL is identified in chronic two year feeding studies. The ADI is determined by dividing the NOEL by a safety factor of usually 100 or 10×10. 10 because humans are arbitrarily considered 10 times more sensitive than the test animals and 10, again arbitrarily, because the most sensitive human is considered 10 times more sensitive than the least sensitive human. Although very assumptive, this is the safety factor currently used in the establishment of

many tolerances.

- If ADI is greater than the TMRC — Tolerance Granted
 - If TDI is greater than the ADI — Reexamine Assumptions
 - If EDE is greater than the ADI — Tolerance Denied
- DERMAL EXPOSURE^{3, 4}

In the estimation of dermal exposure, pads are attached according to the exposure situation so as to collect residues representative of all exposed body areas. The tests are carried out in a manner typical of actual use, both upwind and downwind, using the maximum label application rates. The duration of the tests depend on the chemical. Tests must continue long enough to collect residues, if any occur, but short enough to avoid excessive losses due to volatilization or decomposition. Tests are replicated at least ten times. The exposed pads must be carefully stored for their transport and/or storage prior to undergoing extraction in the laboratory. In calculation of the dermal exposure, there are standard body surface areas. The body surface area of concern and the appropriate resulting residue level is expressed as micrograms of residue per cm² of the exposure pad and then corrected to one hour of exposure time. For calculating more than one body area or the total body area, the mean of the residues found on the appropriate pads is used.

As an added note to those dermal calculations, take a look at figure 1. Rates of absorption through the skin differ with different parts of the body. The forearm is used as the standard and its absorption rate is slated as 1.

To compare with other areas: Scalp 3.7, Abdomen 2.1, Ball of foot 1.6, and the Scrotal area 11 times faster than the forearm. Watch out gentlemen!

RESPIRATORY EXPOSURE^{5, 6}

Respiratory or inhalation exposure results from breathing pesticide vapors, dust, or spray particles. For the most part, fortunately, the pesticides presently used in aquatic management have fairly low volatility and generally present minimum inhalation hazards. However, it is prudent to keep the windows open if chemicals are being transported inside a vehicle. Our spray crews have definitely noted a buildup of fumes when their vehicles are loaded up with chemicals on a hot day and parked with the windows up.

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Means for sampling respiratory exposure vary from modified respirators with exposure pads in place of dust filters to battery powered personal air samplers. The modified respirators provide a more direct means of calculating exposure. The factors that must be considered are generally limited to the residue found on the exposure pad, the duration of exposure, the efficiency of the trapping media — the exposure pad, and correction for loss of decomposition during transport and storage. The calculations for personal air sampling pumps are more complicated and less exact because you must also consider the estimated ventilation rates for the exertion level of the worker.

I have touched very lightly on inhalation exposure because the differences in chemical properties of the many pesticides require the selection of methods be left largely to the ingenuity of the investigators.

In conclusion, aquatic pesticides are designed "to kill" target species with minimum detriment to the user, nontarget species, and the environment. They are necessary management tools, yet there is no such thing

as a "safe" pesticide. There are reasonably "safe" application rates, but all pesticides should be handled with the respect and caution they deserve. ▼

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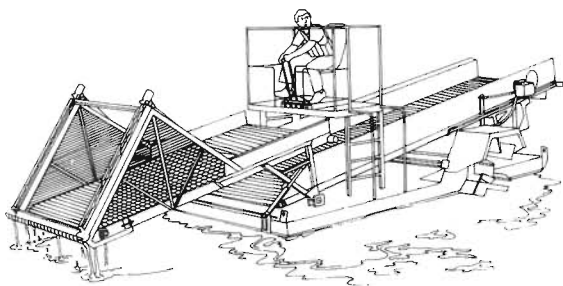
cont. from page 6

the fate of copper in the environment. This would consist of water quality and sediment analyses, and plant sampling. A certain amount of data already exists which indicates that natural levels of copper in aquatic systems range from 10-30 parts per billion (ppb) in water and 5-10 parts per million (ppm) in sediments and plant tissues.

Now the question becomes: "How do the natural levels of copper compare with amounts of copper applied for weed control operations and what safeguards are used to maximize the protection of the aquatic ecosystem?" The rates of copper in the submersed weed control program of the SFWMD are about 4 gallons of a 9% material or about 5 gallons of an 8% material. The actual amount of elemental copper per surface acre, therefore, is 3.6 or 4.0 pounds. Since most of the canal systems average about 10 feet deep, the amount of copper entering the system per application is from 10-15 ppb. This assumes that all of the copper is immediately released into the water column and is dispersed throughout. However, this is not the case. Most submersed applications, not only done by the WMD, but also by other applicators, consists of combining the copper with Diquat or Aquathol K in an invert emulsion. An invert is a stabilized water-in-oil emulsion which produces a mayonnaise-like substance. This emulsion provides an excellent carrier for the products and allows the chemicals to be slowly released from the invert either directly into the plant or into the immediate vicinity of the plant. As a result almost none of the materials escape into the general water column. This concept is also true of other carriers such as the polymers (Nalquatic).

In conclusion, it appears that the apply snail is not in danger of declining in numbers due to the use of copper-based herbicides. It also appears that these herbicides may be tied up in an unavailable form in sediments and decaying plant material. However, research needs to address the factors affecting the fate of copper in aquatic systems and the impacts of aquatic weed control on the apple snail as well as other nontarget organisms. Finally, as this knowledge is passed along to the aquatic applicator, he will be better able to perform his duties more effectively and professionally. ▼

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A RESEARCH NEED: THE PROFESSIONAL APPLICATOR'S IDEAS AND KNOWLEDGE

By

Joseph C. Joyce and William T. Haller

A few years ago at a Florida Aquatic Plant Management Society Meeting a prominent aquatic weeds researcher made a somewhat unusual opening statement to his talk. In essence, it was indicated that he would gear his talk *down* to the level of the applicator so that *they* could understand it (this statement was immediately followed by a frantic attempt to extract a well-worn size 11 boot from the researcher's mouth). This statement becomes rather ironic when one realizes that in order to investigate many of the complex research problems the scientists are continually drawing upon the knowledge and expertise of the true experts in the profession of aquatic plant management: THE APPLICATORS.

In our specialized area of expertise it is difficult to draw a true distinction between a researcher and an applicator. If a distinction is apparent it is usually in the area of basic research which involves the theoretical experimentation, and analysis of the general biological, chemical, social, and natural phenomena which our profession encompasses. But even in this area it is oftentimes the applicator who provides the key and impetus to initiate basic research. A good example of this interaction was the observance by applicators that fall treatments of hydrilla reduced the need for treatments in subsequent years. It was then the researcher, through basic research, who identified the prevention of fall hydrilla tuber formation as the underlying cause for this operational breakthrough and allowed the fine tuning of operational programs to exploit this characteristic of the plant.

The other main type of aquatic weed research is applied or developmental research. This is an extension of basic research to a specific application or the adaptation of research findings to demonstration purposes or projects. Such research involves testing specified products, processes, techniques, equipment and/or de-

vices. This is the area in which there is the greatest interdependence between the applicator and the scientist. Either group may develop a new approach, but it is through cooperation that the approach is "fine tuned" as an operational tool. Unfortunately this is an area in which there is often a lack of continuing dialogue. This situation can have several adverse consequences: (1) the applicator is usually in a position to "see" more than the scientist. The applicator lives and deals with the problem on a day to day basis. The applicator's observations of what products, rates, or techniques work best in certain situations are many times routine operational judgements which the applicator has learned through experience. If available to the scientist, such information could prove valuable in developing research programs. (2) Along this same line, a continual dialogue concerning operational research needs will ensure that the limited research and development monies are being spent in those areas with the highest aquatic plant management research priorities. (3) Scientists, because of their academic achievements are generally thought of as *the* experts. Thus, when aquatic weed problems develop, it is usually the scientist who is first contacted for solutions. Unless there is a continual dialogue between the applicators and the researcher, the best or most applicable technique, method or products may not be recommended. Thus, it can be seen that one of our most valuable research tools is the experience of the applicator.

This discussion is not an attempt to knock the scientist down a notch or to place more importance on the operational aspects in relation to research programs, but instead is intended to stress the interdependence and need for a continual dialogue between the two groups. A partial and by no means complete list of areas in which such dialogue is needed is:

cont. on page 14



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1. Level of control — what factors influence the amount of vegetation removed (intended use, funds available, fish and wildlife considerations, etc.)? What is the desirable level of control for fisheries production, recreational uses, flood control, public health, water supply, etc.?
2. Water quality considerations — which parameters (dissolved oxygen, pH, temperature, hardness, etc.) are the most important and how much monitoring is required in order to make the decision as to whether or not to initiate treatments? How does water quality affect the choice of herbicides, rates and techniques? For example, several applicators have noticed that certain chemical formulations or combinations of products are very effective in certain water bodies but are far less efficient in other water bodies.
3. Spray additives — which surfactants work the best on various plants and with which herbicides? Which weighting agents are the most effective?

4. Herbicide selection — does a higher rate of diquat control hydrilla without the addition of copper? Is copper needed with Aquathol K? Which of the endo-thall products work best in hard water? Are there significantly different control efficiencies for treatments with varying rates of a given herbicide or with different herbicides when the applications are made at varying times of the day or season?

As professional applicators it is both your duty and in your best interest to share your knowledge and experience with the aquatic weed researcher and other applicators. ▼

APMS MEETING PLANNED JULY 13-16

The Aquatic Plant Management Society, Inc. had its midwinter board meeting at the Sarasota Hyatt House Friday, Feb. 1. The two main items of business were preparations for the upcoming annual meeting in July and deliberations on recommendations of the policy council appointed in Chattanooga last July by Past President

Raynes and myself. This year's 20th annual meeting will be held at the Sarasota Hyatt House July 13-16. It is shaping up to be the largest ever to be attended. The facilities are very good and due to the summer season the room rate is very reasonable for such a first rate hotel. They are \$28 single and \$34 double. The meeting rooms and areas for exhibitors are some of the best yet. An added feature of this year's meeting is the kick-off of the photo contest. There will be two categories — slides and prints. Clarke Hudson is chairman of the publicity committee which is handling this, and we will be hearing more about rules and regulations on entering the contest.

The other item of considerable interest at the board meeting concerned the recommendations of the policy council. This group of seven members from a cross-section of the society was asked to recommend to the board, and subsequently to the membership, a chartered course for the society to follow in the future. The highlights of the council's recommendations are:

- Combine the office of secretary and treasurer.
- Increase membership dues commensurate with the times.
- Prepare the necessary change from volunteer to compensated handling of the society's business (possible future appointment of a paid executive secretary).

These suggestions will eventually lead to a better business arrangement for the society which has evolved from an organization of seven Floridians in 1961 to an international scientific society today. The objectives of APMS have not and will not change. The operational capability of managing problem aquatic plants in whatever way possible remains the ultimate objective of the society.

I urge each of you to support APMS at the local, national and international level and issue you a personal invitation to attend the summer of 1980 meeting in Sarasota. Paper titles and abstracts should be sent to Nelson Virden, Rt. 3, Box 414, Jackson, MS 39213, and questions concerning the meeting should be addressed to me or to the secretary, APMS, P.O. Box 06005, Fort Myers, FL 33906. ▼

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THE SIGNIFICANCE OF HERBICIDE USE IN THE AQUATIC ENVIRONMENT

By
Robert J. Gates*

Numerous attempts are being made to curtail the use of all herbicides. Many groups have overreacted to the continued use of any chemical compound for "weed control," yet the demand for effective control continues. I think we must recognize the public alarm raised in the last two decades dictates a need for concern to industry, commercial and agency applicators.

Residues and persistence of certain chemical compounds began to raise questions, despite the herbicides low toxicity. Selectivity, often apparent in repeated programs, destroyed predator as well as prey. We work with this concern today, using herbicides when controlling noxious

aquatic weeds in natural and man-made water resources. While many science people are working to resolve these kind of problems, a much larger issue has developed — environmental inhabitants; answers from research come very slowly.

The 1980's must insure the public that management people, in planning and programming, are qualified to be doing herbicide control work. It is our responsibility to ensure the potential benefits from herbicides are maximized. This will only happen if we understand environmental implications and their use; using them with such discretion that undesirable effects are avoided.

The aquatic use of herbicides for

weed control in our rivers, lakes, canals and other water resources here in Florida is environmentally extremely important. Special interests such as navigation, flood control and recreation are the ultimate benefactors, if continued improvements in application methods are investigated. Likewise, to understand any adverse effects from applications, monitoring must be provided to establish relationship between the water and the herbicide chosen for use. The following steps should always be used in making decisions prior to an application.

1. Identify the plant species to be controlled.
2. Base the selection of the herbicide to be used on information contained in the Herbicide Handbook, W.S.S.A., Fourth Edition, 1979.
3. Read the label for volume of herbicide required per surface acre. Look for application method recommended.
4. Chemistry parameters of the water column should always be provided and recorded (temp., PH; D.O., BOD) prior to and after each application.
5. Always use an invert, polymer or spreader sticker to keep the herbicides on the target plant.

Using these five procedures most aquatic weed field problems can be brought under control without degrading the environment.

It is not prudent to permit weed plants to waste our water resources. It is equally imprudent to contaminate our environment so that its productivity is reduced or its aesthetics despoiled. Weed control requires the input of many disciplines and the cooperation of the weed control expert, also with those who more thoroughly understand the sensitivities of the natural environment.

Understandably, these people have their special interests, but these cannot be permitted to override sound planning, be it environmental, economic or, as in the weed control issue, a combination of both. To bring together the needed expertise may not be easy, but it is essential if our resources are to be used to best advantage for man and the friendly inhabitants that surround him in what we call our environment.▼

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