



(Above) - Year 12 Agriculture students in a garden bed with Horehound.



(Right) - Wild Radish in front of a patch of corn. Sheep paddocks can be seen in background.

Freya Byrne Geelong Grammar School

Part A - Introduction

The area that is being studied in this report is the Agricultural Centre at Geelong Grammar School. The purpose of this report is to identify the major weeds affecting the area, to assess the problem and then to suggest an Integrated Weed Management (IWM) program that will control these weeds. The centre is located on the western side of the school property, and has little shelter due to there being no buildings, and few trees. Horehound and wild radish have taken over parts of the paddock, the chook pen and veggie gardens, causing losses in productivity and time spent removing the weeds.

This area (Figure 1) is significant for students as they use the land for enterprises as a part of their studies. There are vegetable gardens, a chook pen, horses and sheep in the centre. The area is important to the school because it is near the entrance and therefore is seen by people passing through, including prospective students and important visitors. By reducing the weed problem, the area won't be used differently, but there will be an increase in productivity due to less competition.



Figure 1 Geelong Grammar Agricultural Centre, Vegetable Gardens.

When Geelong Grammar School opened more than 150 years ago, it was a small school for boarders. When it moved from the middle of Geelong to its current location in Corio, it bought many acres of land. As the school grew it attracted mostly boys from the country, so they decided to start a large agricultural centre so the boys could continue the work they did at home. The centre worked so well that it provided most of the food for the school. Unfortunately, the idea was lost as the school continued to grow, and it has only been in the last few years that the school has started to build on this again. In 2005, the school began offering Agriculture as a VCE subject and since then the centre has grown and will continue to grow with plans to build sheds, yards, orchards, and for the first time in many years produce is coming out of the centre.

Environmentally, the area is significant because there's a wetlands area nearby that is in the process of being revegetated with native plants and therefore needs to be kept free of all weeds. There isn't any economic significance of the area, though small amounts of livestock may be sold throughout the year. There are families on campus who want to educate their young children about where their food comes from. The centre provides a great opportunity for the children to have a 'hands on' experience with agriculture.

The weeds have become a problem in this area mainly due to past poor management programs. In the last year, the site has received lots of attention. Gardens have been built, and to do this, soil has been brought in which would have had small amounts of weed seed in it, and the natural state has been disrupted. Due to the fact that the area hasn't been disrupted for many, many years, there would be a very big seed bank in the ground, and when the soil was turned, the weeds began to grow. Last year, there was a huge weed problem, and some of the management strategies included hand

weeding, and chemical spraying. This has been successful, and the problem is much better than it was.

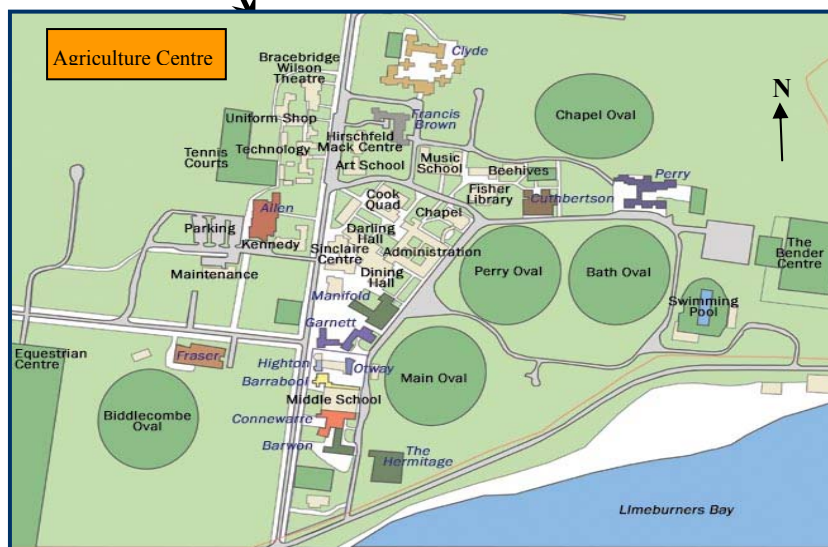
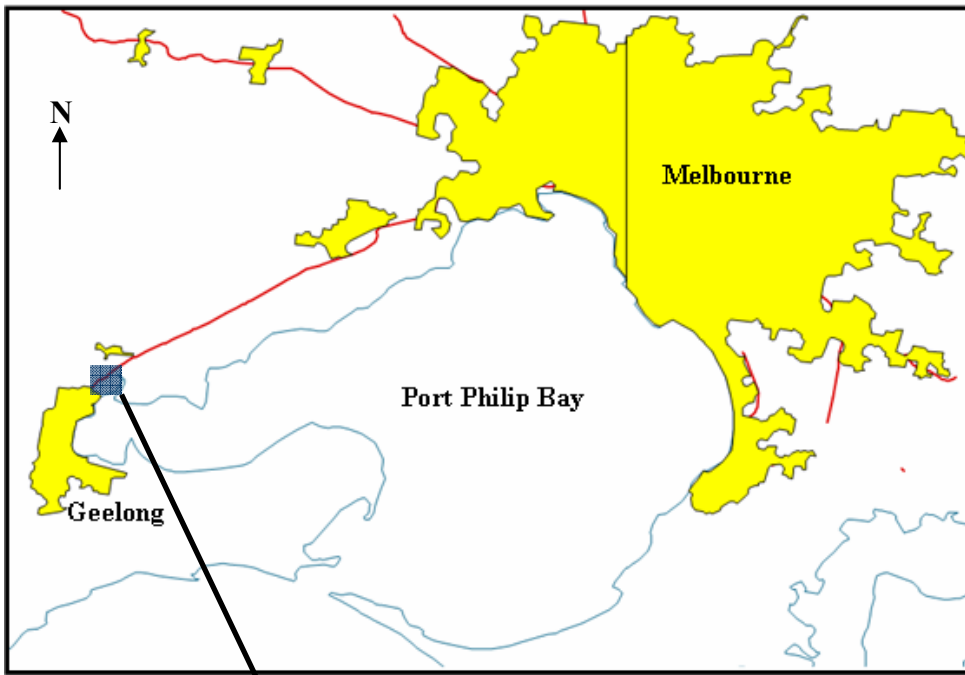


Figure 2 Wild Radish is spreading along the paths into the garden beds at Geelong Grammar



(Left) - Map of Victoria showing the Port Philip region.

(Below) - Map of Port Philip Bay region showing the location of Geelong Grammar.



(Above) - A map showing the Geelong Grammar Corio campus. The Agriculture centre is highlighted in orange.

Part B- Identification of Weeds

Common Name: Horehound

Botanical Name: *Marrubium vulgare*

Across Victoria, horehound is a widespread weed. In the Corangamite Catchment area, it's been classified as regionally controlled. This means control measures are required to prevent spreading. Horehound is a native plant to temperate regions including Europe, Eurasia, the Middle East, the Mediterranean and some parts of North Africa. In Victoria, this weed is common in sheep camps and waste places.



Figure 3 Horehound at Geelong Grammar School.

Horehound is a bushy perennial plant (figure 3) and can grow to 30-80 cm high. It has a strong smell when crushed, and is densely covered in white hairs.

The stems themselves are about 60cm long, very branched and can be upright or trail along the ground. They are woody and hairy, and the roots are taproots, but are quite branched, and spread laterally underground.

The leaves are round, wrinkled and have a bluish-green tinge to them (figure 4). The veins are hard to see from above, but are quite prominent underneath.

The flowers are white and very small, between 6 and 10mm long and there are lots on each stem. Horehound flowers between September and March.

The seeds are brown or black and triangular. They are very small, between one and two mm, and there are up to four per capsule.



Figure 4 Horehound leaves and flower

Common Name: Wild Radish

Botanical Name: *Raphanus raphanistrum*

Wild radish is only a declared noxious weed in the Southern Tablelands and South East region of Victoria. In the Corangamite region where Geelong Grammar is located, wild radish is not a declared weed, however it is still a major problem in the agricultural centre and needs to be eradicated. (See figure 5)

Wild radish is an annual herb that is native to the Mediterranean. The weed is often found amongst crops and can cause significant contamination problems. It can grow to one metre high and wide, but adapts to poor soils by not growing as big.



Figure 5 Wild radish at Geelong Grammar Ag Centre.

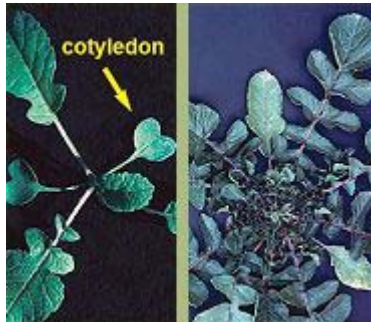


Figure 6 Wild Radish leaves.

The leaves are bright green and have bristle like hairs and they generally get smaller the further up the plant they are. Figure 6 shows the difference in leaves from the rosette at the base (right side of picture), to the top of the plant. Wild radish usually



Figure 7 Wild Radish flowers at Geelong Grammar

flowers from late winter to summer with white to pale yellow flowers, but there are some variations in colour. (refer to figure 8) They grow sparsely along tall stems held above the leaves. (refer to figure 7)

The fruits are held away from the main flowering stem on short individual stems, and can have up to twelve seeds.

The roots are very large taproots, and grow more than a metre deep.



Figure 6 Wild radish showing variations in colour.

PART C – Significance of the Weeds

Horehound is a classified noxious weed in Victoria. In the Corangamite region, where Geelong Grammar is situated, horehound is considered 'Regionally Controlled' which means the weed is important and widespread. Landowners have a responsibility to control and prevent the spread of weeds on their property. In other regions, it is regionally prohibited meaning it must be controlled or eradicated. Wild radish isn't a declared noxious weed in Corangamite; however, it is quite widespread, especially at Geelong Grammar where it is a major problem in many of our paddocks and around the vegetable garden.

Horehound hasn't been found to be toxic; however, some sheep have been reported as experiencing stomach complaints after eating large quantities of the weed. This could be a problem as we have 25 sheep at the centre. Wild radish seed contains *glucosinolates* which are toxic and can cause poisoning if eaten in large quantities. Although livestock generally don't eat it, we need to be careful with our sheep during times when minimal feed is available. As both of these weeds can affect sheep, it's important that they are controlled or eradicated at the agriculture centre.

Horehound is a major pest in pastures and crops in southern Australia. It can be a problem in livestock production because it contaminates wool, taints the flavour of meat, and contains an alkaloid that makes it foul-tasting and indigestible for livestock. It also acts as a host to insect pests. The agriculture students at school need to be aware of these issues, as they will affect the management of the sheep. Horehound is also an environmental problem because it can quickly take over disturbed native vegetation even in poor soils, and smother the other plants. This happened at the agriculture centre at school due to the major disturbances that occurred in 2006. The veggie garden has also been affected which has caused losses in production due to the weeds competing for nutrients and water.

Wild radish impacts on agricultural production, in both crops and pastures. In crops, it competes for space and nutrients which reduces its yield and carrying capacity. The seed also contaminates grain, seed and hay. In pastures, it taints meat and milk products and can kill stock. It is important that at school, wild radish is removed or



Figure 7 Roots from Horehound that was pulled up in the school gardens

contained so that it causes no harm or production losses to the sheep and so that it can't spread seed. Both Wild Radish and Horehound are quite effective when competing with beneficial plants. Both weeds spread along the ground before they grow upwards which blocks the sun from anything else trying to go. They also have tap roots (figure 9) which quickly grow deeper into the ground than other plants so they can reach water and minerals while other plants can't. Horehound disperses seeds primarily by stock because the burr attaches to wool, fur, clothing and other similar materials. Wild Radish can spread seed in this way, but its main means is as a contaminant of agricultural products like hay and cereal or pasture grass seed. Both seeds can also spread by wind, water and contaminated seed. Horses have sometimes been known to pass viable Horehound seeds. The agriculture students at school have to be careful that they don't help these weeds spread by ensuring that their clothes and tools are clean when they leave the weedy area. The horses at the centre may need to be contained before they leave the paddocks in case they spread the weeds.

Part D – Management Strategies

A lot of work has been done improving the Agriculture centre since the beginning of 2006 and the area has changed significantly. The soil became very disturbed which meant that lots of weed seed germinated. The main method for controlling the weeds last year was hand pulling with Round-Up used only in some areas. This was very effective, and the weed problem has been reduced by more than half in just one year. The following is a suggested Integrated Weed Management (IWM) program to control horehound and wild radish at the agriculture centre at Geelong Grammar.

- 1- Firstly weed numbers and locations should be recorded and mapped out so that it's known exactly how many and where the weeds are situated around the centre. These numbers and locations should continue to be monitored.
- 2- It is very important to make sure that 'clean' areas are kept clean from horehound and wild radish. This means cleaning everything before it's used there, checking clothing, machinery and vehicles that enter, and ensuring any animals that enter are 'clean'. Feed that is brought in should have minimal seed problems. These areas should be constantly monitored so that if any weeds appear, they are dealt with straight away.
- 3- The vegetable gardens at school are quite small so one of the best methods for controlling the weeds is simply to hand pull them before they set seed. This method requires labour and time, but it is achievable at school because there are year 11 and 12 students at the centre most days that can do this. There are also families and primary school classes that would love to go to the centre and help. If signs with instructions were placed at the center, then whoever goes to the centre would know what to do with the weeds once they're pulled out. They would also need to be careful not to spread seed.
- 4- Lawn mowing/Slashing- The pathways around the veggie garden should be cut regularly to keep the pathways clean. This may also help to reduce seed production if cut at the right time. The paddocks that are infested can be slashed at least once a year, and this will keep weed numbers down. Although machinery used in both cases will need to be cleaned very carefully so as not to spread seed that has collected in it.
- 5- Grazing can help to reduce plant numbers, but as both wild radish and horehound can cause illnesses and tainted meat in sheep, this technique would need to be monitored very carefully to ensure that only small amounts were eaten by our sheep. The sheep would only eat the horehound when other food is scarce, so this might actually increase weed numbers due to less competition. This would not be a continuous method, but could be used every so often.
- 6- Chemical Control- In the veggie gardens, spot spraying will be very effective. Herbicides can be used; the students just need to ensure that the vegetables aren't sprayed during this process. In the paddocks, spot spraying isn't practical due to the large area that needs to be covered.
- 7- Reseeding- By planting beneficial plants during the autumn the horehound and wild radish will have to compete more, and therefore will not be as dominant. This would be a long term goal with planting repeated a few times until the beneficial plants become established.
- 8- Biological Control is not a practical method at Geelong Grammar due to the scale of the infestation, but there are two moths, one that eats the foliage, and another that eats the roots and stems that could be used to combat Horehound.
- 9- Public Awareness is also needed because the Agriculture centre is a public place. A sign could be put in place alerting visitors to the IWM plan, so that they can take the appropriate steps to help reduce the weed problem.

Part E: Evaluation

The strategy outlined in Part D would improve the Geelong Grammar School Agriculture Centre drastically. The goals for the Integrated Weed Management (IWM) Program stated in Part D are:

- ✚ To make the centre look clean and tidy because it is near the entrance of the school and lots of people see it on their way into the school.
- ✚ Give the school something to publicise because agriculture at Geelong Grammar as a subject is very new.
- ✚ To increase production in the vegetable garden so we maximize usage of the four garden beds that we have made.
- ✚ To reduce weeds in the paddocks so that we can control the horses and sheep diets more effectively.
- ✚ Minimise weed numbers in the area so that the spread of weed is reduced. Many people come through the area each day risking further seed spreading, so its important seeds don't leave with them.








The IWM program stated in Part D would help us achieve the goals stated above. The area will look cleaner, healthier and more looked after. There will be more produce coming out of the gardens, and healthier sheep coming out of the paddocks. The area will become a more enjoyable place to be and families will be happier bringing their small children down to enjoy the surroundings and to learn about how their dinner gets to the table. The grasses will take over again making the pathways clean and looking nice, and the school will be more likely to bring important people and prospective families down to look at the work that is being done.

The strategy that I have offered gives a range of different options for both the gardens and the paddocks. The methods chosen are relatively cheap and easy meaning all of the people that come through the centre can help. There aren't any dangerous chemicals or heavy machinery involved which means people don't have to be hired to help us, and special skills don't need to be learned. The strategy allows flexibility which means that it can fit in around school holidays, and class times so the agriculture students can do most of the work themselves. The flexibility of the plan and signs at the centre mean that every year when new people take over the garden, it is relatively easy to pick up where the last group left off which is important in a school situation. Due to there being less reliance on chemicals there should be fewer resistance problems.

The strategy outlined will be an ongoing process, but every year the weed problem will be reduced which will make the job easier each time. The strategy isn't a quick fix, but because the weeds aren't Regionally Prohibited, and are only a problem in one corner of the school, the work can be spread out over a whole school year. The program is time consuming but very achievable, and flexible. Monitoring of weed numbers has to be done, and as weed number decreases, the program can be altered and new strategies implemented to ensure that the best program is being used at any given time.

There should be very few problems encountered with the IWM that I have suggested. As long as people know what needs to be done, and are aware of not spreading the seed, then the strategy should be successful.

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