

LEVEL Advanced

PEOPLE 2

BUDGET \$\$

WHEN Summer

REPEAT Every 5 years

MODULE 6

VEGETATION PLOTS

IN A NUTSHELL

- Plots permanently marked and re-visited
- Species listed along with their maximum and average height, tiers present in and approx % cover
- Provide robust, numerical data to support general observations and impressions
- INDICATORS MEASURED: Native and exotic plant species composition, plant height, plant cover



WETmak

WETLANDS MONITORING
AND ASSESSMENT KIT

Vegetation is a vital part of any wetland. It provides oxygen, shade, cover, nest sites and food for many other species, as well as contributing to biodiversity in its own right, and sometimes providing materials of cultural importance.

Most groups restoring wetlands will want to know if weeds are increasing or spreading, and if planted or naturally occurring native plants are surviving, thriving, reproducing or self-establishing.

Monitoring vegetation allows to you measure changes in:

- *plant growth (biomass and height)*
- *plant type (composition)*
- *number of plants (diversity)*
- *number of natives to exotic species (native dominance)*
- *weed establishment or spread*
- *appearance of new species (regeneration)*

Changes in plant composition or cover can also tell us something about change in nutrient status and hydrology.

Skills needed

- Plant identification
- Field navigation
- GPS use
- Estimates of plant height and cover (spread)

Equipment checklist

- Standard safety gear
- Vegetation map and/or aerial photo of the wetland
- VEGETATION PLOT DATASHEET
- MAPPING VEGETATION MODULE instructions
- Plant ID books (see useful websites/reading below)
- Pencils
- Clipboard
- Digital camera, memory card and batteries
- Spare camera batteries and memory card
- Compass
- GPS unit, batteries and manufacturer's instructions
- Black plastic weed bag
- Sample bags (Ziploc)
- Permanent marker
- 50 m tape-measure or 2x 30 m tapes
- 5 m builders tape
- 4x plot marker poles per plot with cattle tags attached
- Cattle tags or strip of venetian blind
- Hammer and nails



1. Plan your approach

1.1 Standard monitoring methods

The standard method for monitoring wetland vegetation is via a plot that is permanently marked and regularly re-measured. The instructions are outlined in the Handbook for Wetland Monitoring, see 'Useful websites' at the end of the module for link. A slightly simpler version is presented here, although it is still more suitable for those with advanced skills.

The time and effort required will depend on your wetland size, number of vegetation types, plot sizes chosen, and ease of access. In general, a 5x5 m plot may take 30 mins to 1 hour to complete.

You will need a vegetation map of your wetland before you start, see the Mapping Wetland Vegetation module.

TOP TIP:

Make a folder of photos and pressed samples of plants taken from your site.

1.2 Find out what's already been done

Ask your regional council and Department of Conservation if they already monitor vegetation at your site. Or if they have any species records or other data from previous surveys that would help you establish a baseline.

1.3 Learn your plants

If you don't have a keen botanist in your group, see if your local Botanical Society, National Wetland Trust member, Forest and Bird Society, DOC office, university, or council has anyone willing to help. For instance, they may:

- provide books or other resources to help you identify plants
- join you in the field for each survey
- join you in the field once to teach you the plants in your site
- help you build a photo ID kit and/or pressed sample file of plants in your site
- identify samples you bring back from the field



1.4 Complete a monitoring plan

If this is the first time you are doing vegetation monitoring, complete the WETLAND MONITORING MINI PLAN. If not, check the mini plan to ensure you are following the plan actions. Key decisions will be how many plots, where to put them, and how big they should be.

1.4.1 Number of plots

Aim for 2 or 3 per vegetation type that you wish to monitor. Use your vegetation map to work out how many types of vegetation occur, which are the most abundant, which are of particular interest to you, which you expect to change the most (e.g. where you are doing weed control or planting, or have recently fenced stock out of), and which you will exclude for safety or other reasons.

1.4.2 Plot placement

Try to place plots randomly within each vegetation type. First draw x's on your vegetation map to show roughly which vegetation types you will monitor and how many plots per type. In the field, go on a track or wetland edge to roughly where each x is located. Ask your field partner what day of the month their parents birthdays fall on. The dates will be the metres you walk along the track or edge (a coin flip will decide if you go left or right), and then forwards into the vegetation. Use different random numbers for other plots, e.g. your children's birthdays.

1.4.3 Plot size

Plots are always a square for this module, but the size can vary between 2x2 m and 10x10 m. A good rule of thumb is that the width of your square should be at least the same length as the maximum height of your vegetation, though in highly variable vegetation choose a larger plot size. For willow forest use 10x10, in mangrove forest, manuka scrub, flax, or diverse sedgelands use 5x5, in very short vegetation like lake edge or saltmarsh herbfields 2x2 may be big enough.

1.5 Check your equipment

Have all the gear on the list? Camera working ok? Batteries charged up? Plenty of space on the memory stick? Got a field buddy and permission from any landowners for access? Boots and clothing free of seeds and dirt? When establishing vegetation plots you will need equipment to permanently mark the corners. Use sturdy bamboo poles or garden stakes that can be pushed firmly into the ground. Attach yellow or pink cattle tags to make the poles easier to find - flagging tape and spray paint break down too quickly.

1.6 Plan your route

Try to reach your pre-marked plot locations by the safest route, from the nearest edge or track, but check there are no hazards like deep channels between you and the plot marker.



2. Collect data in the field

Tell a ‘minder’ where you are going, who with, and when you expect to be finished, call or visit them when you leave the site, so they know you are safe. Mark your wetland entry point on your GPS unit in case you lose your bearings.

In the field you will set up and later re-measure permanent vegetation plots in representative areas of vegetation. In each plot, you will list all the species

present and indicate their height range and relative amount of cover. You will also note if seedlings are present.

MINIMISE DAMAGE TO THE PLOT VEGETATION

- keep to the outside of the tapes, be as gentle as you can, don't bend vegetation out of your plot – you want to monitor natural change, not the result of monitoring damage.

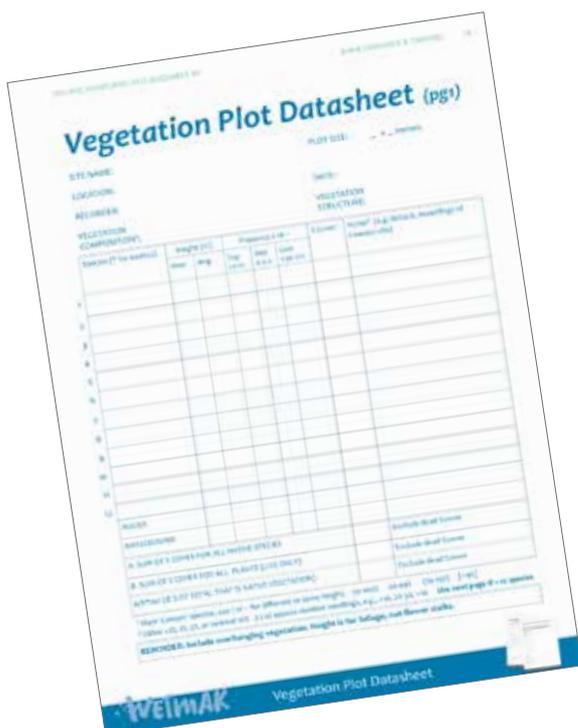
2.1 Set up plot

Practise this step in an area of open grass first to get used to following compass bearings. **KEEP THE COMPASS AWAY FROM ANY METAL.**

When you reach your plot location, place a pole in the ground, tie or fix your tape measure to it, and use a magnetic compass (GPS compasses aren't reliable) to move along north-south and east-west lines. If heading east, turn the compass dial so E is at '12-o'clock' on the compass dial, and turn your body until the needle lines up with the printed north arrow. Keeping both eyes open, face the direction the compass (not the moveable needle) is pointing and look for a landmark about 5 m away to head towards (e.g. a flax stalk). Or send your field partner in the desired direction and have them move left and right until they line up with the compass.

Run the tape out 2, 5, or 10 m depending on pre-determined plot size. Use a second pole to mark the corner. Run the tape around the corner pole to hold it square, then head at right angles to the next corner, etc, until you create a perfect square. You can double check your tape is aligned N-S or E-W by holding the compass on it and checking the lines on the compass match the edge of the tape. You may need to realign the tapes if they have got hooked up around vegetation, or the tape does not end up back at the first pole at the right distance, e.g. should be 8 m for a 2x2 m plot, 20 m for 5x5, 40 m for 10x10.

Keep the tape as straight, tight, and level as you can – if the tape goes up and over or around dense shrubs it affects the length of the plot – slide the tape through between foliage. If a tree is right where your tape needs to go, decide if it is mostly in or out and run the tape around it accordingly.



2.2 Permanently mark it

Push the four corner poles firmly into the soil so they won't wash away in a flood. Give the plot a unique number and write with a permanent marker on a cattle tag, or scratch it onto the venetian strip with a sharp nail. Attach this to the corner pole nearest the track.

Record the GPS coordinates of the plot in NZTM format (use the instruction guide for your particular GPS unit). You may also wish to nail a cattle tag or strip of metal venetian blind to a tree or fencepost along the nearest track, and write on it the direction and distance to the plot.

2.3 Photograph it

Take a photo at each corner, looking diagonally into the centre of the plot. Complete the PHOTO RECORD SHEET for each photo.

2.4 Name the vegetation

Complete the top sections of the VEGETATION PLOT DATASHEET with the name and location of your wetland, current date, your name etc.

Next, classify the plot vegetation by writing the vegetation composition and structure. Refer to the instructions in the MAPPING WETLAND VEGETATION module.

2.5 List the plants

This information tells you what species are present, if there are more native or exotic species, if new species are establishing, or species are dying out in the plot over time.

In the first column of the VEGETATION PLOT DATASHEET list all of the species you can identify. Write unique code names for those you can't identify (see section 2.6 Collect unknown plants). Put a star '*' next to those you know are exotic species.

Don't forget to look up! Include plants that have foliage hanging over the tapes into your plot. It can help to start with the tallest plants, then work your way down to the ground.

Include plants that are dead if you can identify them, but note that they are dead in the comments box. List them on a separate line to the live ones. Don't treat natural seasonal die-back of willow, raupo, etc as dead plants, monitor in summer to avoid this.

Photo Record Datasheet

SITE NAME: _____ DATE: _____

LOCATION: _____

RECORDING: _____

CAMERA TYPE: _____

GPS TIME: _____

PHOTO NUMBER(S)	GPS LOCATION (NZTM 2 or 4 digit)	CAMERA READING(S)	DATE	NOTES (Date, description of where photo was taken, description of area)

FOR PHOTO NUMBER, write the unique number that the camera will use to save the photo. Do not number the camera's SD card, as that number will not be used to save the photo.



2.6 Collect unknown plants

For any species you can't identify, collect a specimen, but only if there is plenty of plant matter in case it's a rare species. For smaller plants collect an entire plant that has fruit/ flowers/ seeds, include roots. For trees take a small branch that has several leaves, not just one leaf, and include flowers/fruit. Take general and close up photographs and note details about its height, growth form, colour etc. Give the species a unique 'code' name, e.g. 'red-flowered herb', and write this on the datasheet and the collection bag (write the date and plot number on the bag too). Take it to a botanist as soon as you can, or press the sample for longer storage – don't keep in a plastic bag for more than one day.

If you find a bad weed in your plot and can easily remove it, bag it in black plastic, but first record its details on your datasheet and clearly state 'REMOVED'. Dispose of to landfill.

2.7 Add height data

This information tells you what species are the tallest, if species are present as mature trees, shrubs and/or seedlings, if species are increasing in height over time (indicating growth/maturation).

For each species, list the maximum height of the foliage – not flowering parts like flax stalks. Use a builders tape for plants up to about 2 m. For taller plants, have a person stand close to it with their arm up to indicate roughly 2 m, stand back and estimate how many 'people' high the plant is and double that number. Or you can mentally halve the height of the plant, estimate that height and double it.

Estimate the average height for each species, to give an idea of how tall MOST of the vegetation of that species is.

Tick which height tier each species occurs in – top is taller than 2 metres, mid is 30 cm to 2 m, ground is below 30 cm. Use a builders tape or 2 m pole with 30 cm marked in coloured tape or pen. Write '–' if there is no foliage or green stems of that plant in a given tier – e.g. ignore a willow trunk in the bottom tier if all the leaves are above 30 cm, but tick ground if there are willow seedling or re-sprout leaves below 30 cm. If, say, the only flax is a leaf hanging into the plot you will tick mid, but not ground.

Include plants visible under water, or floating on water, like duckweed. For floating plants their height will be '0' but for upright plants currently partly under water their height will be height above the ground, not above the water.



2.8 Estimate % cover

This information tells you what species are the most dominant/abundant, if native or exotic species dominate, what species are increasing in amount, or disappearing over time.

For each species, estimate how much of the plot it covers to the nearest of either <1%, 1%, 5%, or to the nearest 10% value.

How much is 1%? In a 10x10 m plot, 1% is 1x1 m; in a 5x5 it's 50x50 cm; in a 2x2 it's 20x20 cm.

This is the hardest part of the module, use the following tips:

- Focus on one species at a time – mentally blank out the rest.
- Don't add up overlapping foliage of the same species, even if it's from a different plant – the total can never be >100% for a given species because it is the amount you would see looking down from above if all the other species disappeared.
- If there are species that look very similar, estimate the total cover of the look-alikes, and then divide that value among them based on what you think is the relative amount of each. E.g. if *Carex tussocks* cover about 60%, and there seems to be two *Carex secta* to every *Carex virgata*, based on the few you could find in flower, then *C. secta* is 40% and *C. virgata* 20%. Make a note that it was hard to separate these and the values are best guess.
- Deal with the less abundant species first, they will probably mostly cover 1% or less, and it gets them off your conscience!
- For those >1%, pretend you are hovering over the site looking down, how much of the plot does that plant cover. More than half (i.e. >50%)? Less than half? More than a quarter? Keep breaking the plot down this way to home in on the nearest 10%.
- If the species forms a single dense clump it's easier to guess cover. If not, try to mentally 'pick up' scattered plants and put them side by side in one part of the plot and estimate how much they would cover if clumped this way.
- For scattered species you could estimate the actual cover of each patch/plant and add them up. Let's say in your 10 x 10 m plot you have three flax plants. Each one is about 2 x 2 m, so 4 square metres. So together they cover 12 sq m. In a 10 x 10 m square there is a total of 100 sq m, so 12 sq m is 12%, you could round this down to 10%.
- For species thinly scattered throughout the whole plot, like bindweed or spike sedge, look at a typical 1x1 m patch of it within the plot. Decide how much it fills. Imagine how much it would cover if you could gently bring it all together into a solid patch. If you think it would cover, say, half of this representative patch then its probably covering half of the whole plot, so write 50%.
- Ignore small foliage gaps in the canopy – this also includes sub-canopy foliage.

Include the amount of the plot covered by water and/or bare ground (exclude bare ground that is under water, it's not bare!)



2.9 Make notes

This allows you to record any features of interest, such as dieback, seedlings, flowering or fruiting etc.

Use the notes column to write anything of particular interest about a species, including if there are dead ones in the plot, and if there are seedlings of tree and shrub species – you'll want to know if weeds are establishing or natives regenerating. Also if the plant is fruiting or flowering, particularly in planted areas or of weed species.

Write general comments on the back page – whatever seems relevant, e.g. cattle recently been through, saw possum dung, etc.

2.10 Check it

Take a good look around your plot to make sure you haven't forgotten any species. Make sure you have a tick or dash in top, mid, ground for every species, and that you've given each a maximum and average height.

2.11 Total the natives

Add up the total % cover for all the native species (ignore values you gave for dead plants and for water or bare ground). Then sum all of the live foliage (native and exotic). Divide the amount of total native cover by the amount of all live foliage and multiply by 100 to calculate the % of the plot that natives comprise.

2.12 Collect in the tapes

Carefully wind up your tapes, but leave the poles in place. Take photos of your datasheets.

Let your minder know you are back safe and sound.



3. Back at base

3.1 Store the data

- Download photos, including photos of your field datasheets, and GPS data files at the first opportunity and save onto a hard drive (internal or external), with backups on DVD/CD stored in a different location to the originals.
- Store photos in folders bearing the site name, module type and year. If you have used the camera's pre-set photo number on your datasheet, don't rename the file. Right click on an image file and select 'Properties' if you want to confirm the time and date a shot was taken.
- Have the GPS data saved as a kml or kmz file so they can be opened in Google Earth or Google Maps. Double check that they are in the right location.
- Enter the data from the data sheets into an excel spreadsheet. Take great care not to introduce errors.
- If you have a web-site, store the images there too, along with the relevant information (or use an image hosting site such as Flickr). You can also load the photos and waypoints onto Google Earth, positioning the image at its actual location.
- Print out a copy of the spreadsheet and put it in a Vegetation Monitoring folder divided into relevant years. Ideally the folder will also contain this module's mini plan, reports, printed maps, directions to the plots, and other relevant monitoring data, along with CDs/ DVDs and notes on where the hard drive copies are stored.

3.2 Analyse and interpret the data

3.2.1 Count the number of species

Add a column to your spreadsheet labelled Exotic, and put '1' in for each row that is an exotic species – the NZPCN website will tell you which are exotic. A quick sum of all the '1's will tell you how many exotic species you have – or you can sort the data on that column so all exotics are listed after all natives. Count the number of species that are native, and the number that are exotic. List the totals of each, and the ratio of native to exotic species.

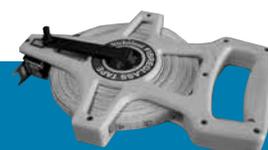
3.2.2 Calculate the % of exotic vs native cover

Add up the total cover for all PLANT species (both pages if more than 13 species) – don't include water or bare ground – and then the total for all exotic species (the * 's make them easy to spot). Calculate the % of the total vegetation cover that is made up of non-native species. You can do this step back at base.

If you have data from previous visits, look for changes, including:

- species not previously recorded - new arrivals or overlooked first time?,
- species not recorded this time - possible decline in a species, successful weed control, or overlooked this time/ mis-identified on one of the visits?
- species newly recorded in a height tier (indicating plant growth)

You can create simple graphs to show change over time, e.g. in total number of native species.



3.3 Report the data

Complete the REPORT TEMPLATE and share the results with your staff/ volunteers, and if appropriate, funders/ supporters and management agencies. Put a printout in your monitoring folder and save a copy with your other monitoring files on your website / computer.

Include in your report (for the wetland as a whole and per vegetation type):

- Total number of species for each of exotic and native species
- Average number of species per plot
- Species most frequently encountered – i.e. that occur in most plots
- Species most dominant – i.e. that have the greatest total % cover
- General vegetation height
- Species present only as seedlings – indicating either weeds to watch or evidence of natural regeneration
- Comments on features like non-seasonal die-back, particularly of weeds under control, and natives you have planted.
- Changes in any of these factors since the last monitoring period

Compare the results with your restoration plan – does it need any changes to deal with new or reduced threats?

3.4 Subsequent visits

- Take a GPS unit with the waypoints of the previous survey and use it to find your plots.
- How often you re-measure the plot depends on the site and what is happening there. If you just want to record what is happening in the absence of any specific restoration work (e.g. a ‘control site’), every 5 years is probably fine. You may want to measure more frequently though, e.g. to know what species in your planted areas are surviving/thriving. Be aware of the potential to damage sites, only visit plots as often as you really need to.
- Re-measure plots at the same time of year to capture the data in the same season. Summer may be easier for access (lower water levels), and you’ll measure deciduous plants e.g. willow, raupo, in full foliage. This will also help distinguish seasonal change from long-term change.



Useful websites/reading

Wetland Monitoring Handbook

www.landcareresearch.co.nz/research/biocons/restoration/docs/handbook2004.pdf

Wetland Plants in New Zealand – a book by Peter Johnson and Pat Brooke

NZPCN has photos and descriptions of native and exotic plant species

www.nzpcn.org.nz

GPS Visualizer – allows you to load a file of GPS data onto a map

www.gpsvisualizer.com/

Loading photos on to Google Maps

www.youtube.com/watch?v=a2SB84D1YWM

Online photo management and sharing

www.flickr.com



Completed example: (blank word version also available from NZ Landcare Trust website)

Vegetation Plot Datasheet (pg1)

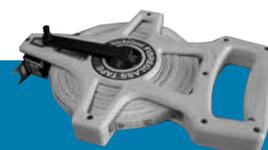
SITE NAME: *Waïora Lagoon* PLOT SIZE: **10 x 10 meters**
 LOCATION: *Off Waïora Lagoon Rd, 10 km south of Onetaha. E1783653 N5989582*
 RECORDER: *Sandi Beech* DATE: *07 March 2012*
 VEGETATION COMPOSITION¹: *Crack willow/raupo* VEGETATION STRUCTURE: *Reedland*

	Species (* for exotics)	Height (m)		Presence v or –			% Cover ²	Notes ³ (e.g. dieback, #seedlings of trees/scrubs)
		Max	Avg	Top >2 m	Mid 0.3-2	Gnd <30 cm		
1	<i>Typha orientalis</i>	4	3.5	✓	✓	✓	70	<i>Forms most of plot, but not growing under willow shade</i>
2	* <i>Salix fragilis</i>	8	8	✓	✓	-	30	<i>Two trees, one rooted outside plot but overhangs, no seedlings</i>
3	* <i>Galium palustre</i>	0.3	0.1	-	-	✓	5	<i>Small dense patch under willow</i>
4	* <i>Prunella vulgaris</i>	0.2	0.2	-	-	✓	<1	<i>Couple of plants in bare area under willow</i>
5	<i>Coprosma robusta</i>	5	3	✓	✓	-	5	<i>Scattered at edge of willow, no seedlings</i>
6	<i>Calystegia sepium subsp roseatum</i>	3.5	2	✓	✓	✓	10	<i>Grows thinly throughout raupo and climbing up it, bright pink flowers indicate it's the native bindweed</i>
7	<i>Carex secta</i>	1.5	1		✓	✓	5	<i>Under willow, 3 or so plants</i>
8	* <i>Dead Sal fra</i>	8	8	✓	✓	-	5	<i>One dead tree, standing</i>
9	NO MORE SPECIES							
	WATER						0	<i>Dry during visit</i>
	BAREGROUND						10	<i>Mostly under willow</i>
A. SUM OF % COVER FOR ALL NATIVE SPECIES							90	Exclude dead %cover
B. SUM OF % COVER FOR ALL PLANTS (LIVE ONLY)							125	Exclude dead %cover
A/B*100 (IE % OF TOTAL THAT IS NATIVE VEGETATION)							67	Exclude dead %cover

¹ Main 'canopy' species, use / or – for different or same height; 50-100% 20-49% (10-19%) [1-9%]

² Either <1%, 1%, 5%, or nearest 10% ³ List approx number seedlings, e.g., <10, 20-30, +10 Use next page if > 12 species

REMINDER: Include overhanging vegetation. Height is for foliage, not flower stalks.



Vegetation Plot Datasheet (pg2)

SITE NAME: *Waïora Lagoon*

DATE: *07 March 2012*

	Species (* for exotics)	Height (m)		Presence V or -			% Cover ²	Notes ³ (e.g.dieback, #seedlings of trees/scrubs)	
		Max	Avg	Top >2 m	Mid 0.3-2	Gnd <30 cm			
13	<i>NO SPECIES TO ADD</i>								
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
	WATER								
	BAREGROUND								
	A. SUM OF % COVER FOR ALL NATIVE SPECIES								
	B. SUM OF % COVER FOR ALL PLANTS (exc. water/ground)								
	A/B*100 (IE % OF TOTAL THAT IS NATIVE VEGETATION)								

GENERAL COMMENTS:

Plot is at the edge of raupo where willow forms a narrow band near a channel that runs along the base of the slope. Low diversity in the raupo, mostly just the native bindweed (bright pink flowers and sepal visible between bracts confirm ID). Other species grow under the willow where the ground is quite bare.

