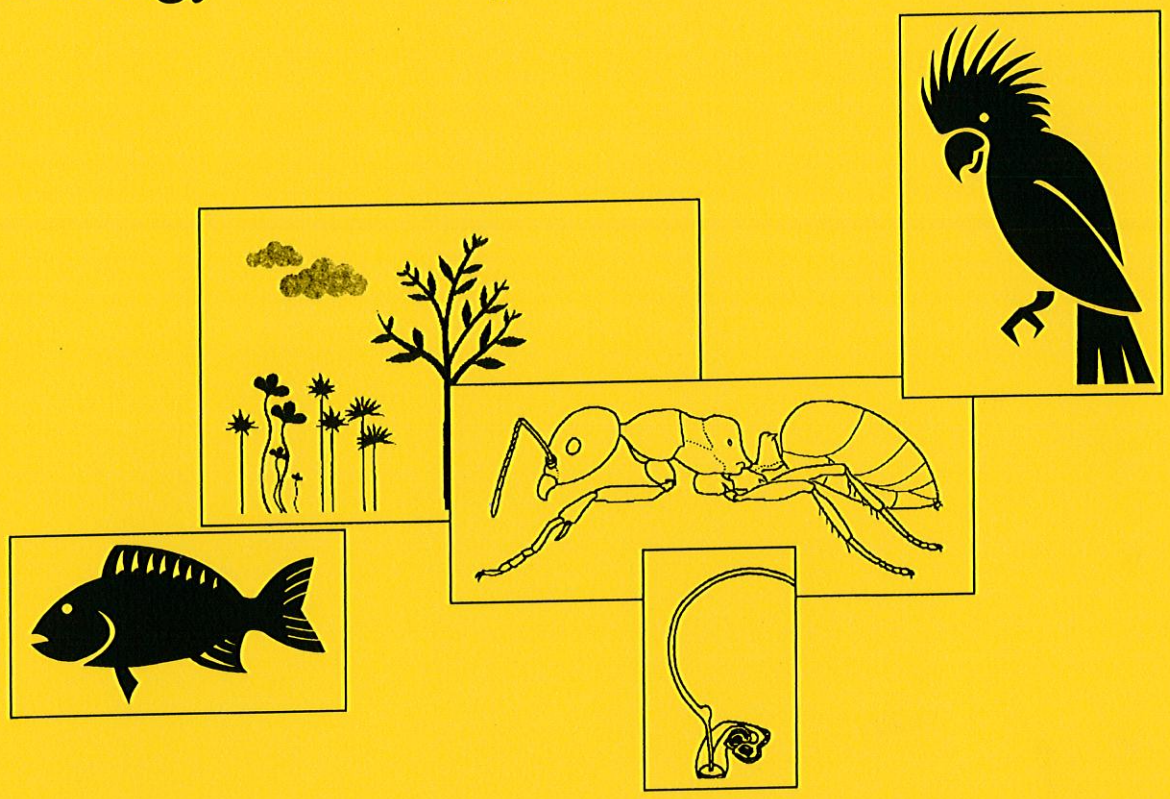
Faculty of Science and Engineering

2011

Biology Work Experience 301



Report

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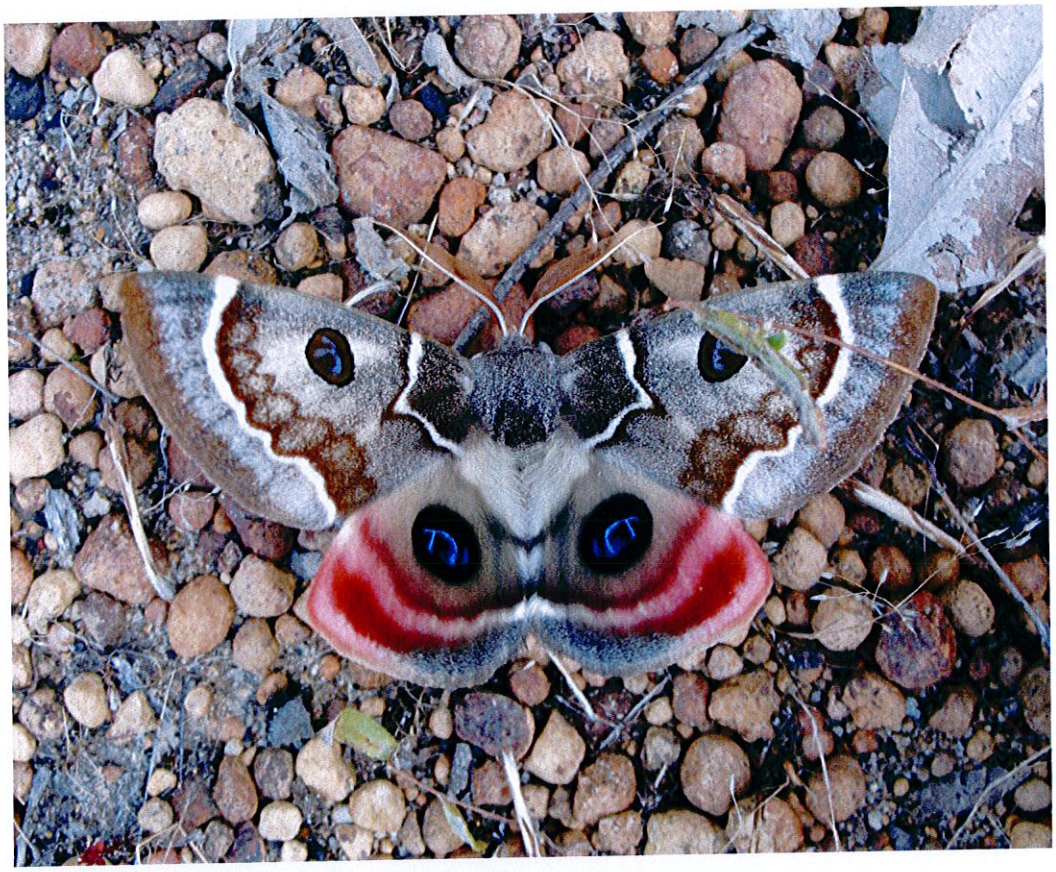
Biology Work Experience 301

Forest Check- Invertebrates



Patricia Louise Dumitro

Student number 13 650 650

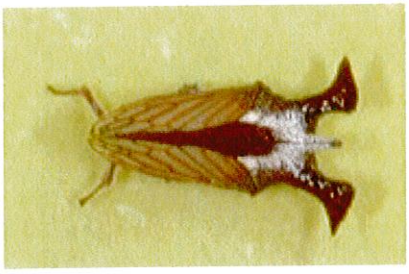
Acknowledgements

I would like to thank Dr Janet Farr for all her help and persistence in showing me the identifiable characteristics of a partially crumpled, grey and non-significant Lepidoptera. For her help and patience throughout the whole laboratory sort and giving me the opportunity to take a hands on approach in the creation of voucher specimens. I also really enjoyed all the extra facts and figures about interesting invertebrate decorations; it opened my eyes to the uniqueness of some species.

Allan Willis for his wonderful patience and guidance throughout the fieldwork and for sharing all your knowledge on silviculture history. It has given me a better understanding into the commercial side of forest management. Thank you Asiko for your gentle and kind words of advice when it came to capturing coarse woody debris specimens.

A big thanks to Robyn and Keith for welcoming me into their home and providing with fascinating conversations. Thank you so much for you hospitality.

Finally I would also extend my thanks to the entire DEC Manjimup Science Division for making me feel extremely welcome in their work place and for providing me with helpful advice for the future.



A Membracid bug with a white pathogen fungus.

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Background of Forest Check

Forest Check is a long-term ongoing comprehensive monitoring program for the Western Australian south west Jarrah forest that originates since 1999. The aim of the project is to collect data to determine wether forest biological diversity is being managed to be sustainable indefinitely. This project is being used as a forest management tool for the Jarrah forests of the south west of Western Australia (*Operating plan* 2006). For practical reasons the project has been divided into the following components, each with a different set of objectives and team. The different areas include flora, invertebrates, vertebrates, fungi and cryptogam.

The entire Science Division has had to compile a comprehensive review as to the specifications, timing, restrictions and labelling techniques, to be carried out during the life span of the project. The detailed operating plan for invertebrates (2006) includes examples of how to correctly label the specimens and the process for storage. This plan is however from 2006 and a few differences in the handling and treatment of the specimens has occurred.

My involvement in work experience was with the Manjimup Science Division in the Entomology branch, who were making there autumn site visit to the Collie area. The focus of the Entomology Department, as supplied by Janet Farr (*Invertebrates* 2008) are listed below

The objectives of this component of Forest Check monitoring is

- To monitor and record the species of invertebrates in the various treatments of managed jarrah and uncut forest.
- Analyse trends in species composition, richness and abundance
- To monitor the presence of Gondwanan relic and affinity invertebrate species with respect to the above treatments
- To monitor the presence of known insect pest species.

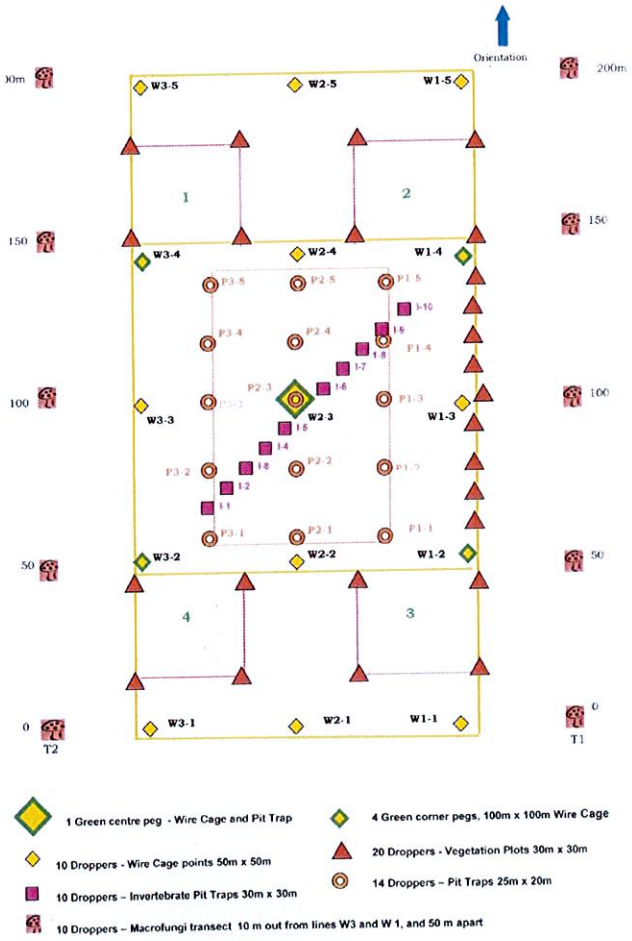
The aim is to resample sites every 5-10 years, with each sample period involving two site visits, one in spring the second in autumn (*Operating plan spring 2002 autumn 2003*).

Image of number 39 a Bogon moth
(http://anic.ento.csiro.au/insectfamilies/image_details.aspx?OrderID=26596&BiotaID=27170&ImageID=6362&PageID=families)

Site description

Each of the sample sites is 2 ha in area (100mx200m) with a central grid of 100mx100m. Each site has a permanent set up of sample points which are indicated with the aid of star pickets with colour specific tapes for different collection types (refer below). This ensures a level of consistency in the locations sampled over long periods involving various individuals.

To create replication among the collection sites each group was formed with various ecological gradients such as soil type, rainfall and geology taken into account, as well as forest history (*Operating plan, 2006*). There are four different forest histories that Forest Check sites can be classified into, these are gap silviculture, shelter wood and or selective cut, coupe buffer or internal reference forest i.e. temporary exclusion areas (TEAS) between adjacent gaps or shelter wood forest, or external reference or control forest i.e. not recently harvested that has minimal harvesting and will areas that will not be subject to harvesting in the foreseeable future (*Operating plan,* 2006). This allows for similar sites to be grouped together so that the variation in forestry history will not as greatly affect the species presence or absence in the area due to disturbance intervals.



Forest Check grid layout (*Operating plan* 2006)

Work Experience Diary
7th April- Day 1

I meet Allan Willis at Kensington then preceded down to the Collie Forest Check sites. Once arriving onsite we set up the UV light traps for the first night of moth collection. During our travels Allan explained the lay out of the forest check sites. I also discovered that the permanent testing plots are used for multiple tests and groups. Once all the sites were set up we then left the field and went in to visit the Collie office.

8th April - Day 2

We went back out in the field to collect the samples from all 10 sites. We disconnected all the UV lights and timers from the batteries. All samples were labelled and stored inside the esky. During each visit to the site we also set up the permanent pitfall traps at the same time. These are left untouched for a 10-day period before collected. Then we travelled back to Perth

11th April- Day 3

In preparation for our second night of UV light trap capture we travelled back to Collie and all our sites to reconnect all the batteries to the lights and timers. We double-checked that all the equipment was still in working order and replaced equipment where necessary. I meet my new team member for the week Asiko, an experienced helper with Forest Check and Janet Farr for the first time.

12th April- Day 4

Today we collected all of last night's samples and labelled and stored then accordingly. There were a few problems with some of the sites, one site the thermometers did not work correctly. Another site samples could not get in to the bucket as a large Hepialidae had blocked the hole of the funnel, restricting other samples to enter.

13th April– Day 5

Today we started our active collection of Forest Check samples. My role was Bush beating the vegetation at 4 different sites. I also carried out one target purist. All samples were placed in specimen jars, labelled and either frozen or placed in alcohol for preservation til sorting occurs.

14th April- Day 6

Today we continued our active collection of samples. I had the opportunity to do Course woody debris (CWD) collection searching under fallen limbs and trunks for invertebrates. I also found a legless lizard.

15th April- Day 7

In the morning we repacked the car for next weeks collection. We then drove down to Ferguson Valley to see a local community action group to provide advice in regards to how to deal with their Gum leaf skeletoniser problem. Janet and Allan did a site visit to the effected trees and provided important information about potential contacts for the group. This meeting provided an insight into how DEC work in association with the community and provide advice were possible for effective action.

18th April- Day 8

Today we set up the light traps for the third and final night collection. Once again we checked that all equipment was in working order and replaced where necessary. We also collected the pit fall traps after the 10-day waiting period labelling all jars. Before leaving the site we made sure that all traps were emptied and closed properly.

19th April- Day 9

Today we collected the final night sample. Packed all up the equipment then travelled to Manjimup. On our way down we did a quick detour to do a site visit to see the delta trap set up looked like and see what the next day held. Was given a history about the reason fro the delta trap set up to use as a population density indicator for gum leaf skeletoniser.

20th April- Day 10

We went and visited the 19 sites with delta pheromone traps and collected the traps as well as the freestanding pole. All delta traps were labelled with site number and date of collection. The number of target species as well as non-target species was counted and recorded on site.

21st April- Day 11

It was a short day in the lab as we were heading back to Perth. Before setting off the delta pheromone traps were deconstructed with the pads labelled, wrapped in glad wrap and then placed inside the freezer for storage. It was determined that the pads were not to be photographed due to the poor conditions of the samples.

14th June- day 12

I meet up once again with Janet Farr at DEC Manjimup to begin my 2 weeks of laboratory sorting. I was given the opportunity to familiarise myself with the lab set up and layout as well as the process in which a sort is carried out. A full detail is provided in laboratory sorting procedure. I began to learn the importance of a first sort into rough groups, which are then compared to voucher specimens. We

got straight into sorting the Collie forest check samples moving through as many as possible a day.

15th June- day 13

Today we continued to sort through the FC autumn sample. I begin to distinguish the key markers for some species but easily confuse it with others. I watched on as Janet proceeded to identify Hymenoptera, Scarabaedie and Diptera and learnt to identify and recognise some of the distinguishing characteristics between the specimens for later identification.

16th June - day 14

Today we finished off the last of the autumn collection sorting. It was a difficult day to distinguish as I started to confuse similar looking species. Today my identification and attention to detail to look for further indicating structures improved. This involved looking at structures other than wing scale formation and colouration.

17th June- day 15

As Janet said, it takes about 4 days to get your eye in. Today I am able to identify and recall the voucher number for the common species appearing in sites, or know the possible location in the room. At the end of the day I was given the opportunity to identify a hymenoptera specimen from the sample. Julia joined us in the laboratory today to help sort through the samples for the rest of the week.

20th June- day 16

Having completed sorting the 2011 autumn samples we started on the specimens from Forest Check spring 2010 that had not been processed. This followed the same process, as that of the previous days however was an opportunity to identify a Scarabaedie. We removed the Forest Check autumn 2011 samples from the dryer, double folded the bags, then placed them inside a large plastic bag, and labelled with sample type, year and season. Then the bag was closed and stored in the library.

21st June- day 17

All three of us continued to work on the 2010 spring site samples. We could see a noticeable difference between sample due to the increased sample size as well as the number of species present. We started to record 1172- a moth that is in the size range or over 1cm however could not be identified any further.

22nd June- day 18

We continued to sort through the Forest Check samples and we discovered some of the larger samples due to warmer temperature however all we wet. This created an interesting mixture to sort through in an attempt to identify as many relevant samples as distinguishable. We also sorted out all the new P1 vouchers that had been created to ensure they could be photographed once all the sorting had been completed. I also had an opportunity to pin a specimen and manipulate the wings to open up the specimen to make it easier to identify in voucher collection. After sorting through some moth samples for the day I was given the opportunity to learn the basics as the identification and differences of Asilideas. In one of the samples we found a treehopper, though too small to be counted it was interesting to learn about the morphological adaptations that the species has undertaken for camouflage. We also collected a new species of dragonfly, however unable to identify further at the time.

23rd June- day 19

Today was simply a wet sample day, with all the samples creating a wet tangled mat of stuck together bodies, making identification difficult. Even though the number of 1172 (unidentifiable moths) increased all efforts were made to id them to group. In the spring samples the number of Coeloptrea increased as well as the variety of Hymenoptera. It was interesting to see the sorts moving from nearly all moth samples to a more species diverse sample.

24th June- day 20

Today is my final day in the lab; we completed the Forest Check Spring sort. We double-checked that we had all the sites marked off the white board to ensure all had been sorted. We then shut all the voucher boxes to prevent museum bug attack.

Julia and myself sorting through a site collection

Active Capture techniques

There were 4 different types of active hand collection carried out over the 10 sites. These included vegetation beating, net sweeping, coarse woody debris (CWD) or litter hand search and targeted pursuit. The process that followed was that each of us had a specific collection technique to follow each site. We all collected on the same site at the same time for an hour and we were called to the centre once time had been completed. Upon reaching our time limit we would return to the vehicle and label all our samples.

Vegetation beating

With the aid of a beating stick as well as a white canvas 1 m^2 beating sheet various forms of vegetation were beaten in an attempt to dislodge small vegetation dwelling invertebrates. In most of the quadrants *Eucalyptus* sps. Was generally found to have a large number of specimens; however no preference was given to this vegetation type. Any invertebrates that fall on the canvas were then quickly pinned down with a paintbrush and swept into a specimen jar.

Net sweeping

The sweeper moves the net back and forth over low-level vegetation or litter to collect invertebrates that hover or will jump when startled. This technique usually results in the collection of small flying and jumping invertebrates. Every now and again the sweeper will stop to check the net and place any specimens into the ar.

Course Woody Debris or Litter hand search

An individual is to search under fallen logs and course debris or in leaf litter to find any ground dwelling invertebrates. They are pinned down with a paintbrush and then sweep them into sample jar.

Targeted pursuit

This was opportunistic in nature with an individual following a specimen, when spotted was followed and then collected straight into the specimen jar.

Field sample storage

Storage of all the active hand collections were placed into small or medium sample jars and labelled with site number and date. The samples were then placed inside a labelled bag then placed inside the field esky. Once back to the accommodation samples were put into the freezer until they could be placed in the Manjimup Entomology laboratory freezer awaiting sorting.

A sweep net full of the samples collected.

Passive capture techniques

UV light traps

Using a light trap is a passive capture technique to collect nocturnal species attracted to UV light. The best time to set up a capture is when the moon is wanning, as this limits potential competition. The trap was set up in the centre of the trial plot, usually with little vegetation to maximise light attraction. The minimum night temperature will also affect the collection size, with the optimum temperature being above 12°C. Forest Check sample period occurred over a 12-hour time limit from 6pm til 6am for three separate site collections.

The UV light trap was set up according to the outlines made in the *Monitoring biodiversity in the South-West forests: Concept plan* (2006). A UV light trap consists of the following materials, a 12v battery, a bucket with mesh whole in middle for water drainage, a funnel lid, a UV light with clear plastic vanes, ocky strap, and a timer. The timer has been placed inside poly piping to protect it form water damage if it should rain. There is also a thermometer placed in the area around the trap, out of direct sunlight to record the minimum and maximum temperature for the day.

Setting up a trap means that all the materials mention above are carried to the site. The bucket is placed down and secured in place by using rocks or fallen limbs to hold it in place. The Bug kill was then deposited in the bucket with the funnel lid place on top. The UV light and vanes are then opened up and secured in place on top of the funnel with the ocky strap. Then the light and the timer where attached to the battery. Once that is done then the timer is set and used to check wether the UV light is working. The trap was left over night.

The next morning we would arrive back on site and collect all the samples in the bucket. They were placed in a paper bag with the site number, date, minimum temperature and any other observations recorded. Any samples that were sitting on the ground around the bucket had their number recorded and left alone. The samples were then taken back to the car and placed inside the esky.

If the trap was to be left set up for next capture we then disconnected the battery from the UV light and timer and placed the bug kill in a sealed bag. We would deconstruct the UV light and fold it up and leave it next to the battery. After the final capture all components were disconnected and carried back to the car.

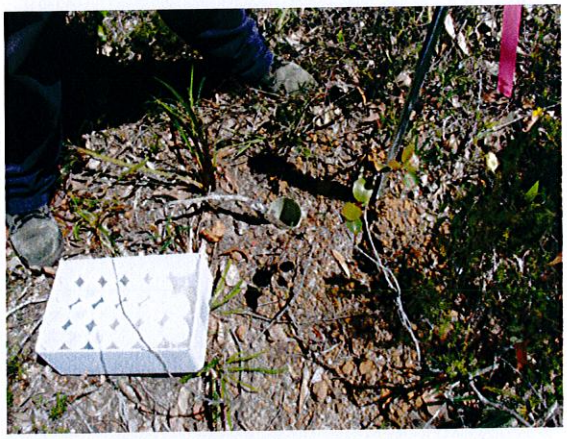
What a set up light trap looks like
(Image sourced from http://www.leptraps.com/images/01about/07-lt12Vdc15watt.jpg)

Pitfall traps

Having permanent pitfall traps meant that we only had to set the traps up and not have to do the hard work of digging the holes. All of the holes were PVC lined and uncapped, with escape pathways (branches) in each. The pitfall traps were located diagonally across the site with 5 located either side of the light trap, which acted as the central point.

The most efficient way to open up the traps was to start at the top of the line and work our way down, to ensure that no trap was forgotten. A second check that we had in place was to count out the exact number of solo cups required to set the line and only take them with us. We then proceeded to walk down the line removing the escape branch, as well as any build up of litter from the base of the hole. This is to ensure that no creatures are living below the cup and so that the cup sits flush with the ground. Once enough vegetation had been removed a 90mm solo cup was placed in the ground which then had 120ml of propylene glycol was squirted in with a drenching gun. If any vegetation or debris was hanging over the cup it was moved away so that it could not provide a corridor over the pitfall trap. The traps were left for 10 days before we cam back to collect the samples.

Sample collection followed the same process as set by starting from the top and working our way down the line. The solo cup was collect, and then the Solo cup was emptied into a sieve so that large vertebrates could be placed inside. This also meant that leaf matter could be excluded; providing it was evident no vertebrates were attached. The material in the sieve was then turned into a funnel over a large specimen jar. More propylene glycol was then squirted over the sieve to move the samples further down until the sieve and funnel were clean. This meant that more then one-sample jar per pitfall could be required. Each jar received an internal label not with site number, pitfall number as well as the date. Before leaving each pitfall trap an escape branch had to be placed into PVC hole to ensure there was no accidental by catch.



An example of a correctly closed pitfall trap

Pheromone traps

The traps had been previously set for a long term monitoring program for gum leaf skeletoniser population watch. These traps were set up for just under a year period to observe when the maximum density of gum leaf skeletoniser moth occurred. This project is not part of the Forest Check Collie 2011 sample however due to time availability I was able to help collect these traps.

Trap collection consisted of driving to the site and unclipping the freestanding pole and trap from the site. All traps were left intact and labelled with date and site number. Once all traps were collected they were transported back to the entomology lab to be processed. Once in the lab we proceeded to count the number of target species present and the number of non-target species. The sticky plates where then removed form the trap, labelled with site number and date then wrapped up in glad wrap before being stored in the freezer. None of the final plates were photographed as they were all in poor condition.

1) Image of the Desire Pheromone trap. 2) Photographic record for the plate of the trap. 3) The inside of a trap before being removed for storage.

Sample sorting

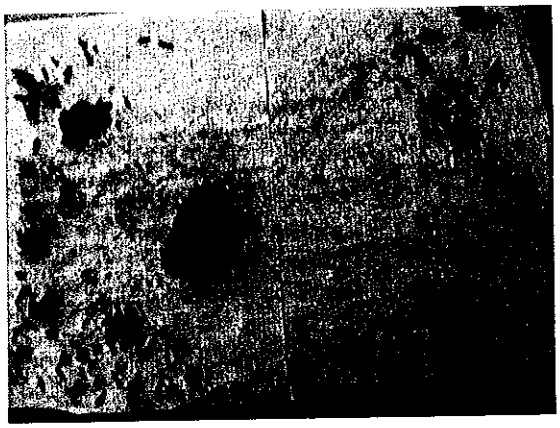
For the purpose of Forest Check the Manjimup Entomology department decided upon a minimum size limitation on the invertebrate samples. All samples must be 1cm or bigger, unless they are a Gondwana link species. This has been done due to the sheer number of invertebrates collected and for efficiency of the sorting. The program also has a safety net for unidentifiable moths that meet the size limitations; they are classified as 1172. This is done so that the biomass of the sample can remain relevant even if identification is not possible due to poor sample condition.

UV Light sample sort

When samples are sorted for Forest Check or Walpole Fire Mosaic (WFM) they are done so by comparing previously caught known voucher specimens against the new sample. The first step is to take out your frozen sample and let it start to defrost. Then the voucher boxes are removed from their storage room, and displayed them around the laboratory. Specimens from the same family are placed together making it easer to distinguish specimens. Once the library was

opened it was suggested that I walk around and look at some of the similarities and differences between each of the boxes. This helped to provide a point of reference later on in the sort.

Once a sample was selected we then record the site location, date, minimum temperature onto the specific Forrest Check paper work. There was also a back up list on the white board, which provided a running checklist of sites that had been sorted. After marking off the sample site and filling in the paperwork we would then empty out the defrosted sample onto a sheet of grid paper. The mass of Lepidoptera were then separated out into smaller groups with similar features, such as size, wing shape, and colour. All other species of invertebrates were grouped together based on similar characteristics. All specimens of size would be moved to the out margins of the paper, with the excess to stay in the centre (Refer picture below). This process meant that we could collect the specimens that were appropriate and of size to Forest Check study and could ignore non-relevant specimens. Once the sort was deemed to be closed we would start the process of identification.



A sample after the first initial sort, the largest pile is the ignored material.

Identifying specimens was simply done by comparing one sample to the other voucher specimens. Once a specimen had been identified the number of the voucher was recorded as well as the abundance in the sample. If there are already four P2s then the specimen was moved to the centre of the sort. If there was not four P2 and the specimen was in good condition then it would be erected as a P2. If the specimen could not be identified then it would be erected at a new voucher.

Once all the samples had been identified they would then be placed back inside their labelled paper bag and placed into a drying oven, which was set at 80°C. The sample were left inside for two to three days before being removed and all the FC samples being placed together into a large plastic labelled bag. They were then moved into the storage room.

Erecting a new voucher

When a specimen could not be found within the vouchers a new specimen was created. This was only done when the specimen was in a good condition or had a very distinguishing attribute that would make it easily recognisable. This was also done to any specimens that did not quite fit the normal criteria to another sample, as it could be the presence of another species. The idea of the voucher library is to have at least four P2's that way if the collection is split there are enough examples to remain. The P2's also helps to show variation within the collection.

To create a new voucher, a P1, you need to assign an identification number; this is easily done by looking up the last new species number. Once the number has been determined then you can create a label for the specimen. The paperwork cannot be forgotten. On the New species sheet the size of the specimen, the colour, the family if known any possible affiliations, site number and date are to be recorded. The new specimen is also written into the site sheet as well as its status as a P1 or P2 so that if someone wanted to find it they would know to search through the voucher boxes not in the FC Collie 2011 samples.

The new voucher, wether P1 or P2 was then placed into the new voucher box for confirmation that it is not in the collection or the suggested number. It was also separated for a photograph for the lab book.

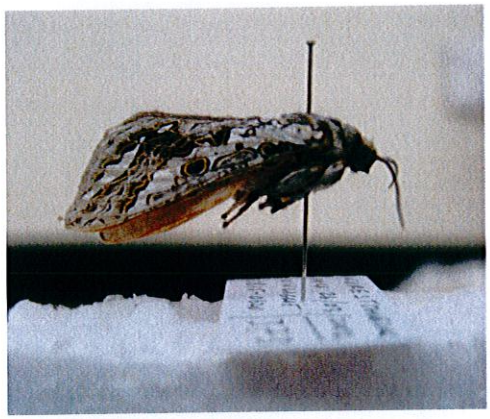


Image of an Abantiades hydrographus

Voucher labelling order

For both Forest Check and Walpole Fire Mosaic the following label order must be carried out, site number, date of collection, how specimen collected, specimen status (i.e. p1 or p2) and voucher number. All FC are written in black while WFM are all in blue for easy and quick identification as to site location.

Personal Safety in the Field

Scheduled calls

Calls were made to Collie office upon arrival to site each trip, detailing our current location, the planned travel route and estimated end time. At the end of each day a secondary call was placed to inform about our exit form the site as well as our route of travel. Kensington branch also had our departure times and dates for the time of the collection and were informed of our movements.

Personal Protective Equipment (PPE)

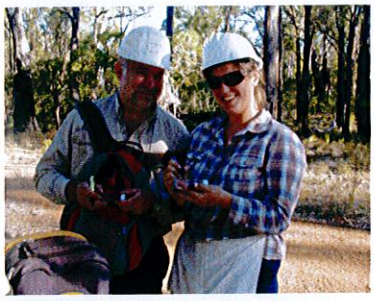
PPE for the program included long sleeved shirts and trousers to protect against scratches from the bush as well as tick bites and sunburn. Steel capped boots or hiking boots due to walking over undulating surfaces where a must. Hard helmets were worn in case of falling limbs, with the option of safety or sunglasses to protect eyes. PPE also included the availability of sunscreen and insect repellent as well as after bite treatments such as stingos. In each car there was a complete and comprehensive first aid kit, as well as a smaller first aid kit contained within a back pack when site were located further away from the car.

Stag trees

Instructed how to identify stag trees within the sites for my own protection from falling limbs. If the site was known to be of risk then was informed of the site conditions. To identify a stag tree you look around the ground of a tree for previously fallen limbs around its base. If the limbs have bark and are hollow it is likely that the whole tree has damage and is potentially unsafe. Work under such trees was to be limited in time.

Handling moth samples

In order to stop the specimens flying out of the UV light trap an insecticide was placed inside the bucket, a commercial product known as Bug kill. The active ingredient in this product is dichlorous, a low level carcinogenic. This meant that extreme care was taken when handling the product. Handling was only done so with gloves and a mask to protect from breathing in the fumes. This problem did not go away at the end of the collection, which meant that all containers of bug kill had to be accounted for as well as stored adequately so as not create accidental deaths.



Allan and myself labelling our active catches if full PPE.

Environmental protection

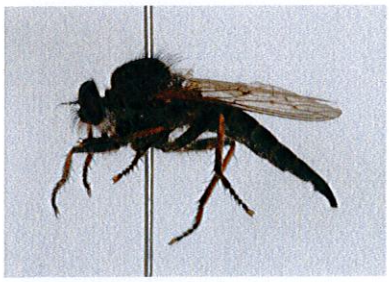
Travel through disease protected area

Phytophthora cinnamomi (PC) or dieback is a wide spread management problem particularly in the south west of Western Australia. Its presence in the area has made management of the unaffected areas a top priority for authorities, to minimise further contamination. The problem with PC is that it can be spread by root-to-root contact with a host plant, dispersal of zoospores in water or through animal or human movement of soils (Stukely 2008).

Travel through dieback areas or areas susceptible to disease are restricted at all times by DEC regulations. All of these sites contain signs to inform the driver of restricted access to the area. This warns the driver about the potential risk of travelling through the area and the precautions that must be made to protect the flora and fauna, such as sticking to the road. In this area it is extremely important that the rules and regulations for travel are adhered to as these are in place to protect the interest of the environment and potentially local agriculture. To travel into these areas the entomology department had to inform the DEC department as well as seek approval to travel into these high-risk areas. They receive a permit to inform anyone that they do indeed have permission to be in this area. If it had rained during the fieldwork we would not have been able to travel to the sites due to the increased risk of spreading PC.

Propylene glycol

At DEC the department have in place regulations that ban the usage of ethylene glycol in pitfall traps to be changed to Propylene glycol. This change has been brought about due to a number of reasons. One is the change to propylene has been to reduce the accidental by catch of vertebrates (particularly honey possums); this is an unfortunate common side effect of pitfall traps which researchers are trying to reduce. Another reason behind the change is for the preservation of DNA for further studies. It has been determined that the propylene is less destructive to DNA of the specimens, meaning they are better preserved for future studies if required.



Photograph of an Asilidae

What I gained from my experiences

During my work experience I learnt how to correctly set up a UV light trap to ensure the preservation of the samples. I had the opportunity to put into perspective the importance of labelling and note taking and to have safety checks placed with all data so it can never be lost.

In the laboratory I learnt how to create a voucher specimen for the catalogue as well as how to pin a sample for the FC catalogue. I learnt about unique Australian species as well as characteristics that distinguish them from everything else. I also had the opportunity to enjoy the visual display of a current voucher catalogue system.

Below are four different specimens of Melononthinae, I discovered that the only way to distinguish between members of the family it to put them under the microscope and look for difference in their head hair patterns.

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All images, unless otherwise stated courtesy of Dr. Janet Farr.