UnderStories

Winter 2012 Number 58

Promoting, preserving, protecting and rehabilitating native vegetation

Coordinator's Report

What a busy autumn it has been. The Understorey Network's main project over the passed two years, working on forty-spotted pardalote habitat is due to finish up at the end of June, and over the past few months we have been working hard with landholders and Conservation Volunteers Australia teams to plant over two thousand natives (mostly white gums). Part of this project has also included the establishment of a long-term trial examining ways of encouraging natural regeneration of white gum woodland. This is progressing well, with the first little eucalypt seedlings starting to pop out of the ground.

We are fortunate that as one project finishes another one starts, with the recent announcement of the Australian Government's Biodiversity Fund, which is part of the Clean Energy Futures Plan. NRM South will be leading a project continuing to revegetate threatened species habitat on Bruny Island and we will have plenty of trees to grow for that. The Understorey Network was also successful in receiving funding for a project that will support our growers' scheme for two years, and includes seed collecting and propagation workshops around the state – watch this space...

Thank you to everyone who grew plants as part of the growers' scheme this year. Unfortunately many people reported poor results (I think due mainly to the potting mix used). It is great to get your feedback so we can make improvements. A big thank you to everyone who grew plants to help with fundraising at the Tolosa nursery. We have had some very successful plant sales and still have plenty left over. We will be having another sale day in July and plants are also available for sale every Monday (except public holidays) between 10am and 1pm.

I would also like to thank all the members who have helped out on our stalls and displays over the past few months, including the Penguin Organic and Sustainable Living Festival, a Salamanca Market Stall, Treadlightly Envirofest and Agfest. It is a great strength of our organisation to have such wonderful support.

You will find membership renewal forms included with this edition of Understories, please post or email these in, even if you renew using direct deposit. For new members, if you have joined since the 1st of January, you do not need to renew this year. Growers' Scheme registrations are also included, so I look forward to receiving your requests for plants or seeds or offers of help. We already have some great projects to grow for, including threatened species habitat on North Bruny Island and a project restoring landscape function and reinstatement of connectivity within lowland grazing areas of the Derwent Valley and Southern Midlands.

All the best.

Oliver Strutt
Coordinator

Inside this issue

Germination of native plants: the science and experiences of the Tasmanian Seed bank

James Wood is the seed bank manager of the Royal Tasmanian Botanical Gardens. He has worked in seed conservation for 22 years, initially working at the seed bank program of the Royal Botanic Gardens Kew and then moving to Hobart in 2006. He has been involved in germination studies for over 16 years finding it fascinating, frustrating and fun.

This article continues in the next Understories edition.

Most people interested in propagating of native plants can be frustrated by the difficulty that some seeds present. Whether it is for horticulture or conservation programs many plants are routinely dealt with through vegetative propagation, but this poses problems. For the horticulturist it severely impairs selective breeding for better forms. For the conservationist it poses the serious problem of diminishing or skewing the gene pool of material used for re-introduction or restoration purposes.

I work in the field of seed conservation at the seed bank of the Royal Tasmanian Botanical Gardens. The aim of seed bank programs is to safeguard the genetic diversity of wild plant populations by holding seed collections in long-term, sub-zero storage. When collecting we try to ensure we get good genetic sampling. In the laboratory we make sure that this diversity isn't skewed by the cleaning process, that the seeds we hold are of high quality and that the viability is maintained once the collections enter storage. However all of this time and effort relies on the fact that we can eventually turn our seeds back into plants, and the cheapest and simplest means of doing that is to get the seeds to germinate. Unfortunately the germination of wild species is not that easy. This makes germination testing a very large part of the work carried out at a seed bank.

Germination testing at the seed bank

The Tasmanian seed bank opened in late 2005 and by the end of 2011 we had set-up over 3,560 tests on 830 collections. The tests we perform can run from as little as four weeks to as long two years, but a usual length of time is about 20 weeks. Germination trials are conducted on any collection which has greater than 500 seeds. These trials are performed in temperature and light controlled incubators. The seed bank currently has nine incubators with a set daily light period of 10 hours light, 14 hours dark. Six of these are running at constant temperatures from 5°C to 30°C, in 5 degree steps. The remaining three incubators are set to alternate temperatures, with the temperatures warmer during the light period and cooler during the dark period. The reason for configuring these alternating regimes will be discussed later in this article.

The seeds tested are sown onto the surface of a 1% Agar gel held in 9cm plastic petri dishes. We use this medium as it is relatively sterile, fairly cheap and hydration levels are easy to monitor and maintain. Additionally as the gel and dish are clear, germination is fairly easy to observe and record. Germination is recorded weekly on paper testing sheets and at the end of every test we cut test any remaining seeds to assess the quality.

Figure 1: Standard materials used in germination testing at the Tasmanian Seed Conservation Centre. Germination test sheets, seeds sown on Petri dishes of 1% Agar gel, seed packets, forceps and marker pens.

Why are wild species difficult to germinate?

People often experience problems trying to propagate native plants from seed. Germination is often very slow, sporadic, poor or even absent. It should be recognized that some failure is often due to seed quality. Some species can be very poor seed producers. For example in the last few years we have tried to make collections of montane daisy bush species but regularly find that most, if not all, of the seed produced is empty or aborted. The reasons for these failures are not well understood and are probably varied. The important thing to remember here is to cut-test a sample of your seed before sowing to check that you actually have viable seed.

But even with good healthy seed, germination can often fail. A failure of a healthy seed to germinate given water, air and nutrients is referred to as seed dormancy. Although frustrating, seed dormancy plays an important part in the life cycle of many plants. With some plants non-dormant seed is shed in vast quantities each year and the seeds germinate wherever they may land. Most of these seedlings will be doomed to failure as they try to grow in unsuitable conditions or try to compete with larger established plants. Small roots and tiny leaves struggle to find water, nutrient and light and so the seedling perishes. An alternative strategy is shed dormant seeds. These seeds will sit in the soil for several years monitoring the conditions around them and waiting for environmental clues that tell them that competition is low and the chances of establishment are high.

For species bearing dormant seed this behavior allows them to develop semi-persistent, soil seed banks. In some habitats the seed sits in the soil for several years waiting for a disturbance event to remove competition (like a bush fire, for example)

The success in germinating seeds here at the Tasmanian Seed Conservation Centre is fairly similar to other seed bank programs. About 40% of the material collected in our program is very straightforward. These are mostly non-dormant collections, meaning the seeds germinate readily and usually under a wide range of temperatures. The other component of this easy, 40% fraction is hard-seeded (Physically Dormant) collections. An additional 15% of collections are slightly tricky to germinate and require 1-3 months of pre-conditioning to induce germination. The remaining 45% of collections are very dormant and pose significant problems.

In their studies seed scientists categorize dormancies in a variety of ways. To explain some of the most commonly encountered problems I'm going to review the three most commonly researched dormancy types.

Physical Dormancy

These are the "hard-seeded" species, where the seed coat stops the uptake of water and so prevents germination. Physically Dormant seeds will be familiar to us all, with common examples like *Acacia* and native peas. Here the seed coat needs to be cracked (typically using hot water) prior to sowing. Unlike the other dormancy traits, Physical Dormancy is very strongly correlated with taxonomy and is common in plant families like Mimosaceae, Fabaceae, Caesalpinaceae, Malvaceae, Convolvulaceae and Rhamnaceae. This is not to say all members of these families are Physically Dormant, just that it's more often the case. For example *Acacia* species are typically hard-seeded however *Acacia harpophylla* (Queensland/NSW) is not. The term "hard-seeded" is commonly used to refer to Physically Dormant seeds, but the colloquial term is a bit deceptive. Seed coats do not necessarily have to be "hard" to be water repellant. The small seeds of *Pomaderris* and *Spyridium* species have rather soft, leathery coats but these are impenetrable to water. Tests conducted at the Tasmanian Seed bank have shown that without treatments to crack the coat, 0-10% germination is a typical response, however with coat-cracking germination responses of 70-100% are achievable.

People often associate hard-seededness with seeds having thick, woody coats. It would seem natural to assume that thick stone fruited species would benefit from scarification, but this doesn't appear to be true. Some thick coats or covering can slow the uptake of water but they do not pose a serious barrier to water getting in or, for that matter, the seed getting out. Stones can benefit from an overnight soak in water to improve imbibition but ultimately making sure they have good contact with the germination medium is crucial for water uptake. This may go some way to explain the old gardener's tips of planting larger seeds deeper into the pot.

Cracking Physical Dormancy

The classic treatment for cracking Physical Dormancy for home practitioners is placing the seeds in boiling or near boiling water. In seed banks we typically remove Physical Dormancy for thinner coated species by chipping the seed coat under a dissection microscope with a scalpel. For thick coated species like some Acacia's we use needle files and abrade a groove in the coat until we hit the storage tissue. Such techniques are obviously time consuming and not practical for large seed quantities but for research purposes they are useful as they can be applied in a controlled fashion.

Recently we have started trialing heat shock treatments. This is done by placing seed samples in a monolayer in a small Aluminium foil envelope and then sandwiching the envelope between two metal trays of dry sand pre-heated to a set temperature. Through a series of trials we have found that heating *Pomaderris* seeds to 120°C for 10 minutes was guaranteed to alleviate physical dormancy. Interestingly however when we conducted this regime on a selection of legume species, with larger seeds, we actually killed the seeds. The message here then, is one single treatment cannot be expected work well for all species.

Morphological and Physiological Dormancy

The seeds that pose the most challenge to germinate are more than likely exhibiting what scientists refer to as Morphological Dormancy and/or Physiological Dormancy. A Morphological Dormancy is where the embryo actually matures within the seed after dispersal. This process can often take one or two seasons to take place before the embryo has developed enough to initiate germination. Physiological Dormancy is a dormancy where environmental conditions can either prime and/or trigger the germination event. For Morphological Dormancy to be resolved the seed must be imbibed (i.e. it has taken up water) as this is a growth process. For Physiological Dormancy the case is less clear but most of the processes currently identified require the seed to have taken up water and therefore be metabolically active.

Many people propagating from seed will be familiar with seeds possessing a Physiological Dormancy even if the term is new. Common examples are seeds that germinate in the Spring, but only if sown the Autumn and allowed to experience a Winter chill. The exposure of low temperatures for several weeks reduces the dormancy level in the seed so that as soon as temperatures rise (in the Spring) germination takes place. Such behavior is frequent in plants from the cold temperate regions of the Northern Hemisphere and also montane habitats around the world.

Unlike Physical Dormancy, Morphological and Physiological Dormancy are far more plastic and don't have a strong correlation to taxonomy. The depth and level of expression is also flexible and within a single species it can vary across that species distribution, but it can also be impacted by local climatic condition. This means that the dormancy level of seeds collected from a single population of a species in different years can be quite different.

Double trouble

Nature being what it is dormancy types can also occur in combination. The combination of morphological and physiological dormancies (referred to as Morpho-physiological Dormancy) is not uncommon. Typically the embryo develops over one season and the embryo then initiates a Physiological dormancy and a second season then removes this barrier and germination can commence. Physically dormant seed can also possess Physiological dormancy. In these cases the seed coat needs to crack to allow water in, but germination is delayed until the seed senses that environmental conditions are right. A few of our montane legumes show this combination but it is also very common in some of our native *Pomaderris*.

Although scientists are keen to understand the nature of seed dormancy, for most practitioners knowing whether your seed possess Morphological, Physiological or Morphophysiological Dormancy is fairly esoteric. The important thing here is that unlike Physical Dormancy water can enter your seed readily, but germination will not take place unless the seed receives a specific environmental trigger or a series of environmental triggers.

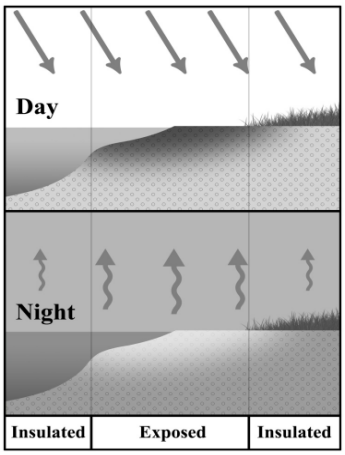
Why do seeds have dormancy?

For those keen to cultivate plants seed dormancy can seem like an unnecessary hurdle imposed by the plant that impedes progress. From the plants point of view however seed dormancy can be an extremely successful survival strategy. Consider for a moment the properties of a seed and those of a seedling. Typically a seed is tolerant of desiccation, has a low metabolic rate, good food reserves and hence no demand for light or nutrients. In contrast the typical seedling has no tolerance to desiccation and diminishing food reserves, balanced against tiny leaves to capture light and a rudimentary root system to supply moisture and nutrients for growth. Clearly the process of germination moves the plants from the robust form of the seed to the vulnerable form of the seedling. Germination therefore is a gamble and it's perhaps no surprise the plants have developed strategies to ensure that the seedling has the best chance of establishing.

In non-dormant species seeds will germinate wherever they land and tiny seedlings will have to compete with large established plants if they land amongst established vegetation, or if they luckily land in an open spot, hope that the surface soil moisture lasts long enough for them to establish a deeper root system. Thousand of seedlings will emerge within weeks of dispersal from the parent plant and only to perish.

Dormancy is an attempt to avoid this waste. The plants try to ensure that germination only takes place at the right time and they do this in a variety of extraordinary ways.

Avoiding the competition



There are two common mechanisms that seeds use to avoid germinating in the presence of larger, established plants and both exploit changes in the soil environment that the presence or absence of plants create. The first uses daily changes in soil temperature. Where vegetation is well established the soil surface is insulated from warming by the sun and from cooling at night. Where the soil is exposed however, the soil is heated by the sun during the day and cools at night, particularly so in the top centimeter or so. Research has shown that temperature fluctuation of over 10°C each day is often critical for germination for many species. Large temperature fluctuations may be particularly important for small seeds as this can used to discern whether they are close to the soil surface even though they may not be exposed to light.

Figure 2. Soil temperature fluctuations. Arable field weeds and aquatic plants often respond to fluctuating soil temperatures to ensure that they germinate in open soil or (in aquatic plants) shallow water.

Another change in the soil created by the absence of actively growing plants is an increase in soil nitrate levels. Nitrate availability is crucial for the growth of plants and within established vegetation uptake is usually high, so free nitrate in the soil will be low. Removal or loss of vegetation will often allow for a build up free nitrate from organic breakdown and other inputs. A number of plant species, particularly small seeded disturbance site herbs or ephemeral weeds, are sensitive to the presence of nitrate and this can be another big stimulant to germination.

At the seed bank we simulate these requirements in two ways. Fluctuating temperatures are created using programmable incubators that alternate temperatures on a daily cycle. The presence of nitrate is simply a matter of adding a tiny amount (0.101g in a litre of water) to our Agar dishes. Note that both of these requirements are adequately met when sowing seeds in a standard seed mix and placing outdoors or under glass. As these requirement are typically met in the natural environment we don't technically describe these traits as dormancy mechanisms. But it's useful to bear in mind that if you place your seeds in a location that actually dampens temperature fluctuations you may reduce seed germination.

In Australia's fire dominated environment it's not surprising to find many seeds that exploit the opportunities presented after a fire. A blackened soil with a fertile ash obviously provides nitrate and fluctuating temperatures. The fire event itself can also be a primer. One simple primer is the cracking of hard-seeded species by the high temperatures and this explains the rapid flush of native peas and Acacia's that follow the first good rains after a fire.

To be continued next edition….

James Wood

The USN is on Facebook

The Understorey Network now has its own Facebook page so if you would like to know what is planned in the way of workshops, field days, etc. then all you have to do is "search" for "Understorey Network" and our page will magically appear. It can also act as a conduit for discussion, for example, how your plants are growing (or not), problems you might have with propagation, taking cuttings, etc. You do need to be a member of Facebook to be able to access the discussion page or make a comment. It is easy to sign up with Facebook if you so wish.

It would be good if you could "like" us. I am told that as we are an organisation we cannot have 'friends' but I'm not sure this is true. If anyone out there could tell me if this is really so and if not how to rectify it I'd be grateful.

Please email me, Anne Griffiths, at brianneg1@bigpond.com

Anne Griffiths

Propagation Pointers

Family Name: Thymelaeaceae	
Species Name: Pimelia nivea	
Common Name: Round-leaf rice flower or cotton bush Height 0.6m to 2m with 10 or more white to pinkish flowers at the end of main branches. Seed is in a fruit or drupe. Widespread plant endemic to Tasmania, common on rocky hillsides up to 1000m. A tough plant with tolerance of dry exposed areas. Will grow in clay to loam soils and in wet to dry areas.	
Seed treatment	A difficult plant to grow from seed. After collecting seed let it mature in its own fruit or drupe then clean seed from fruit and try planting Dec-Jan and don't expect germination until the following spring. Treating the seed with the smoke method before sowing could also help
Propagation notes	Cuttings should strike if planted March to May but roots may not appear until Sep-Oct
Seed sowing months	As explained sow Dec-Jan even try also April-May as most seed that comes from a drupe passes through a bird's digestive system and is distributed onto the ground during Nov-Dec. If using the smoke system treat the seed and sow at the time already explained.
Growers, if you have propagated this species and can further add to the information provided we would very much appreciate hearing from you. *Please email* Oliver@understorey-network.org.au	

Warner Wait

USN at Agfest 2012

Three busy days with lots of interest from the Agfest-goers in what we do, what we try to do, and how we do it. As usual the plant lists for the various Council regions were very popular, and as there were many people who want to revegetate their properties with Tasmanian plants we were able to market the USN very effectively (at least I hope so!). If the number of pamphlets we gave out is any indication, we should have an influx of new members. And again, it is the lure of the free, or at least cheap, plants that is the big drawcard.

We shared space with Tasmanian Land Care Association in their tent, and for this we are very grateful. We were able to hep each other during the busy times and Land Care and Understorey Network, with the Tasmanian Land Conservancy next door, was an excellent combination. Thank you to both those organisations for their help.

We look forward to being there again next year and will be looking for volunteers to help support our stand then. I can recommend it, it was fun.

Annie Griffiths

President's Report Winter 2012

This autumn has been a very busy time for the USN, achieving lots thanks to our coordinator and the very many volunteers who help so much. Our plants at the Tolosa nursery are looking good which contributed to our very successful plant sale in late March. We held our stall at Salamanca Markets, attended the Treadlightly Envirofest at the Hobart Botanical Gardens and also attended Agfest, sharing the Landcare tent. All stalls were successful and created lots of interest as well as gaining us some new members. Many thanks to our northern members who volunteered at Agfest.

Last month I went over to Bruny Island with Oliver and NRM South to have a look at the seed trials that have been set up. A great deal of work has been done, thanks to volunteers, in setting up several sites each one 10 meters square and each square being divided by 4 plots with a seed collecting tray in each plot. All these trial areas have had to be fenced against stock, wallabies and possums. The whole idea of the trial is to try and find ways of encouraging Eucalyptus viminalis to germinate and grow for the endangered Forty Spotted Pardalote that feeds from this particular Eucalypt.

This coming season the Understorey Network will be very busy with tree and shrub plantings on several different properties including Tinder Box and Bruny Island. This is fantastic as the main objective of the USN is to encourage people to collect seed from their local area as local plants appear to do so much better in their own area. We are always willing to help in seed collection and plant identification and once again encourage people to use local plants in shelter belts and for any degraded area that need more protection for both shelter and habitat.

We have been successful in obtaining another grant so we can continue on with our objectives and keep our full time coordinator. We are still looking for someone who can keep our Website up to date which would make it the most comprehensive site in Tasmania for plant details. We are always looking for close up photos of plants too so please send any you may have to the office.

I hope everyone has had a successful growing season and have heaps of healthy plants to plant out this winter. Please don't give up on your seed if they haven't germinated yet. I have experienced that seed sown last spring sometimes, depending on the species, won't germinate until the following year. So I wish you all well and good luck with your plantings.

Warner Wait

Tolosa Nursery Update

Even though I personally had a failure with my Banksia seeds , the nursery is heaving with healthy looking specimens just ready to plant out into your (or a friends) gardens. AND, what is more some of them are MY Callistemon! How about that?! So come on along to the nursery on a Monday and stock up for autumn plantings. There will also be another plant sale on July 21 for you working folk. Our willing volunteers are ready to help you pick and choose plants for your space.

I love working at the nursery with the plants (the people are quite nice too) and as a volunteer on the USN stall at the Treadlightly Festival I even got to meet a certain hero of mine, Peter Cundall. What a man! He was so entertaining I could have listened to him "chunter on" all day. It was a fitting reward for me so soon into my Understorey Network volunteer career.

So don't be shy and retiring, get on out there and volunteer, grow, plant or buy. Every little effort counts.

Bridget, Margaret, Anna & Sue with boxes of plants for you

Sue Sagewood

What's Happening

Please call the office on 6234 4286 or email oliver@understorey-network.org.au for more information or to RSVP for any of the workshops. Also check the website for the latest Calendar of Events.

White Gum Regeneration Trial Field Day (South)
The endangered forty-spotted pardalote depends on white gums for habitat. Lack of white gum regeneration is a concern for the survival of the species.
The Understorey Network, Kingborough Council and NRM South have established a long-term experiment on Murraryfield, North Bruny, to determine methods that encourage the regeneration of white gum woodland. This field day is an opportunity for people to come and look at the experiment and some of the early results, and to discuss management of native bush, restoration and revegetation of pardalote habitat.
When: Thursday 21st July 2012, 11:30am
Where: Murrayfield (North Bruny Island)

Native Plant Sale – Tolosa Nursery Fundraiser (South)
Come and choose from a wide variety of Tasmanian native plants in tubestock or 6 inch pots.
When: Saturday 21st July, 10:30am to 2pm
Where: Tolosa Nursery, Tolosa Park, Glenorchy

Annual General Meeting
Understorey Network AGM and presentation by guest speaker Dr Magali Wright on the role of mycorrhizal fungi in ecological restoration.
When: Saturday 8th September 2012
Where: Riverview Room, Royal Tasmanian Botanical Gardens, Hobart

Depot Day for Growers Scheme (South)
Collect your materials for the growing season + propagation workshop.
When: Saturday 6th October (Times to be advised in separate letter to growers)
Where: Tolosa Park, Glenorchy

Tolosa Nursery 5 Year Birthday Celebration (South)
Come and help celebrate the five year anniversary of the official opening of the Tolosa Community Nursery, with a free native plant, BBQ, music and more.
When: Saturday 20th October
Where: Tolosa Park, Glenorchy

Depot Day for Growers Scheme (North)
Collect your materials for the growing season + propagation workshop.
When: Saturday 3rd November (Times to be advised in separate letter to growers)
Where: Launceston (Location TBC)

Depot Day for Growers Scheme (North West)
Collect your materials for the growing season + propagation workshop.
When: Sunday 4th November (Times to be advised in separate letter to growers)
Where: Ulverstone (Location TBC)

Understorey Network Committee Meetings
When: The second Monday of every month, 5:15pm
Where: USN office, Level 1, 148 Elizabeth Street Hobart
All members are welcome to come to our regular meetings – please RSVP for catering purposes

Contact Details

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Visit our website and Plant Propagation Database:
www.understorey-network.org.au