


Trees on the Farm

Uses, Planning, Planting, Maintenance and Management

Great Lakes Council | Landcare Australia | Hunter - Central Rivers CMA Catchment Management Authority

Tree plantings- make the most of the potential

- Trees can make an important contribution to ecosystem processes that improve land productivity, for example nutrient and water cycling, erosion control
- Trees can provide a diversity of useful and potentially marketable yields
- Careful preparation and an integrated plan will help to make the most of the great potential offered by tree plantings

Trees are multifunctional

- Improved nutrient cycling
- Improved hydrology and water efficiency
- Erosion control
- Habitat, biodiversity and ecosystem services including pest and disease control
- Windbreaks- benefits for stock, pastures and crops
- Shade for stock
- Not least! Useful yield- timber, firewood, fruit, nuts, fodder

Synergies of function can be achieved with design

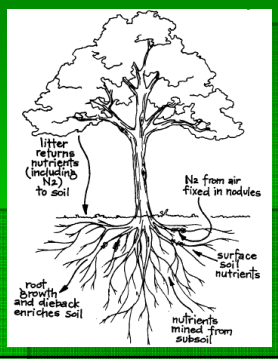
Nutrient Cycling

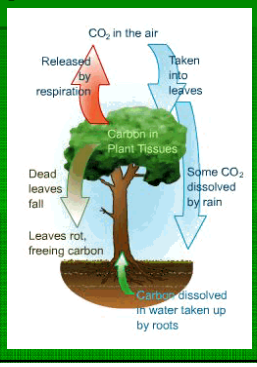
- Nutrients are the chemical compounds used by living things for energy, biomass production and life functions.
- Nutrients are required for growth, maintenance and reproduction
- In natural ecosystems, nutrients circulate between air, water, soil, plants, animals and microbes in a relatively 'closed' cycle
- Most agricultural systems are very 'open' with nutrient loss and export

Trees enhance nutrient cycling by:

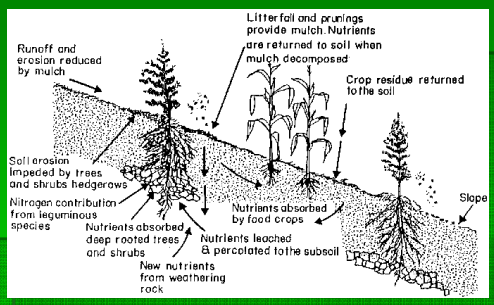
- Increased nitrogen input via biological nitrogen fixation by microbes associated with the roots of leguminous trees
- Enhanced availability of nutrients resulting from the production and decomposition of substantial amounts of tree biomass- substantial carbon fixation by photosynthesis
- Uptake and utilisation of nutrients in deeper layers of soil by deep rooted trees

Trees and the cycling of nutrients from the atmosphere





Nutrient cycling in alley systems



These principles are also applicable to pasture systems

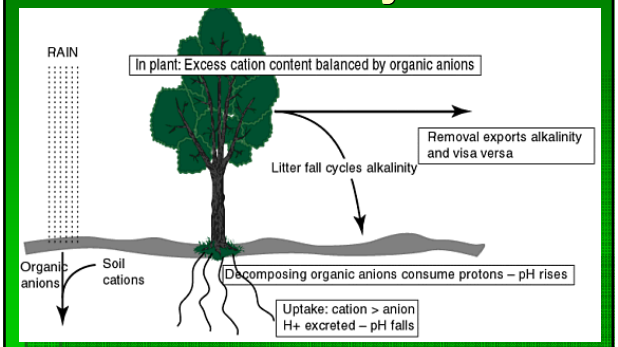
Trees help reduce soil acidity in high rainfall areas

- The most acidifying systems are those where large amounts of biomass are harvested and removed from the land, where the recycling of nutrients is inefficient and nitrate is allowed to leach from the soil, and where ammonium-based fertilisers are used.
- **Nutrient recycling**: trees will take up nutrients from deeper soil layers, some of which will be returned to the soil surface in litter. In this way, trees act as 'biological pumps', retrieving cations and – to a lesser extent anions previously leached from the surface soils;
- **Complexing of soluble cations**: soluble organic materials in leaf litter can complex cations such as calcium, iron and aluminium. This would increase their mobility in the soil and thereby affect soil-forming processes. Complexing of aluminium would also render it less toxic to plants;

Trees and soil acidity

- **Neutralising soil acidity**: the decomposition of organic anions (manufactured by the plant to balance the excess of mineral cations) in leaf litter will consume protons and raise pH at the surface layer of the soil; and
- **Effects on the nitrogen cycle**: the deeper rooting patterns of trees and shrubs and their perennial nature mean that they will capture more soil nitrate than crops and pastures, thereby reducing nitrate leaching – which is highly correlated with the rate of acidification.

Trees and soil acidity

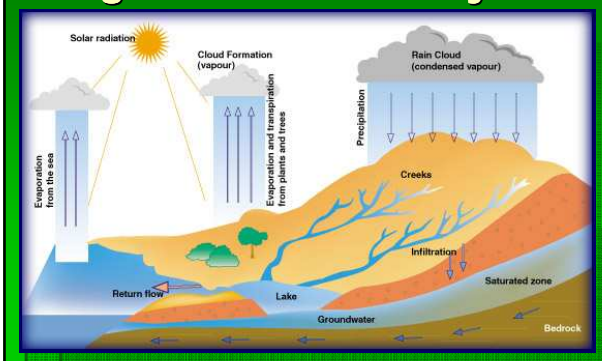


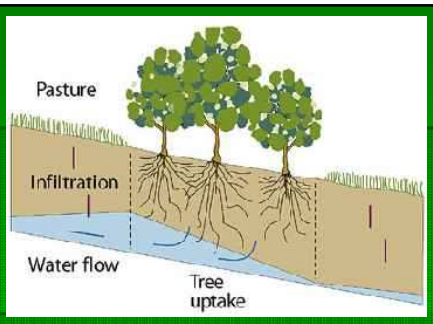
Soil acidity is less in treed areas than in cleared areas

Trees are important to the water cycle

- Recent research is confirming that tree loss is resulting in reduced rainfall.
- Trees can bring moisture up from deeper in the soil profile than can smaller plants
- Transpiration (water emitted to the air) from trees contributes to local rainfall
- Treed areas create a moist microclimate
- Trees reduce water loss and have a moderating effect on flood and drought conditions
- Trees filter runoff and improve water quality

Diagram of the water cycle





Trees can intercept water moving laterally across the landscape.

Trees are essential for ecosystem function

- Trees provide habitat and food for many species of birds, mammals and invertebrates
- Greater diversity of trees will support a greater diversity of animal species
- Trees play an important role in nutrient cycling
- Trees play an important role in the hydrological cycle

Diverse yield from diverse tree plantings

- Timber- hardwood and softwood, either marketed or on-site use
- Food: small scale provides fresh food for home consumption, larger scale can provide income
- Bush foods and grafted fruit and nut trees can be included in a diverse planting
- Fodder trees can provide a feed reserve, or can be alley cropped with pasture

Planning and preparation are essential for successful plantings

- Trees are a long term investment, living for decades or even centuries
- Relatively little extra effort and expense before and during planting will have long term benefits
- Soil preparation can have a big impact on survival and growth
- A planting plan in accordance with the whole picture of the property's functioning will maximise the benefits of the planting

Planning your tree planting

- Define the goals in the context of the whole farm
- Plan the sites which are to planted
- Plan the species to be planted in the context of desired outcomes
- Plan the composition of species within planting sites

Site considerations

- Priority sites may include streambanks, contour belts and fencelines
- Plantings will need to be consistent with stocking system, and new fences may be required to protect young plants
- Plantings that require higher maintenance or regular harvesting should be planned for easy regular access
- Consider prevailing winds and fire hazards

Species considerations

- Local provenance- true endemic species will generally provide better habitat benefits, and tend to be better adapted to locality
- Other native trees- perhaps chosen for bush tucker or other specific characteristics such as timber value
- Other food trees- whether for home consumption or commercial venture, there is potential to integrate with broader planting plan
- Fodder trees
- Nitrogen fixing leguminous trees- all of the above categories can include leguminous trees.

Species composition within a planting

- Consider the expected growth habit and size of tree species when planning spacing
- Plantings will tend to be in rows following the lines of aeration ripping- a staggered planting pattern between rows will make best use of space and create the best windbreak effect
- Solar access will become a limiting factor to growth as plantings mature- as a general rule, taller trees should be placed on the southern side of planting sites, and shorter trees and trees with higher light requirement on the northern side
- Fast growing, hardy trees can provide a windbreak for trees that require shelter

Species composition within a planting

- As a general rule, species should be well mixed- this will reduce competition between adjacent plantings and will tend to mimic natural forests
- A high proportion of nitrogen fixing leguminous trees (eg acacias) should be included and be well dispersed throughout the planting.
- Extra leguminous trees can be planted in between typical tree spacing as 'sacrifical' trees which can be progressively pruned back- this produces mulch and releases extra nitrogen and carbon to the soil as roots die back in response to pruning

Soil preparation

- Trees for revegetation are often planted into marginal soil
- Soils are often heavily compacted, impairing root development and reducing biological fertility
- It is common for significant nutrient deficiencies to be present

Reducing compaction

- Aeration ripping with a Yeomans Plow, Agrowplow or equivalent will improve biological fertility, reduce compaction, reduce acidity and make planting easier
- These plows lift and aerate the soil without inverting it, and soil profile is maintained
- Water infiltration is improved, especially with planned 'Keyline' cultivation
- Best results will be obtained if this is done well in advance of planting, ideally a full twelve months before.

Yeoman's plow and Agrowplow, showing coulter discs and aerator shanks

Maximising the benefit of aerator plows

- Plowing is best done well in advance of planting, effects on soil biology and pH will not be realised until there has been decent rain
- The pattern of cultivation should be on contour or using the Keyline pattern. This may not be possible if plantings are along existing roads or fencelines.
- If forced to go off contour, contour lines should be ploughed across at regular intervals to reduce erosion and water and nutrient loss.
- In the case of pastures and crops, the process should not be repeated too frequently: every 5 years is appropriate

The Keyline Pattern

- Keyline cultivation is one aspect of P. A . Yeoman's holistic soil and water management system outlined in 'The Keyline Plan' and subsequent publications
- In brief, Keyline cultivation is the use of an aerator plow in a pattern that is slightly off contour, running slightly downhill from the centre of valleys to the edge of ridges in the landscape.
- This pattern encourages water flow away from gullies and toward ridges, retaining more water in the soil and reducing erosion.

Soil fertility for trees

- It is advisable to analyse soil for any major deficiencies before starting a major planting
- Trees require a balanced supply of nutrients for healthy growth
- A good, balanced fertiliser applied at planting can have a significant impact on growth and survival.
- Be cautious with soluble salt-based fertilisers, which may damage soil microbes, deplete organic carbon and lock up soil minerals. This is particularly a problem for native trees, which are highly reliant on fungal biota.

The planting process

- Bear in mind the long term benefits of tree planting- extra care during planting is very worthwhile for long term benefits
- Competing grass needs to be removed with herbicide or deep mulching
- Holes must be larger and deeper than the pot. Smooth edges to the hole are best avoided.
- A balanced fertiliser is placed into the planting hole

The planting process

- Careful, gentle handling of the plants throughout is essential. They are living things and transplanting is very stressful to them.
- The root ball needs to be below the level of the surrounding soil, allowing a depression to hold water
- Water in with a liquid feed to reduce transplant stress. Kelp and kelp products are beneficial as they contain plant hormones, minerals and microbial food.
- A good soaking should be applied. Infrequent, deep watering encourages healthy root growth.

Mulching and protection

- Good mulching will reduce water loss and weed/grass competition
- Tree guards protect the young trees from wind and temperature extremes
- After watering in, place a weed mat around the tree, ensuring the mat slopes down to the trunk and channels water to the tree
- Next a tree guard is placed
- A thick application of dry mulch should be added around the outside of the guard