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# Species choice, sites and silviculture

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# Species: *A very important decision*

- Silviculture
- Products
- Unchangeable



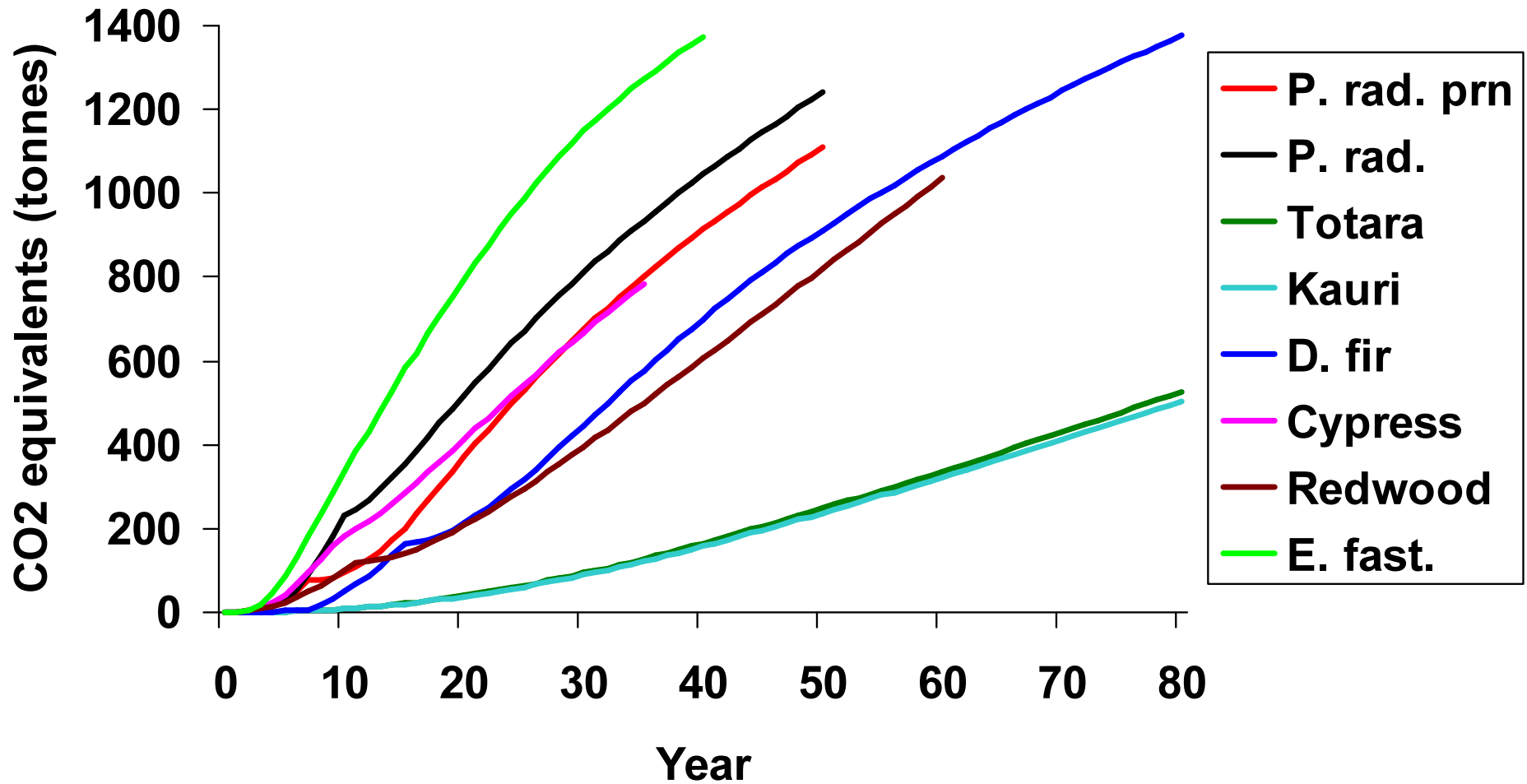
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# Factors affecting your choice

- Objectives of plantation
- Species available
- Site characteristics



# Carbon uptake varies with species



Source : Beets *et al.* (2008)

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# Considerations

- Markets
  - Site tolerances
  - Obvious disease limitations
    - Douglas-fir & *Phaeocryptopus*
    - *E. nitens* & *Paropsis* or *Kirramyces*
    - Exacerbated by poor siting
  - Uncertainty
    - Research investment on a species
    - Models
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# Site influences: Tree performance

- Two main factors
  - Rainfall
    - Distribution
  - Temperature
    - Extremes
- Other influences
  - Fertility
  - Exposure
  - Drainage
  - Snow
  - Salinity



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# Site influences: Feasibility

- Proximity to markets
  - Transport costs
- Infrastructure
  - Roothing
  - Slope
  - Current cover
- Constraints on harvesting
  - Terrain
  - Erosion
  - *On some sites harvest costs exceed log value*



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# Silviculture

- A programme of treatments is required to meet your objectives
    - Called a “silvicultural regime”
  - Regimes vary with
    - Objectives
    - Species
    - Sites
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# Regime

- Establishment
  - Site management
  - Planting
- Tending
  - Pruning
  - Thinning
- Intermediate treatments
  - Fertilisation
  - Protection
- Final crop stocking
- Rotation length



# Effects of thinning

- Reduced competition
  - Less mortality
- Greater diameter growth/tree
  - Increase in taper
- *Reduced* volume/ha
- Deeper crowns
- Crown expansion
- Increase in branch size
- Lower stiffness
- Pathogens
  - Thinning can either increase or decrease impacts



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# Effect of increasing stocking

- More rapid carbon accumulation/ha
  - Greater volume growth/ha
  - Lower volume/stem
    - May reduce value/m<sup>3</sup>
      - Especially for clearwood regimes
  - Smaller branches
  - Stiffer wood
    - Better for structural uses
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# Impacts of carbon credits

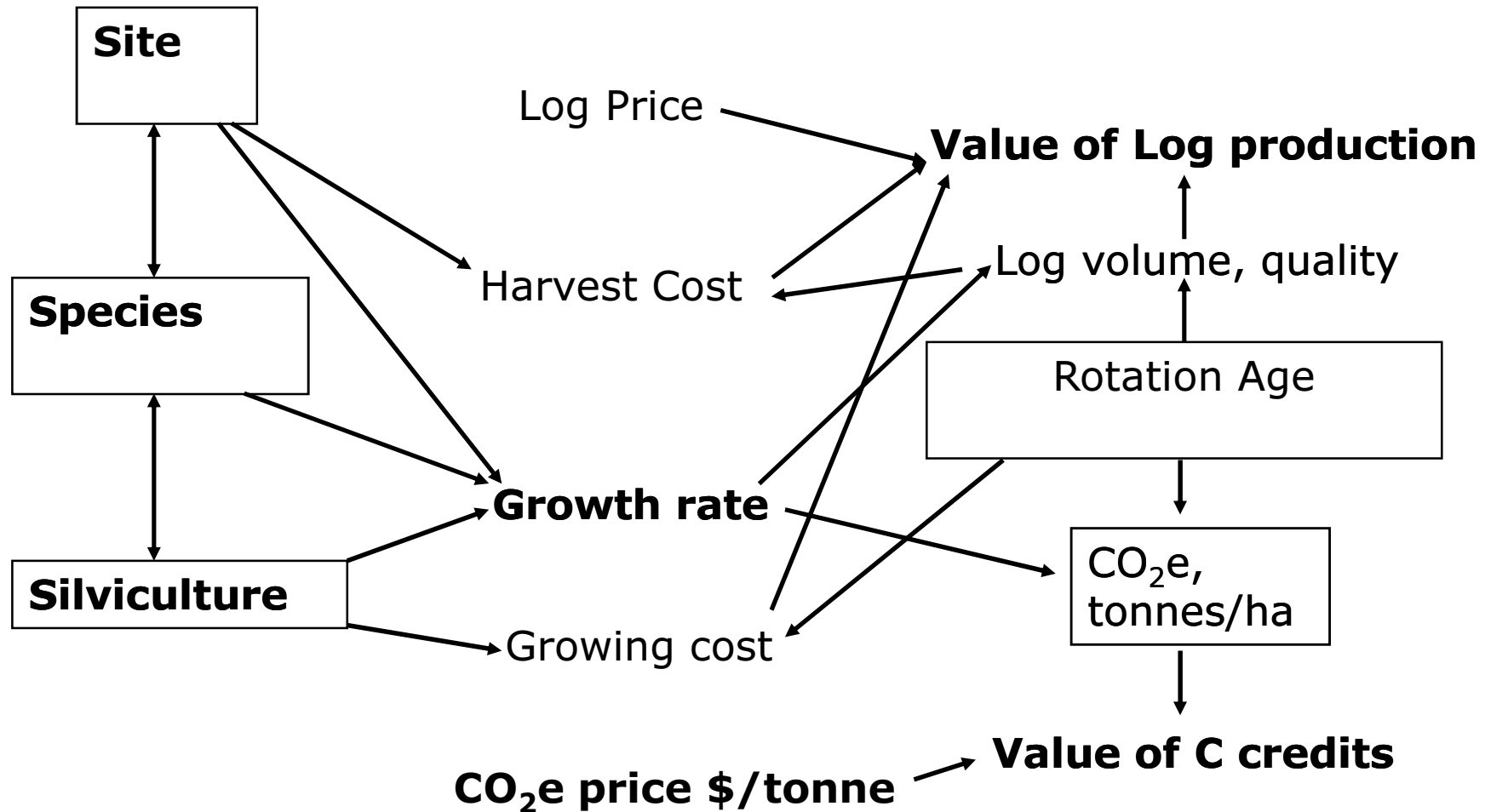
- Likely increase in stocking
  - Increase in optimum rotation length
  - Continuous cover forestry more desirable
    - PFSI
    - Small coupe harvesting
  - In some circumstances the crop may not be harvested
    - High value of carbon
    - Remote or inaccessible sites
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# Species choice, sites and silviculture

- Species, site and silviculture all interact
  - Need to clearly identify objectives
  - Profitable carbon forestry arises from
    - Growing the right species
    - on the right site
    - using the right silvicultural regime
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# Species, sites and silviculture influence value



# Example: Radiata pine

- Rapid growth
  - High C sequestration
- Short-lived
- Not suitable for continuous cover
- Can prosper on a wide range of sites
- Relatively disease-free
- Intensive silviculture required
  - Variety of uses and regimes
- Productivity and markets well characterised



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# Radiata pine

- Medium sites
  - Ex-farm
  - Quite productive
- Short-Medium Rotation (25-50 yrs)
- Versatile silviculture
  1. No thinning
  2. One thinning
  3. Pruning and one thinning



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# 1. Planting and no Thinning

- Pros
  - Cheap
  - Simple
- Cons
  - Risk of collapse
  - Long-term nature uncertain



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## 2. Framing Stands (One Waste Thinning)

- Pros
  - Relatively cheap
  - Well characterised
  - Market increasingly robust
- Cons
  - Whether can produce structural grades



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## 3. Pruned Stands (Pruning, One Waste Thinning)

- Pros
  - Market well known
  - High quality product
- Cons
  - Expensive
  - Risks
    - Poor quality control
    - Poor timing



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# Other species

4. **Douglas fir**
5. **Eucalyptus nitens**
6. **Redwood**
7. **Cypress**
8. **Regenerating native forest**



# Example: Douglas-fir

- Modest growth rates
  - High C eventually
- Long-lived
- Potential for continuous cover
  - Small coupe harvesting
- Good at high elevations
- Frost tender when young
- Very sensitive to drought
- Wind firm
- Less intensive silviculture
- Productivity and markets well characterised



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# Scenario: Douglas fir

- One waste thinning
- No pruning
- Framing & construction timber
- Medium-Long rotation
  - >40 years
- Pros
  - Good market
- Cons
  - Slow growth



## Example: *Eucalyptus*

- Rapid initial growth
  - High C sequestration
- Short-lived
- Not for continuous cover
- A range of sites
  - Species choice is critical
- **Disease prone**
  - Good site selection required
- Intensive silviculture
- Excellent structural wood
- **Productivity and market uncertain**



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# Scenario: *Eucalyptus nitens* (Shining gum)

- Pulpwood
  - No thinning
  - No pruning
- Short rotation
  - Rapid early growth
  - Maximum 25 years
- Pros
  - Cheap
  - Productive
- Cons
  - Risk of disease
  - Poor estimates of productivity



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# Example: Redwood

- Modest growth rates
  - High C eventually
  - **Productivity not well characterised**
- Long-lived
- Potential for continuous cover
  - Small coupes
- Sprouts from stumps
- **Very site specific**
  - Especially exposure and moisture
  - Good site selection is critical
- Largely disease free in NZ
- Intensive silviculture
- Excellent wood properties
- **Market uncertain**
  - Californian



# Example: Cypress

- Modest growth rates
  - High C eventually
  - **Productivity not well characterised**
- Short-lived
- Site specific
  - Especially exposure and moisture
  - Good site selection is critical
- **Cypress canker**
  - Cannot recommend macrocarpa anymore
  - *Lusitanica* less affected
- Intensive silviculture
  - Expensive pruning
- Excellent wood properties
- **Market reasonably robust**



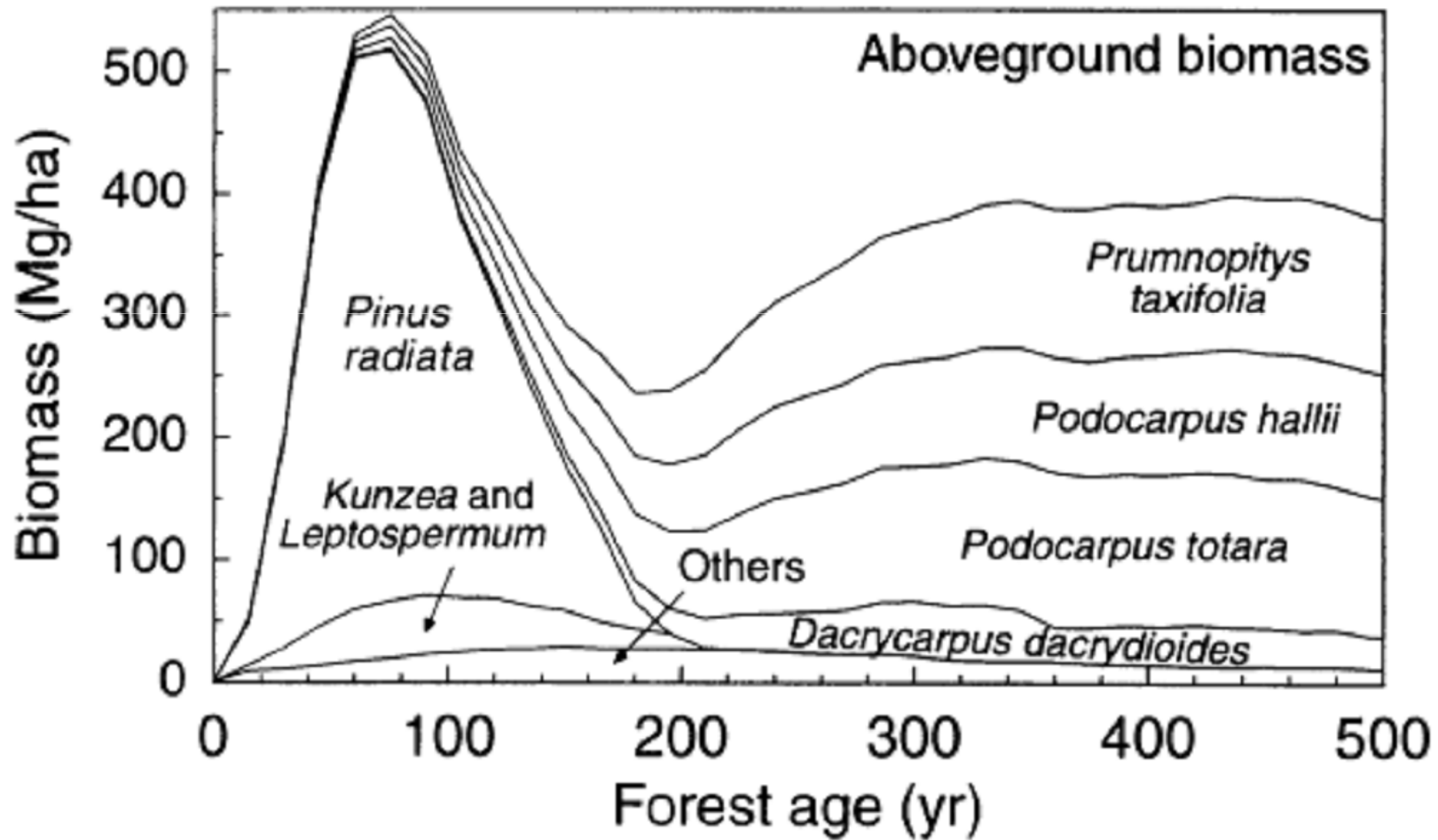
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# Scenario: Regenerate Native Species

- Permanent forest
  - Sustained harvest possible
- Relatively slow growth
  - Poorly characterised
- No planting cost
- Protection required
  - Domestic stock
  - Animal pests
  - Invasive plants
  - Fire



# Plantation forest regeneration with no harvesting



Site near Christchurch, elevation 7 m

Source : Hall (2001)

# What we know about species options

Species	Site specificity, risk	Market for wood	Ability to model for range of sites
Radiata pine	Flexible, elevation limit, wind risk	Well developed	Good
Douglas-fir	Flexible, sensitive to low moisture	Well developed	Reasonably good
Eucalypts	Quite site specific, pathogen risk	Uncertain in NZ, good in Australia	Limited
Redwood	Specific to moist, sheltered sites	Uncertain in NZ, good in California	Poor
Cypresses	Specific to moist, sheltered sites	Reasonably good	Poor
Native forest regeneration	Better on warm, moist sites	N/A	Not required

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# Making choices

- Identify objectives
- Gather information
  - Locally
    - Sites, Soils, Climate
  - Species' characteristics
  - Publications
  - Databases
- Decision support
  - Expert advice
  - Software
- Financial analysis

