Harvesting-silviculture interface with reference to manual and mechanised operations

Diana Rietz and Simon Ackerman
Harvesting-Silviculture Interface

- Closely related and affected by one another
- Technological advances have occurred in both sets of operations in SA

Opens up opportunities for improved efficiencies

1. Define challenges- opportunities
2. Determine causes
3. Consider solutions:
   - Short- (immediate), medium- and long-term
Challenges:
Challenges: Silviculture perspective due to harvesting:

- Residues and timber waste
  - Quantity – fire hazard
  - Distribution – physical impediment and compartment access

- Stump height
  - Mechanised ops: physical impediment and maintenance

- Stump coppice-ability
  - Mechanised ops stump damage

- Rutting and compaction

- Compartment accessibility
  - Steep compartments mech harvested
Challenges: Harvesting perspective due to silviculture:

- Orientation and “straightness” of tree lines
  - Mechanised ops: contour vs up-down slope straightness of rows

- Vegetation management/weeding
  - Mainly pre-harvest of sawtimber stands

- Spacing
  - Mechanised ops accessibility to compartment

- Non-uniform and coppiced stands
  - Efficiency of mechanised ops
Why do these challenges/opportunities exist?

Possible reasons:

• Management structures and focus
  • Separate management of harvesting and silviculture
  • Drive to lower costs within each operational area

• Outsourcing/contracting of operations

• Increased mechanisation of operations
  • Labour – ergonomics
  • Cost effective
  • Technological advances
  • Lack of flexibility

© ICFR 2013
Current responses to the challenges

Silviculture:
- Residues and timber waste - Burned
- Stumps - Cutting/Cut stumps low
- Stump coppice - Limit coppicing
- Rutting and compaction - Limit coppicing

Harvesting:
- Orientation and “straightness” of tree lines - Investigated
- Vegetation management - Compartment cleaning
- Spacing - Investigated
- Non-uniform and coppice stands - Limit
How can we create greater synergy between harvesting and silviculture?

By adjusting the current “modus operandi”: 

• Variety of operations employed within the industry
• Economics of any change in operations must be economically viable
• The implications of any change must be understood as fully as possible prior to embarking on that change

Other potential solutions
Harvesting opportunities:

Residues and utilisable timber waste.

Can we:

- Mulch/coarse mulch?
- Bio-energy production? (portable fast pyrolysis)
- Community collection of timber and large branches?
- Longer log lengths or optimised lengths?
- Better monitor and promote timber extraction?
- Own operations?
- Alteration of operations?
Harvesting opportunities:

Stumps

- Adapt operation/machinery to cut stumps lower?
- Perform pre-harvest under canopy burn?

Stump coppice-ability

- Machinery selection?
- Row width?

Rutting and compaction

- Timing of operations?
- Matching machinery to sites?
Silviculture opportunities:

Orientation and straightness of tree lines

- Improved planning/company policy?
- Implications on
  - Stand productivity and mechanised operations
  - Erosion and vegetation management
Silviculture opportunities:

Pre-harvest vegetation management (sawtimber)
- Leave residues from thinnings in sunlit areas?
- Keep forest floor intact (reduce undercanopy burning)?

Spacing (row widths)
- Optimised for operations?
- Implications for stand productivity and vegetation management?

Non-uniform and coppice stands
- Ensure better silviculture?
Silviculture (mechanised):

Seedling specifications

- Seedling size – optimal?
  - Number of seedlings per tray
  - Biodegradable inserts
  - Nursery requirements
  - Tray transport
- Seedlings vs cuttings?
- Diseases from damage in planting

Pit size and quality specifications

- Adjustment to hydrogel application

Residues and timber waste mgt

- Machinery adaptation?
What are the common denominators in these potential solutions?

1. Research
   - Future research priorities – integration of mechanised operations
   - Utilise current knowledge (mainly around manual operations)

2. Planning and communication
Planning: Determine the links between components of the *entire* supply chain

Five main components:

1. Research and development - Site-species matching, mill requirements etc.

2. Nursery – Seedling/cutting quality

3. Silviculture - Spacing, pruning, thinning, etc.

4. Harvesting - System selection, site conditions etc.

5. Transport – Distance to mill, transport type etc.

*Full* supply chain planning required

Many components affect one another
Planning example:

R&D
- Genetics

Nursery
- Plant quality

Silviculture
- Pre-plant ops
- Planting
- Tending
- Pruning

Harvesting
- Machine trails
- System selection
- Timing

Transport
- Distance
- Type

Growth+Yield
- Growth rate
- Tree size
- SPH

Site-species matching

Revisit how we plan and test implications
Conclusions

• Mechanised operations will become more prevalent

• Need to adapt/invent new systems originally designed for manual operations to that of mechanised systems

• Communicate

• Recognise that opportunities exist to reduce the delivered cost of wood – costs/tonne – implications for global competitiveness

• Ensure future wood supply by realising implications of changes on site productivity
ICFR/FESA collaboration:

- Industry survey complete – Publication in process
- Further interaction with key members in all companies and other researchers to determine research priorities
- Initiate research
- Decision support tool
Acknowledgements:

- Many company people

- Fellow researchers at the ICFR

© ICFR 2013