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NORWEGIAN INSTITUTE OF  
BIOECONOMY RESEARCH

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# A pedagogical interface for developing production management practices in Norwegian wood supply

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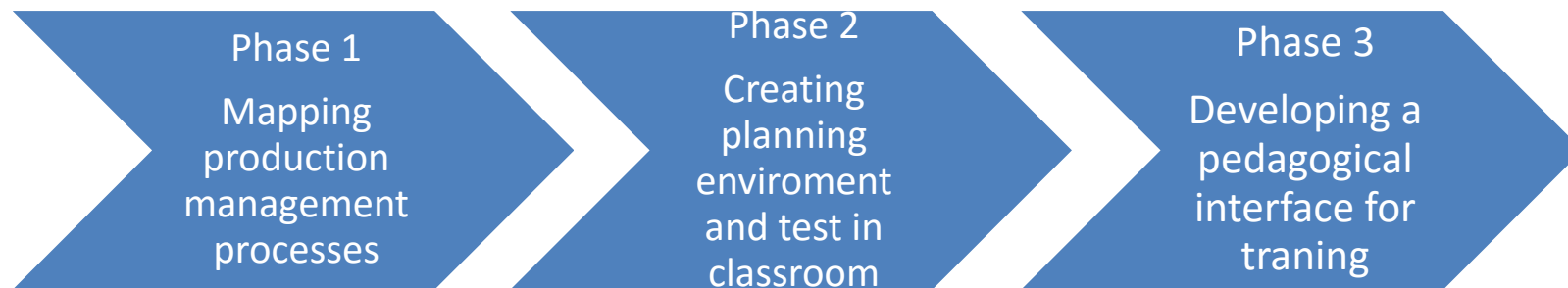
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Narve Opsahl - Nortømmer

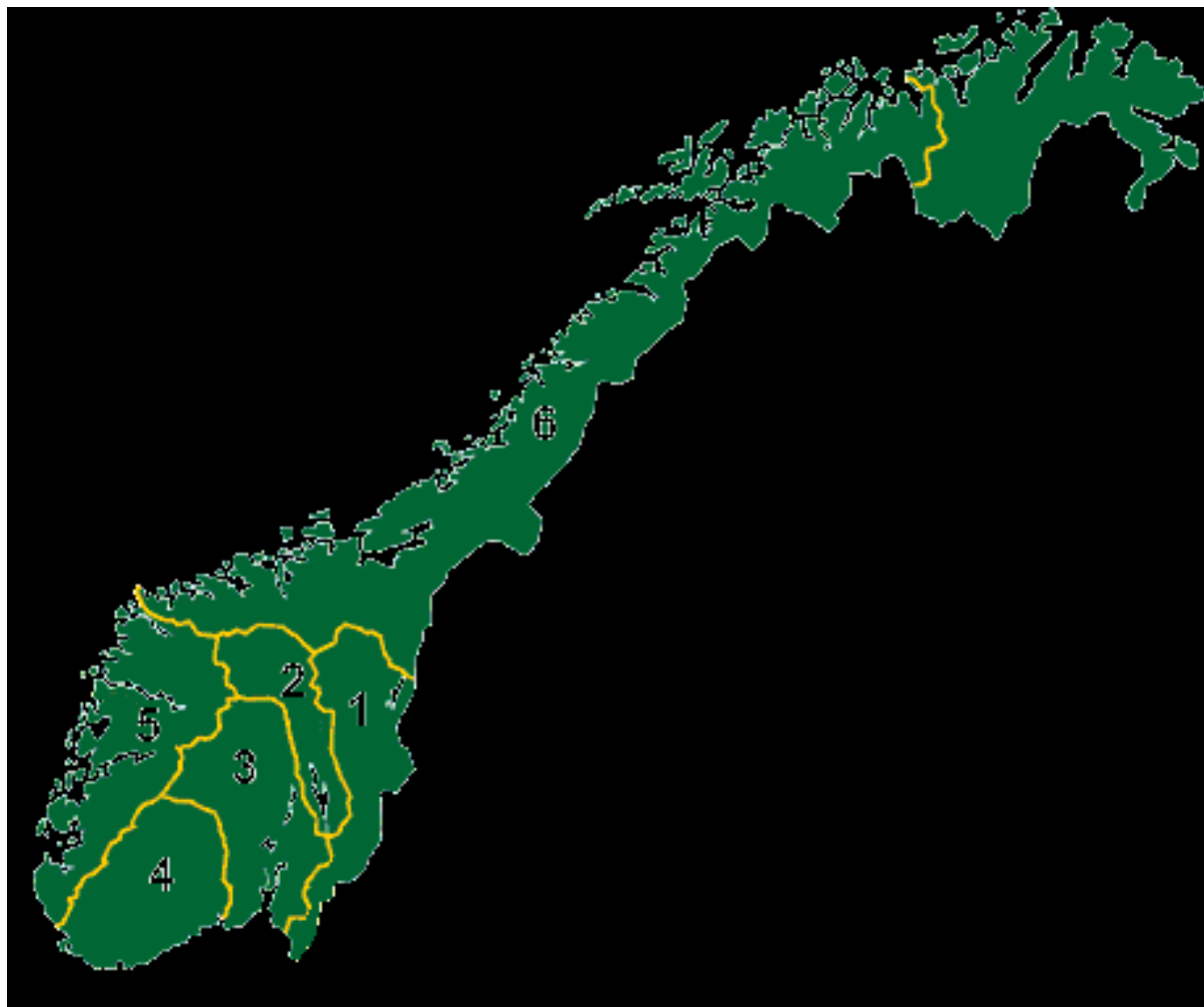
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# Aim and design

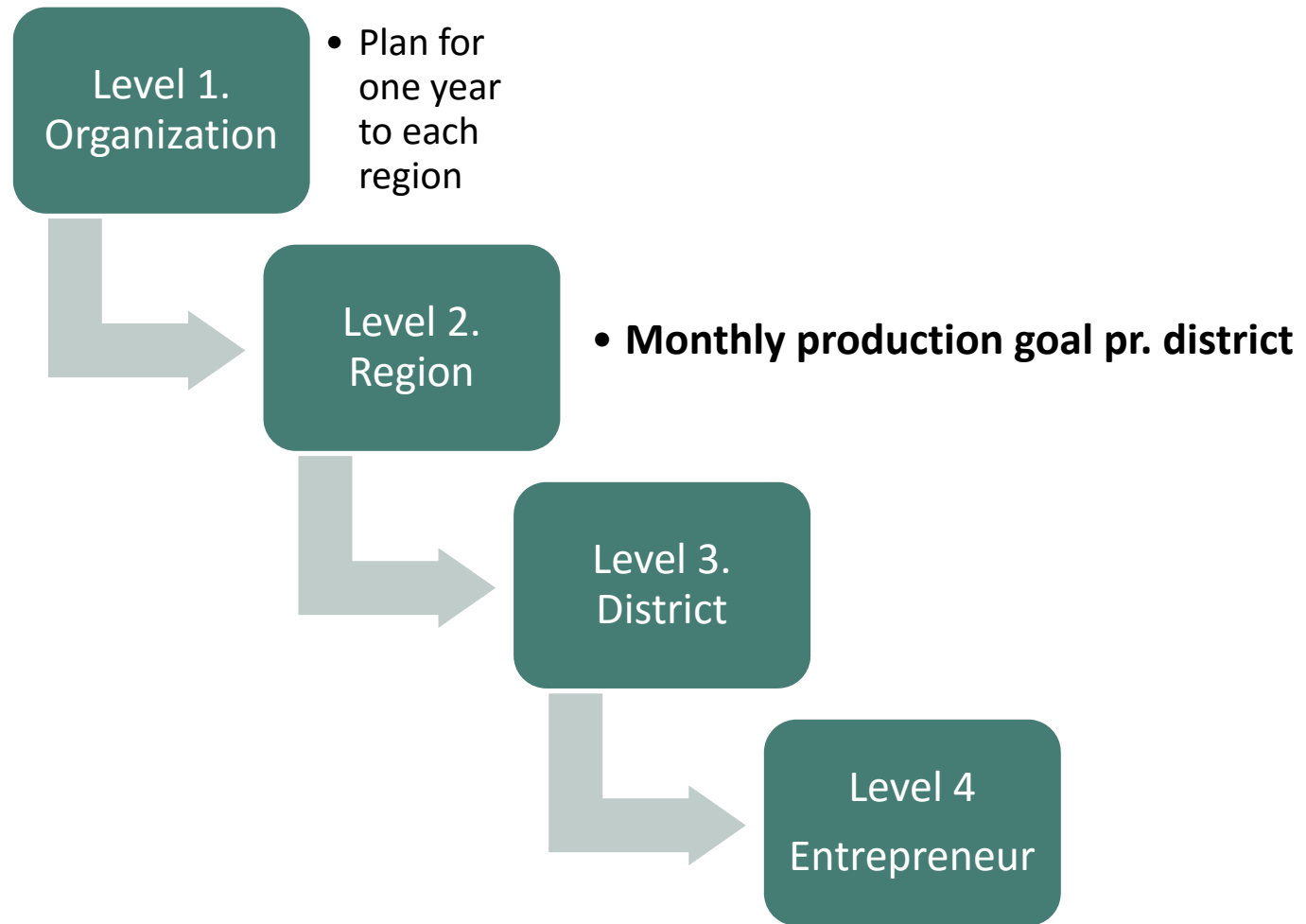
- Mapping, visualizing and improving production management practices in Norwegian wood supply



# Forest owner associations in Norway at National and regional level

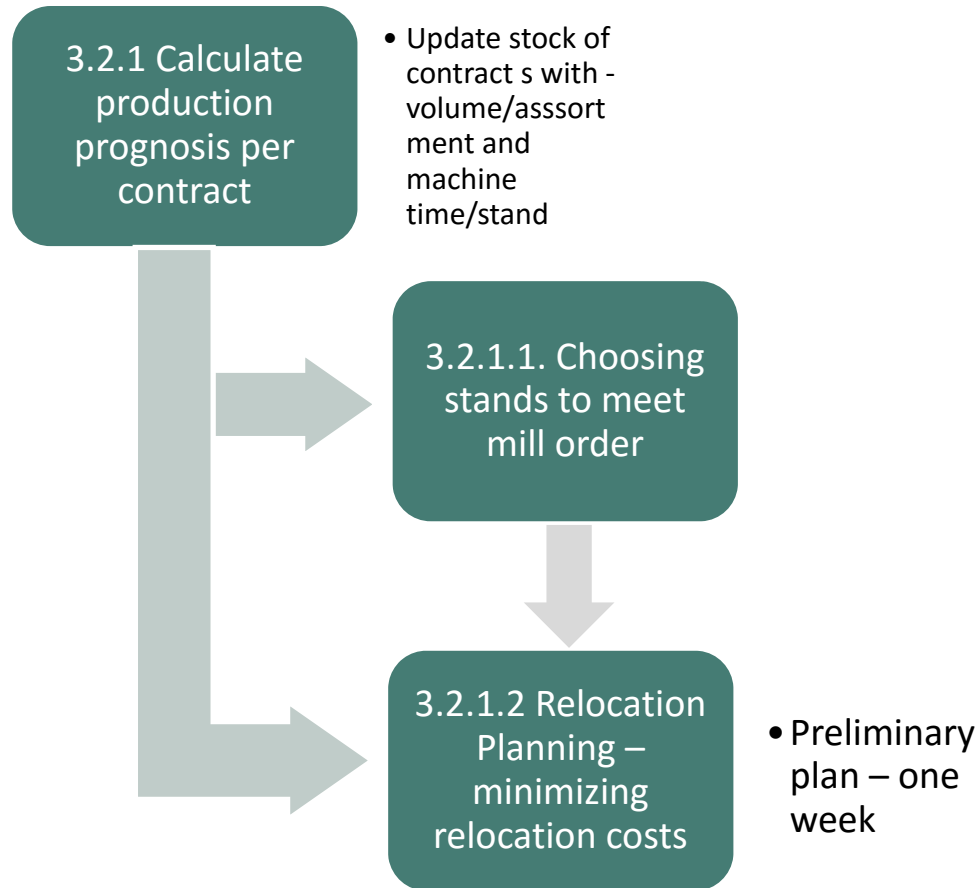


# Four Activity Levels



# Creation of preliminary plan for one week

## Two different ways of working



# Bearing capacity in Norway



Class 1 – always available: spring, summer and winter (dry gravel)



Class 2 – typically available during summer and winter (moist gravel)



Class 3 – only available with winter conditions (wet peat and clay sites)

# Planning sheet in excel (in principle)

Contract		Volume per assortment				Machine hours		Ground damage	
No.	Selected?	1	2	3	4	Harvester	Forwarder	Bearing capacity	Costs/operation
1	1							1	
2	0							2	
3	1							3	
4	1							1	
5	0							2	
....i	1							3	
Prognosis									
Goal									
		<b><math>\Sigma</math>delivery bonus</b>				<b><math>\Sigma</math>machine penalty</b>			<b><math>\Sigma</math>repair costs</b>

Phase 2

# ... and in reality

Månad		Avvik (m3)										Andel av volymen för olika sortiment (%)										Rep krav													
		3 %	10 %	10 %	4 %						3 %	10 %	10 %	4 %						10 kr/m3	2 bärighetsklasse														
Beslut ("ja"=1)		38 83 118 -35 204										4,6 2,6										Avv:B													
ID	Averka? Flytt mellan Dr	Typ	B	ha	m3/ha	m3	Skred	Skot	Vol G	Ti	Vol T	Ti	Vol B	M	Vol L	Mv	Vol TOT	Gti	Ti	Bantiv	LoMv	TOT	Skotare flytt	tot	Skotare flytt	tot	G Ti	T Ti	B Mv	L Mv					
1	0	O A	3	5	200	0,3	24	28	650	100	200		50		1000	0	0	0	0	0	0	0	41,7	2,0	0,0	38,5	2,0	0,0	65	10	20	5	0	0	0
2	0	O A	1	2	5	180	0,2	15	16	142	3	142		28		315	0	0	0	0	0	0	21,0	2,0	0,0	19,7	2,0	0,0	45	1	45	9	0	0	0
3	0	O A	3	3	280	0,25	22,5	25	728	10	291		10		1040	0	0	0	0	0	0	0	46,2	2,0	0,0	41,6	2,0	0,0	70	1	28	1	0	0	0

with bearing capacity 1-3 and rutting repair costs

Sum of volume/assortment

Sum of machine hours

Net surplus = delivery bonus – utilization costs – rut repair costs

98	0	O C	2	4	310	0,41	30	28	558	347	248		87		1240	0	0	0	0	0	0	41,3	2,0	0,0	44,3	2,0	0,0	45	28	20		0	0	0				
99	0	O C	3	2	300	0,39	29	28	438	12	150		0		600	0	0	0	0	0	0	20,7	2,0	0,0	21,4	2,0	0,0	73	2	25		0	0	0				
100	0	O C	1	2	240	0,24	17	16	47	24	84		13		168	0	0	0	0	0	0	9,9	2,0	0,0	10,5	2,0	0,0	28	14	50		0	0	0				
				2,4			37616	20527	30696			10559	99398																									
				SUMMA(m3)		1238	933	1318	815	4304			224,6	222,6			1104																	5087,5				
				PLAN (m3)		1200	850	1200	850	4100			220	220																								
				avvik		38	83	118	-35	204			4,6	2,6																								
				abs avvik		38	83	118	35	271			0	0																								
				krav lec. Precision		10 %	10	120	85	120	85			250	0																							
				buns (kr/m3)		10	10	120	85	120	85			0	0																							
				bonus		12384	9331	13179	8149	43043			0	0																								
				avvik		38	83	118	-35	204			4,6	2,6																								
				abs avvik		38	83	118	35	271			0	0																								
				tilatt avvik (hrs)		250	0	0	0	0			0	0																								
				gvertid (kr/h)		0	0	0	0	0			0	0																								
				stiltstand		0	0	0	0	0			0	0																								
				bonus		12384	9331	13179	8149	43043			0	0																								
				faktura		0	0	0	0	0			0	0																								
				bonus-faktura-rep		0	0	0	0	0			0	0																								

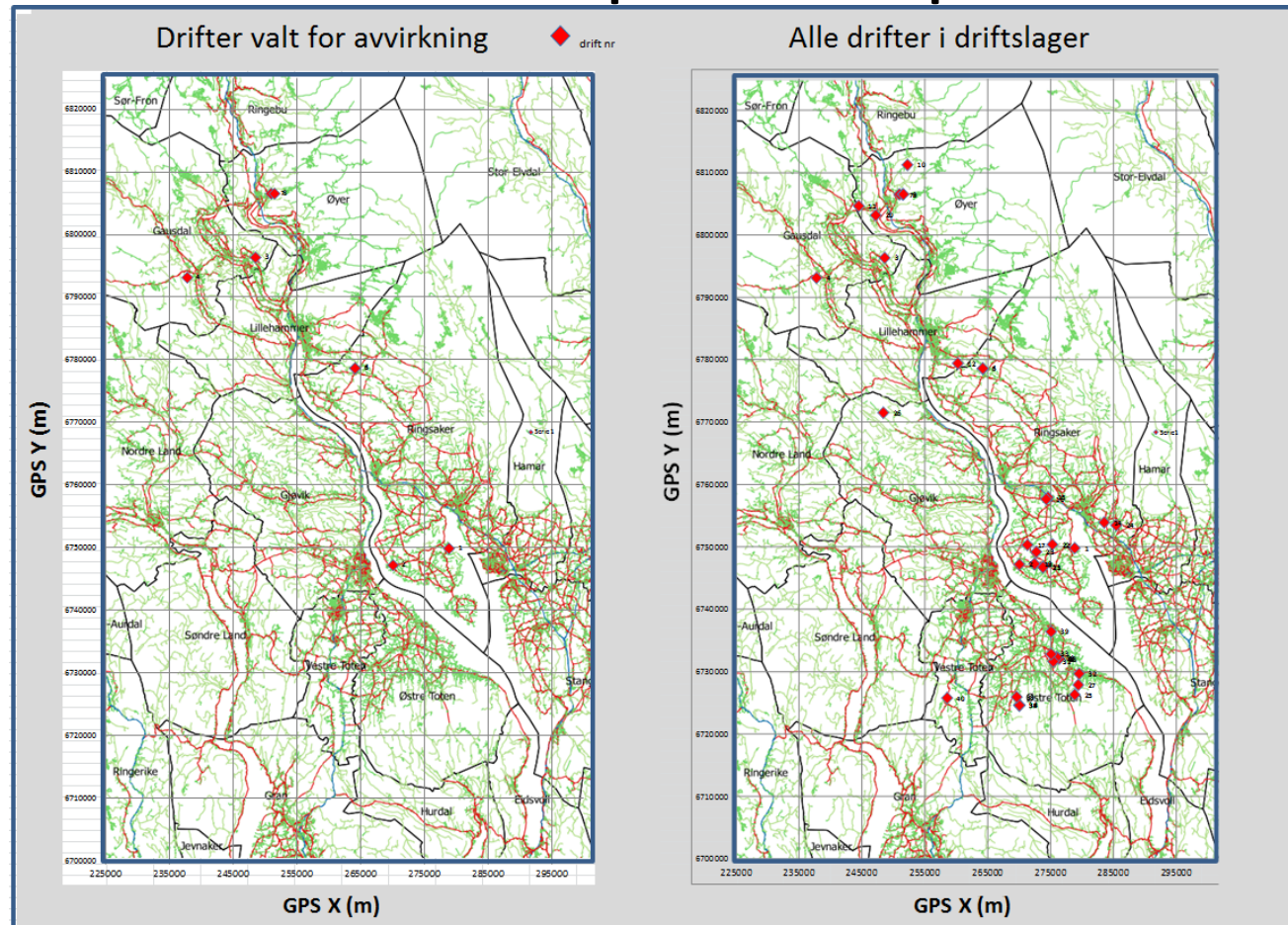
Phase 2



Creating planning environment and test in classroom



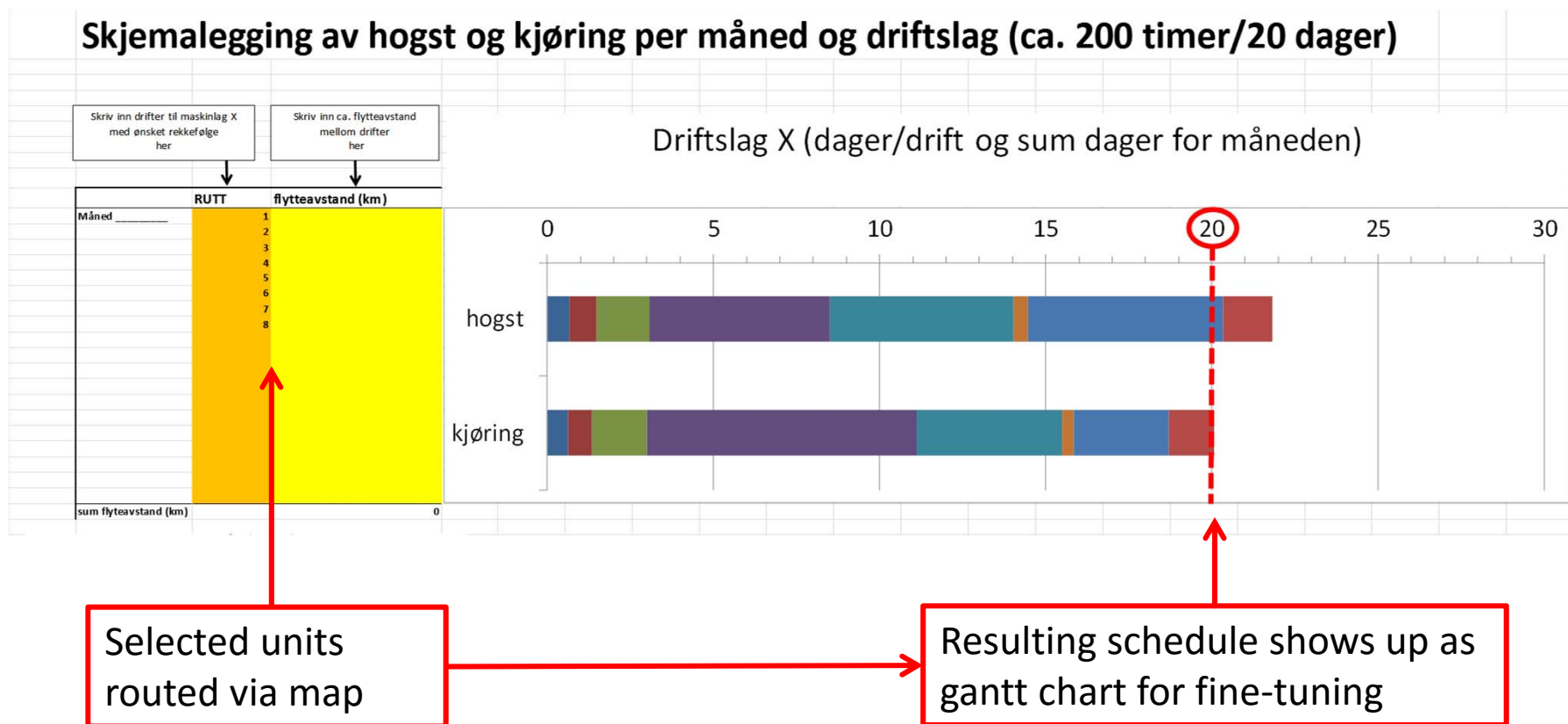
# Selected contracts for harvesting period shown up on map



Selected (1)

All units (0,1)

# Selected contracts routed with resulting schedule/team



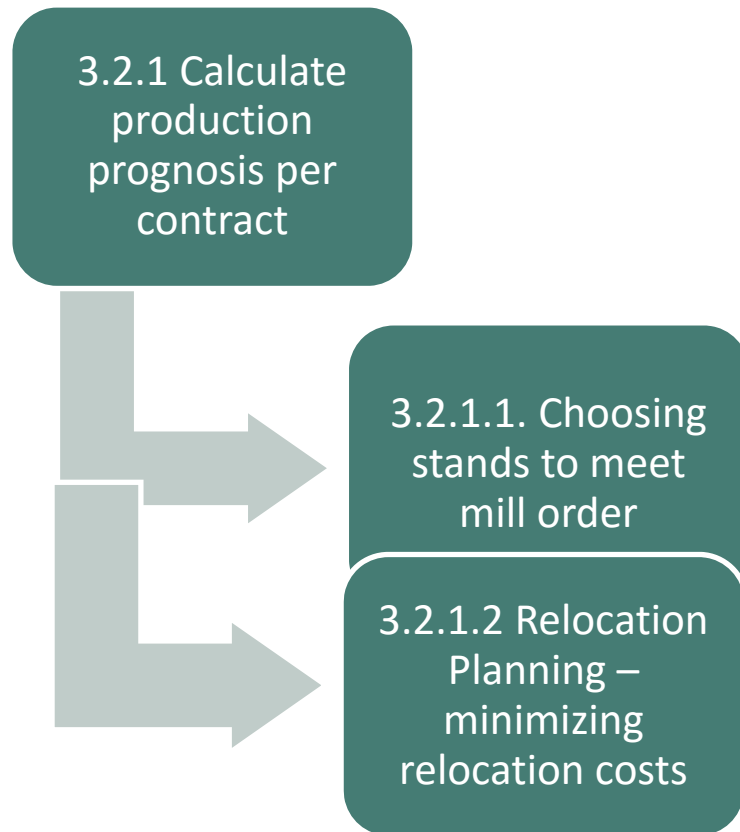
# Group work - comparison of results

Groupe	Delivery Bonus	- Machine Penalty	- Ground Repairs	= Net result
1				
2	Maximize delivery precision			
3				
4				
5	Minimize relocation costs			
6				
7				
8				

Optimal solution

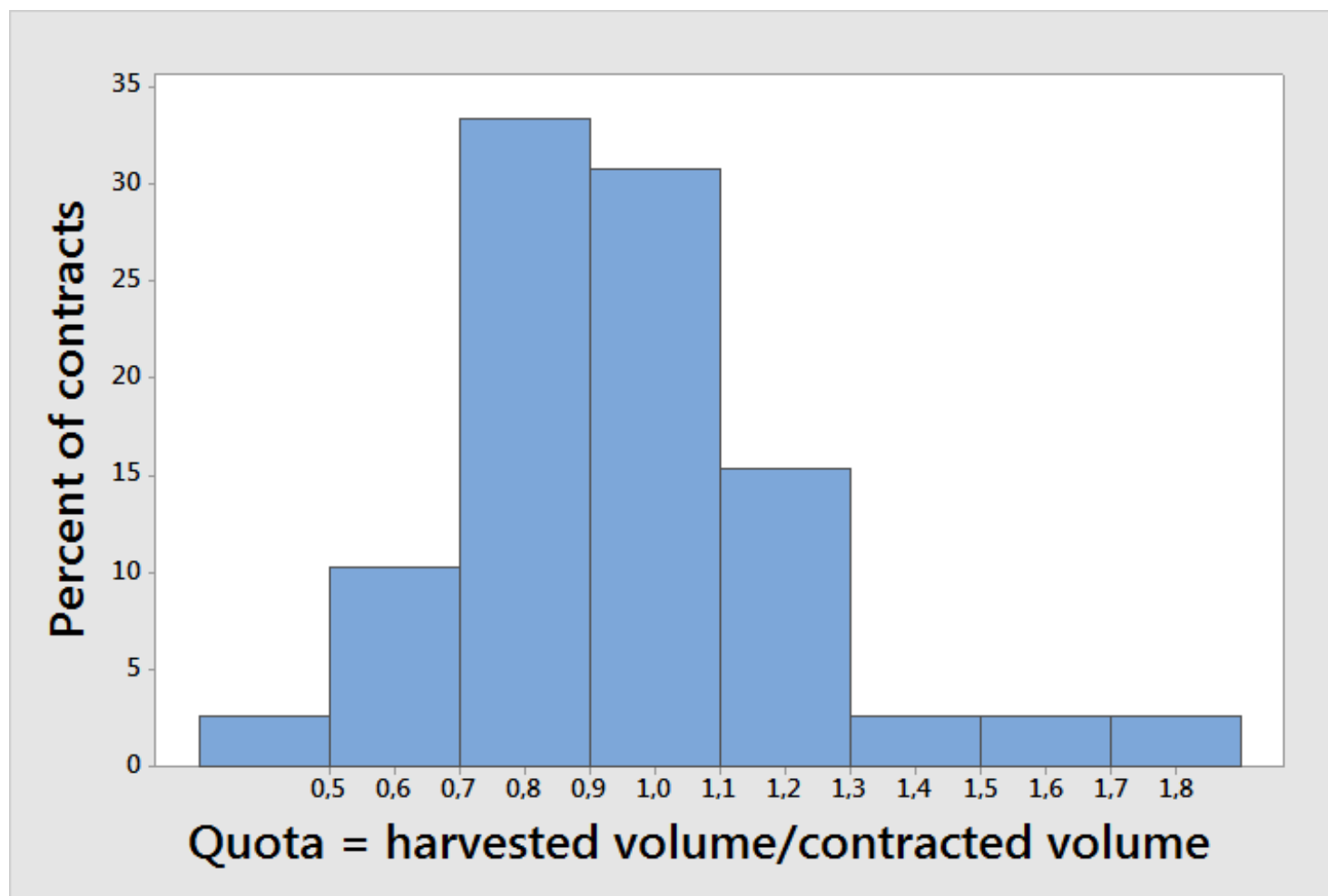
# Balance between

# Market orientation vs. Relocation costs vs. rutting



Bonus/penalty	
Delivery bonus	15-25 ZAR/m <sup>3</sup>
Relocation costs	10-15 ZAR/m <sup>3</sup>
Rut repair costs	< 10 ZAR/m <sup>3</sup>

# Precision of production planning data – contracted vs actual harvested volume



# Conclusion

- Better prognosis
  - Volume/assortment
  - Machine time/stand
  - Bearing capacity
- Communication between production manager and forest owner
  - Flexibility in choosing contracts
- Communication between production manager and logging company
  - Always something that comes up
    - Need to replan