

Contact Pressure Allocation under Bogie Axles and Tracked Vehicles



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- **Current Developments**
 - supply chain requirements
 - harvesting techniques have changed
 - machine weights are increasing



- **Threats to Soil**
 - soil compaction
 - soil erosion



- **Current Avoidance Strategies**
 - reduced tire inflation pressure
 - limitation of wheel loads
 - application of tracks

- **Main Questions**
 - critical soil stresses
 - objective input parameters of machines
 - (influence of tracks)



- **Background**

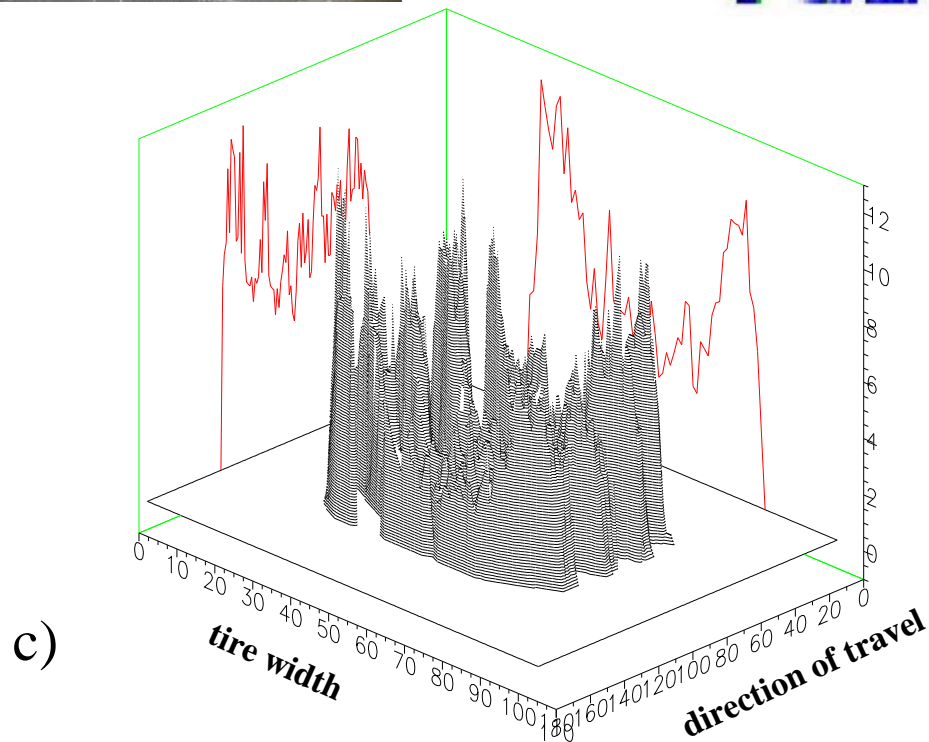
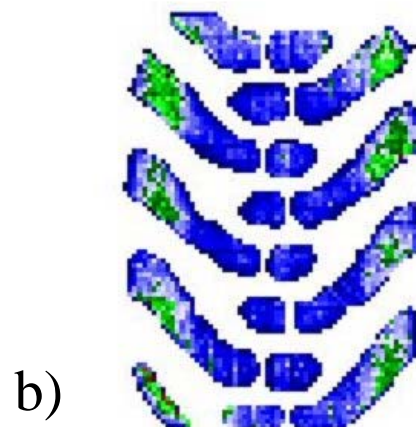
- **Pressure Allocation on Contact Areas under Forest Tires**
- contact patches are inappropriate to evaluate the real contact pressure
- pressure is underestimated by patch area and load

- **Test Design**

- 70 standard tires for forestry
- 5 different loads
(10 kN, 20 kN, ..., 50 kN)
- 7 inflation pressures
(0,5; 1; 1,5; 2; 3; 4; 5 bar)
- tires were run in 5 km



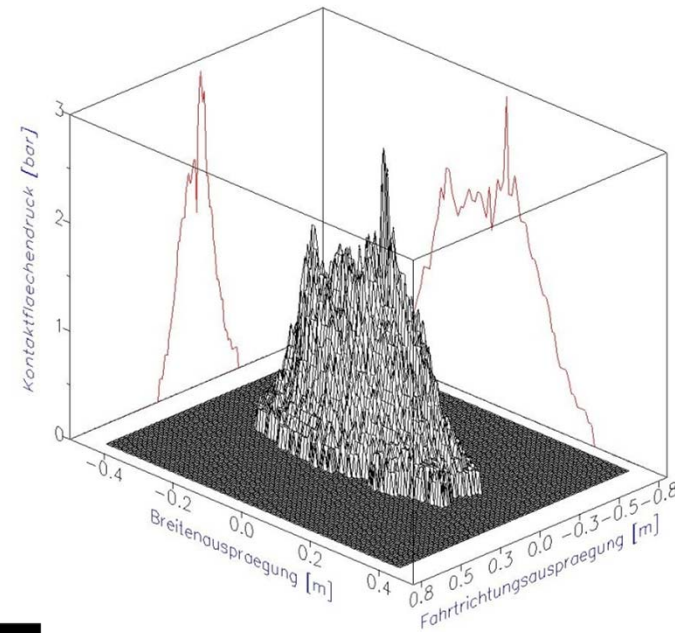




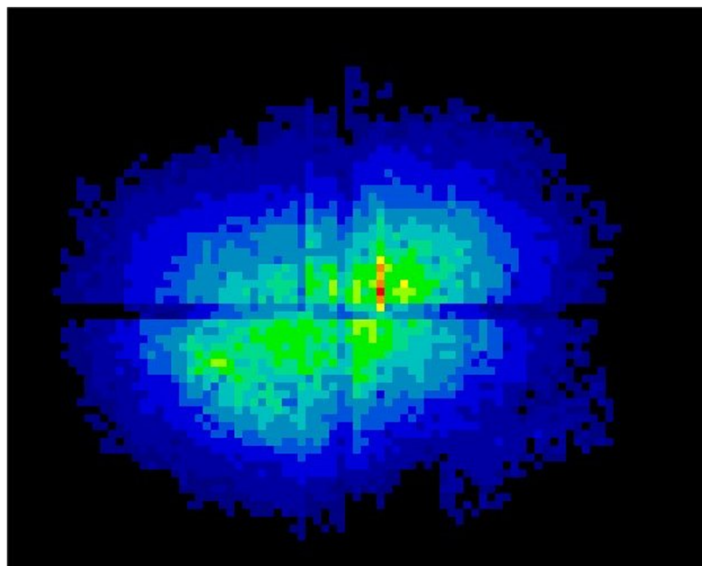
- a) tire 600/55 – 26,5 PR 16
- b) pressure allocation on sensor mat
- c) 3 D view on pressure allocation



a)



b)



c)

- a) tire (pushed into sand)
- b) 3 D view on pressure allocation
- c) pressure allocation on sensor mat
(600/55 – 26.5 PR 16)

- **Contact Pressure of Tracks**

- Korhonen (2008)

$$p = \frac{F_N}{(1,25 * D + L) * B}$$

- Matthies (2008)

$$p = \frac{F_N}{0,2 * L * B}$$

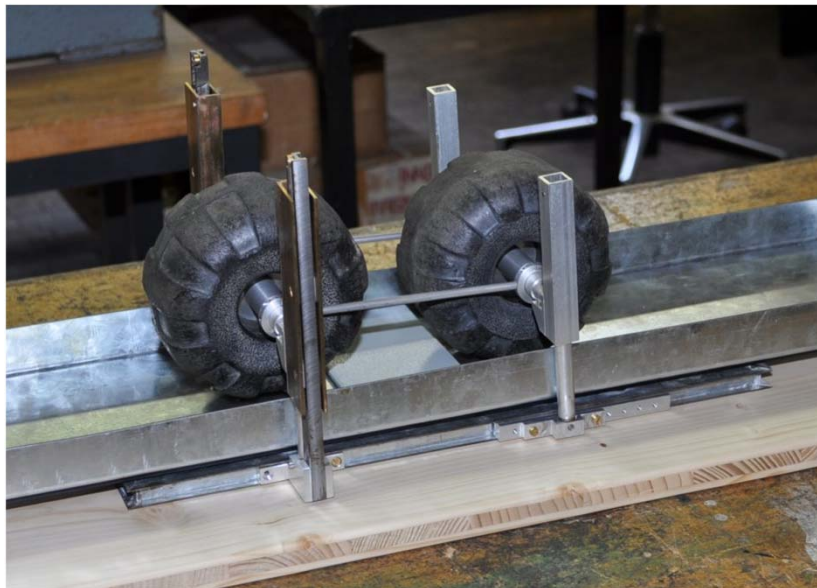
p	= pressure
F _N	= axle load (kN)
D	= wheel diameter
L	= distance between wheels
B	= width of tracks

results differ with the factor **10**
(0,2 bar vs. 2,2 bar)

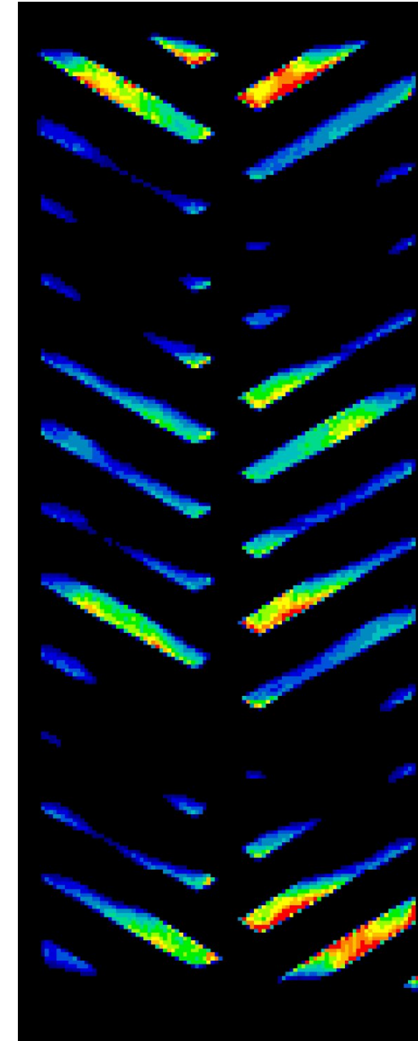
Pressure Allocation in Contact Areas under Tracks

- under sand (20 cm)
- sensor mats (resolution 0,7 cm²)
- load simulation separate for the two wheels
- test design
 - 3 different track types (traction, medium, flotation)
 - wheel loads between 10 kN and 70 kN
 - 2 different wheel distances (22.5 vs. 26.5 tires)

- base frame, sand box, load simulation
- 6 sensor mats (each 43 cm * 37 cm) alined in 2 rows of 3 mats
- measured area: 9.538 cm² (130 cm * 74 cm)
- measuring area has to be moved up to 6 times



- **Mobile Measurement Area (3 Mats)**
 - measurements with a sugar beet harvester
 - field tests with a forwarder



- impact of forest machines comes in to public sense
 - tracks are an option for soil protection
 - information about the contact pressure of tracks is missing
 - PrAllCon-track provides reliable pressure allocations
 - comparison between tracks and tires
 - different track models can be evaluated and compared
- **project will answer current questions of soil protection**