

EGU 2011 - Vienna



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Dune rehabilitation using a mechanical fixation technique

*Effect on sediment fluxes and on the recovery of the
herbaceous groundcover*

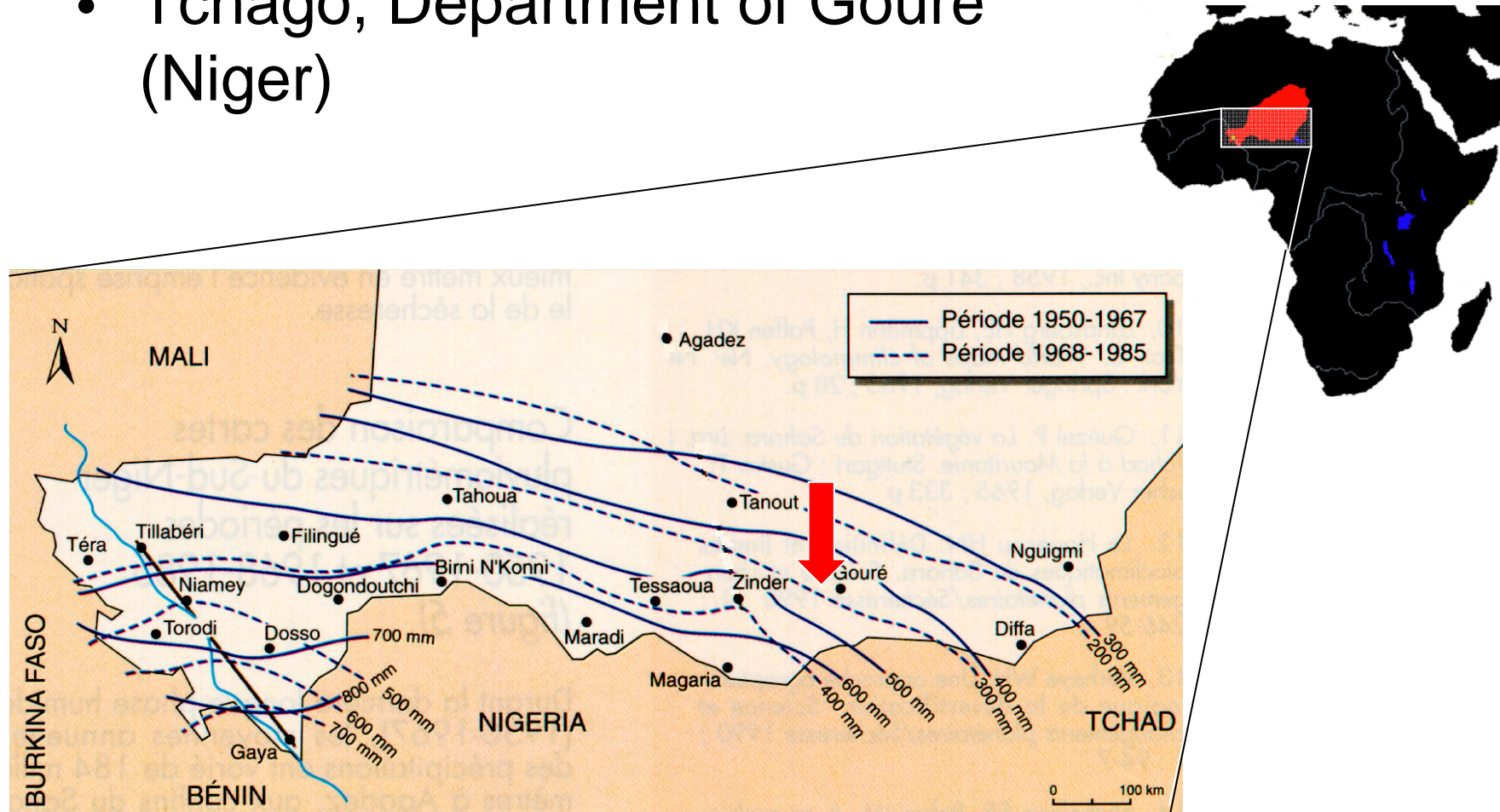
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Earth and Life Institute - Environmental Sciences

Location

- Tchago, Department of Gouré (Niger)



Semi-arid climate

300 mm annual rainfall (June - Sept.)

Mixed crop-livestock system

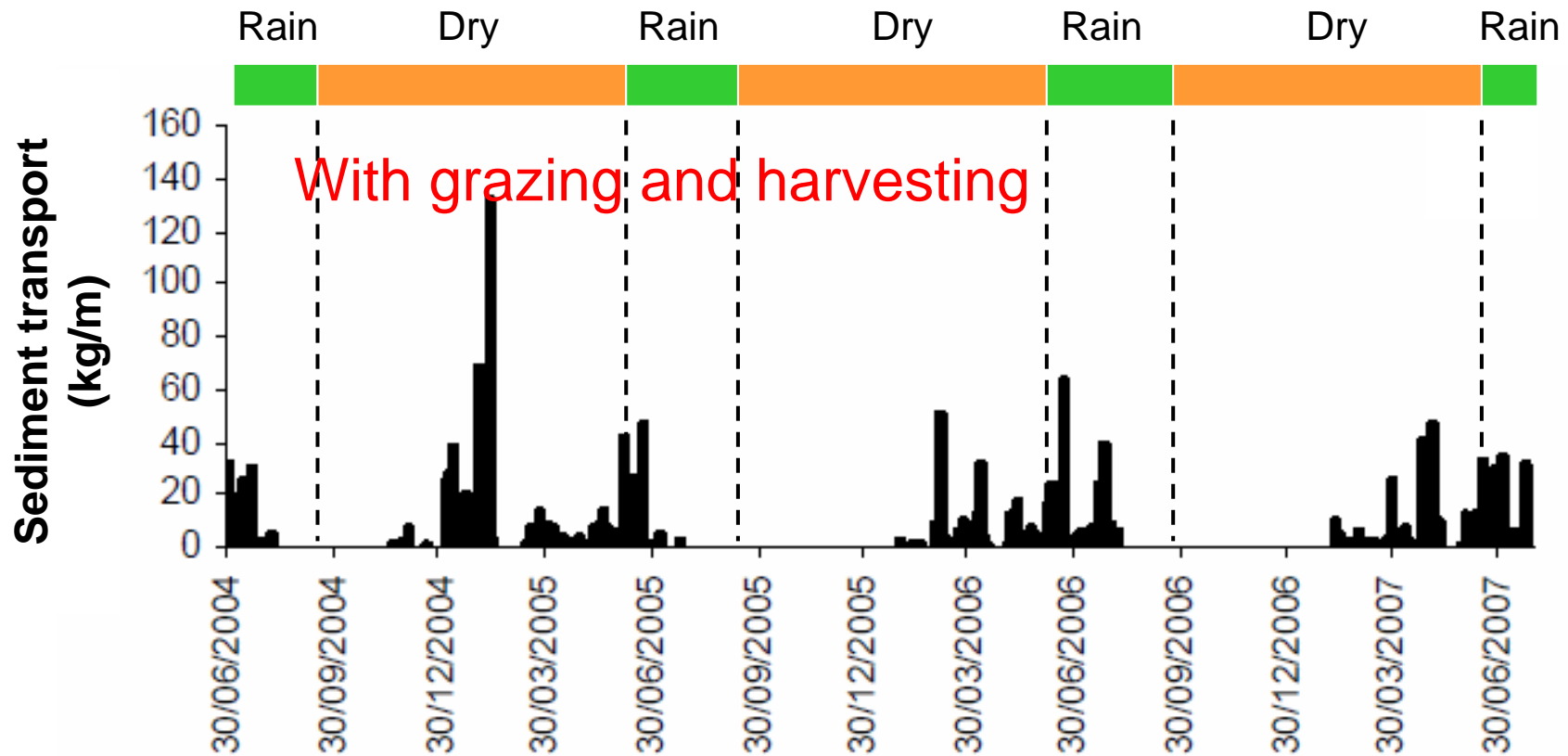


Cropland

Fenced-off area

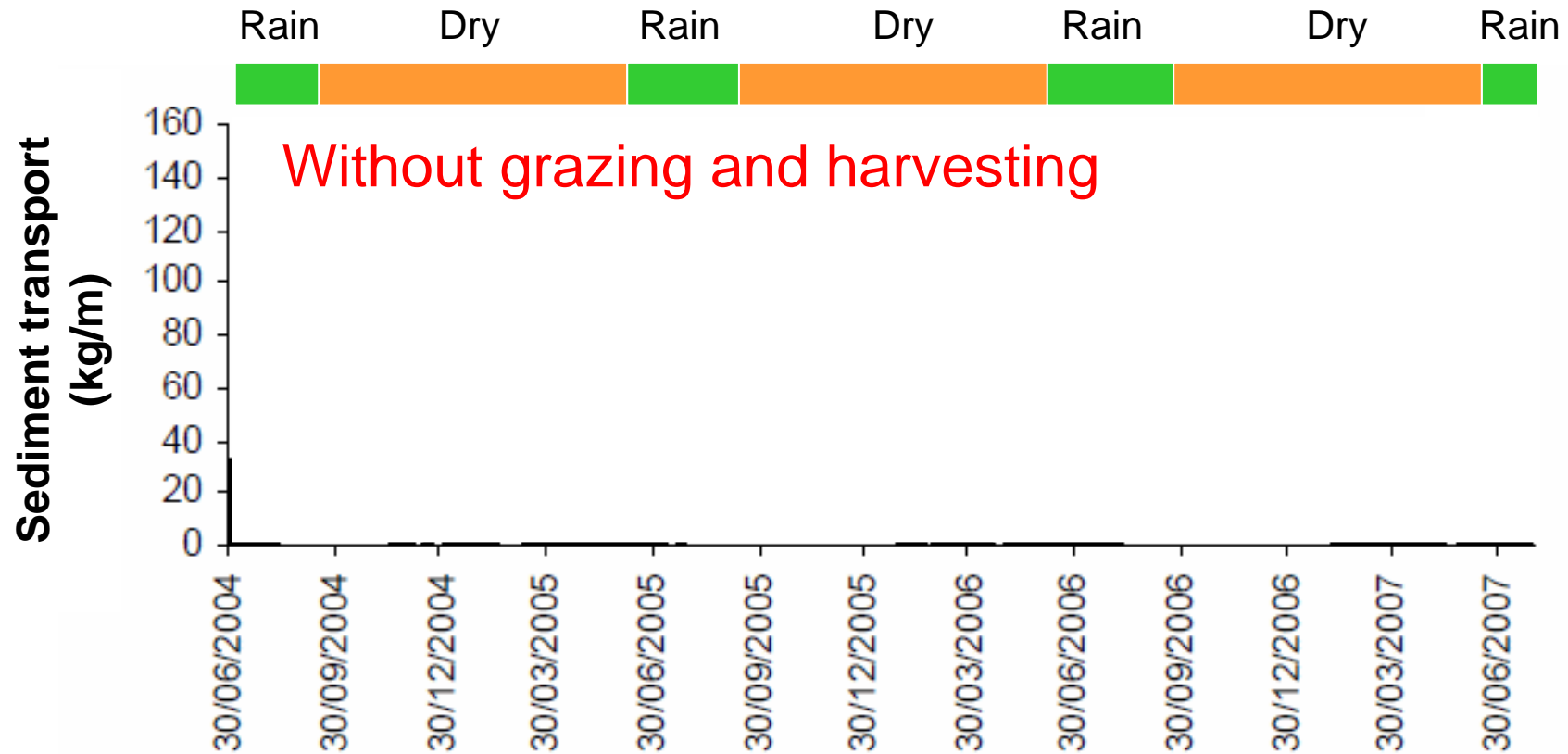
**Strong impact of
human activities !**

Problem statement



Seasonal variation in calculated sediment mass transport on pasture (Tidjani, 2008)

Problem statement



Seasonal variation in calculated sediment mass transport on pasture (Tidjani, 2008)

Problem statement

Dune reactivation :
30000 hectares in 30 years



Problem statement

Conventional dune fixation technique :

- Mechanical fixation using low windbreaks made of dead branches (*but rapid decay !*)
- Planting of shrubs and trees (*but slow !*)
- Natural regeneration of grasses ??

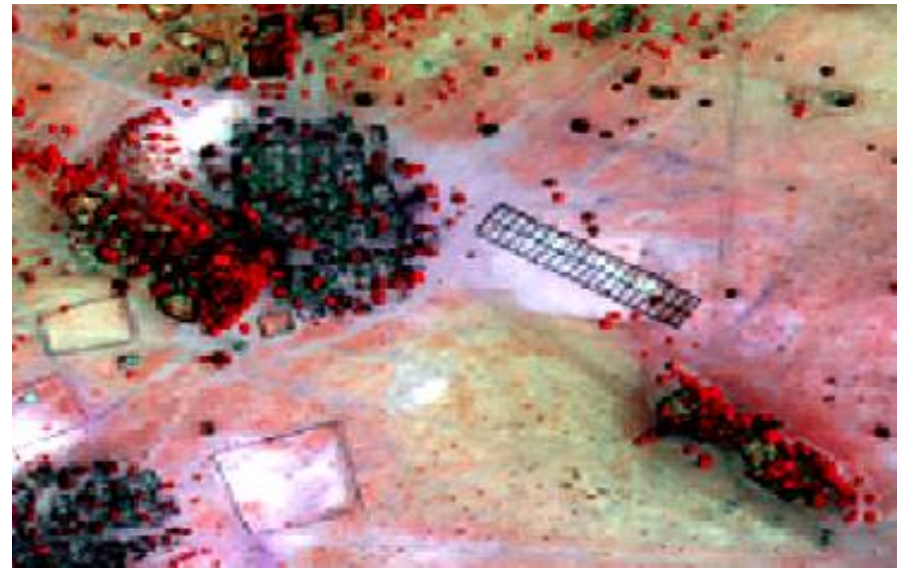


Objectives

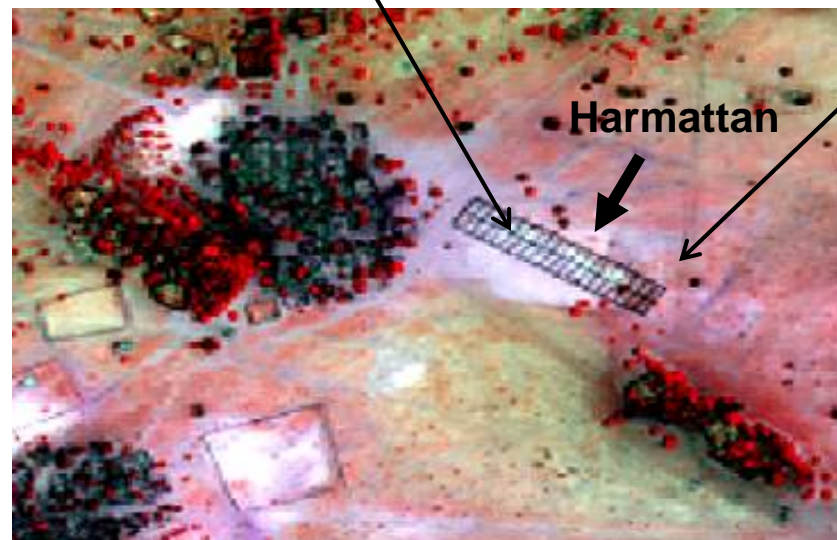
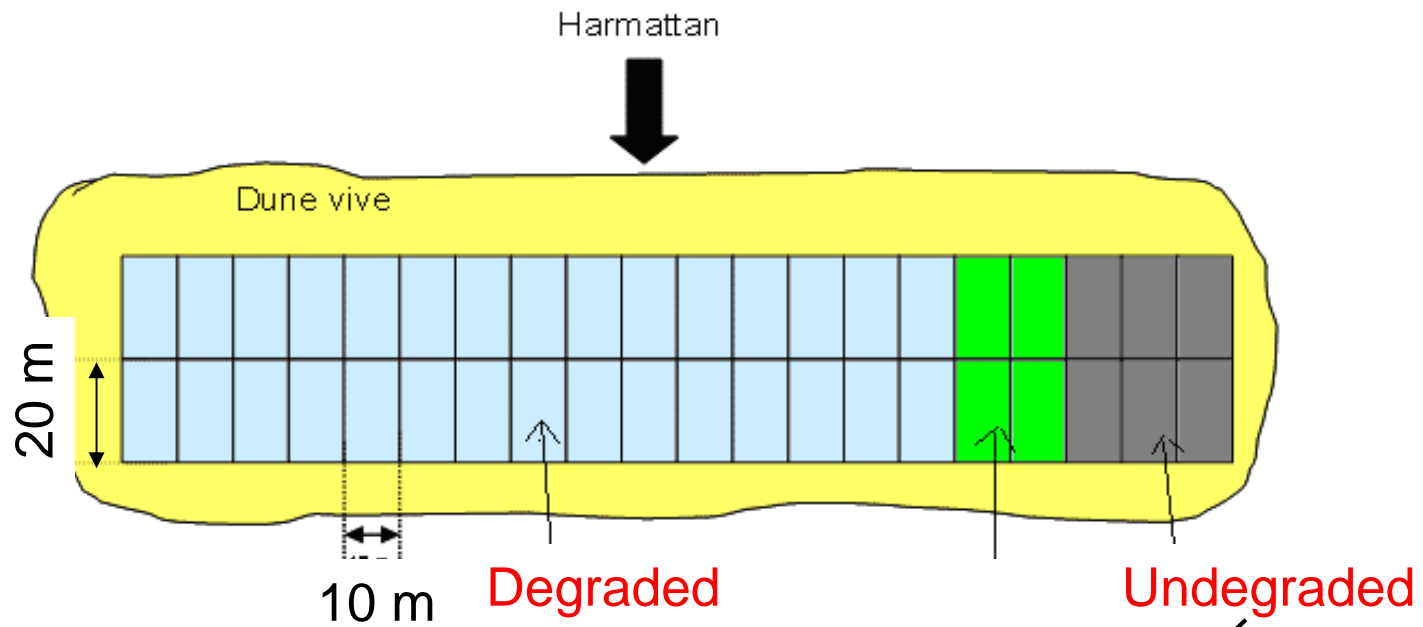
- To evaluate the effect of a mechanical fixation technique :
 - on sediment fluxes
 - on soil fertility
 - on the recovery of the grass cover, both quantitatively and qualitatively

Materials and methods

- Reactivated sand dune in the village of Tchago (Dept. of Gouré)
- Mechanical fixation : Branches of *Leptadenia pyrotechnica*, 1.5 – 2 m high



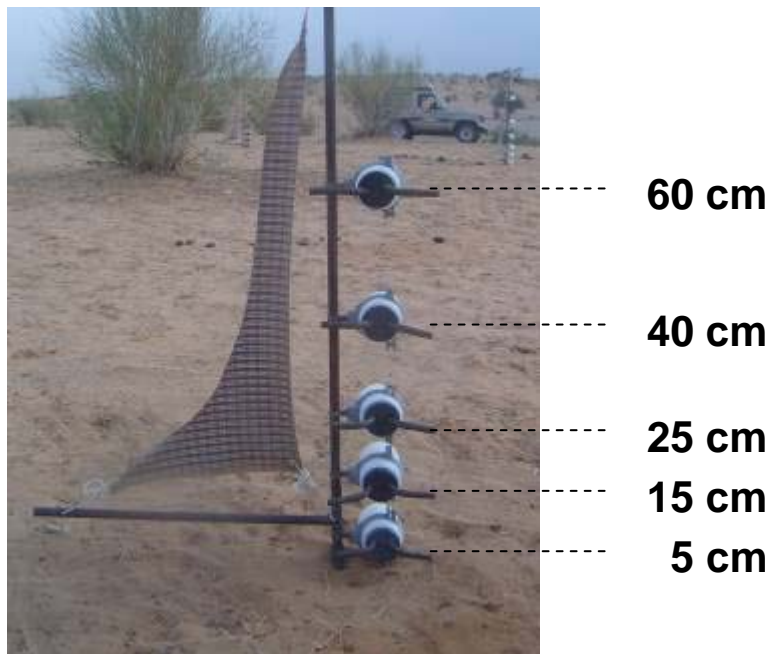
Experimental dune : 2 x 20 plots (20 m x 10 m)



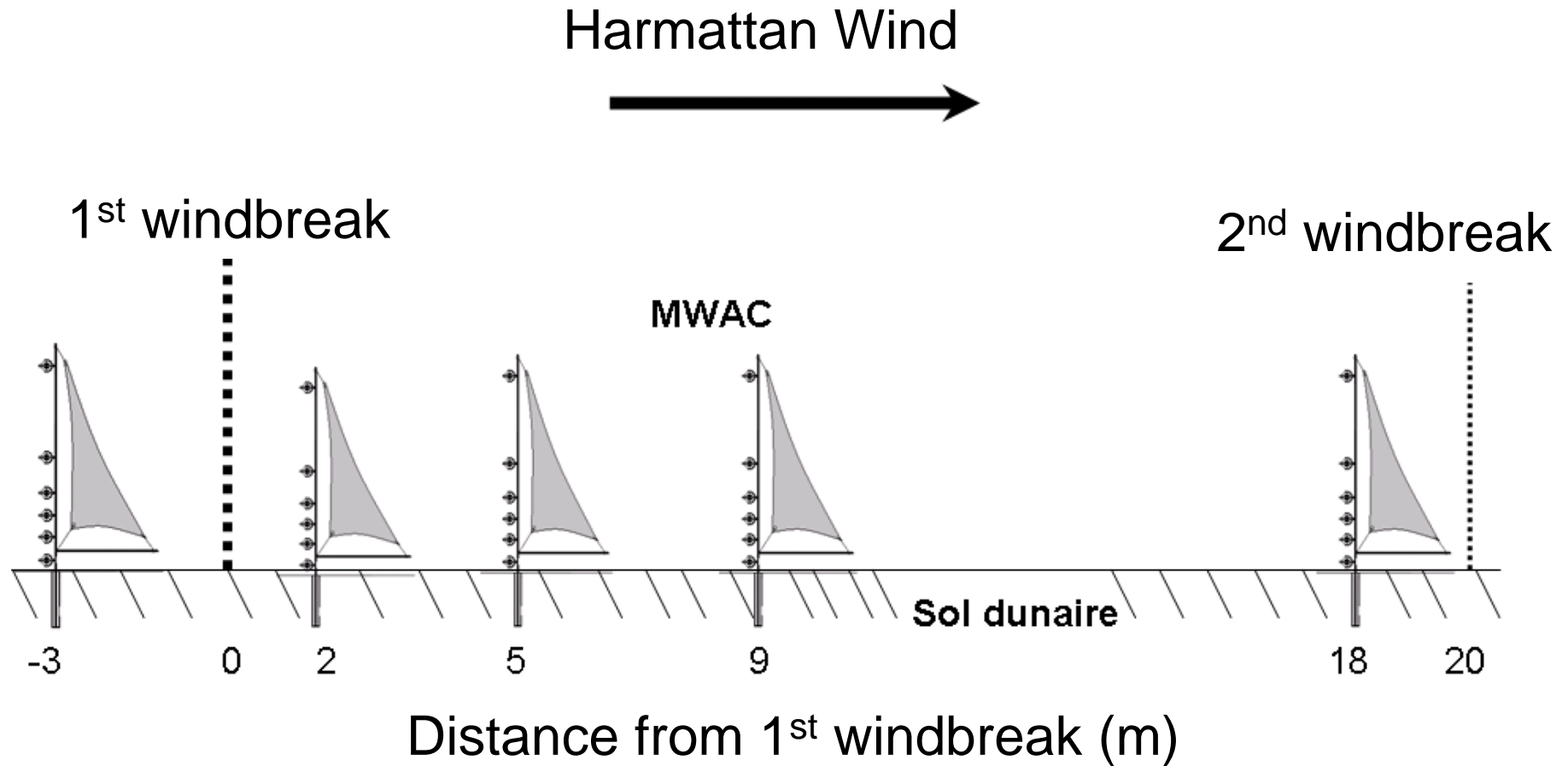
Materials and methods

- Wind measurements : velocity, direction (2 m)
- Sediment flux measurements (Feb – March)

MWAC sediment catcher



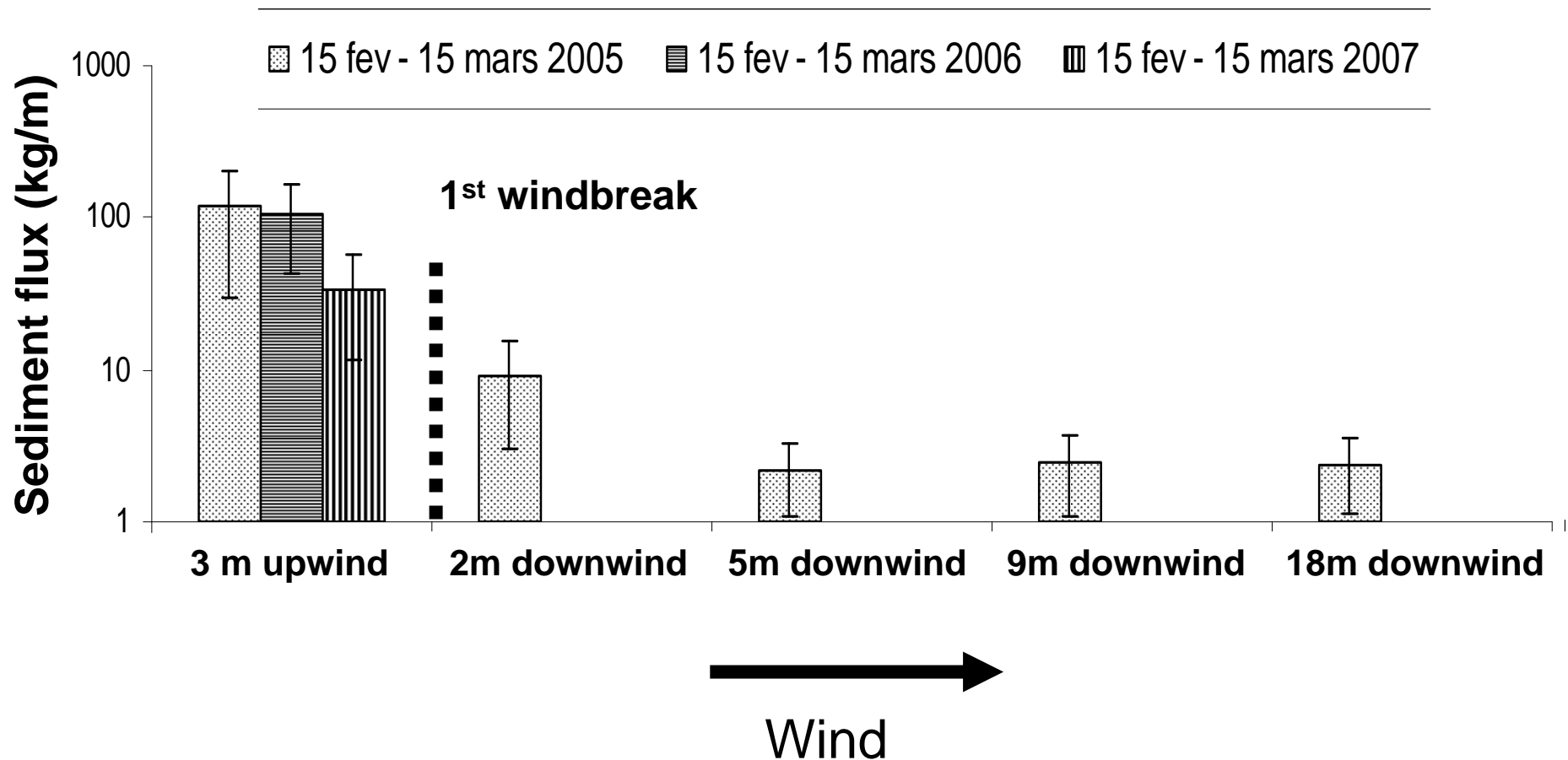
Materials and methods



8 Transects in total

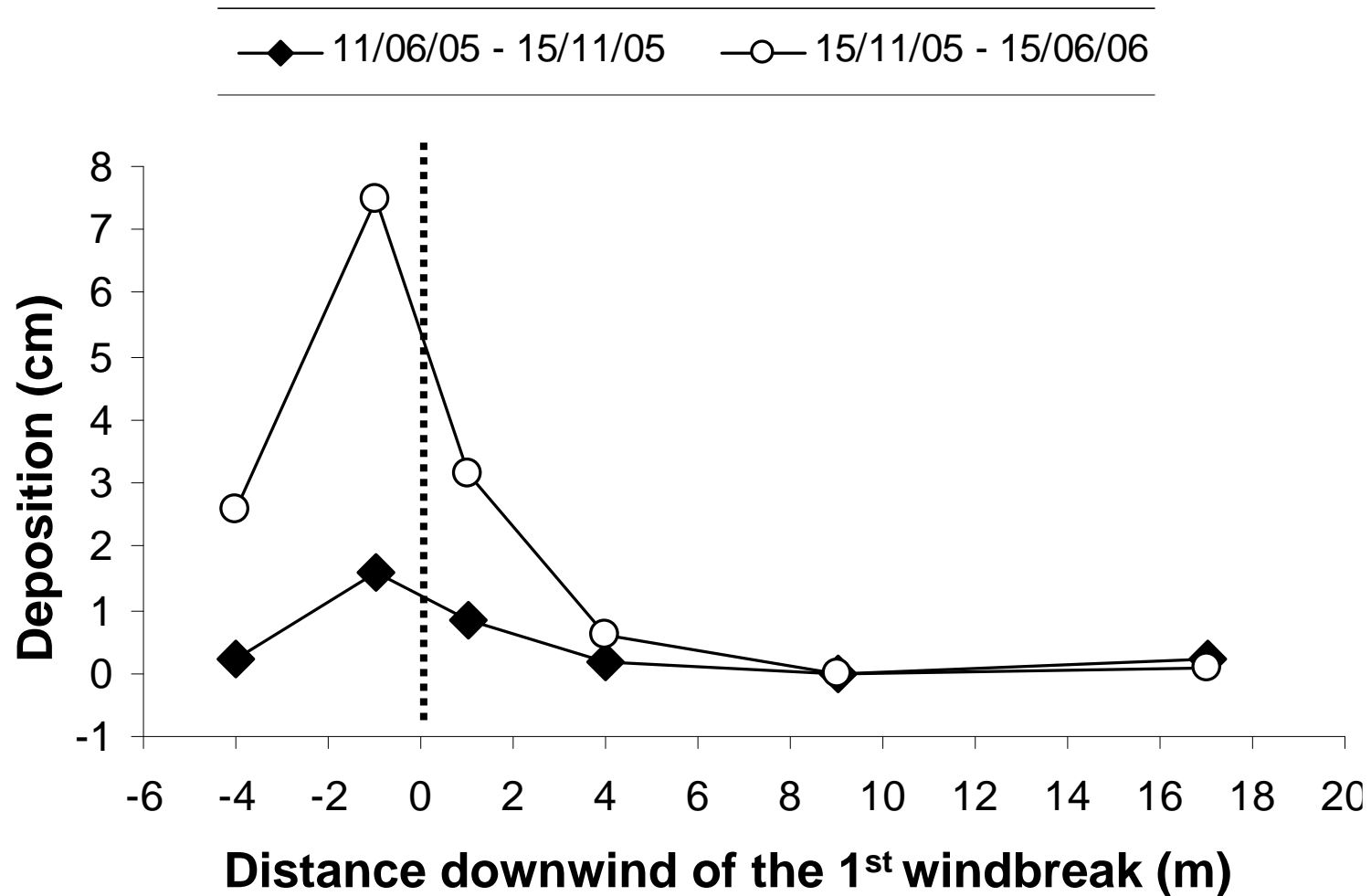
Results

Effect of windbreak on dry-season sediment fluxes



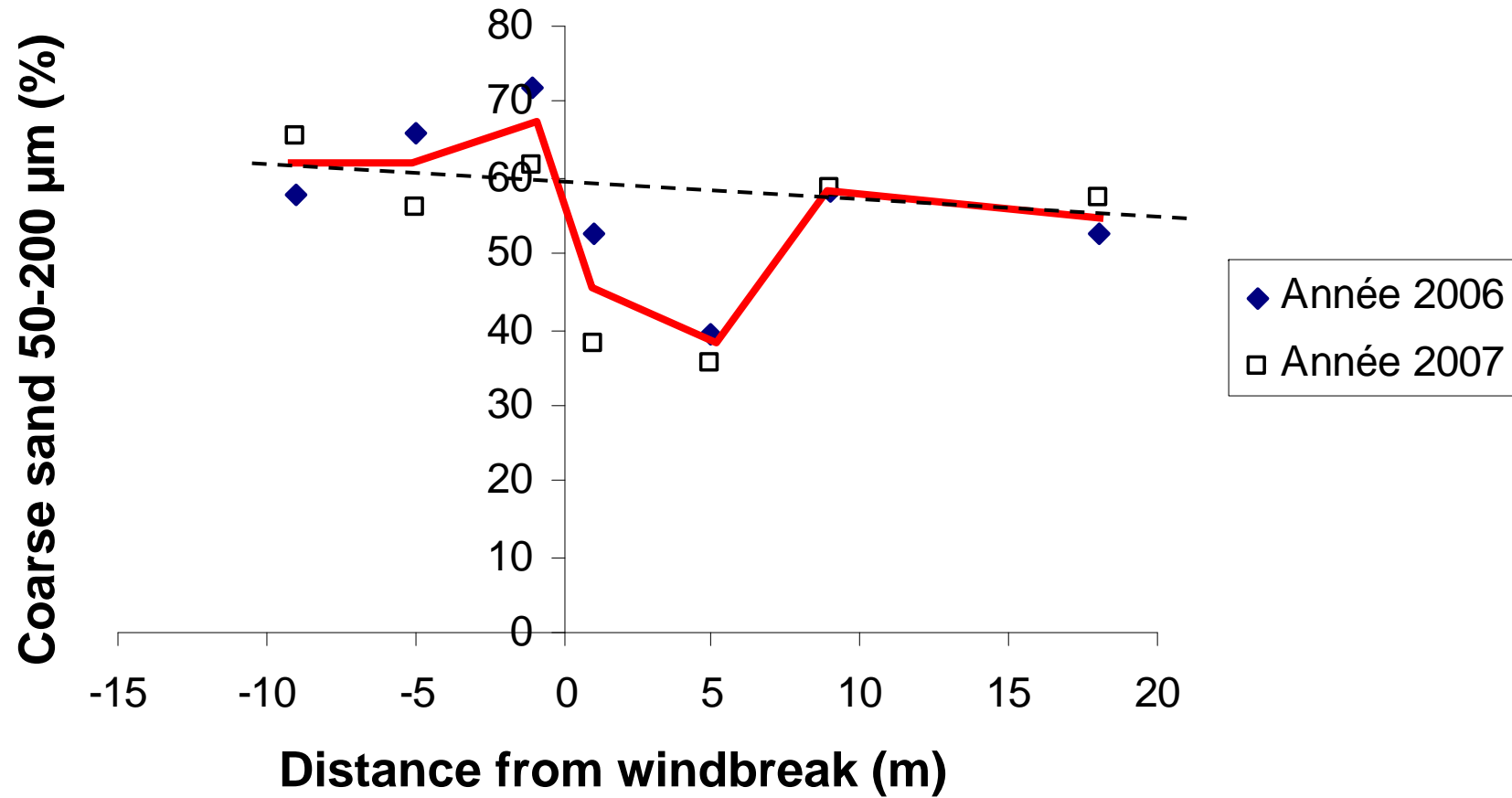
Results

Changes in surface topography during a 1-year period



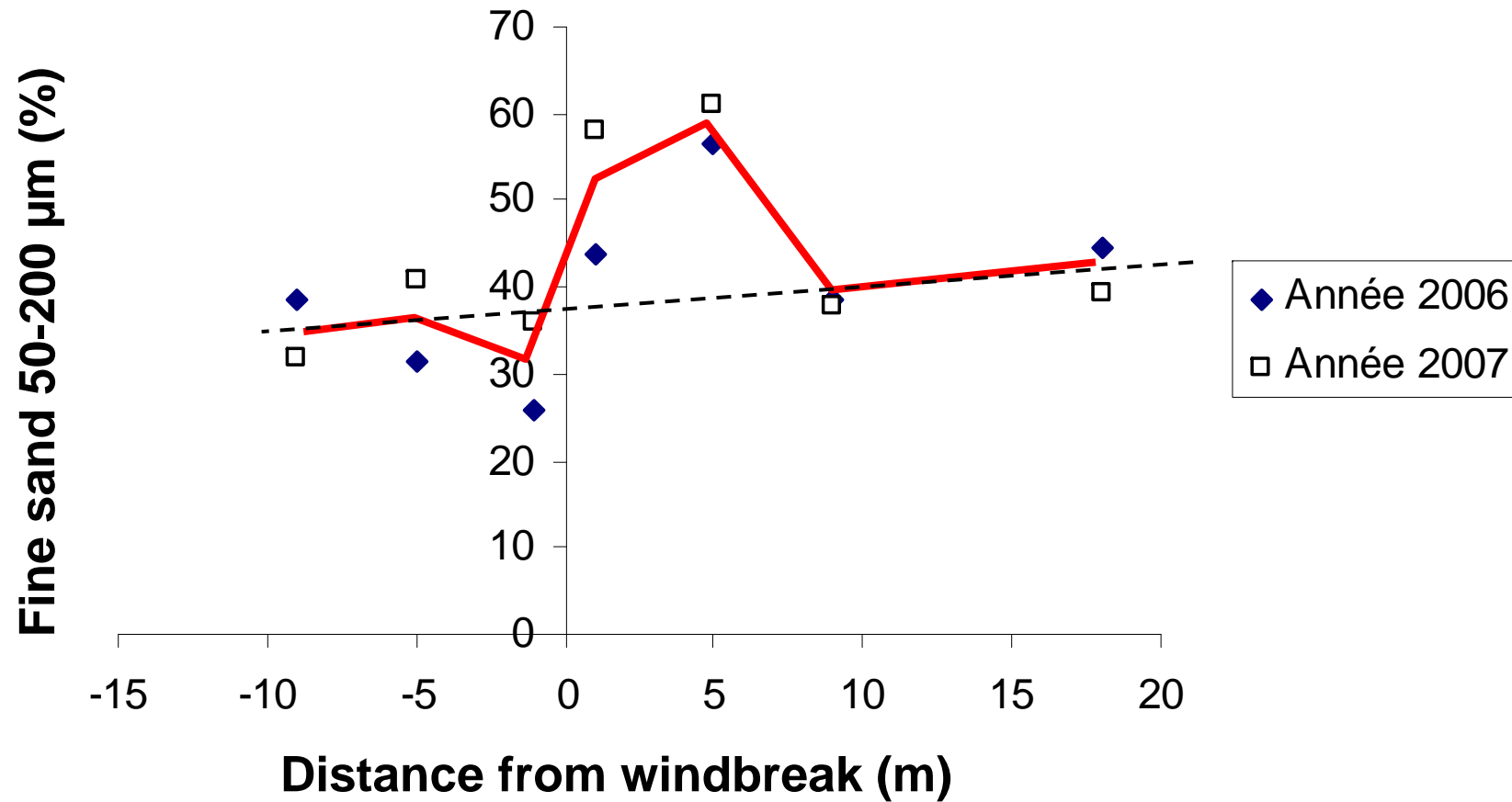
Results

Effect of windbreak on soil texture (0-10 cm)



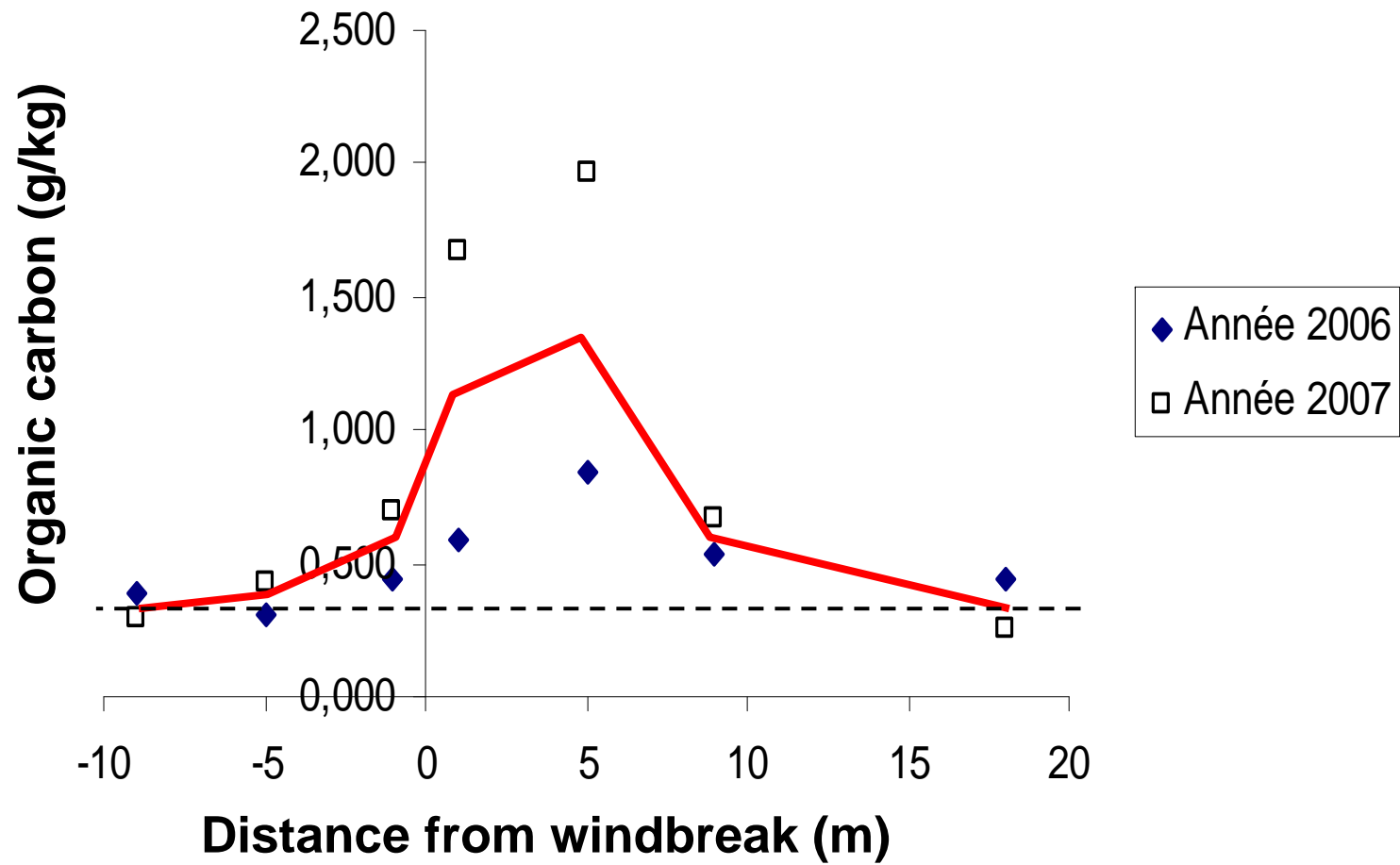
Results

Effect of windbreak on soil texture (0-10 cm)



Results

Effect of windbreak on soil texture (0-10 cm)



Results

Recovery of herbaceous groundcover



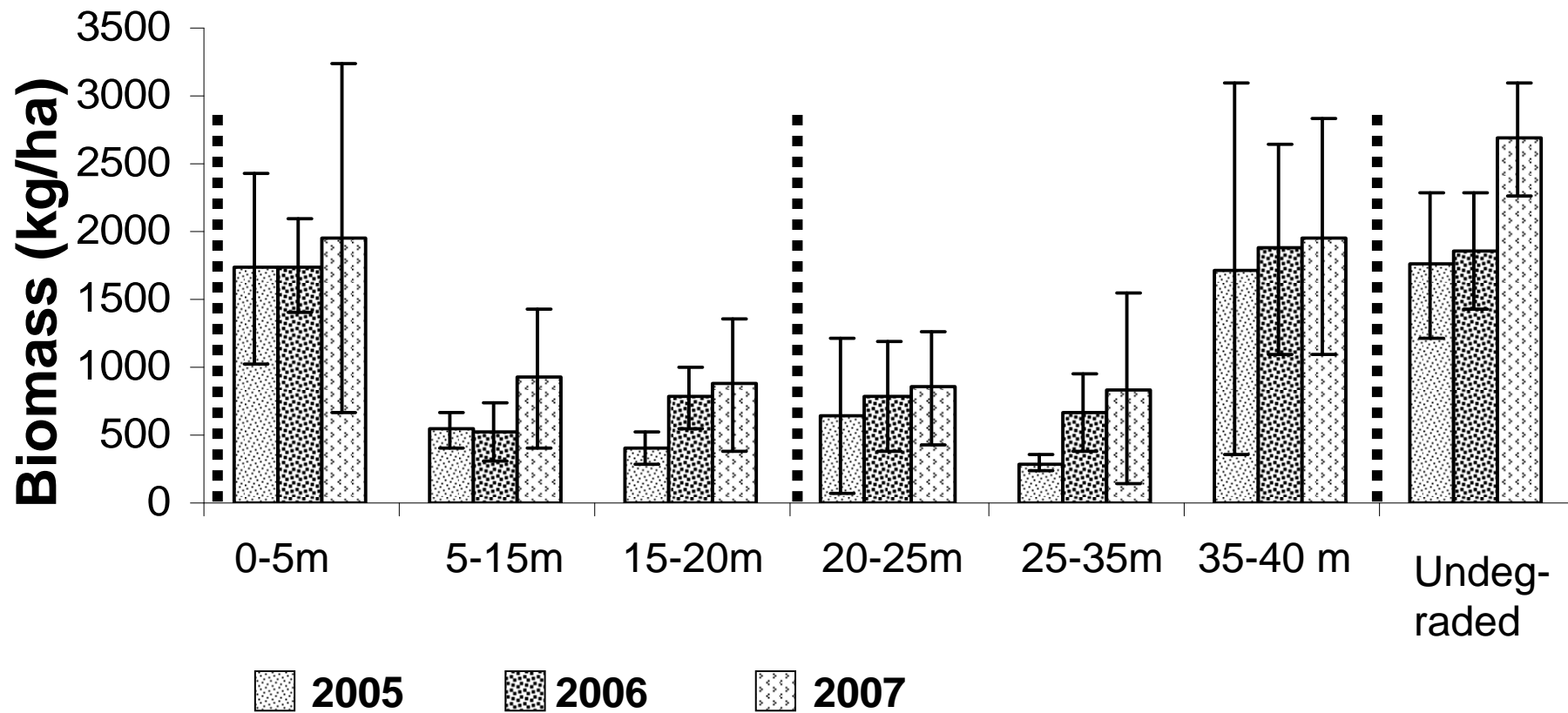
Results

Herbaceous cover development

Harmattan (NNE)



Monsoon (SSO)



Results

Biodiversity of herbaceous ground cover

Location	Number of species (families)		
	2005	2006	2007
Outside	/	26	15
Inside	13 (8 families)	29 (18 families)	59 (20 families)
Undeg- raded area	11 (8 families)	33 (18 families)	71 (23 families)

Conclusions

- The mechanical dune fixation technique was very effective at reducing sediment fluxes : 98% in the first year, and virtually 100% thereafter.
- This is the result of the combined effect of the windbreak and the recovery of the herbaceous groundcover

Conclusions

- Immediately behind the windbreak, the soil is enriched in fine particles as well as Corg and Ntot (not shown).
- The latter may be both the cause and the result of better growth of the grass
- In the fenced-off area, grass biodiversity recovered to levels almost similar to the undegraded area

Recommendations

- The effectiveness of the technique strongly relies on grazing control
- As the windbreaks decay rapidly, the outer windbreaks must be maintained regularly in order to keep animals out.
- Inner windbreaks do not need to be maintained once the grass cover has established.
- Limited exploitation of the grasses for animal feed may be possible in good rainfall years...
- Rapid grass recovery is not observed on all fixed dunes !

Thank you for your attention

