Decentralized Water and
Wastewater International Network(DEWSIN)
Kathmandu Nepal 2009

On-site wastewater treatment in Flanders, opportunities and threats for constructed wetlands

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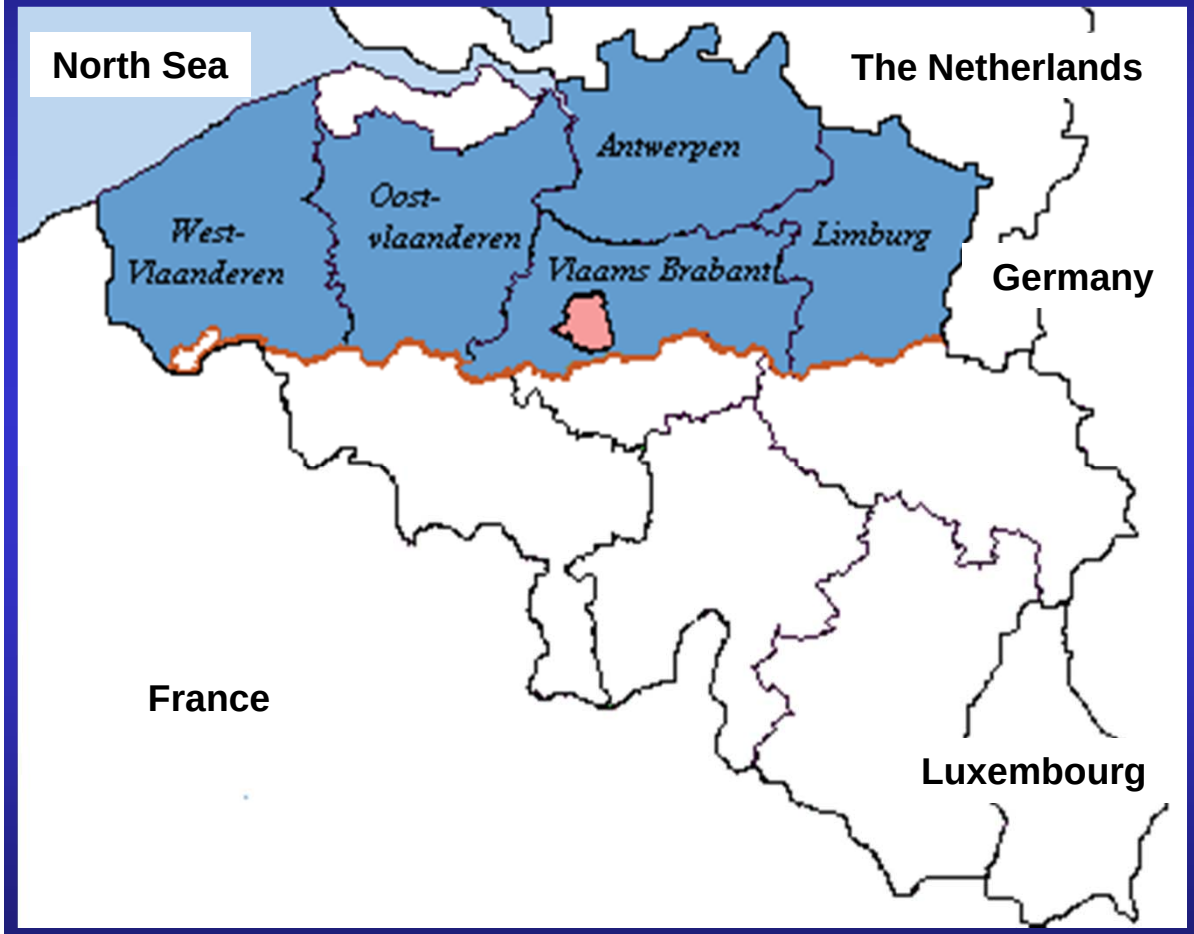
Water Policy in Flanders

Flanders



- 13,522 km²
- 6.1 million people
- 451 inh./km²

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Water Policy in Flanders

- **European directives**:
  - European Urban Wastewater directive (1991)
  - European Water framework regulation (2000)

↓

Belgium

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- **Flemish regulations:**
  - Flemish Regulations on the Environmental Permit: Vlarem I (1991) en II (1995)
  - Decree on Integral Water Policy (2003)

Water Policy in Flanders

Aquafin(1990)

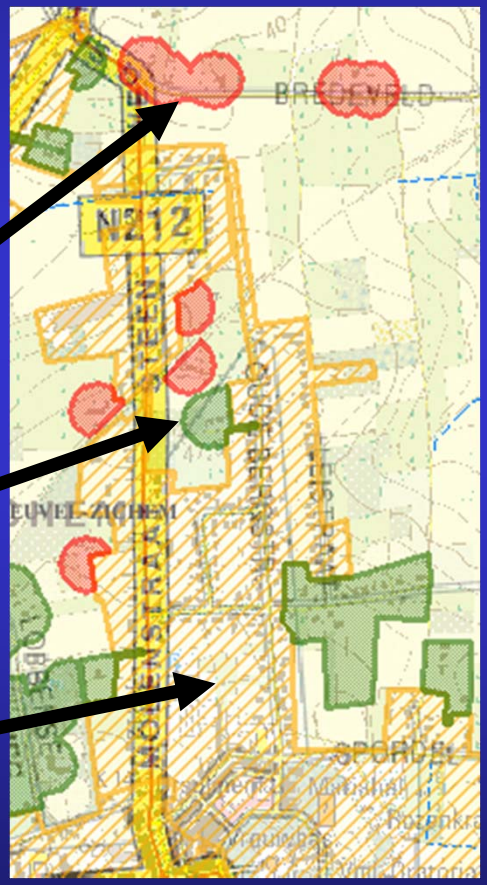
- Domestic wastewater collection and treatment
- Supramunicipal level
- Shareholder: Flemish Government

Water Policy in Flanders

2007: 83.9% collective treatment

Zoning plans:

- individual treatment per family home
- sewer system connected to a small-scale WWTP
- sewer system connected to a large-scale WWTP



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Water Policy in Flanders

Effluent standards for individual WWTP's:

- pH 6.5- 9
- BOD < 25mg/l
- Suspended Solids < 60mg/l
- no nutrients in concentrations higher than 10 times the environmental quality standards of the receiving watercourse
- no fats, oils or floating products

Constructed Wetlands

Types of constructed wetlands:

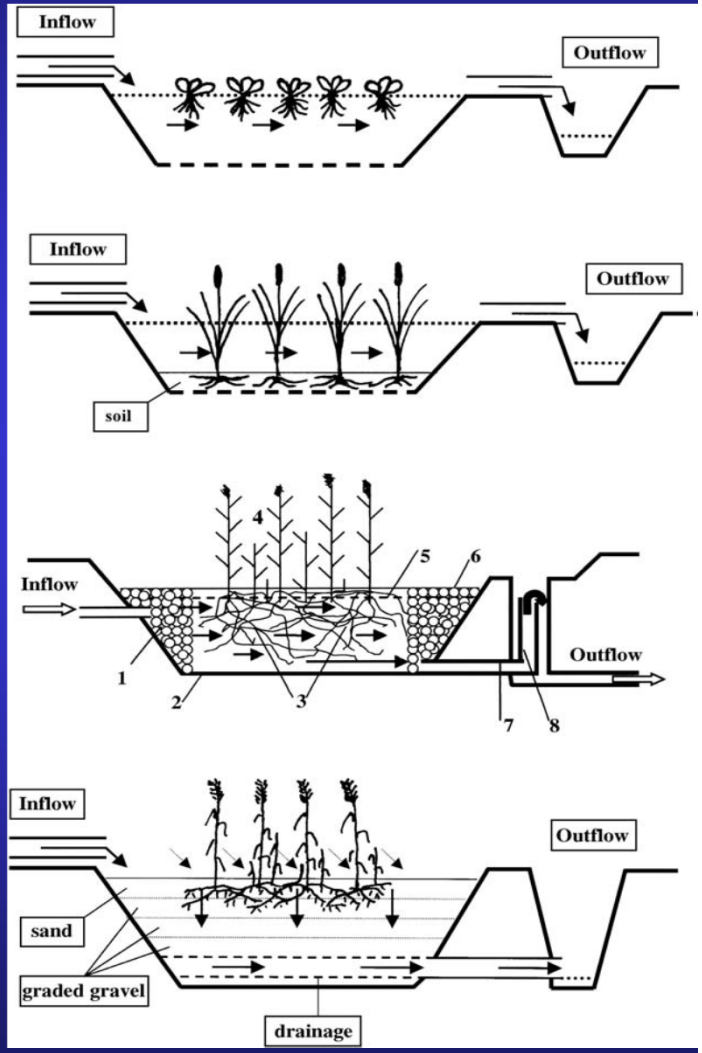
- ***Surface flow wetlands***

(free-water surface wetlands (FWS)

  - Stabilization ponds;
  - Floating Macrophyte Filter Systems

- ***Subsurface flow wetlands*** *(SF)*
  - Subsurface horizontal flow wetland

  (rootzone reedbed)
  - Subsurface vertical flow wetland.



Constructed Wetlands

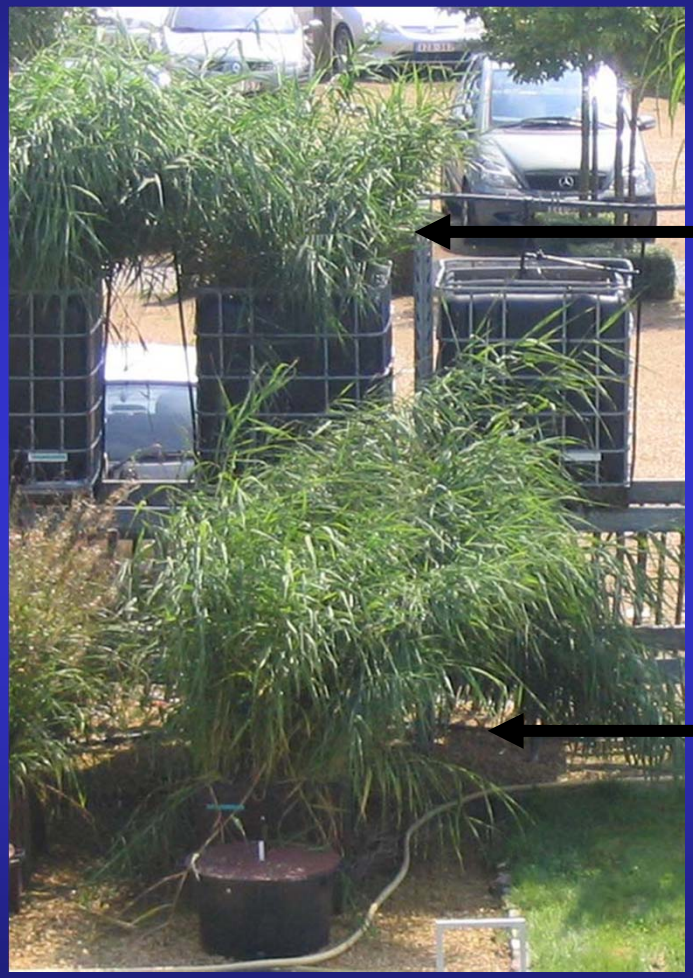
- ***Wetland treatment:***
  - Organic matter, TSS, N, P, pathogens
- ***Removal mechanism:***
  - ***Biological:***
    - microbial degradation
    - plant uptake
  - ***Physico- chemical:***
    - adsorption
    - sedimentation
    - precipitation

Materials and Methods

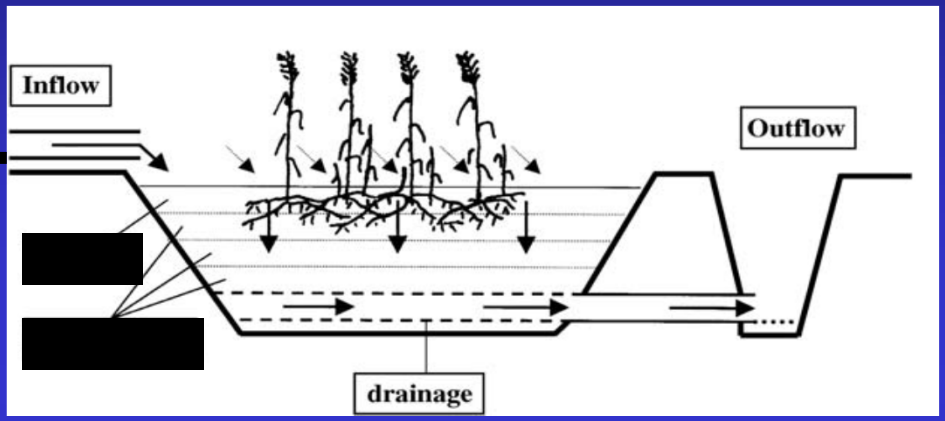
- different systems: VSSF, HSSF, stabilisation pond
- different media: sand,expanded clay,gravel
- different plant species:

Phragmites australis, Iris speudacorus, Carex riparia, Scirpus lacustris, Eriophorum angustifolium, Sparganium erectum, Miscanthus floridulus

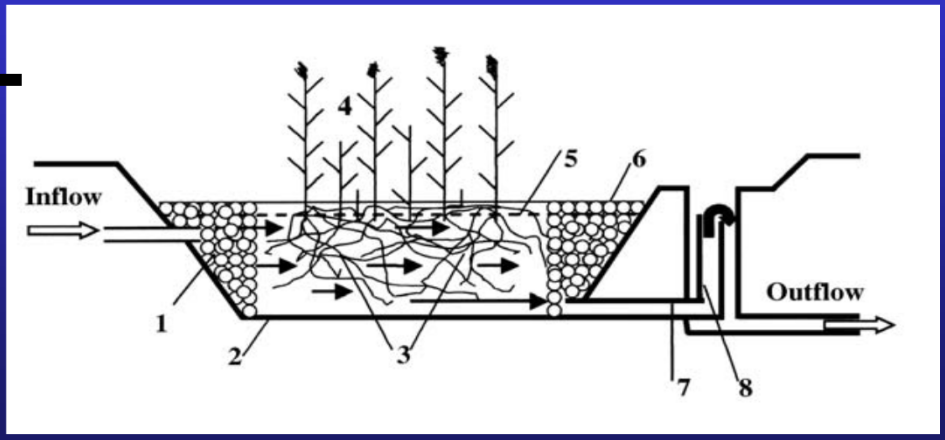
Materials and Methods



Vertical Subsurface Flow Wetland



Horizontal Subsurface Flow Wetland



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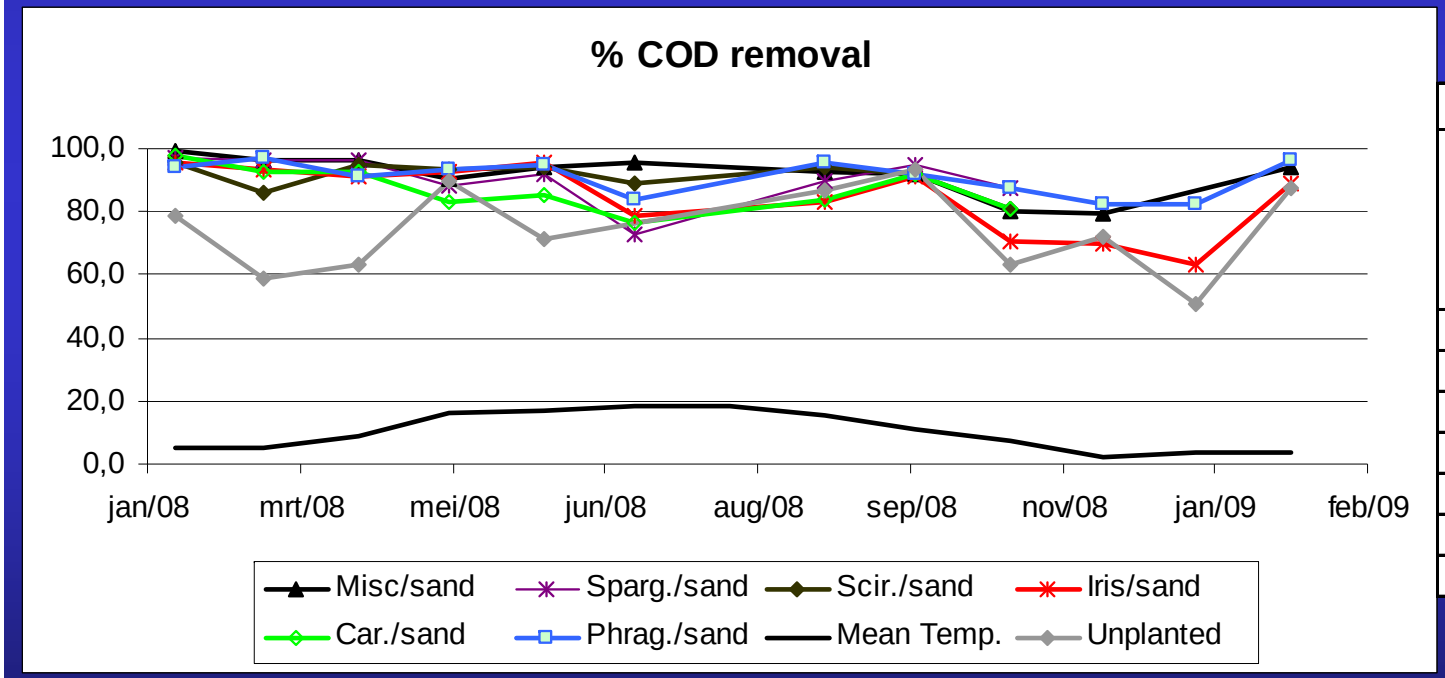
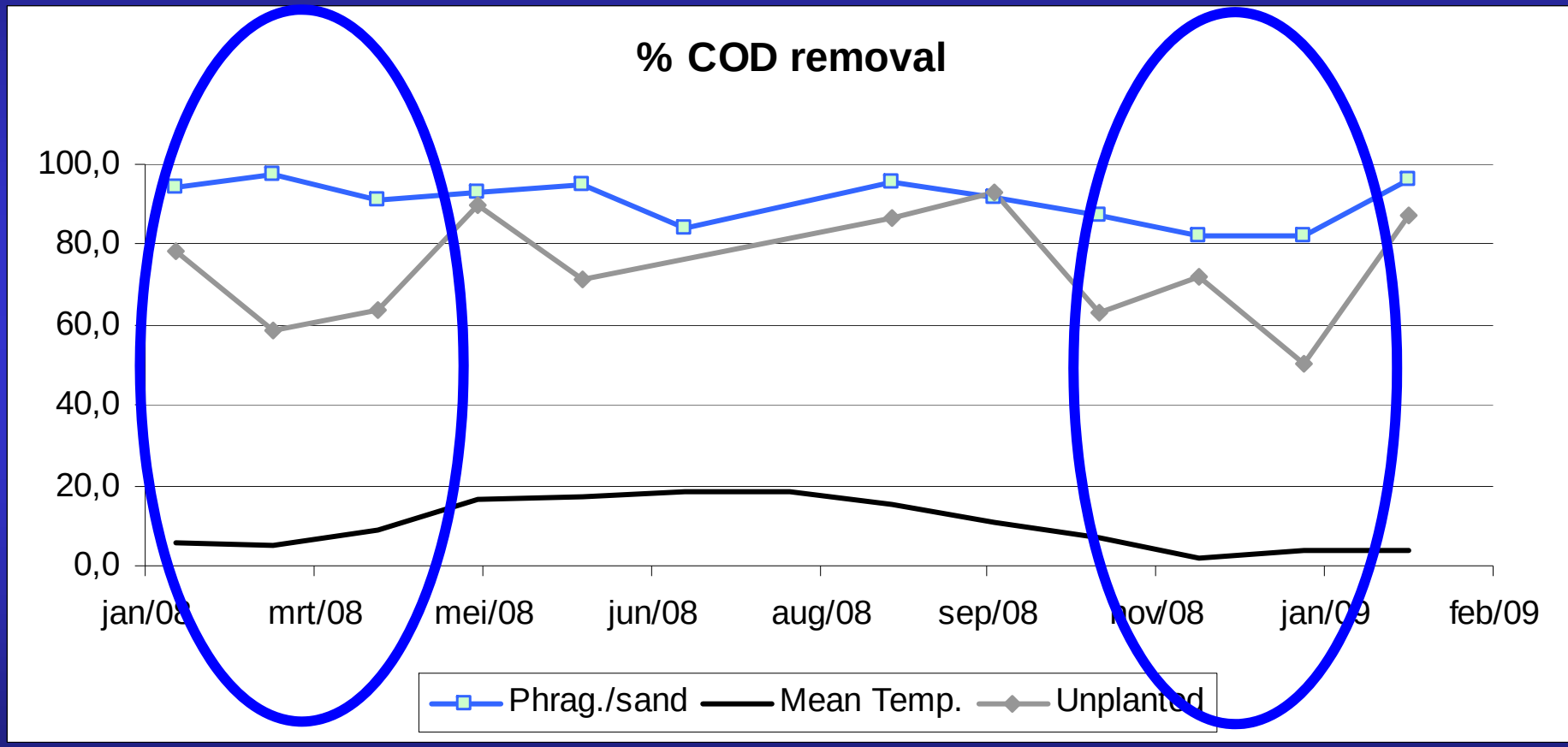
Results and Discussion

- ***ORGANIC MATTER: Temperature***



	% COD	
	Mean Value	n
Scirpus Sand	**92,1**	31
Miscanthus Sand	**91,9**	55
Phragmites Sand	**91,0**	28
Sparganium Sand	**90,6**	30
Carex Sand	**87,3**	29
Iris Sand	**86,2**	59
Unplanted Sand	**76,1**	59

Results and Discussion



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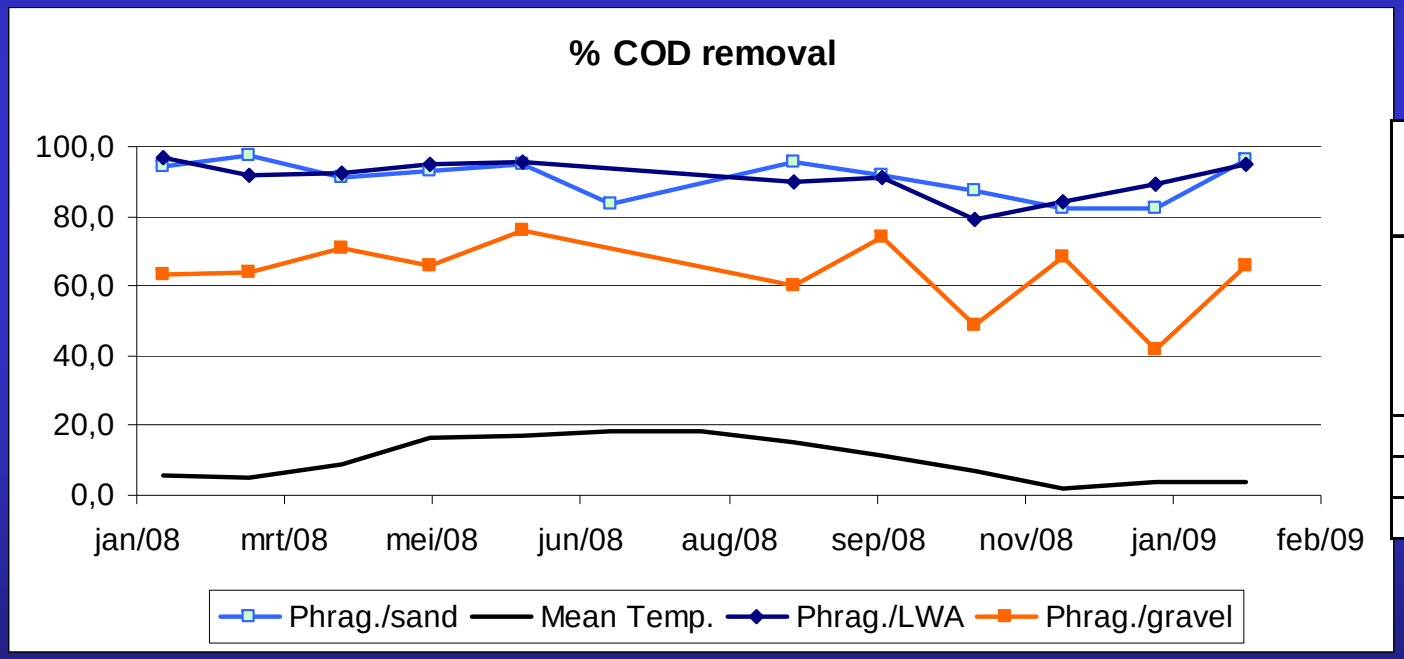
Results and Discussion

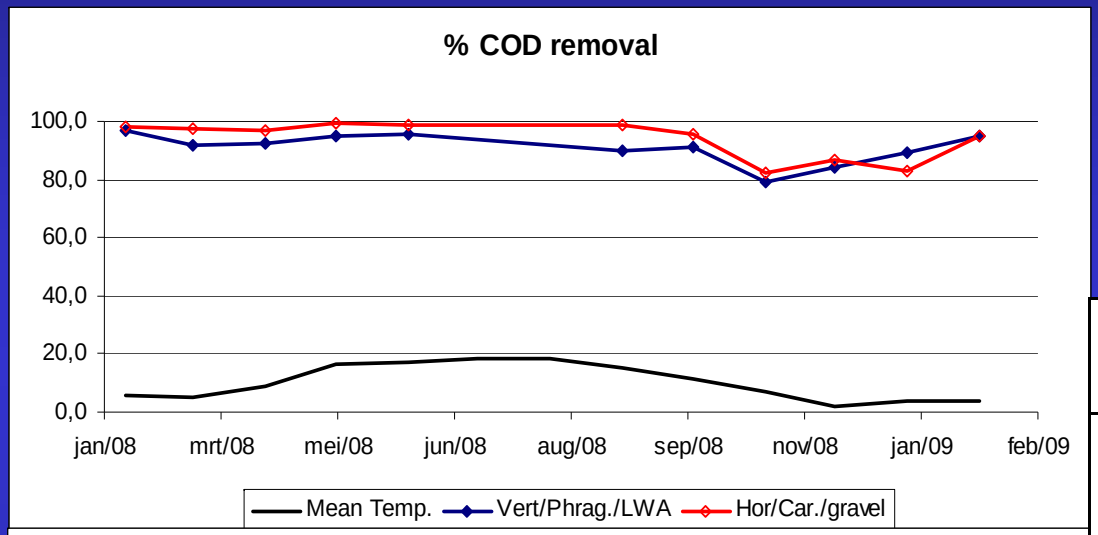
- ***ORGANIC MATTER : different substrates***

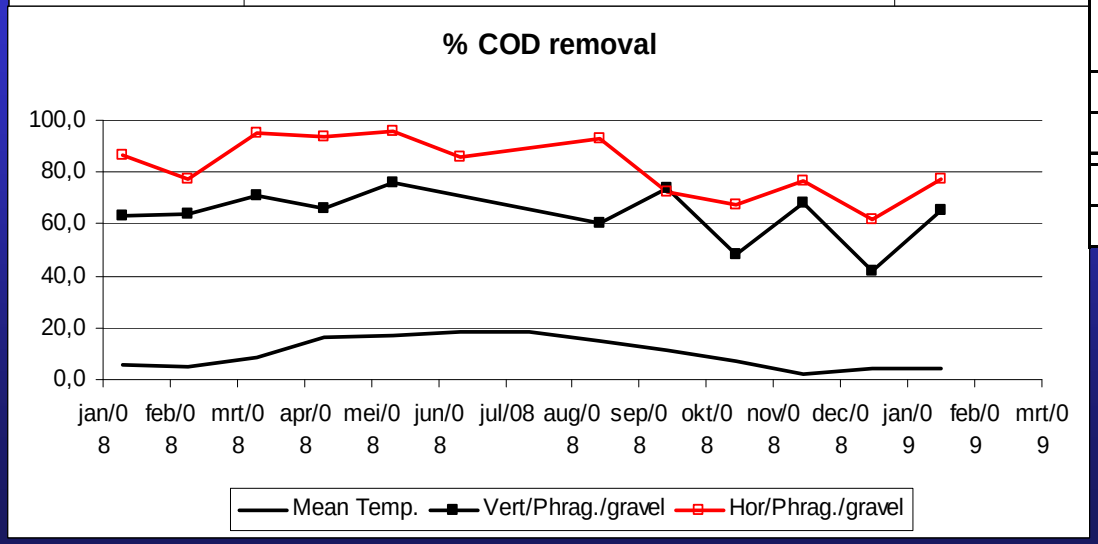


	% COD	
	Mean Value	n
Phragmites LWA	**92,9**	62
Phragmites Sand	**91,0**	28
Phragmites Gravel	**65,2**	61

Results and Discussion

- ***ORGANIC MATTER: hybrid systems***

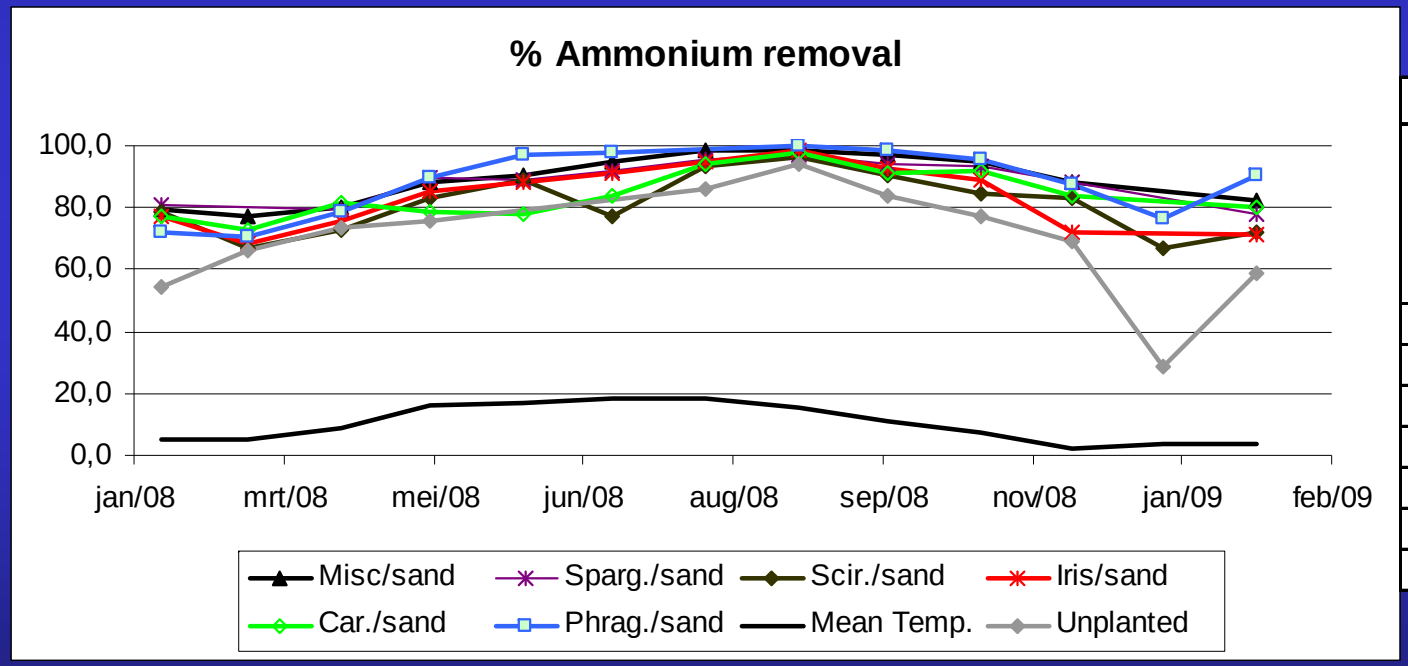




	% COD	
	Mean Value	n
Phragmites Vertical LWA	**92,9**	62
Carex Horizontal Gravel	**95,4**	57
Phragmites Vertical Gravel	**65,2**	61
Phragmites Horizontal Gravel	**85,3**	43

Results and Discussion

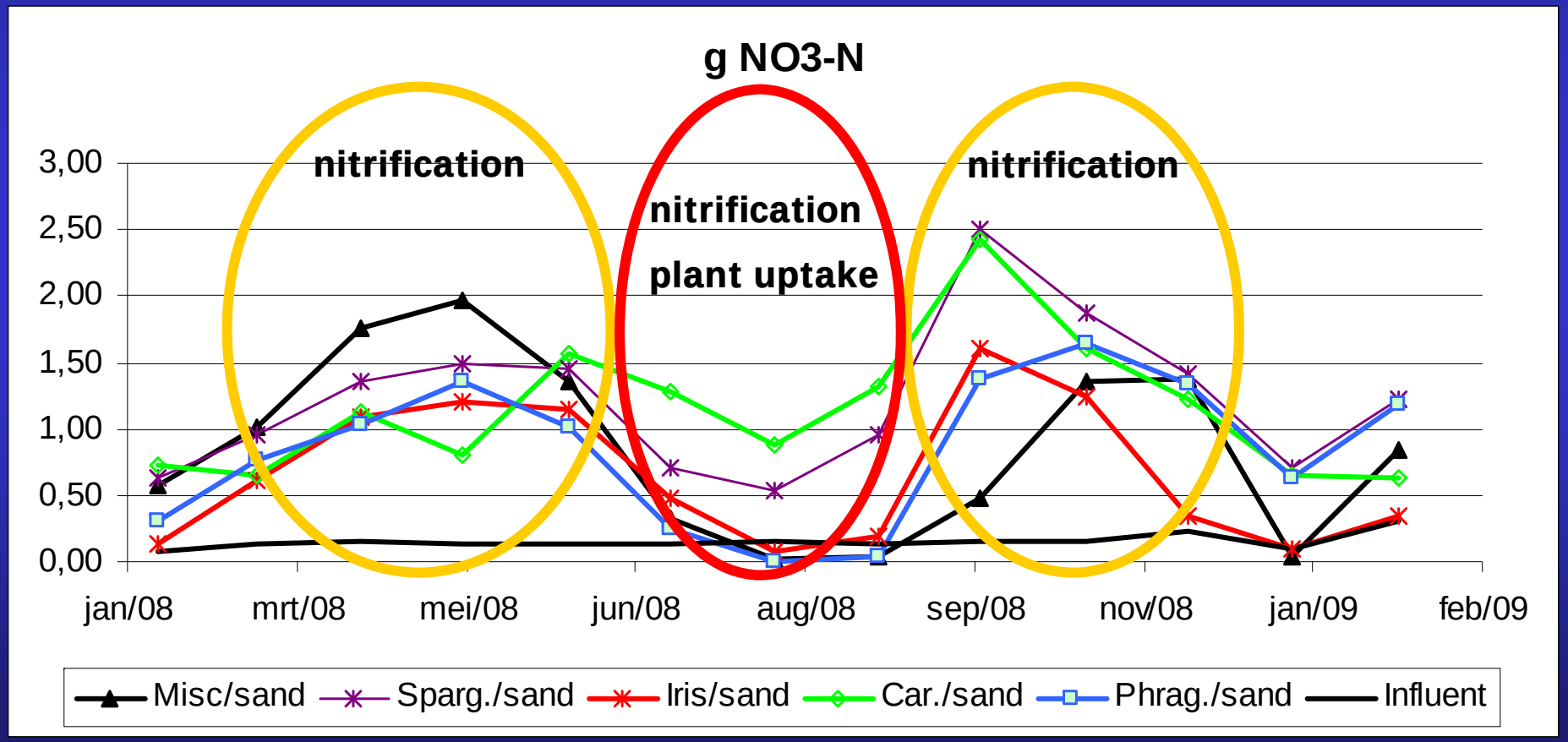
- ***Ammonium removal***



	% NH4-N	
	Mean Value	n
Phragmites Sand	**93,5**	67
Miscanthus Sand	**92,0**	66
Sparganium Sand	**90,6**	69
Scirpus Sand	**87,2**	70
Carex Sand	**86,3**	54
Iris Sand	**85,2**	71
Control Sand	**71,1**	67

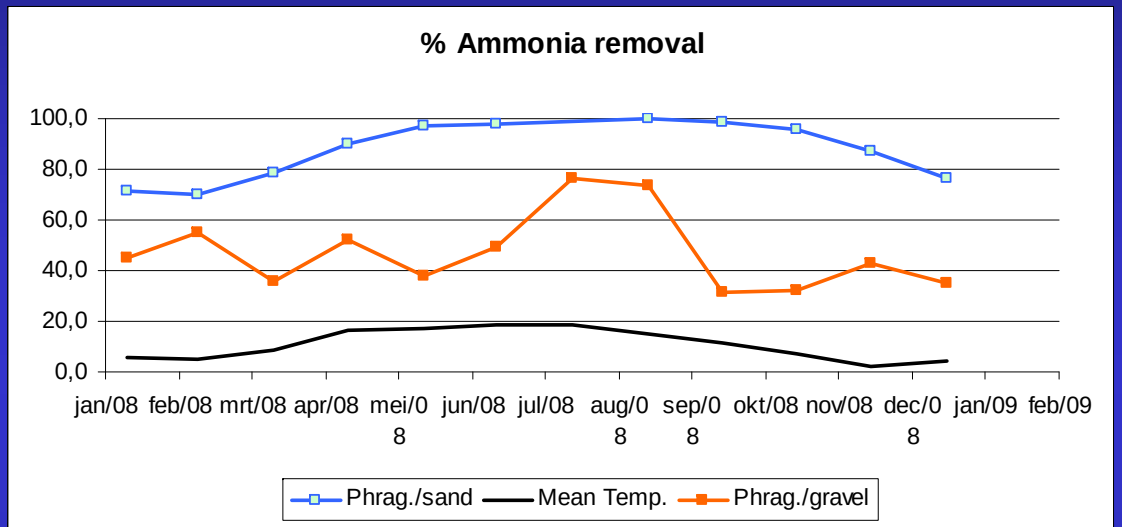
Results and Discussion

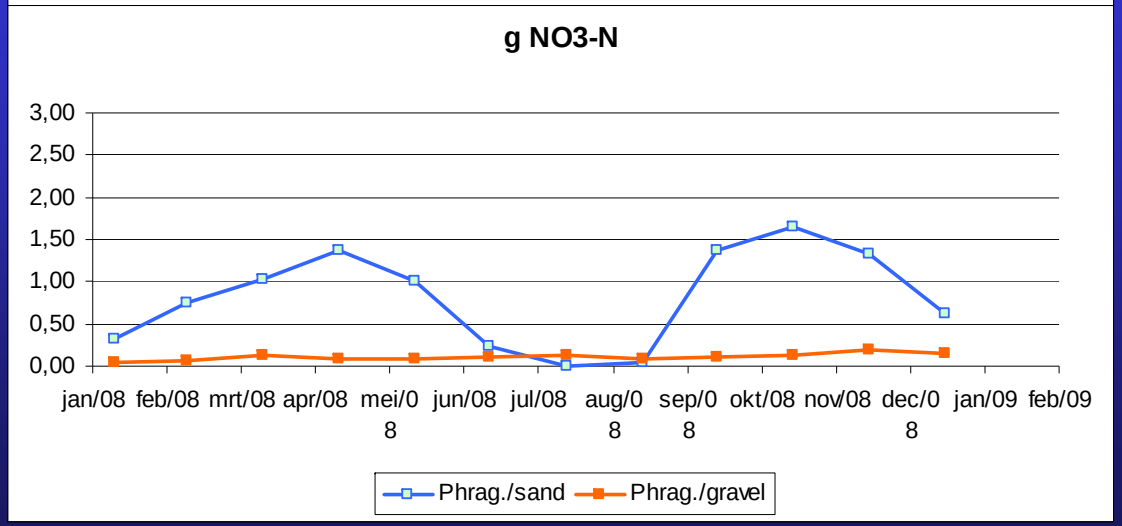
- ***Nitrification - plant uptake***



Results and Discussion

- ***Different substrates***





	% NH4-N	
	Mean Value	n
Phragmites Sand	**93,5**	67
Phragmites LWA	**88,8**	68
Phragmites Gravel	**52,3**	71

Results and Discussion

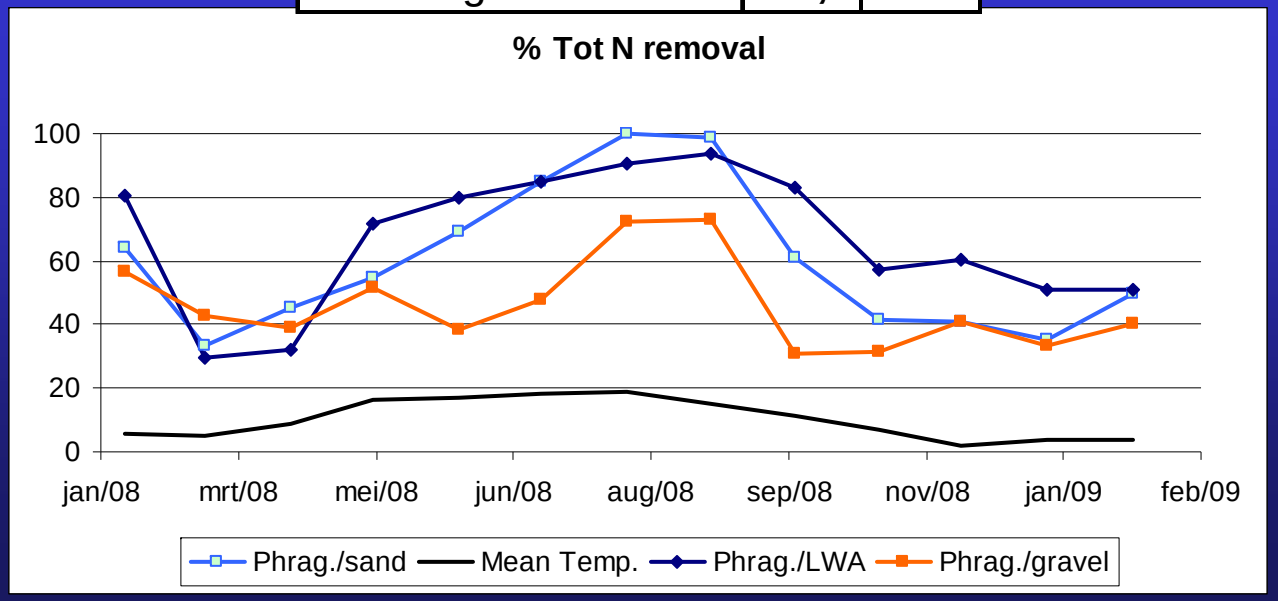
- Percentage Total N removal: plant spp.

	% Total N	
	Mean Value	n
Miscanthus Sand	**67,5**	67
Phragmites Sand (H)	**67,2**	64
Phragmites Sand	**65,2**	66
Iris Sand	**63,6**	69
Sparganium Sand	**52,9**	70
Carex Sand	**48,0**	51
Unplanted Sand	**47,1**	68
Scirpus Sand	**46,6**	68
Carex Sand (H)	**41,8**	51
Eriophorum Sand	**39,7**	52

Results and Discussion

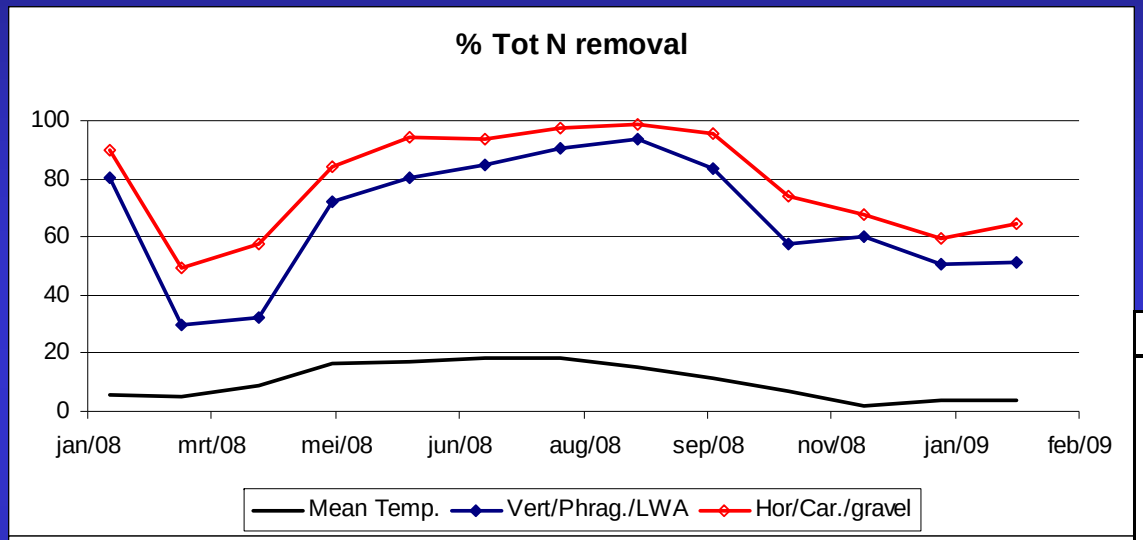
- Percentage Total N removal: substrates

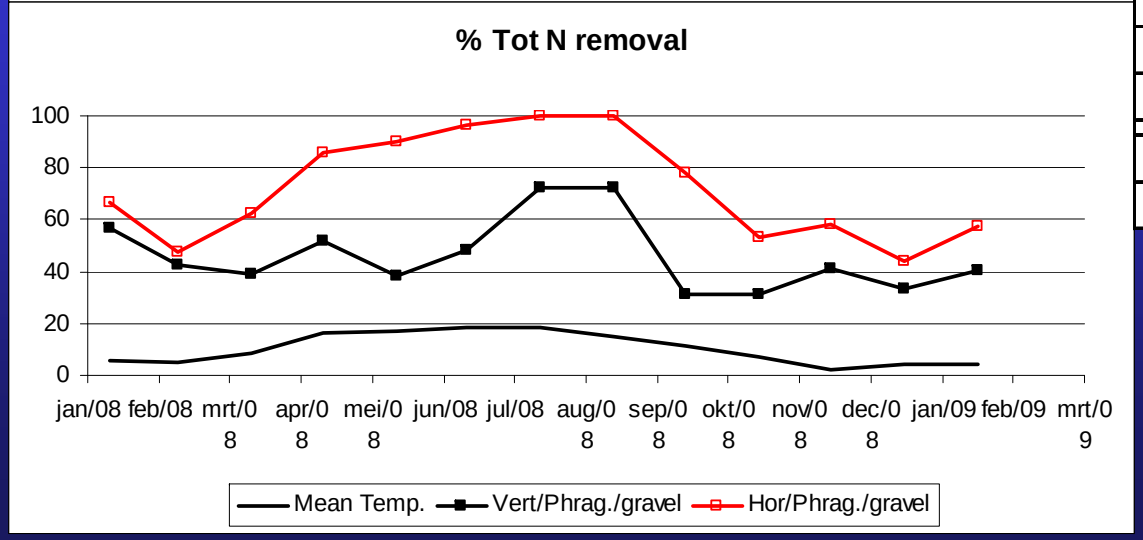
	% Total N	
	Mean Value	n
Phragmites LWA	**70,9**	70
Phragmites Sand	**65,2**	66
Phragmites Gravel	**51,3**	71



Results and Discussion

- Percentage Total N removal: Hybrid systems





	% Total N	
	Mean Value	n
Phragmites Vertical LWA	**70,9**	70
Carex Horizontal Gravel	**81,9**	66
Phragmites Vertical Gravel	**51,3**	71
Phragmites Horizontal Gravel	**77,4**	53

Results and Discussion

Phosphorus removal

	% Total P	
	Mean Value	n
Phragmites LWA	**89,4**	49
Miscanthus Sand	**58,4**	22
Phragmites Sand (H)	**51,8**	46
Phragmites Sand	**46,9**	47
Sparganium Sand	**35,9**	53
Phragmites Gravel	**13,4**	52

	% Total P	
	Mean Value	n
Phragmites Vertical LWA	**89,4**	49
Carex Horizontal Gravel	**98,3**	48
Phragmites Vertical Gravel	**13,4**	52
Phragmites Horizontal Gravel	**62,0**	34

Conclusions

- The removal of organic matter is very reliable through the year;
- As for nutrient removal nitrogen is nitrified almost completely in most systems;
- The removal of total N is limited and depends on the substrate and plants used;
- Phosphorous removal is only important in substrates that can adsorb phosphorous,but these materials will become saturated.

Thank you!!!

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