“Direttiva nitrati: dalla ricerca alla gestione del territorio – Inquinamento diffuso e aree tampone

Le fasce riparie di fontanili e canali come filtri naturali per contenere l’inquinamento da nitrati in Pianura Padana

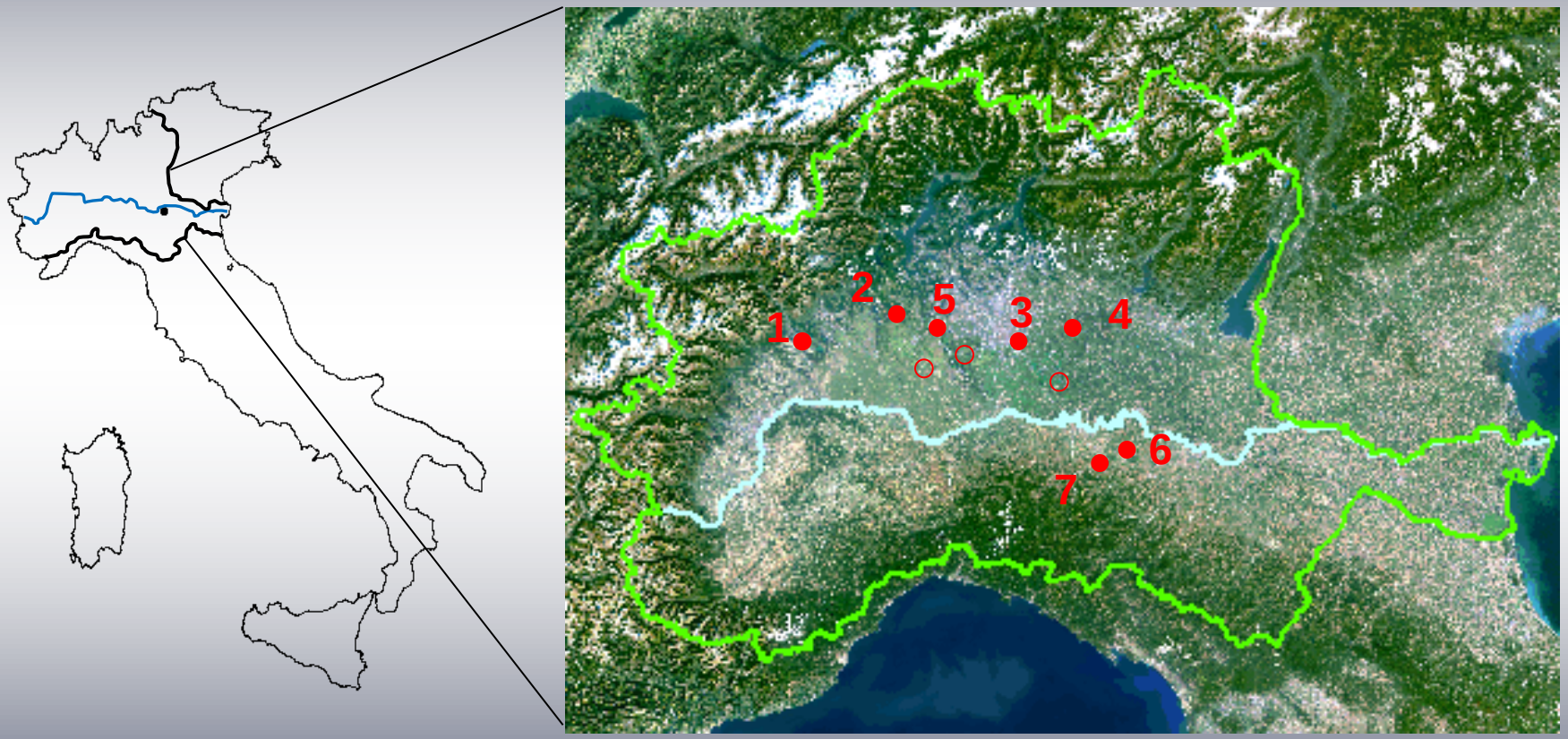
Raffaella Balestrini, Cristina Arese, Alessandro Lotti

Istituto di Ricerca sulle Acque - IRSA-CNR

Legnaro, 31.5/ 1.6.2011

SITI SPERIMENTALI

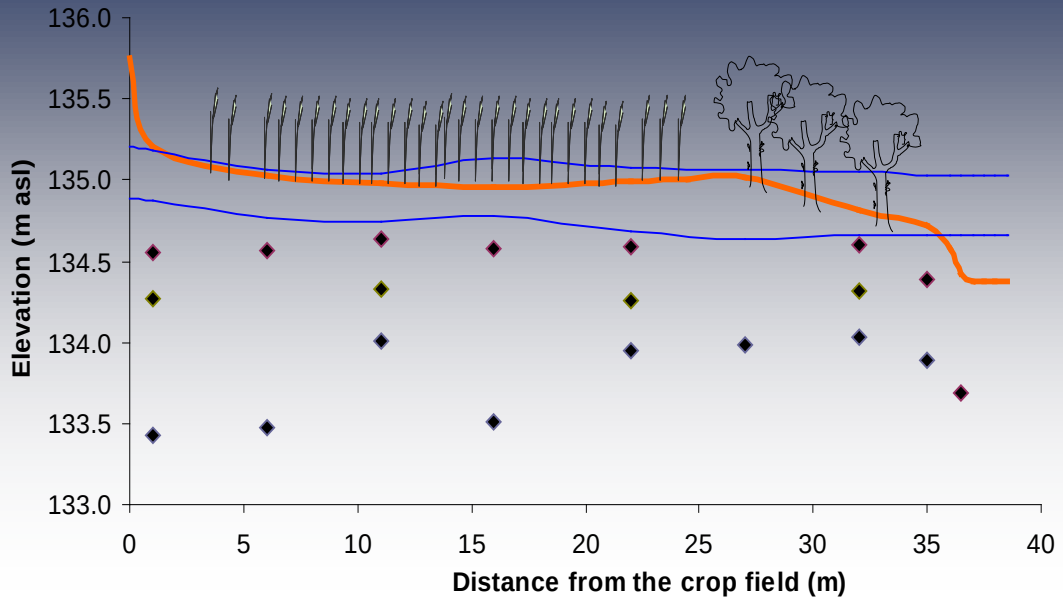
- Lago (1)
- Fontanili (2-5)
- Canali (6-7)



Fondazione Lombardia per l'Ambiente

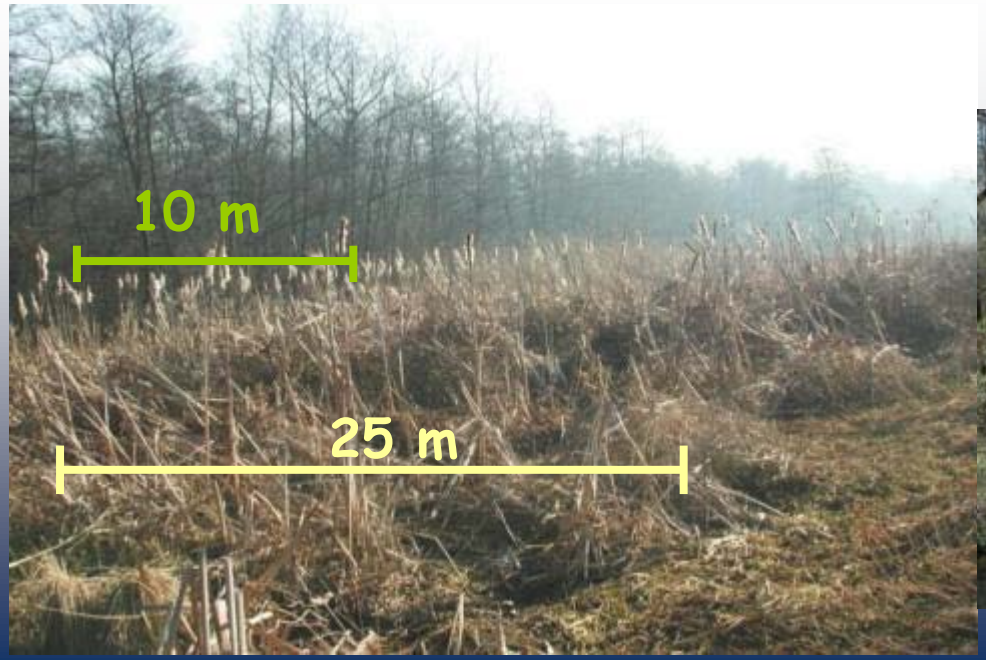
RegioneLombardia

2. F.Le Fontanin (Bacino del Ticino)

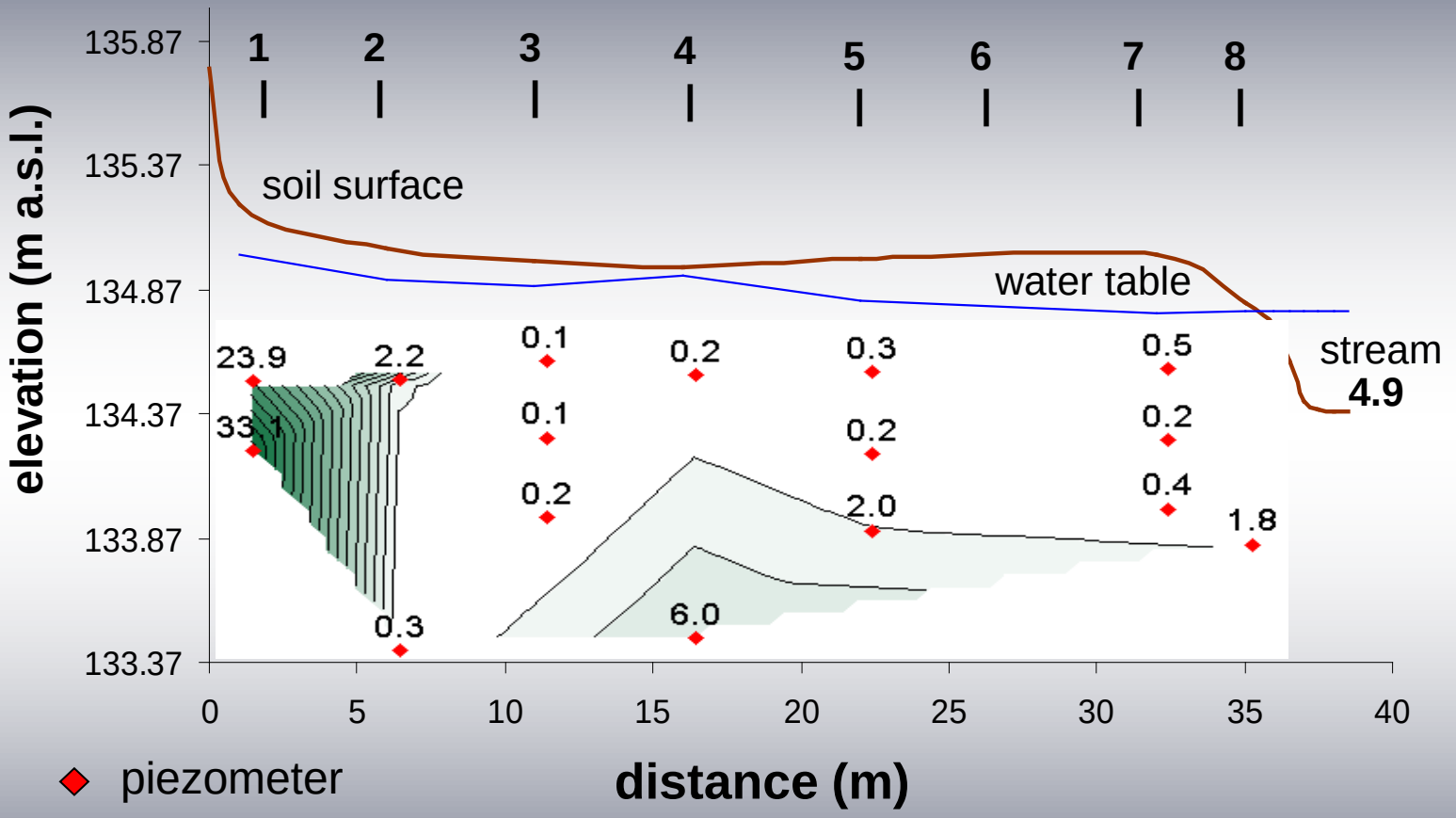


Variazioni del livello della falda: 0.4 m

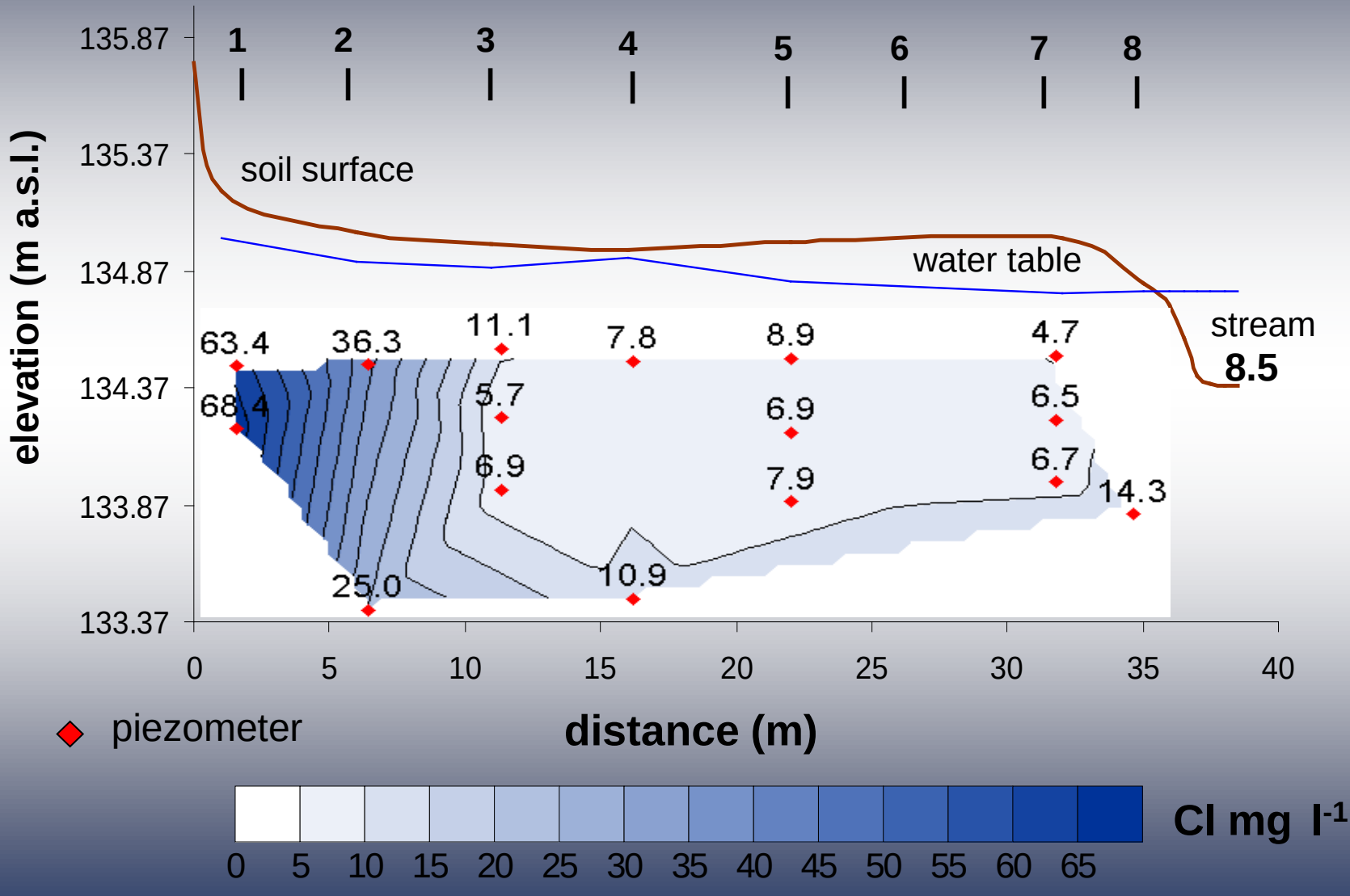
Soggiacenza: 0.2-0.3 m



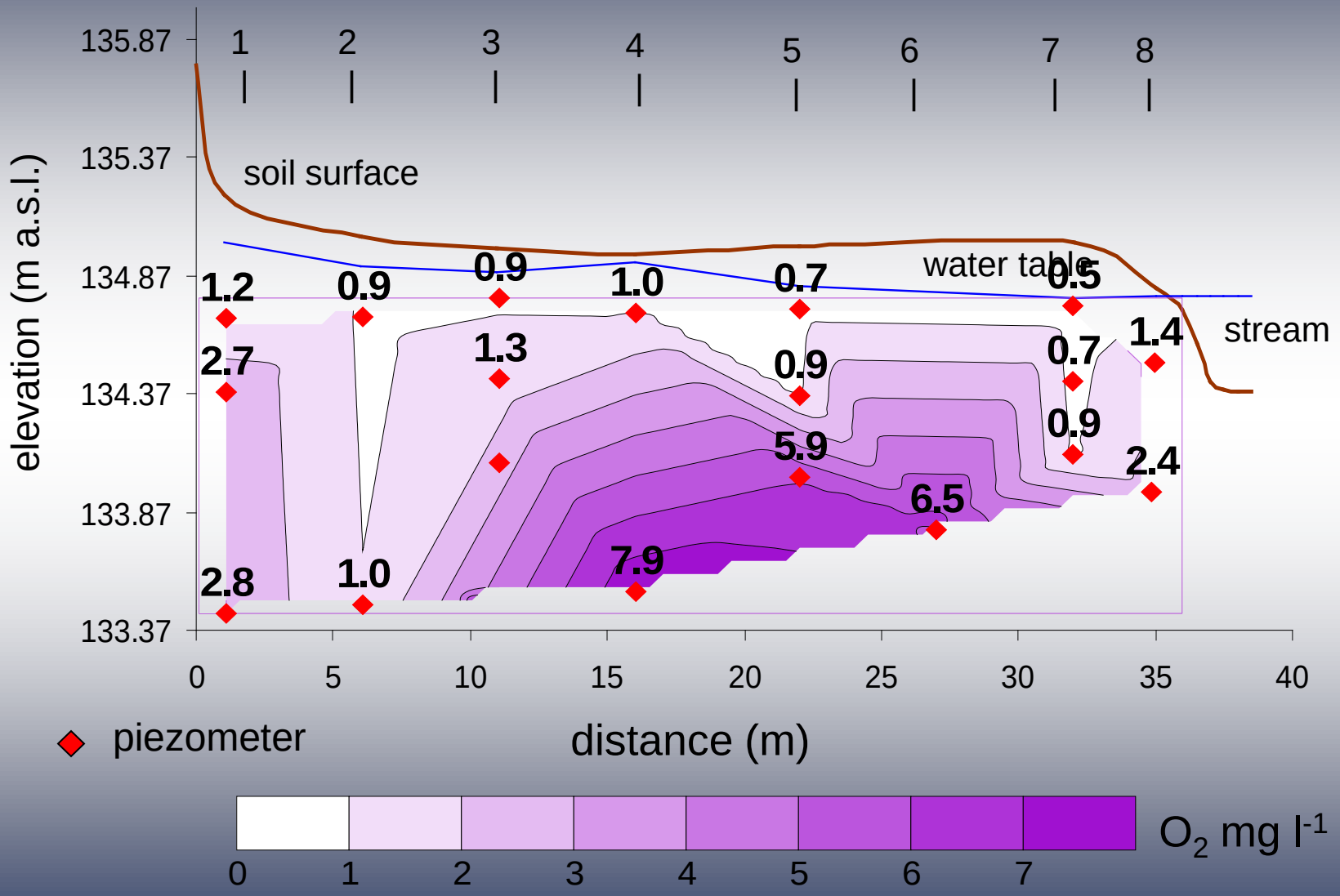
Variazioni spaziali del nitrato dopo la fertilizzazione



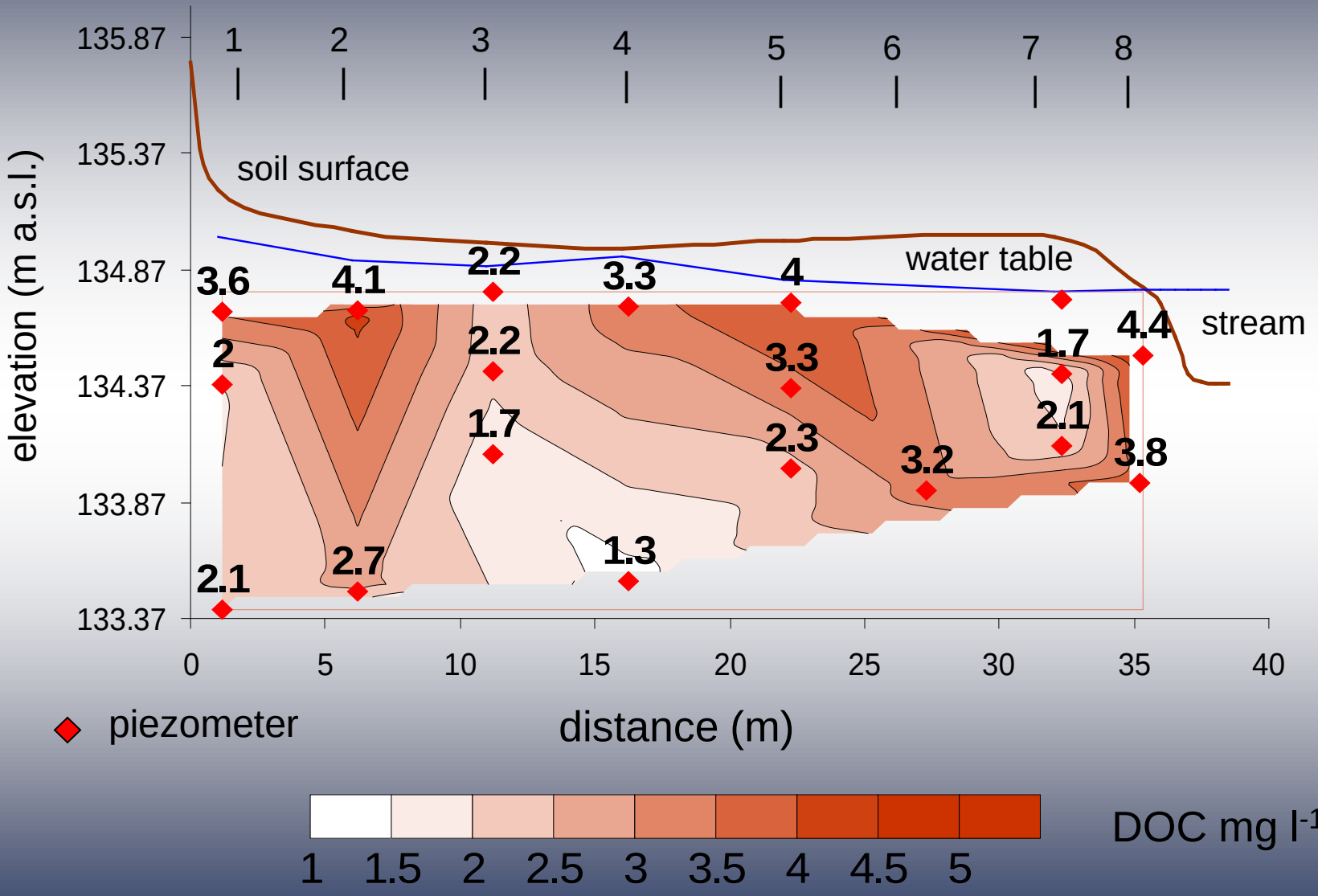
Variazioni spaziali del cloruro durante un evento di fertilizzazione



Variazioni spaziali dell'ossigeno – concentrazioni medie annuali



Variazioni spaziali del DOC - concentrazioni medie annuali



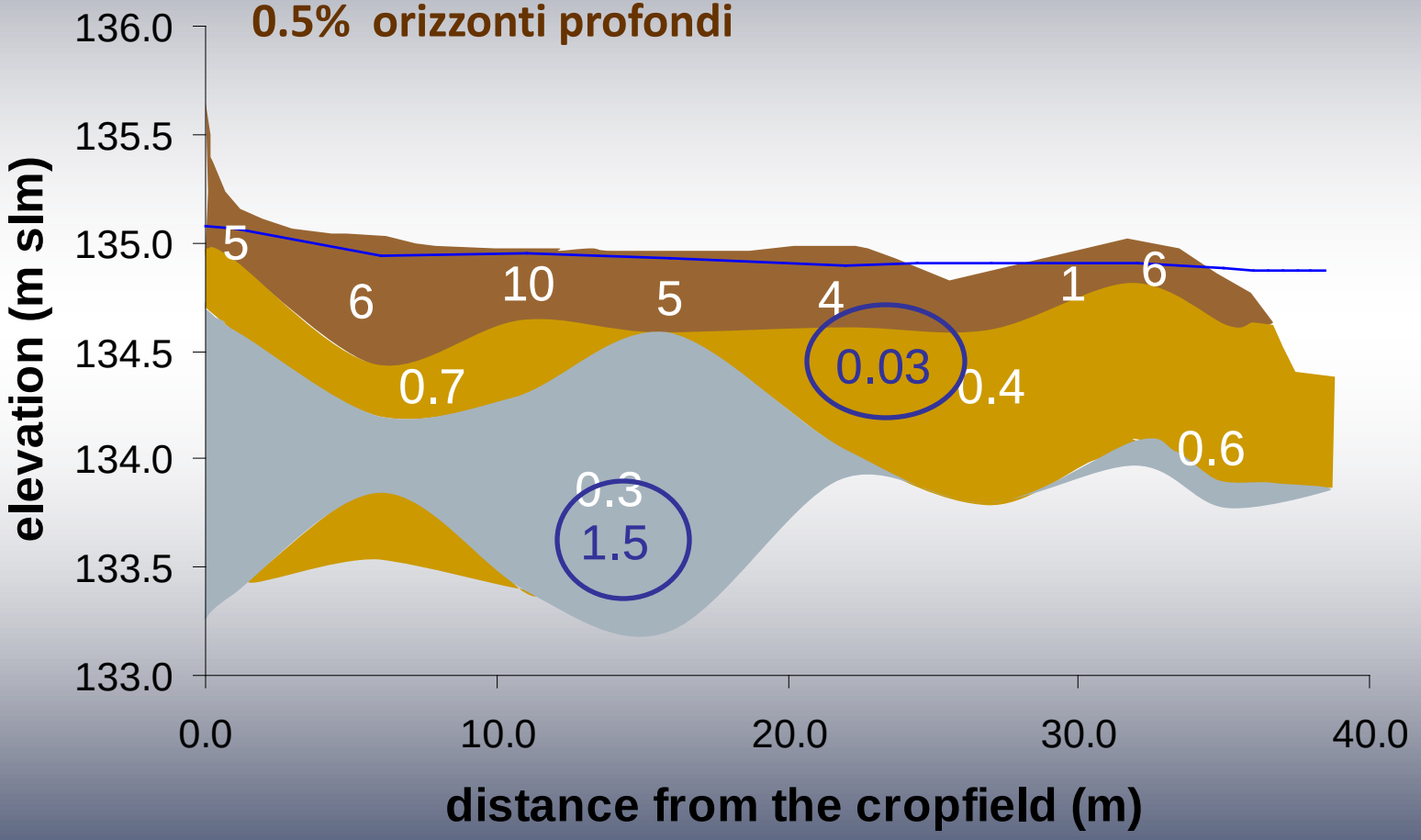
Caratteristiche pedologiche

C org nel suolo

5 % orizzonti superficiali

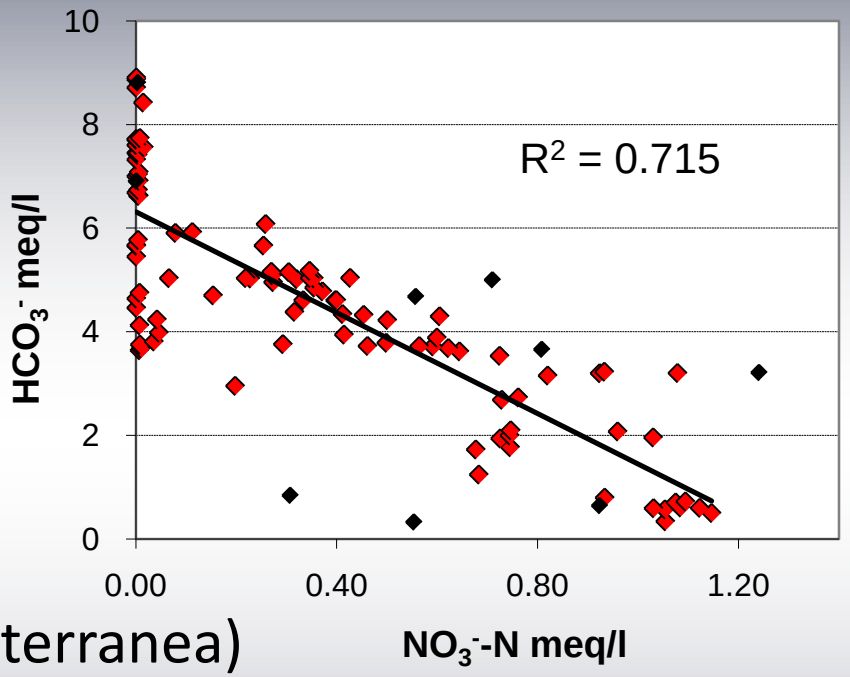
0.5% orizzonti profondi

Conducibilità idraulica



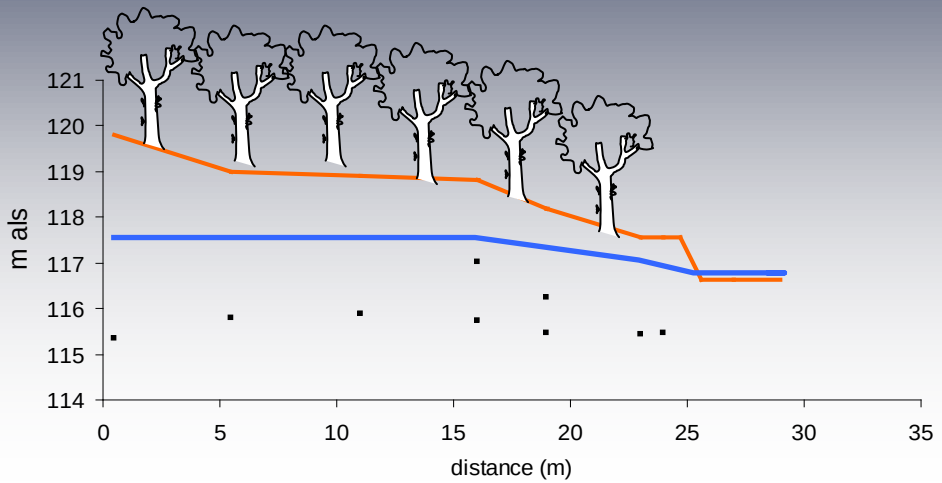
Approccio sperimentale

- Confronto con i cloruri
- Ossigeno disciolto
- Nitrito
- Gradiente di alcalinità



- Idrologia (pioggia, acqua sotterranea)
- Suolo (tessitura, C_{org}, denitrificazione potenziale)

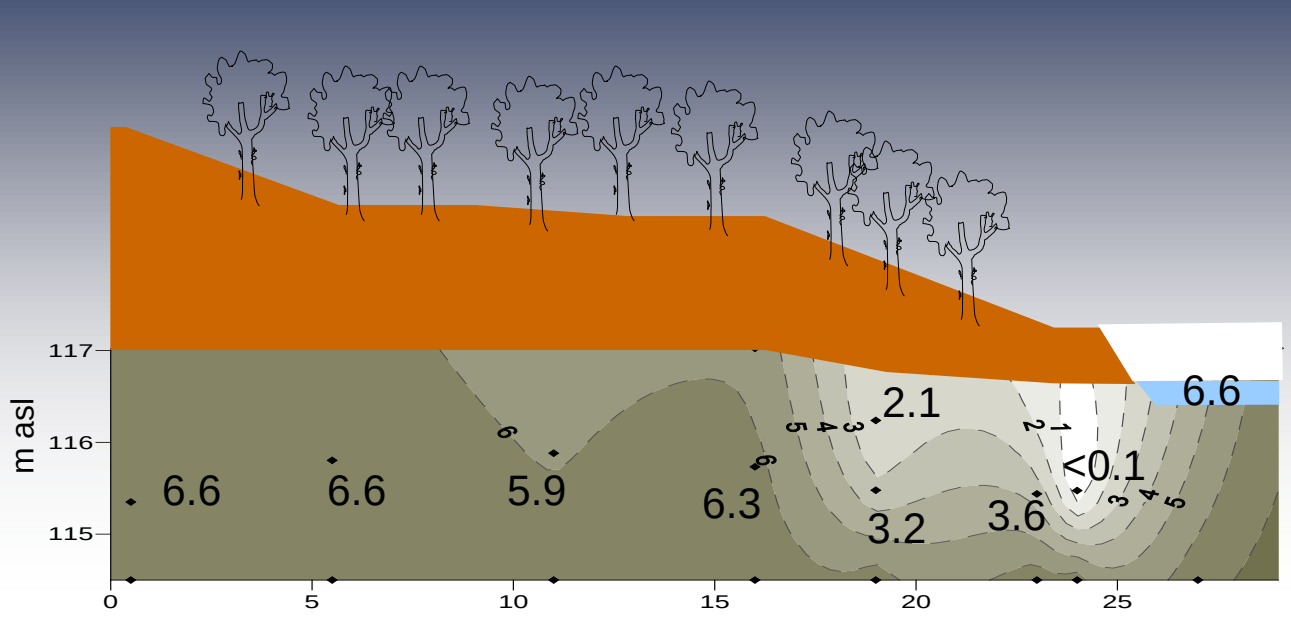
3. Fontanile Rile

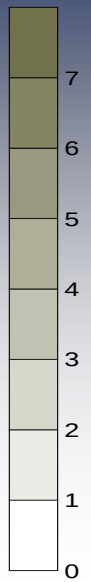


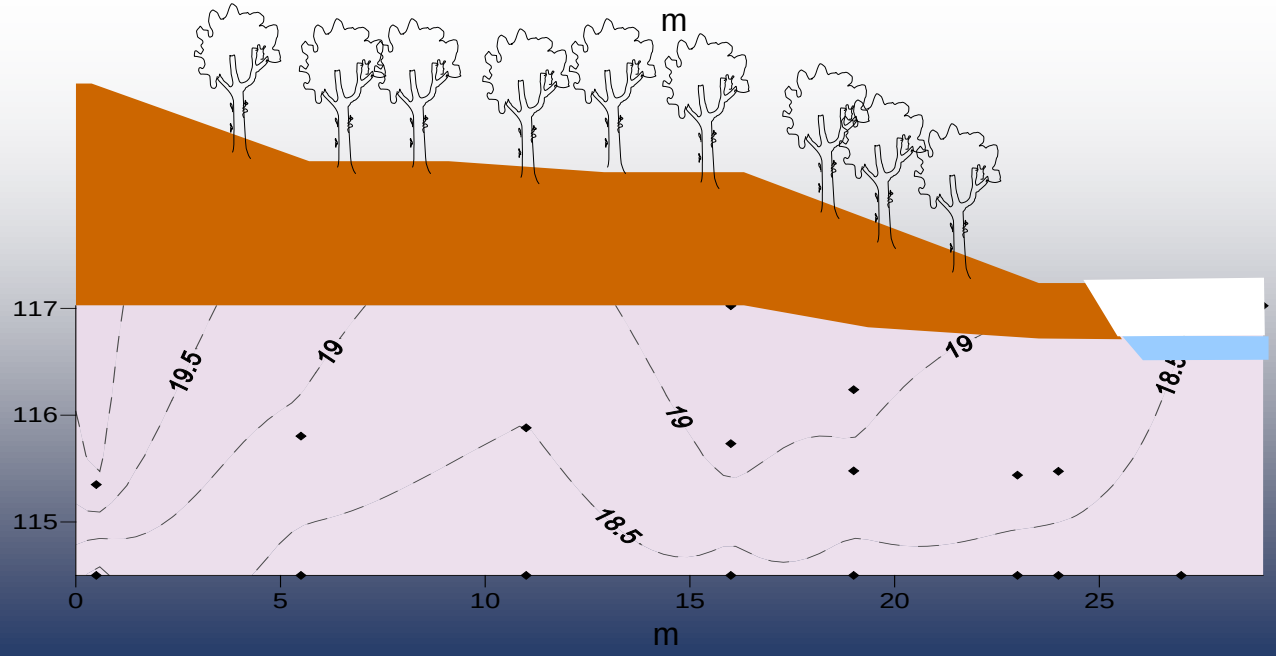
Variazioni del livello della falda: 0.4 m

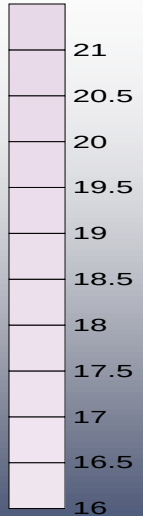
Soggiacenza: 0.6-2.3 m

Variazioni spaziali di nitrato e cloruro

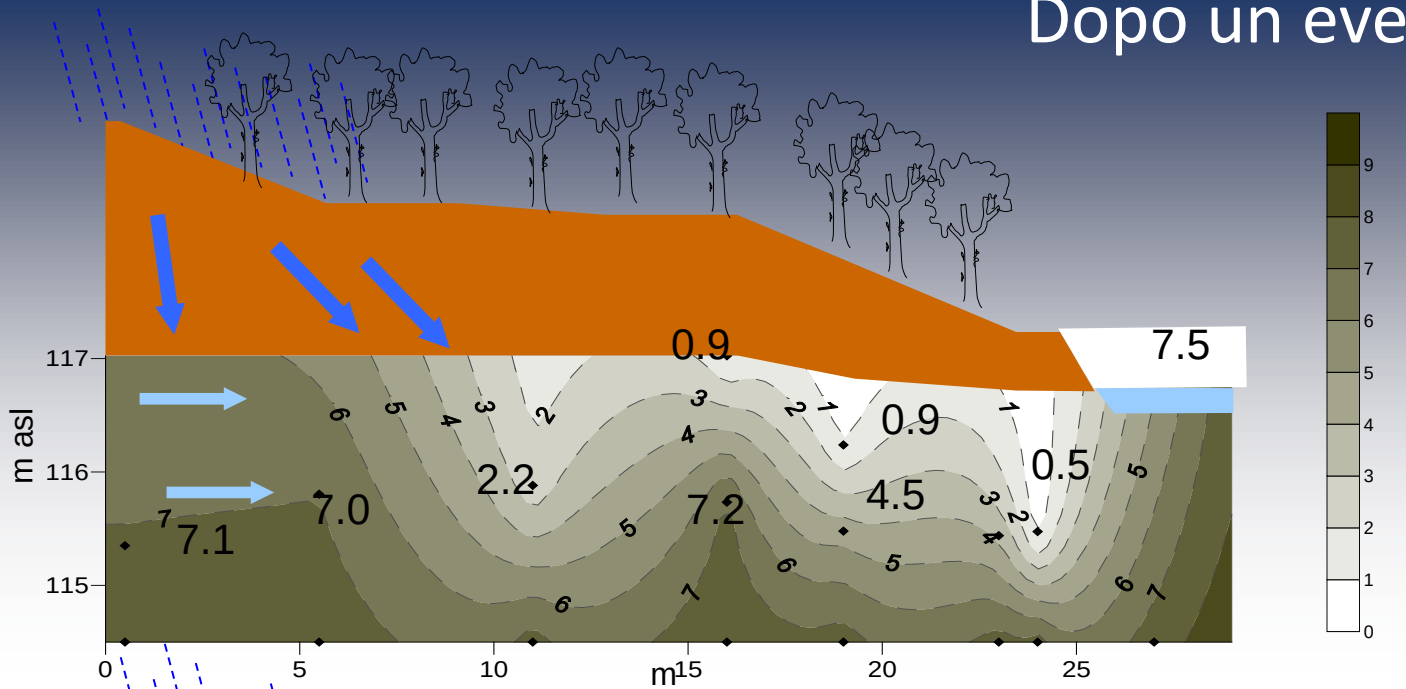






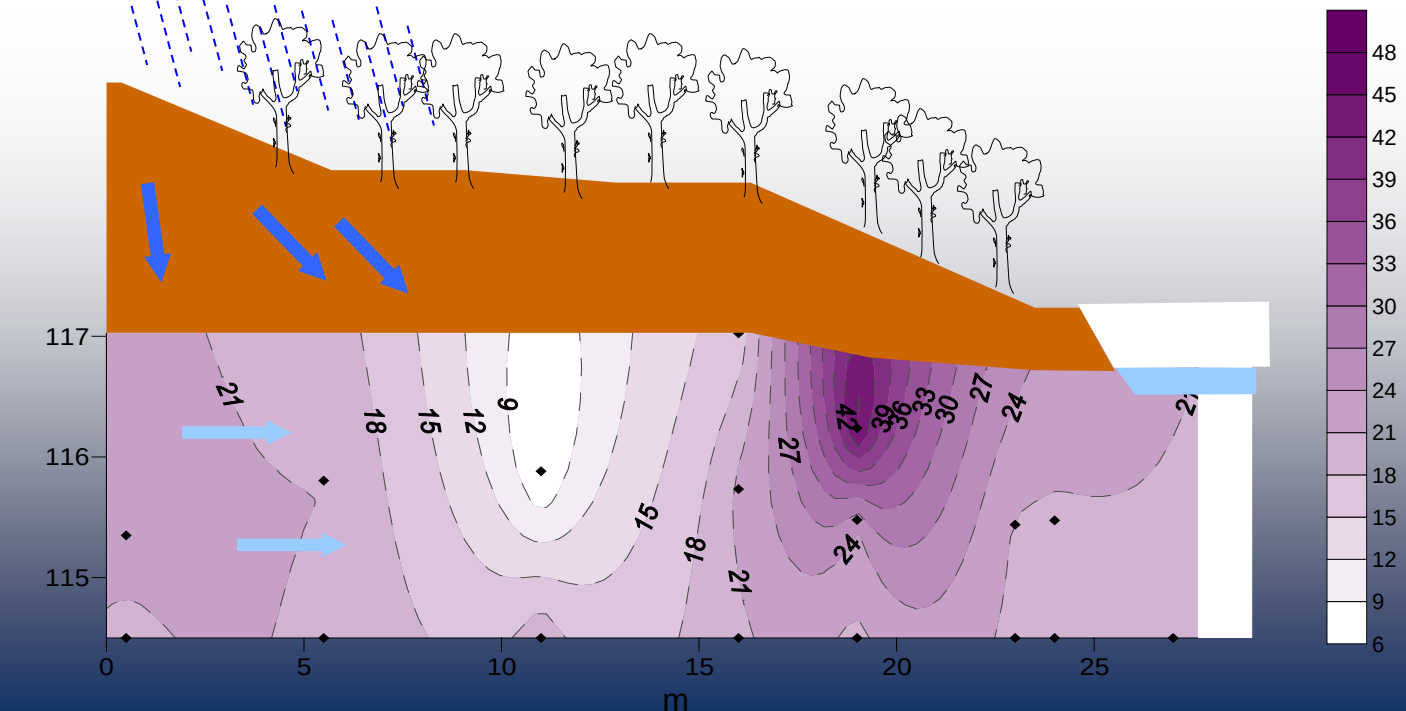


Dopo un evento piovoso



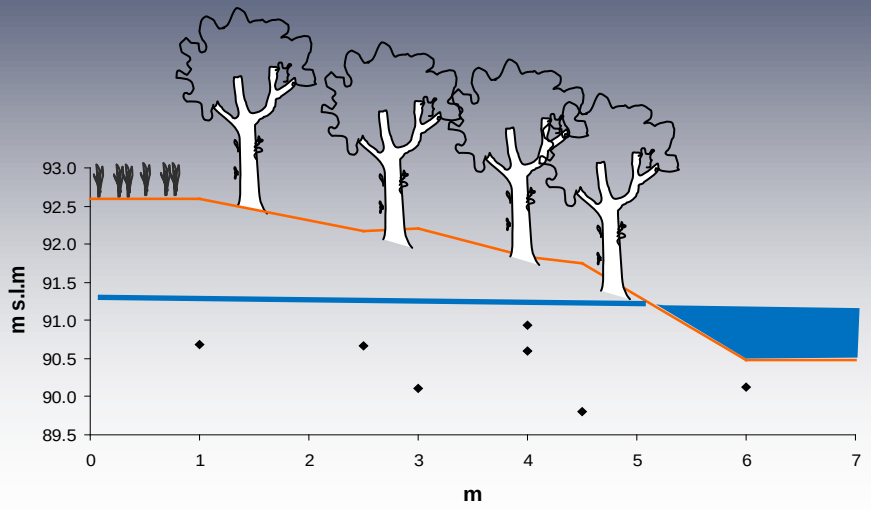
N-NO3 mg/L

19/12/2008



Cl mg/L

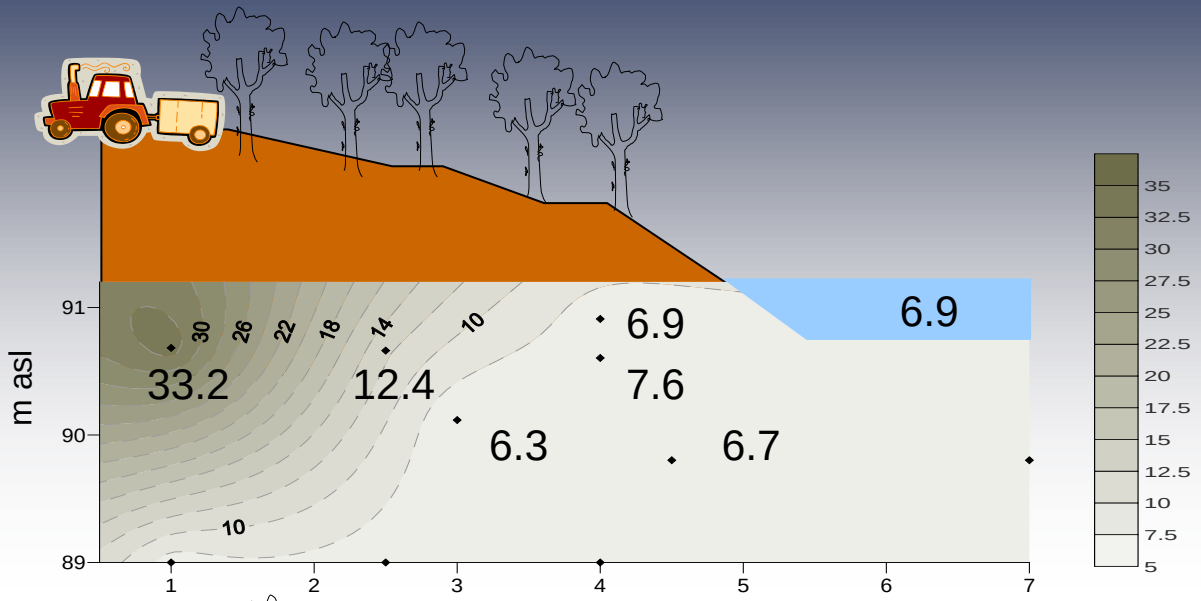
4. F.le Fontanone



Nessuna variazione del livello della falda

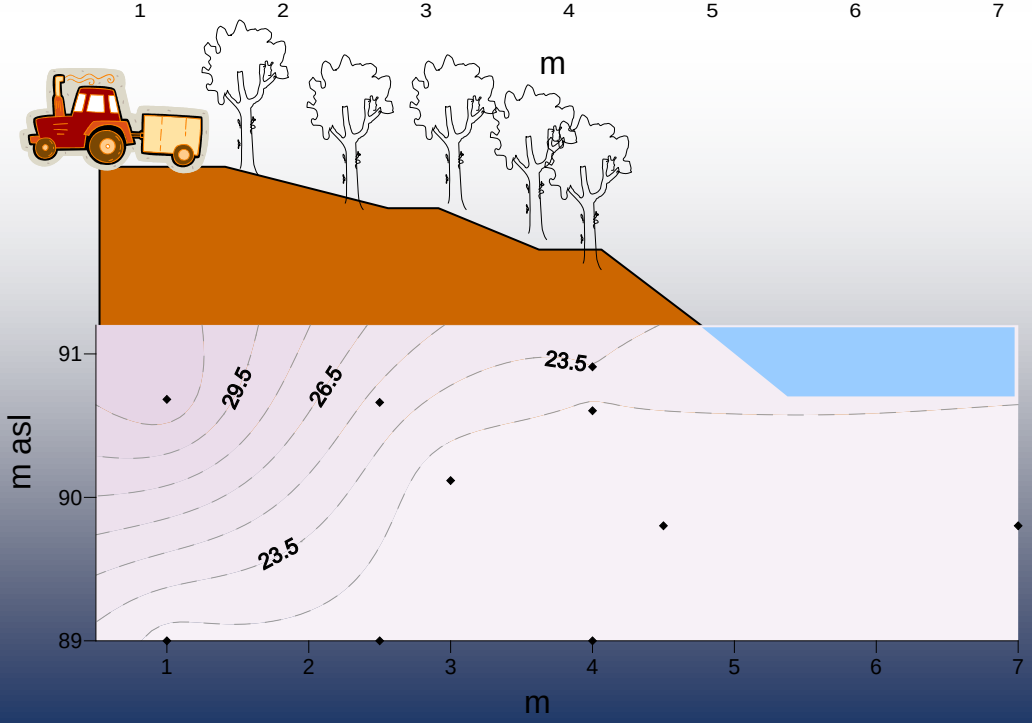
Soggiacenza: 0.6-1.6 m

Variazioni spaziali di nitrato e cloruro dopo la fertilizzazione



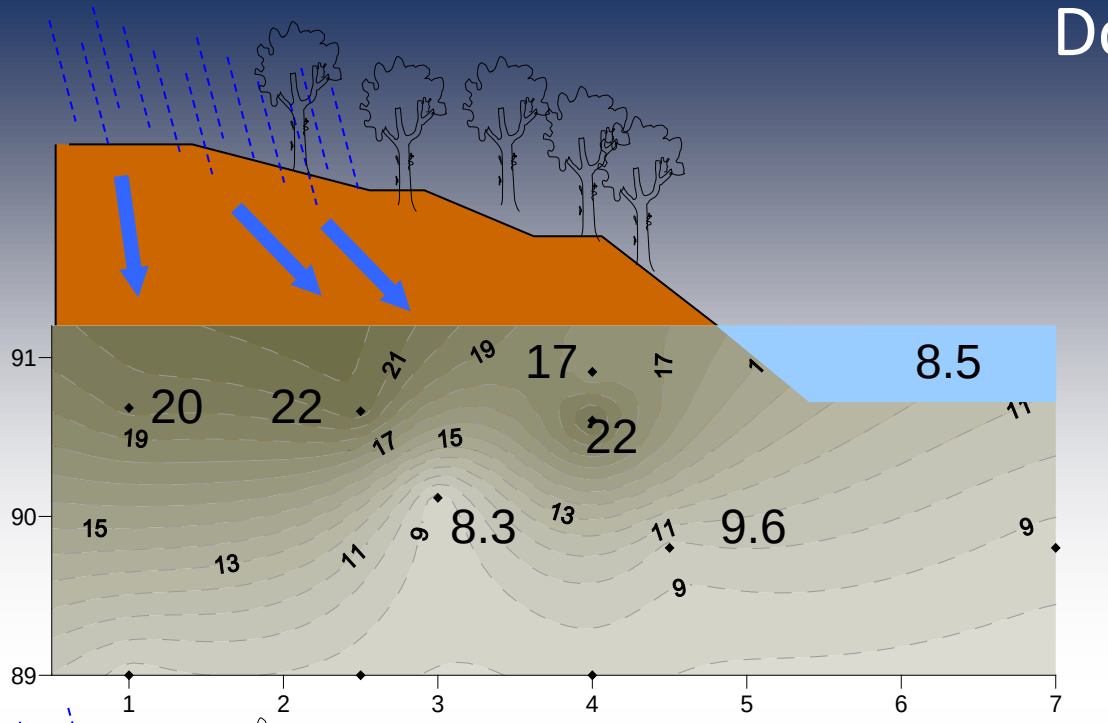
N-NO3 mg/L

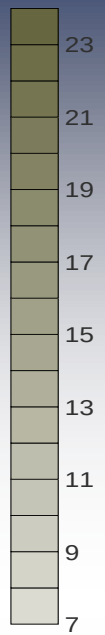
Luglio 2008



Cl mg/L

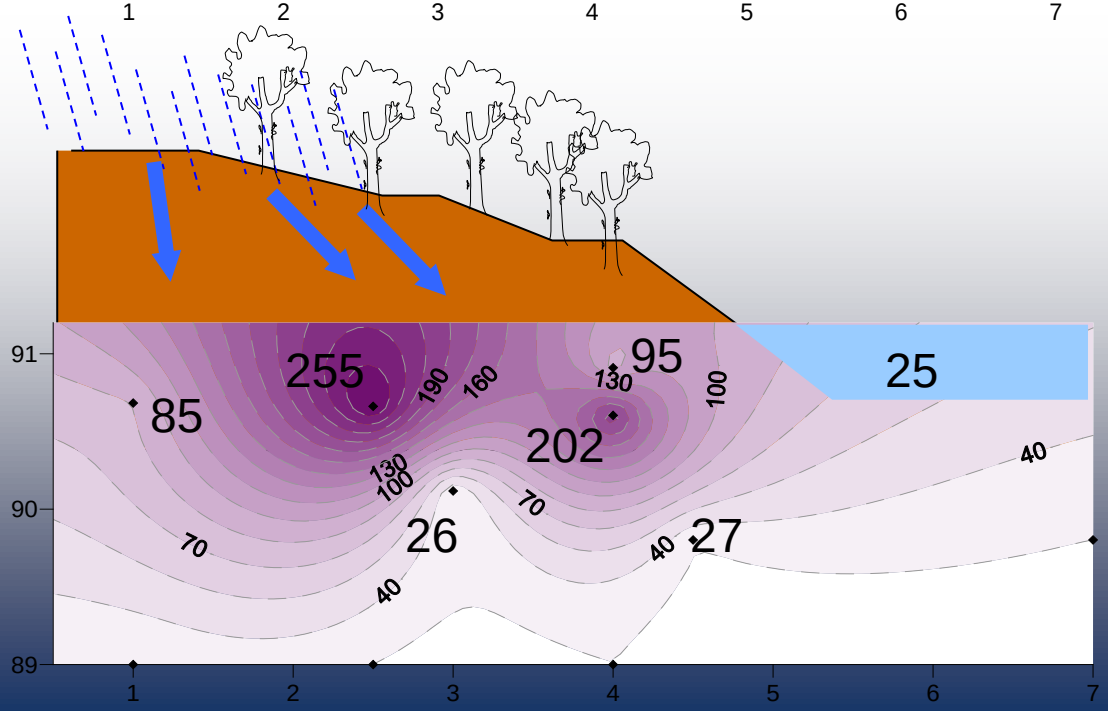
Dopo un evento piovoso

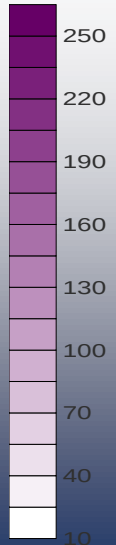




N-NO3 mg/L

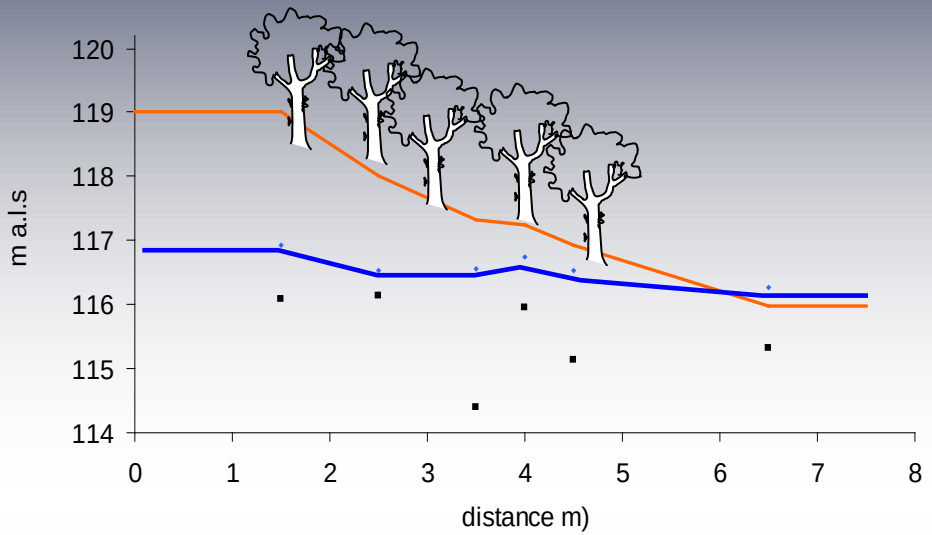
19/12/2008

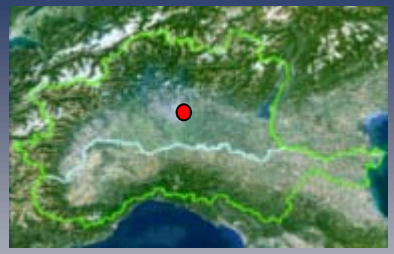




Cl mg/L

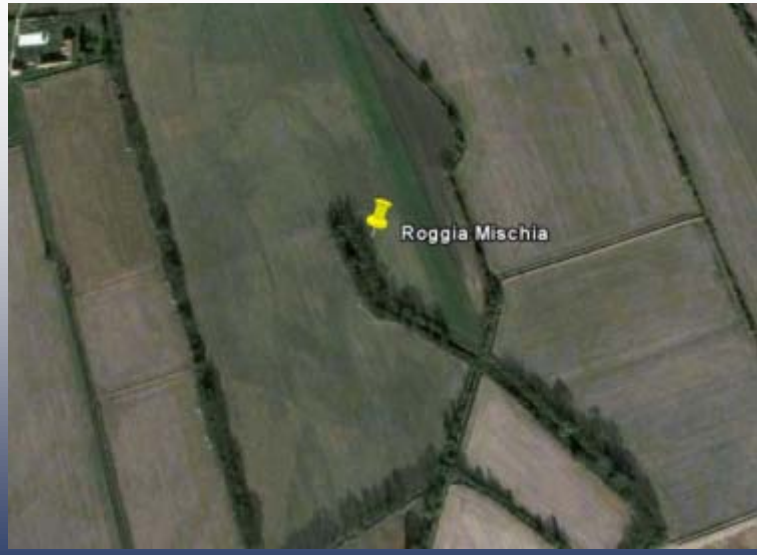
5. Roggia Mischia



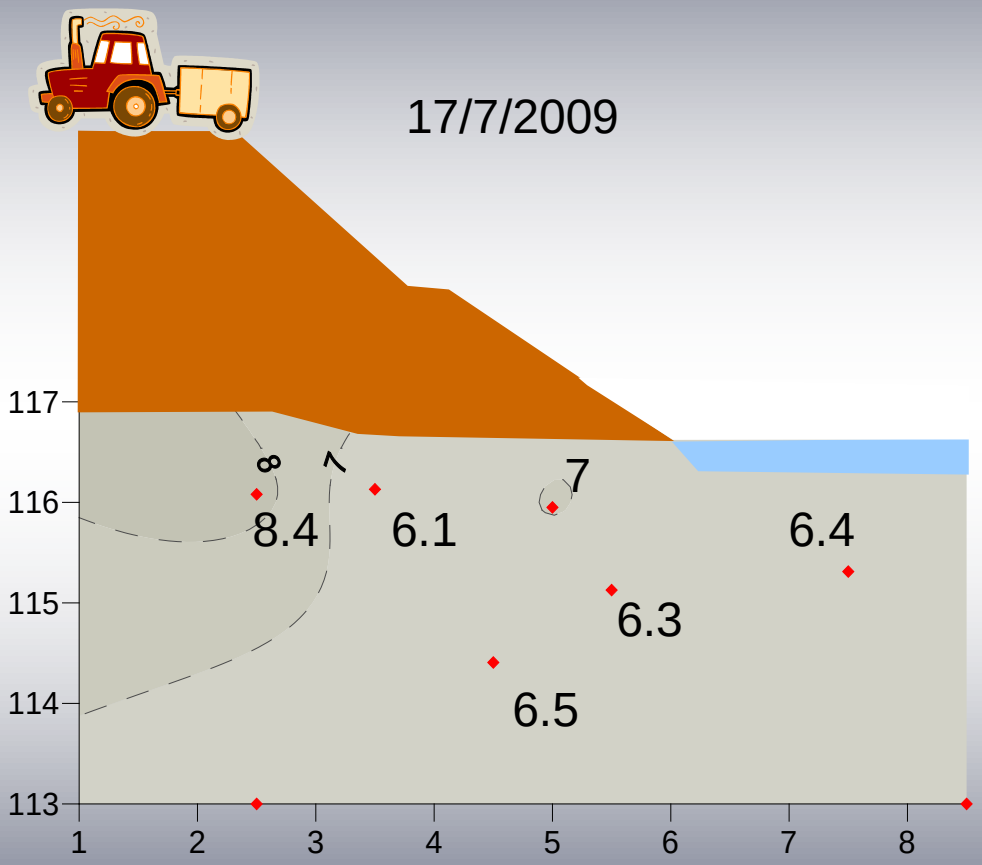


Variazioni del livello della falda: 0.3 m

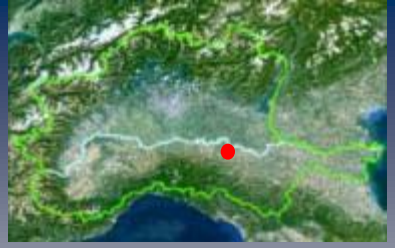
Soggiacenza: 0.5-2.2 m



Variazioni spaziali di nitrato dopo un evento di fertilizzazione



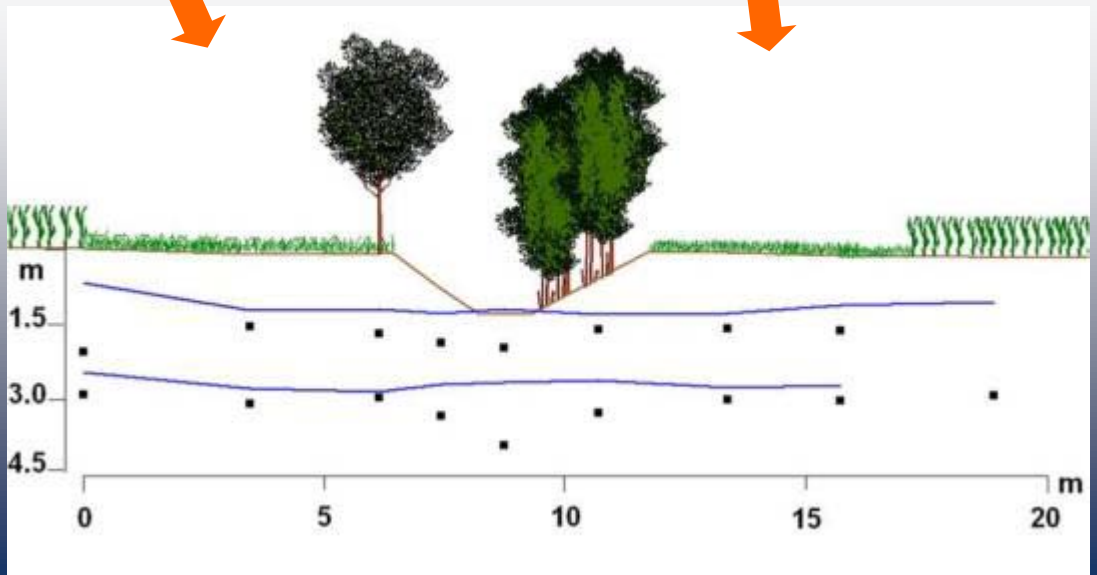
6. Bedollo Sud



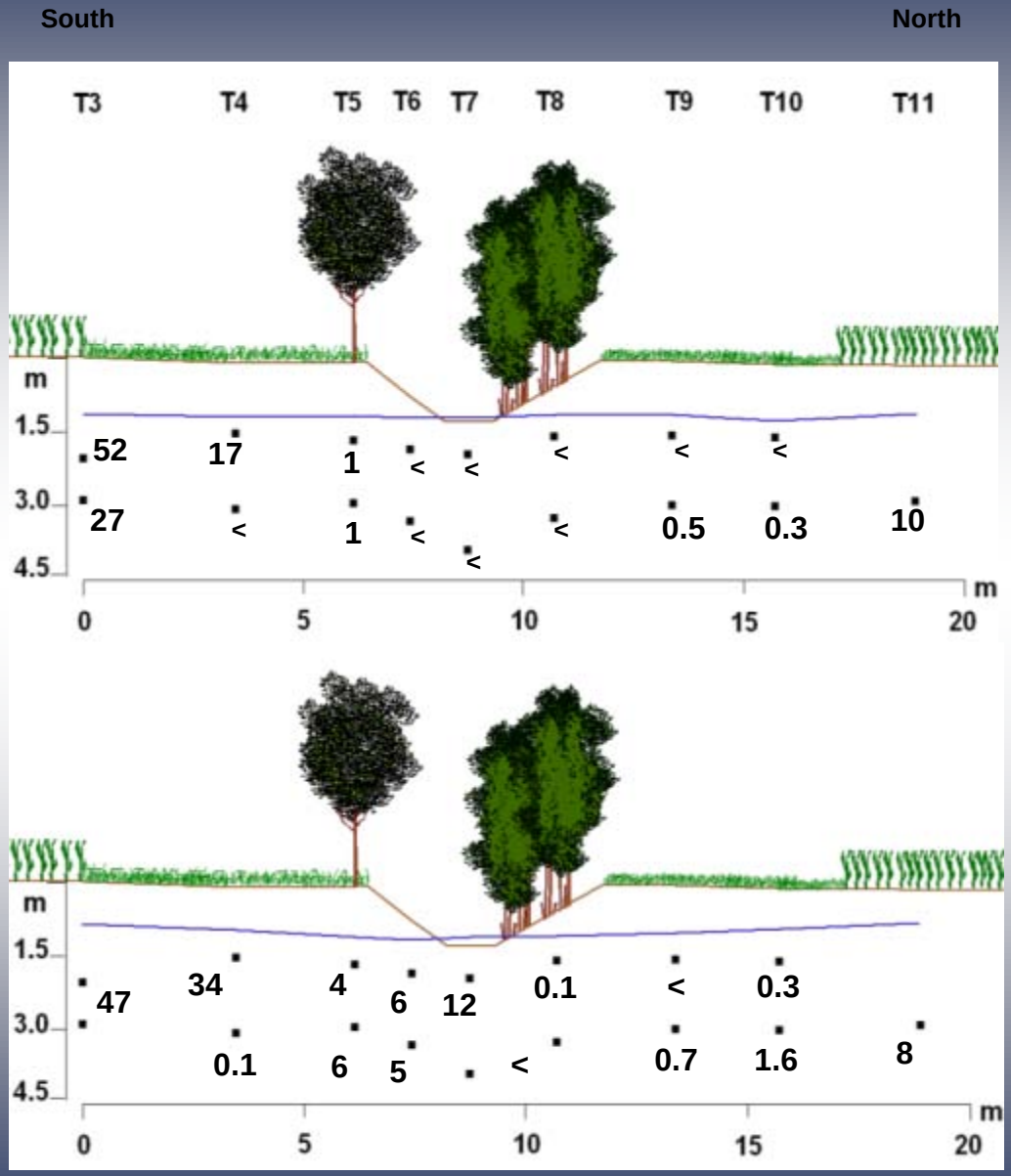
6. Bedollo Nord

Variazioni del livello della falda: 2 m

Soggiacenza: 1 - 3 m



Variazioni spaziali di nitrato



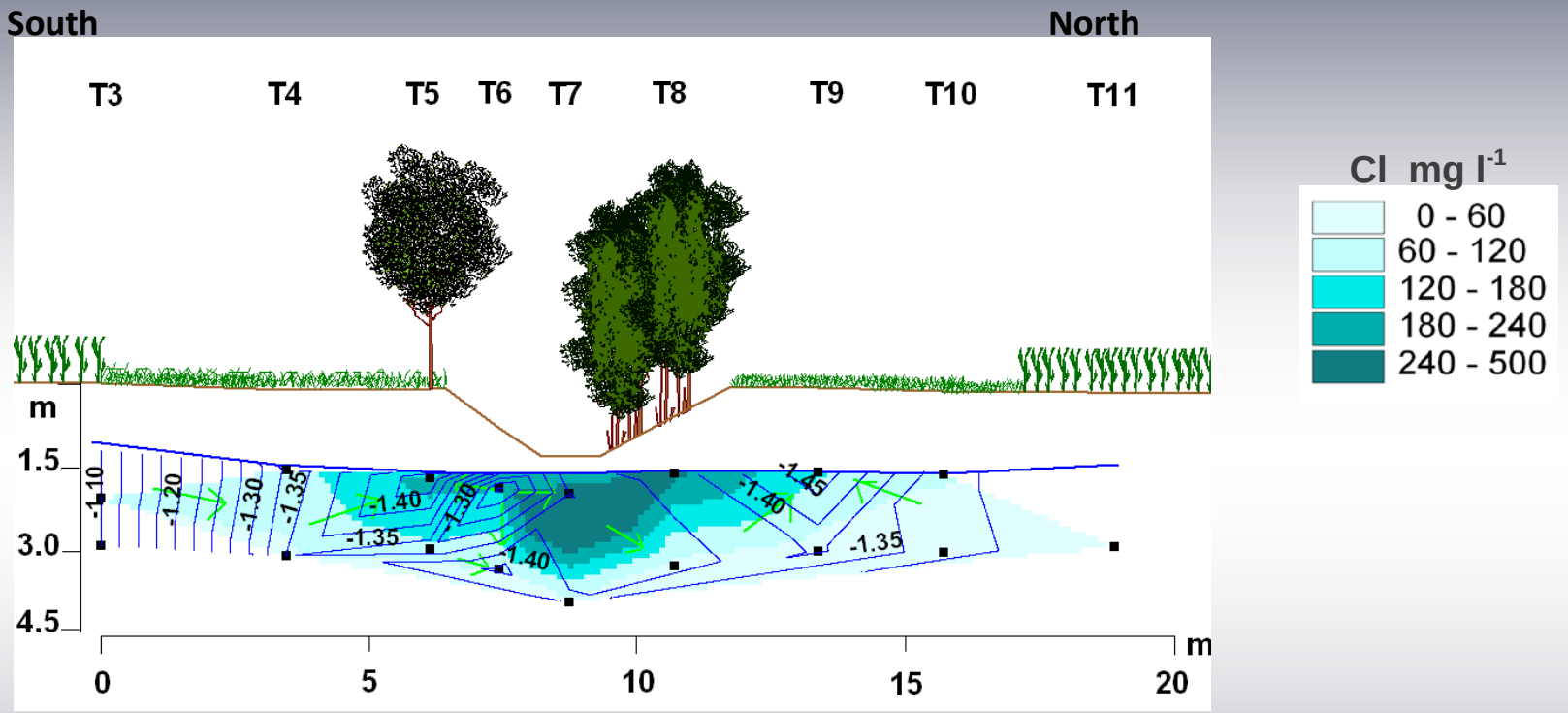
Fertilizzazione: Giugno 2008

N-NO3 mg/L

Evento piovoso: Dicembre 2009

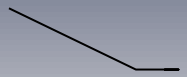
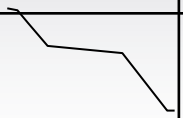
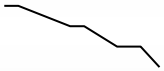
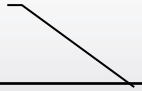
N-NO3 mg/L

6. Bedollo



Cloruri indicatori di evapotraspirazione

In sintesi

Area di studio	Topografia	Ampiezza (m)	Pendenza %	Vegetazione	Suoli	C org %	Ksat cm s^{-1}	Rimozione NO3 (%)
1. L. Candia		110	3.7	Canneto e veg. arborea	Sabbia e limo	2 s 7 d	4×10^{-3} – 2×10^{-5}	100
2. F. Fontanin		35	2.6	Canneto e veg. arborea	Sabbia	5 s 0.5 d	2×10^{-3} – 2×10^{-5}	100
3. F. Rile		24	9	Veg. arborea	Sabbia, limo e argilla	2 s 0.2 - 1 d		60-100
4. F. Fontanone		5	24	Veg. arborea	sabbia	3 s 0.1 - 4 d		20-50
5. F. Mischia		5	60	Veg. arborea	sabbia	1.4 - 2.4 s 0.5 - 1 d		0
6. S-Bedollo		6.5	0.2	Veg. erbacea e arborea	Argilla e limo	2.5 s 0.5 d	7×10^{-5}	100
7. N-Bedollo		6.5	0.2	Veg. Erbacea e arborea	Argilla e limo	1.3 s	7×10^{-5}	100

s = surface layers , d= deep layers

CONCLUSIONI

La rimozione del nitrato avviene in spazi molto ristretti (hot spots) dell'acquifero subsuperficiale dove si verificano le condizioni ideali per il processo di denitrificazione (assenza di ossigeno, disponibilità di carbonio organico, presenza di nitrato).

→ L' ampiezza della fascia riparia non influenza direttamente l'efficienza di rimozione del nitrato

Il fattore chiave per la denitrificazione sembra essere il tempo di residenza dell'acqua che dipende strettamente da:

→ la tessitura dei suoli e dei sedimenti

→ le caratteristiche topografiche .

Il carbonio organico è un fattore cruciale nel controlllare la denitrificazione non solo in termini quantitativi ma anche qualitativi.

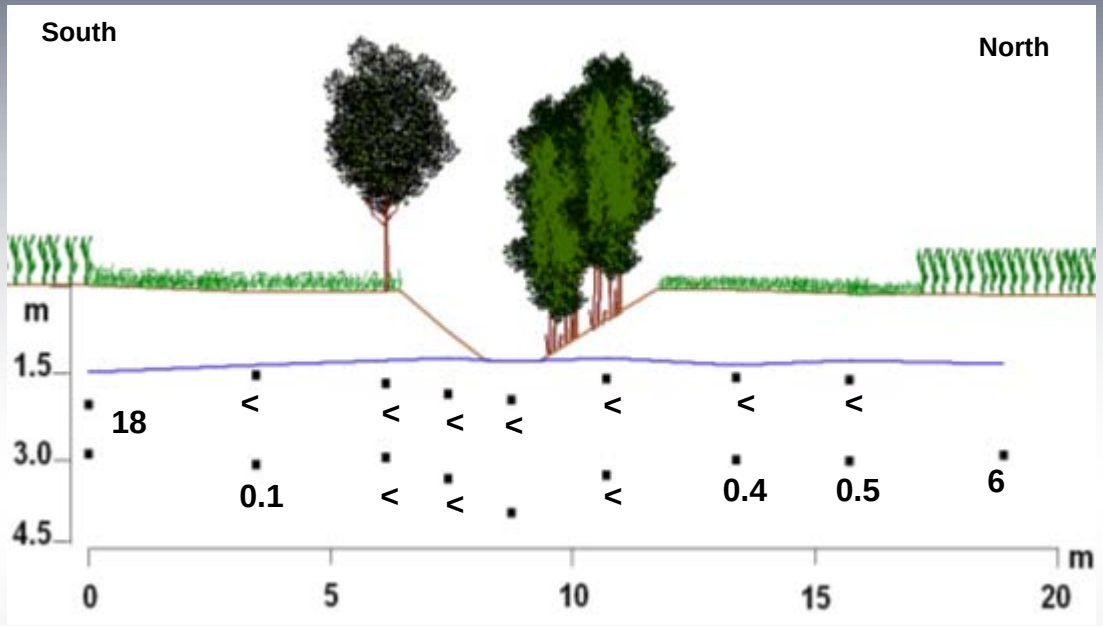
Complesivamente i risultati ottenuti costiuiscono un'importante verifica sperimentale del ruolo delle fasce tampone vegetate lungo i corsi d'acqua del reticolo idrografico minore della Pianura Padana.

Non tutte le fasce riparie funzinano come buffer strips e sicuarmente fasce riparie più estese offrono una maggiore varietà di condizioni e di habitat potenzialmente idonei per la denitrificazione .

Fasce riparie complesse arricchiscono sia qualitativamente che quantitativam,ente gli habitat del corpo idrico e quindi aumentano l'efficienza di autodepurazione del fiume stesso.

Grazie per l'attenzione!

NITRATE VARIATION IN THE RIPARIAN SUBSURFACE WATER



Dormant season: March 2009

"Riparian buffer strips s a multifunctional management tool in agricultural landscapes"

Buffer strips in the Italian legislative context

Common Implementation Strateg
for the Water Framework Directiv
(2000/60/EC)

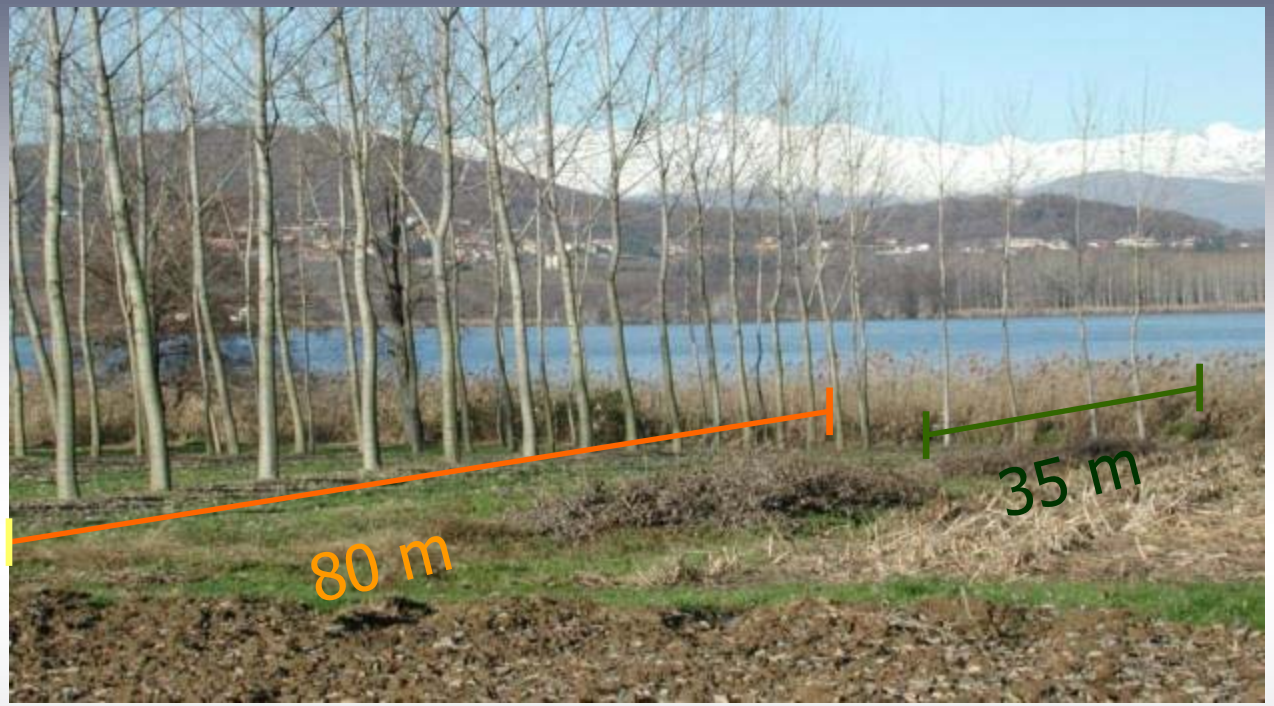
Wetlands Horizontal Guidance

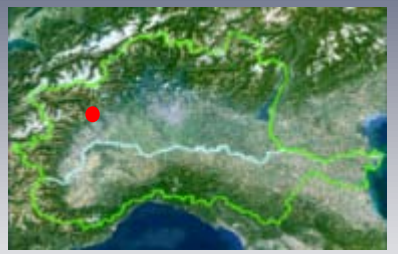
Horizontal Guidance Document on the Role of Wetlands in the Water Framework Directive

Final Draft

7th October,1st August, 22003

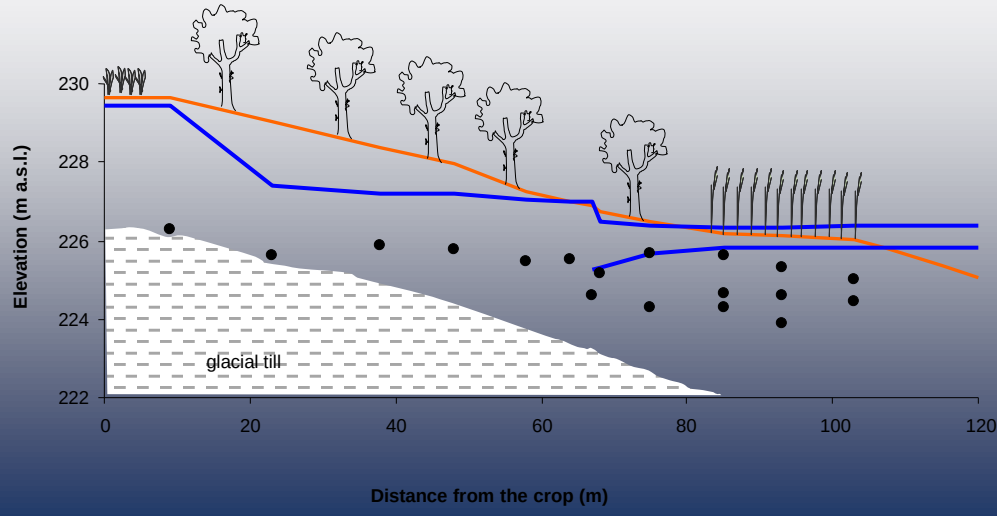
1. Candia Lake



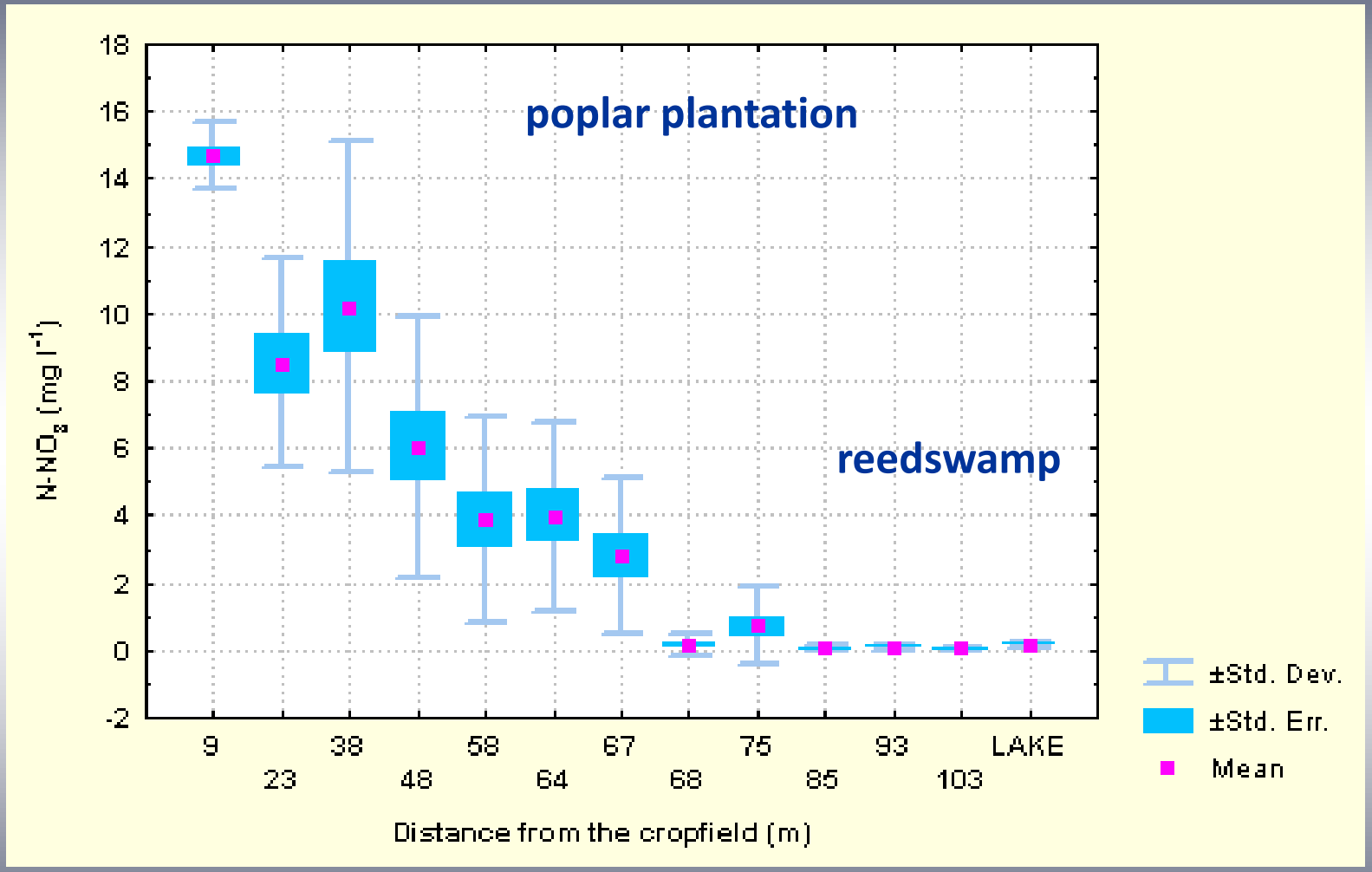


Great variation of the water table:
from 0.5m to 3m

water table depth:
in summer 0.5 – 4 m
in winter 0 – 2 m

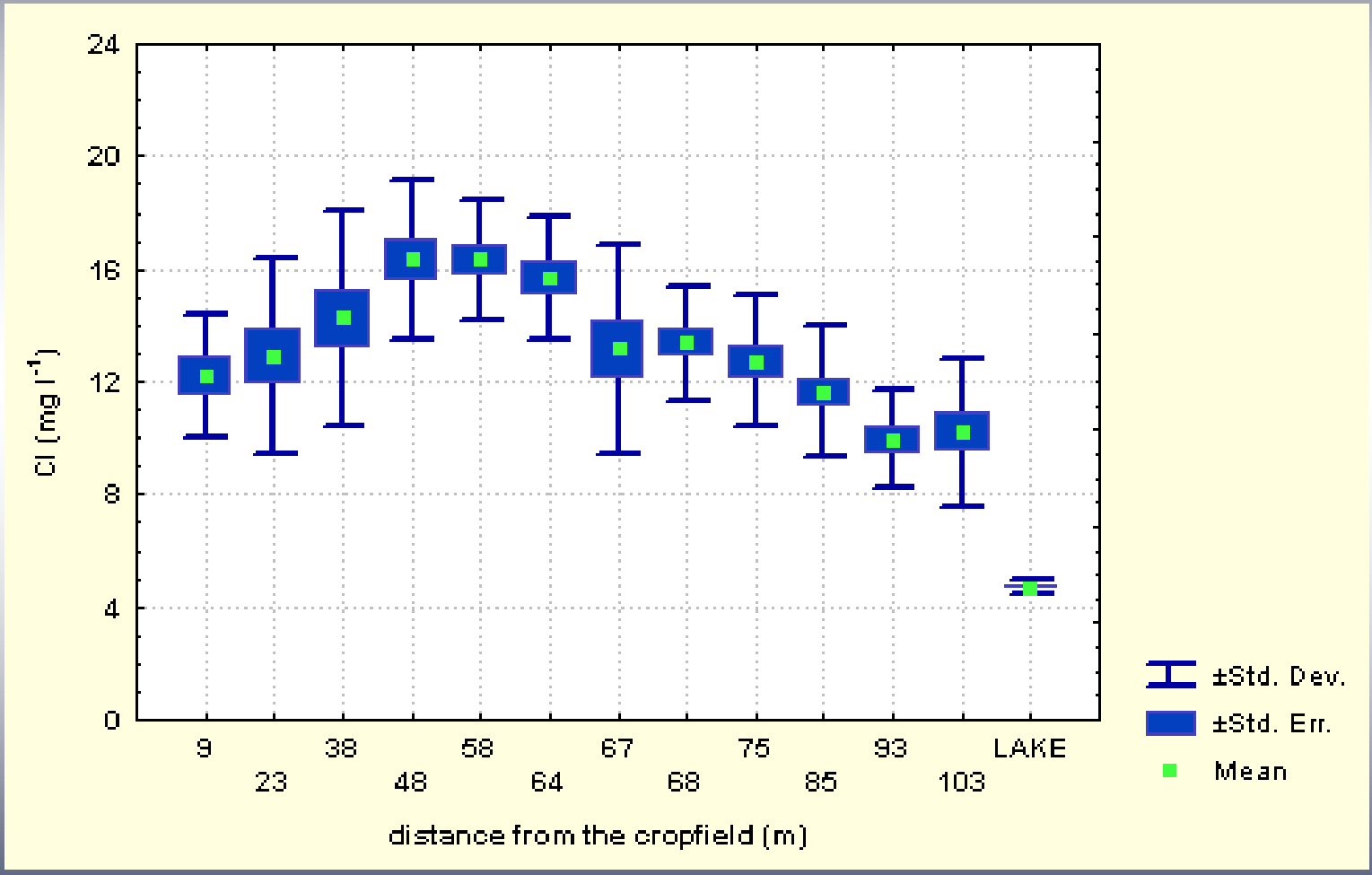


NITRATE VARIATION IN THE RIPARIAN SUBSURFACE WATER



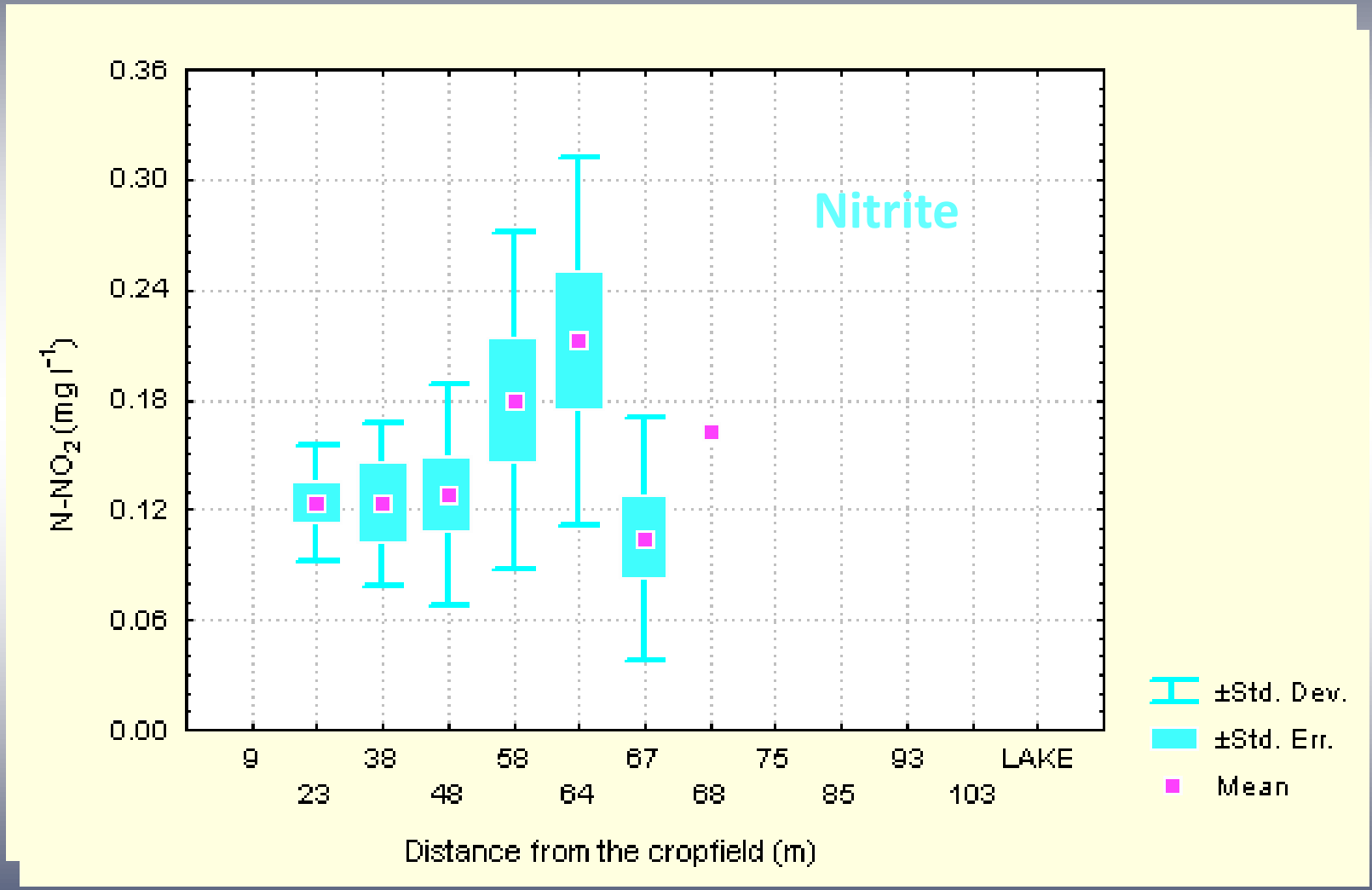
1. Candia Lake

Dilution effect? Comparison to Cl^-



1. Candia Lake

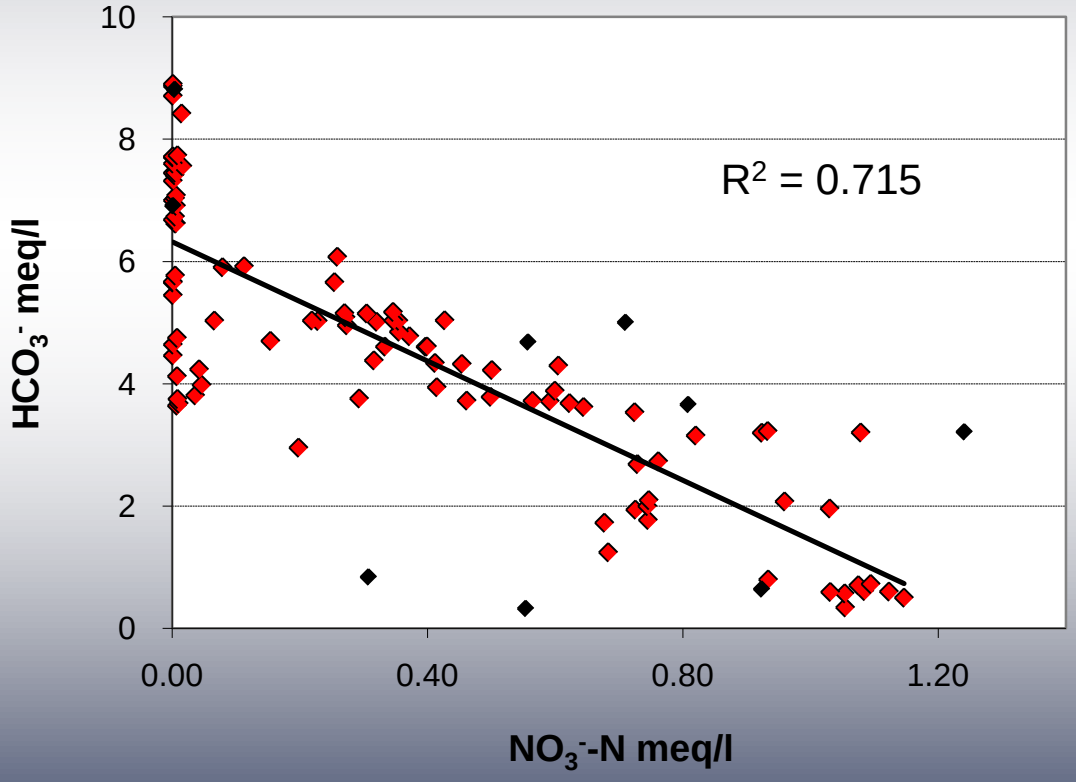
Indicators of denitrification



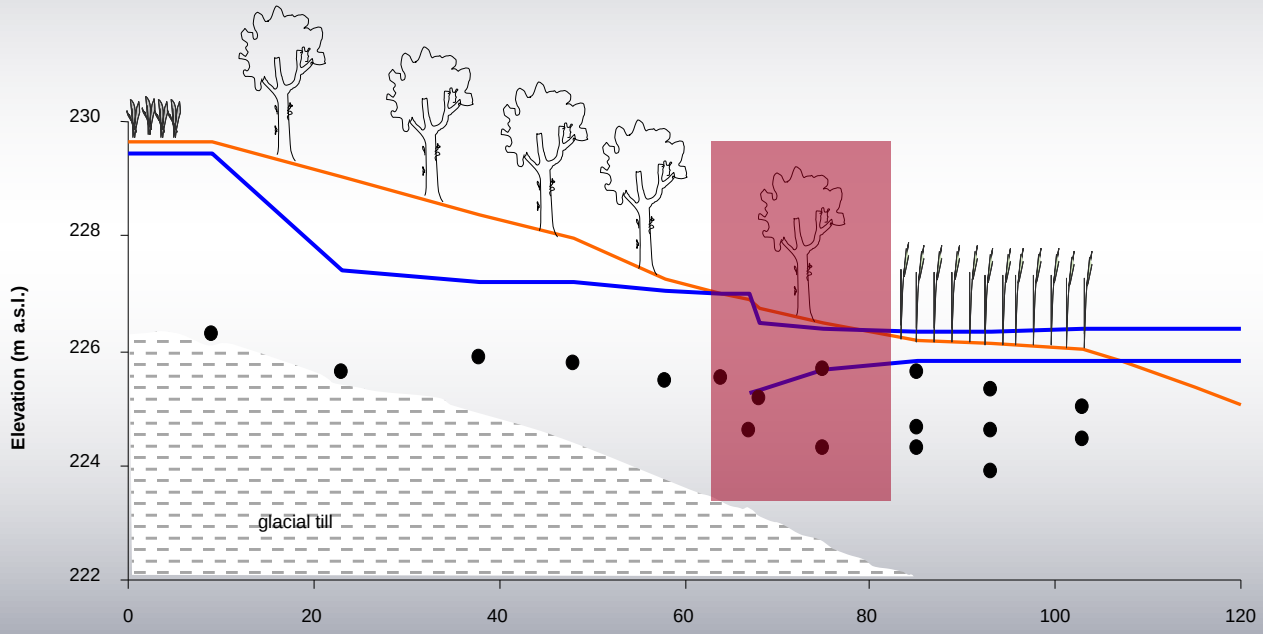
1. Candia Lake

Indicators of denitrification

DENITRIFICATION → **Production of 1 eq of alkalinity per mole of NO_3 reduced**



NITRATE VARIATION IN THE RIPARIAN SUBSURFACE WATER

N retention 100%

- Slope decrese
- Hydraulic conductivity decrease
- High water table