Regeneration of the terrestrialization mire „MellnSee“ –

rising water level versus nutrient input

Frank Gottwald and Alexander Seuffert, 2004

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- EU-LIFE Project and monitoring
- Location and history:
  from the lake to the mire
- Status quo: vegetation zones

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- conclusions

EU - LIFE-Project „Bittern Recovery Programme at the SPA Schorfheide-Chorin“ (LIFE-NAT/D/005943)

09/1999 – 09/2003

responsible bodies: Biosphere Reserve Schorfheide-Chorin

supported by: Land Brandenburg; NaturSchutzFonds Brandenburg; NABU; BUND Freunde der Erde; EU LIFE Programme

MellnSee

is one of 10 project sites across the SPA „Schorfheide-Chorin“

plan: - rising the water level in a drained mire by damming up the only draining ditch

aims: - rewet the whole former lake area,
- stop peat decomposition,
- install a more natural water balance

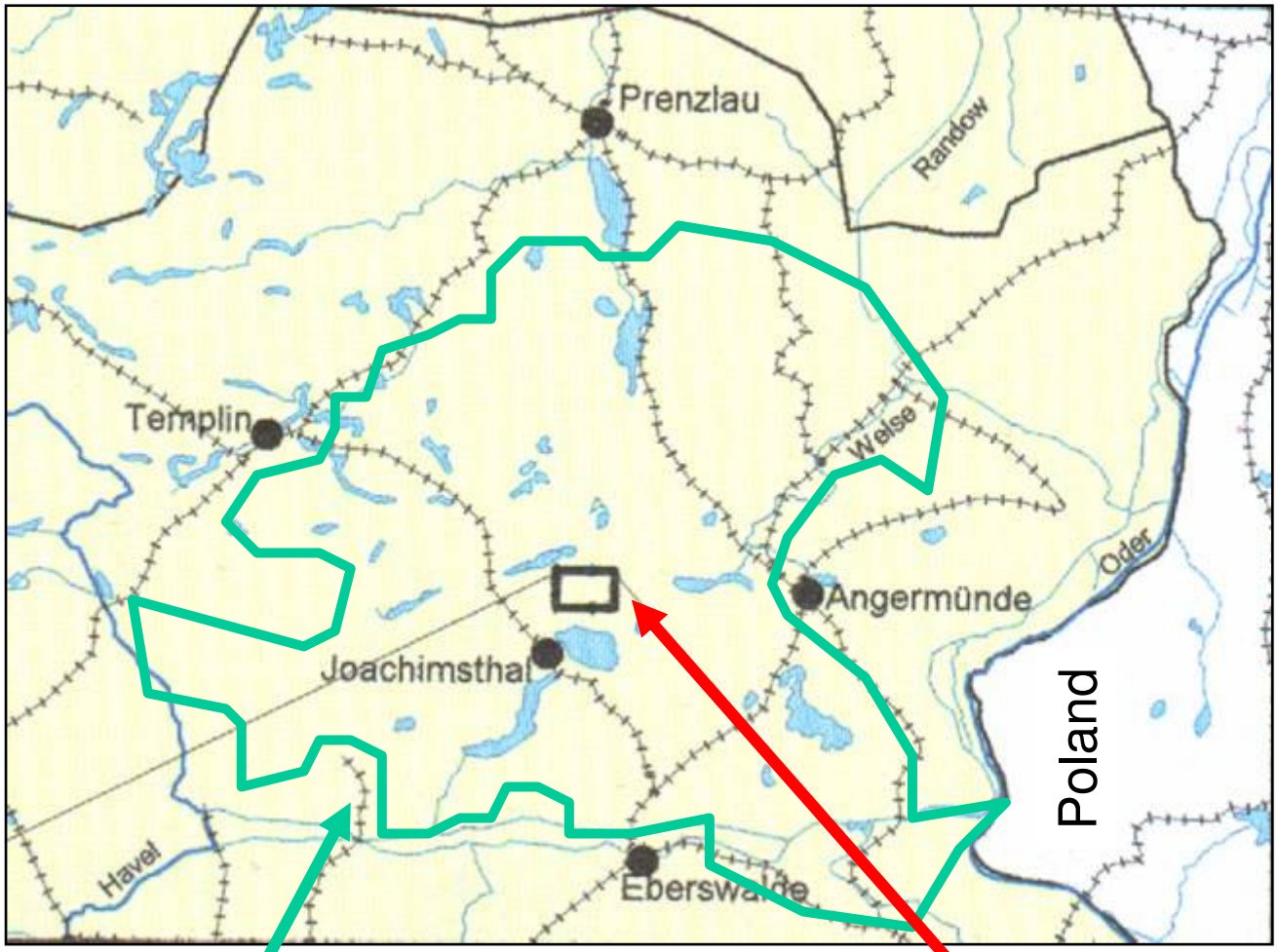
Monitoring Mellnsee

(since 2001)

measures:
- maping the vegetation zones
- soil and water analysis
- observation of the water levels

aims:
- design a time schedule for the whole rewetting process
- determine the optimal water level for peat-producing communities

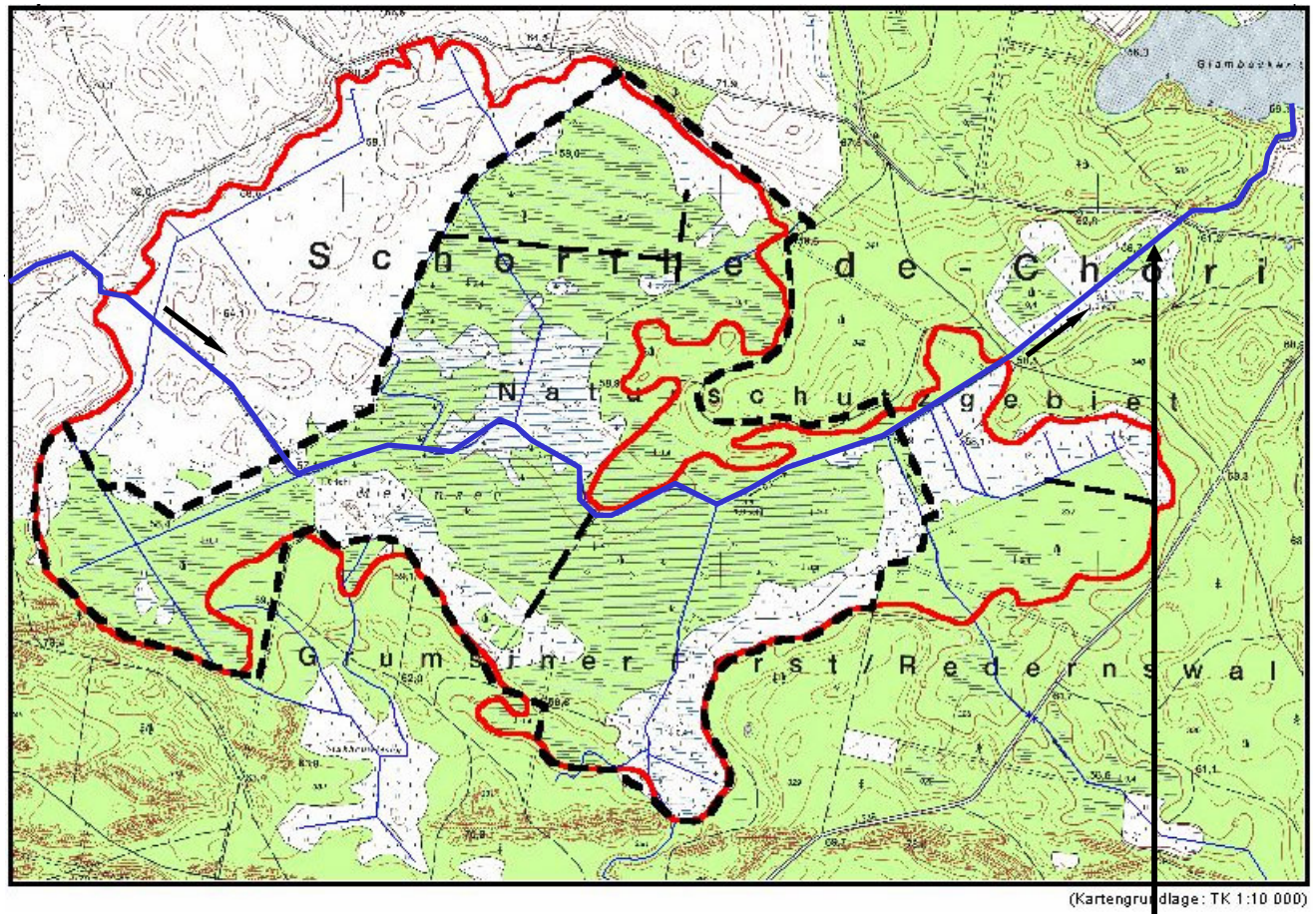
north-eastern Brandenburg



UNESCO Biosphere Reserve
„Schorfheide-Chorin“

MellnSee

Mellnsee



— former lake area (300 ha)

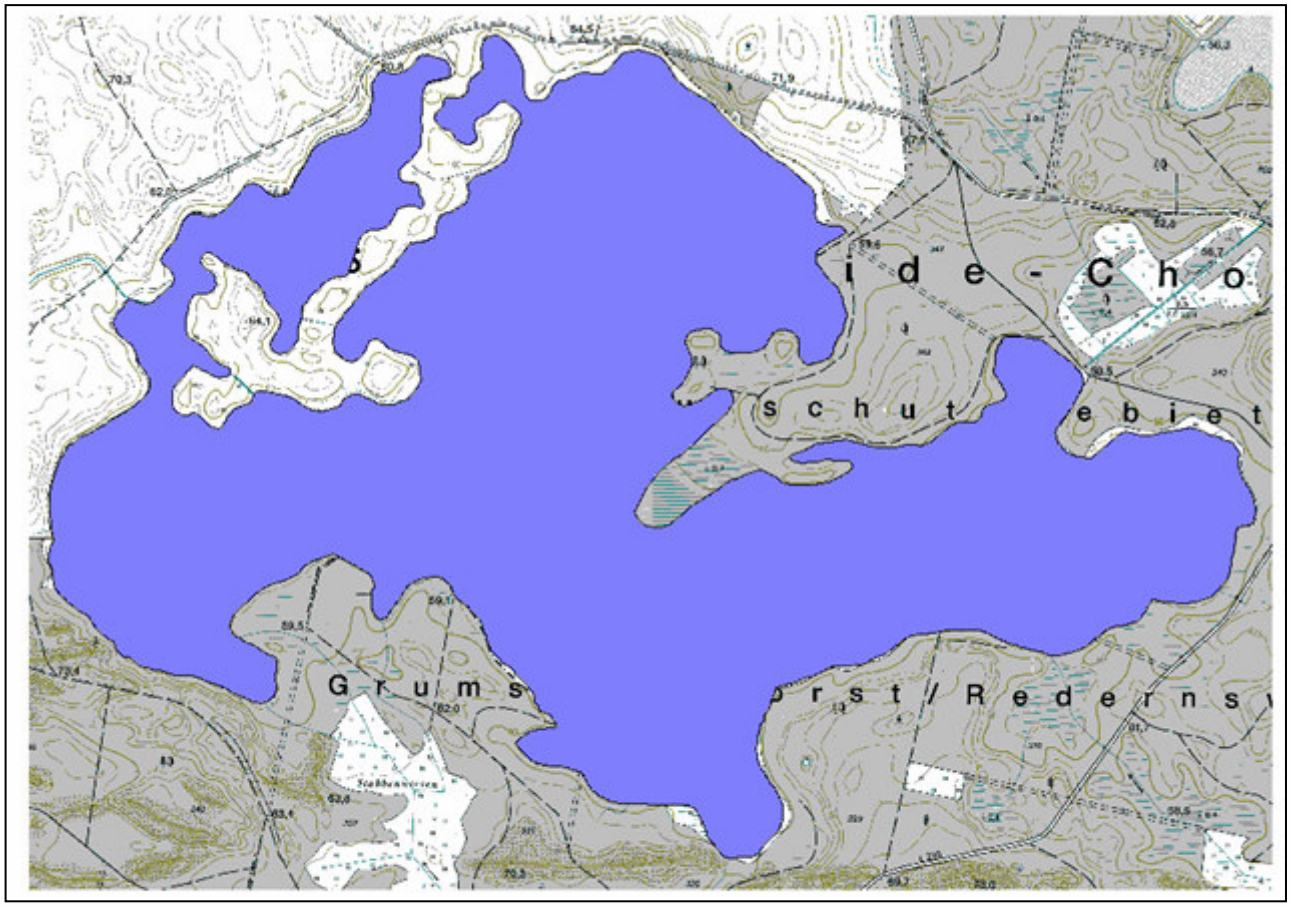
····· protected area (core zone)

— ditches

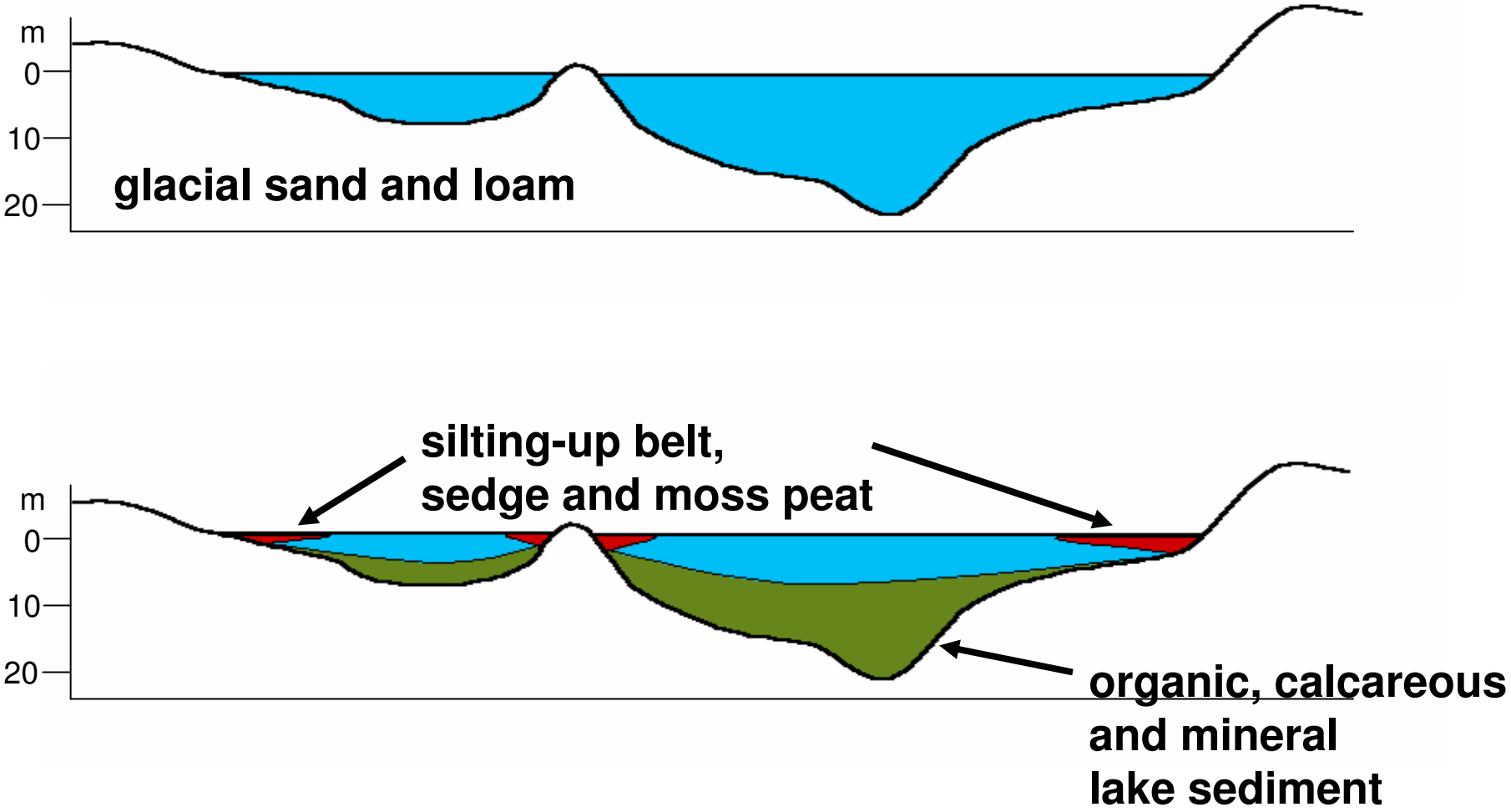
river Welse

Landscape characteristics

- hilly moraines with glacial substrates (sand, loam)
- post glacial sand dunes
- glacial depressions
- melt water channels
- many lakes and mires without an original outlet of water



12 000 BP (before present): assumed original lake extension



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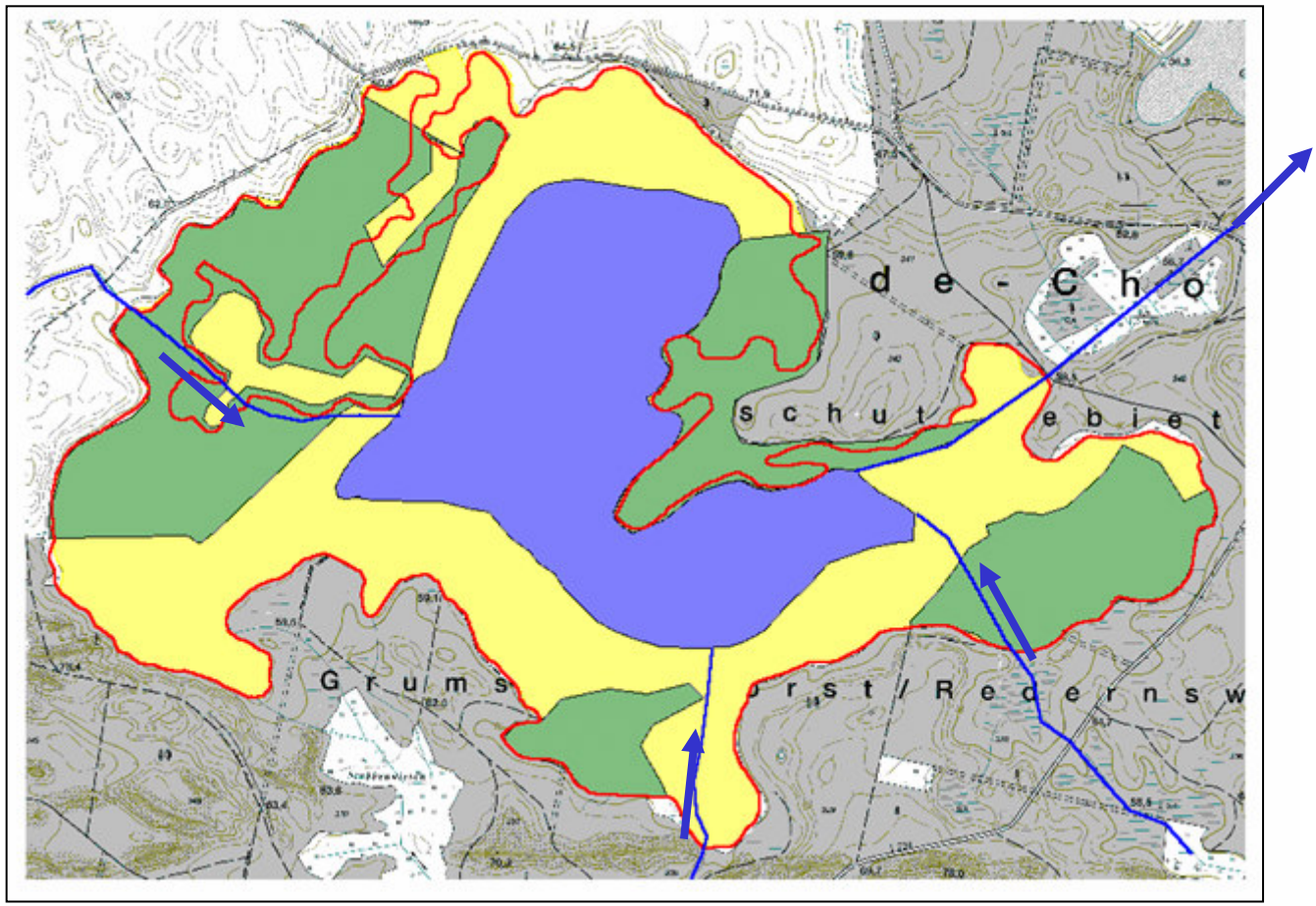
Melioration history

- 13th century: first melioration: water mills
- 1786: a new ditch drains the lake, water level falling

⬇

Mellnsee belongs to the catchment area of the river Oder/Odra → Baltic Sea



1846

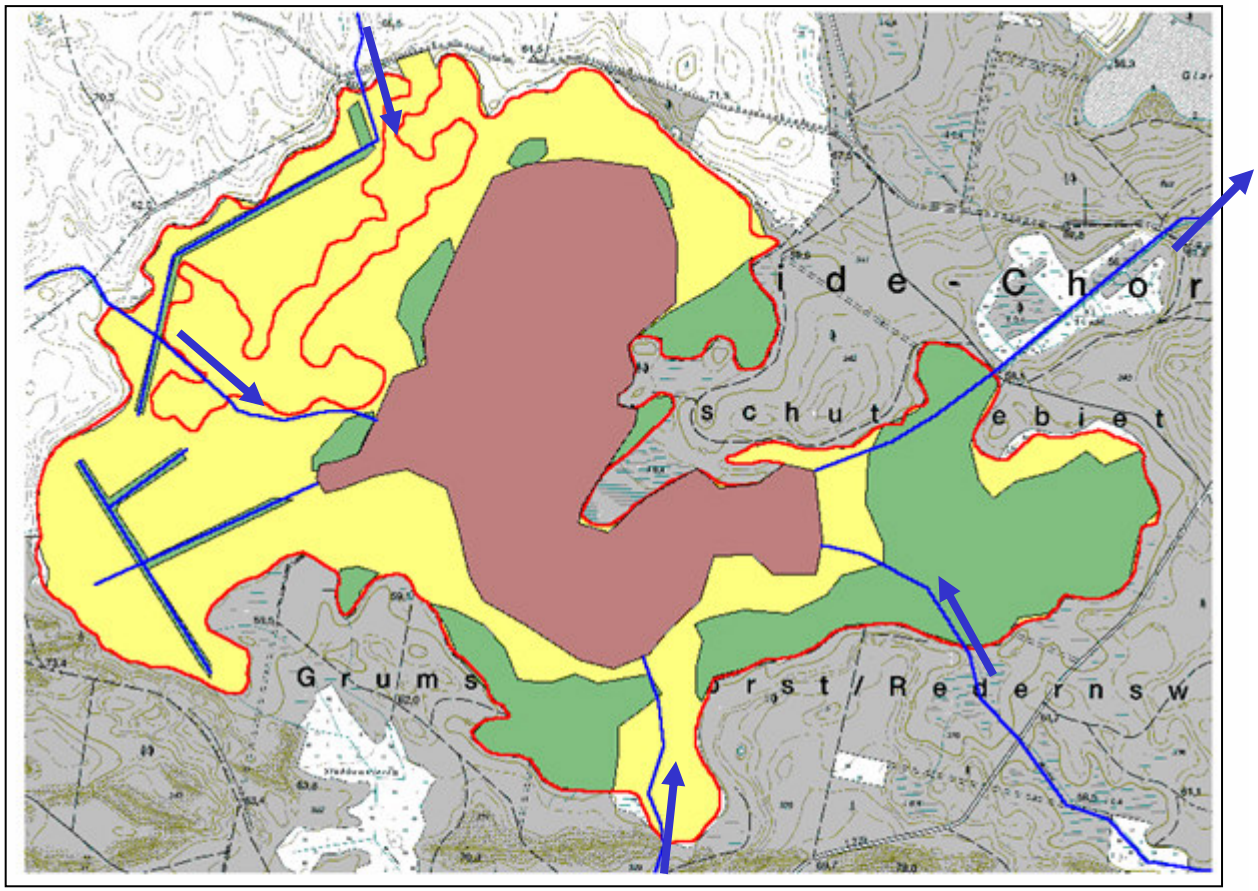
(Wagner 1846)

assumed original lake extension

meadows, pastures and open mire

arboreous mire (birch, alder)

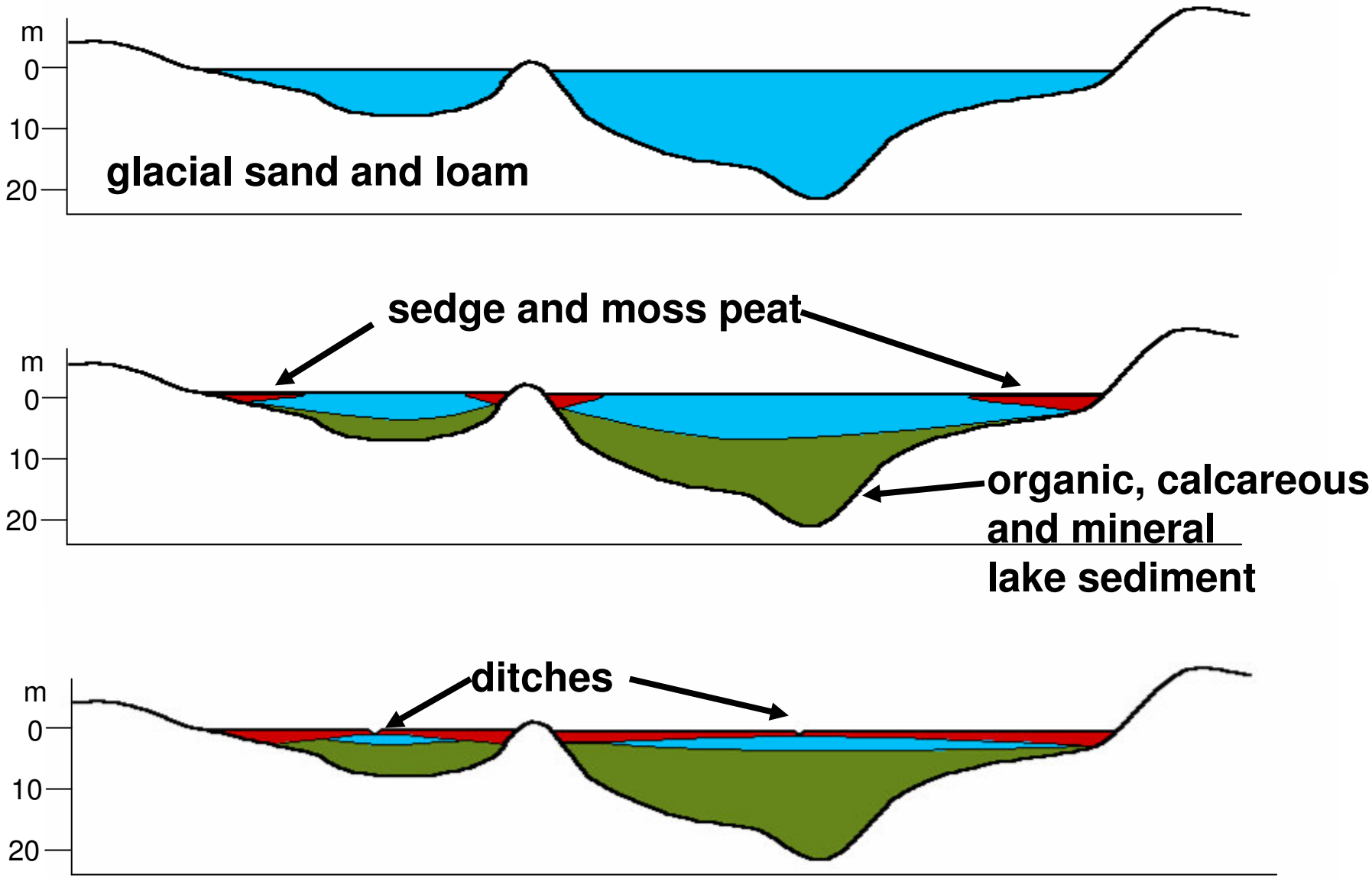
lake extension in 1846



(königl. Preuß. Landesaufnahme 1884)

1884

- young open mire
- arboreous mire (*Alnus*, *Betula*)
- meadows and pastures
- assumed original lake extension
- ditches



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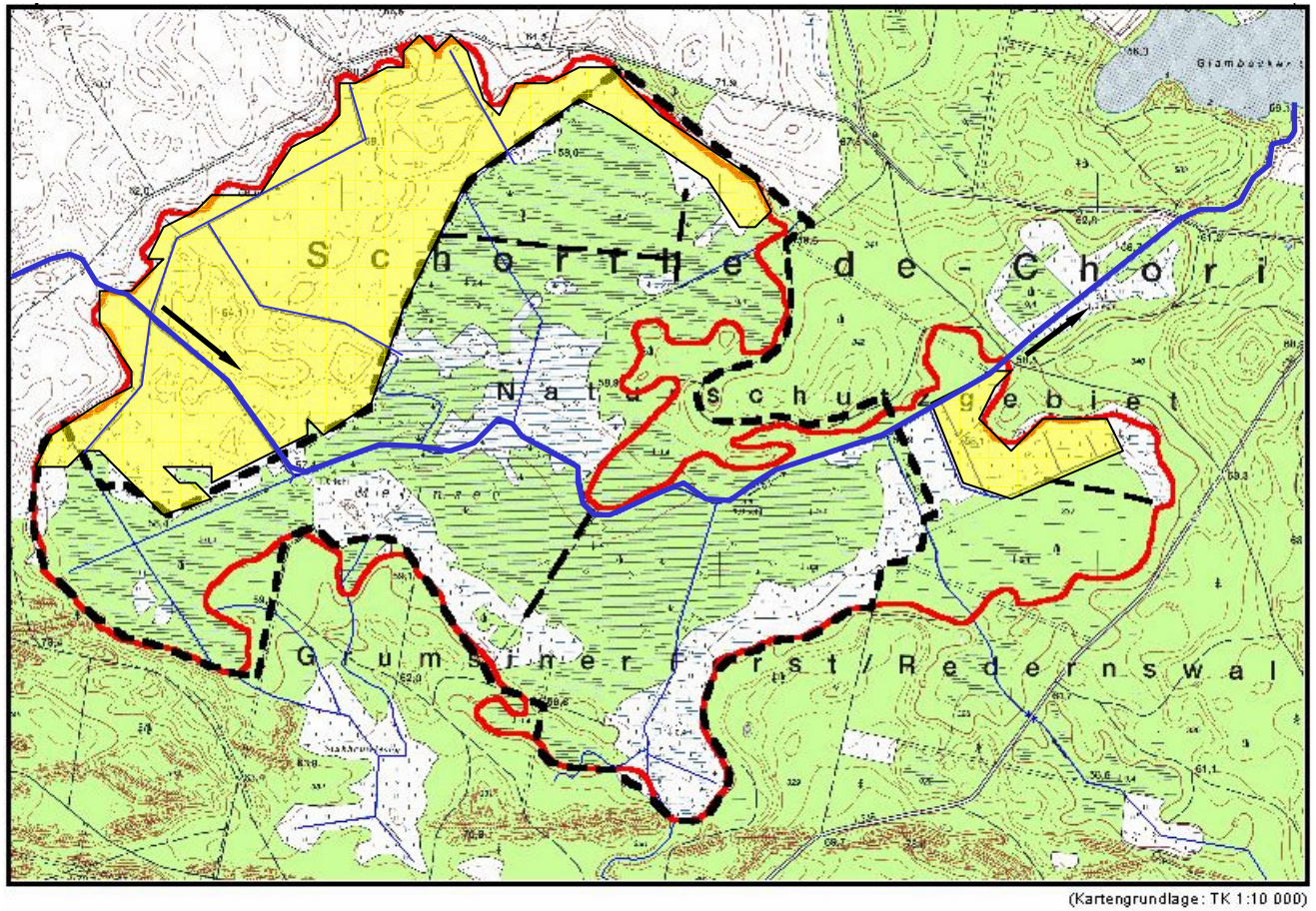
catchment area: 60 km²



Recent

- fallow meadows and pastures or open mire
- woods (*Alnus* and *Betula*)
- meadows and pastures
- former lake area
- ditches

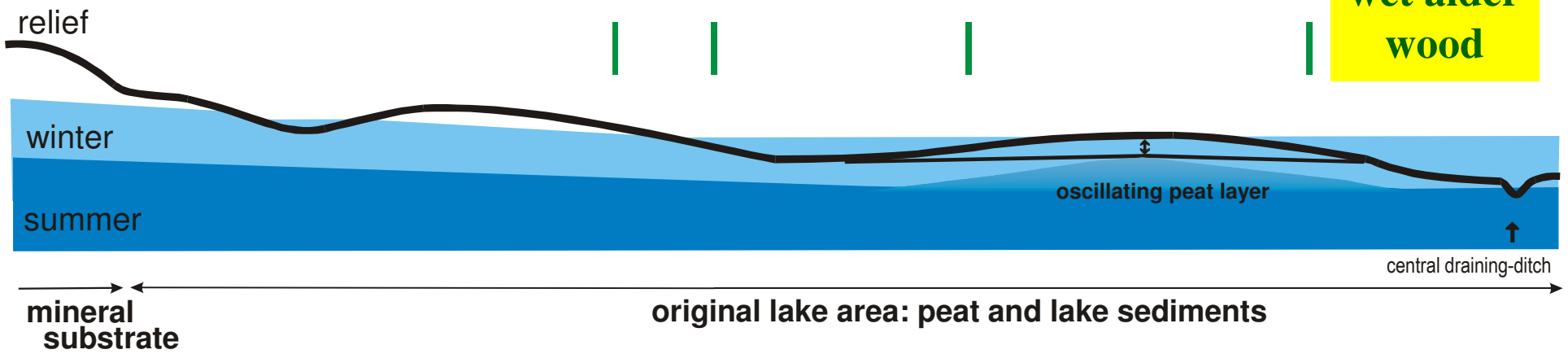
Vegetation zones and relief of the melln area

influencing factors:

- hydrological situation
- nutritional situation
- agricultural practices

- zone strongly influenced by water regime of main ditch

reed and wet alder wood



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reed and eutrophic wet alder wood

Phragmition, Caricion elatae, Alnion glutinosae

- **eutrophic: most species with high nutritional demands**
- **nutrient input by water of main ditch**

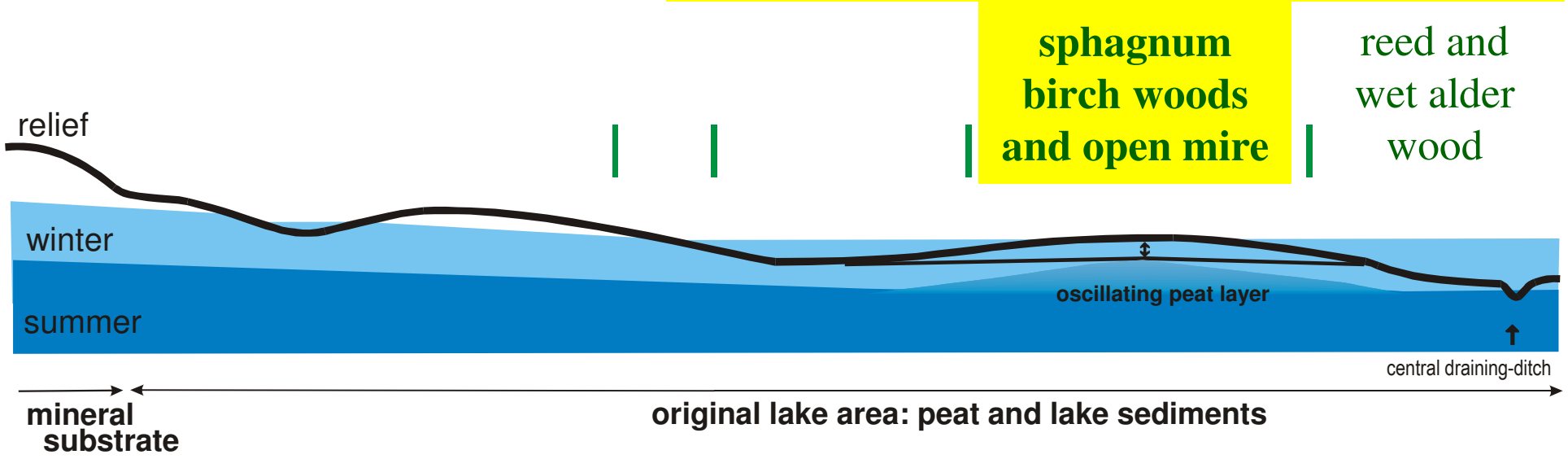
reed and eutrophic wet alder wood

Phragmition, Caricion elatae, Alnion glutinosae

typical plant species: ***Alnus glutinosa*, *Phragmites australis*, *Lemna minor*, *Carex elata*, *C. paniculata***

Vegetation zones and relief of the melln area

- zone with relatively small fluctuation of water level
- oscillation of thin peat layer on liquid lake sediments
- capillar water storage in peat and living mosses



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mesotrophic sphagnum-birch woods

Carici-Betuletum pubescentis, Sphagno-Alnetum glutinosae

EU habitat type 91D1:
“bog woodland”

mesotrophic sphagnum-birch woods (Betuletum)


Sphagnum spec., *Drosera rotundifolia*

typical plant species:

Betula pubescens

***Sphagnum* div. spec.**

Molinia caerulea

Carex lasiocarpa

C. echinata

Potentilla palustris

birds:

Snipe (*Gallinago gallinago*)

Crane (*Grus grus*)

mesotrophic moss-dominated open mire (“brown moss mire”)

Caricetum lasiocarpae, Paludello-Caricetum Succow (1970), Sphagno teretis-Caricetum Succow (1970)

EU habitat type 7140: “Transition mires”

- only small areas left (ca. 2 ha)
- in the present state natural succession would lead to mire-woods
- kept open by cutting young trees from time to time

mesotrophic moss-dominated open mire

- „brown mosses“ build up large parts of the older peat layers
- many species from the stock of the original silting-up belt

typical plant species:
“brown mosses” (*Drepanocladus, Calliergon, Campylium)* ; *Sphagnum* div. spec.

Epipactis palustris
***Liparis loeselii* (Habitat Directive Annex II)**
Carex lepidocarpa

birds: **Snipe (*Gallinago gallinago)***

Threatened plant species of mesotrophic mire

Cat 1	Critical
Cat 2	Endangered
Cat 3	Vulnerable

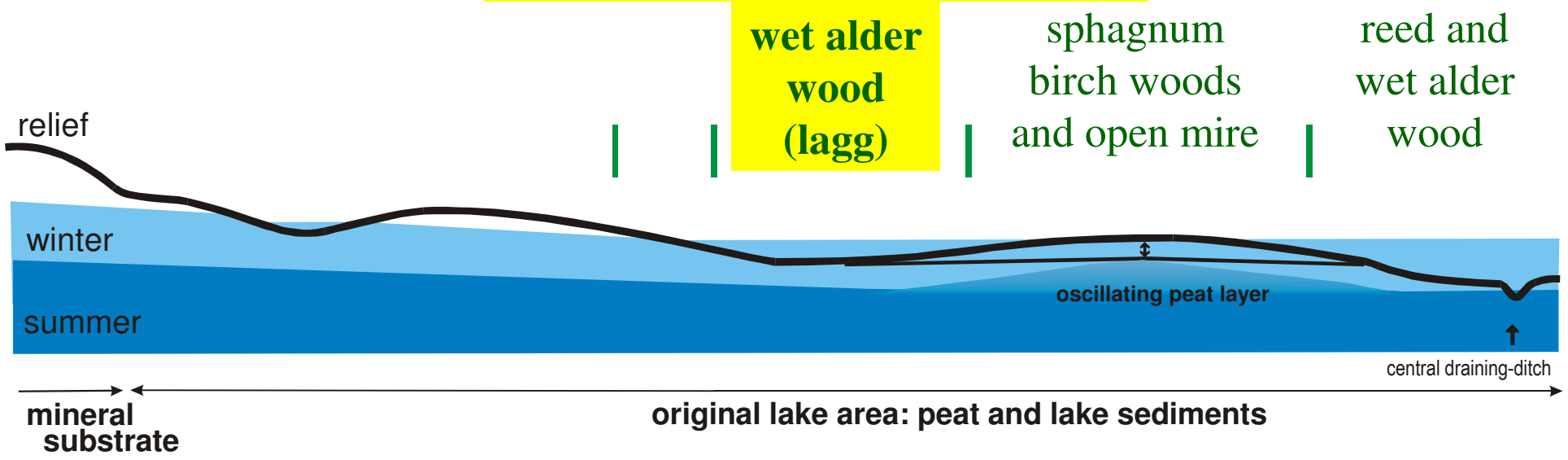
upper plant species	Red Data Cat.				
	BB	GER	FFH	mire wood	open mire
Carex lepidocarpa	1	3			x
Drosera anglica	1	2			x
Eleocharis quinqueflora	1	2			x
Liparis loeselii	1	2!	II		x
Calamagrostis stricta	2	3+			x
Carex flava	2				x
Carex lasiocarpa	2	3+		x	x
Dactylorhiza incarnata	2	2			x
Epipactis palustris	2	3+			x
Parnassia palustris	2	3+			x
Triglochin palustre	2	3+			x
Utricularia minor	2	2-			x
Briza media	3				x
Carex appropinquata	3	2-		x	x
Carex curta	3			x	x
Carex echinata	3			x	x
Carex nigra	3				x
Carex panicea	3				x
Carex rostrata	3			x	x
Crepis paludosa	3			x	
Drosera rotundifolia	3	3			x
Dryopteris cristata	3	3+		x	x
Epilobium palustre	3			x	x
Eriophorum angustifolium	3				x
Euphrasia micrantha	3	3+			x
Hottonia palustris	3	3-		x	
Hydrocharis morsus-ranae	3	3		x	
Linum carthaticum	3				x
Menyanthes trifoliata	3	3		x	x
Potentilla palustris	3			x	x
Salix repens	3				x
Stellaria palustris	3	3		x	
Utricularia vulgaris	3	3		x	
Vaccinium oxycoccos	3	3			x
Valeriana dioica	3			x	x
sum	35	21	1	15	30

mosses	Red Data Cat.				
	BB	GER	FFH	mire wood	open mire
Drepanocladus cossonii	1	3			x
Helodium blandowii	1	1			x
Paludella squarrosa	1	2			x
Sphagnum contortum	1	2			x
Sphagnum fuscum	1	2		x	x
Sphagnum subnitens	1	3		x	x
Sphagnum warnstorfii	1	2		x	x
Calliergon giganteum	2	3		x	x
Campylium stellatum	2				x
Dicranum bonjeanii	2	3		x	x
Riccardia incurvata	2	3			x
Riccardia latifrons	2	V		x	
Sphagnum capillifolium	2	V			x
Calliergon stramineum	3	V		x	x
Fissidens adianthoides	3	3		x	x
Plagiomnium elatum	3	3		x	x
Plagiomnium ellipticum	3	3		x	
Polytrichum strictum	3	3		x	x
Sphagnum angustifolium	3	V		x	x
Sphagnum russowii	3	V			x
Sphagnum teres	3	3		x	x
Thuidium tamariscinum	3	N1		x	
sum	22			14	19

- mires with subneutral-basic character have become extremely rare and are difficult to restore
- open mire especially rich in rare species

Vegetation zones and relief of the melln area

- great fluctuation of water level
- eutrophic owing to peat decomposition



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eutrophic wet alder wood (lagg) Carici elongatae-Alnetum glutinosae, Cardamino-Alnetum

eutrophic wet alder wood Carici elongatae-Alnetum glutinosae, Cardamino-Alnetum

birds: Green Sandpiper (*Tringa ochropus)*, Crane (*Grus grus*)

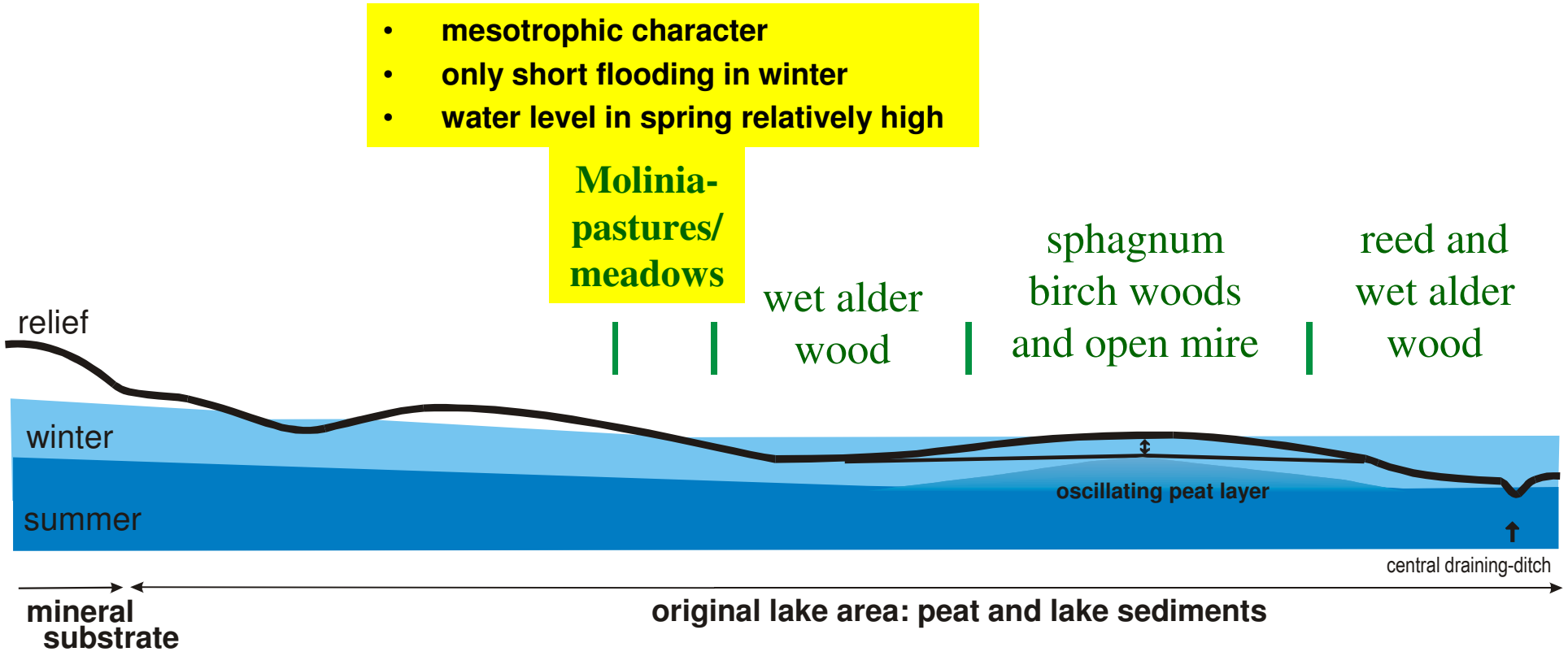
eutrophic wet alder wood

Carici elongatae-Alnetum glutinosae, Cardamino-Alnetum

typical plant species: ***Alnus glutinosa*, *Carex elongata*, *C. acutiformis*, *Thelypteris palustris*, *Iris pseudacorus***

Vegetation zones and relief of the melln area

- mesotrophic character
- only short flooding in winter
- water level in spring relatively high



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Molinia pastures and meadows

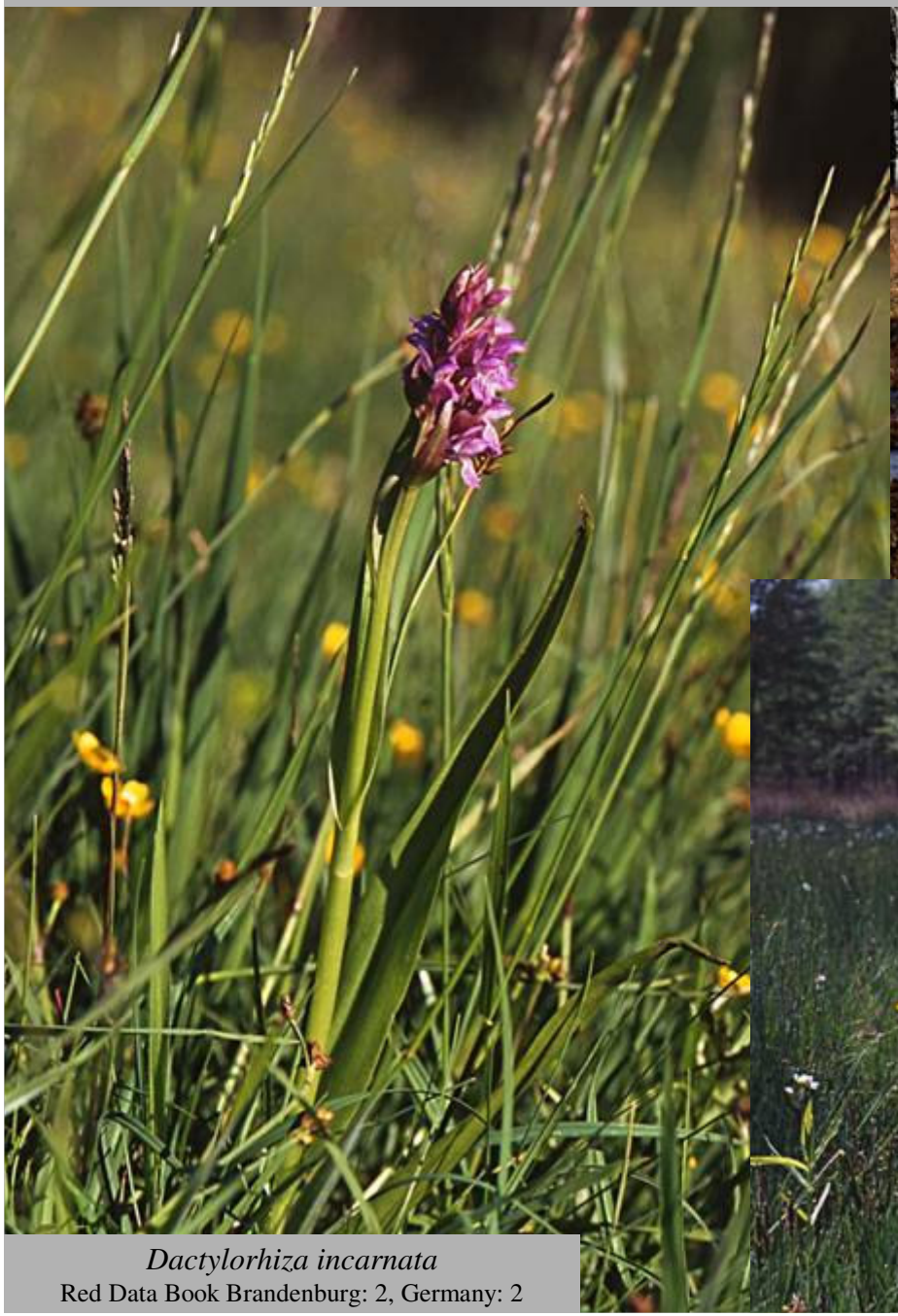
Eu-Molinietum, Parnassio-Molinietum, Caricetum nigrae

EU habitat type 6410:
“Molinia meadows on peaty soils ”

- **widespread in NO-Germany in former time, have become rare due to drainage, fertilization and abandonment of agricultural using**

Molinia pastures and meadows

Eu-Molinietum, Parnassio-Molinietum, Caricetum nigrae



Dactylorhiza incarnata
Red Data Book Brandenburg: 2, Germany: 2

typical plant species:

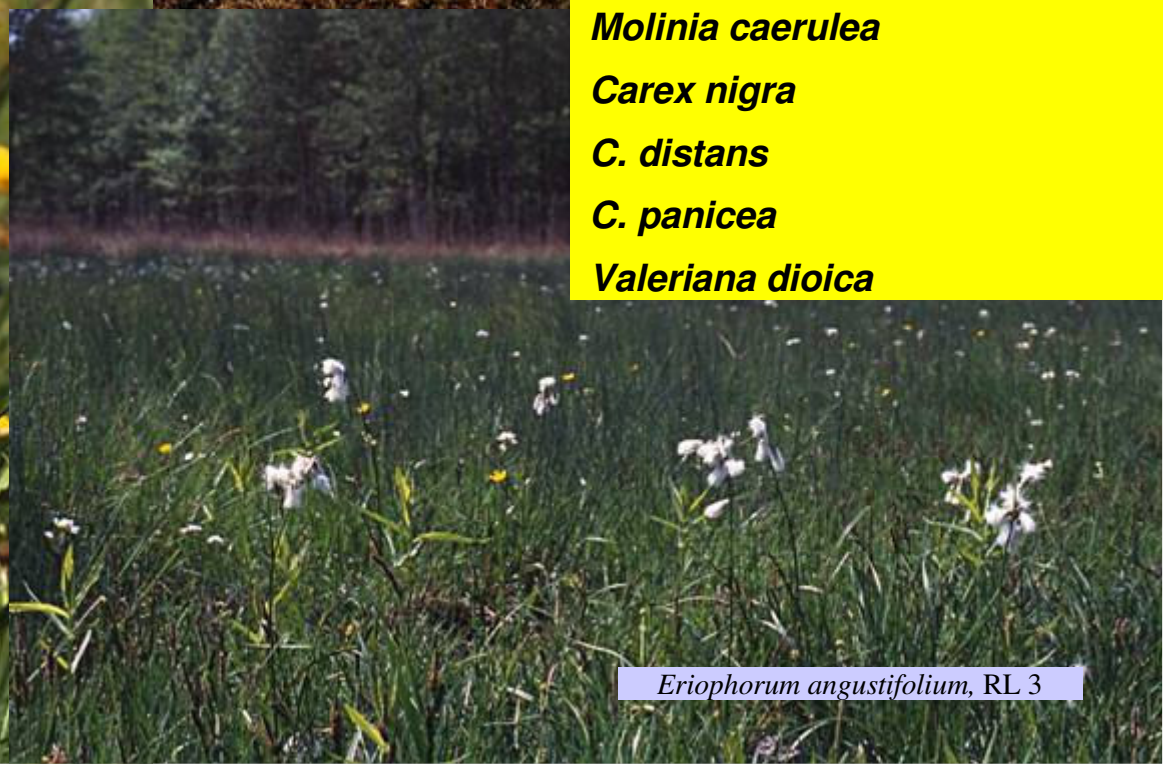
Molinia caerulea

Carex nigra

C. distans

C. panicea

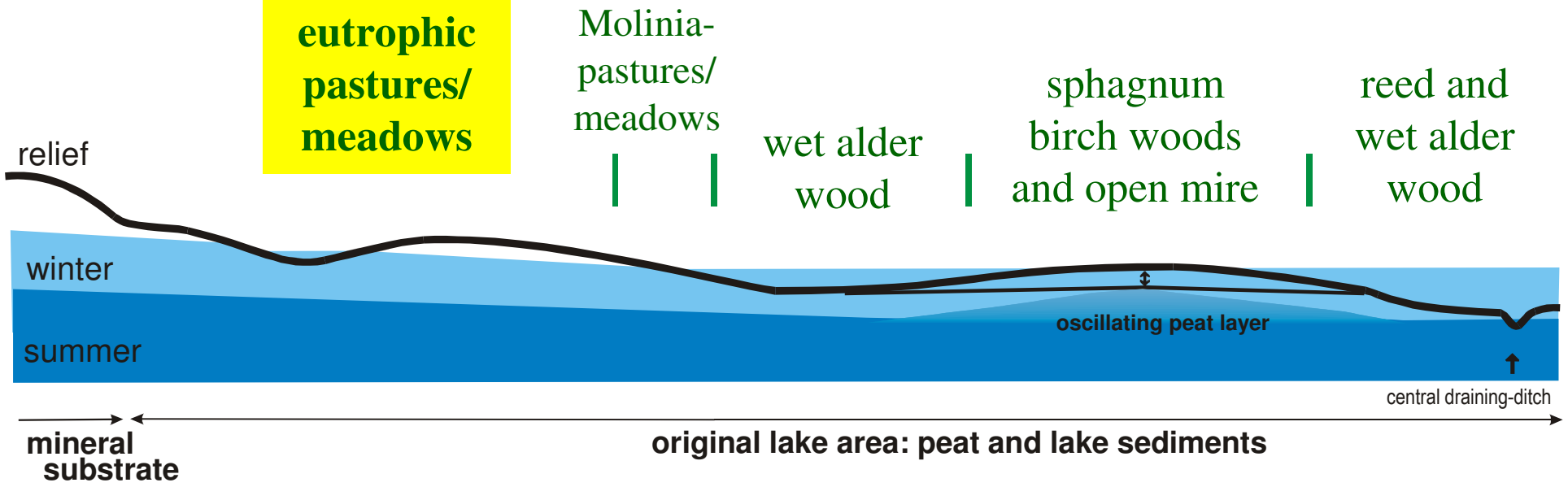
Valeriana dioica



Eriophorum angustifolium, RL 3

Vegetation zones and relief of the melln area

- great fluctuation of water level or soil surface constantly dry
- peat degraded



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eutrophic pastures and meadows Cynosurion, Calthion, Agrostietalia stoloniferae

typical plant species: ***Trifolium repens*, *Festuca pratensis*, *Bromus hordeaceus***
Agrostis stolonifera*, *Carex acutiformis*, *Phalaris arundinacea

Threatened plant species of melln mire

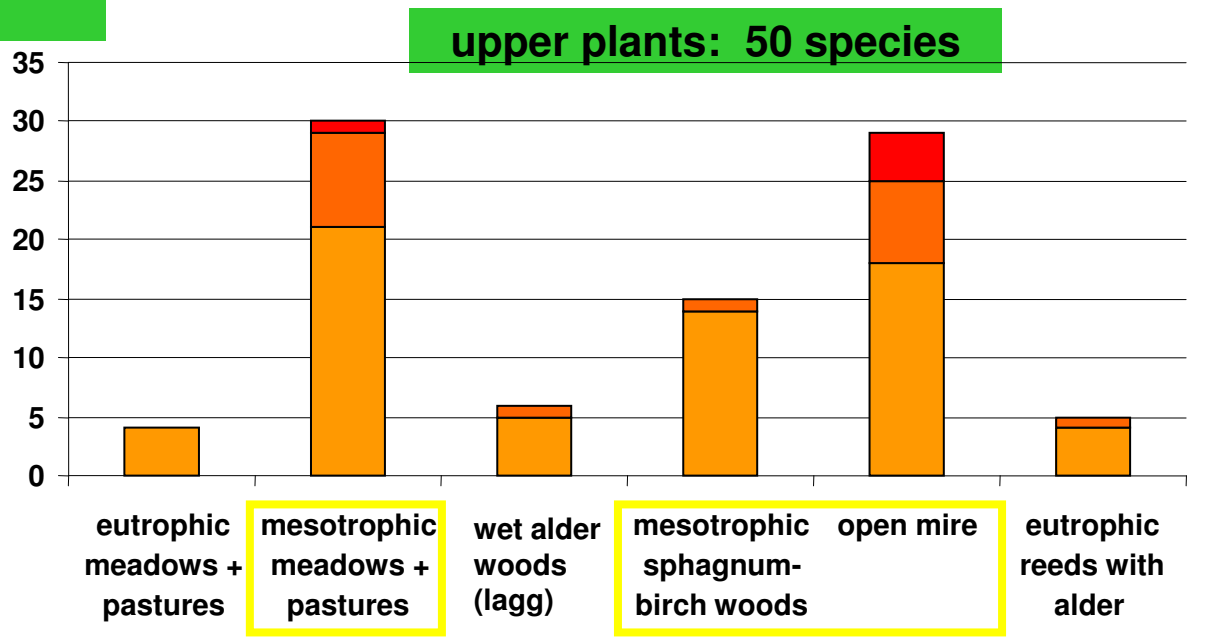
Cat. 1 = Critical

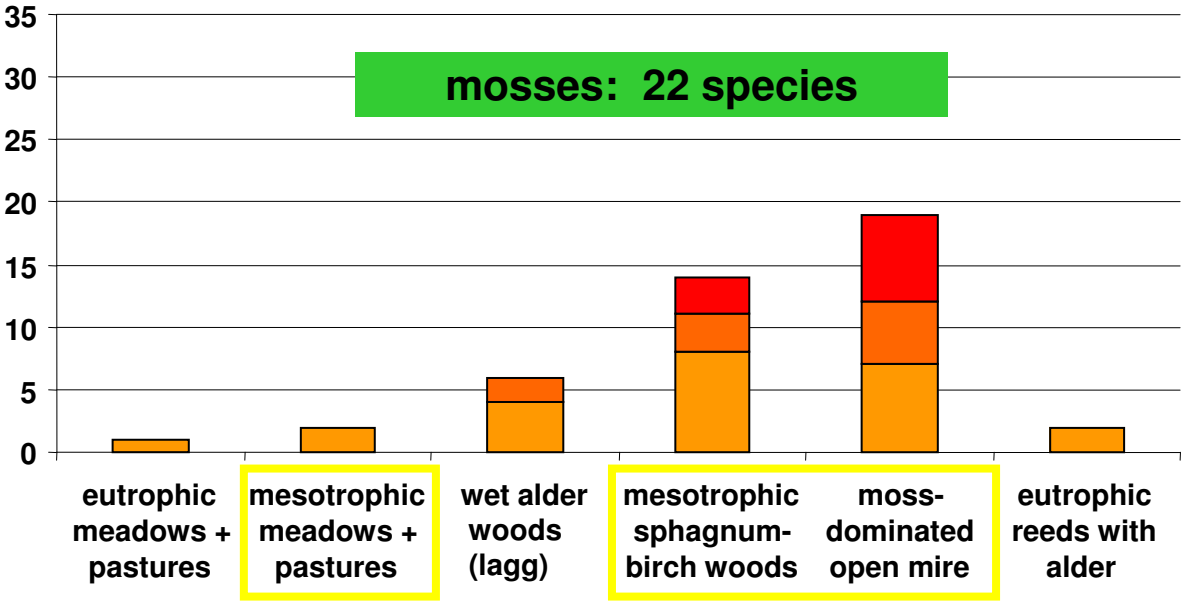
Cat. 2 = Endangered

Cat. 3 = Vulnerable

according to the Red Data Book of Brandenburg

EU-habitat-type





Thank you!

Regeneration of the mire „MellnSee“

part II - abiotic aspects and conclusions

- **Peat chemistry**
- **Hydrology: monitoring of water levels**
- **Water chemistry**
- **Conclusions for mire management**

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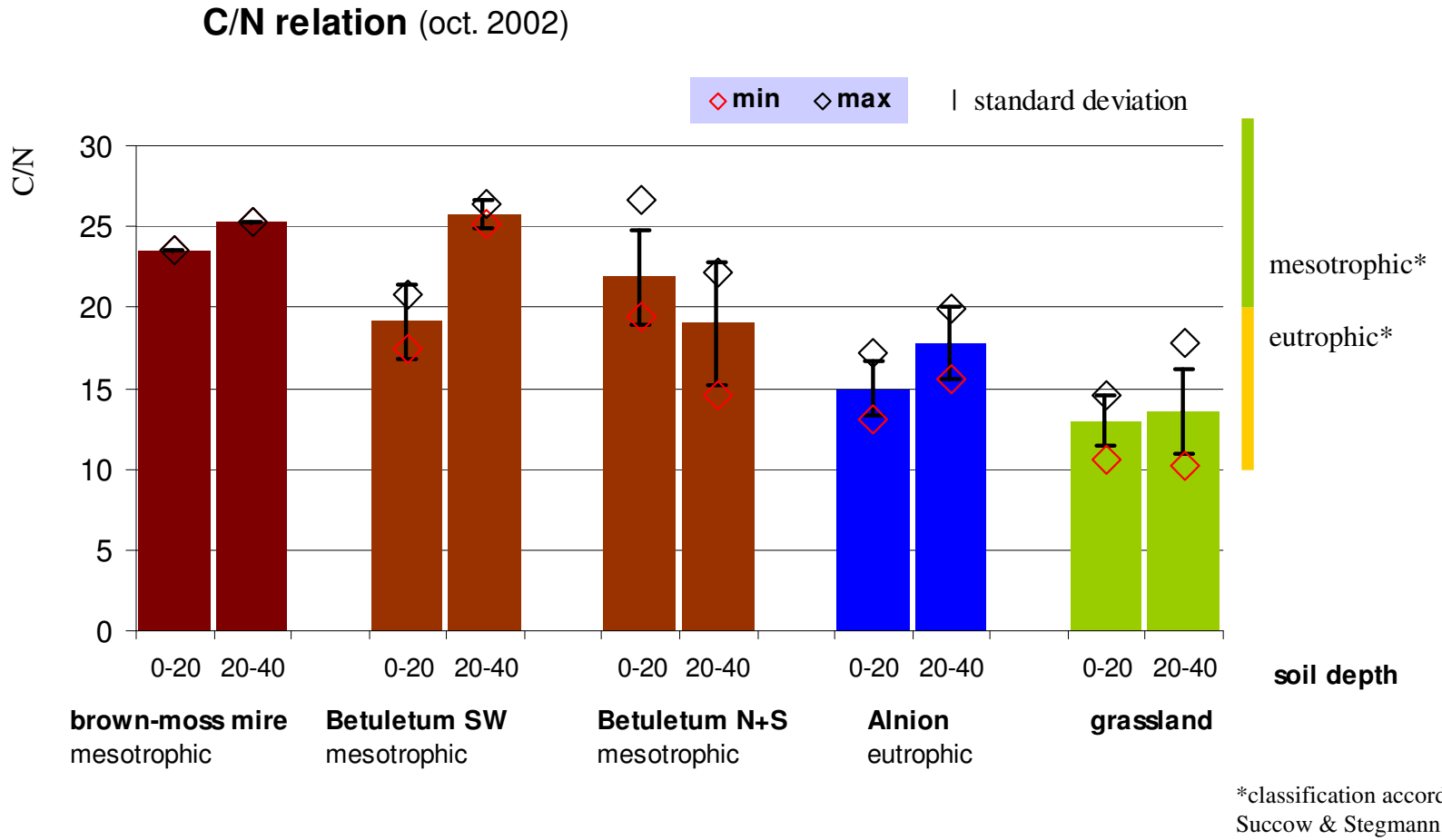
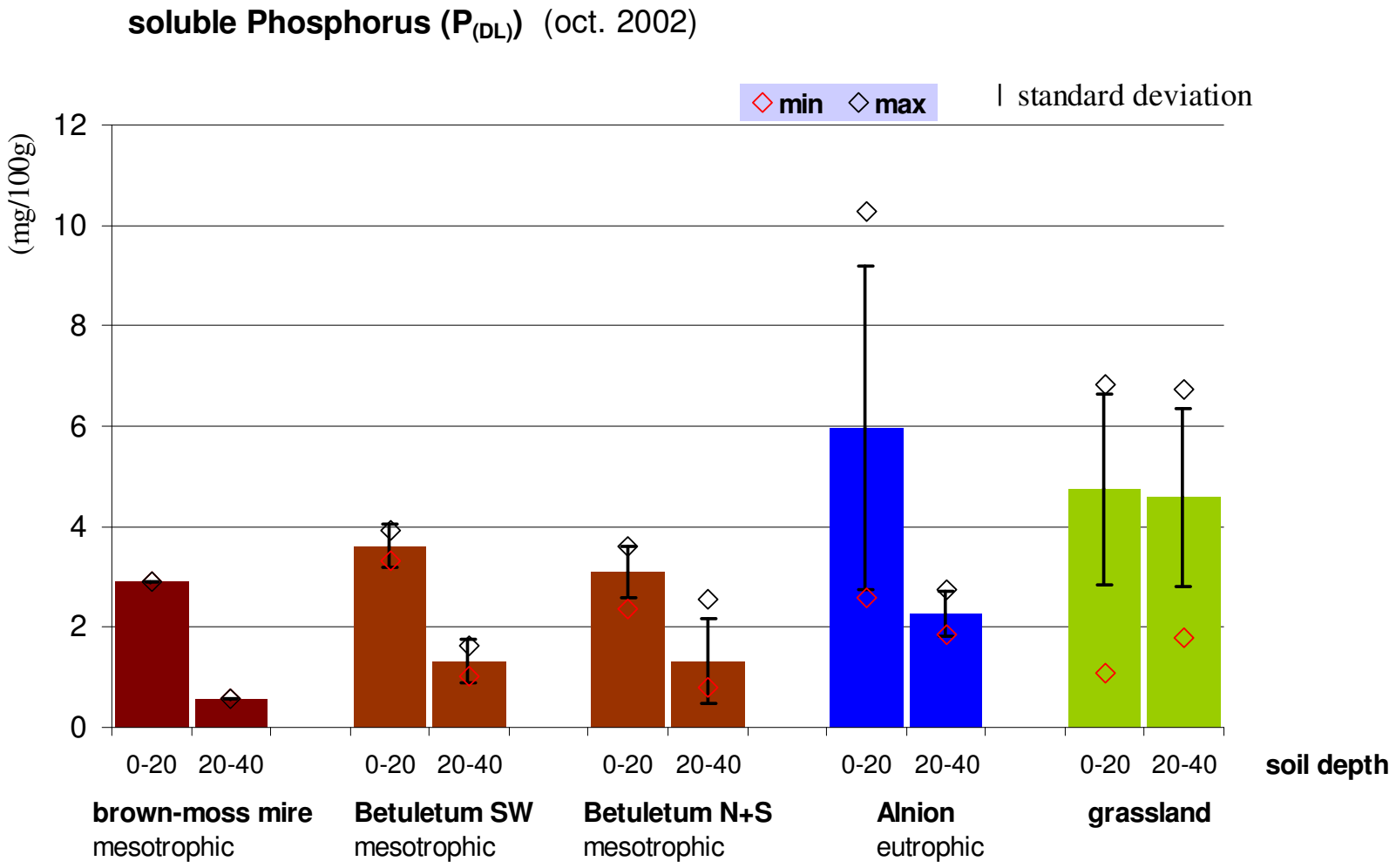
Peat chemistry



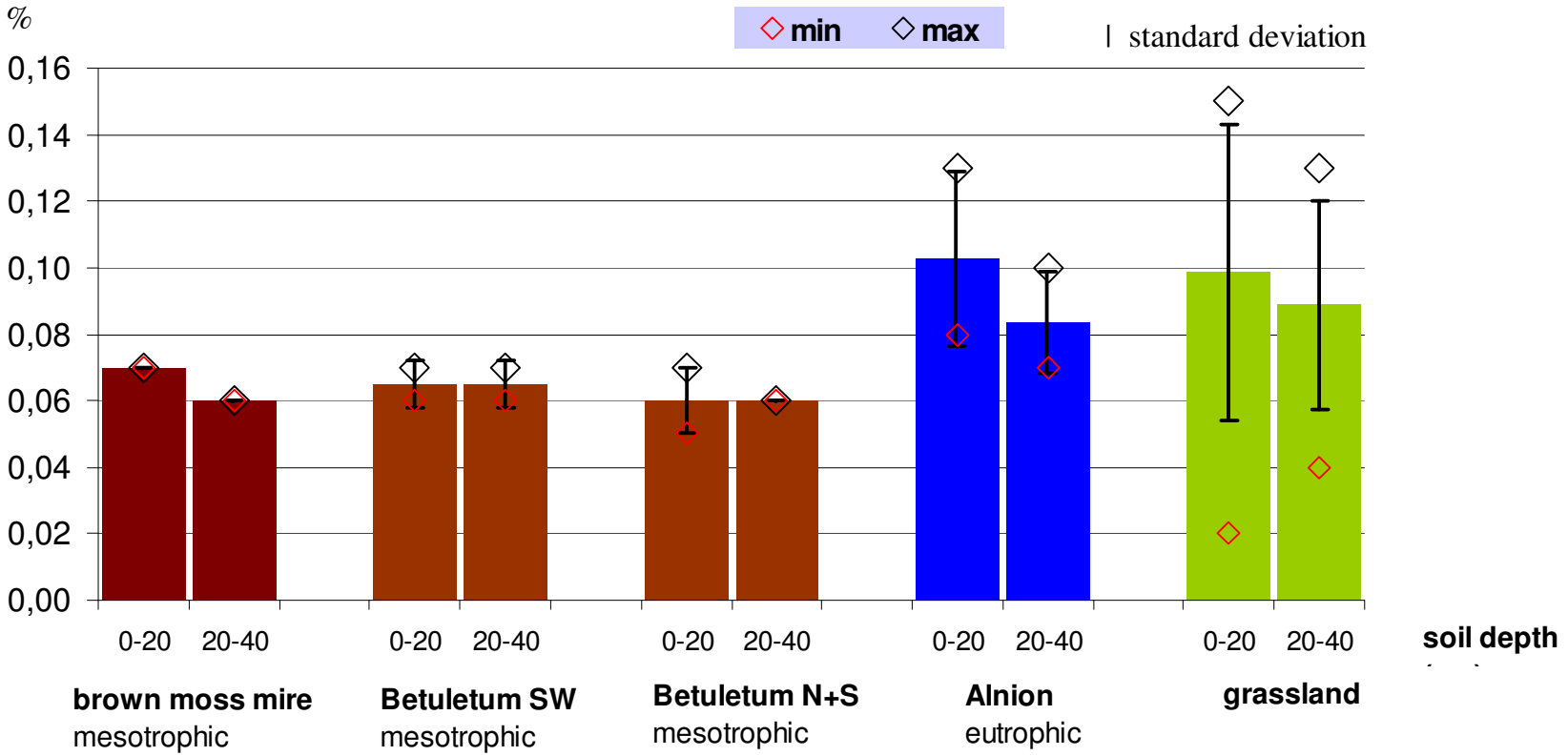
*classification according to Succow & Stegmann 2002

Peat chemistry



Peat chemistry

total Phosphorus (P_t) (oct. 2002)



Monitoring of water levels

- in relation to ground surface by means of perforated plastic tubes
- 14 gauges since 2001 / 40 gauges since 2004

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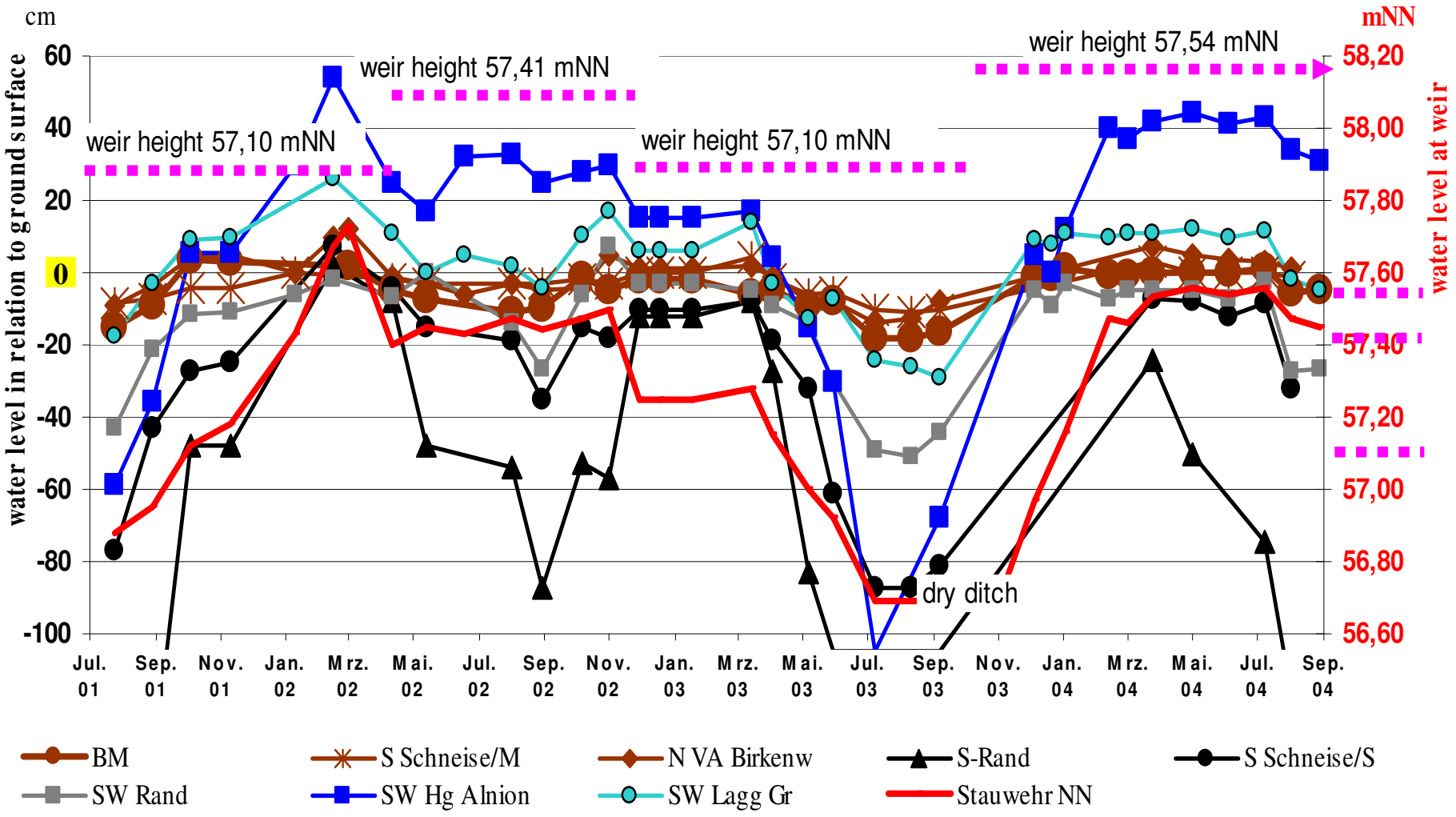
Water levels of Melln mire - 1



water level at weir (outlet)

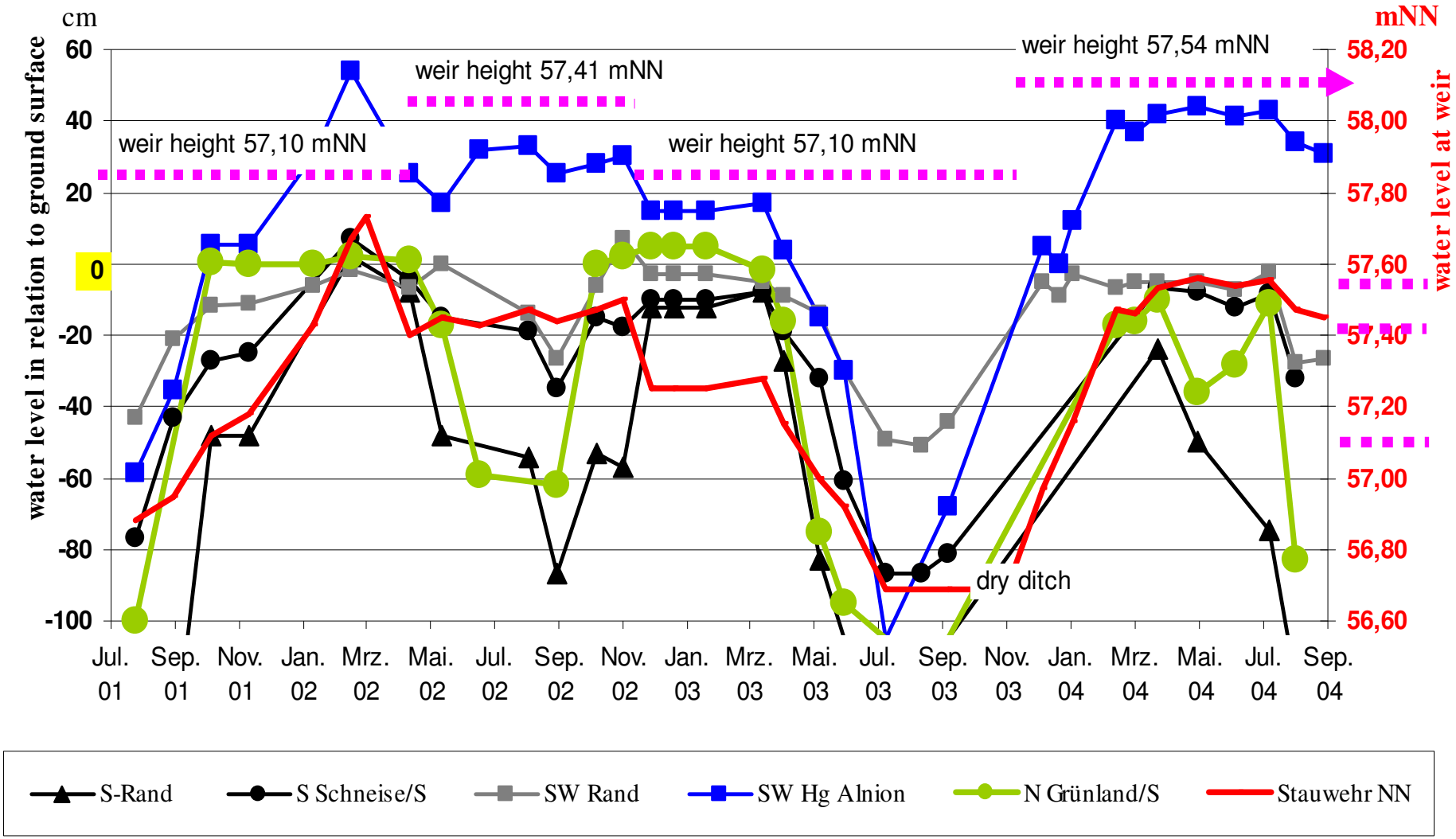
Alnion (main ditch)

Alnion (Lagg)

mesotrophic areas

periphery

Water levels of Melln mire - 2



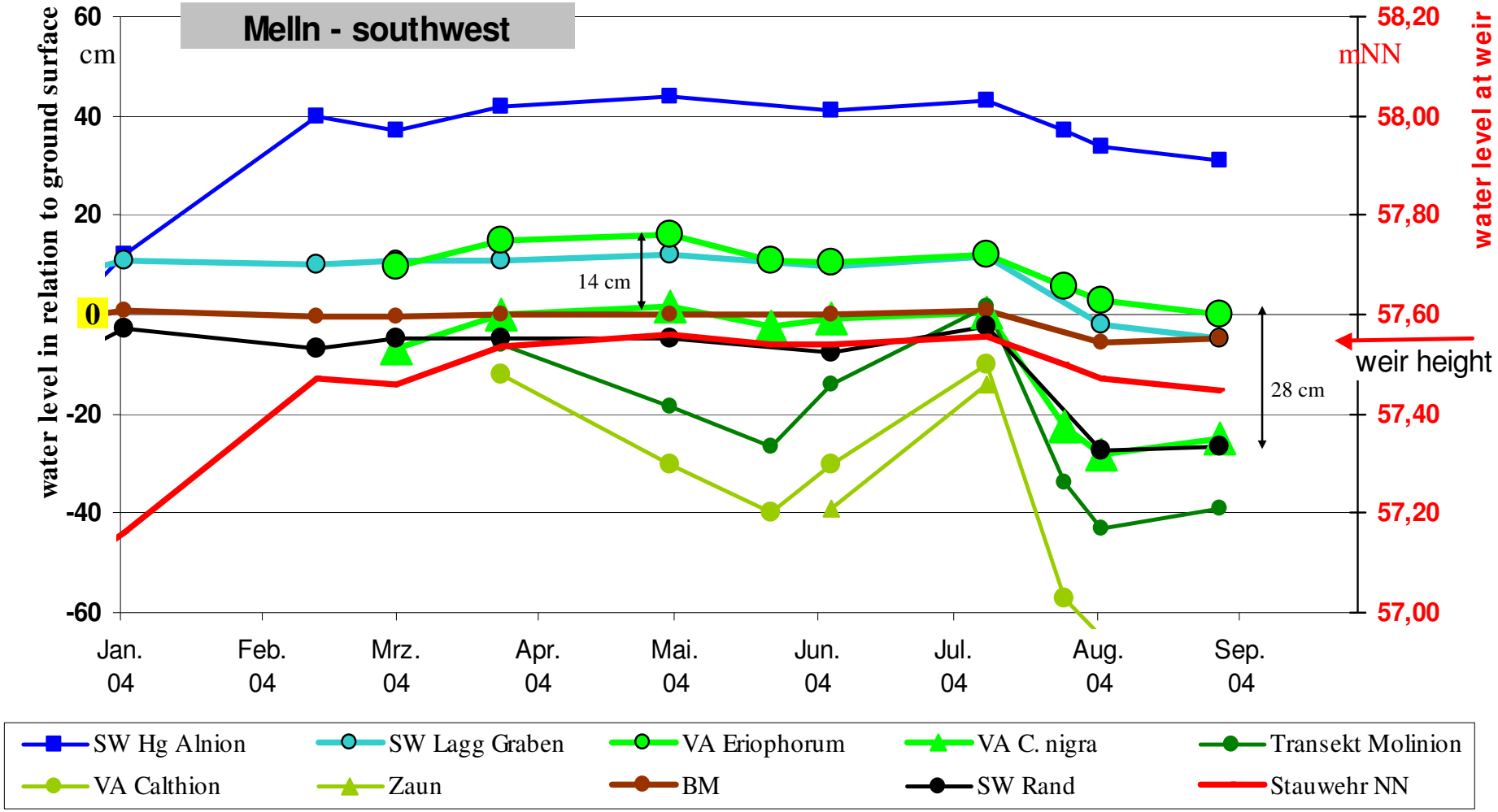
water level at weir

periphery

Alnion

grassland N

Water levels 2004



water level at weir

Alnion (main ditch)

Alnion (Lagg)

brown-moss site

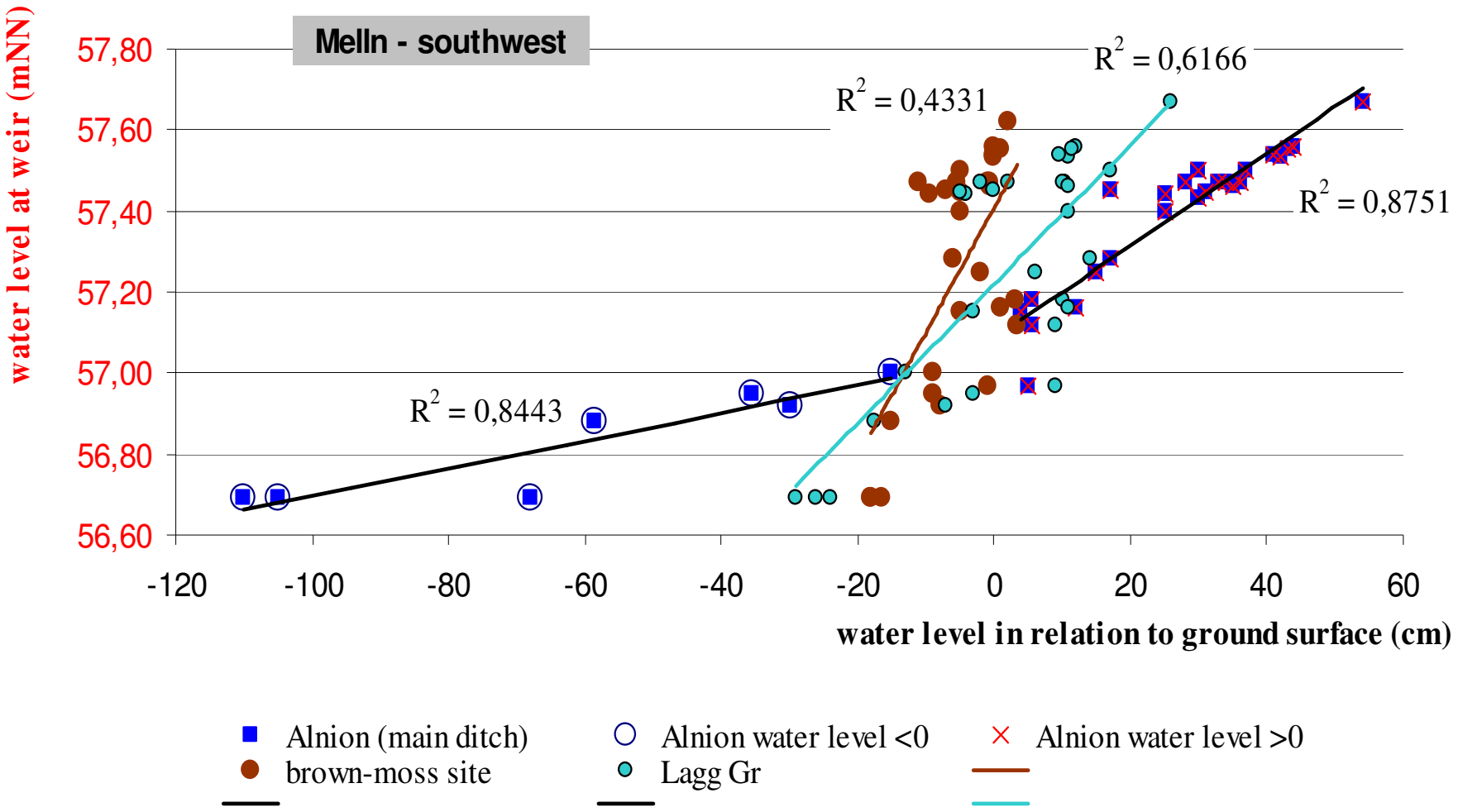
periphery
(bottom of slope)

sedge pasture

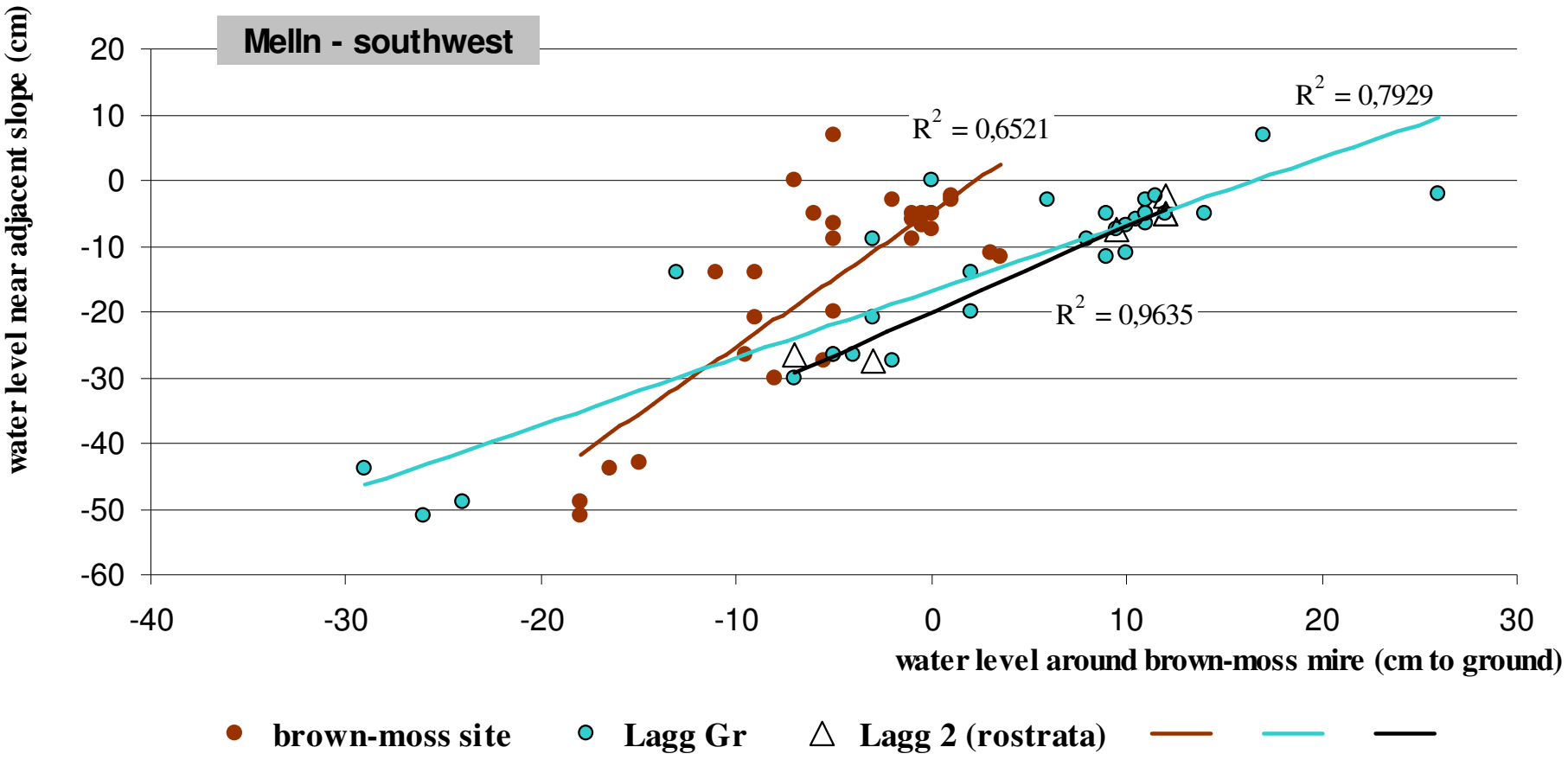
molinion pasture

eutrophic pasture

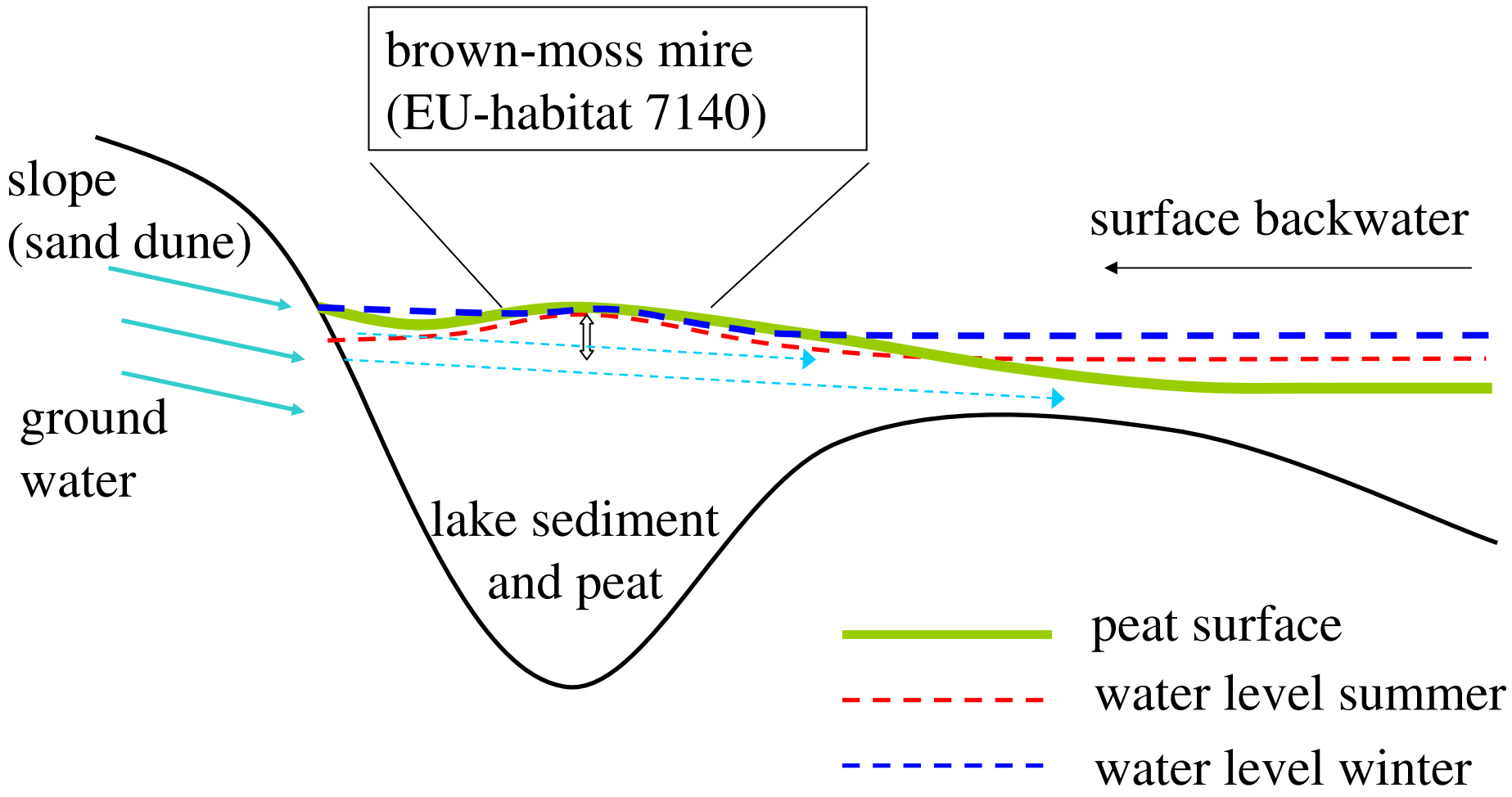
Correlation between water levels around the brown-moss site and at the weir



Correlation between water levels around the brown-moss site and the level nearby the adjacent slope



Hydrology of the brown-moss site



Water chemistry

- water samples from 20 sites every 3 months

- NO_3^- (nitrate)
  NO_2^- (nitrit)
  NH_4^+ (ammonium)
  PO_4^{3-} (ortho-phosphate)
  P_t (total phosphorus)
  K (Potassium)
  electrical conductivity
  temperature
  O_2 (oxygen)
  pH

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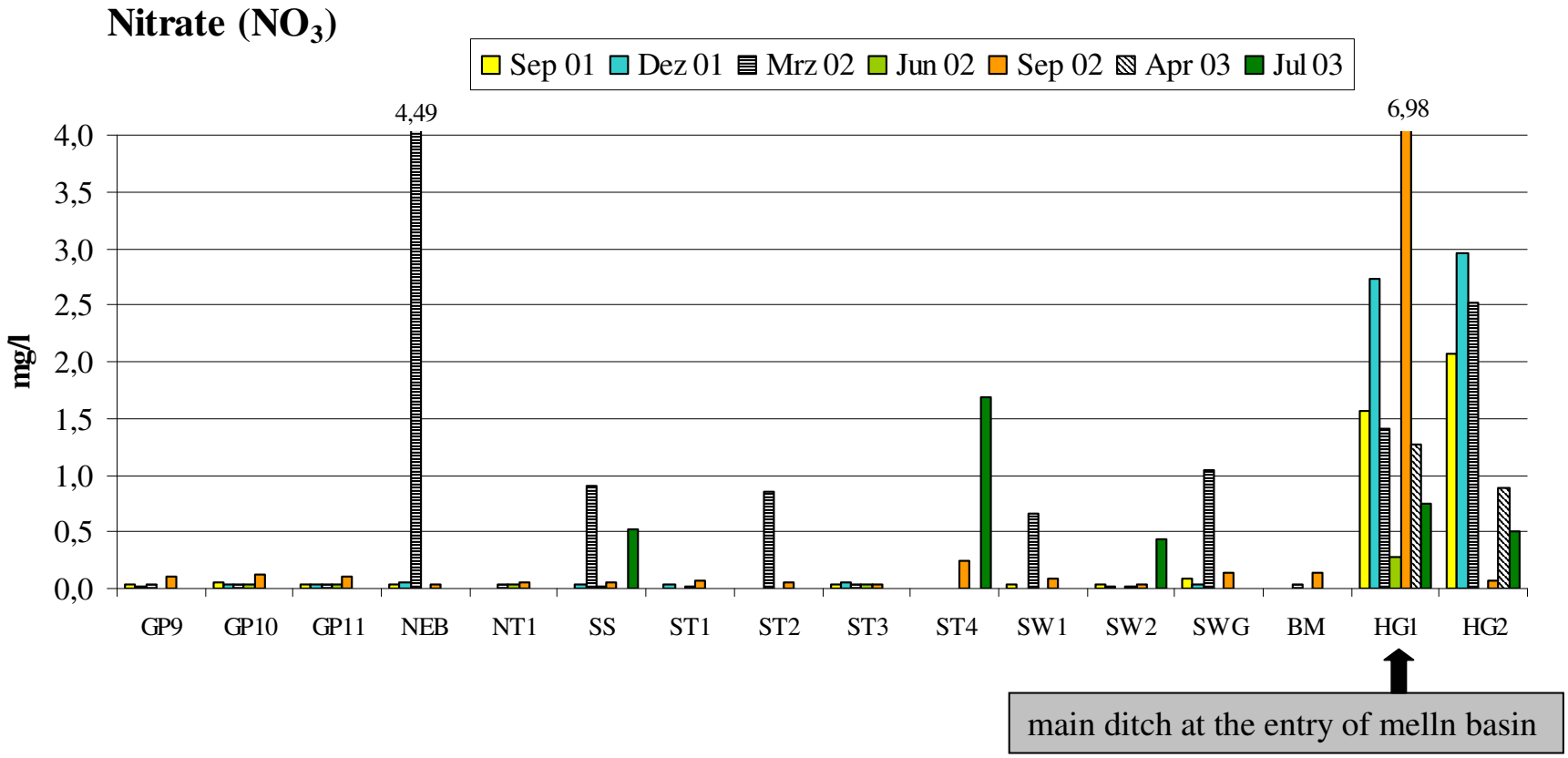
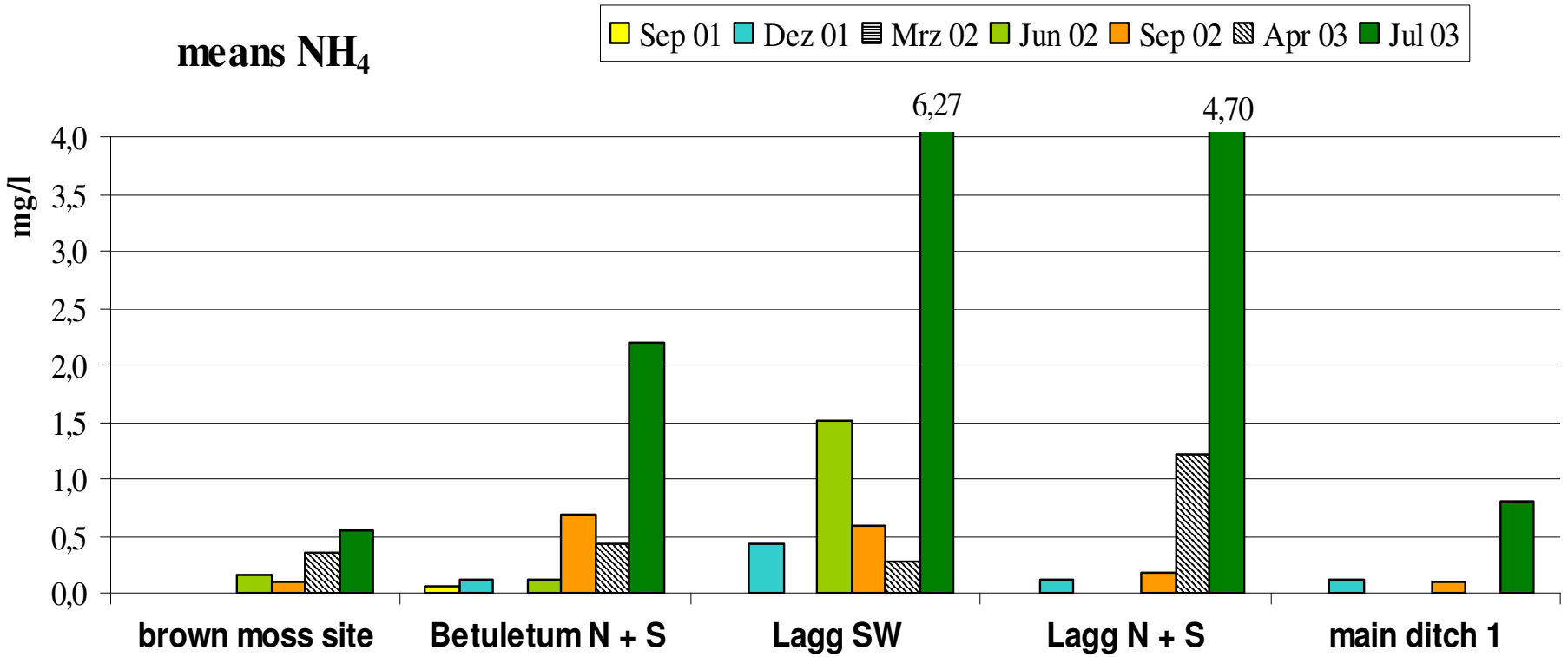
Water chemistry - Nitrate



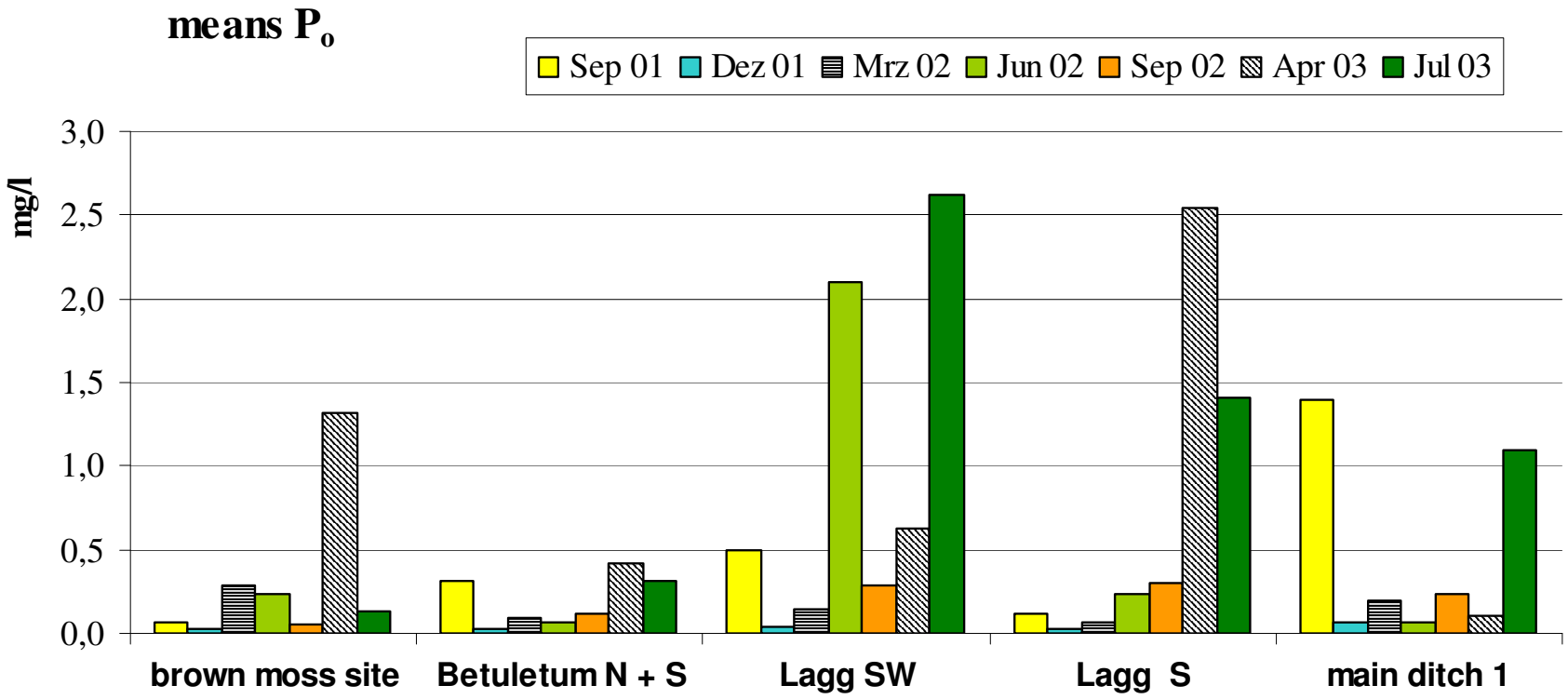
- **high values of nitrate in water of main ditch**
- **presumed to stem from intensively used agricultural fields and drained grassland beyond the Melln mire (catchment area)**
- **nitrate in Melln mire in flooded regions at times of high water level** (Mrz 02)
- **and at sites drying out during very low water level** (jul 03)

Water chemistry - Ammonium



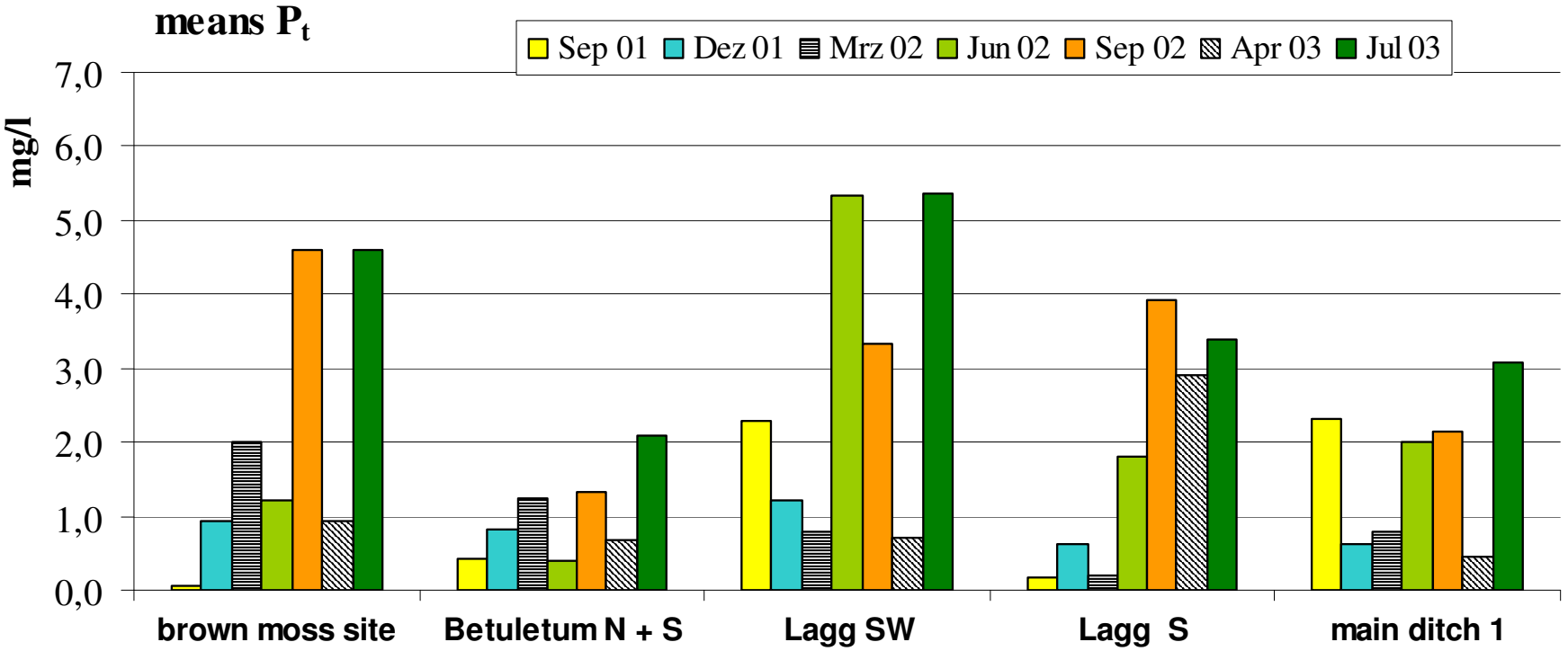
- ammonium originates in decomposition processes of organic material
- very high values in summer 03 during low water levels, even in some mesotrophic areas
- at „normal“ water levels NH_4 is present especially at sites with high water level fluctuation (Lagg)

Water chemistry – soluble Phosphorus



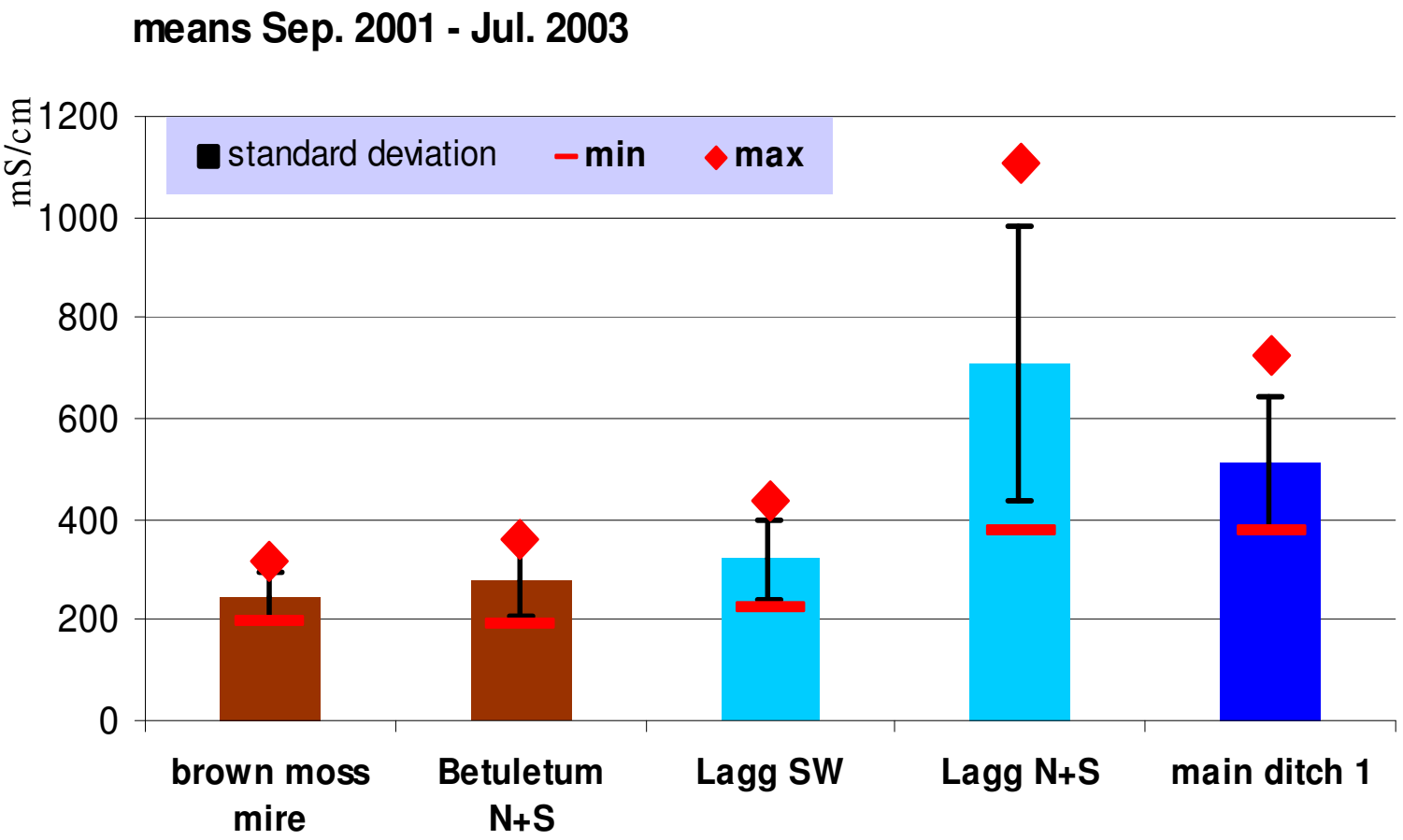
- **soluble phosphorus is especially high in the lagg zones**

Water chemistry – total Phosphorus



- total Phosphorus generally high at most sites except in Sept. 01
- increase during the study period?

Water chemistry - Electrical Conductivity



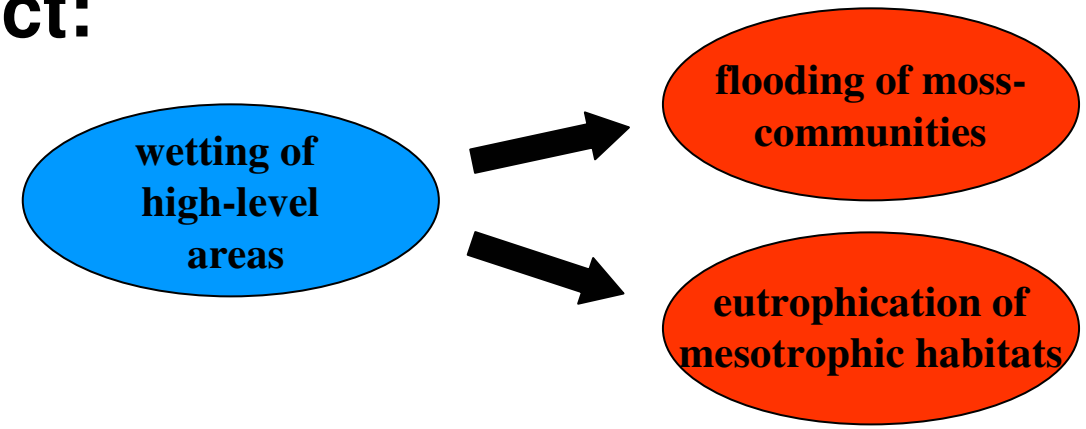
- reflecting the over-all amount of nutrients in the water
- low values in mesotrophic areas
- high values in some lagg zones and the main ditch

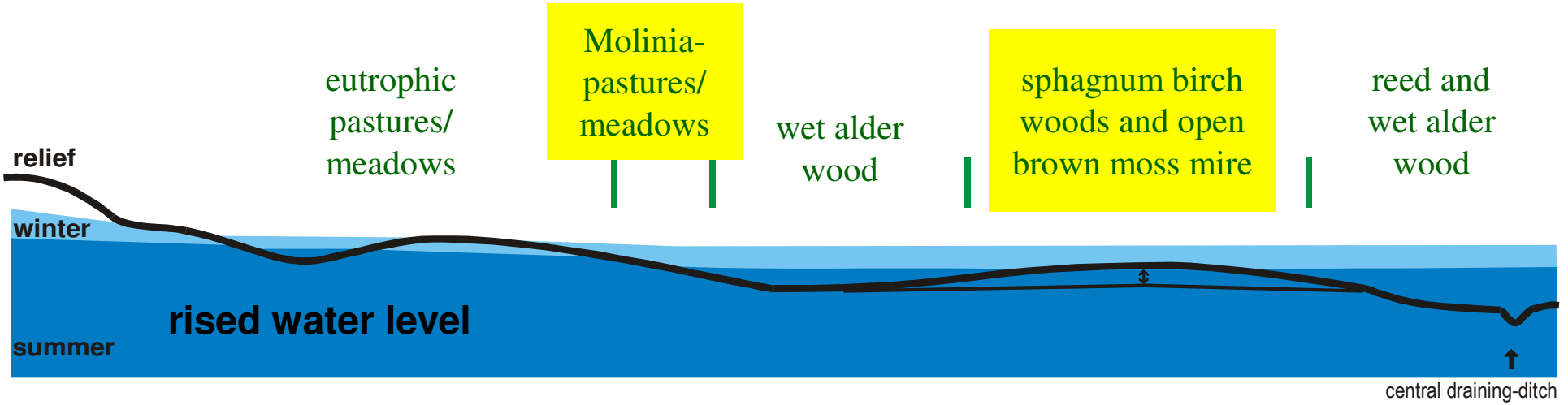
Summary + Conclusions

- **Water levels at the present state should be sufficient to stop decomposition of peat in the mesotrophic zones and the lagg zones of the mire.**
- **Water levels in the periphery of the Melln mire and in most parts of the grassland are still very low at times.**
- **Water levels are optimal for the development of Sphagnum-rich forests but are not sufficient to stop succession to alder wood in open mire areas.**
- **The most valuable brown-moss site depends on water influx from adjacent slopes, probably this is the precondition for the existence of this special moss community.**
- **Further increase of weir height / water levels could result in eutrophication of mesotrophic areas because of enhanced water exchange with the lagg zones and with nutrient-rich ditch water.**
- **This applies especially to the brown-moss mire, because at this site swimming up of peat layers is unlikely at present.**
- **The best solution would be a better water retainment in the catchment area of the Melln mire. This would minimize the fluctuation of water levels and would reduce the nutrient input from the catchment area into the Melln basin.**

conflict:

stop peat decomposition
maximum water retainment





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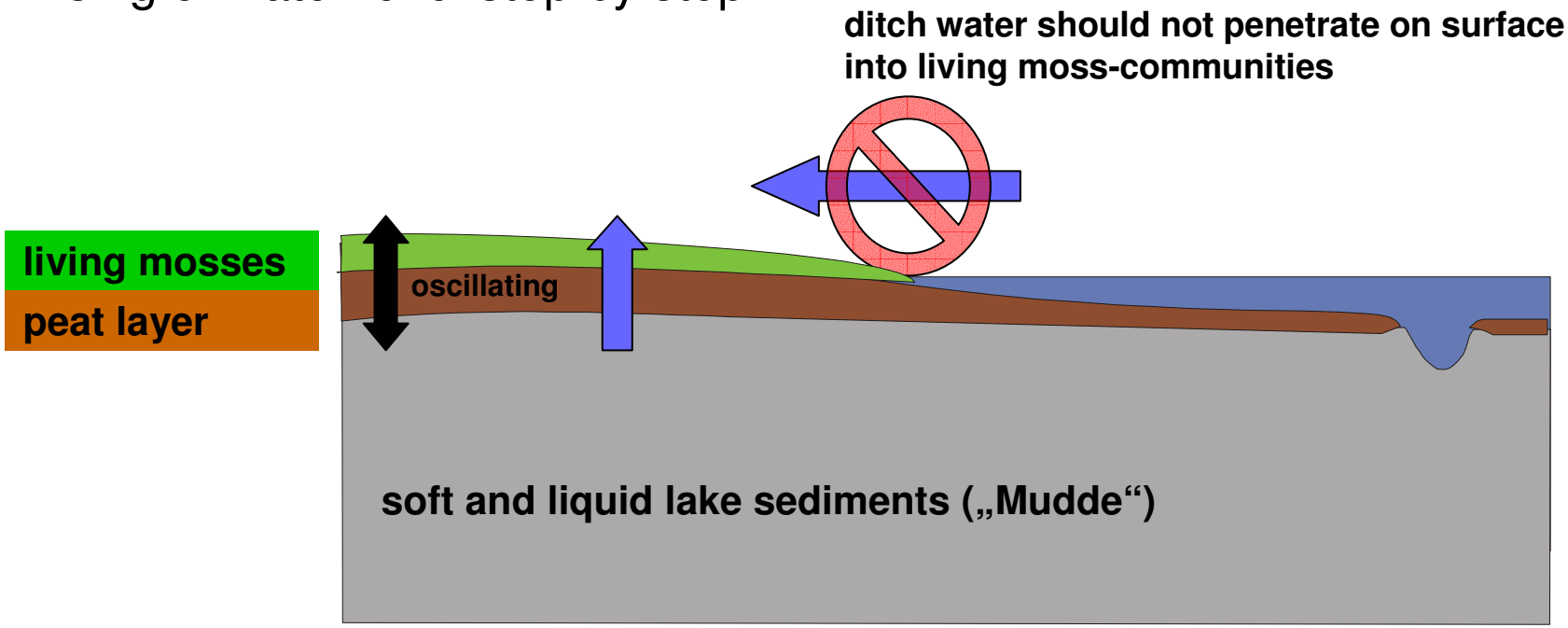
compromise:

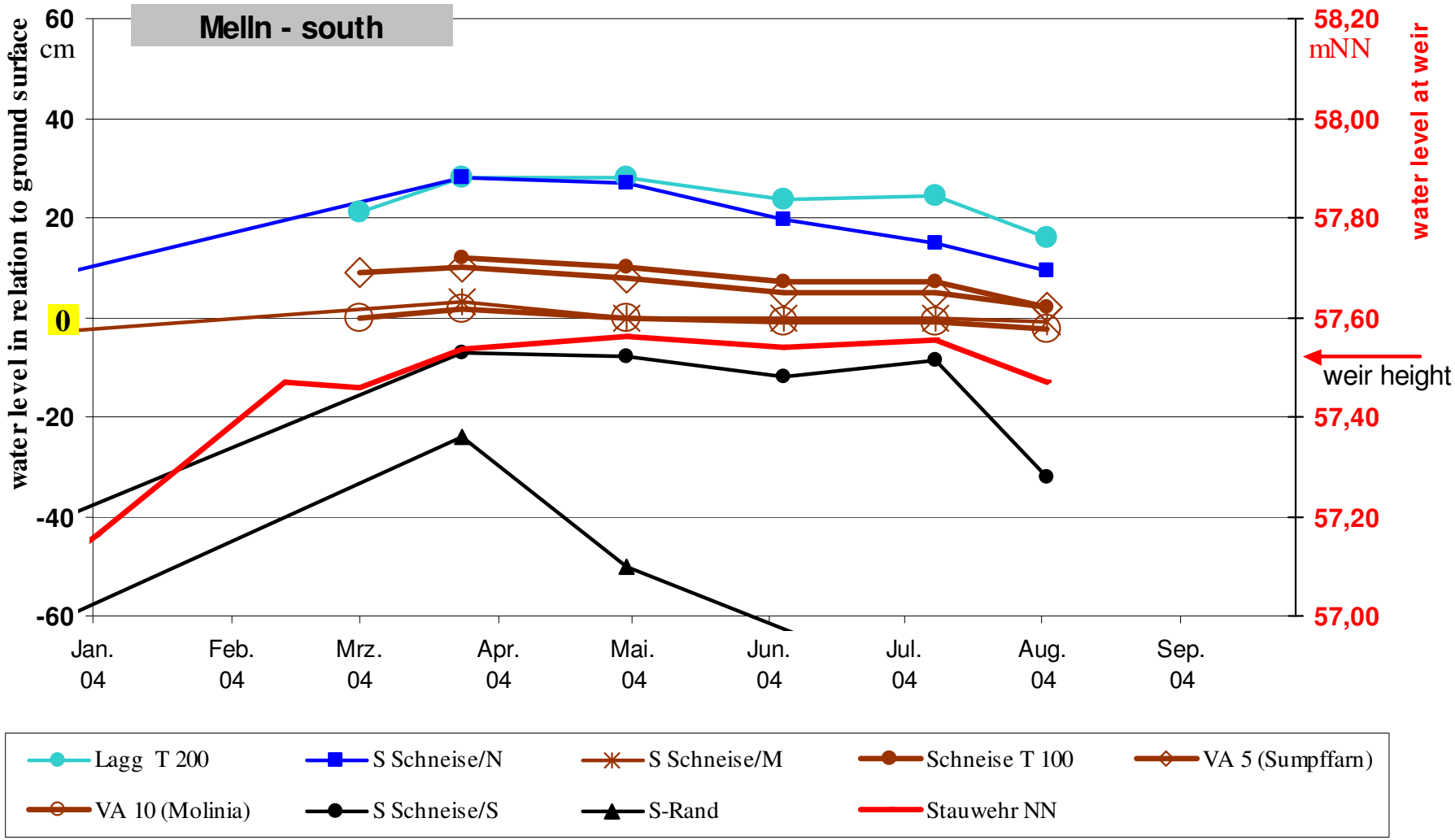
rising of water level step by step



- **first step allows oscillation of mesotrophic zones on liquid lake sediments**
- **nutrients of ditch water are mostly retained in peat layer**
- **During first step the brown-moss site is determined by nutrient-poor ground water, succession probably has to be controlled by cutting trees from time to time**
- **with time oscillation capabilities of peat-layers should be improved**
- **further raising of water level in 5 years?**

Thank you very much for interest and discussion

Water levels 2004



water level at weir

Alnion (main ditch)

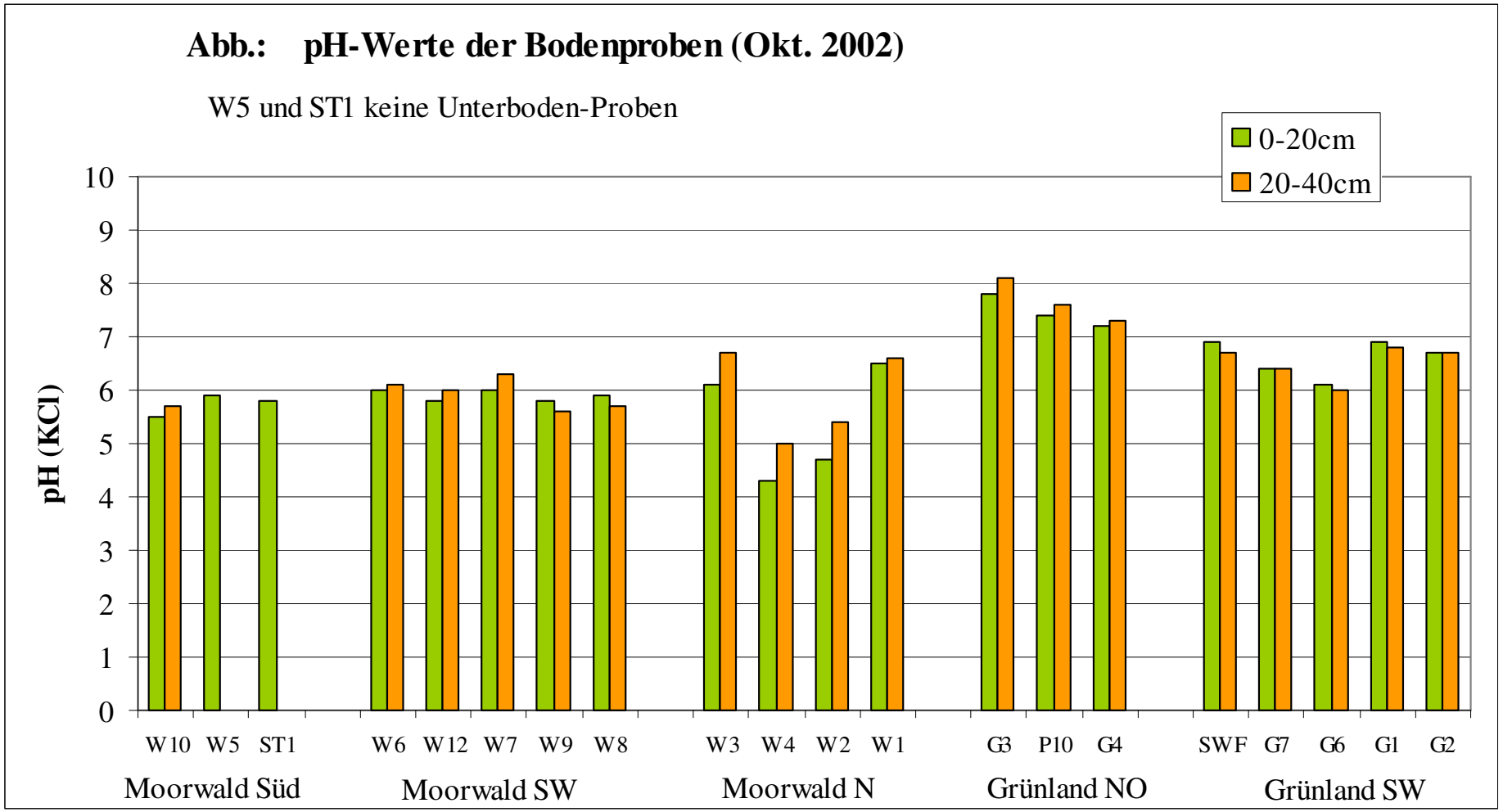
Alnion (Lagg)

mesotrophic areas

periphery

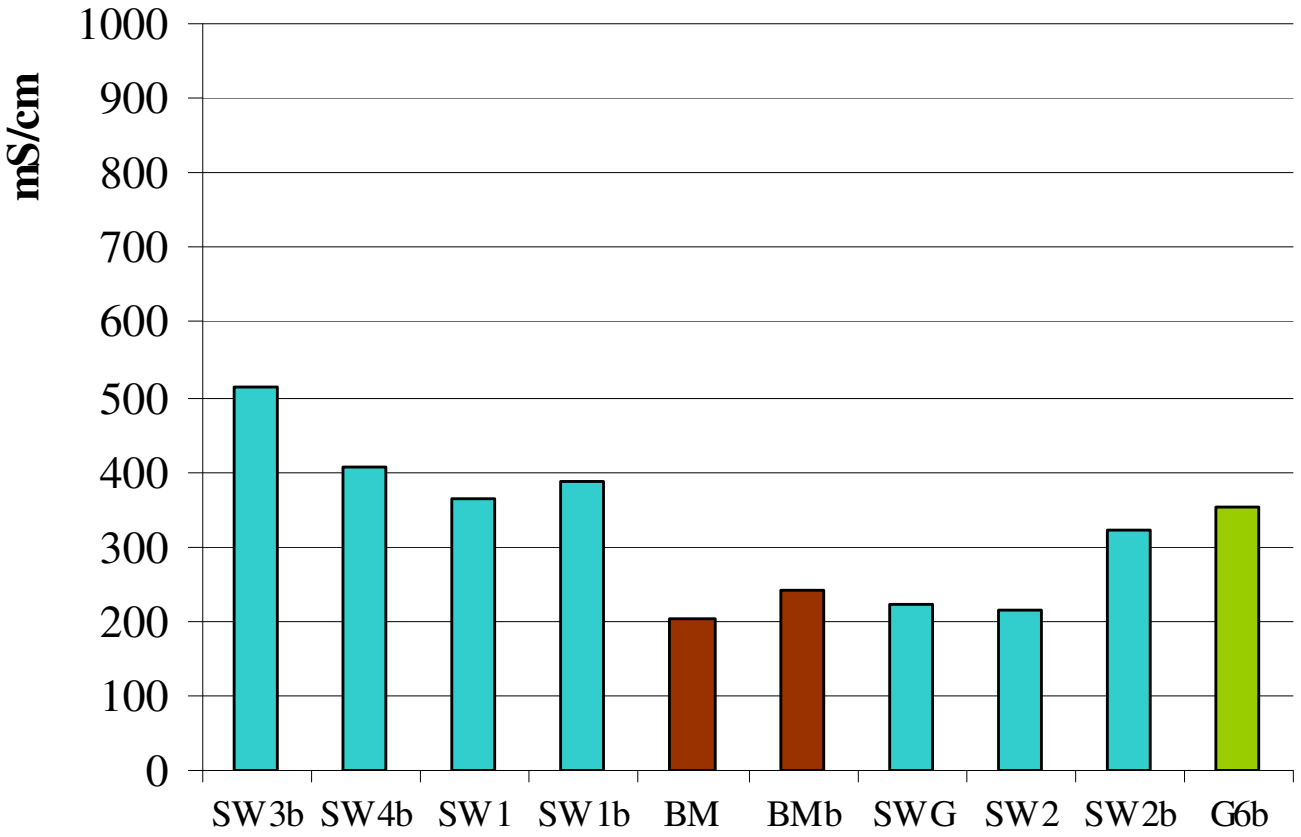
peat chemistry - pH

Abb.: pH-Werte der Bodenproben (Okt. 2002)



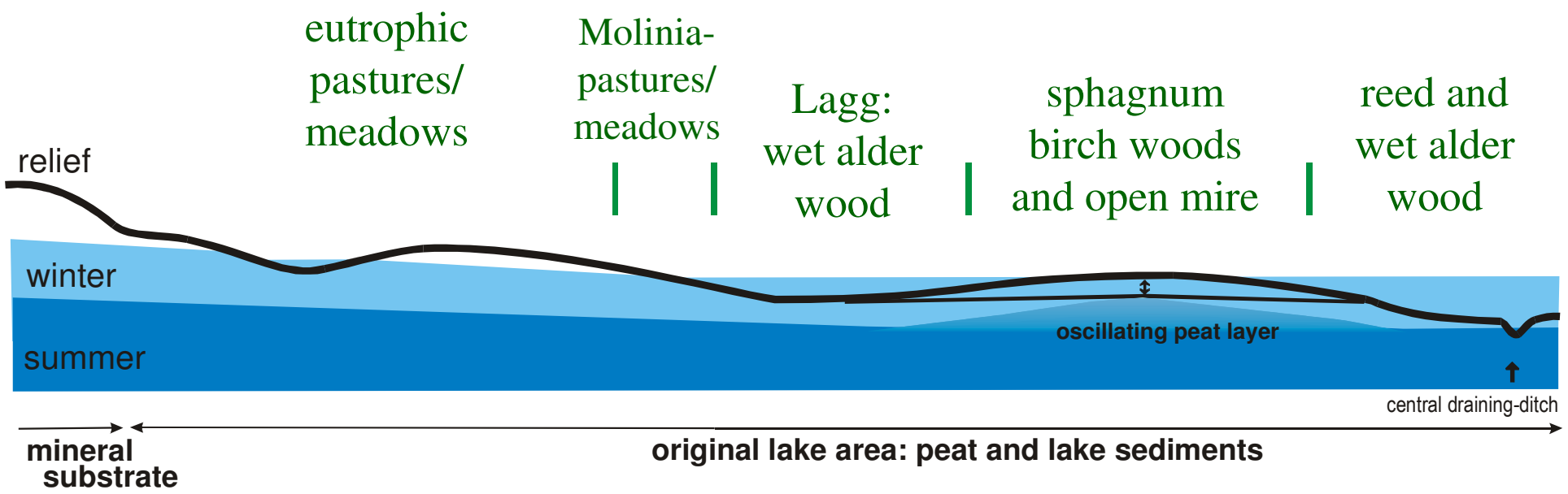
water analysis - discussion

Electrical conductivity around brown-moss mire, 2.12.03



- water coming from the slope (left) probably looses nutrients on its way through the peat layer

Vegetation zones and relief of the melln area



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Threatened butterflies of low-grazed Molinia pastures and sedge reeds

Lilagold-Feuerfalter (*Lycaena hippothoe*)
Red Data Book BB: 1, Germany: 2

Baldrian-Scheckenfalter (*Melitaea diamina*)
Red Data Book BB: 1, Germany: 3

Großer Feuerfalter (*Lycaena dispar*)
Red Data Book BB: 2, Germany: 2, FFH Annex II