



On-site and environmental effects of soil erosion by wind

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SVEUČILIŠTE U
ZAGREBU



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Državni hidrometeorološki zavod



Meteorološki izazovi 3: Ekstremne
vremenske prilike i utjecaj na duštvo.
Zagreb, 21-22.11.2013.



Introduction:

Čepić field, before 2/3 February 2012



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Zagreb, 21-22.11.2013



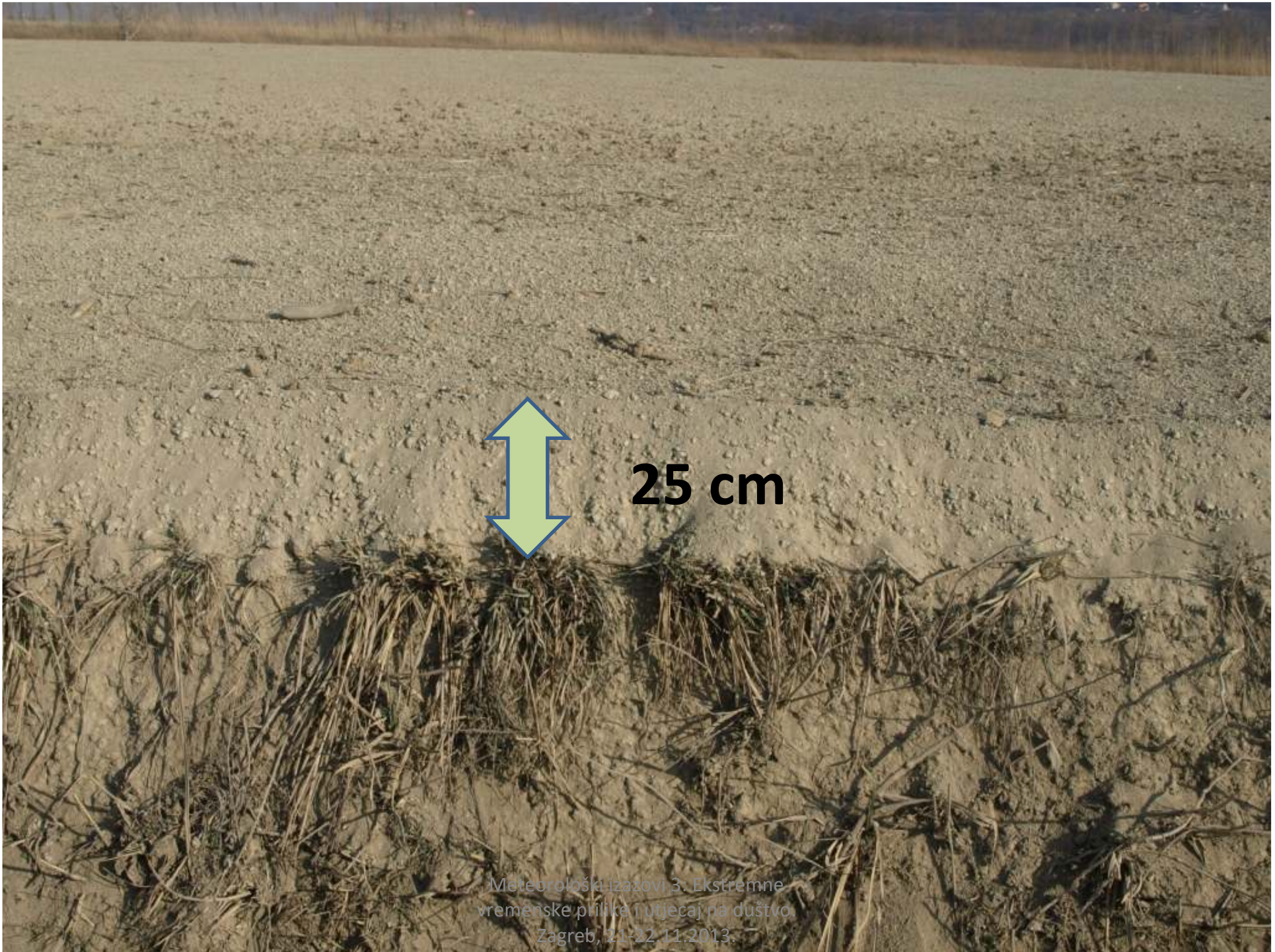
Čepić field, after 2/3 February 2012



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fotozine.org



25 cm

February 2011



February 2012



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Problems in environment caused by wind erosion



Meteorološki izazovi B: Ekstremne
vremenske prilike i utjecaj na društvo.
Zagreb, 21-22.11.2013.



Meteorološki izazovi 3: Ekstremne
vremenske prilike i utjecaj na društvo.
Zagreb, 21-22.11.2013



Meteorološki izazovi 5: Ekstremne vremenske prilike i utjecaj na društvo.
Zagreb, 21-22.11.2013



Meteorološki izazovi 3: Ekstremne vremenske prilike i utjecaj na duštvo.
Zagreb, 21-22.11.2013.



February, 2012

May, 2012

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vremenske prilike i utjecaj na društvo.
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10 February 2012



17 May 2012



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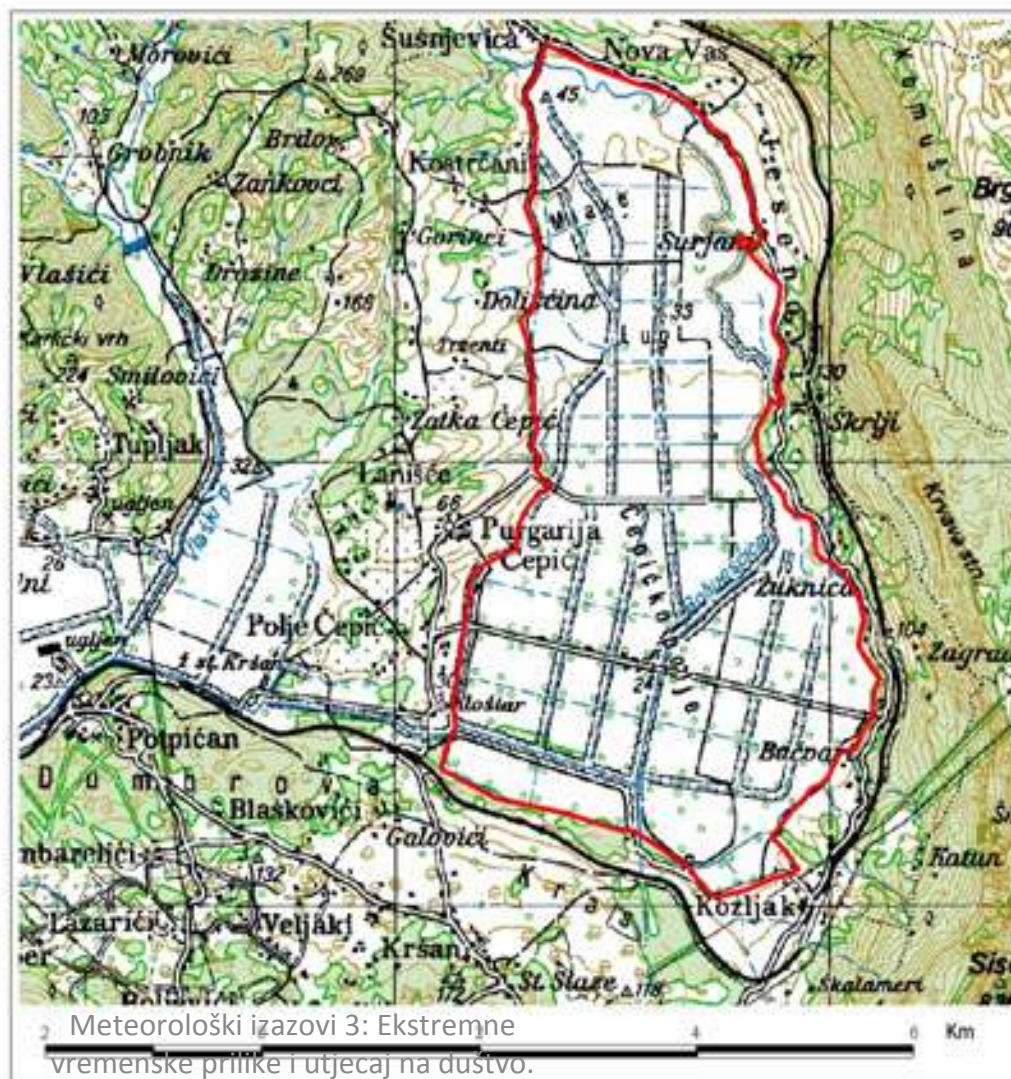
Aim of research

To define causes of wind erosion in Čepić field



Materials and methods

Geographical location of Čepić field



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CONSORZIO DI BONIFICA

DEL

SISTEMA DELL'ARSA

RELAZIONE

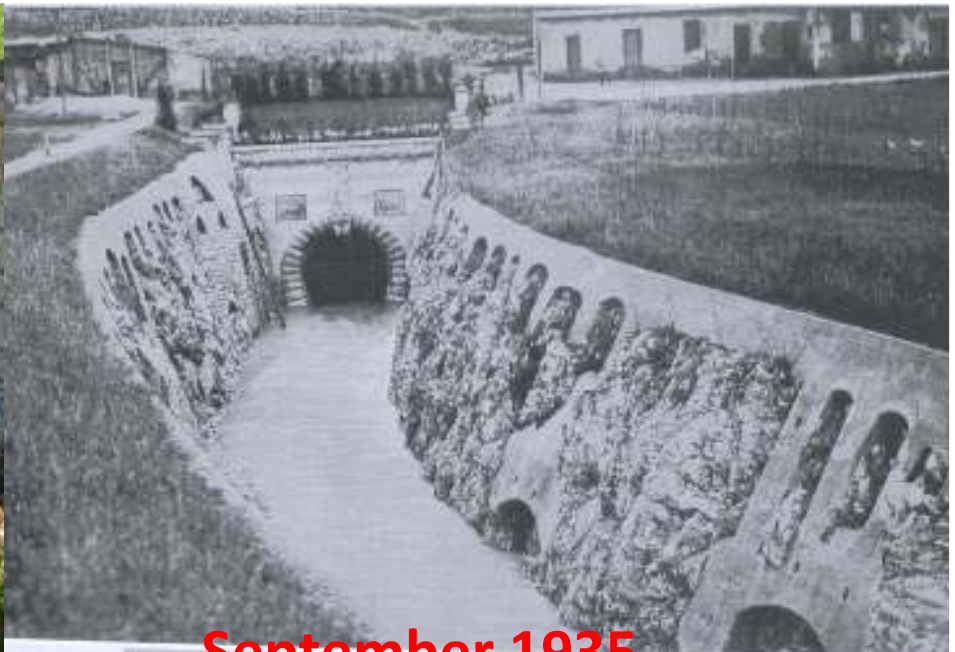


ALBONA D' ISTRIA - OTTOBRE 1934-XIII





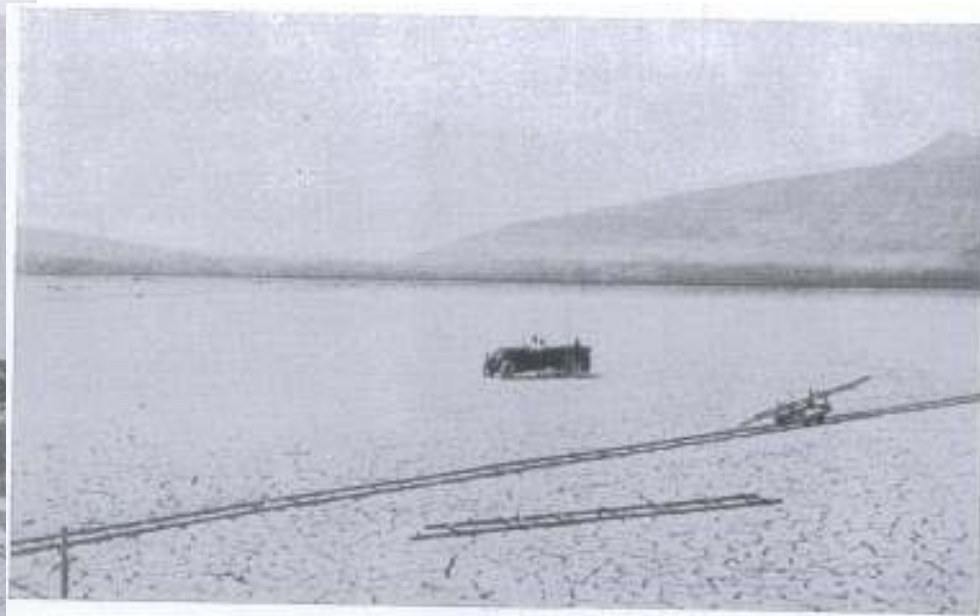
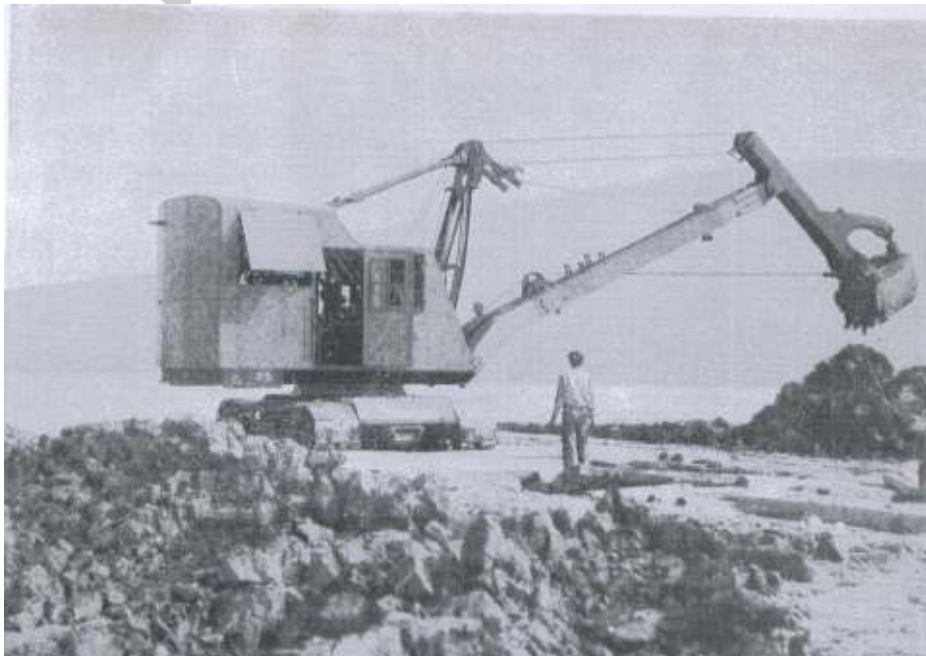
May 2012



September 1935



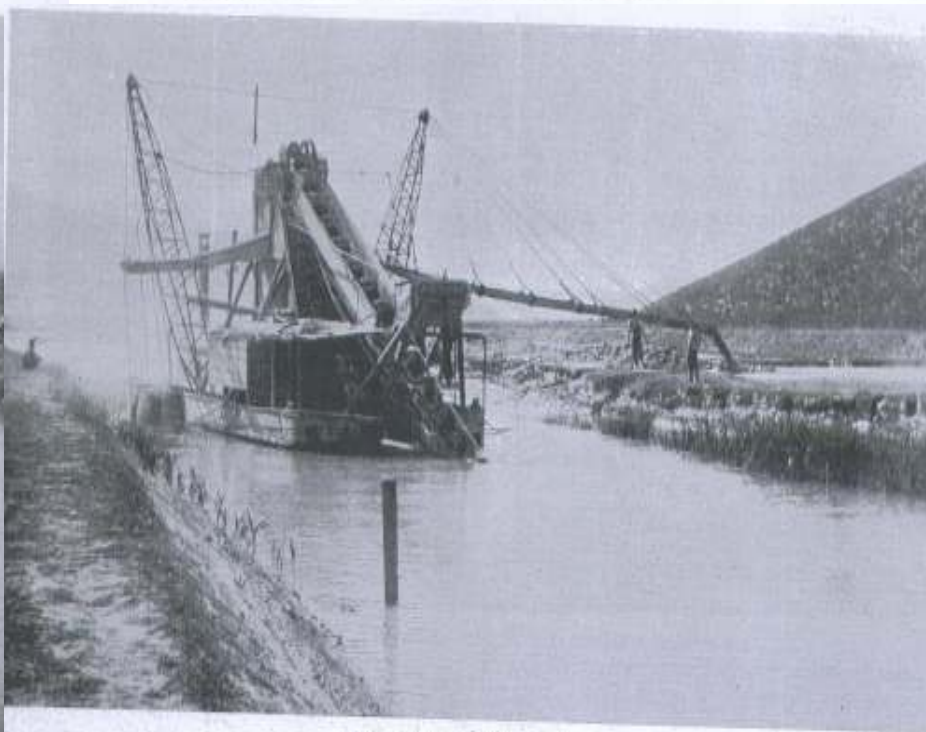
Portale d'imboccatura della galleria prima dello scarico



Il fondo dell'ex lago otto mesi dopo lo scarico



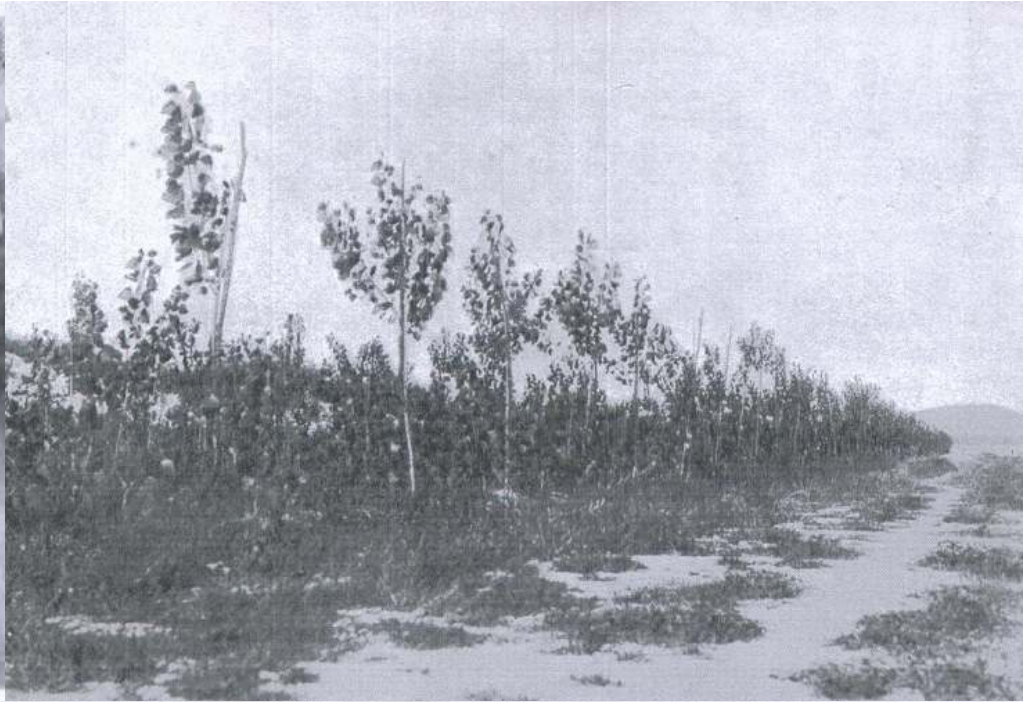
Arginatura della foce del fiume Arsa



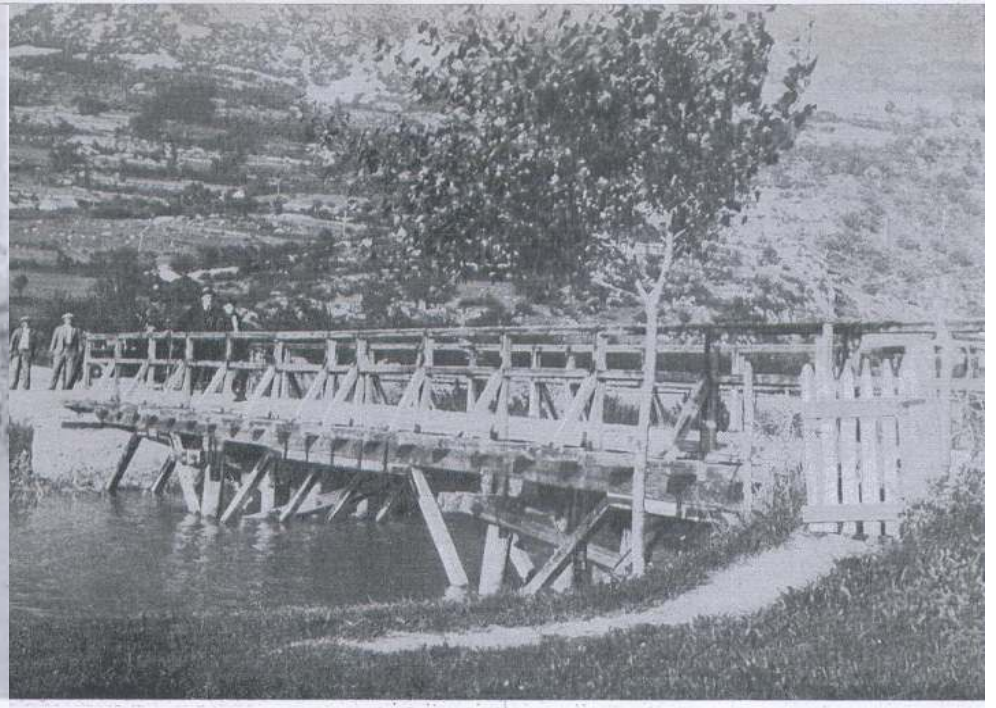
Draga alla foce del fiume Arsa



Il canalone dopo il salto



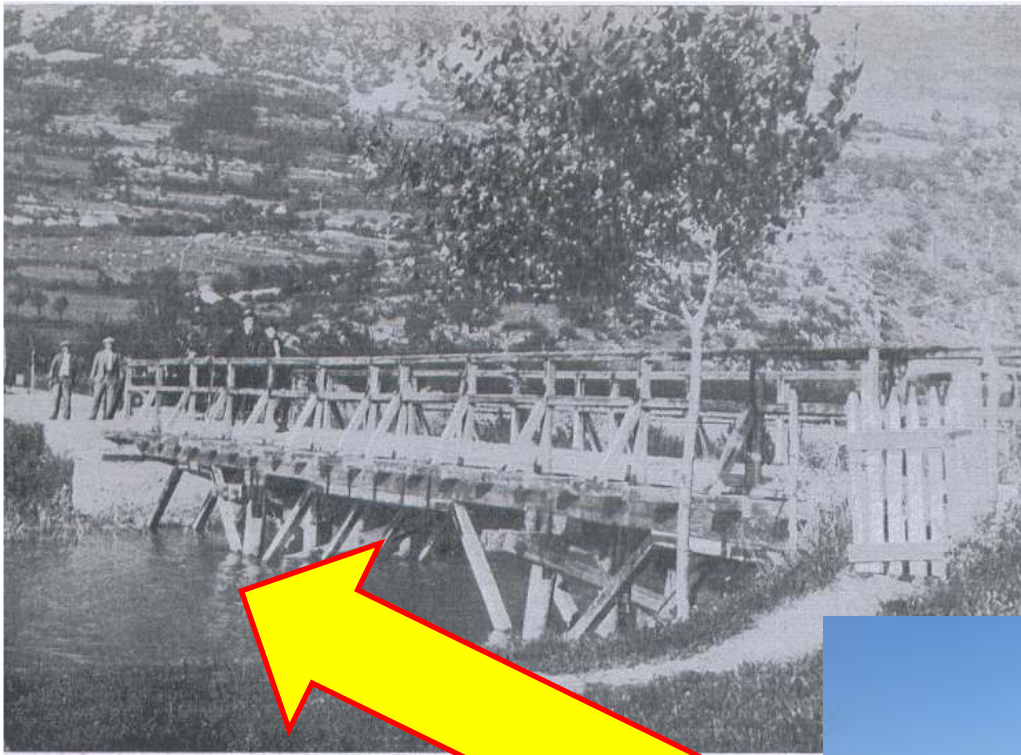
Canale di volo



Ponte sul canalone vicino la foce

First cause of wind erosion

Year 1934



Ponte sul canale

Year 2012



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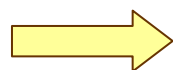


Second cause of wind erosion – meteorological conditions

PRECIPITATION

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	god
R 2011	20.4	58.7	122.9	42.8	103.8	69.5	66.0	1.7	42.5	72.3	35.3	37.8	673.7
R 2012	21.7										<i>dry</i>	<i>dry</i>	

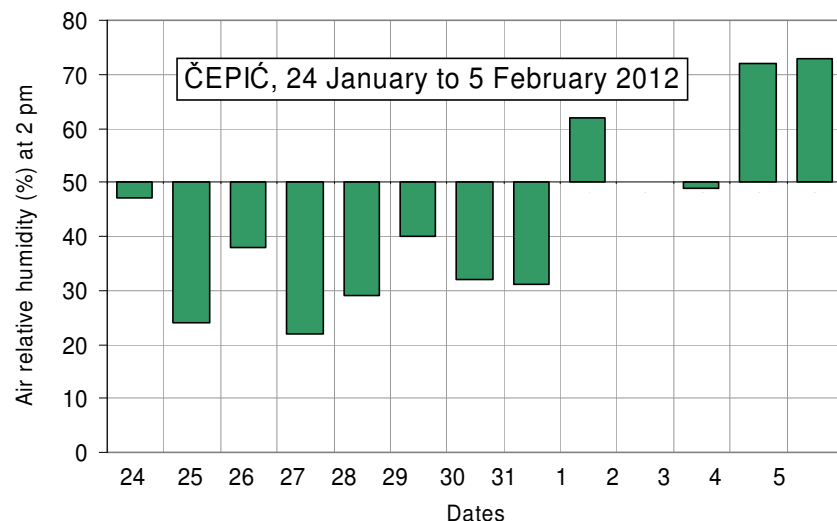
dry



three-month dry period

2011 extremely dry year

RELATIVE HUMIDITY



In the eight-day period that preceded soil erosion by wind, relative humidity at noon was lower than 50%

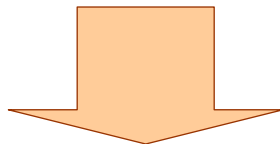
Source: Kisić, I., Husnjak, S., Gajić-Čapka, M., Cindrić, K., Bilandžija, D., Prekalj, B., 2013: Erozijska tla vjetrom u Čepić polju – uzroci, posljedice i mjere ublažavanja. Hrvatske vode 21(83), 291-304.



Second cause of wind erosion – meteorological conditions

Standardized precipitation index SPI

- Accumulated six-month amount of precipitation in the period August 2011 to January 2012 (SPI6) was **the lowest in the last 31 years**
- Also, the period from March 2011 to February 2012 (SPI12) also was **extremely dry** in relation to multi – year average



Such deficit in precipitation amounts during the longer period can cause soil water deficit

Source: Kisić, I., Husnjak, S., Gajić-Čapka, M., Cindrić, K., Bilandžija, D., Prekalj, B., 2013:
Erozija tla vjetrom u Čepić polju – uzroci, posljedice i mjere ublažavanja.
vremenske prilike i utjecaj na duštvo. *Hrvatske vode* 21(83), 291-304.
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Second cause of wind erosion – meteorological conditions

AIR TEMPERATURE

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	god
Air temperature at 2 m height													
t _{average} 2011	4.5	4.9	8.3	13.4	17.2	21.3	22.2	23.1	20.0	12.6	7.9	5.7	13.4
t _{average} 2012	1.8												
Minimum air temperatures at 5 cm height													
t _{min 5cm} (1961-1990)	-20.1	-16.0	-14.8	-10.0	-4.1	0.2	1.5	-1.4	-2.0	-9.1	-13.9	-19.5	-20.1
t _{min 5cm} 2011	-14.8	-16.4	-16.3	-6.5	-5.5	6.8	3.6	5.5	3.6	-9.5	-11.2	-15.2	-16.4
t _{min 5cm} 2012	-18.5												
n tmin 5cm<0°C (days)	21.6	20.8	16.9	7.9	0.5	0.0	0.0	0.0	0.3	3.8	11.5	19.4	102.7
n tmin 5cm<0°C 2011	25	21	21	18	5	0	0	0	0	10	21	20	141
n tmin 5cm<0°C 2012	27												

n number of days

Precipitation categories	Limits of percentiles	Temperature categories
extremely dry	<2.0	extremely cold
very dry	2.0-8.9	very cold
dry	9.0-24.9	cold
normal	25.0-75.0	Normal
rainy	75.1-91.0	warm
very rainy	91.1-98.0	very warm
extremely rainy	>98.0	warm

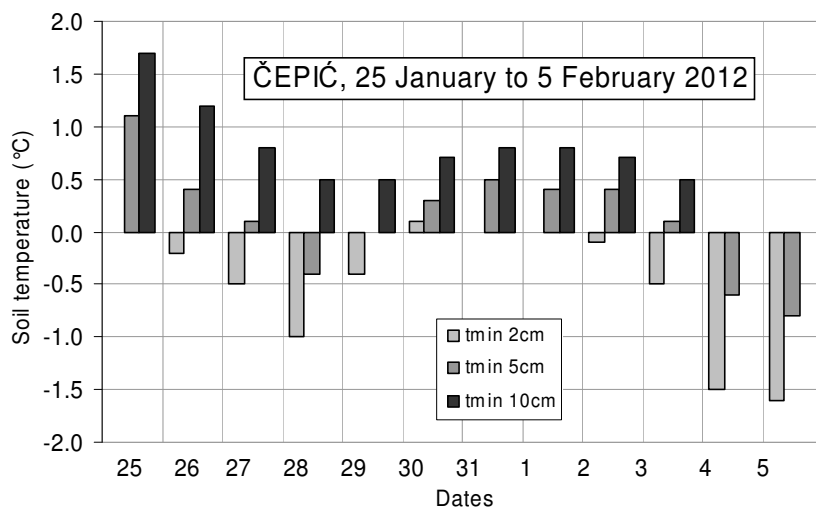
Source: Kisić, I., Husnjak, S., Gajić-Čapka, M., Cindrić, K., Bilandžija, D., Prekalj, B., 2013:

Erozija tla vjetroṃ u Čepić polju – uzroci, posljedice i mjere ublažavanja.
 vremenske prilike i utjecaj na duštvo. *Hrvatske vode* 21(83), 291-304.
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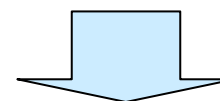
Second cause of wind erosion – meteorological conditions

SOIL TEMPERATURE



Soil temperature at different depths measured in the period from 25 January to 5 February 2012

Soil temperature at 2 cm and at 5 cm depth were mainly *negative* from middle January to the end of the second decade in February



frozen soil surface



Source: Kisić, I., Husnjak, S., Gajić-Čapka, M., Cindrić, K., Bilandžija, D., Prekalj, B., 2013: *Erozija tla vjetrom u Čepić polju – uzroci, posljedice i mjere ublažavanja. vremenske prilike i utjecaj na duštvo. Hrvatske vode 21(83), 291-304. Zagreb, 21-22.11.2013.*



Second cause of wind erosion – meteorological conditions

Wind – the direct cause of soil erosion in the Čepić field

From the climatological daily

dates	7 sati	14 sati	21 sat	Duration of phenomenon	kratice
1.2.2012.	NNE	ENE	ENE		
Beaufort (Bf)	4	5	6	kv-nn windy	rj - early morning
2.2.2012.	ENE	ENE	ENE		kv - late evening
Beaufort (Bf)	6	6	6	rj-kv strong wind	n - night
3.2.2012.	ENE	ENE	ENE		
Beaufort (Bf)	6	6	6	rj-kv strong wind	4 Bf - moderate wind
4.2.2012.	ENE	ENE	ENE		5 Bf- moderately strong wind
Beaufort (Bf)	6	5	6	rj-10.30 strong wind	6 Bf - strong wind (gale)



Continuous four-day period with strong wind is exceptional occurrence in January and in other winter months, but they can be expected in the area of Čepić field

Source: Kisić, I., Husnjak, S., Gajić-Čapka, M., Cindrić, K., Bilandžija, D., Prekalj, B., 2013:
Erozija tla vjetrom u Čepić polju – uzroci, posljedice i mjere ublažavanja.
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Meteorološki izazovi 3. Ekstremne vremenske prilike i utjecaj na duševno
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Third cause of
wind erosion



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Third cause of
wind erosion

Fourth cause of wind erosion



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Conclusions:

- **More and more extreme meteorological situations**

(in Zagreb last week, on Sardinia - Cleopatra before two days, 450 mm of precipitation fall in 12 hours)

- **Urgent restoration of wind breaks**

Selection of windbreaks types: poplar, cypress or something else

- **Different tillage management, reduced annual number of tillage operations, more vegetation on soil surface**

- **Different types of crops**

- **Education of farmers on different tillage management**

- **Joint cooperation of different professions**