Double Desalinization Approach (DDA) as Integrated Solution for Salt-Affected Soil Management in Water Shortage Region

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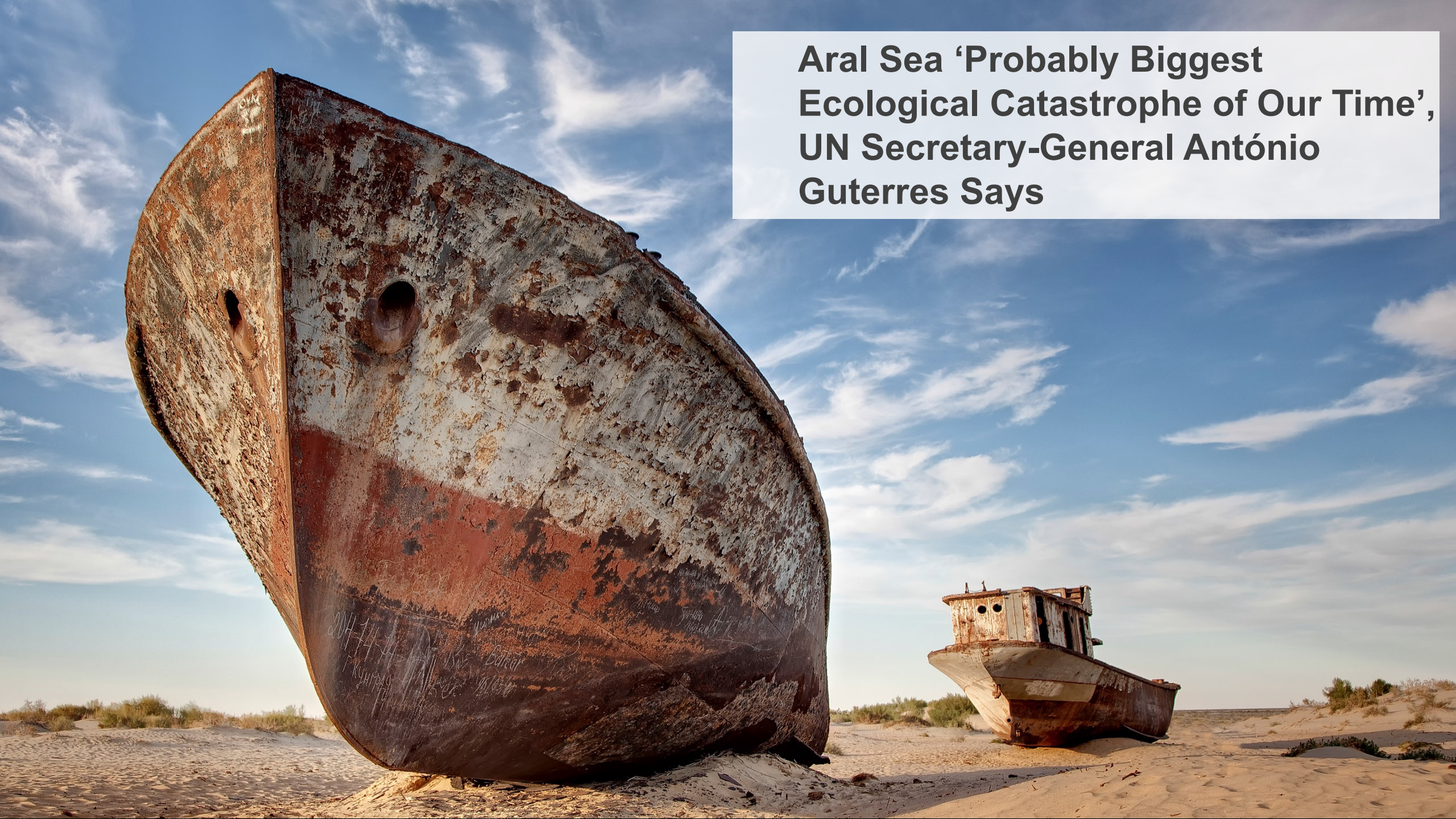
依法以智，保持水土，山川秀美，资今裕后

Conservation and Development



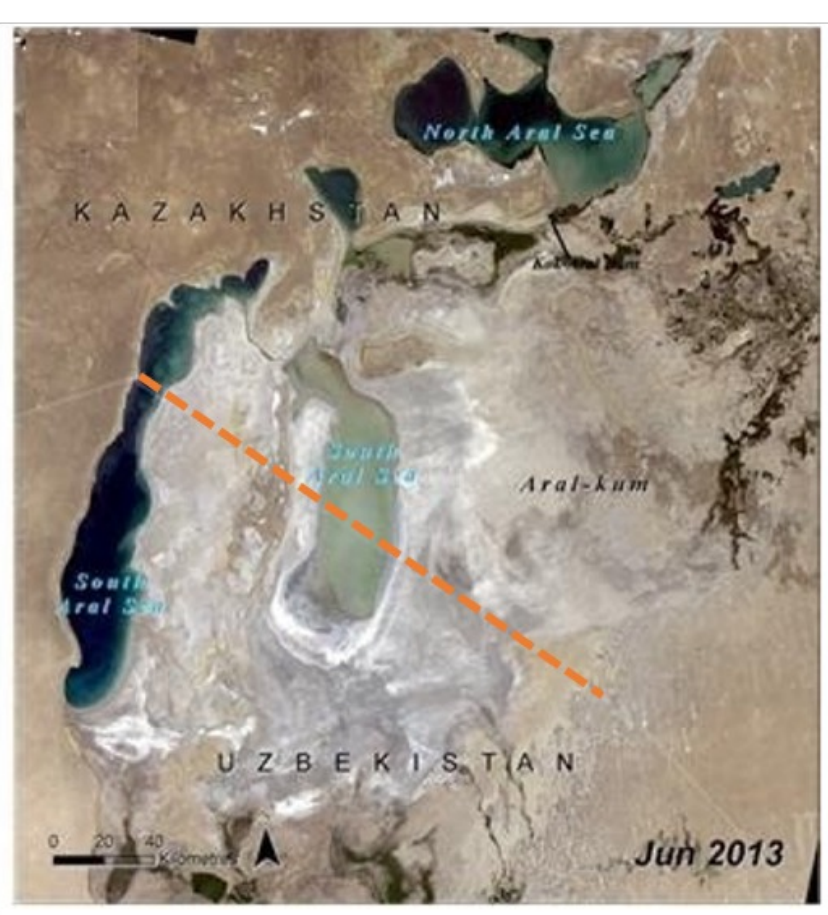
Aral Sea ‘Probably Biggest Ecological Catastrophe of Our Time’, UN Secretary-General António Guterres Says

Shrinkage of area: 85%

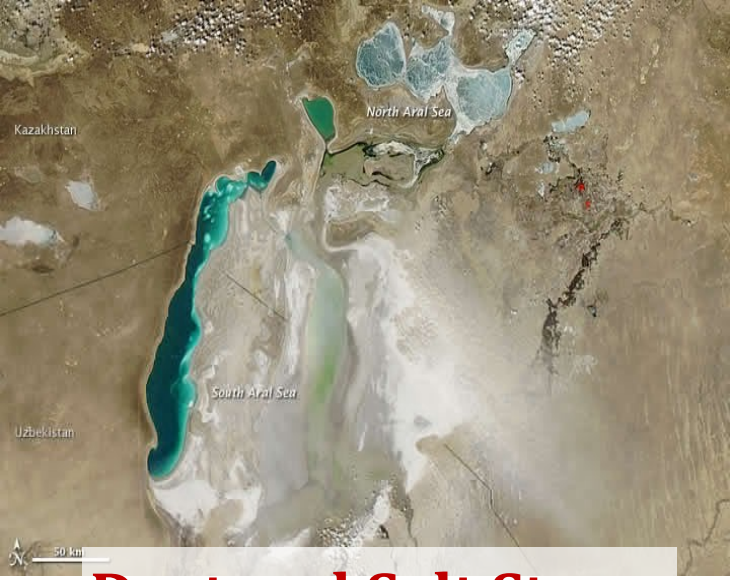
68 thousand km^2 → 1.0 thousand km^2

Decline of water > 95%

1064 km^3 → 30 km^3



Beginning about 1960, the Aral Sea's water level was systematically and drastically reduced, because of the diversion of water from the Amu Darya and Syr Darya rivers for purposes of agricultural irrigation.



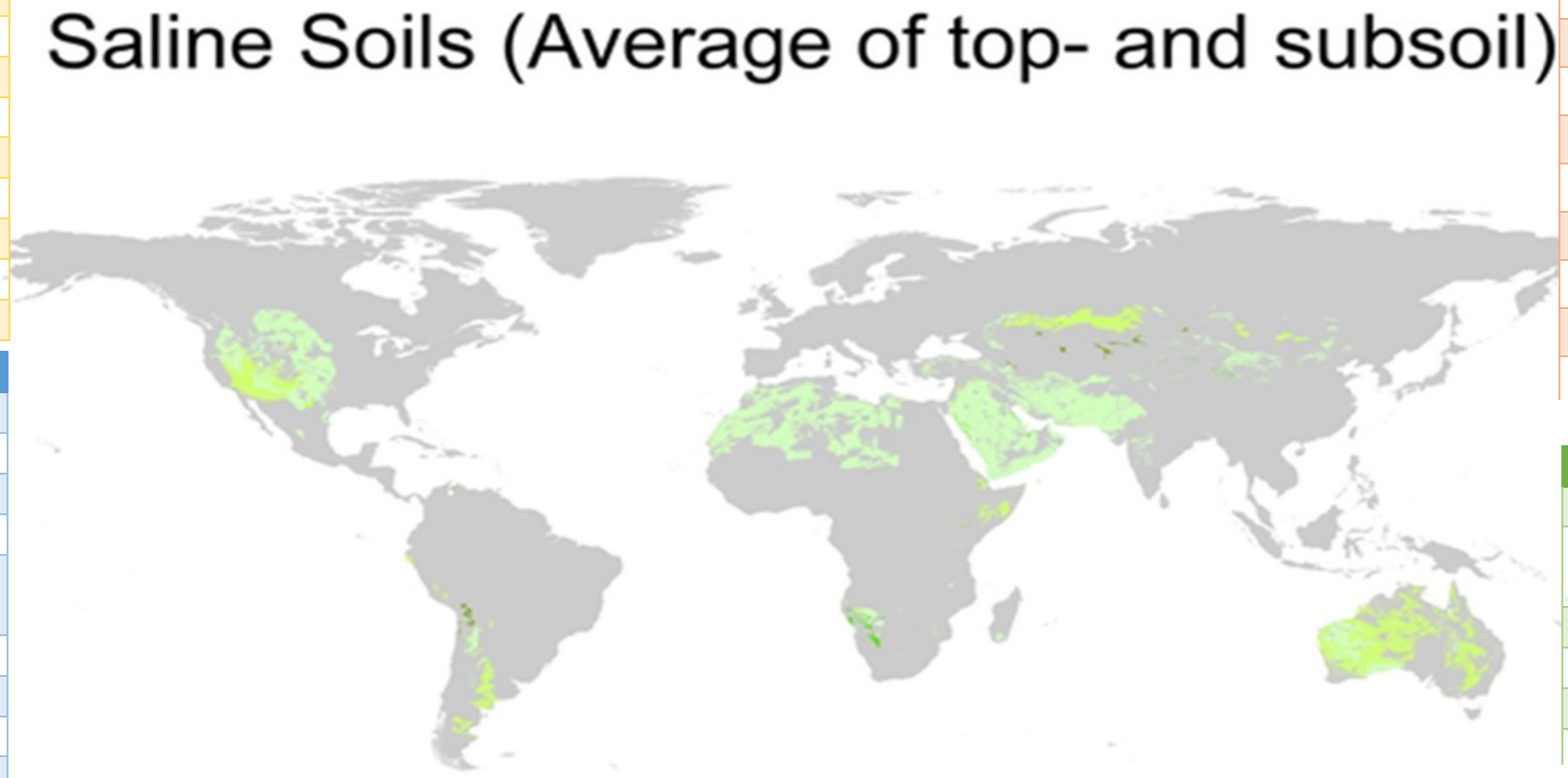
- 8000 ton salts or more/km^2， drying-up lake
- 400 -150 million tons /year
- Come with water and disperse with wind
- All around areas suffering：cropland salinization of Turkmenistan

Dust and Salt Storm

Global saline soils

Country	Total Area
Chile	8,642
USA	8,517
Chad	8,267
Egypt	7,360
Canada	7,238
Iraq	6,726
Nigeria	6,502
Saudi Arabia	6,002
Bolivia	5,949
Botswana	5,679
Somalia	5,602

Country	Total Area
Sudan	4,874
Kenya	4,858
Brazil	4,503
Mongolia	4,070
United Rep. of Tanzania	3,537
Algeria	3,150
Afghanistan	3,101
Malaysia	3,040
Bangladesh	3,017



Country	Total Area
Australia	357,240
USSR	170,720
Argentina	85,612
China	36,658
Iran	27,085
India	23,796
Paraguay	21,902
Indonesia	13,213
Ethiopia	11,033
Pakistan	10,456

Country	Total Area
Mali	2,770
Libyan Arab Jamahiriya	2,457
Namibia	2,313
Afars and Issas	1,741
Mexico	1,649
Sarawak	1,538

Legend

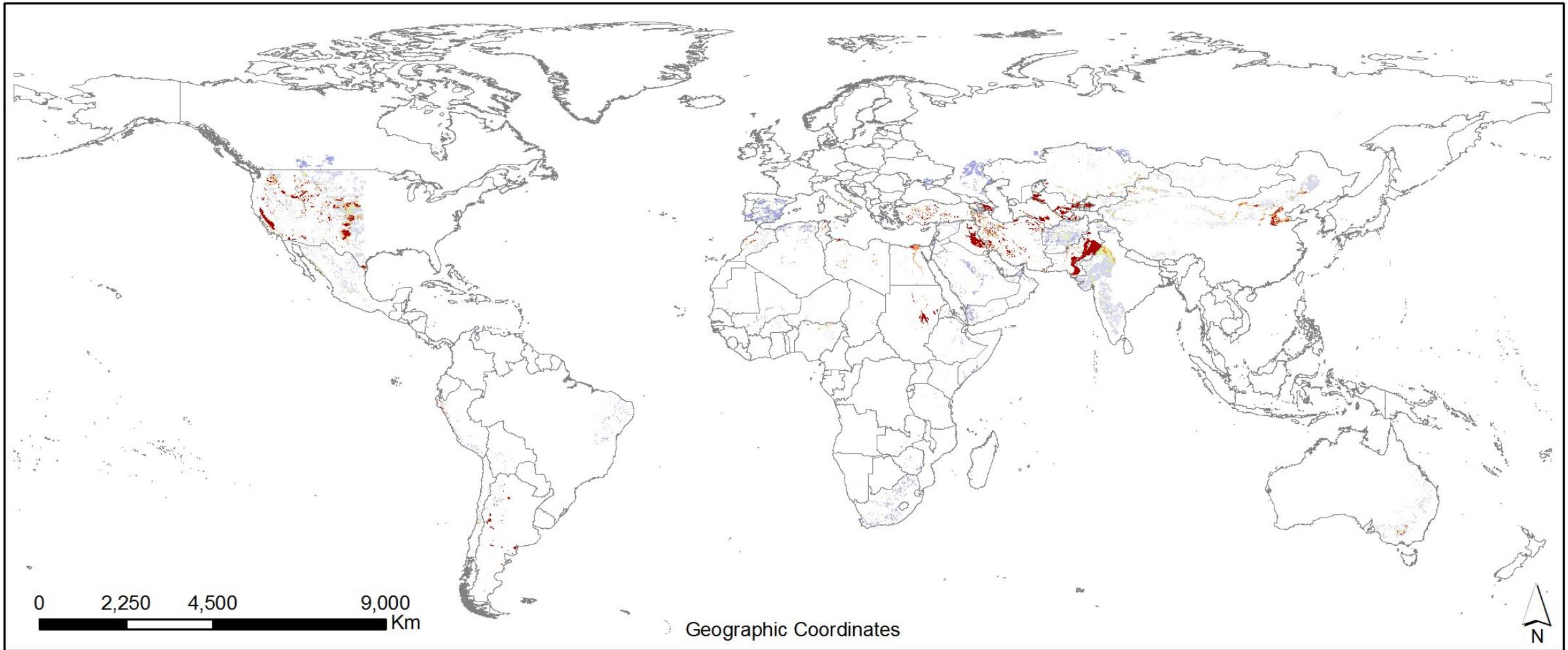
Saline soils by severity

- Slight
- Moderate
- High
- Extreme
- Very extreme

Note: This map indicates the location of saline soils worldwide but does not properly present their areal extent. This is because each mapping unit consists of up to nine soil units and, while not all of these may be affected, the map depicts the whole mapping unit to be salt-affected.

Source of Data: FAO/IIASA/ISRIC/ISSCAS/JRC, 2008. Harmonized World Soil Database (version 1.0). FAO, Rome, Italy and IIASA, Laxenburg, Austria.

March 2009, BIOSAFOR Consortium

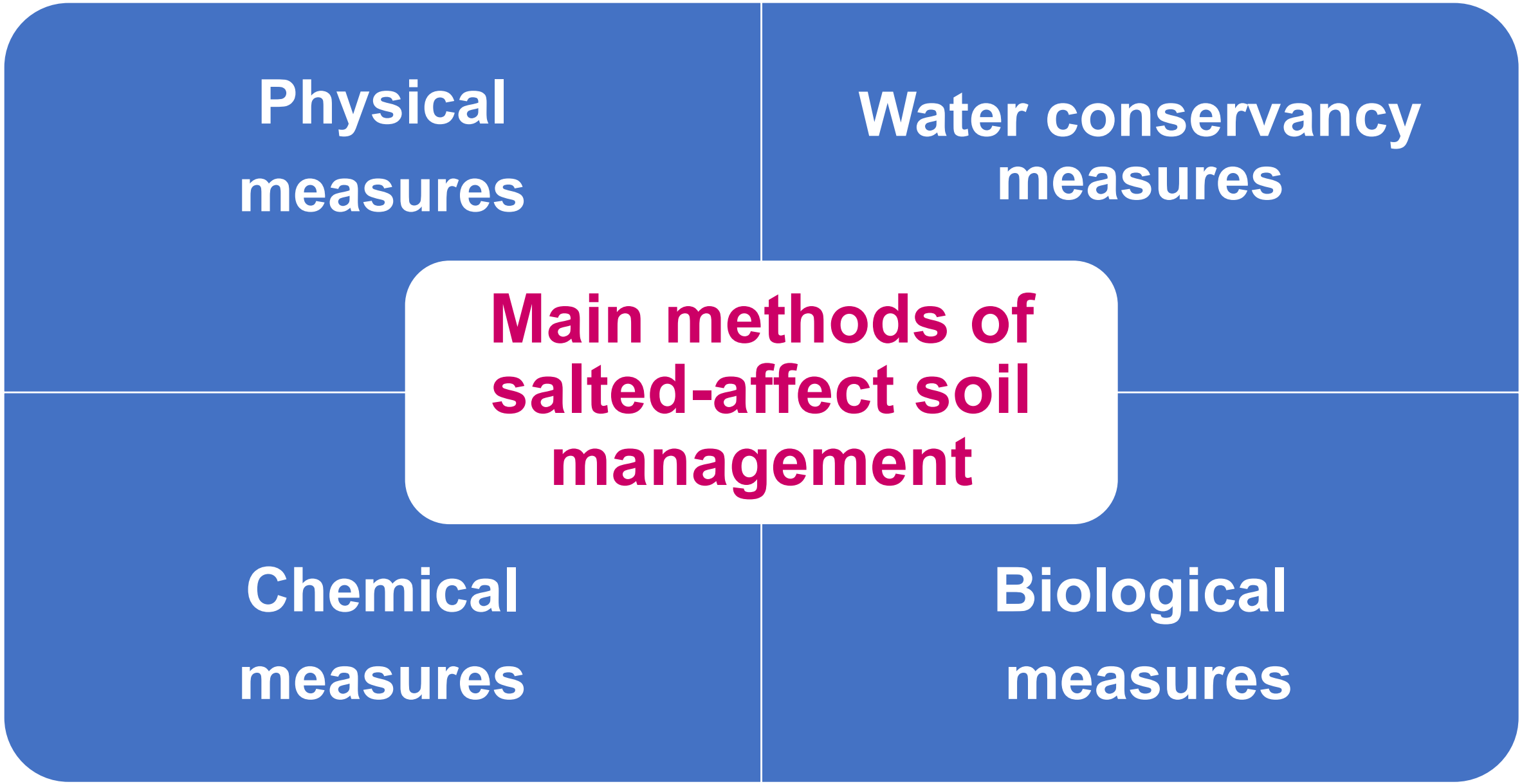


Irrigation Salinity Risk

5 - 5.01 | 5.01 - 6 | 6 - 7 | 7 - 8 | 8 - 29

LADA

Source: F. O. Nachtergaele, M. Petri, R. Biancalani, G. van Lynden , H. van Velthuizen, 2010. Global Land Degradation Information System (GLADIS) version 0.5. An Information database for Land Degradation Assessment at Global Level.


Physical measures
Water conservancy measures
Main methods of salted-affect soil management
Chemical measures
Biological measures

Example in Bayannur

- Irrigation area 1.4 million ha, and 5.2 billion m^3 annually, 1/7 of the runoff of the Yellow River
- 0.7 million ha cropland, and 44% are salt-affected land

Integrated method

- Organic fertilizer application
- Sand-mixture to improve soil permeability
- Application of desulfurized gypsum and modifier to alkali
- Straw mixture to reduce water movement
- Hidden tubes for salt drainage

Shortcomings and problems

Economic costs: Annual input; Short-term benefit

Water resources cost

Ecological impacts: local ecosystem, quality of downstream, aquatic life; Lake eutrophication and salinity

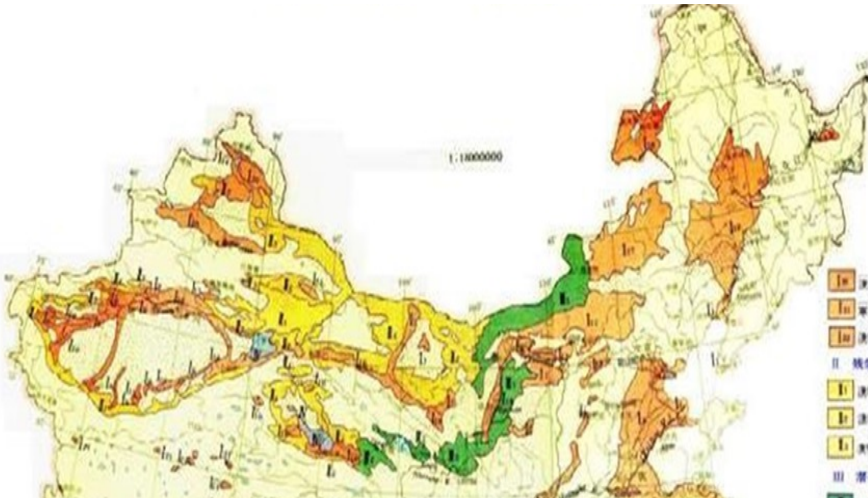
Options in different conditions

- Seasonal irrigation on-site: salt in the soil will cost a great amount of water every year
- Drainage of polluted water: damage the water body and system
- Water-shortage area: hopeless

Best way:

- Considering the impacts of salts in soil and the wetland
- Abstract soil from soil

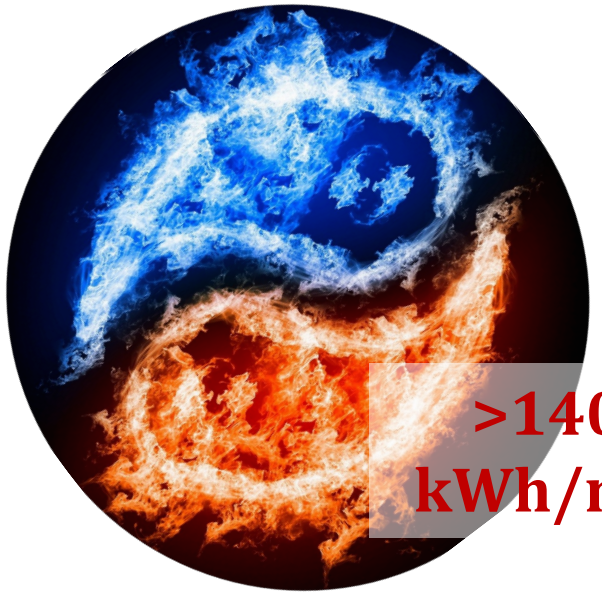
China



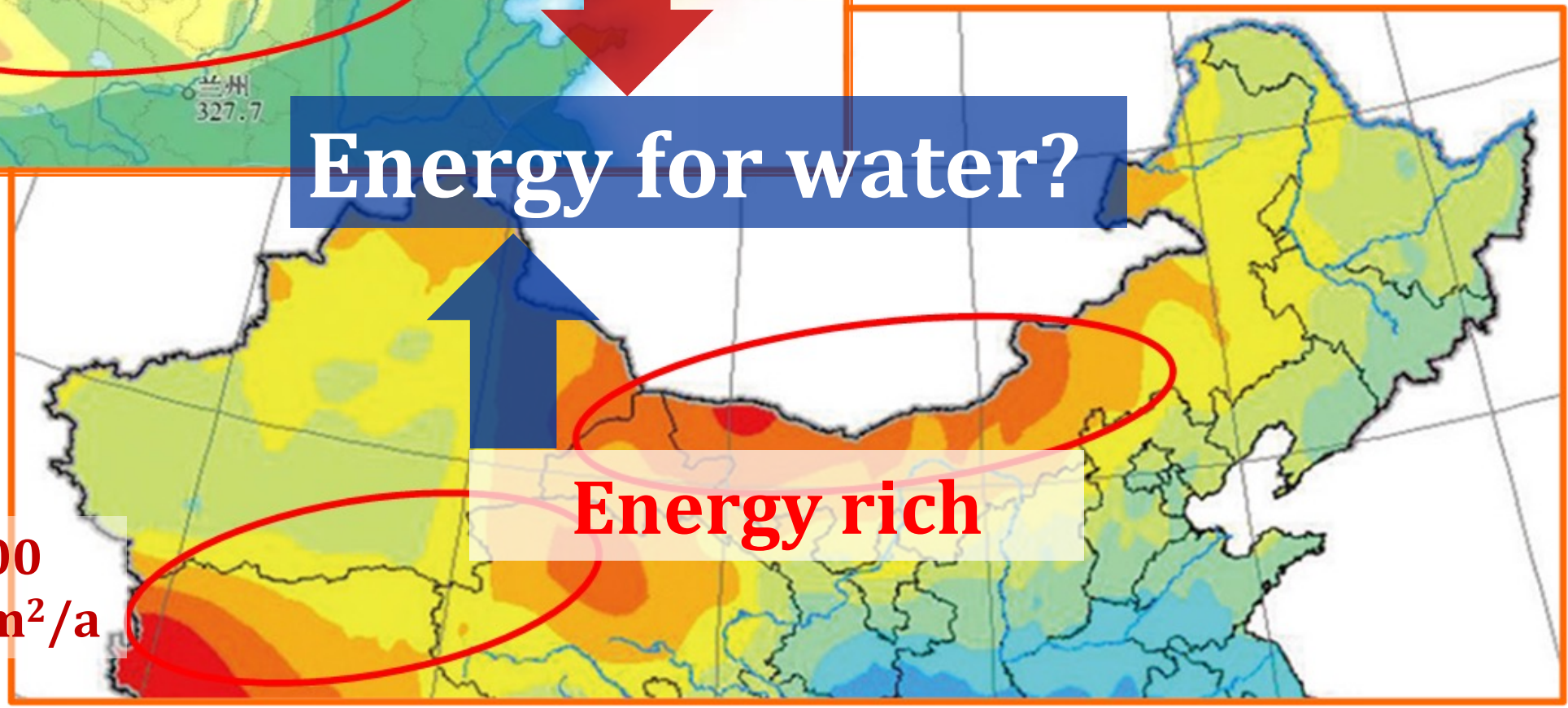
Water scarcity

<300 mm/a

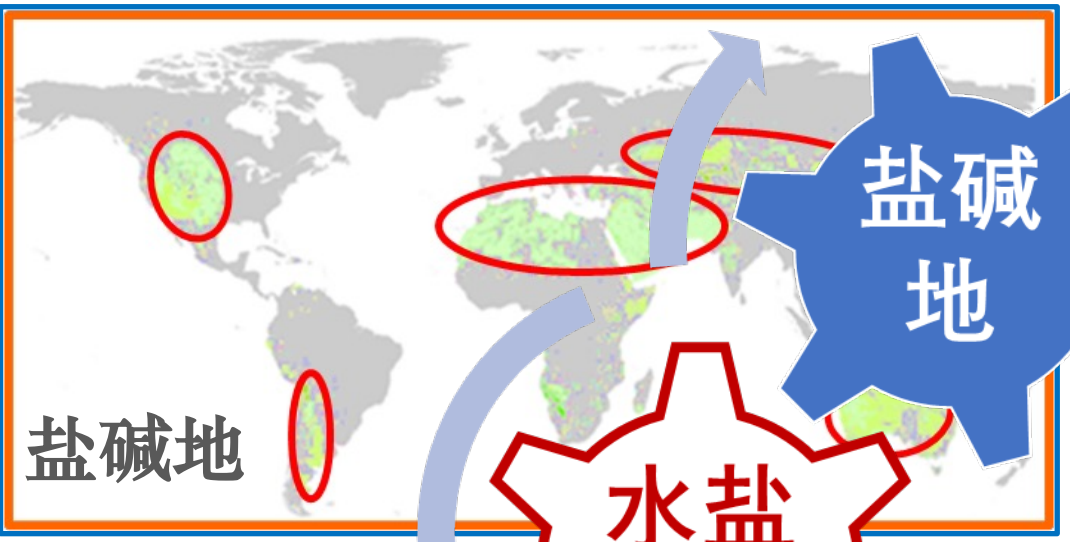
Energy for water?

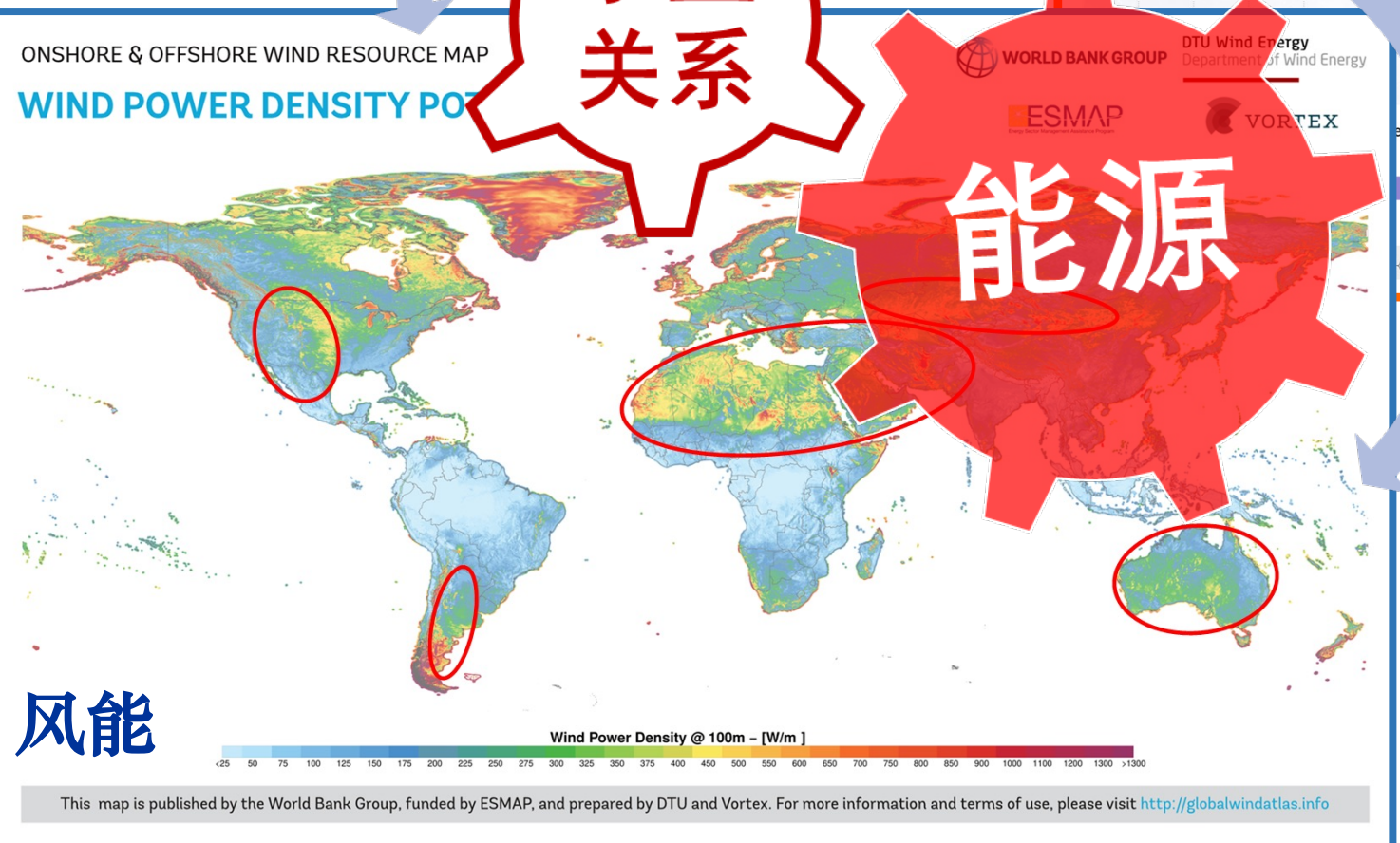


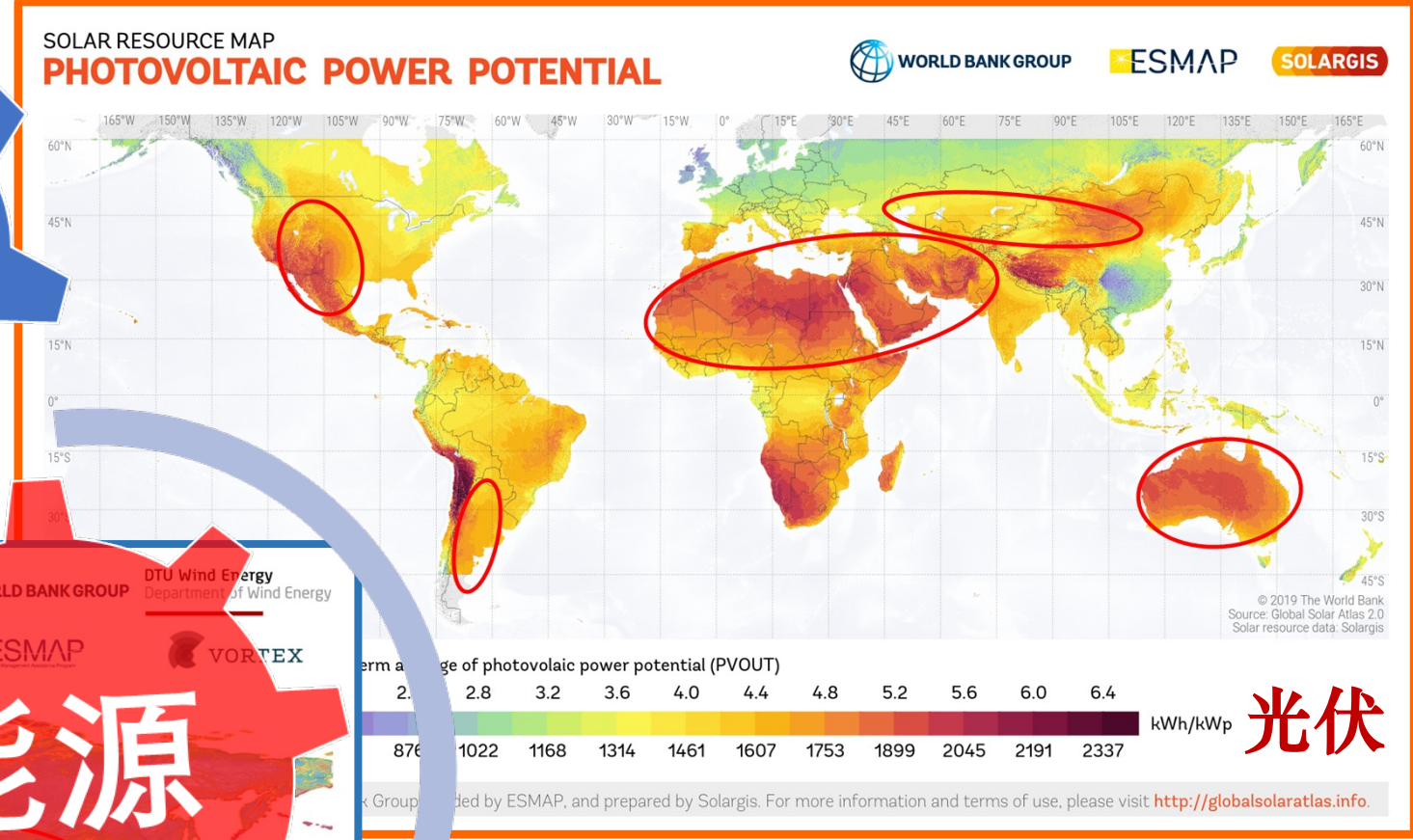
>1400 kWh/m²/a



Energy rich







水盐关系

能源

风能

光伏

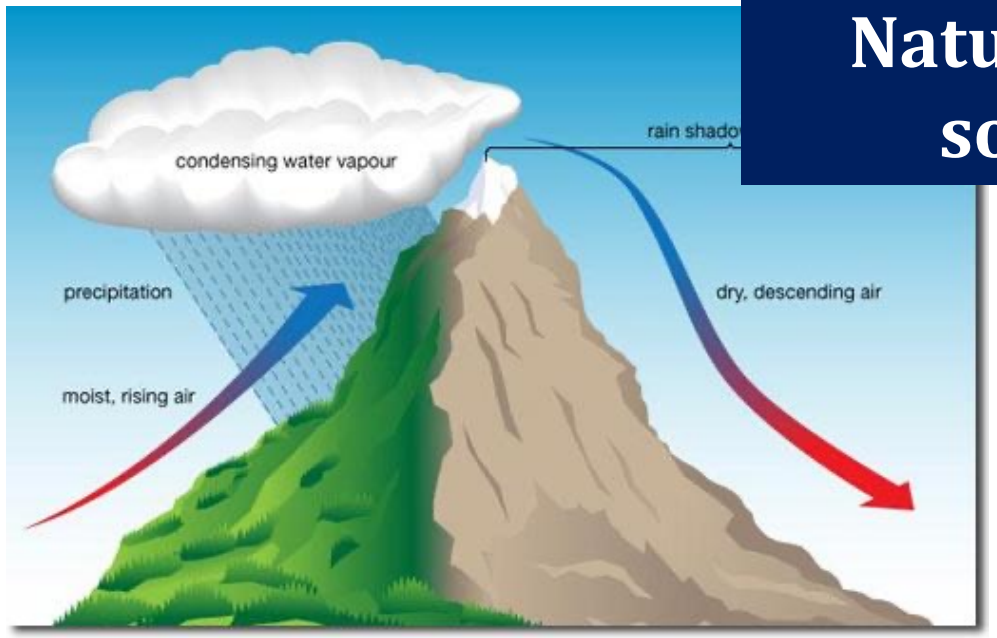
Salt and food：

Water shortage

Clean energy

Value of landform

Nature-based solution



Condensation in tubes

Dry air

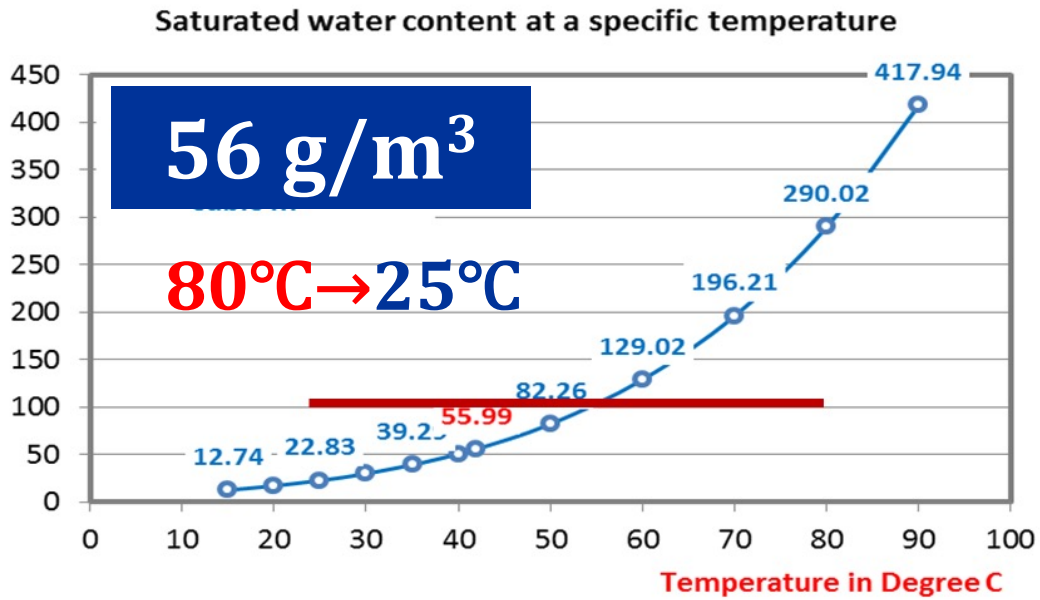
Clean water

Hot vapor

Solar energy

High concentration saline-alkali drainage

Heating with Unstable or excess electric energy



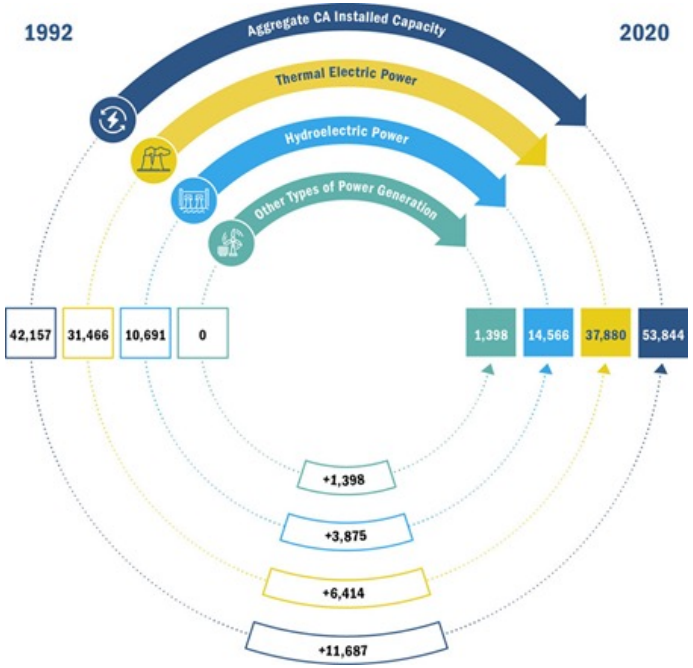
ELSEVIER

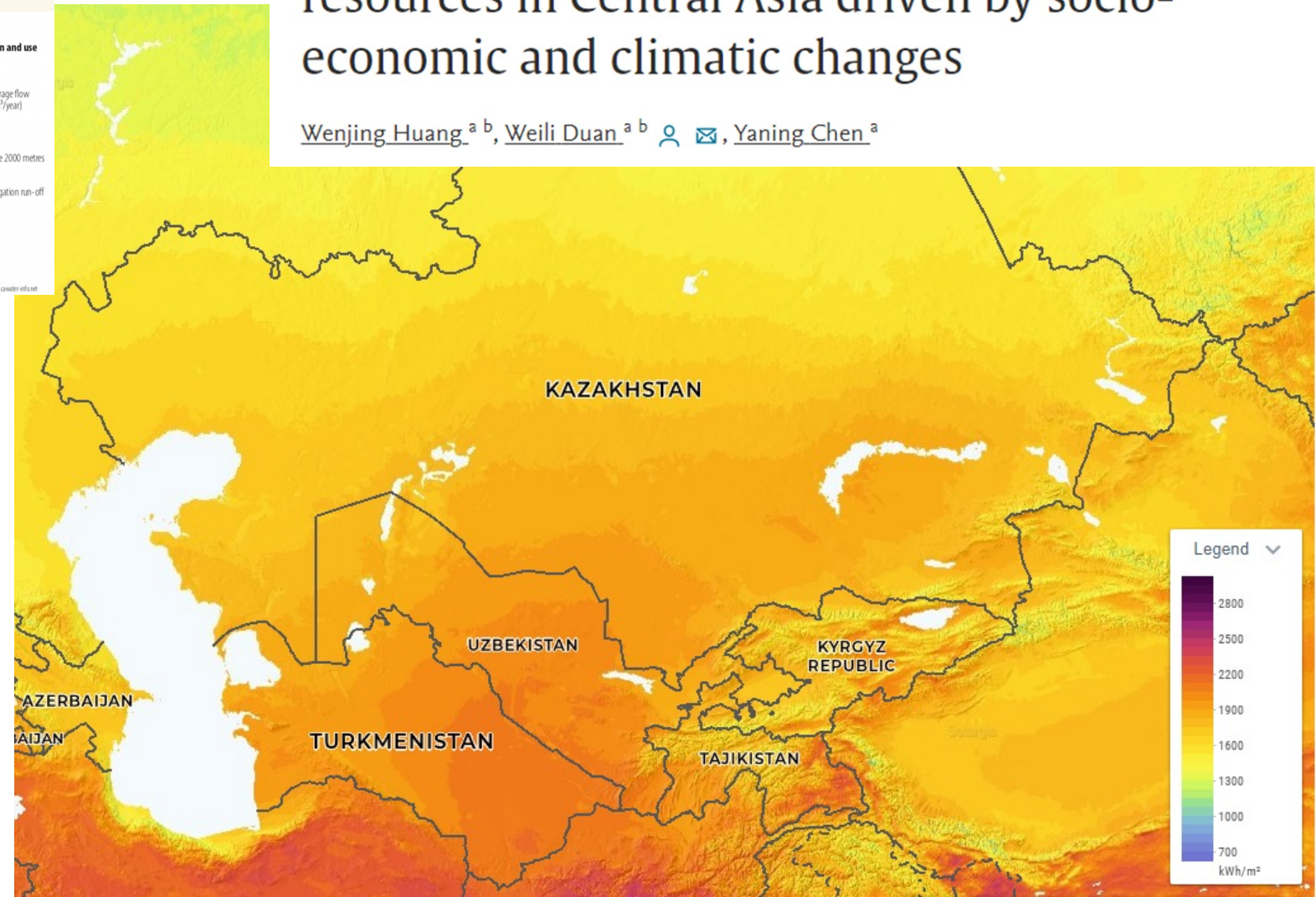
Science of The Total Environment

Volume 784, 25 August 2021, 147193

Rapidly declining surface and terrestrial water resources in Central Asia driven by socio-economic and climatic changes

Wenjing Huang [a b], Weili Duan [a b], Yaning Chen [a]

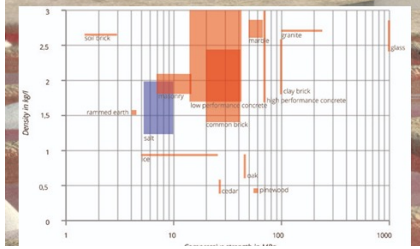




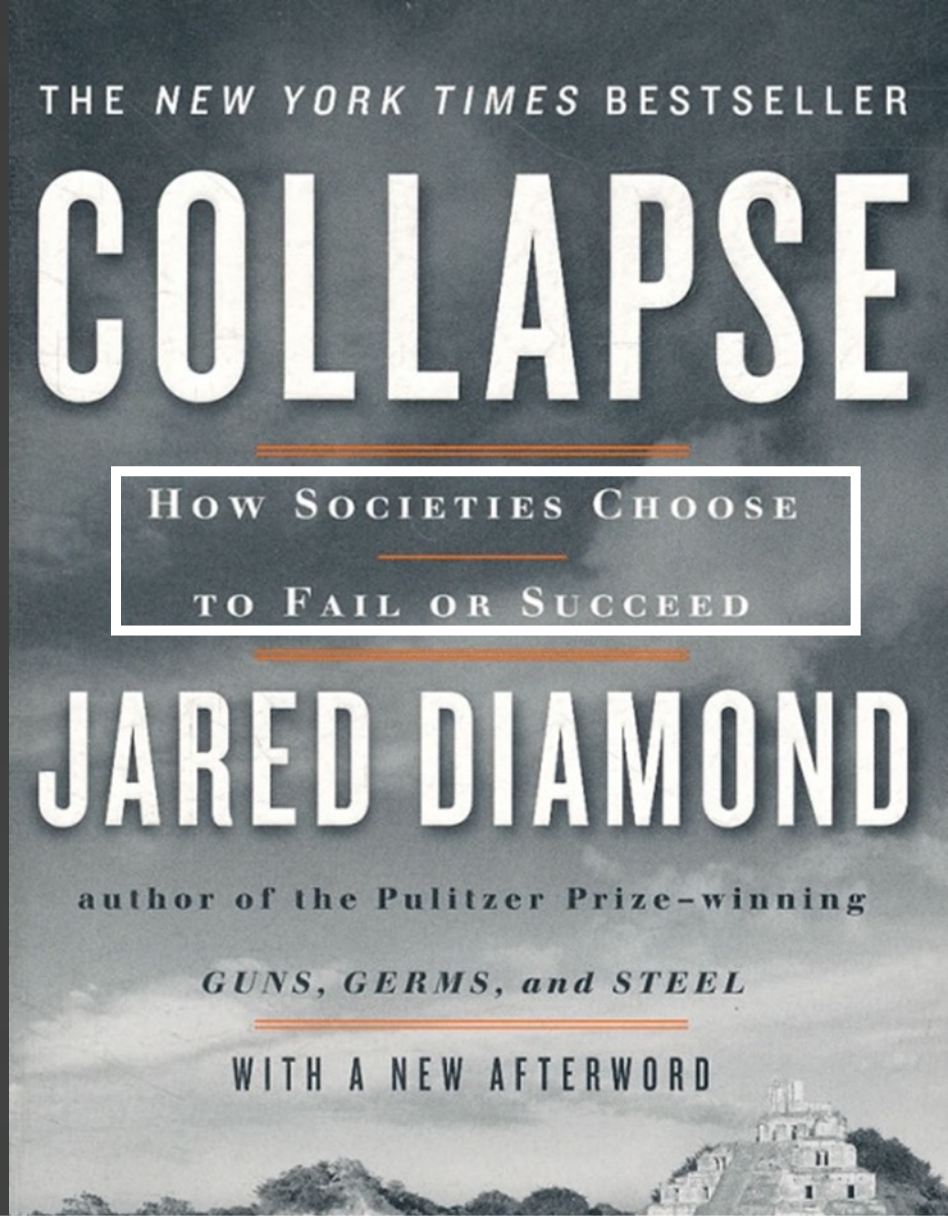
Usage of salts

用盐做建筑

The TU Delft faculty of Civil Engineering



http://www.notechmagazine.com/wpcontent/uploads/2016/02/building-with-salt.jpg



Collapse: How Societies Choose to Fail or Success

Je Maintiendrai! (我将一如既往)

荷兰填海：land and mind

WHAT IS OUR CHOICE ?

Thank you for you attention!

Welcome you for further discussion, cooperation and visiting our university.

Fei Wang （王飞）

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