Digital Diagnostic Atlas:

MURGAB RIVER BASIN

Zafar Gafurov and Sarvarbek Eltazarov

IWMI International Water Management Institute

Program: Transboundary water management in Central Asia

german cooperation DEUTSCHE ZUSAMMENARBEIT

Implemented by: giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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As a provider of international cooperation services for sustainable development and international education work, we are dedicated to building a future worth living around the world. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) has over 50 years of experience in a wide variety of areas, including economic development and employment, energy and the environment, and peace and security. The diverse expertise of our federal enterprise is in demand around the globe, with the German Government, European Union institutions, the United Nations, the private sector and governments of other countries all benefiting from our services. We work with businesses, civil society actors and research institutions, fostering successful interaction between development policy and other policy fields and areas of activity. The German Federal Ministry for Economic Cooperation and Development (BMZ) is our main commissioning party.

About IWMI

The International Water Management Institute (IWMI) is a non-profit, scientific research organization focusing on the sustainable use of water and land resources in developing countries. IWMI works in partnership with governments, civil society and the private sector to develop scalable agricultural water management solutions that have a real impact on poverty reduction, food security and ecosystem health. Headquartered in Colombo, Sri Lanka, with regional offices across Asia and Africa, IWMI is a CGIAR Research Center and leads the CGIAR Research Program on Water, Land and Ecosystems (WLE).

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International Water Management Institute (IWMI)

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/ river basins / digital technology / maps / simulation models / satellite imagery / climate change / irrigation / soils / vegetation / Central Asia /

Please send inquiries and comments to IWMI-Publications@cgiar.org

Acknowledgments

The Digital Diagnostic Atlas of Murgab River Basin is based on data and information obtained from published and grey literature as well as spatial analyses carried out using publicly available sources. The authors would like to thank Salman Siddiqui and Bekzod Akramov for their input and feedback to content of the atlas. Additionally, the authors would like to acknowledge Oyture Anarbekov, Kakhramon Djumaboev and Shovkat Khodjaev for their useful comments.

Project

giz
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Zusammenarbeit (GIZ) GmbH

The geodatabase and digital diagnostic atlas were generated within the framework of the "Transboundary Water Management in Central Asia" project being implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in collaboration with the International Water Management Institute (IWMI) and the Ministry of Agriculture and Water Resources of Turkmenistan. Since 2009, the project has been supporting the five Central Asian states (Kazakhstan, Kyrgyzstan, Uzbekistan, Turkmenistan and Tajikistan) in strengthening regional water cooperation, application of Integrated Water Resources Management (IWRM), and river basin planning.

For further details about the project, visit:
https://www.giz.de/en/worldwide/15176.html

Donor

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Federal Foreign Office

Auswärtiges Amt (Federal Foreign Office), Germany

Contents

Introduction

"Transboundary Water Management in Central Asia" project, funded by the German Federal Foreign Office since 2009, supports the five Central Asian states in strengthening regional water cooperation, IWRM application and basin planning. An essential prerequisite for basin planning is sound data and information on actual water and land resources and their use within the basin. The primary goal of the program is to move forward a process of political rapprochement in Central Asia that leads to closer cooperation in the use of the scarce water resources and may result in joint water management in the long term. The program aims to foster regional institutional cooperation, especially among institutions that regulate matters of water distribution in Central Asia such as the Interstate Commission for Water Coordination (ICWC) and the International Fund for Saving the Aral Sea (IFAS), so that these institutions have stronger positions in the political system to make tangible impacts. Principles of river basin management are being introduced and applied in selected transboundary river basins in Central Asia to strengthen transboundary management practices. To this end, capacity of water management organizations is being improved both on institutional and individual levels.

A strong and permanent element of the project is data generation in water-related state aspects, with a view to specifically developing a geodatabase and digital diagnostic atlas using open source data.

Data Accuracy and Reliability

The Digital Diagnostic Atlas of Murgab River Basin was created using open source GIS, Remote Sensing and analogue information which was already published by world renowned organizations and used in public projects and scientific research certified by international agencies.

Availability and Accessibility

The Digital Diagnostic Atlas of Murgab River Basin can be obtained in digital form for use by external parties with the approval of the Ministry of Agriculture and Water Resources of Turkmenistan and GIZ.

Software Employed

This geodatabase and the associated maps were created on a computer machine running Windows 10 Professional and using QGIS 2.17, Google Earth Engine. End users should download the package that is most appropriate for the version of QGIS software that they are using. It is important to note that QGIS is not only required to make use of the map package and the associated geodatabase.

Data Sources

International Water Management Institute (IWMI)

National Aeronautics and Space Administration - Land Data Products and Services (NASA LP DAAC)

International Center for Agricultural Research in the Dry Areas (ICARDA)

Central Asian Countries Initiative for Land Management (CACILM)

European Space Agency (ESA)

World Climate Research Programme (WCRP), Coupled Model Intercomparison Project (CMIP)

Map Projection and Coordinate System

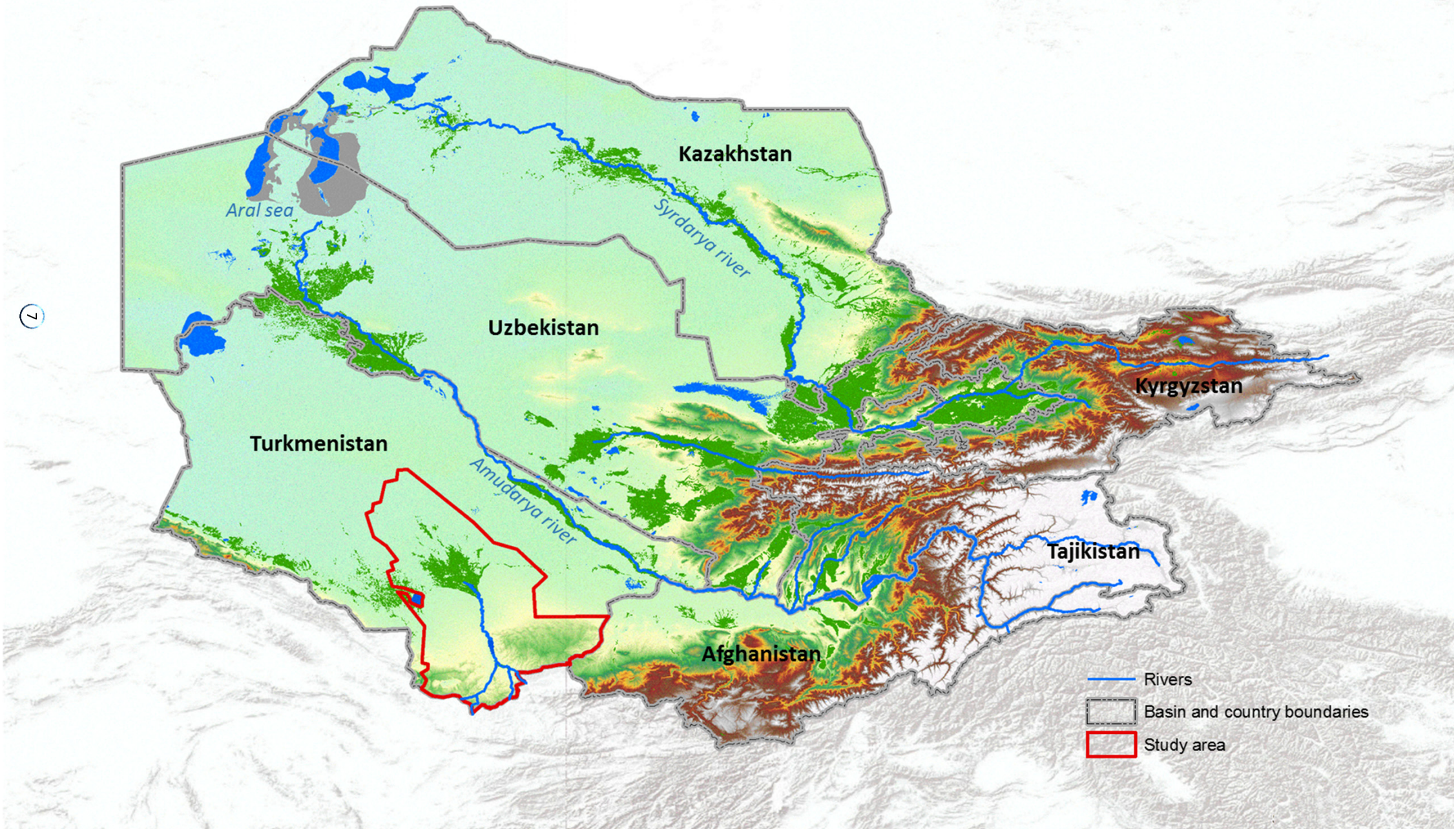
Map projections describe the techniques that represent the Earth's curved surface on a flat map. Coordinate systems describe the grid referenced and measurement units, effectively translating the map projection. In order to overlay the GIS layers on each other, a single data frame is required. In the geodatabase, the layers are projected into a common coordinate system World Geodetic System 1984.

Objective and Recommendation for Use

The main objective of the Digital Diagnostic Atlas of Murgab River Basin is to provide data, maps, charts, and infographics on water and land resources of the region in a consolidated form. The authors hope that it can be used as a tool to inform management practices and support decision making at the local, national, and regional levels.

Aral Sea Basin

IWMI
International
Water Management
Institute

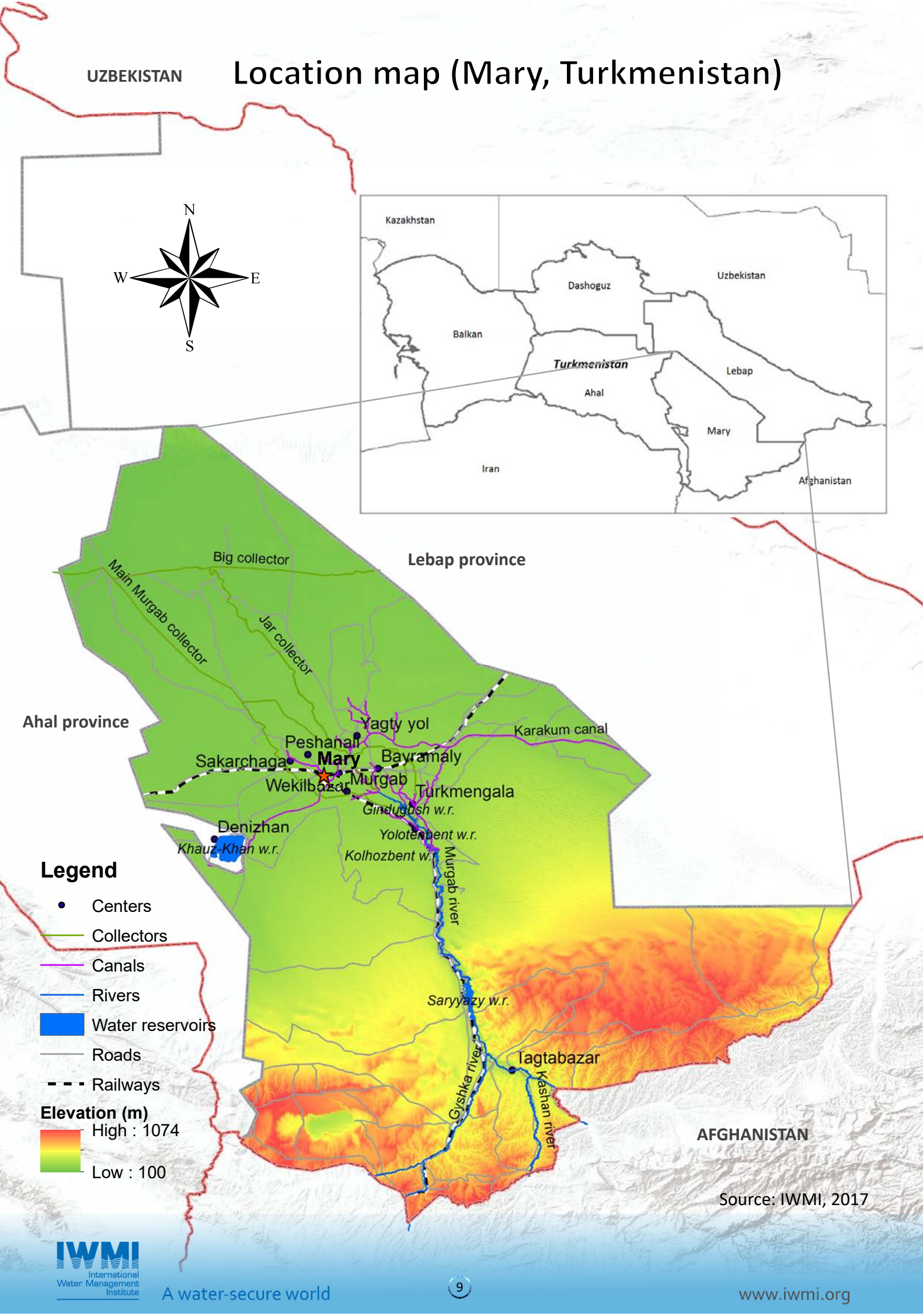


Satellite view

Mary province is one of the five provinces of Turkmenistan. It is located in the south-eastern part of the country, bordering Afghanistan. Its capital is the city of Mary. With an area of 87,150 km^2 (33,650 sq. mi) and a population of about 1.5 million, the province has an average population density of about 15 persons per square kilometer but reaches 150-200 per square kilometer in the most developed oases. Mary province's agriculture is irrigated by the Karakum Canal, which flows east to west through the heart of the province, and by the Murgab River, which flows south to north, entering the province from Afghanistan. While the northern portion of the province is within the Central Asian southern desert ecoregion, the southern portion of the province is characterized by a savanna of pistachio and desert sedges, known as the Badkhiz-Karabil semi-desert.

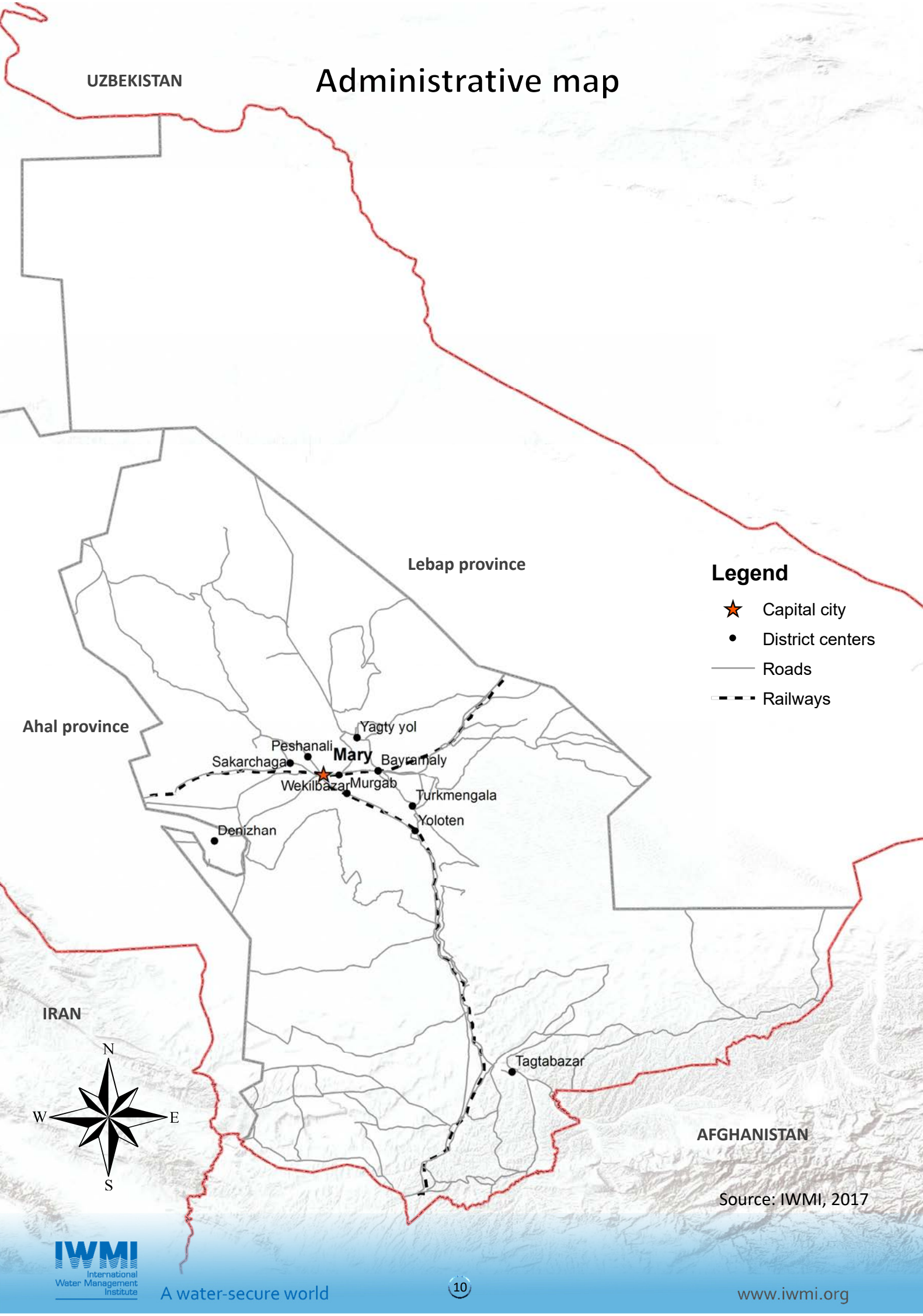
Source: IWMI, 2017

Location map (Mary, Turkmenistan)



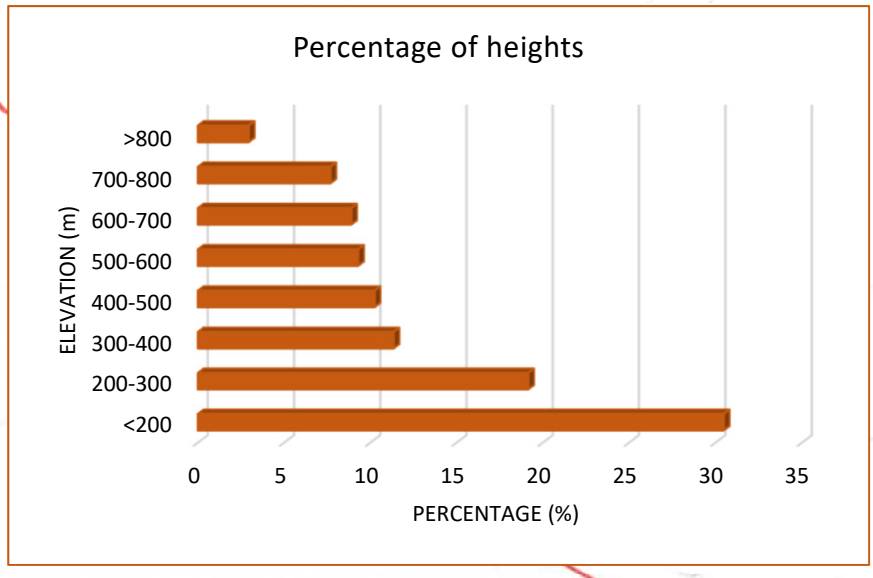
Source: IWMI, 2017

Administrative map



Source: IWMI, 2017

Digital Elevation Model



UZBEKISTAN

Lebap province

Ahal province

IRAN

AFGHANISTAN

Legend

Elevation (m)

High : 1074

Low : 100

N

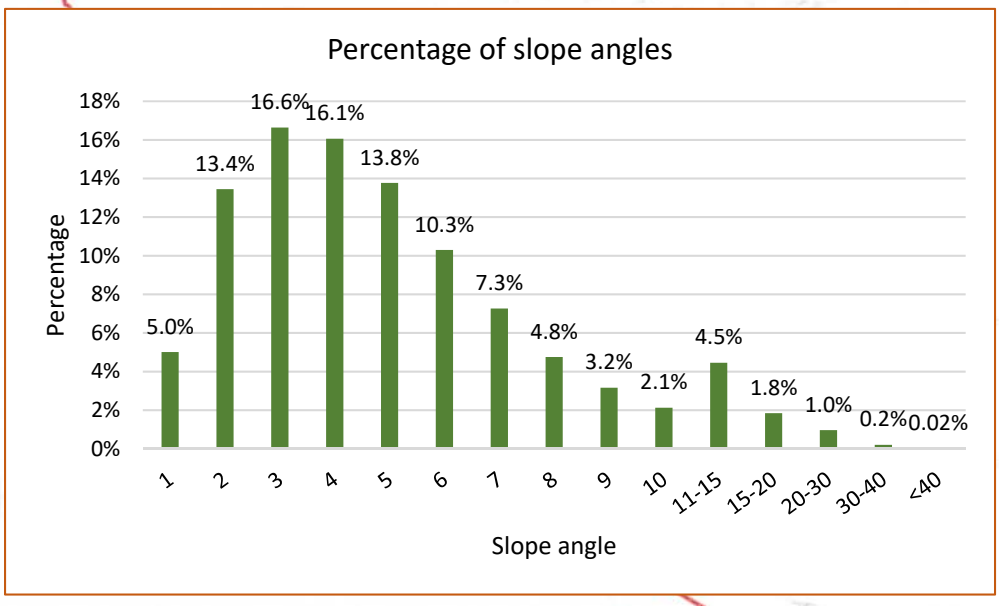
W

E

S

Source: NASA LP DAAC, 2015

Slope map

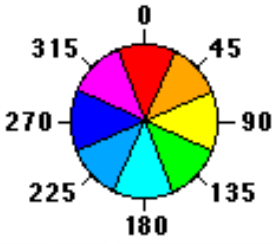


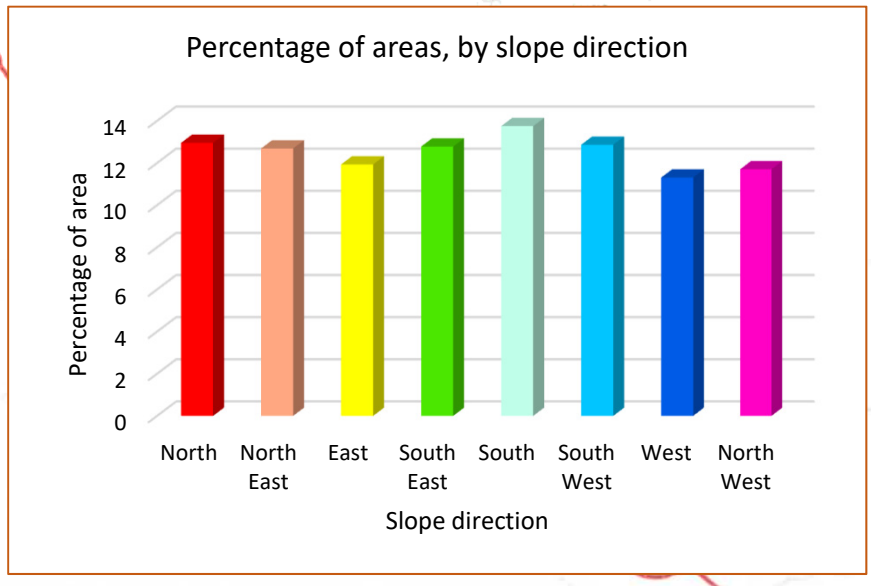
Source: IWMI, 2017

Aspect map

UZBEKISTAN

Hue indicates direction of aspect





Lebap province

Ahal province

IRAN

AFGHANISTAN

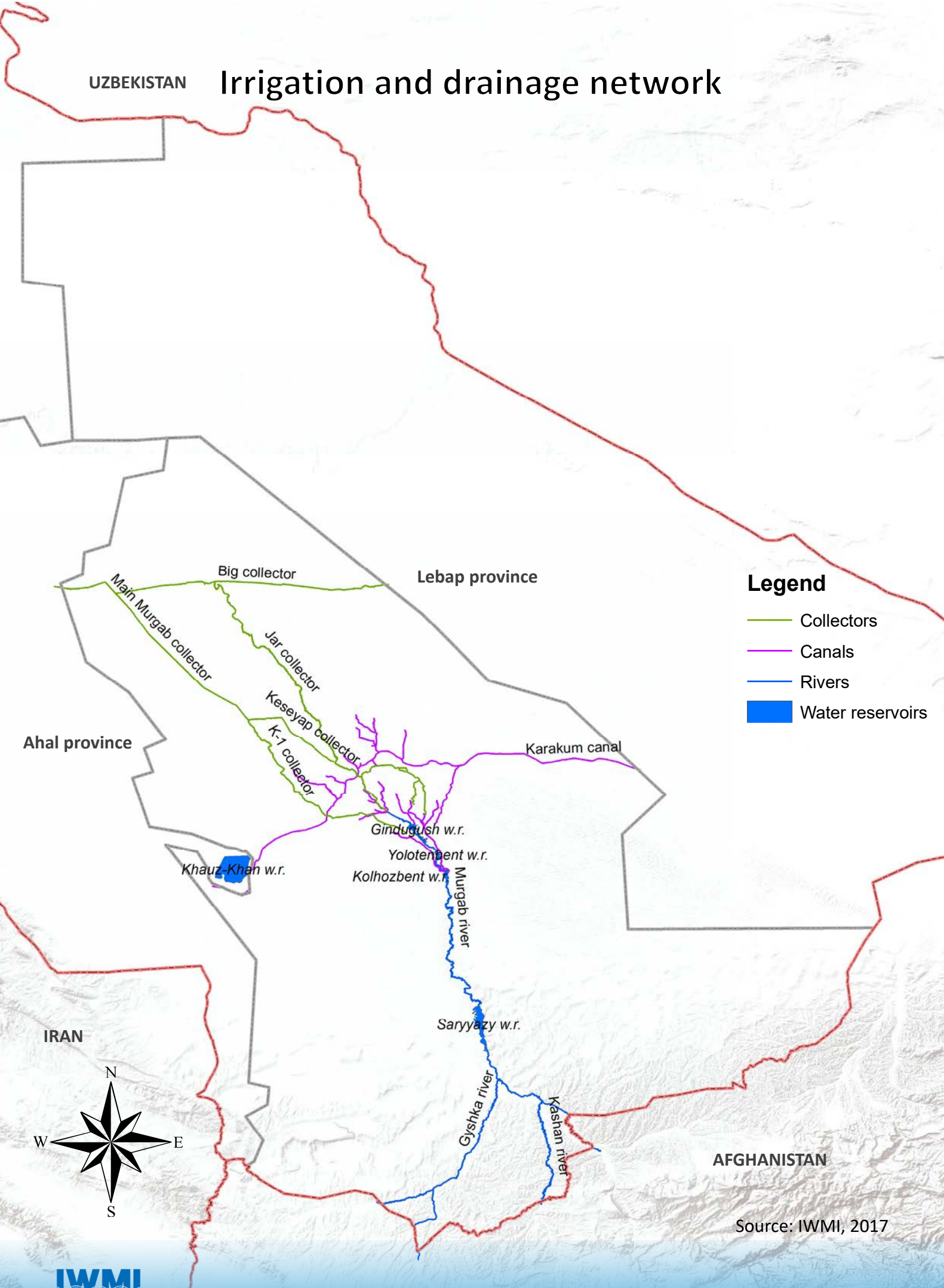
Legend

Slope direction

- North
- North East
- East
- South East
- South
- South West
- West
- North West

Source: IWMI, 2017

Irrigation and drainage network

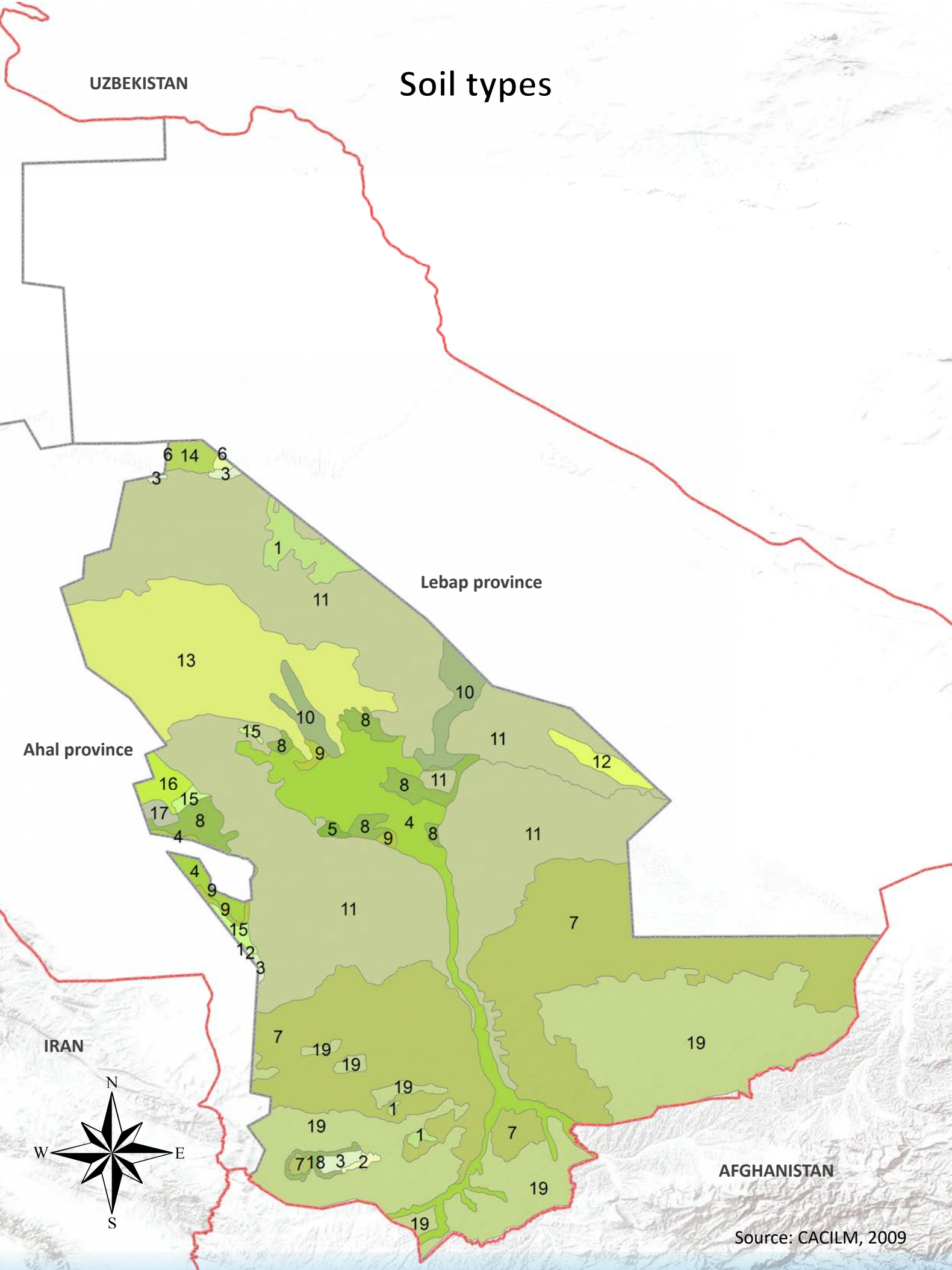


Source: IWMI, 2017

Watershed map

Source: IWMI, 2017

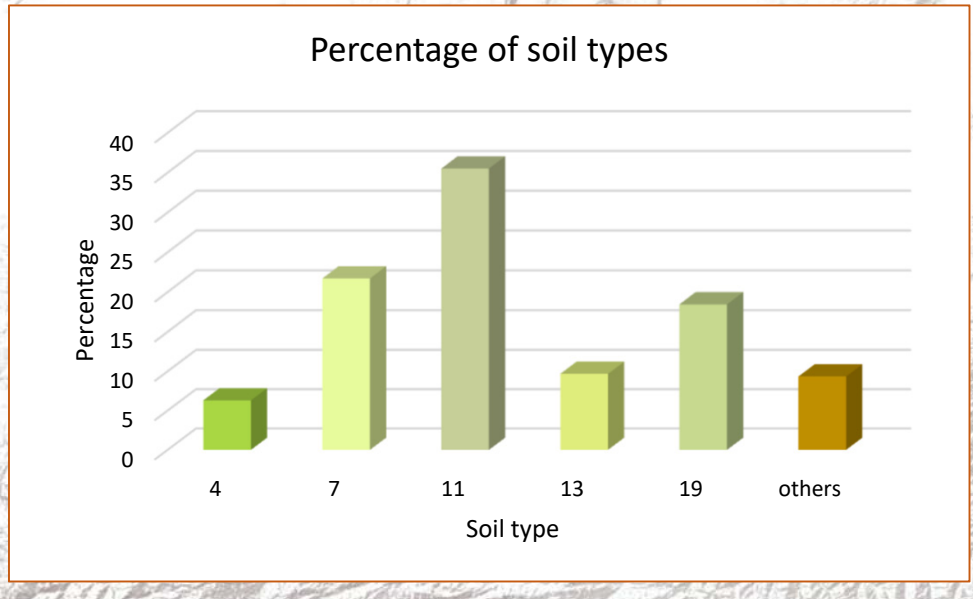
Soil types



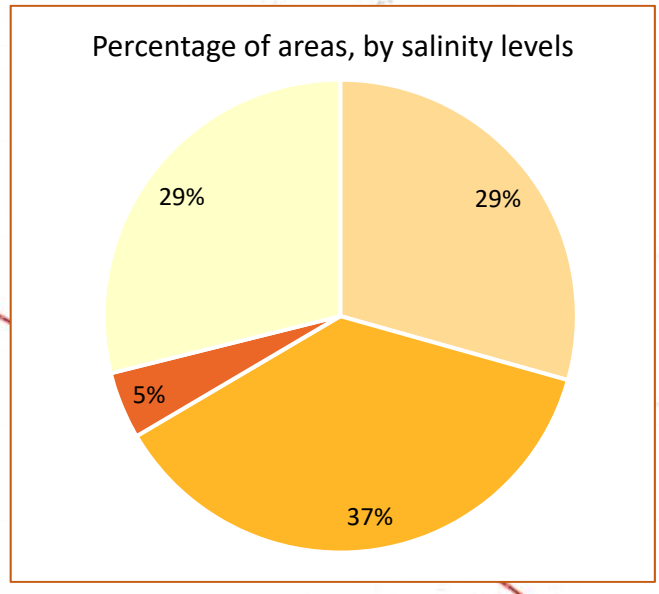
Source: CACILM, 2009

Legend

- 1. Blown and poor fixed sands
- 2. Desert sandy solonchak-like on wind deposits, proluvium and aluvium
- 3. Desert solonchaks
- 4. Irrigated meadow
- 5. Irrigated meadow-desert sandy
- 6. Light sierozem subtropic hot unfreeze throuch
- 7. Light-brown desert subtropic unfreeze through
- 8. Meadow desert (takir-like) soils
- 9. Meadow desert sandy
- 10. Meadow-oasis saline and irrigated meadow-desert (takir-like)
- 11. Sand (50%) and sandy desert (50%)
- 12. Sand (60%) solonchak (40%)
- 13. Sand (70%) takir-like (15%) and takir (15%)
- 14. Sandy desert (60%) and light-brown (40%)
- 15. Takir (50%) and takir-like (50%)
- 16. Takir-like desert subtropic unfreeze through
- 17. Takirs and meadow takirs
- 18. Terrace, screes and rock yeld
- 19. Typical sierozem subtropic hot unfreeze throuch



Soil salinity



UZBEKISTAN

Lebap province

Ahal province

IRAN

AFGHANISTAN

Legend

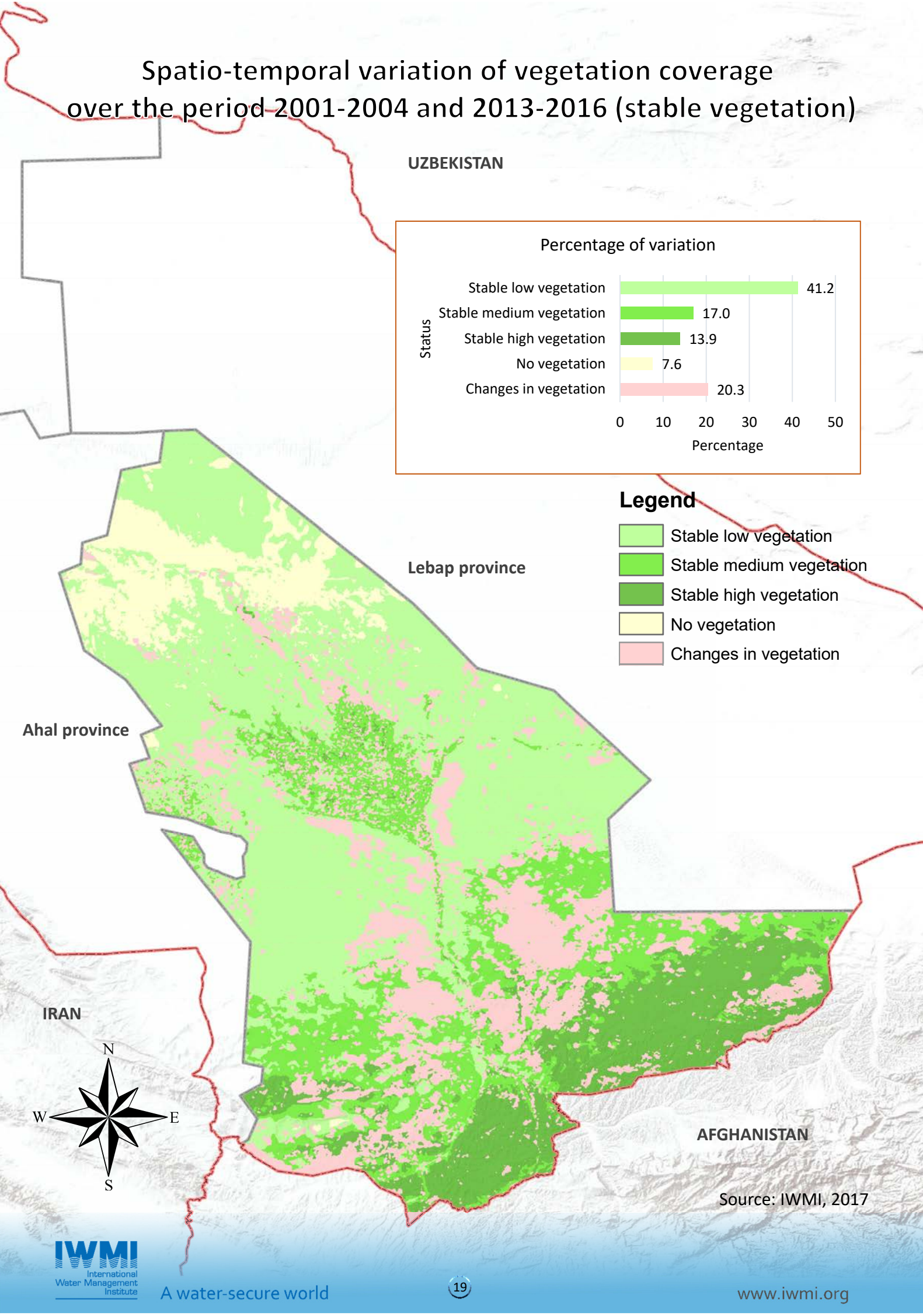
Soil salinity level

- Non saline
- Slightly saline
- Moderately saline
- Strongly saline

N
W
E
S

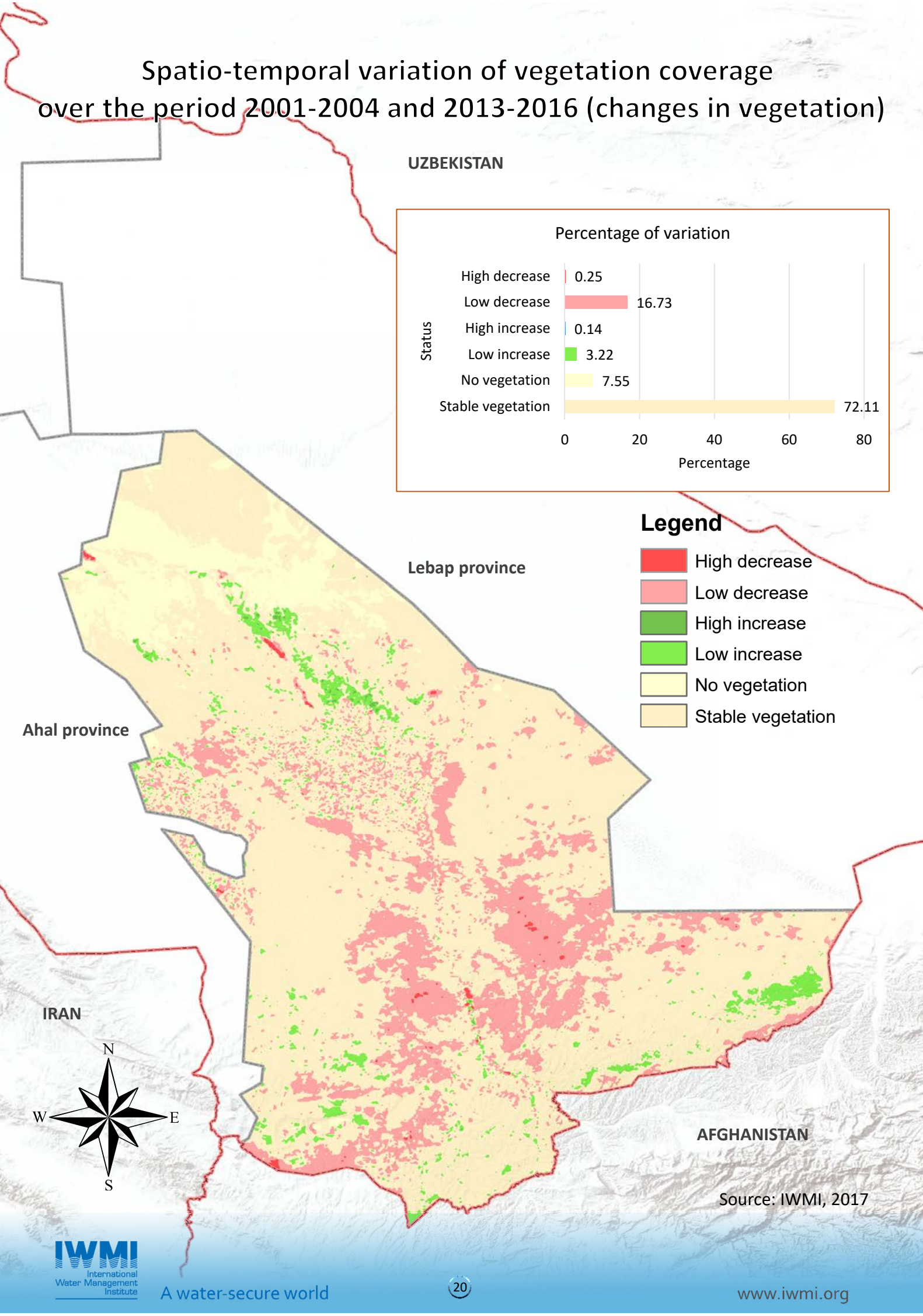
Source: ECO Geoscience Database 2016

Spatio-temporal variation of vegetation coverage over the period 2001-2004 and 2013-2016 (stable vegetation)



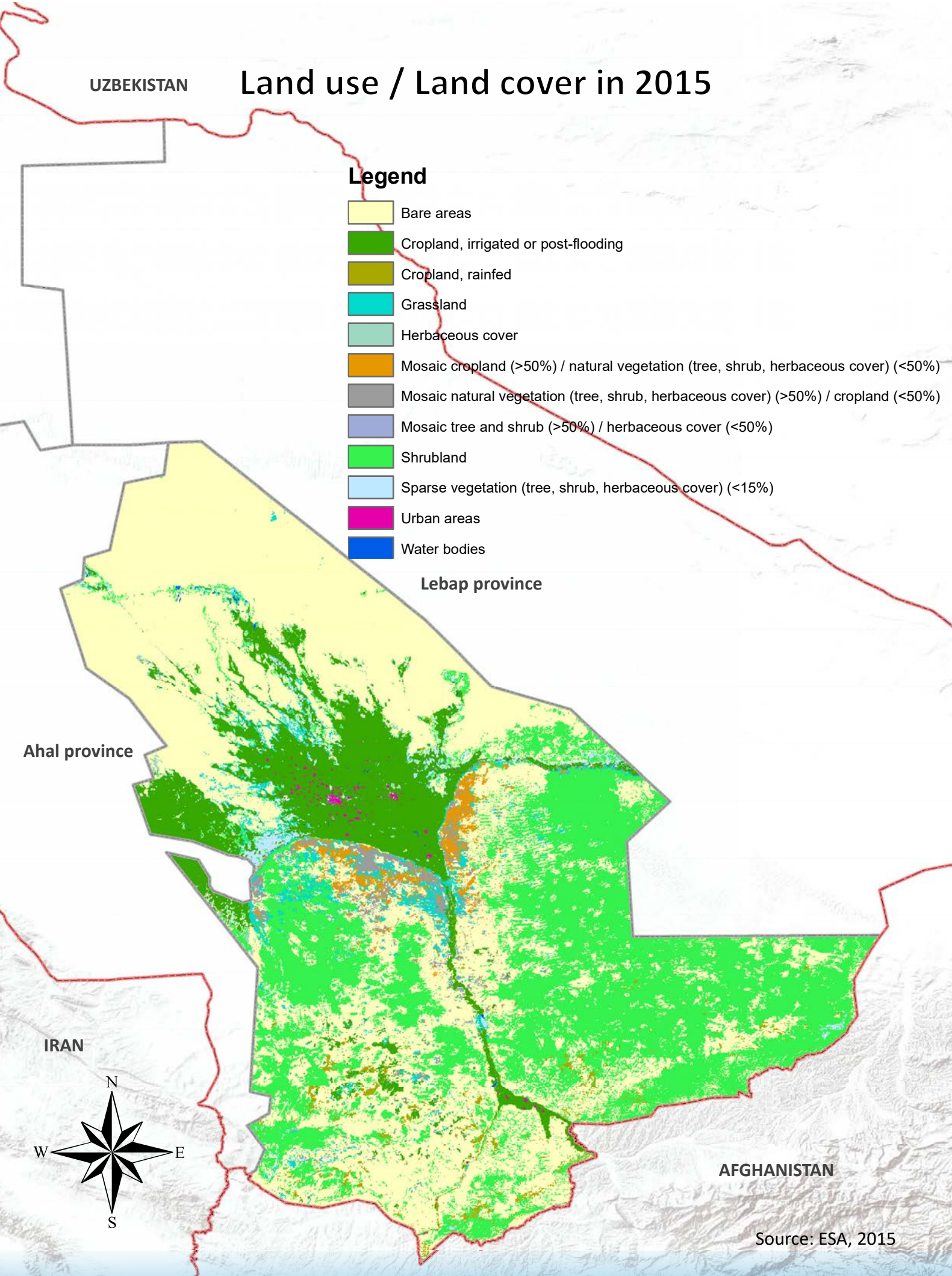
Source: IWMI, 2017

Spatio-temporal variation of vegetation coverage over the period 2001-2004 and 2013-2016 (changes in vegetation)



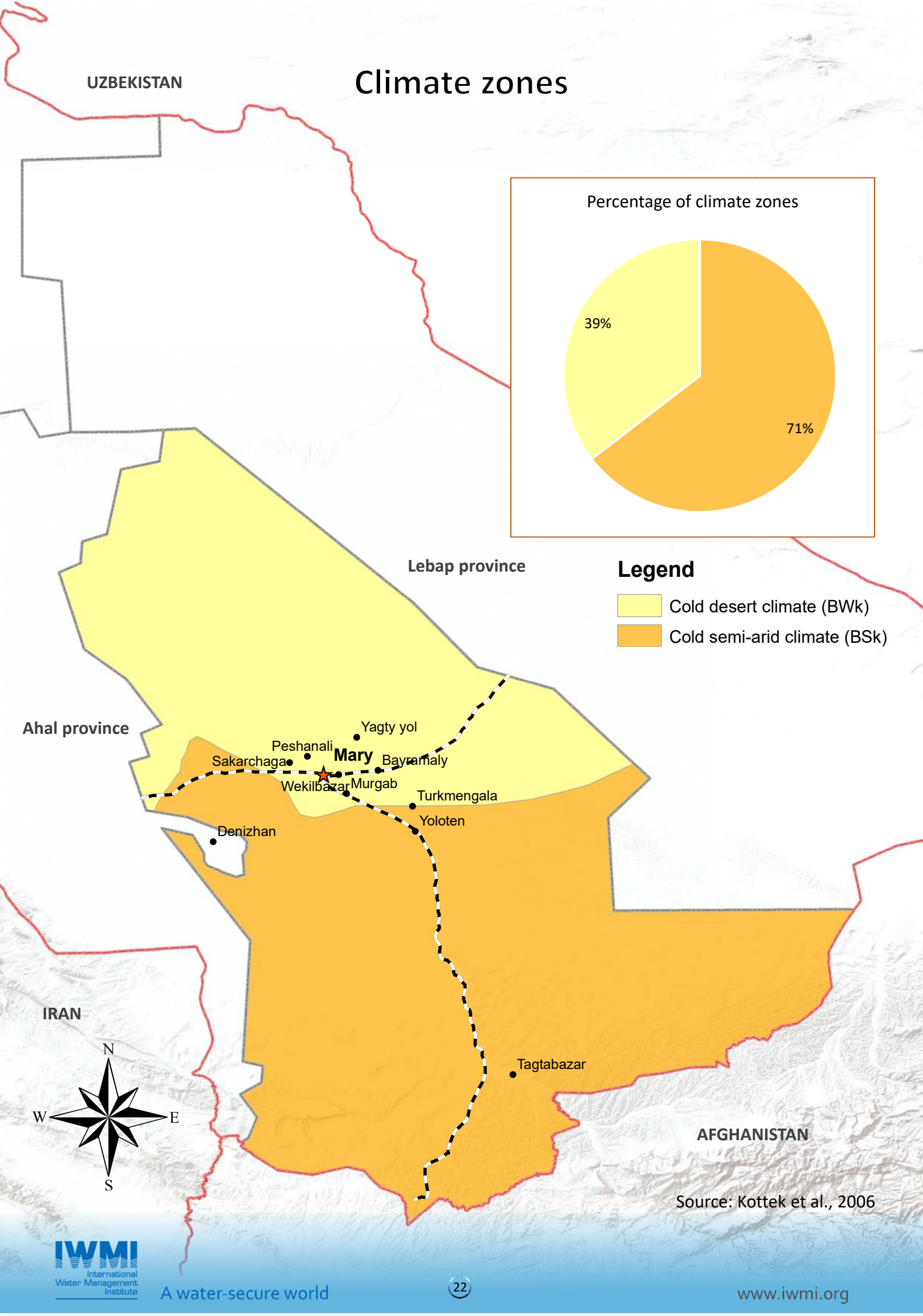
Source: IWMI, 2017

Land use / Land cover in 2015



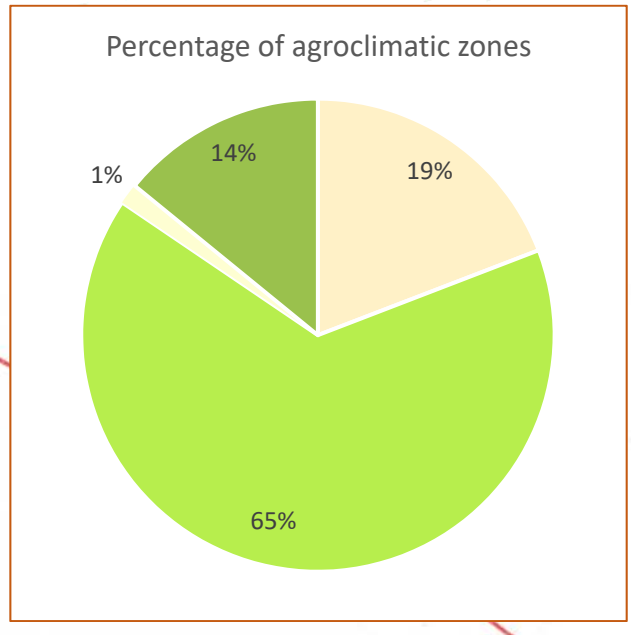
Source: ESA, 2015

Climate zones



Source: Kottek et al., 2006

Agroclimatic zones



UZBEKISTAN

Lebap province

Ahal province

Yagty yol
Peshanali
Mary
Sakarchaga
Bayramaly
Wekilbazar
Murgab
Turkmengala
Yoloten
Denizhan
Tagtabazar

IRAN

AFGHANISTAN

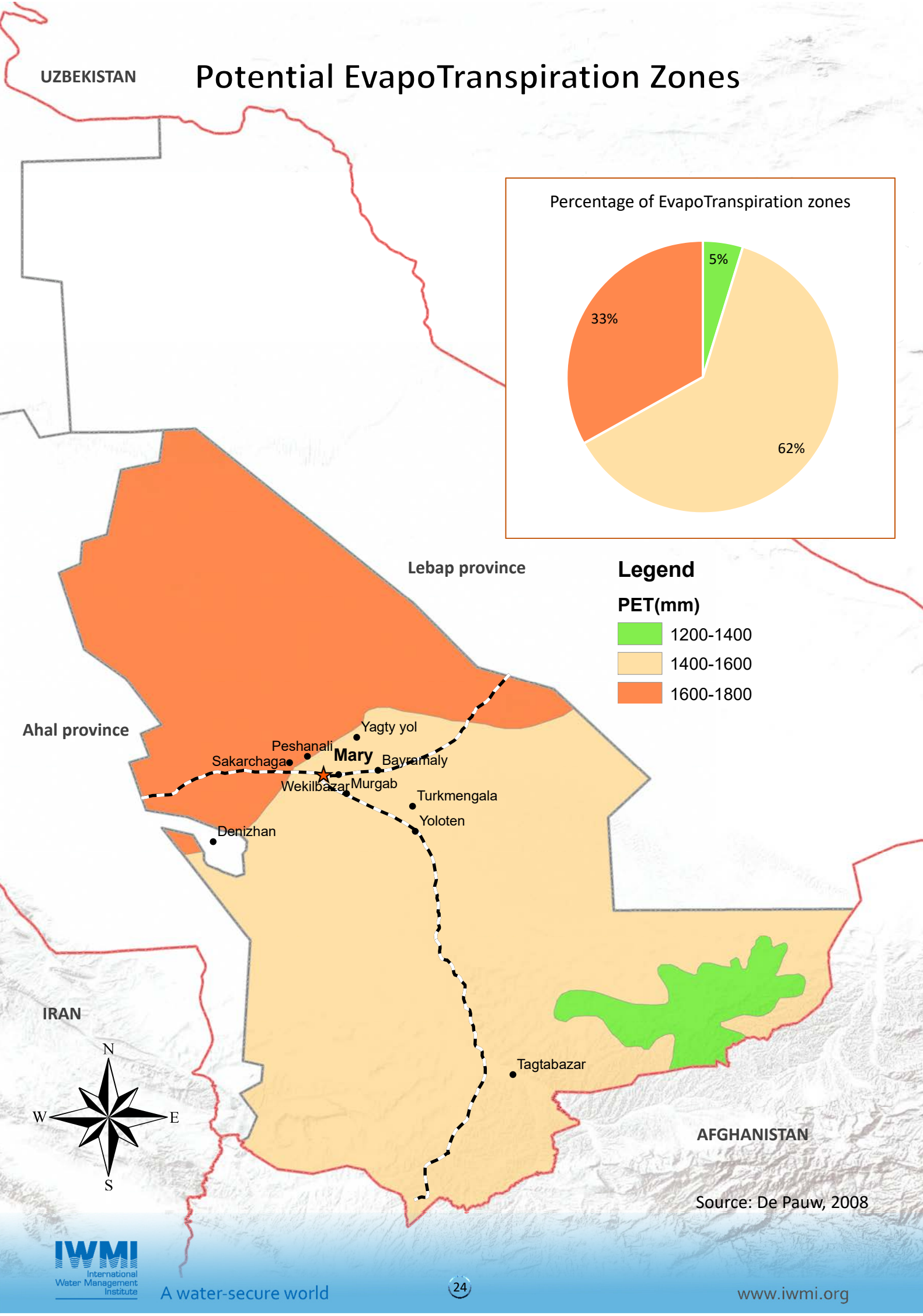
N
W
E
S

Legend

- Arid, cold winter, cool summer
- Arid, cool winter, very warm summer
- Arid, cool winter, warm summer
- Semi-arid, cold winter, warm summer

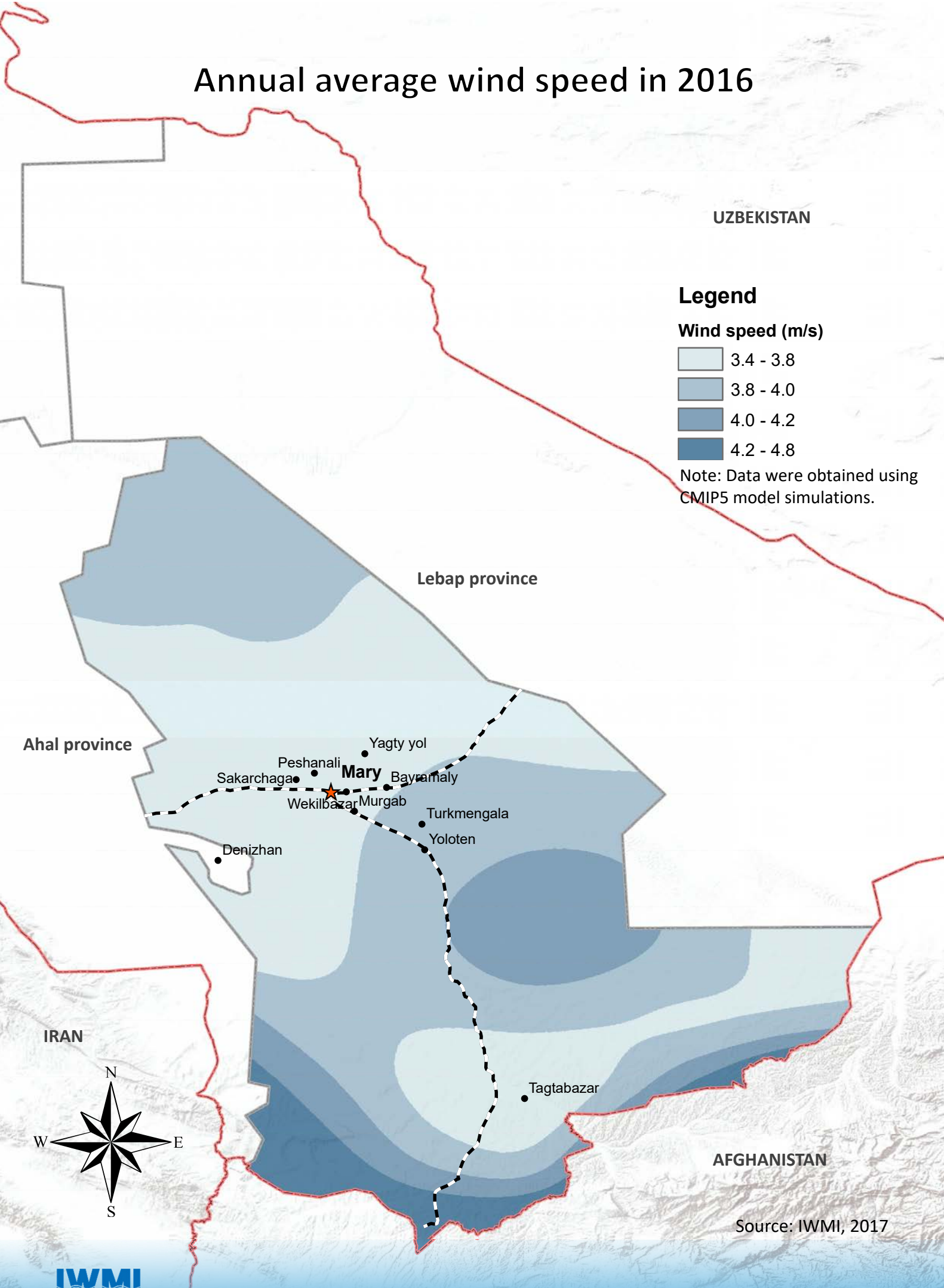
Source: De Pauw, 2008

Potential EvapoTranspiration Zones



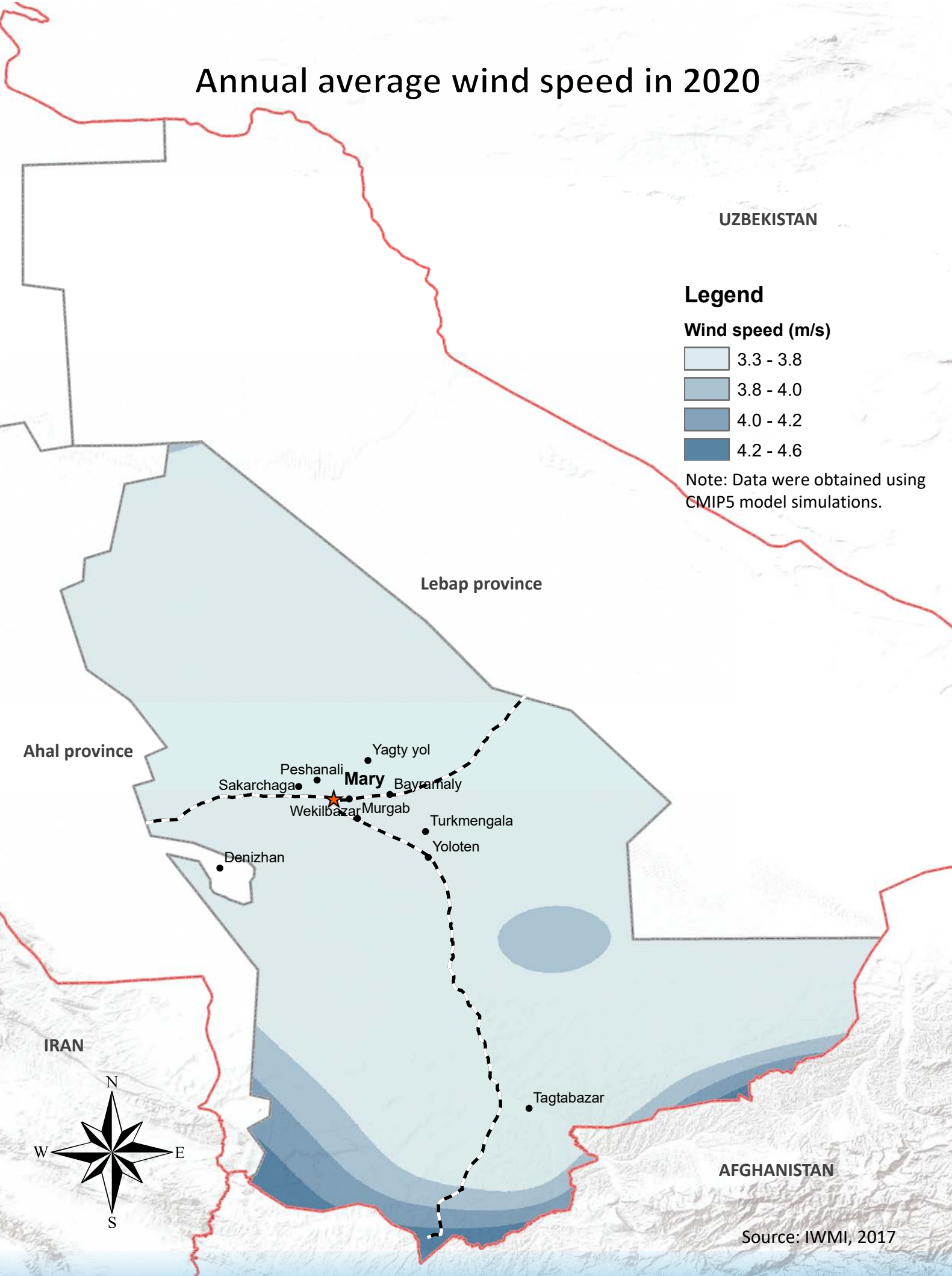
Source: De Pauw, 2008

Annual average wind speed in 2016



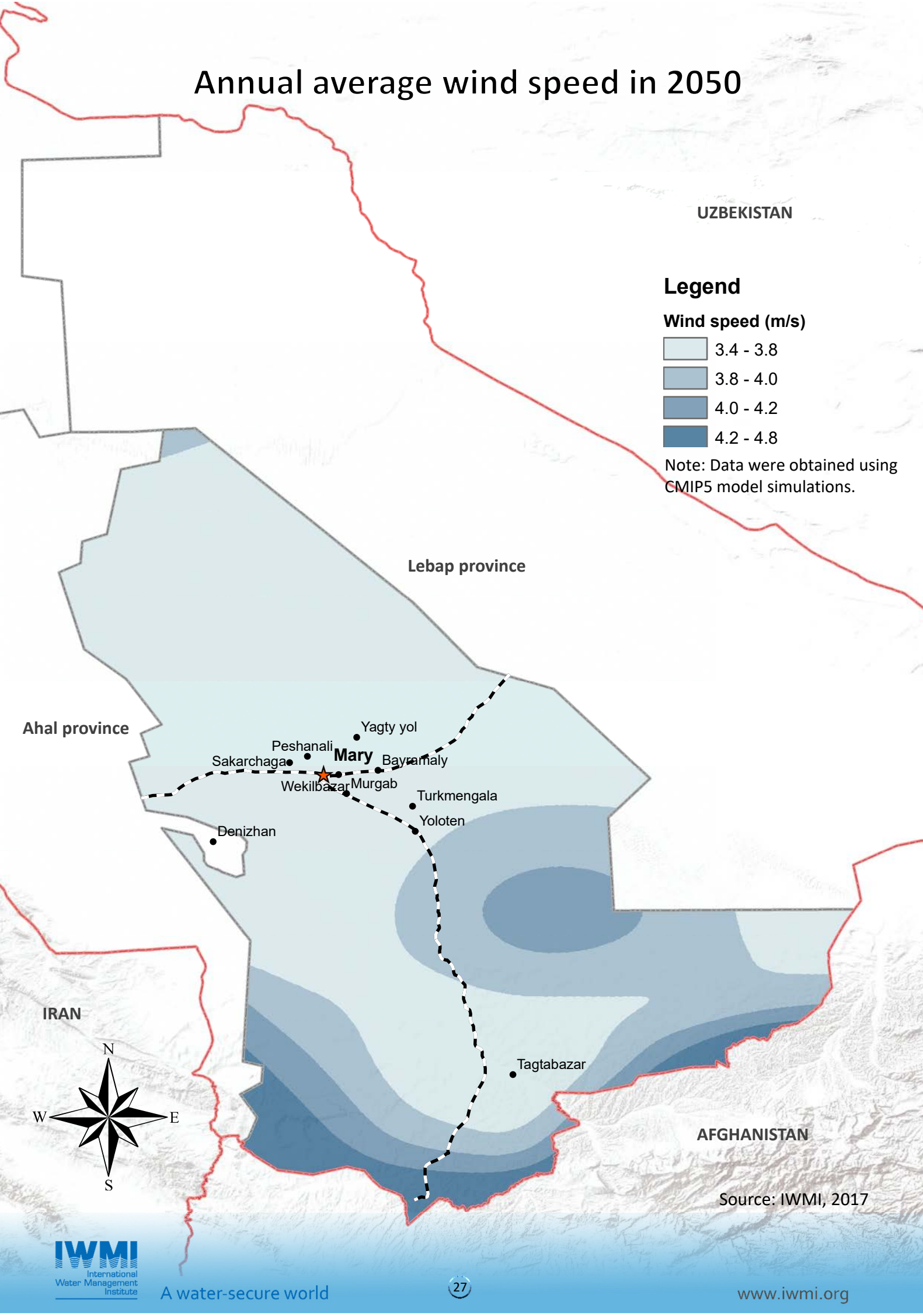
Source: IWMI, 2017

Annual average wind speed in 2020



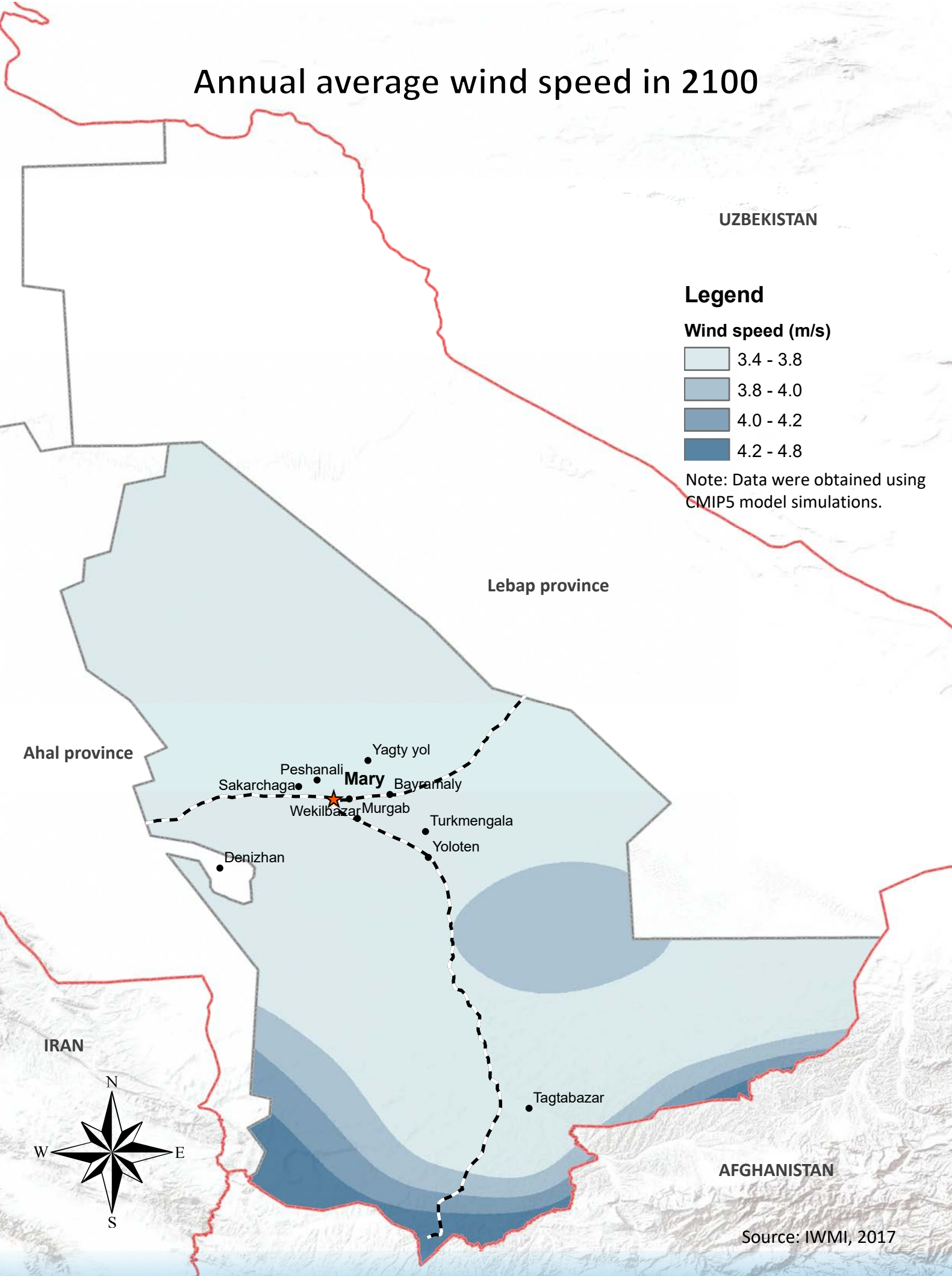
Source: IWMI, 2017

Annual average wind speed in 2050



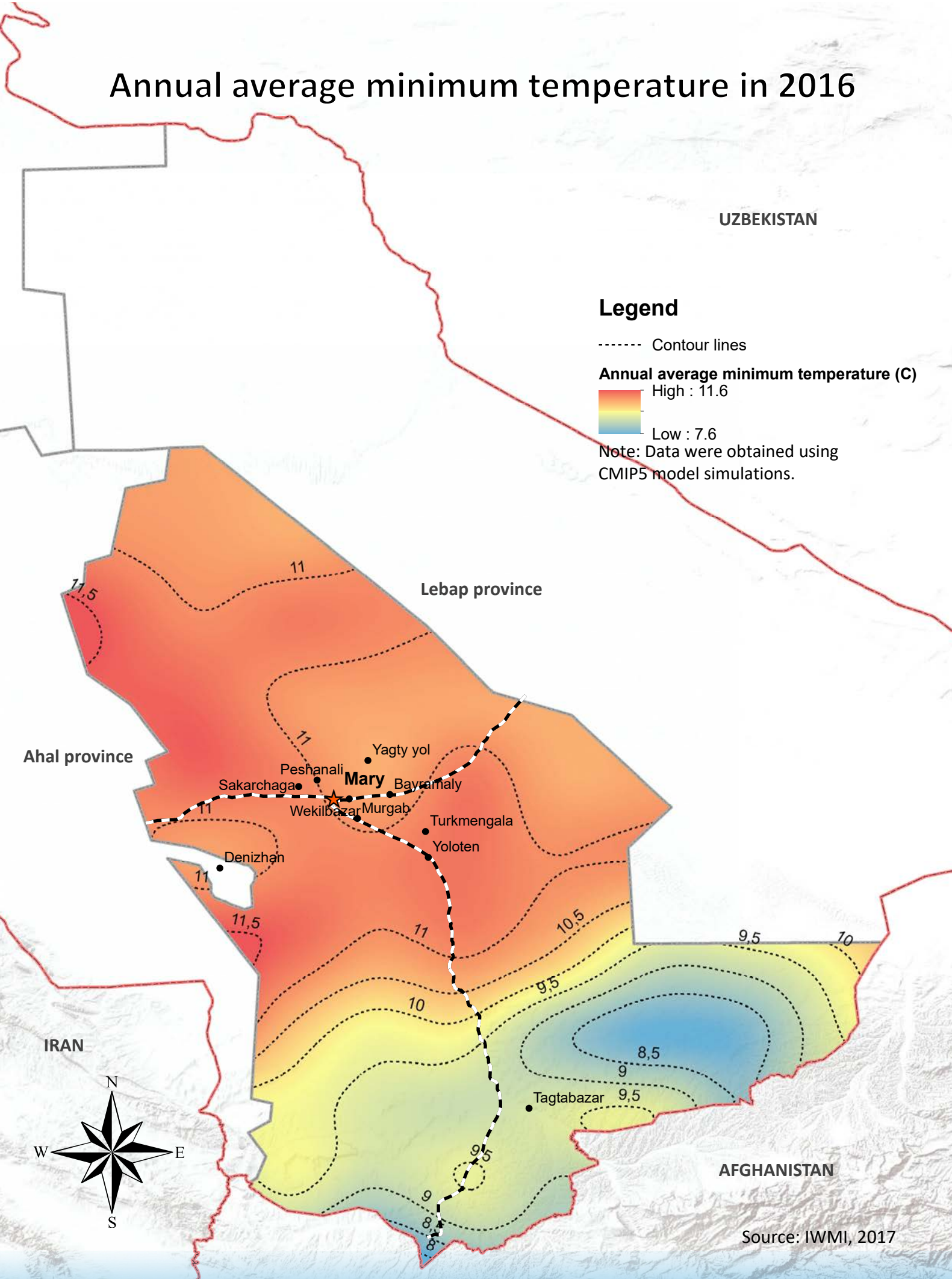
Source: IWMI, 2017

Annual average wind speed in 2100



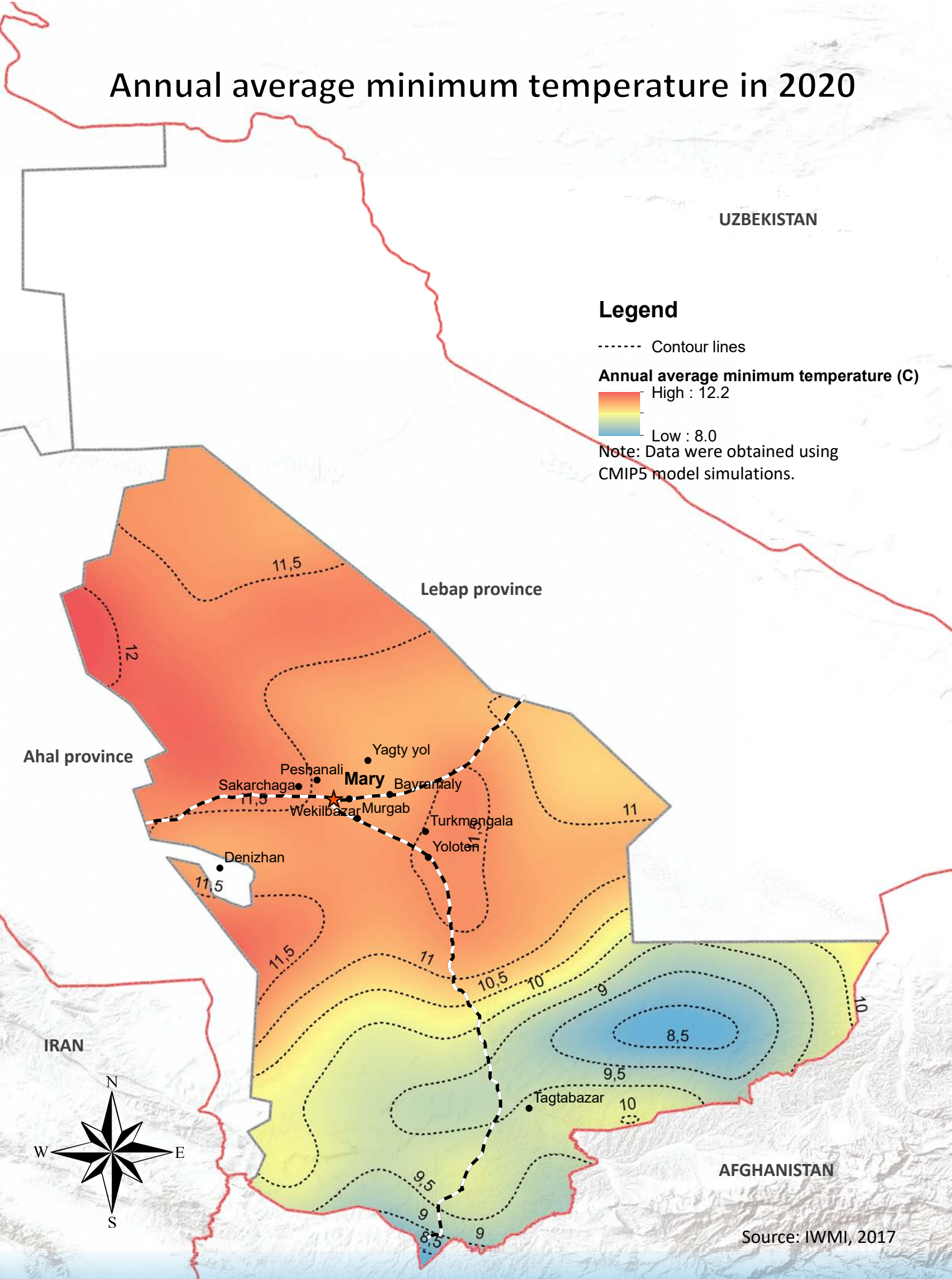
Source: IWMI, 2017

Annual average minimum temperature in 2016



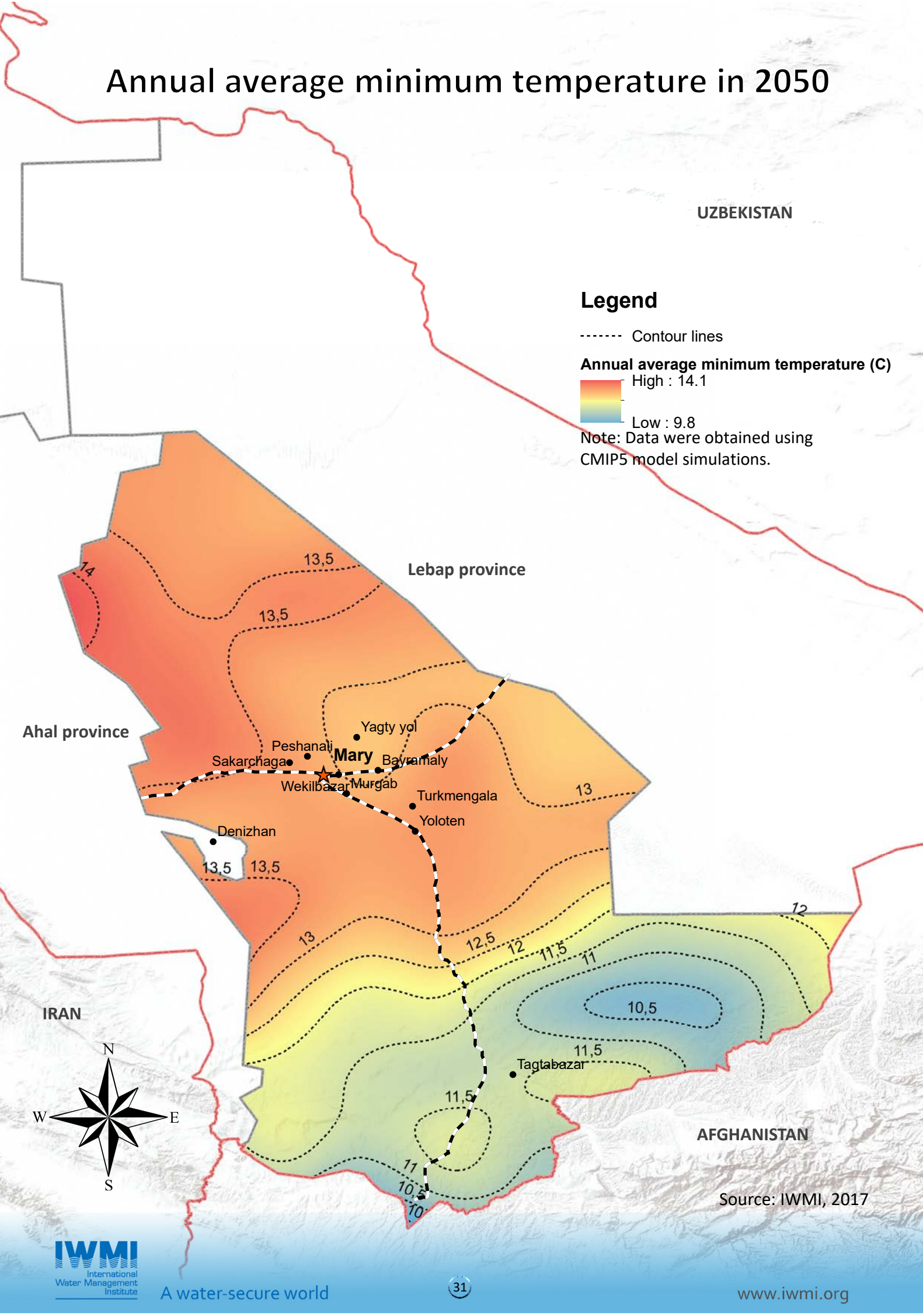
Source: IWMI, 2017

Annual average minimum temperature in 2020



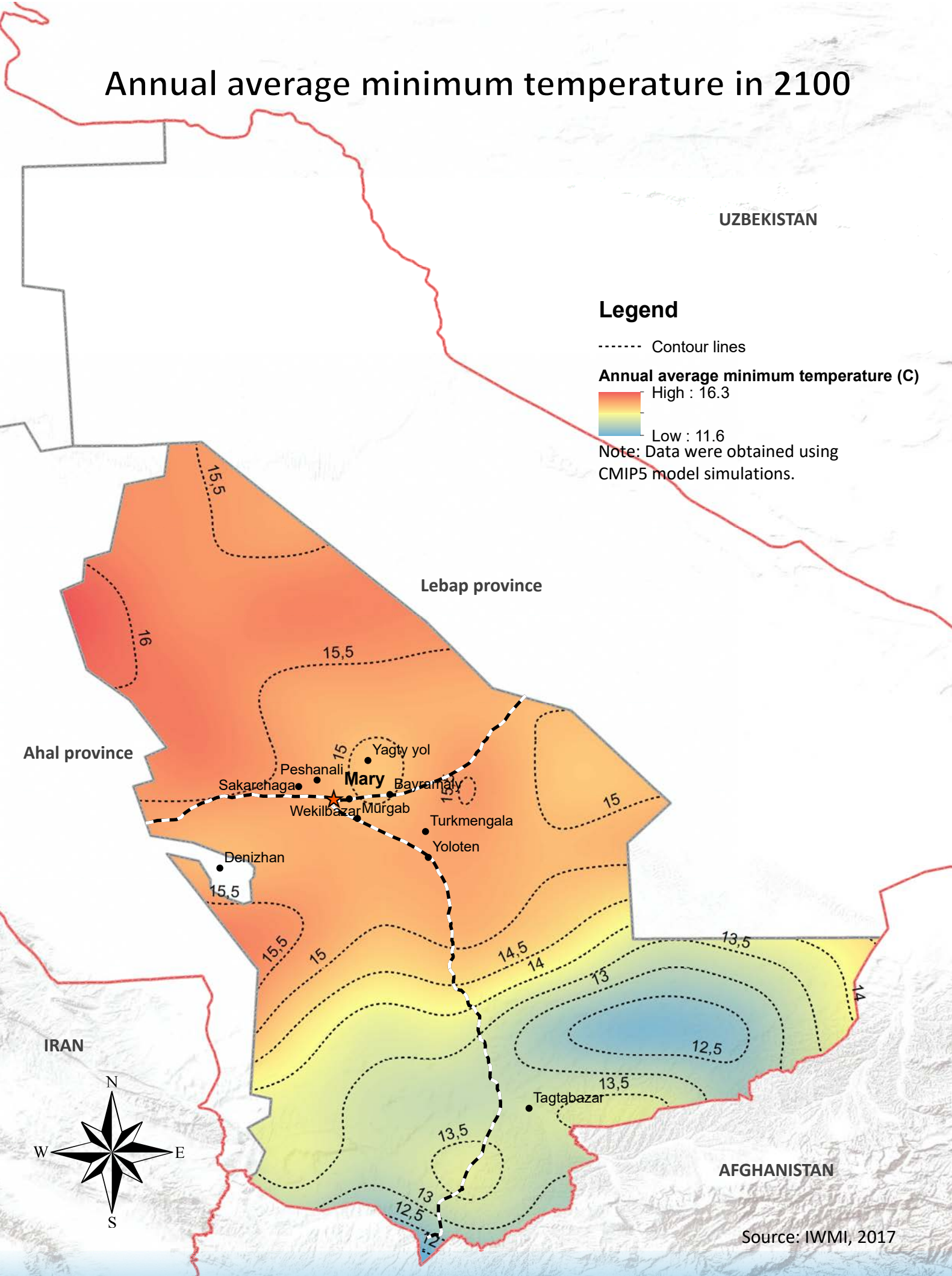
Source: IWMI, 2017

Annual average minimum temperature in 2050



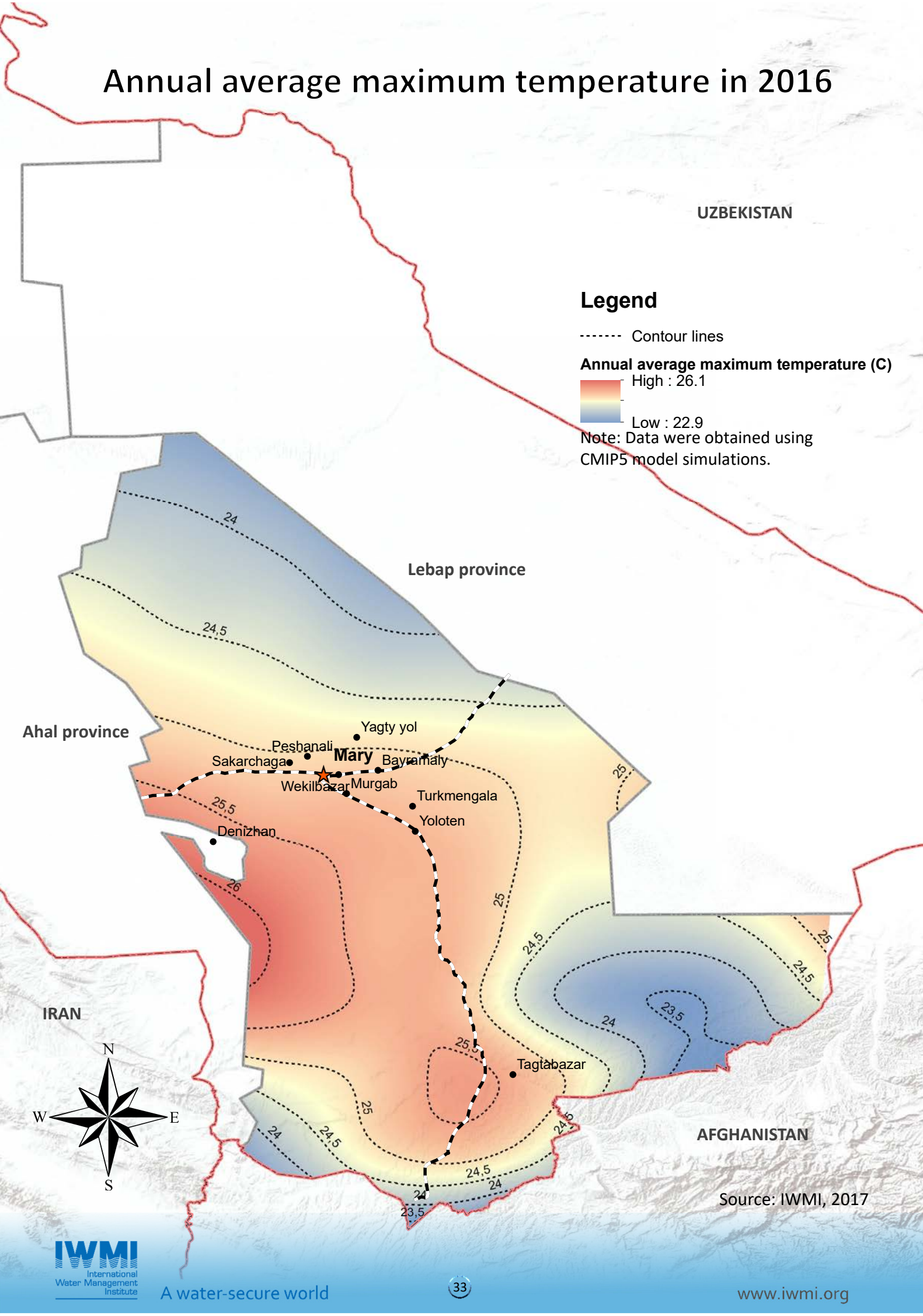
Source: IWMI, 2017

Annual average minimum temperature in 2100



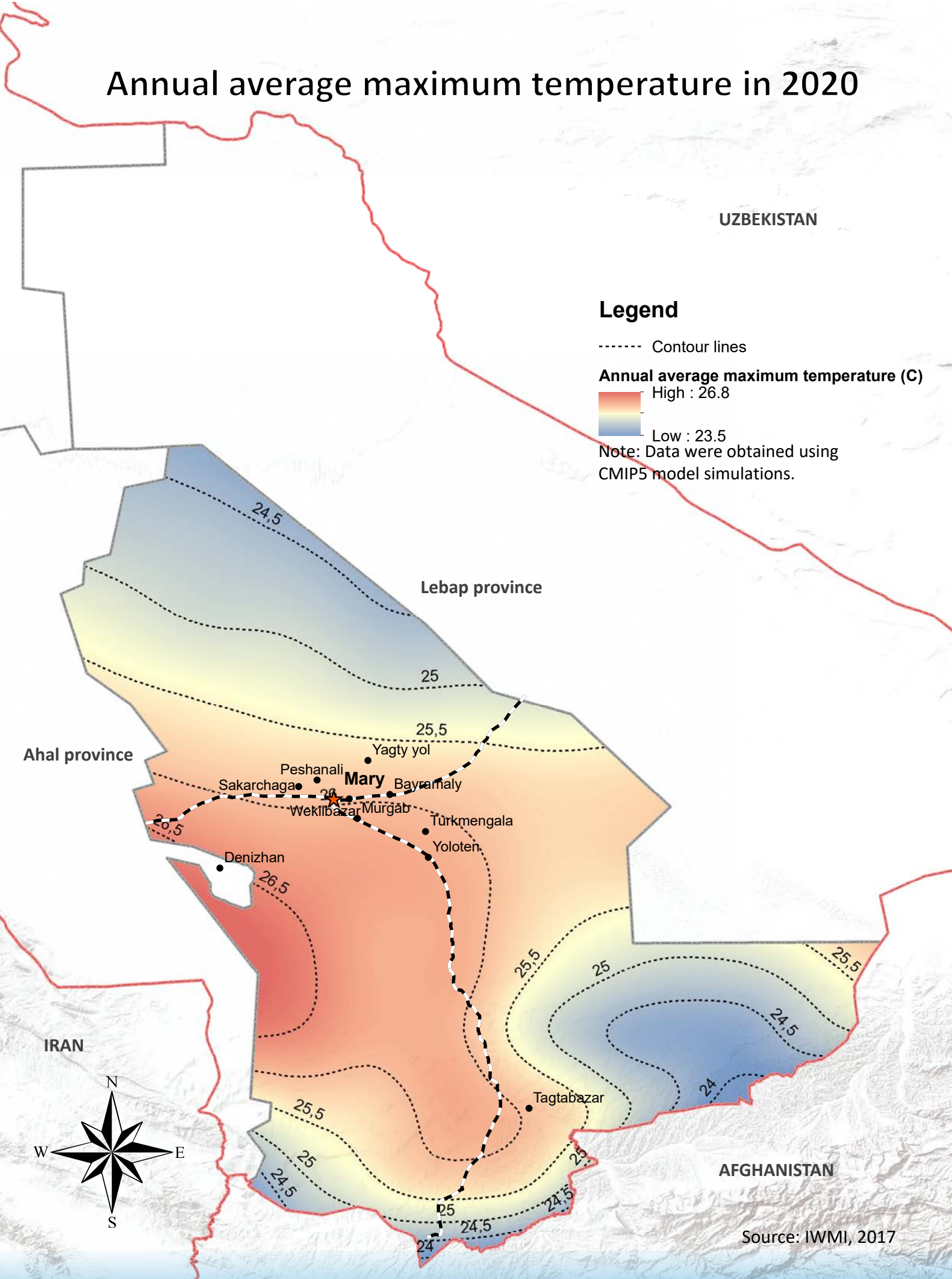
Source: IWMI, 2017

Annual average maximum temperature in 2016



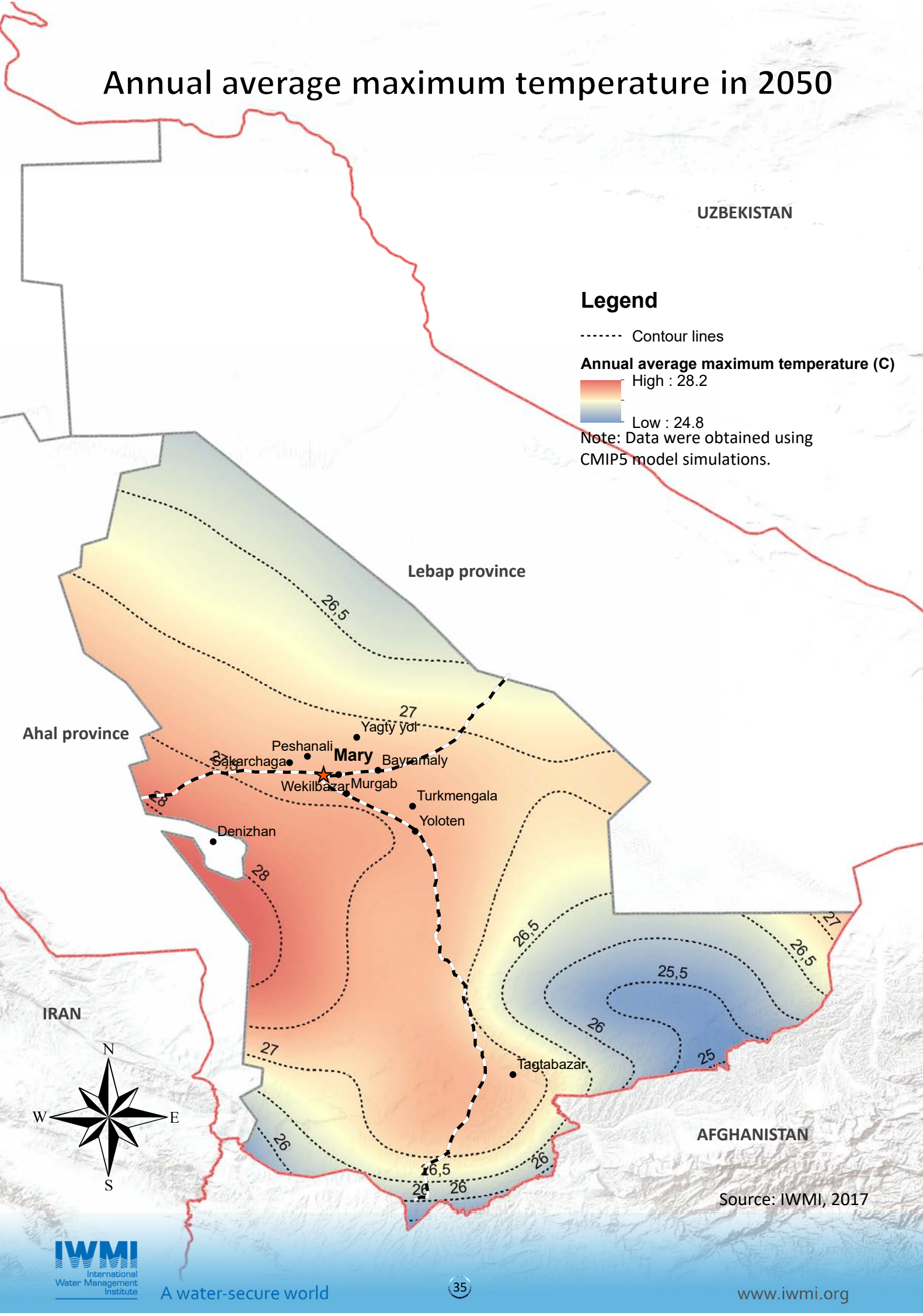
Source: IWMI, 2017

Annual average maximum temperature in 2020



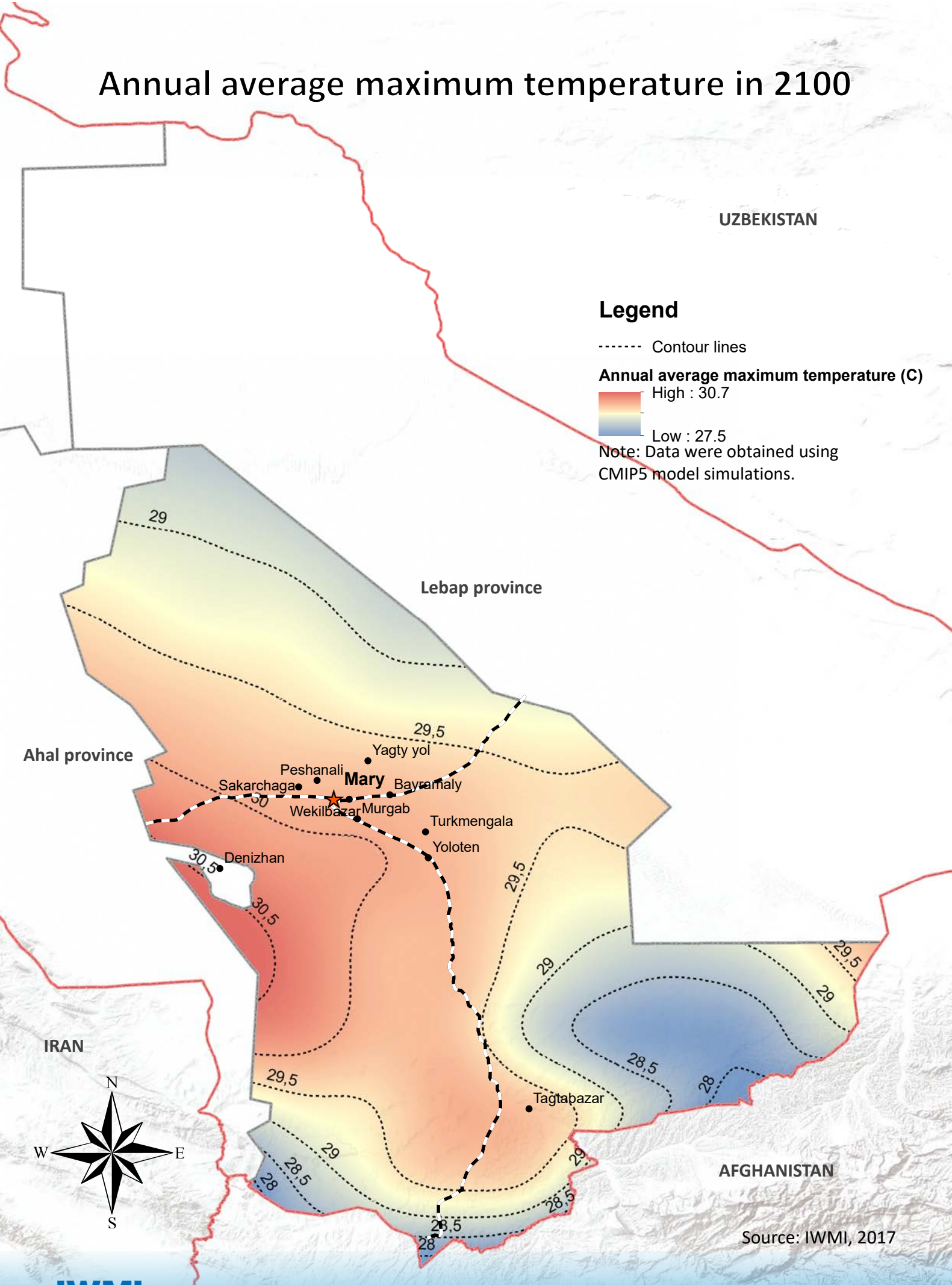
Source: IWMI, 2017

Annual average maximum temperature in 2050



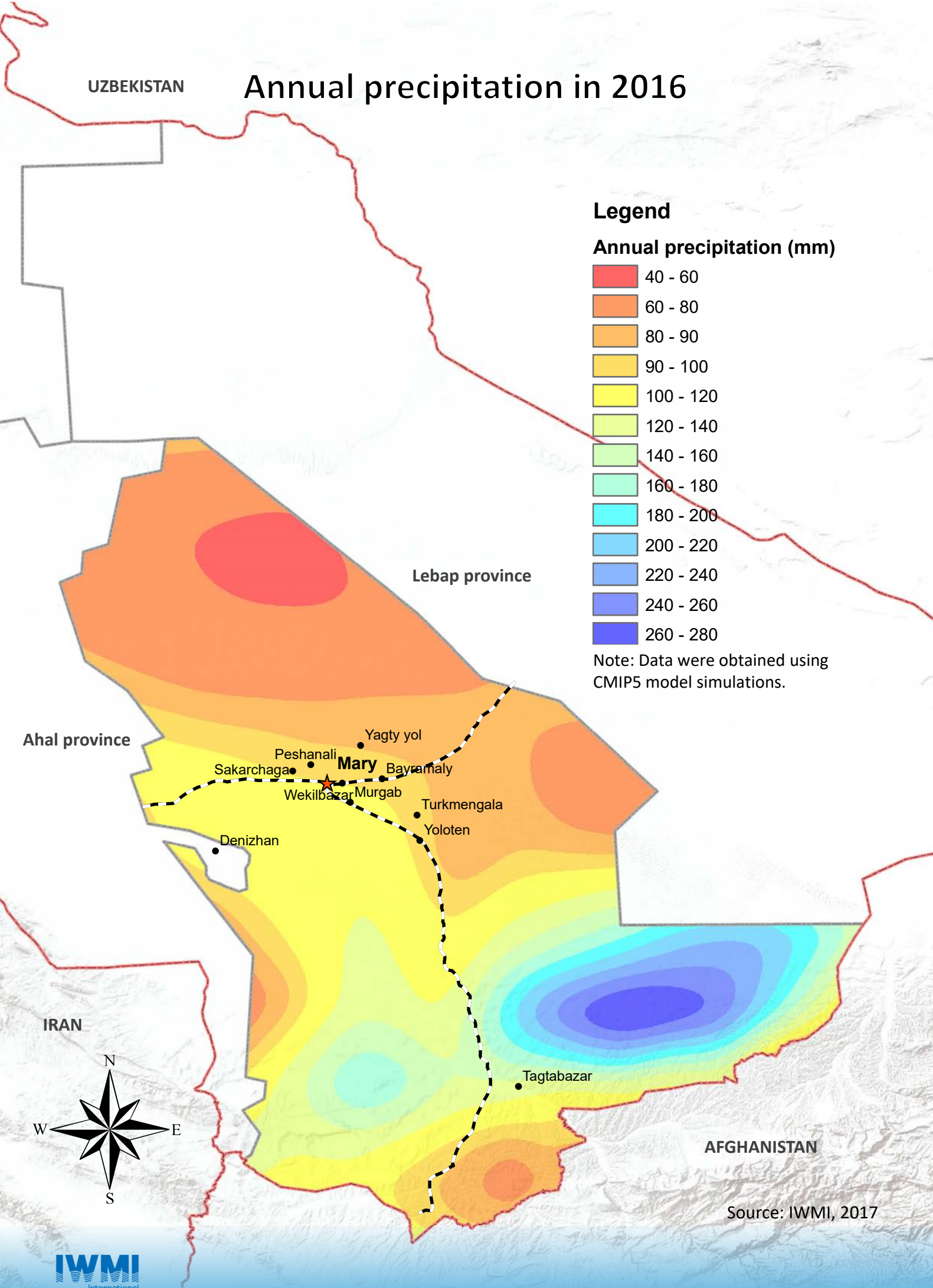
Source: IWMI, 2017

Annual average maximum temperature in 2100



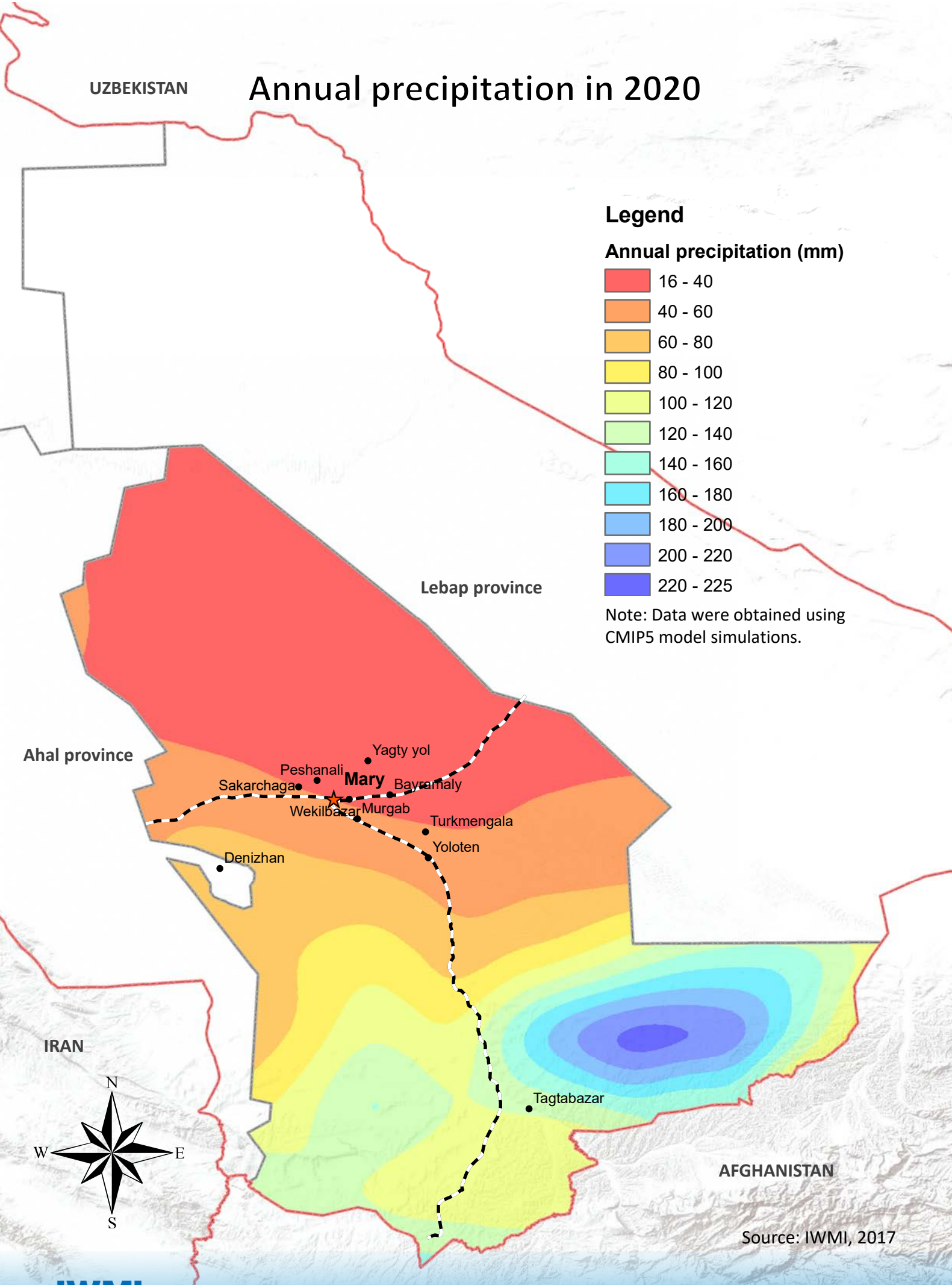
Source: IWMI, 2017

Annual precipitation in 2016



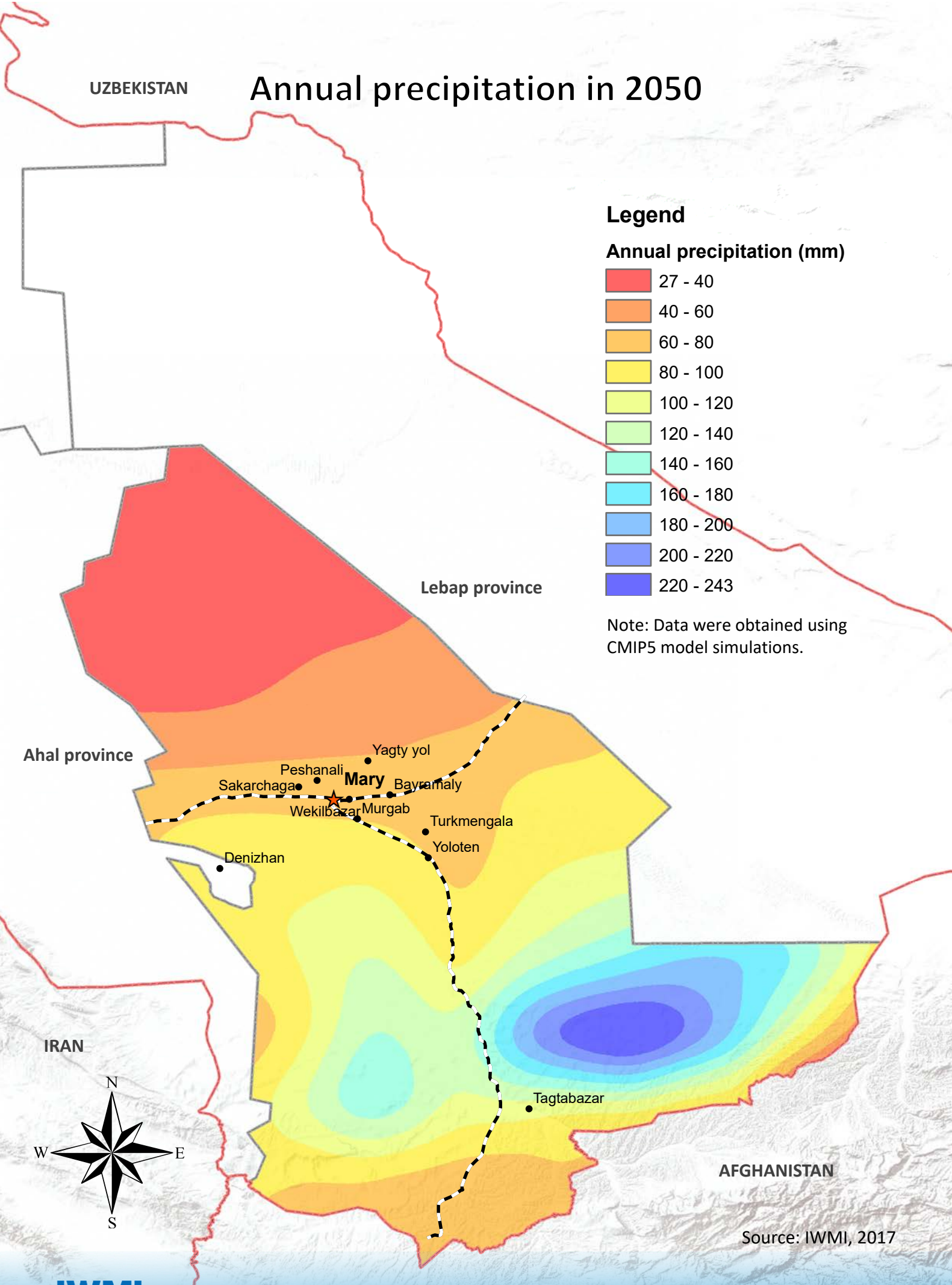
Source: IWMI, 2017

Annual precipitation in 2020



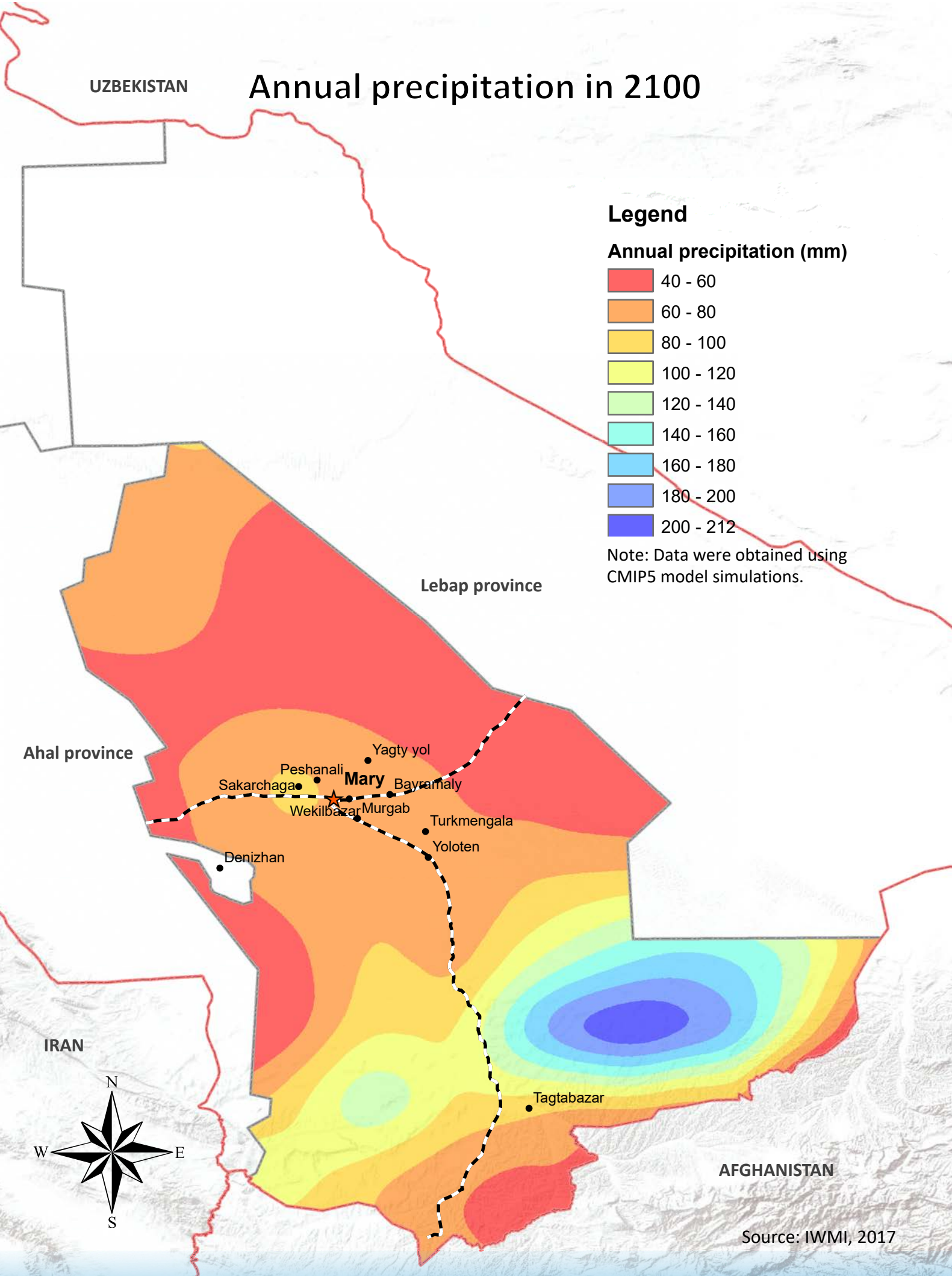
Source: IWMI, 2017

Annual precipitation in 2050



Source: IWMI, 2017

Annual precipitation in 2100



Source: IWMI, 2017

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