

**Component 2:  
National Laboratory Capacity  
Assessment**

# Plant Health

# National laboratory capacity for plant health

- The governing principle for **phytosanitary measures** consistent with the IPPC is that they **should relate only to regulated pests (quarantine pests and non-quarantine regulated pests)** of specified regulatory status and of defined taxonomic identity.
- With some pests, identification to genus may be sufficient, e.g. fruit flies in the genus *Bactrocera* or *Liriomyza* leaf miners, if a country lacks all species in the genus and all species could be of economic importance. If not, identification to genus will be necessary.
- For fungal and bacterial plant pathogens, some species in a genus might not be pathogenic to plants at all, and there are likely to be host specificities.
- Hence the importance of diagnostic and identification technology appropriate to the pest organisms in question.

# Laboratory capacity in relation to these principles

- Unfortunately, laboratory capacity for phytosanitary issues is the least developed overall in the CAREC region among the three SPS sectors.
- Even without actual laboratory inventories, the [comparative lists of quarantine pests](#) known to be present but partially distributed in some of the countries in the CAREC region illustrates the limited capacity to identify quarantine pests.
- All the organisms identified are insects, nematodes and mites relatively easily identified to the required level of detail, plant pathogens causing distinct and unique symptoms or with unique signs or weeds/invasive plants.
- Laboratory diagnostic work should not cause unnecessary delays to processing the import of goods so that the testing requirement is not considered as a non-tariff barrier (Article 8/Annex C of SPS Agreement).
- Similarly, fees charged for testing should be based on cost-recovery.

# Laboratory capacity investigated

- Entirely absent from these lists are pests requiring the use of laboratory techniques beyond microscopy. For many plant pathogens, traditional methods of isolation and cultivation on artificial media coupled with morphological examination by microscopy, classical biochemistry or basic serological tests like agglutination are inadequate to meet the current standards of identification required for valid regulatory action.
- With the exception of perhaps PRC (for which no information was made available and in which no access to laboratories was granted), none of the CAREC regions studied had even basic capacity to protect the country in question from quarantine pests beyond relatively easy-to-identify insects and a few plant diseases by symptoms or by morphology of the causal fungi.
- (No information was available from the regional countries not included in lists of quarantine pests).
- In some countries, identification to genus of nematodes has been achieved but this may not be adequate for valid regulatory action.
- Capacity to detect and identify viruses and phytoplasmas is lacking entirely.

# Consequences of limited laboratory capacity

- It is clear from **these lists of QPs** that the phytosanitary authorities will have no idea about what quarantine pests in the category of 'not identifiable with available techniques' are present in or absent from the territories within their jurisdiction.
- Overall, these lists are not reliable because of what is not reported' so phytosanitary authorities will have no idea about what quarantine pests in the category of 'not identifiable with available techniques' are present in or absent from the territories within their jurisdiction

# Why better phytosanitary laboratories are needed

- The neglect of phytosanitary diagnostic capacity reflects the long tradition of animal husbandry and veterinary services and only the recent emergence of horticulture in most of the CIS countries.
- The exceptions to this are Uzbekistan and Tajikistan.
- However, increased consumption of fresh vegetables and particularly fresh fruit is an indicator of rising urban prosperity. These commodities are of high value in international trade and so there are opportunities for regional countries to develop export trade in fruit and vegetables as well as supplying the domestic market.
- Hence the importance of phytosanitary diagnostic services going beyond the basic biosecurity need.

# Basic considerations for recommendations for national phytosanitary capacity upgrading

- Regional capacity considered in another session
- Basic [comprehensive inventory of equipment](#) for identification and diagnosis of quarantine pests has been drawn up
- Assumptions of trained staff, adequate infrastructure, biosecurity measures, ICT, adequate recurrent budget
- Recognises that many laboratories have microscopes with excellent optics but these need to be assessed for adaption for advanced techniques (e.g. fluorescence)



# Basic considerations for recommendations for national phytosanitary capacity upgrading

- Awareness creation of the value of horticultural products for domestic consumption and for export leading to prioritisation of investment in phytosanitary laboratory capacity.
- Countries with adequate financial resources should invest in creation of phytosanitary diagnostic capacity to provide at least the basic level of technology to secure borders against quarantine pests – inventory presented above
- Countries lacking the necessary resources should consult with donors on a bilateral basis once they have prioritised the need for enhanced phytosanitary diagnostic laboratory capacity – not realistic for any one donor to equip all countries

## Other Considerations

- Providing field-testing kits (modelled on home pregnancy testing) for **preliminary** testing for plant diseases. They are available for a wide range of plant pathogens. Primarily for use in surveillance for quarantine pests in country but they also have limited application at borders. These should not be used as replacement for full laboratory testing where available but would in the interim provide reliable indications of the need for more definitive testing.

# 'Laboratories' at BCPs

- There is also the question of 'laboratories' at the BCPs that most countries in the region claim to have or to aspire to.
- In reality, basic equipment such as stereomicroscope or mounted magnifying glass should be available in a room with good lighting and a purpose-built table for examination. This should not be seen as a 'laboratory' but as an **inspection and sampling facility** according to [minimum conditions](#).
- This then leads on to question of **post-entry quarantine (PEQ)** facilities for **planting material (germplasm)** that are very expensive to build and maintain in traditional form but may not be needed in view of availability of tissue culture (micropropagation) to replace traditional vegetative propagation and the value of pest risk analysis to source material of low risk.

# Recommendations for BCPs

- Additionally, border facilities should include inspection facilities ('laboratories') adapting the 'Minimum conditions' as a guide (Annex 2). The facilities include reliable electricity supply and communication facilities.
- PRA should be done (preferably on a coordinated regional basis) for importation of planting material:
  - Actual needs in relation to development of agriculture and horticulture
  - Sourcing to reduce pest risks
  - PRA for any proposed importation including needs for post-entry quarantine and diagnostic capacity
- Each country should develop basic tissue culture capacity as a pre-requisite for safe handling of imported germplasm.

# **Animal Health**

**DIAGNOSTIC CAPACITIES OF  
VETERINARY LABORATORY NETWORKS  
IN COUNTRIES OF THE CAREC REGION**

# Subjects

- **General state of veterinary laboratory networks in the CAREC region**
- **Developed veterinary laboratory networks in the CAREC region**
- **Developing veterinary laboratory networks in the CAREC region**
- **Least developed veterinary laboratory networks in the CAREC region**

**General state  
of veterinary laboratory networks  
in the CAREC region**



**Early detection and confirmation of suspect cases of diseases is essential to ensure their proper control and containment. Currently, numerous methods ranging from isolation and identification of causative agents to isolation and identification their RNA / DNA are currently available for detection and diagnosis of animal diseases.**

**Pathogen isolation is regarded as “the gold standard technique”, but it is not always easy to be implemented and is not rapid, thus not adequate for an early detection system. Therefore for running early detection system veterinary services prefer to use methods of diagnosis based on HAT, CFT, AGID, IT, ELISA and PCR**

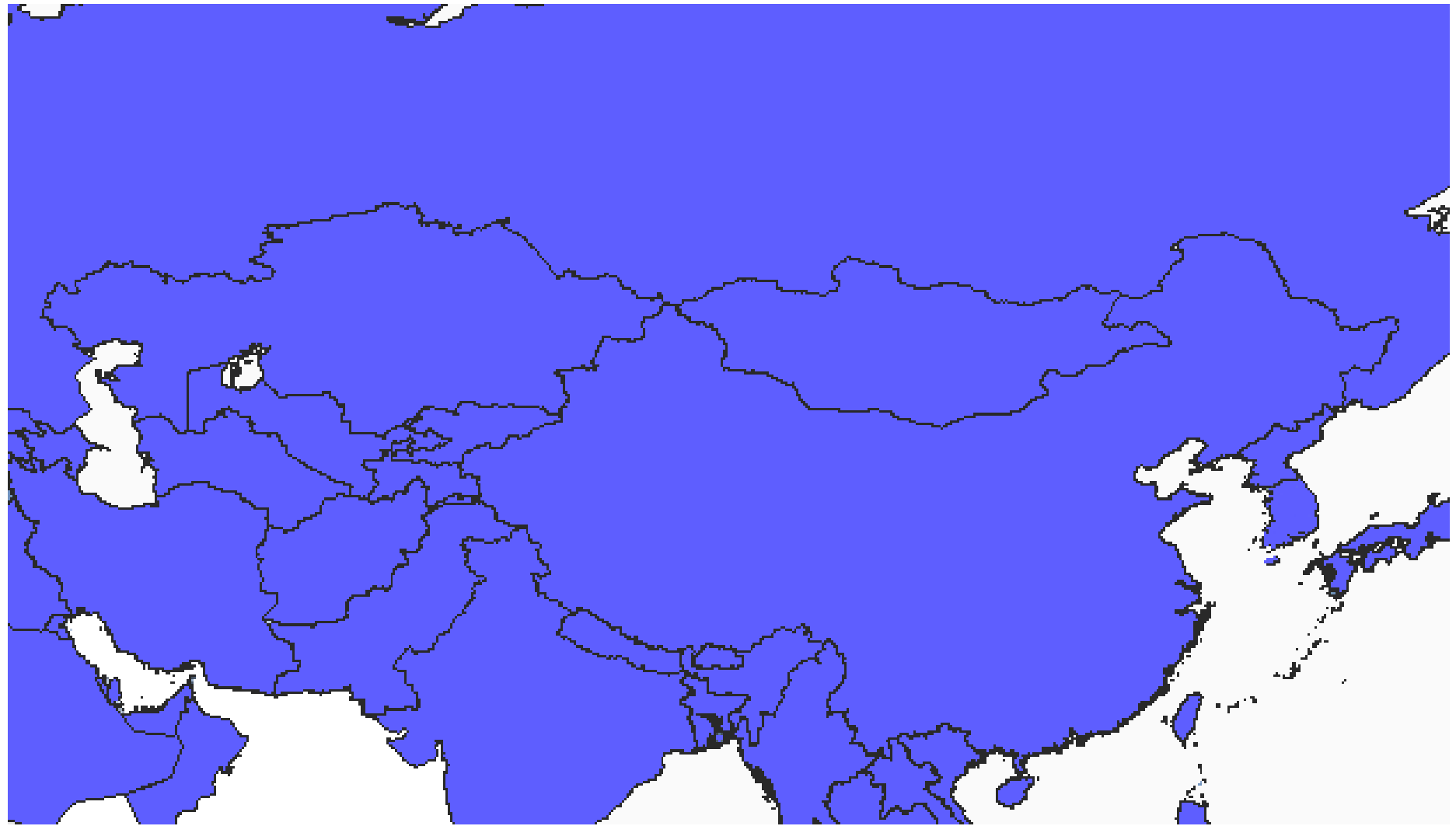
**To operate early detection system the national veterinary laboratory network should have not only relevant equipment and consumables, but also properly trained laboratory personnel, adequate conditions for testing and system for laboratory quality management to ensure the accuracy, validity and reliability of test results.**

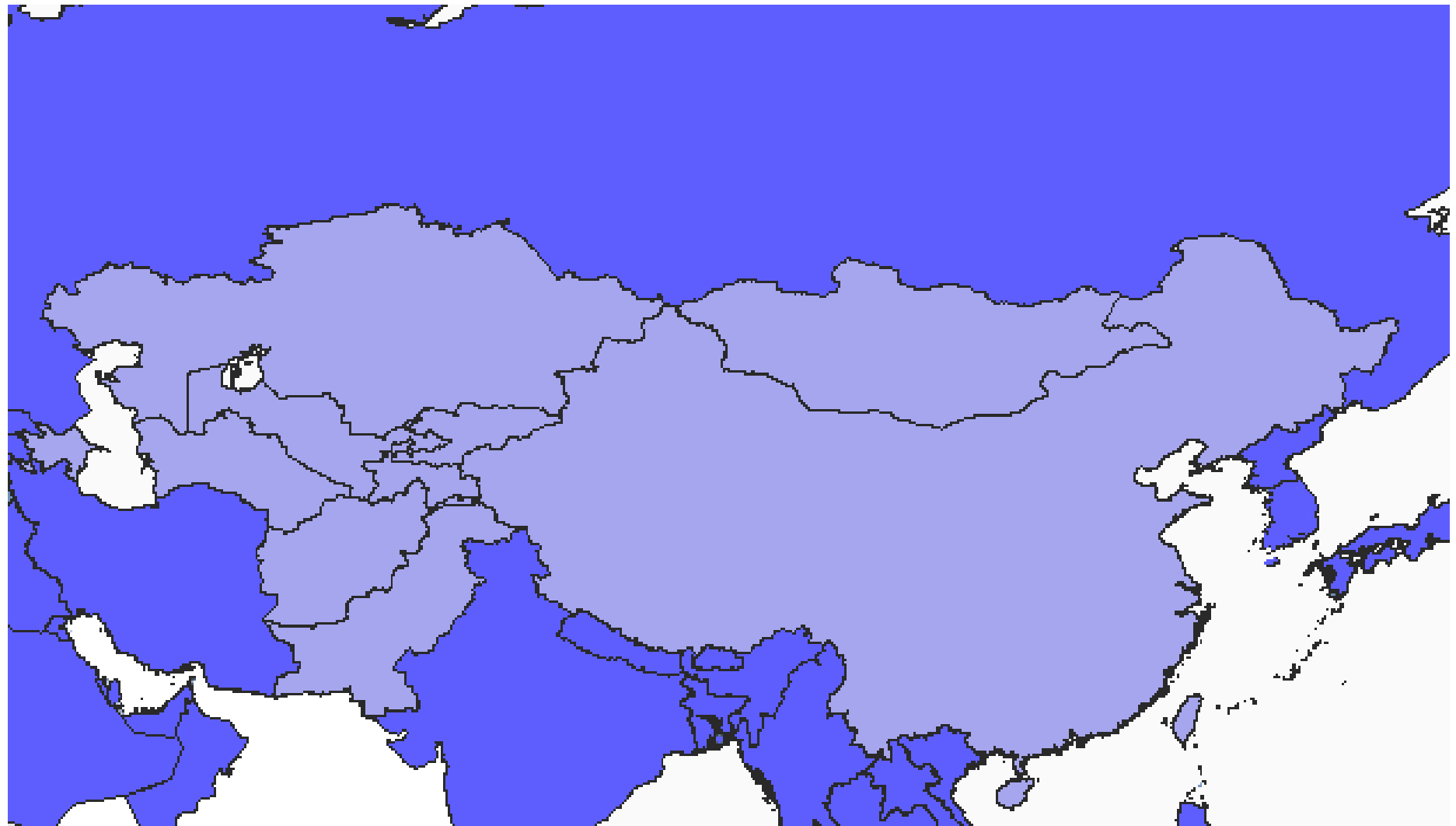
**The assessment of capacities of veterinary laboratory networks in countries of the CAREC region indicated, that very few of them are currently capable of meeting criteria above. Based on findings of the assessment, veterinary laboratory networks have been grouped into 3 categories: 1) developed; 2) developing; and 3) less developed.**

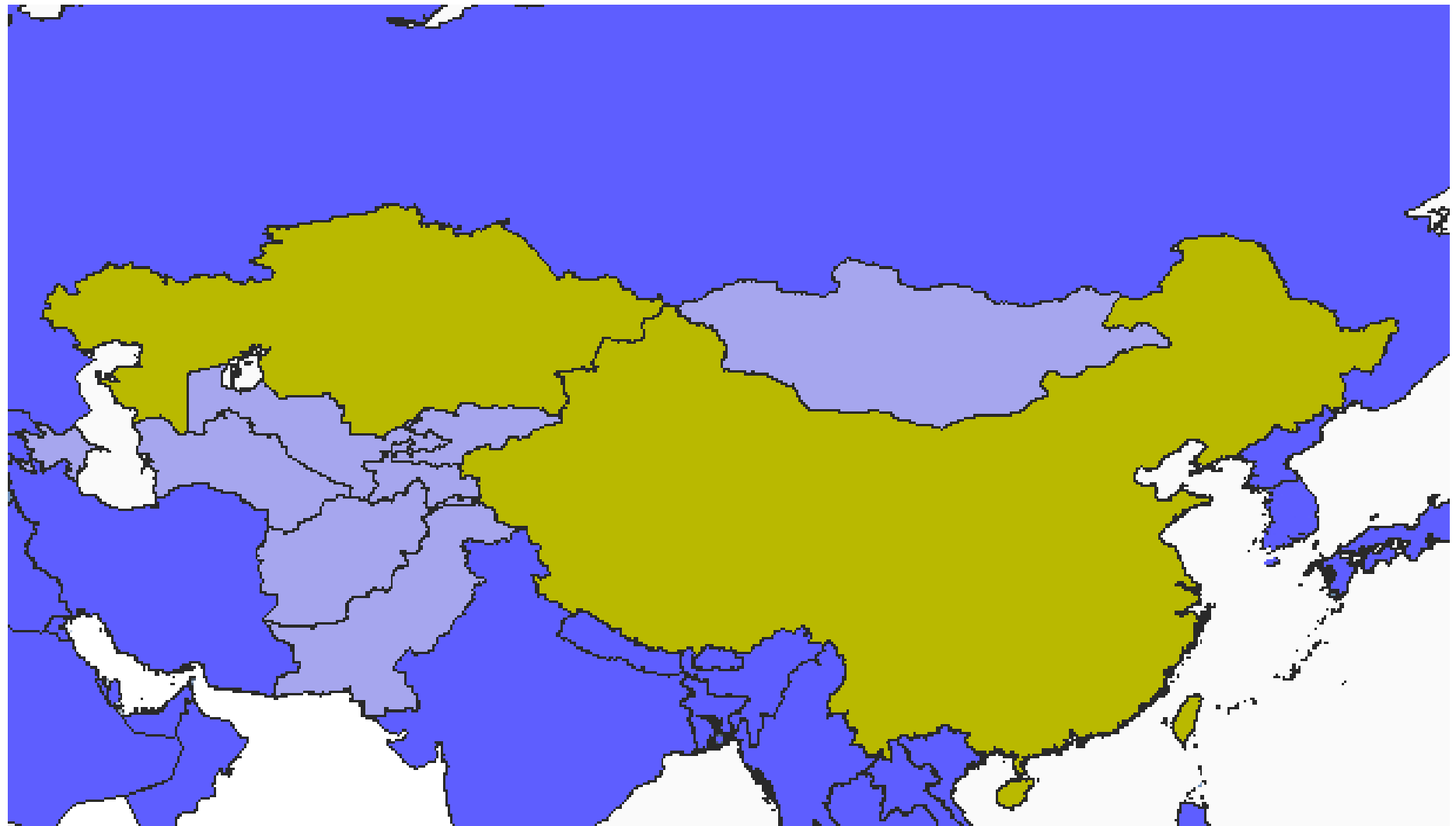
## Capacities of veterinary laboratory networks



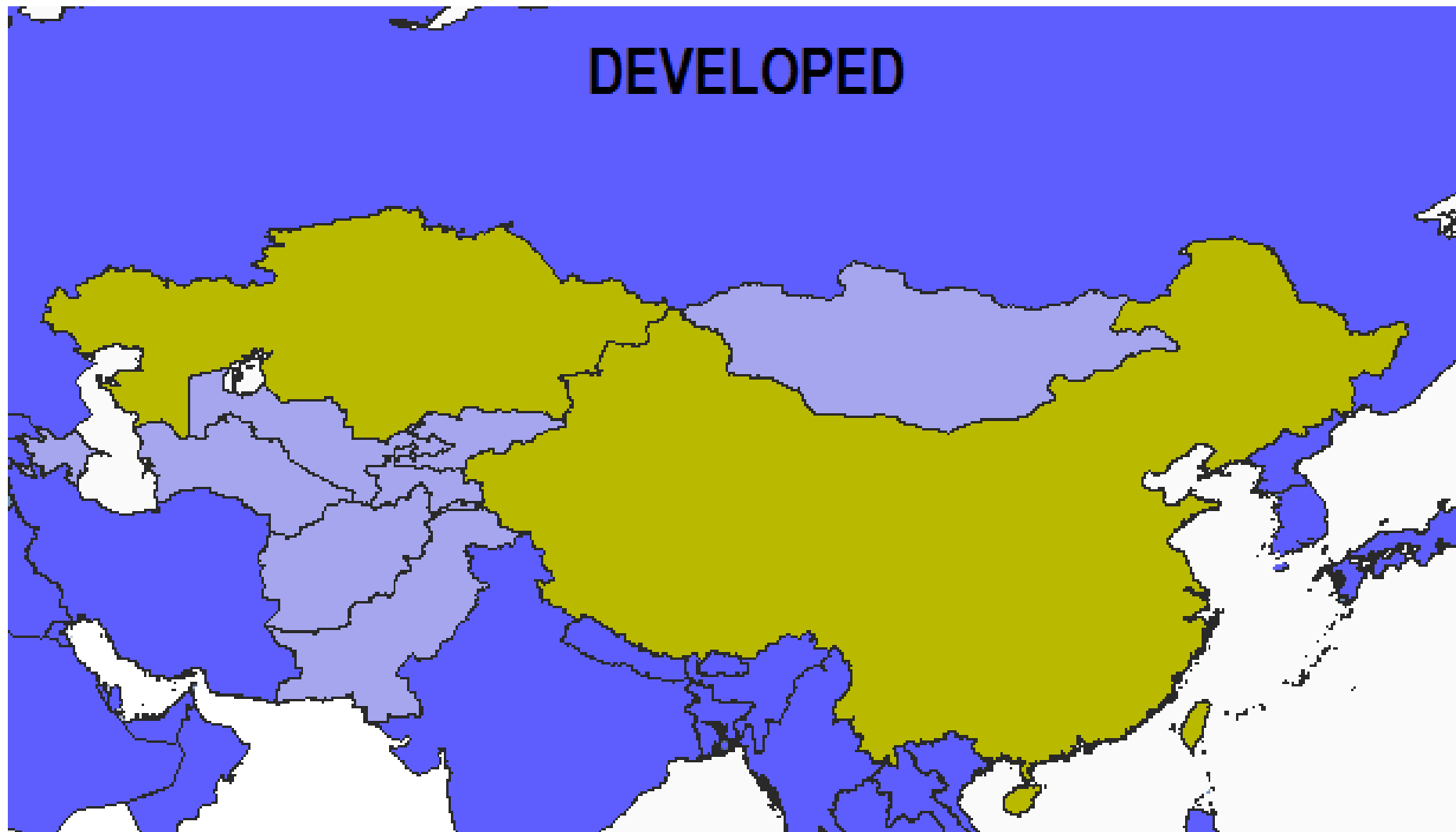
**Developed veterinary laboratory networks  
in the CAREC region**







# DEVELOPED





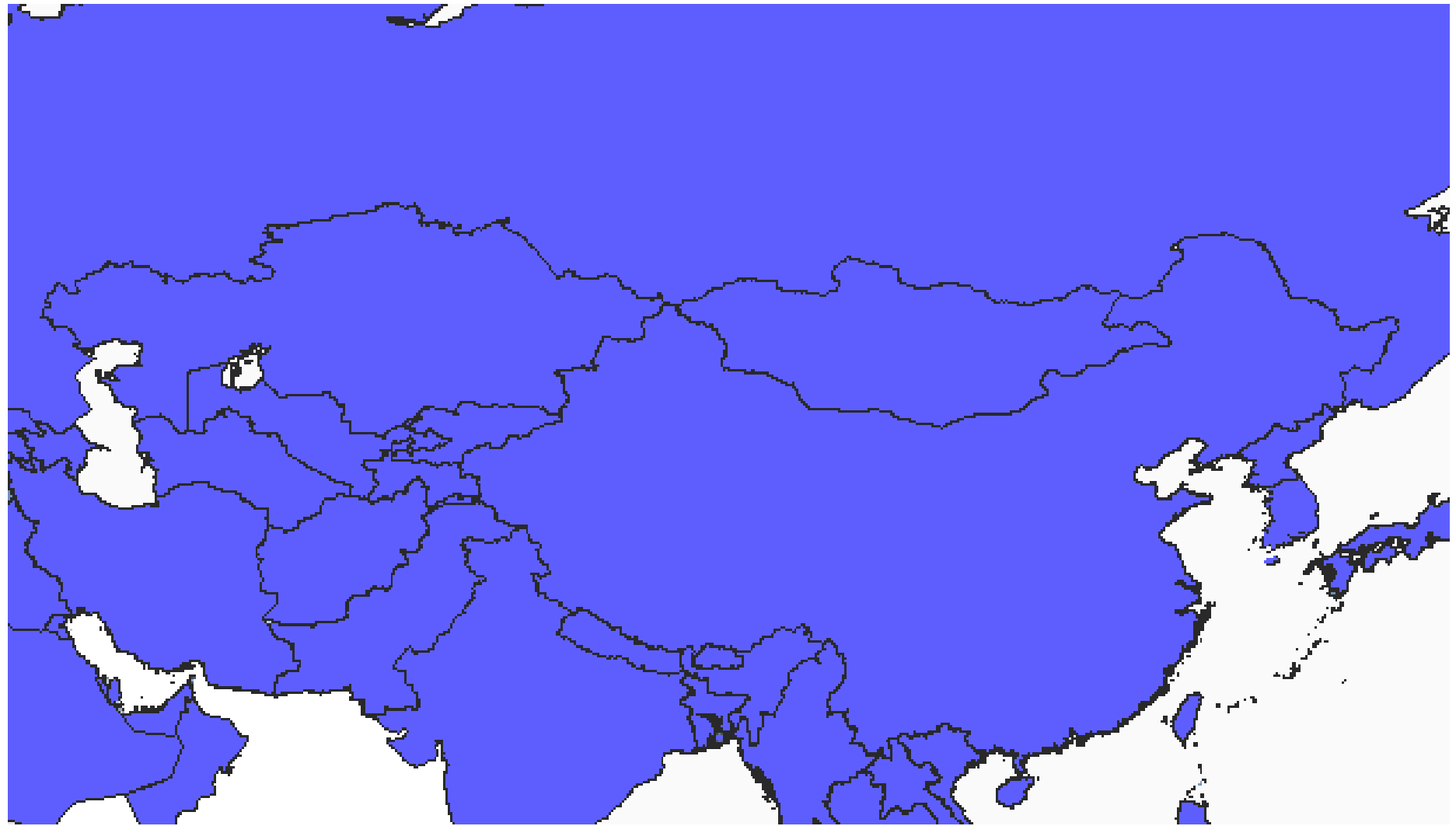


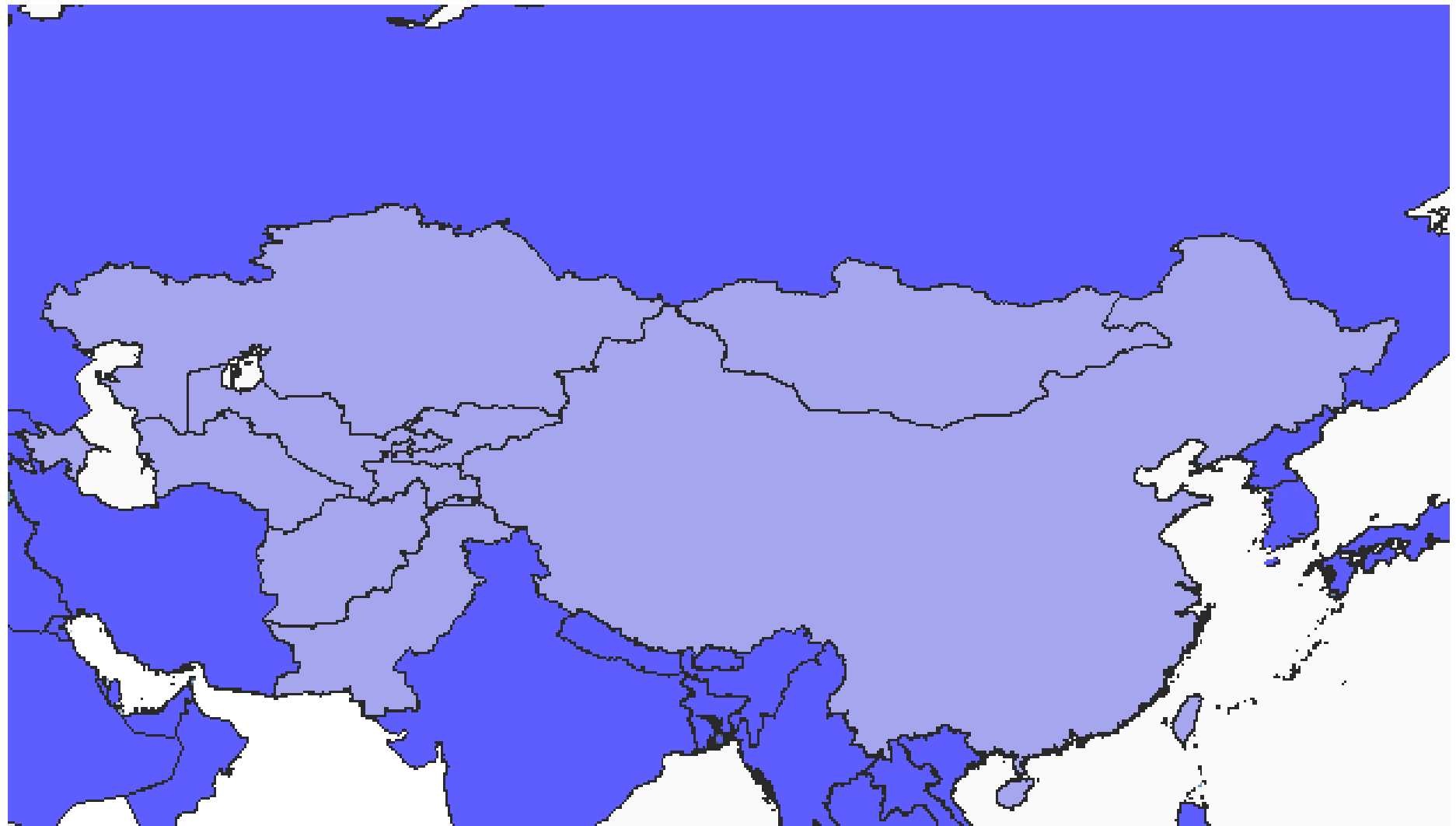
- **Laboratories at all levels have relatively adequate infrastructures, including facilities, premises, systems for constant supply of electricity and water and operate waste management systems.**
- **Laboratories at regional levels provided with equipment and diagnostics and consumables for early detection and tentative diagnosis of endemic diseases using OIE-listed alternative tests.**
- **Laboratories at central level provided with equipment and diagnostics]and consumables for early detection and tentative diagnosis of endemic diseases using OIE-listed prescribed tests.**

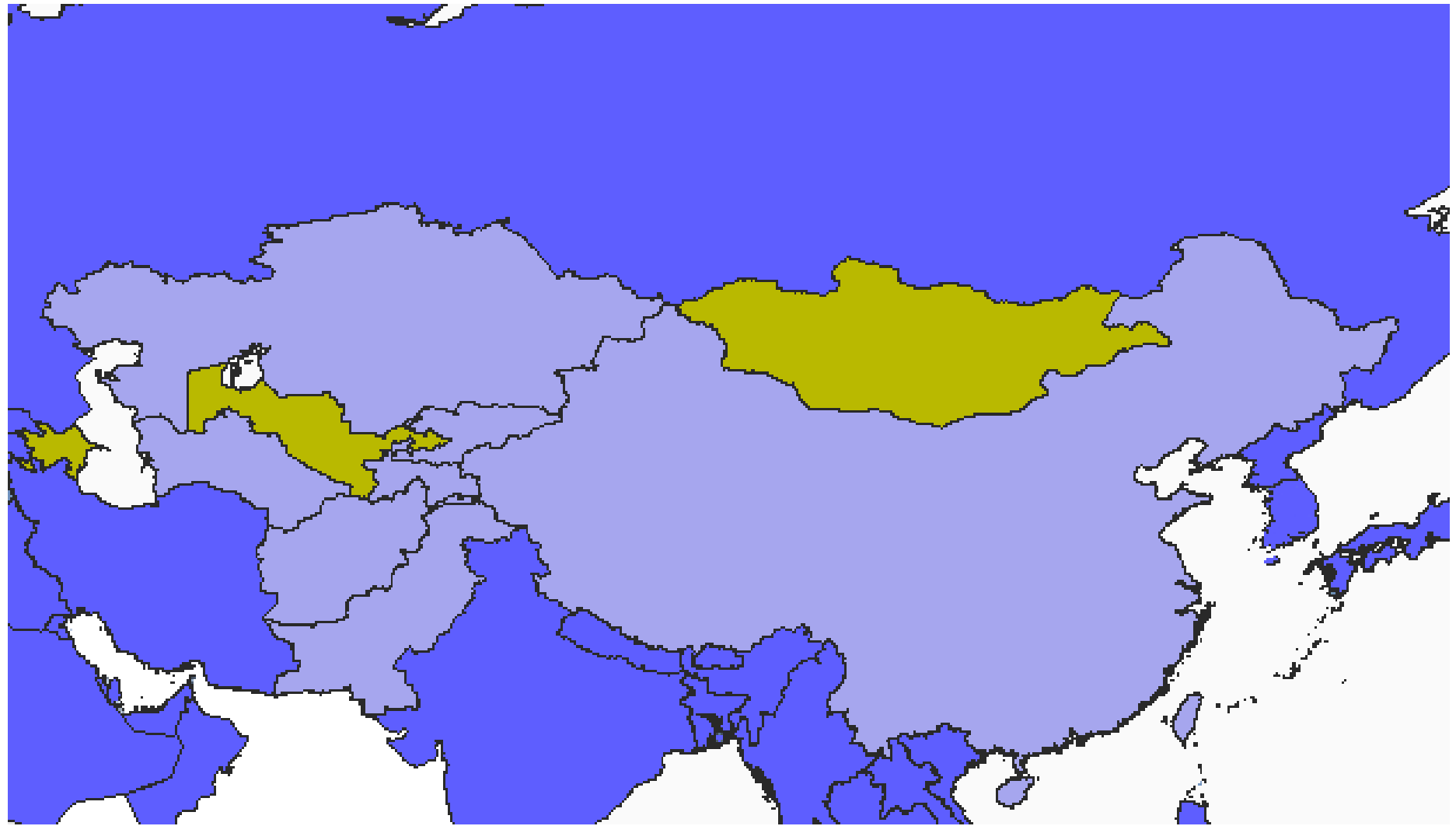


- **Many of the laboratories at all levels have quality management system and operate at BSL 1, while some of the laboratories at provincial and central levels operate at BSL 2 and 3 levels.**
- **Most of the laboratory personnel at all levels possess adequate skills for detection and tentative diagnosis by using classical diagnostic methods (bacteriology, serology, histopathology etc.).**
- **Most of the laboratory personnel at central and provincial levels possess adequate skills for detection and confirmatory diagnosis by using advanced diagnostic methods (AGID, ELISA, PCR, etc.).**

# **Developing veterinary laboratory networks in the CAREC region**

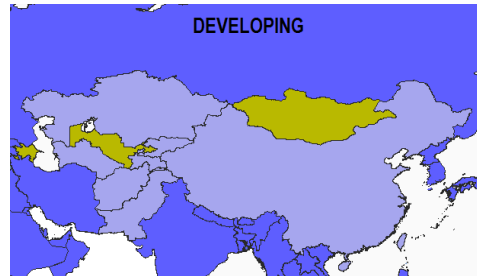






# DEVELOPING





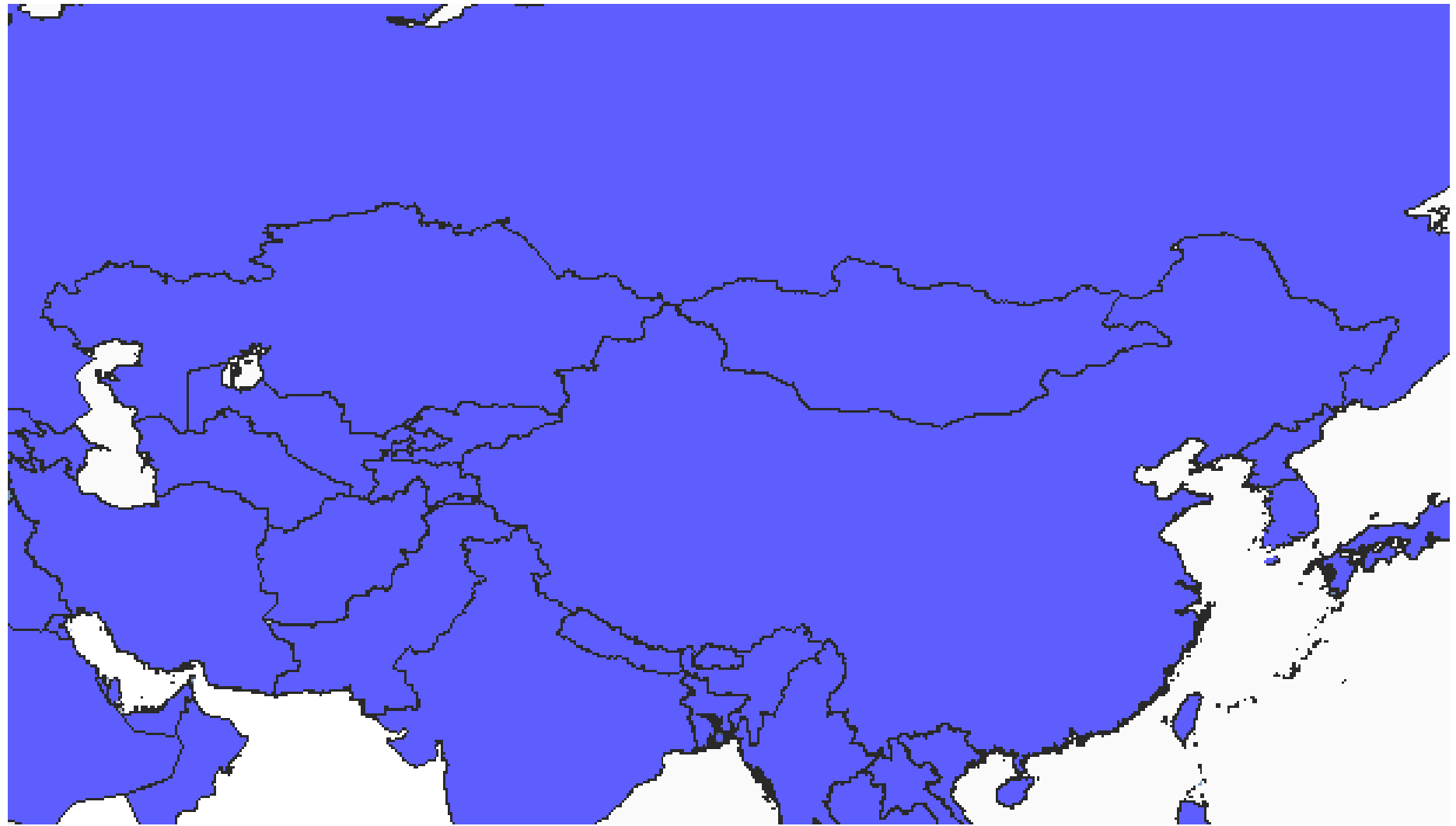
- **Infrastructures of many laboratories at all levels are inadequate and insufficient in terms of facilities, premises, systems for constant water and electricity supply and waste management.**
- **Only some of the laboratories at regional levels have equipment, diagnostics and consumables for early detection and tentative diagnosis of endemic diseases using OIE-listed alternative tests.**
- **Laboratories at central level have equipment and diagnostics and consumables for early detection and tentative diagnosis of only a few endemic diseases by means of OIE-listed prescribed tests.**

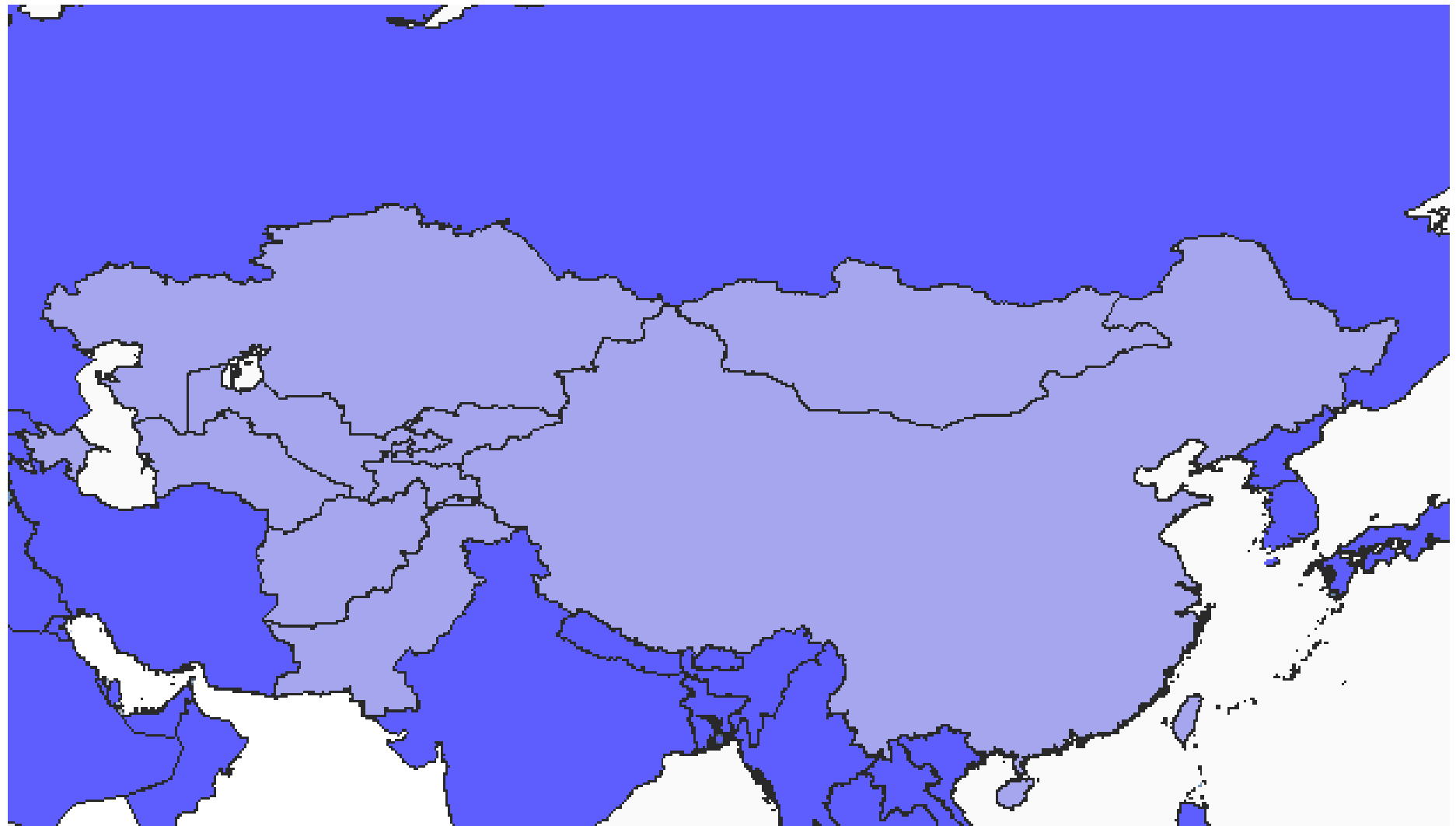


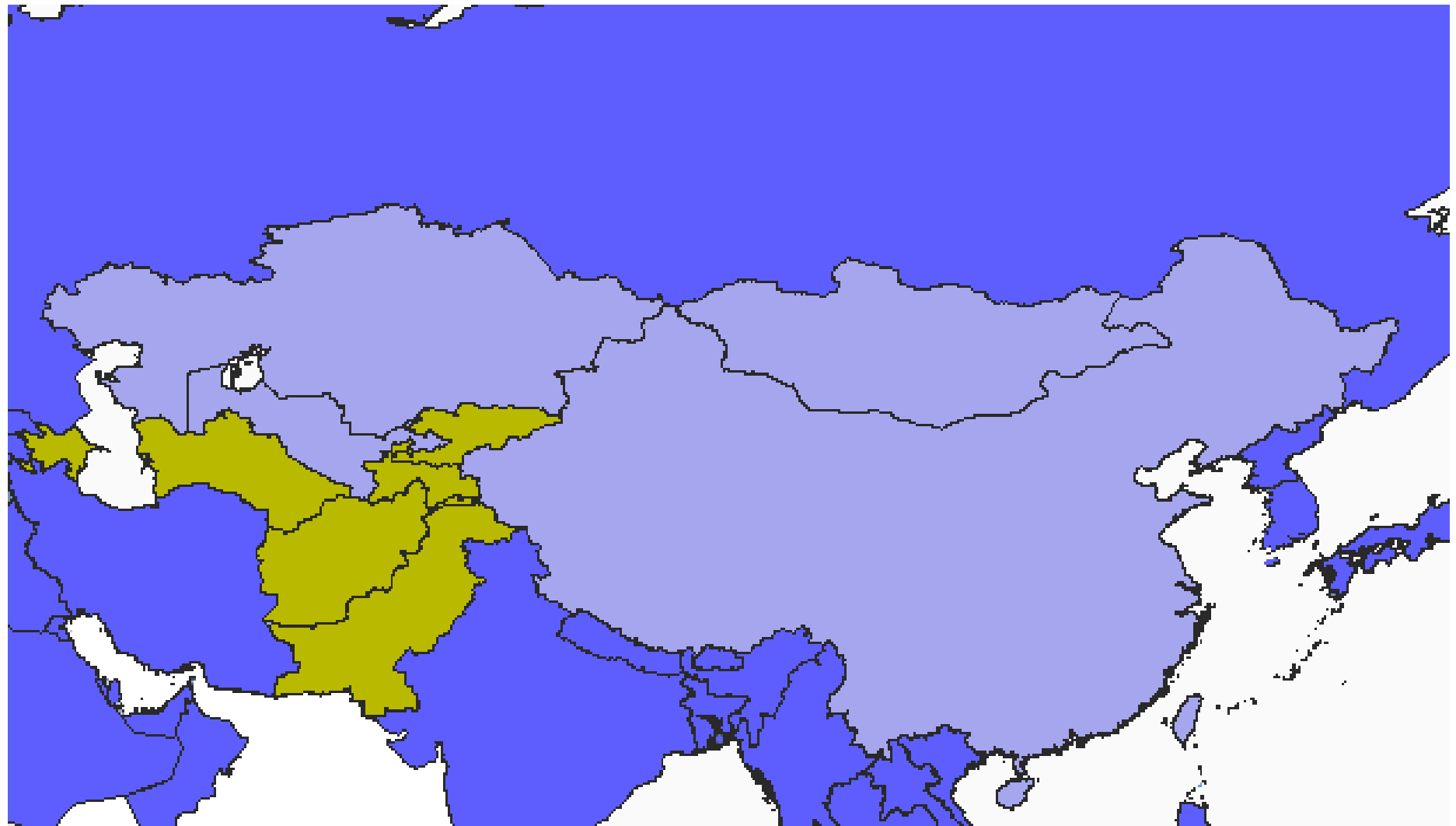


- **Only a few laboratories in the country have quality management system and operate at BSL 1 and 2. Some of the laboratories at central level also possess facilities for operation at BSL 3.**
- **Only some of the laboratory technicians at regional level possess adequate skills for detection and tentative diagnosis by using combination of classical and advanced methods of diagnosis.**
- **Most of the laboratory technicians at central possess adequate skills for early detection and confirmatory diagnosis by using combination of classical and advanced methods of diagnosis.**

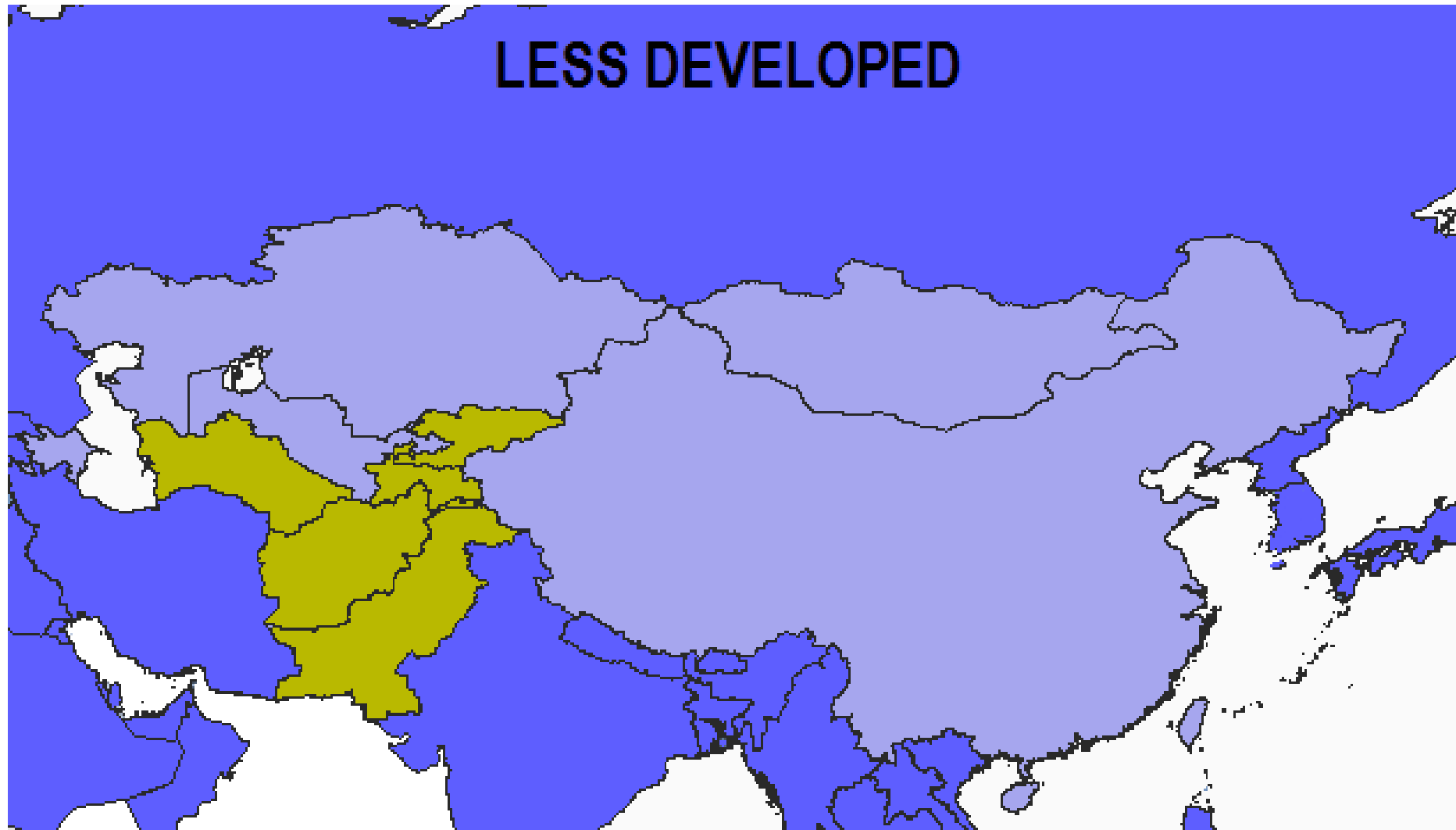
**Least developed veterinary laboratory networks  
in the CAREC region**

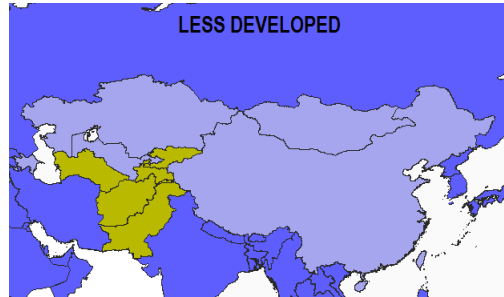




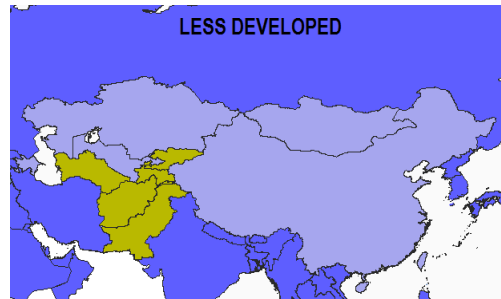


# LESS DEVELOPED





- **Most of the laboratories at all levels don't have adequate infrastructures and struggle with the lack of facilities, premises, systems for water and electricity supply and waste management.**
- **Most of the laboratories at regional levels don't have equipment and diagnostics and consumables for detection and tentative diagnosis of endemic diseases using OIE-listed alternative tests.**
- **Laboratories at central level have equipment, diagnostics and consumables for early detection and tentative diagnosis of only a few endemic diseases using OIE-listed alternative tests.**



- **None of the laboratories in the country has capacity for operation of quality management system. Only laboratories at central level have capacities that allow operating close to BSL 1.**
- **Only some of the laboratory technicians at regional level possess adequate skills for detection and tentative diagnosis by using classical methods of diagnosis (serology, bacteriology etc.).**
- **Most of the laboratory technicians at central level are skilled in detection and tentative diagnosis by using classical methods of diagnosis, but lack skills for application of advanced techniques.**



# **Food Safety**

# Infrastructure of the Laboratories

## Findings

- In general, still fragmented structure of the various laboratories.
- Mongolia : With the National Laboratory for Food Safety, Mongolia has a State of the Art laboratory facility.

## Recommendations

- Further rationalisation of laboratories is required.
- National Reference laboratory for Food Safety in Mongolia is a benchmark laboratory for the region.

# Equipment for Food Microbiology

## Findings

- Methodologies are classical to analyse pathogenic bacteria
- Emerging pathogenic bacteria such as the pathogenic strains of E coli and/or strains of Salmonella are not analysed.
- There is no or limited capacity to analyse Campylobacter and toxins of Staphylococcus aureus.
- No measurement of water activity (  $A_w$  )
- *What solutions are proposed?*

# VIDAS or Mini VIDAS equipment



# VIDAS or Mini VIDAS equipment

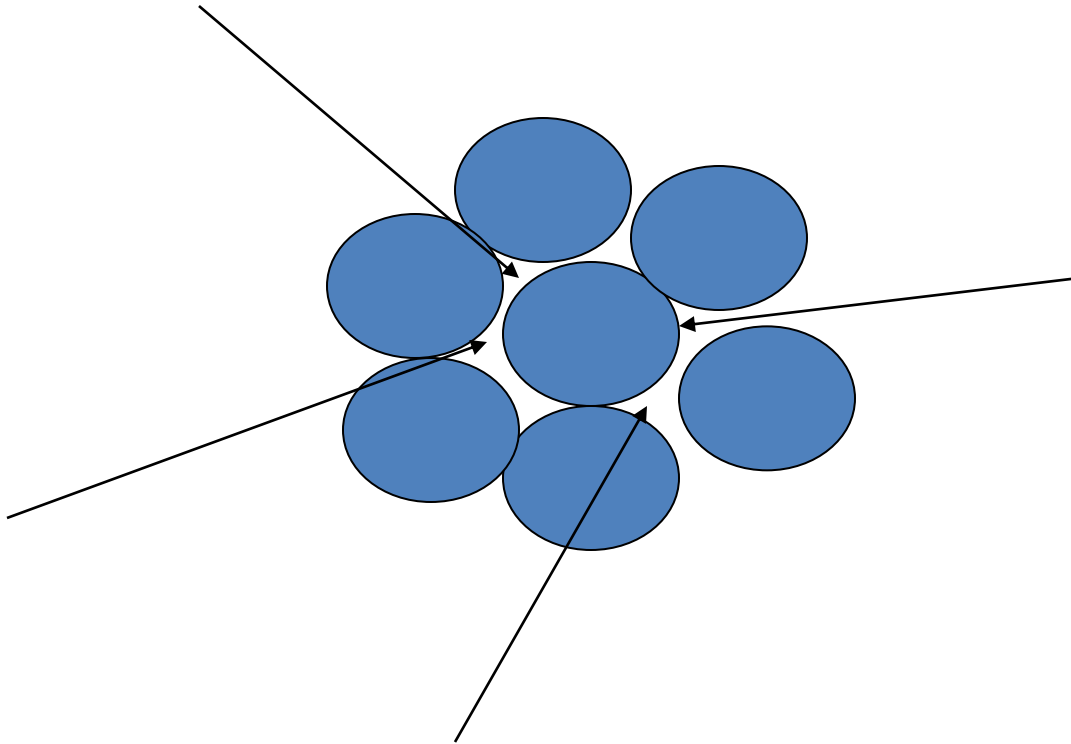
Target	time-to-result
<i>Salmonella</i> spp	Next day
<i>Salmonella</i> spp	48 hours
<i>Listeria</i> spp	Next day
<i>Listeria</i> spp	48 hours
<i>Listeria monocytogenes</i>	Next day
<i>Listeria monocytogenes</i>	48 hours
<i>Listeria</i> spp & <i>L. monocytogenes</i>	48 hours
<i>E. coli</i> O157 (incl. H7)	Same day
<i>Campylobacter</i> spp	48 hours
Staphylococcal enterotoxins A to E	Same day

# Water Activity for food microbiology

## Water activity ( $A_w$ )

- Know your food product
  - Intrinsic values such as pH , Moisture content, and  $A_w$  must be known
  - Step 2 of 12 HACCP steps: Product specification.
  - $A_w$  is not known in Central Asia
- Simple definition of  $A_w$ 
  - "Free" water in the product

# Water activity



# Water activity, Pathogens and Food products

- *Campylobacter* – 0.98
- *Aeromonas* – 0.96
- *Listeria* – 0.94
- *Escherichia* - 0.93
- *Salmonella* – 0.93
- *Bacillus* – 0.90
- *Vibrio* - 0.86
- *Staphylococcus* 0.85
- *Aspergillus* – 0.77
- *Penicillium* – 0.62
  
- No Microbiological proliferation < 0.60

Fresh fish – 0.986

Fresh fruit - 0.98

Fresh meat – 0.98

Eggs - 0.97

Bread - 0.94

Salami – 0.91

Sweetened Condensed Milk 0.82 – 0.84 (0.87)

Dried figs – 0.72

Chocolate – 0.69

Flour – 0.575

Dried soup – 0.42

Sugar – 0.19

Crackers – 0.1

Suitable  $a_w$  for growth of most pathogens

Some bacteria, yeasts and moulds



# Aw meters



# Recommendations on Aw

- Essential laboratories in the country must be equipped with Aw meter.
- Food inspectors must understand Aw.
  - Its is not it the curriculum of Veterinarians and Medical Doctors

# Equipment analysing chemical contaminants.

## Findings

- Common chemical contaminants are analysed such as heavy metals, pesticides and mycotoxins and also melamine
- Some very classical methods are applied such as TLC ( Thin layer Chromatography) for analysis of pesticides and mycotoxins.
- More emerging chemical contaminants such as PCBs Dioxins, PAH and 3 MCPD are not analysed.

**Matrix** prepared on list of equipment needed for individual countries (attachment to the report)

- Essential component in the budget: Training