

# An Undying Legacy

## Nuclear Legacy Sites in the Kyrgyz Republic

### Background



Throughout the second half of the 20<sup>th</sup> Century, uranium mines throughout the Kyrgyz Soviet Socialist Republic provided inputs for Soviet nuclear missiles. The Republic also hosted a uranium mill, which processed mined uranium ore into usable fuel. Since 1991, these sites have fallen into disrepair, posing significant health, environmental, and security risks to the region. These risks are exacerbated by the presence of fault lines throughout the country, increasing the likelihood of a major earthquake hitting the region, which could cause the release of radioactive materials from these sites into regional water sources.

### Methods

The project aims to identify the most vulnerable nuclear legacy sites in the Kyrgyz Republic. In determining vulnerability, four criteria are applied: 1) Close proximity to fault lines, 2) Close proximity to previous earthquake epicenters, 3) Close proximity to rivers, and 4) Highly rugged terrain. All results were reclassified to a scale of 1-5, with 5 being the highest level of vulnerability. The Raster Calculator was applied to create an additive vulnerability model, with scores ranging from 5-20. Proximity to fault lines and rivers were given the highest weight in the vulnerability analysis.

#### Proximity to Fault Lines and Rivers

The Euclidean Distance tool was applied to determine areas in the Kyrgyz Republic in close proximity to fault lines and rivers.

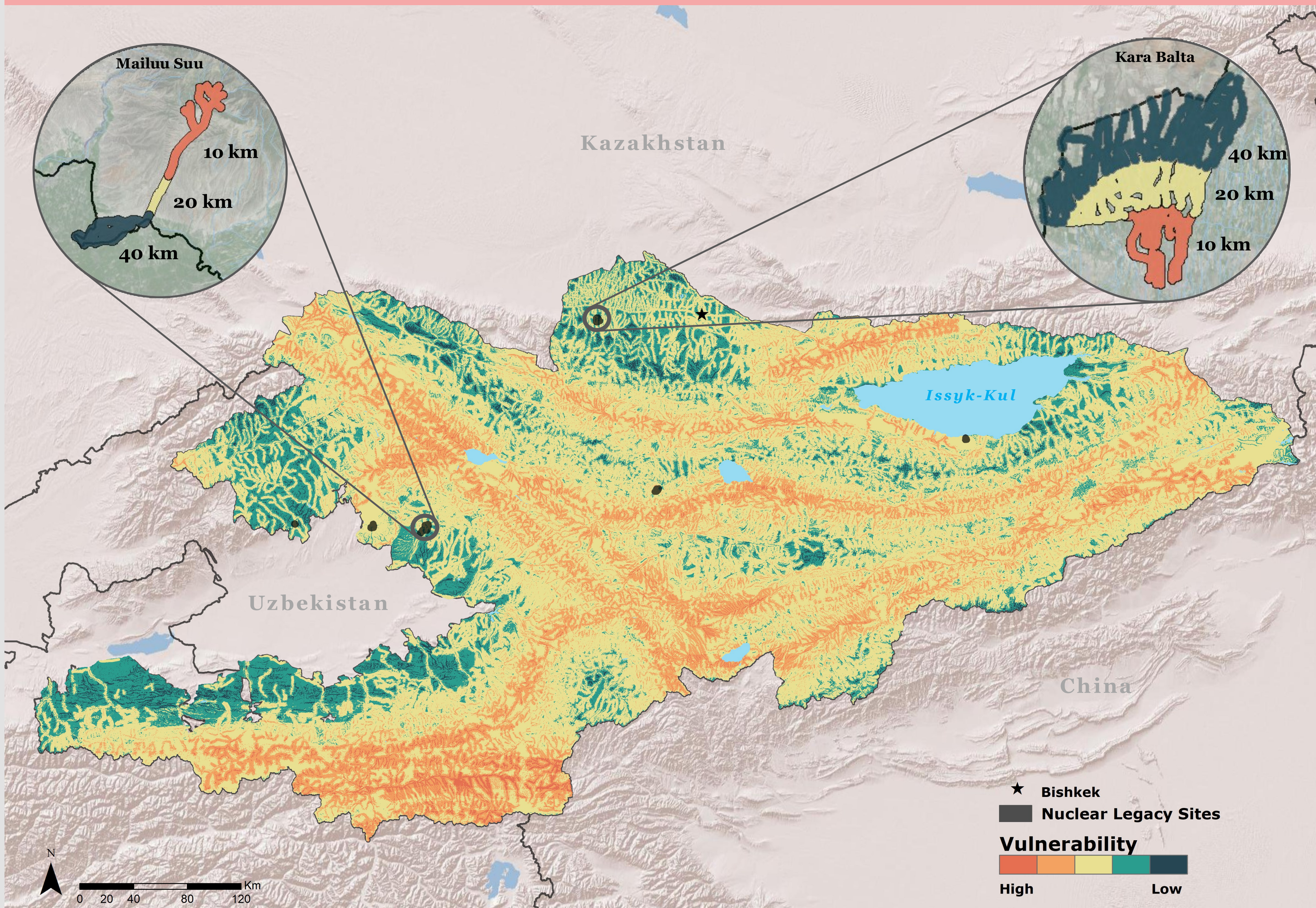
#### Proximity to Earthquake Epicenters

In analyzing proximity to past earthquake epicenters, only earthquakes with a magnitude of 4.5 and above were considered. The Kernel Density tool was applied to determine areas in the Kyrgyz Republic with the highest concentration of past earthquakes.

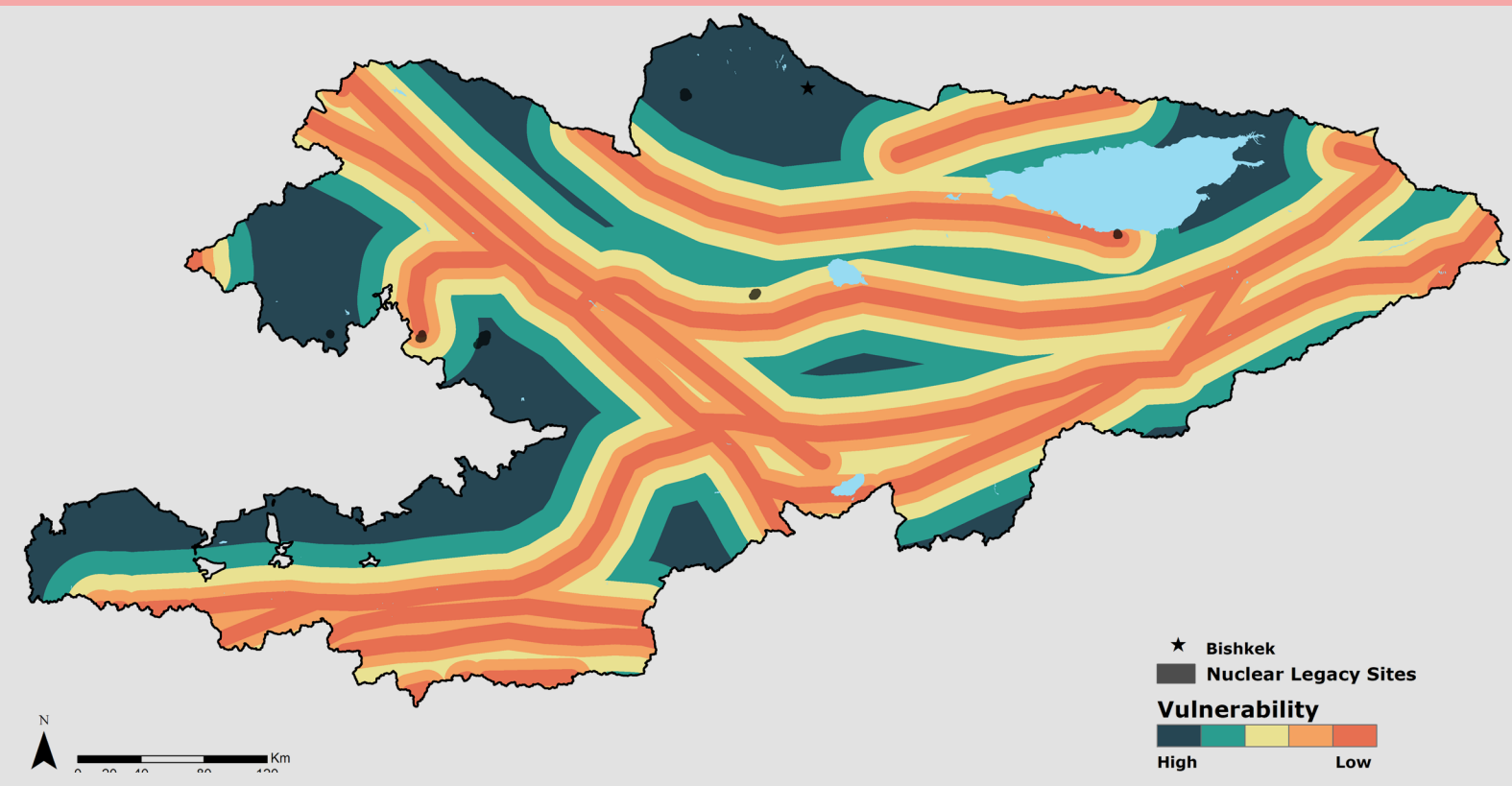
#### Terrain Ruggedness

To determine ruggedness, the Focal Statistics tool was utilized to find maximum, minimum, and mean elevation. The formula  $(\text{Mean} - \text{Min}) / (\text{Max} - \text{Min})$  was applied to calculate ruggedness.

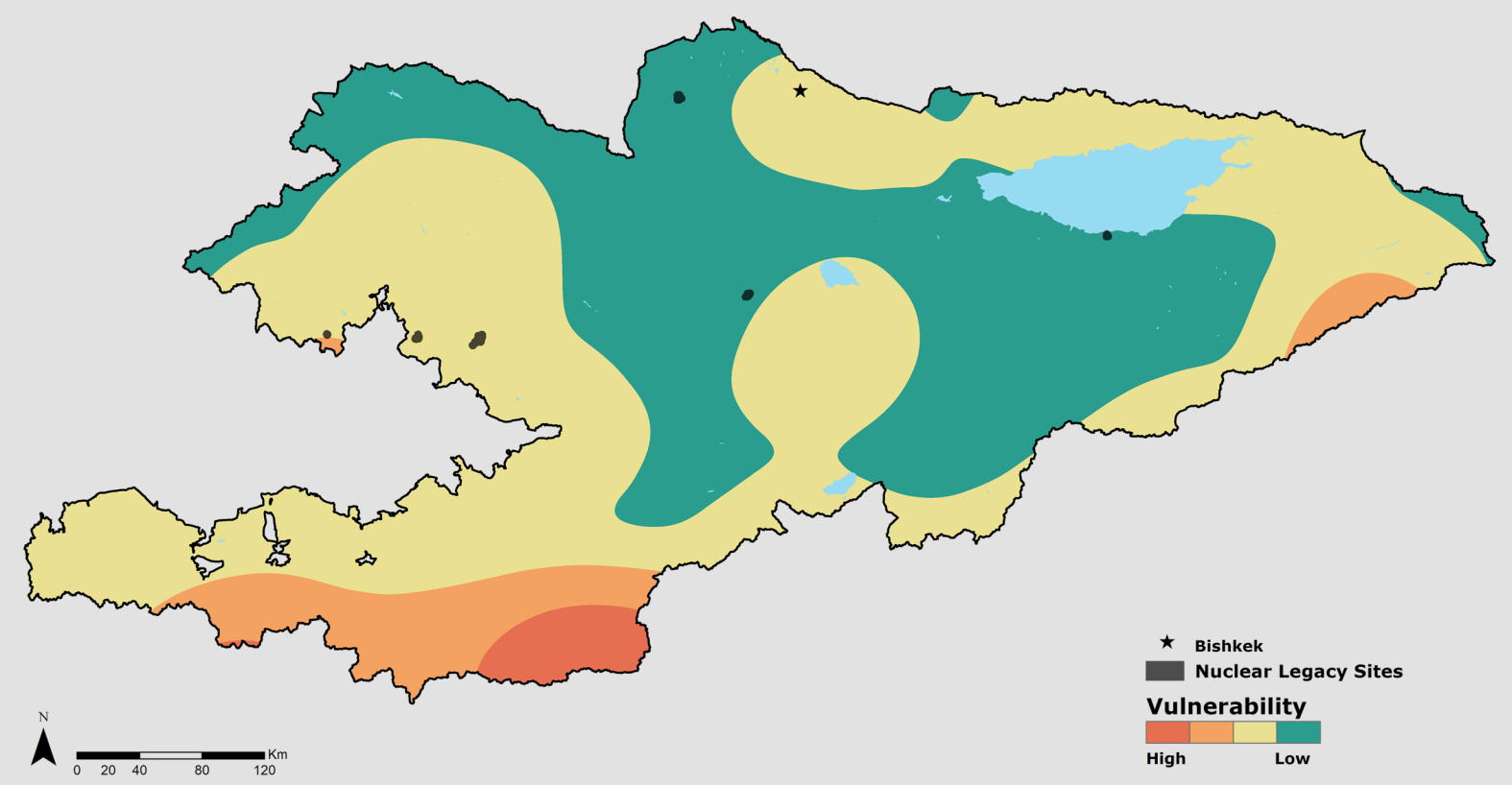
### Vulnerability Analysis



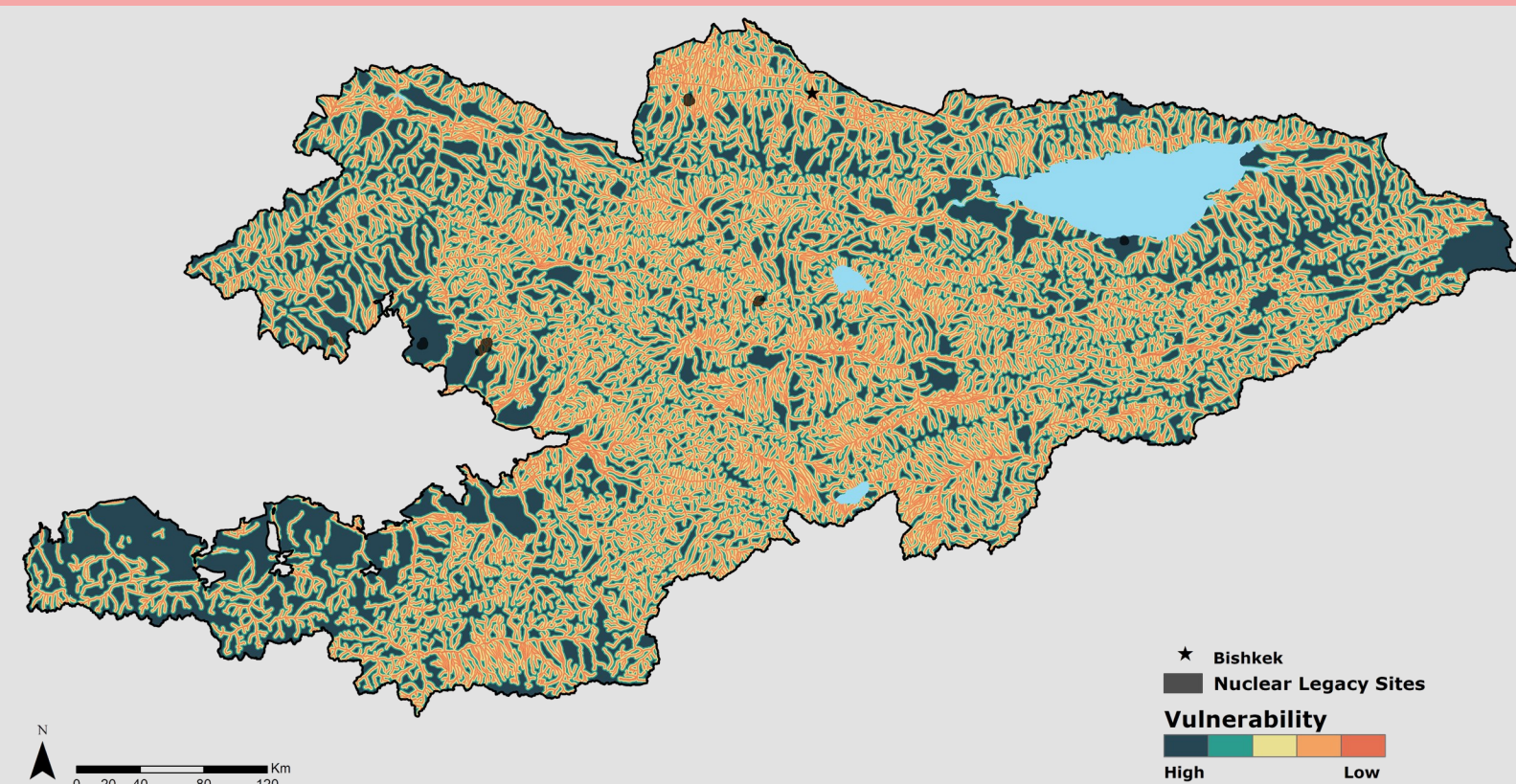
#### Fault Lines



#### Epicenters



#### Rivers



#### Ruggedness



### Results

After constructing the vulnerability model, the Zonal Statistics tool was applied to determine mean vulnerability scores for six nuclear legacy sites:

| Site       | Mean Score |
|------------|------------|
| Ming Kush  | 2.82       |
| Kyzyl Djar | 2.79       |
| Kadji Sai  | 2.74       |
| Shekaftar  | 2.56       |
| Mailuu Suu | 2.49       |
| Kara Balta | 2.44       |

While vulnerability scores are one factor in determining remediation priorities, it is also important to understand potential impacts of nuclear contamination around these sites. This project calculated how many people and how much cropland might be impacted if nuclear materials seep into local water sources.

In determining these numbers, four impact zones were analyzed: land directly surrounding the legacy sites, land 10 km downstream from the sites, land 20 km downstream from the sites, and land 40 km downstream from the sites.

