

Annex 16

Maps of Potential Forest Investments

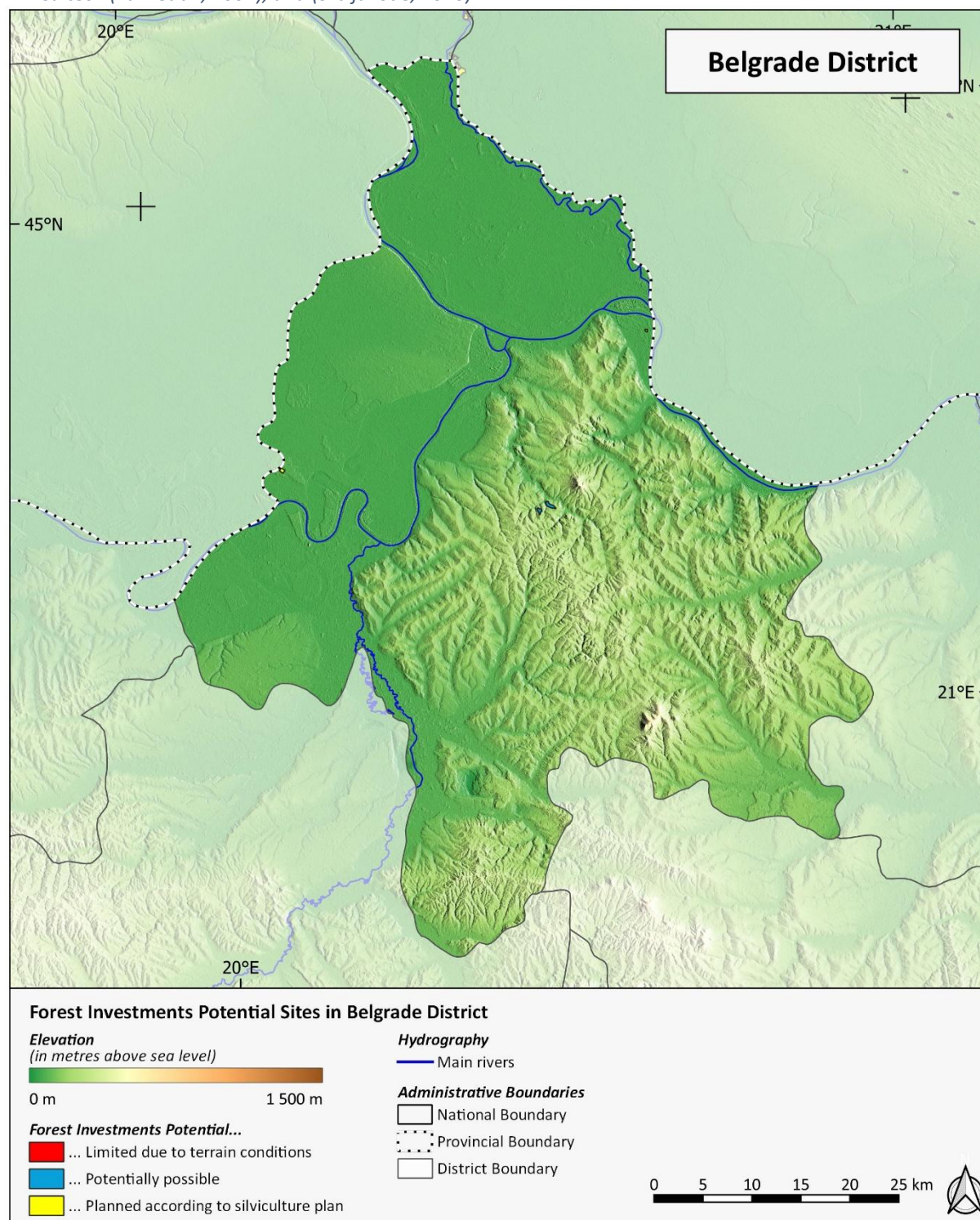
For the GCF-FAO Project “Enhancing the resilience of Serbian forests to ensure energy security of the most vulnerable while contributing to their livelihoods and carbon sequestration (FOREST Invest)”

The designations employed and the presentation of material in this document do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The FAO Regional Office for Europe and Central Asia appointed the Forestry Institute in Belgrade to identify forest investments potential sites. This preliminary study, called the AffSerb study, selected 909 sites throughout Serbia using a comprehensive GIS analysis of available digital data on forest management, digital cadaster maps, digital terrain model (DTM), as well as other local information. These sites are distributed over 20 of the 30 districts of Serbia and are presented by districts in Figure 1 to 20.

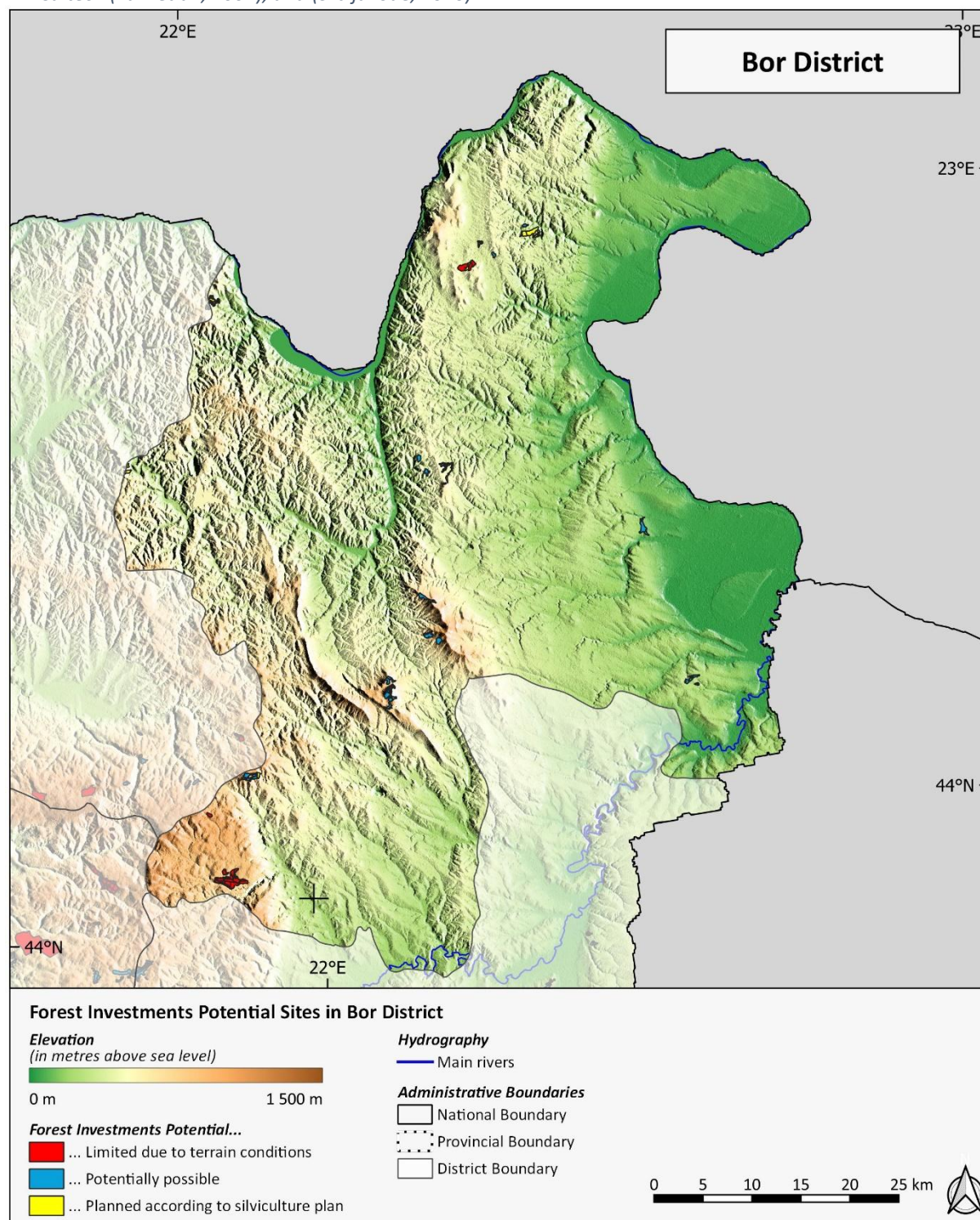
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Figure 1 – Potential afforestation sites in the Belgrade District, provided by the AffSerb preliminary study¹
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



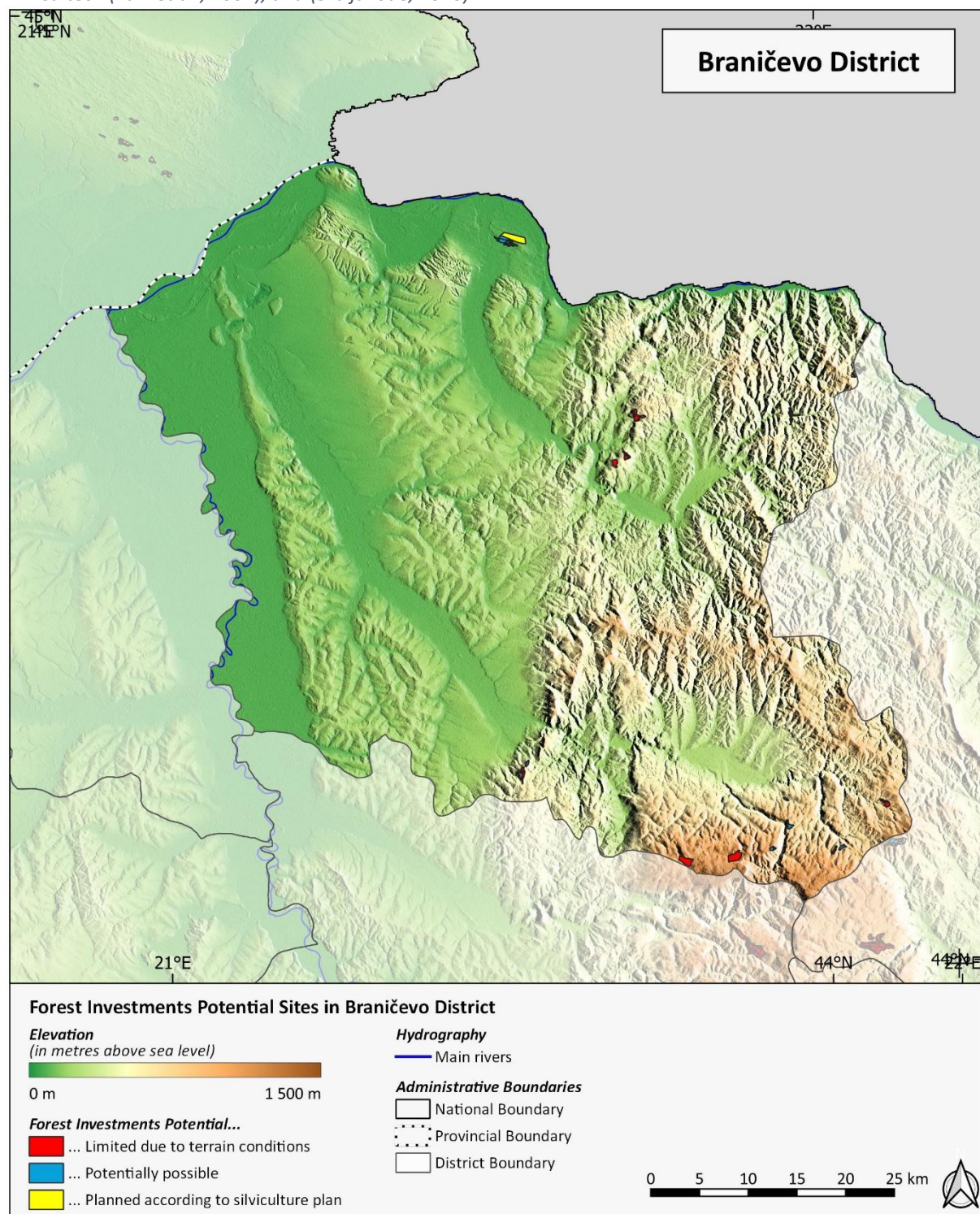
¹ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 2 – Potential afforestation sites in the Bor District, provided by the AffSerb preliminary study²
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



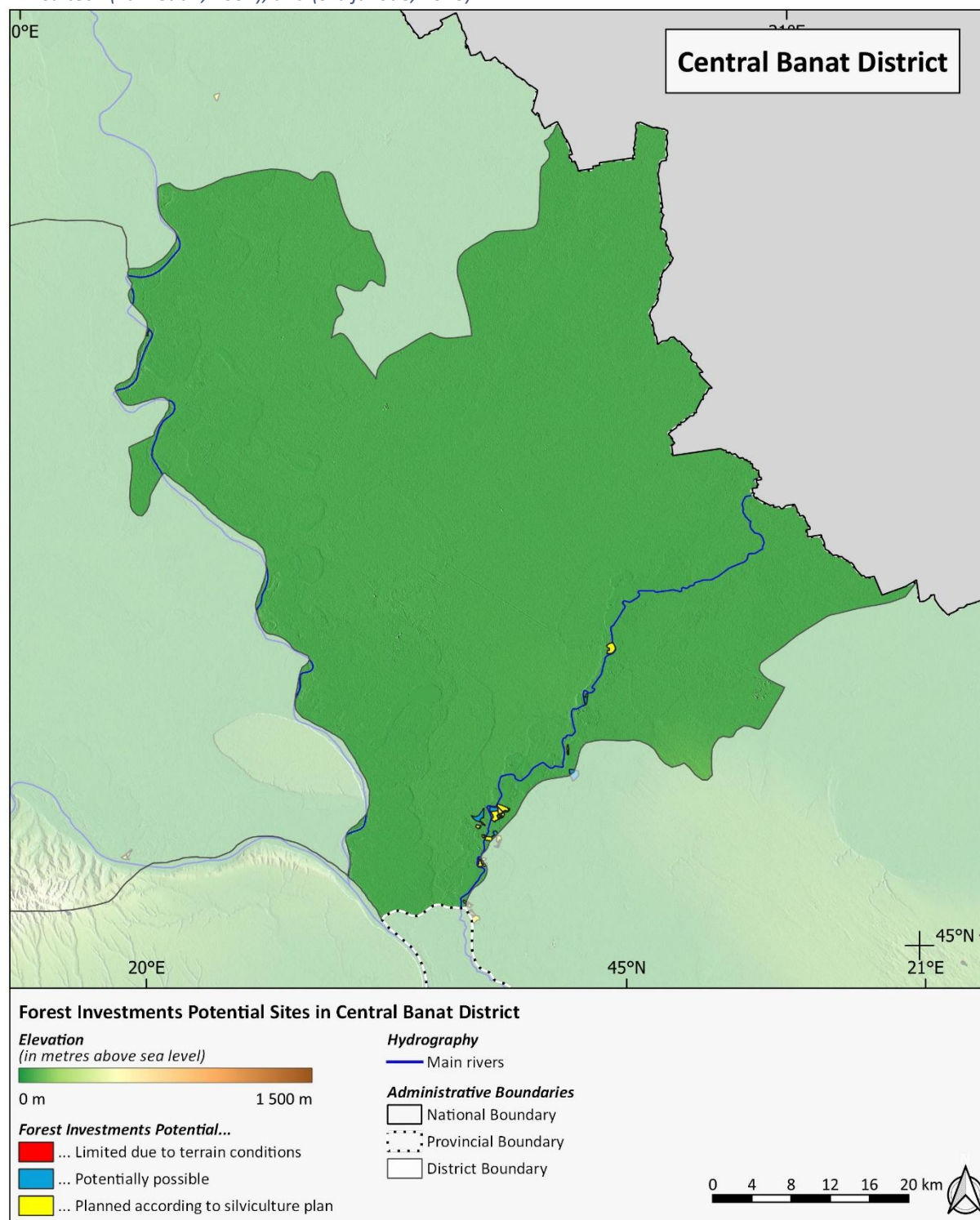
² The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 3 – Potential afforestation sites in the Braničevo District, provided by the AffSerb preliminary study³
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



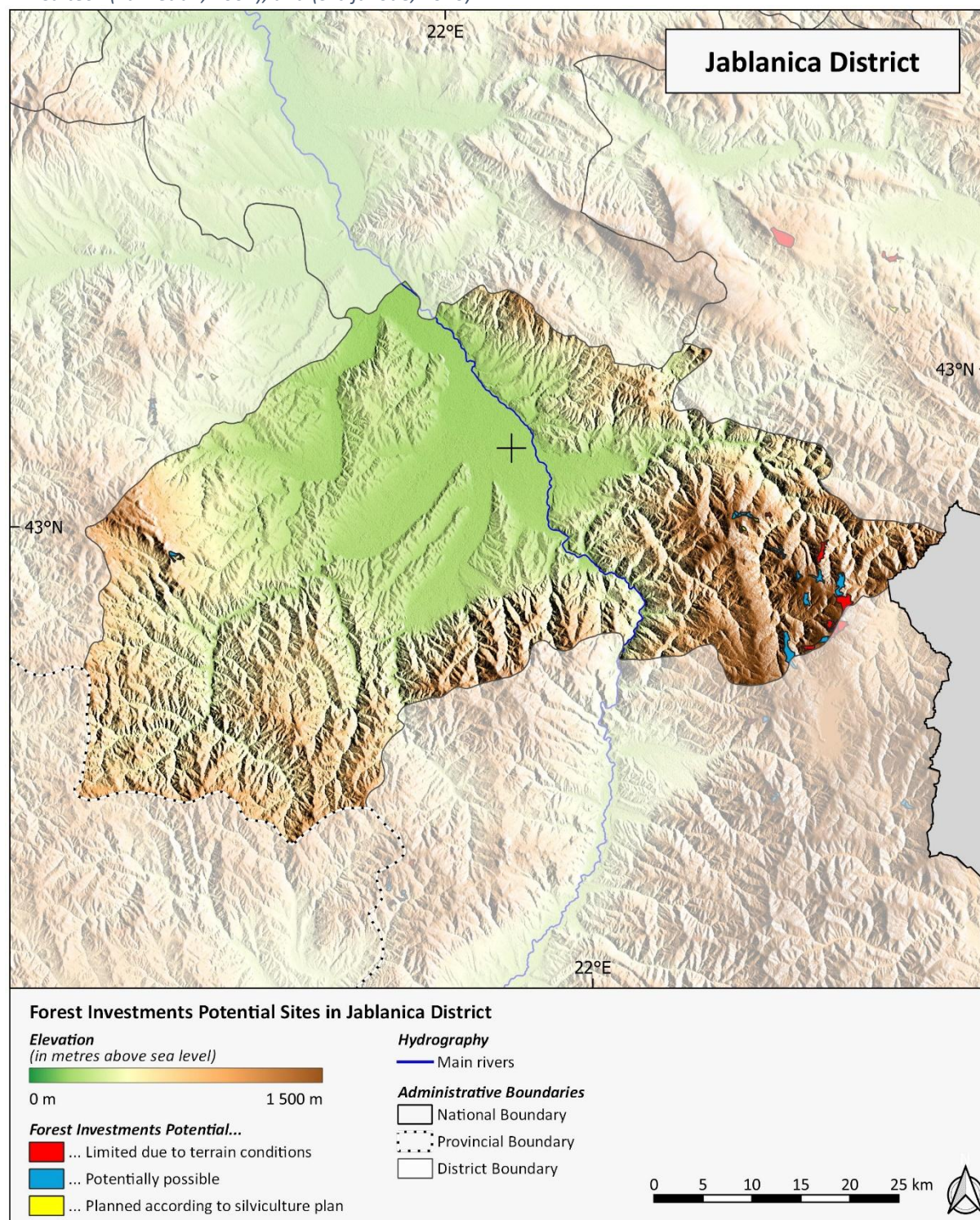
³ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 4 – Potential afforestation sites in the Central Banat District, provided by the AffSerb preliminary study⁴
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



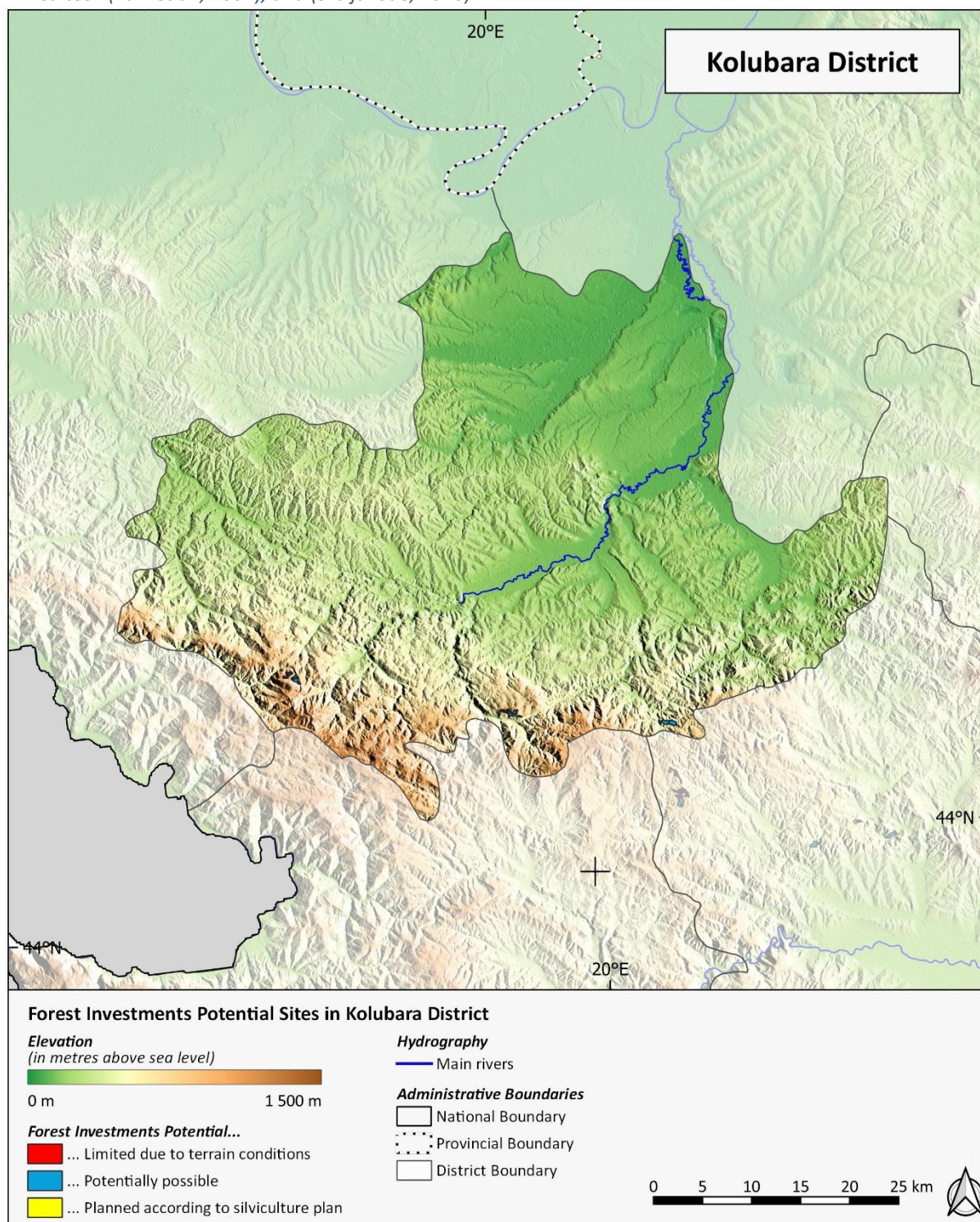
⁴ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 5 – Potential afforestation sites in the Jablanica District, provided by the AffSerb preliminary study⁵
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



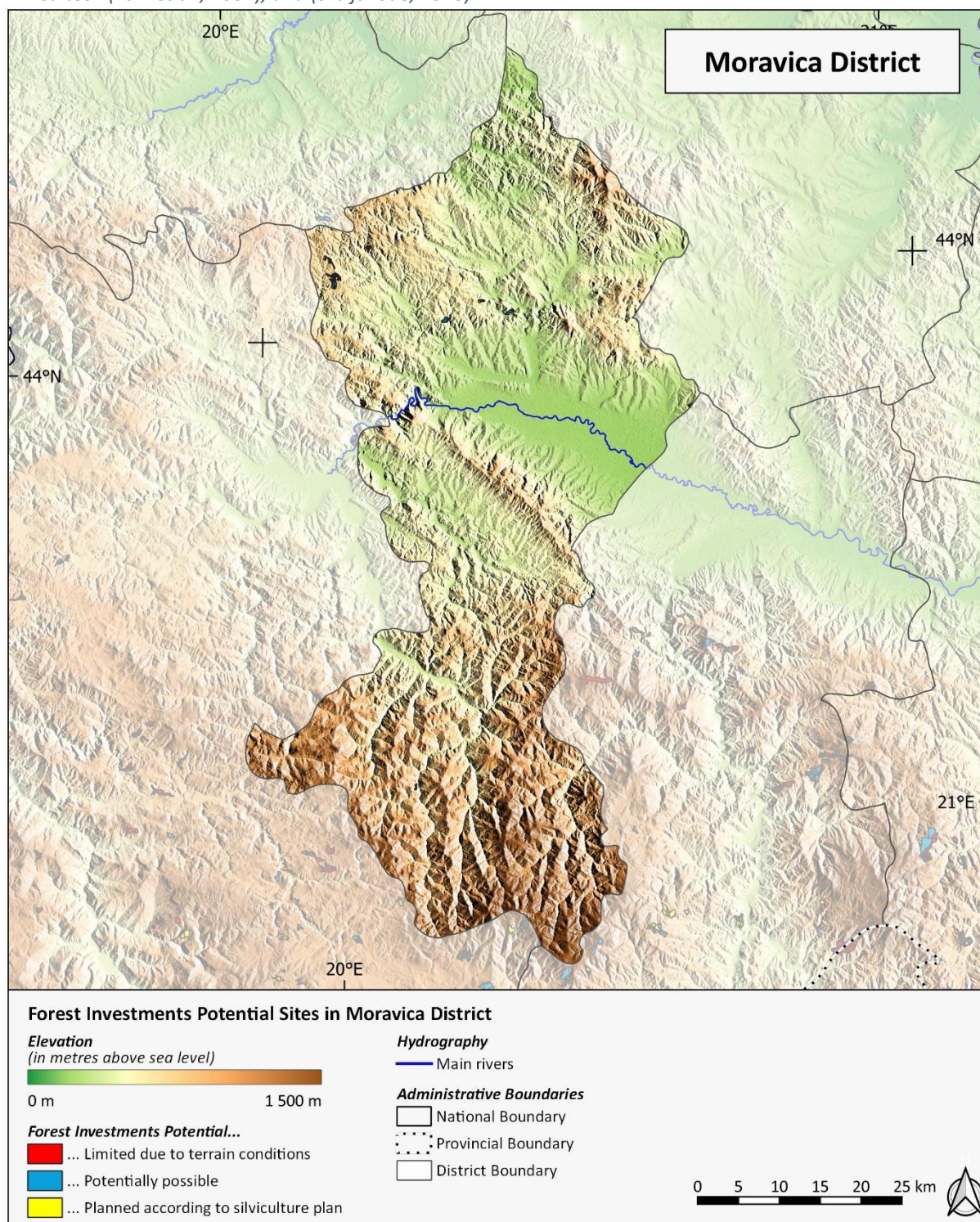
⁵ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 6 – Potential afforestation sites in the Kolubara District, provided by the AffSerb preliminary study⁶
 Overlayed on a topographical and hydrological map. Data source: Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



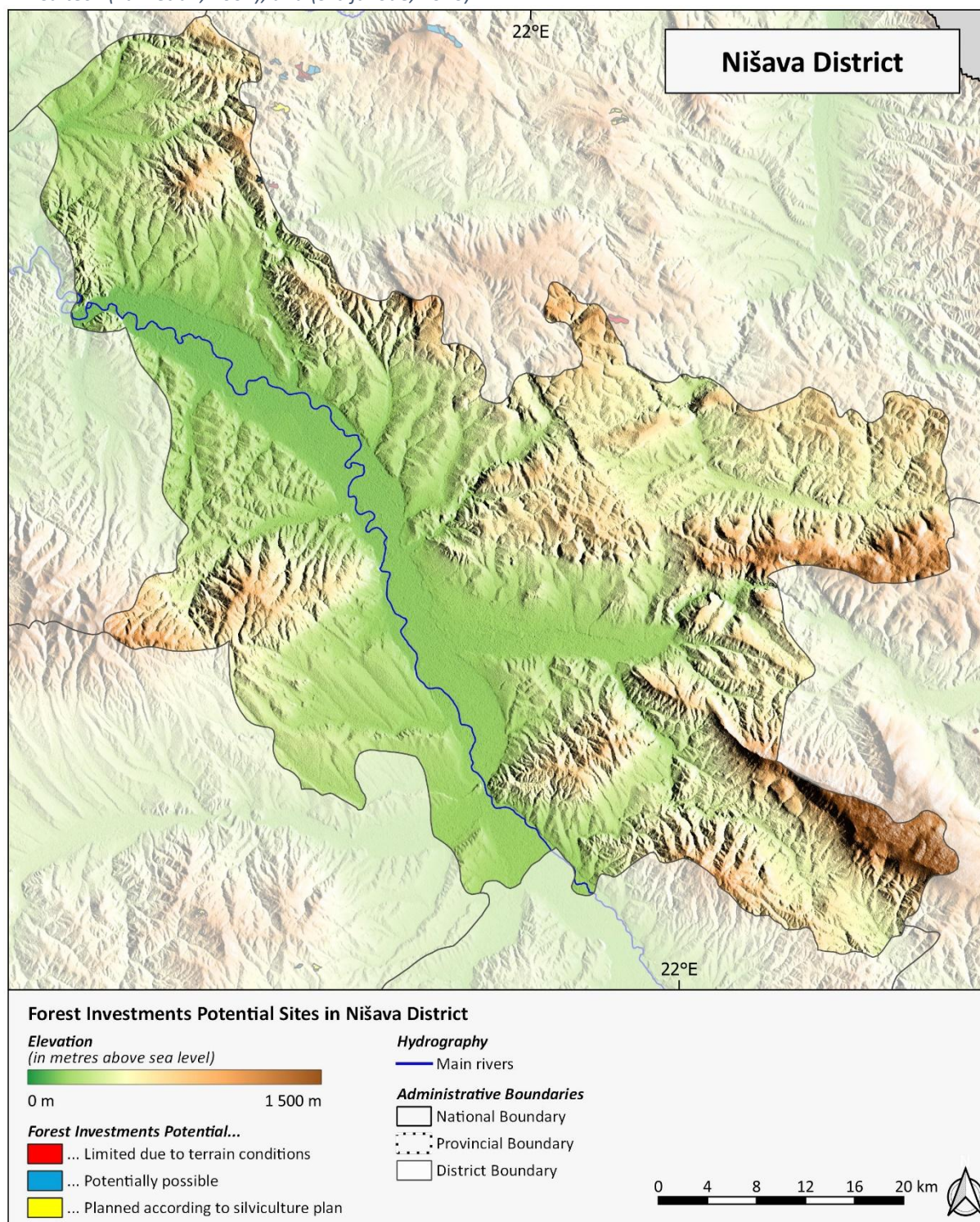
⁶ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 7 – Potential afforestation sites in the Moravica District, provided by the AffSerb preliminary study⁷
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



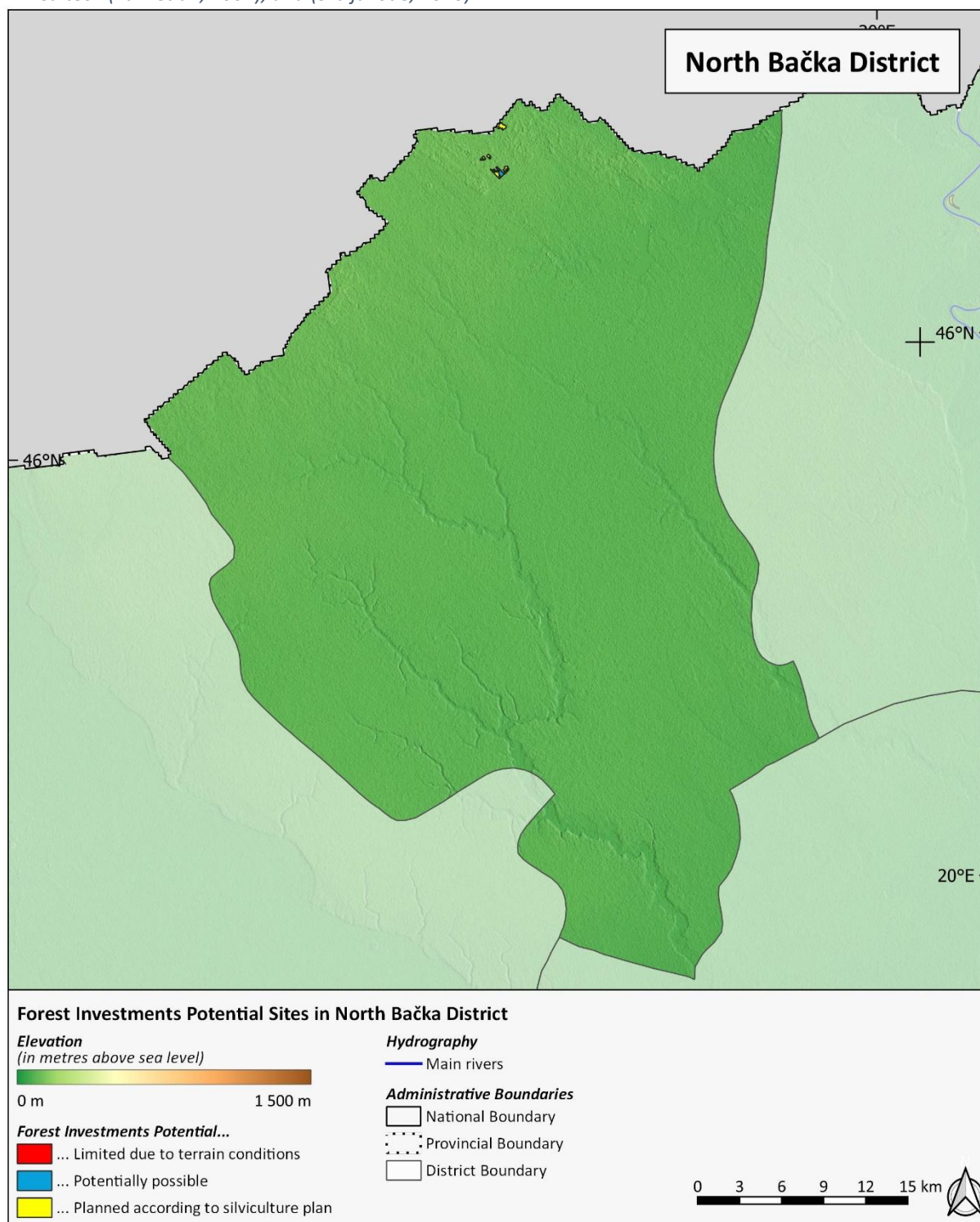
⁷ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 8 – Potential afforestation sites in the Nišava District, provided by the AffSerb preliminary study⁸
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



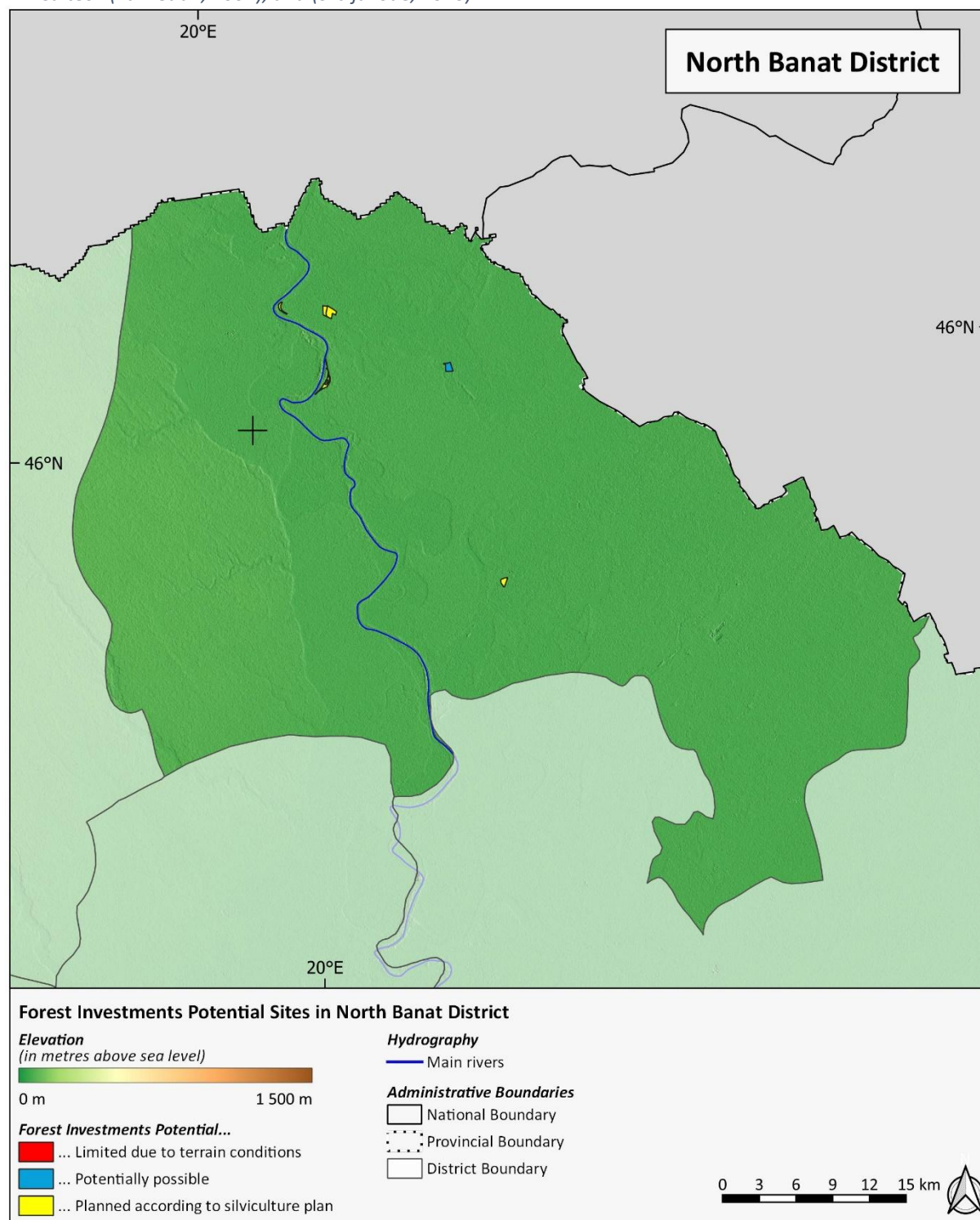
⁸ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 9 – Potential afforestation sites in the North Bačka District, provided by the AffSerb preliminary study⁹
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



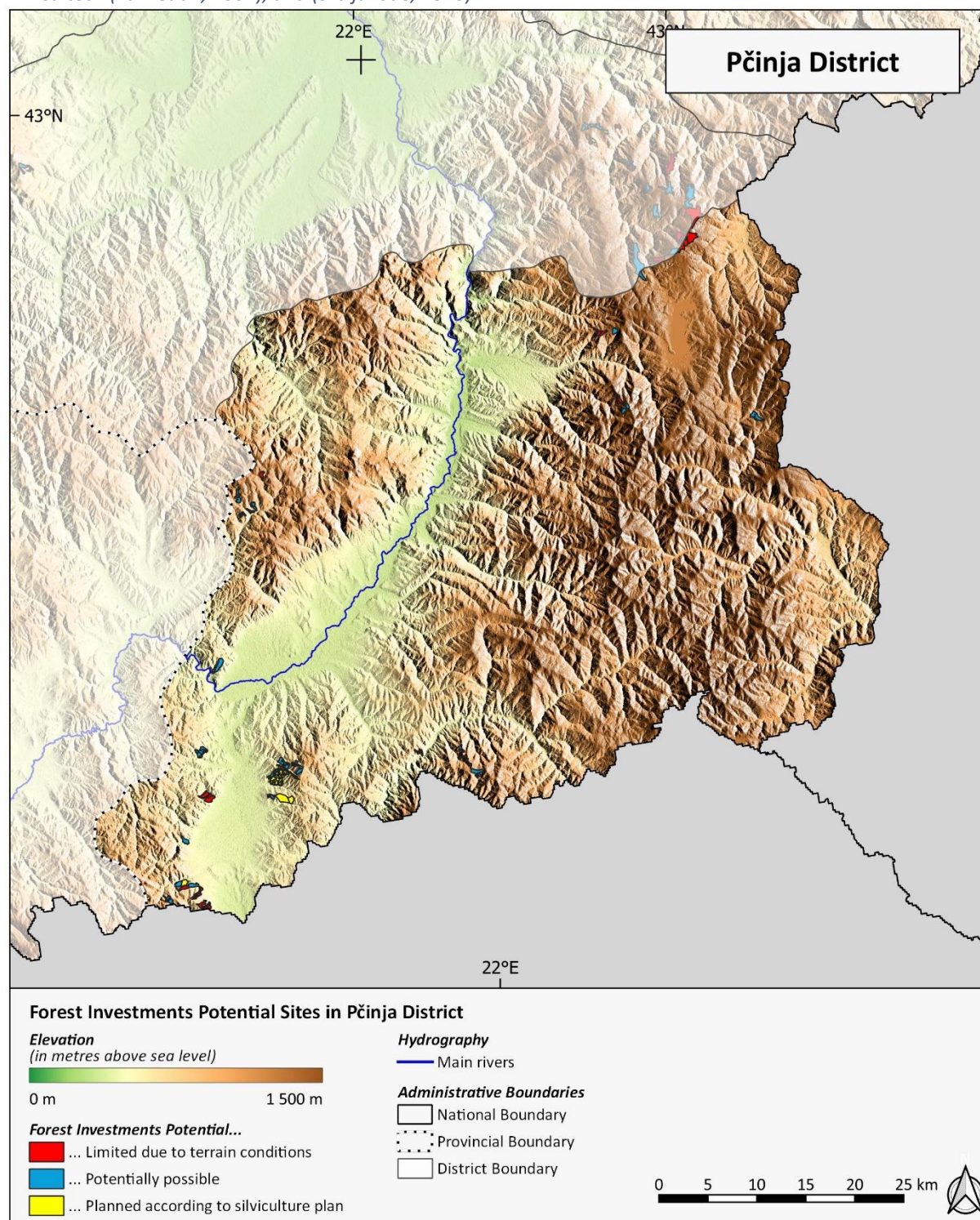
⁹ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 10 – Potential afforestation sites in the North Banat District, provided by the AffSerb preliminary study¹⁰
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



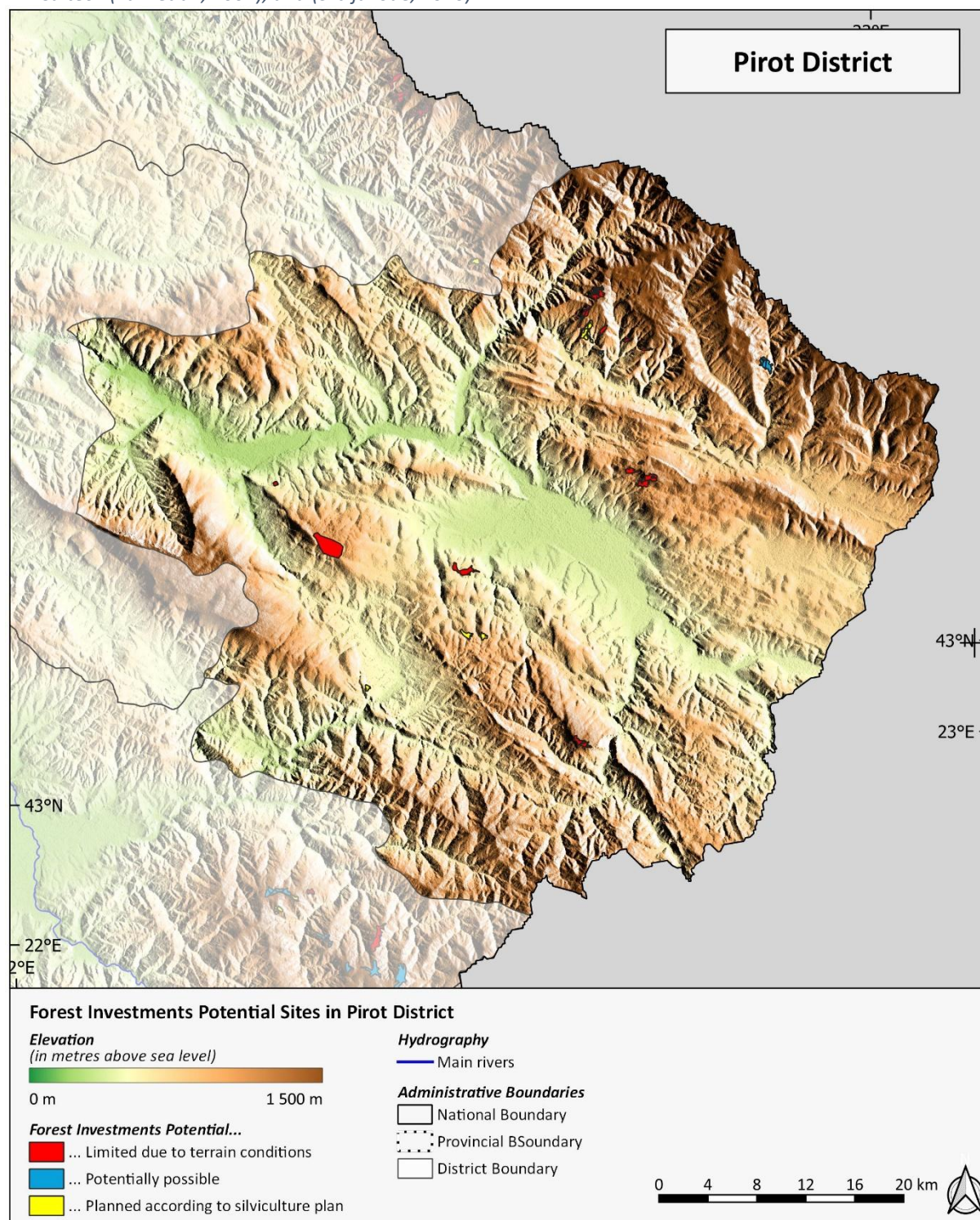
¹⁰ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 11 – Potential afforestation sites in the Pčinja District, provided by the AffSerb preliminary study¹¹
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



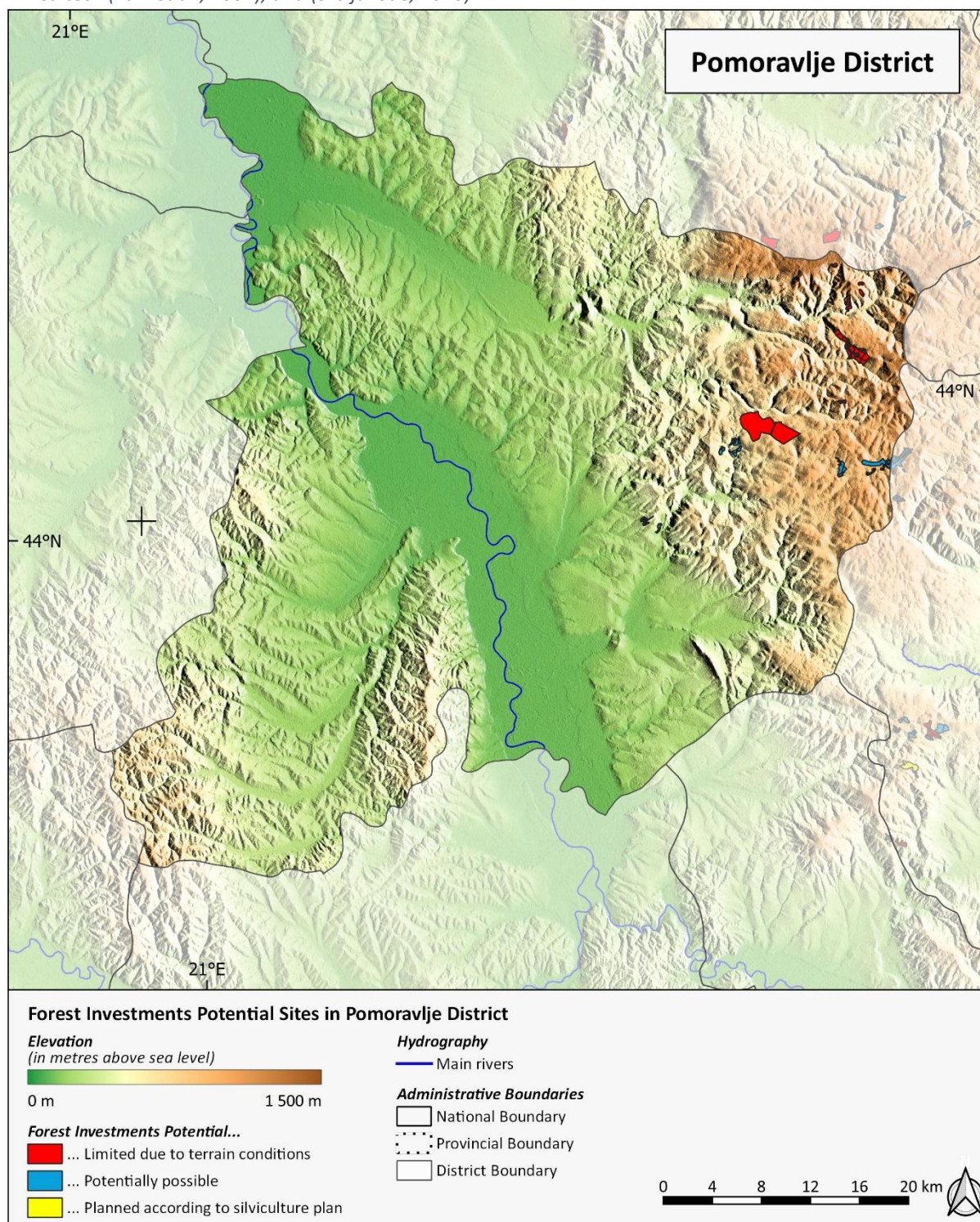
¹¹ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 12 – Potential afforestation sites in the Pirot District, provided by the AffSerb preliminary study¹²
 Overlayed on a topographical and hydrological map. Data source: Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



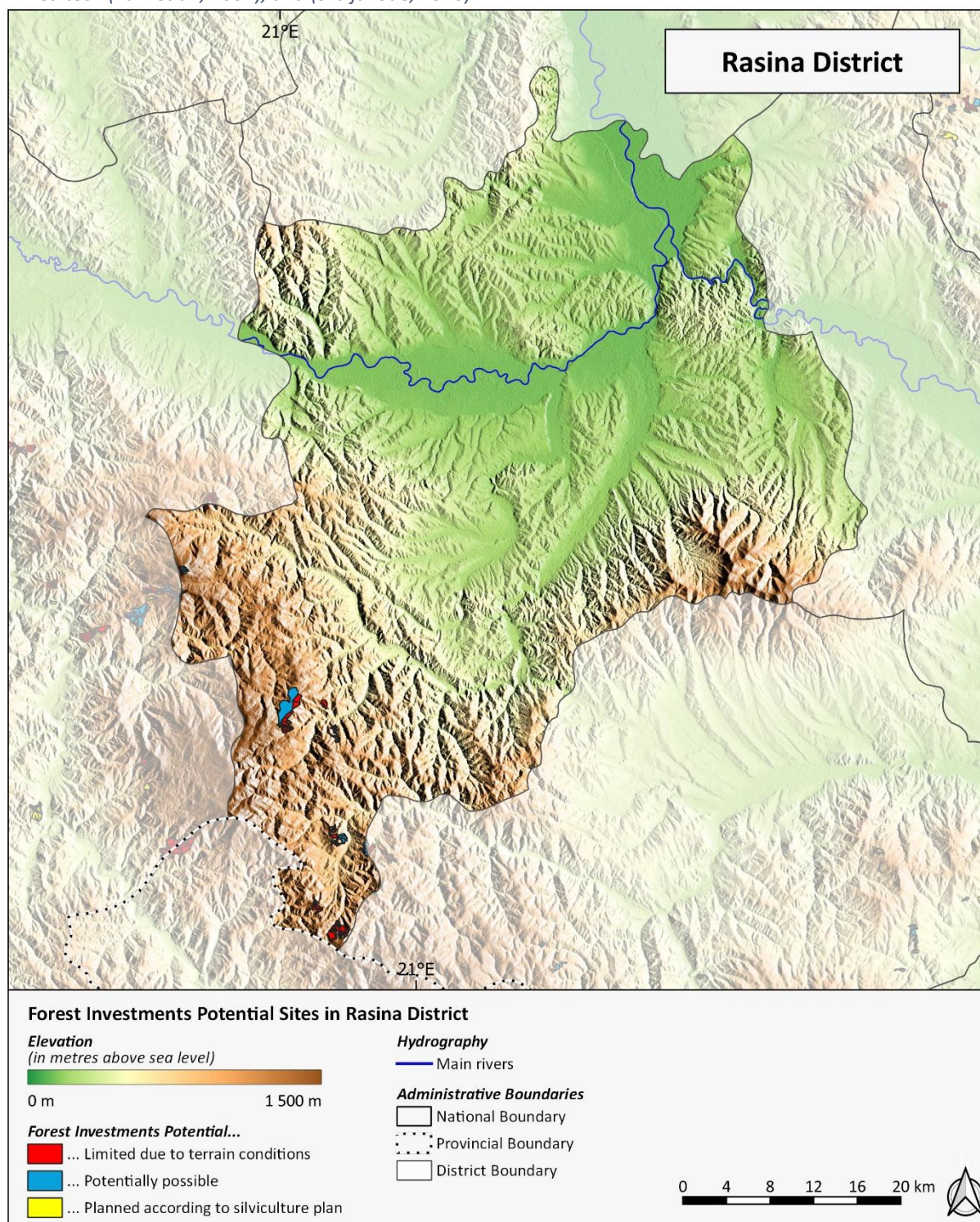
¹² The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 13 – Potential afforestation sites in the Pomoravlje District, provided by the AffSerb preliminary study¹³
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



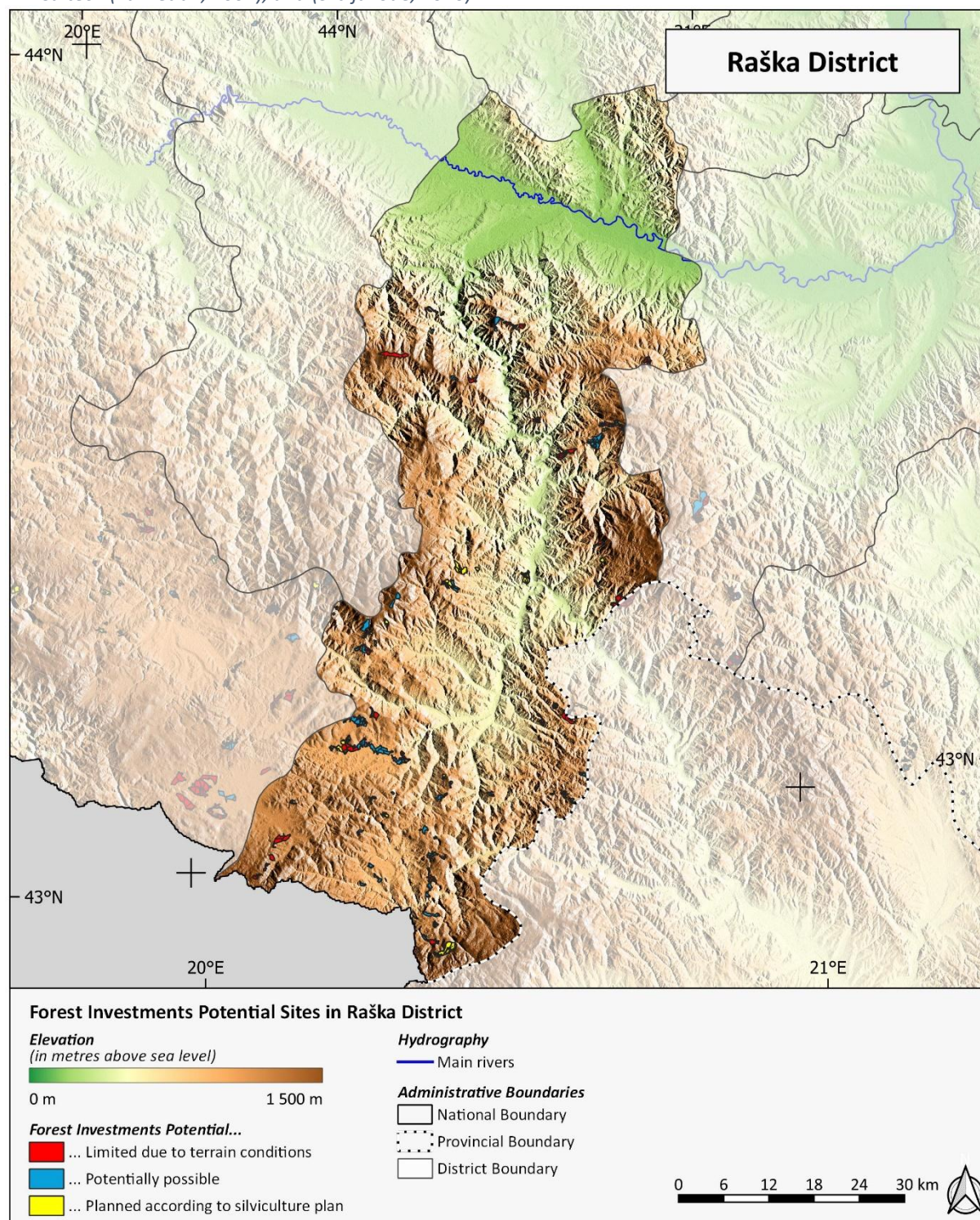
¹³ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 14 – Potential afforestation sites in the Rasina District, provided by the AffSerb preliminary study¹⁴
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



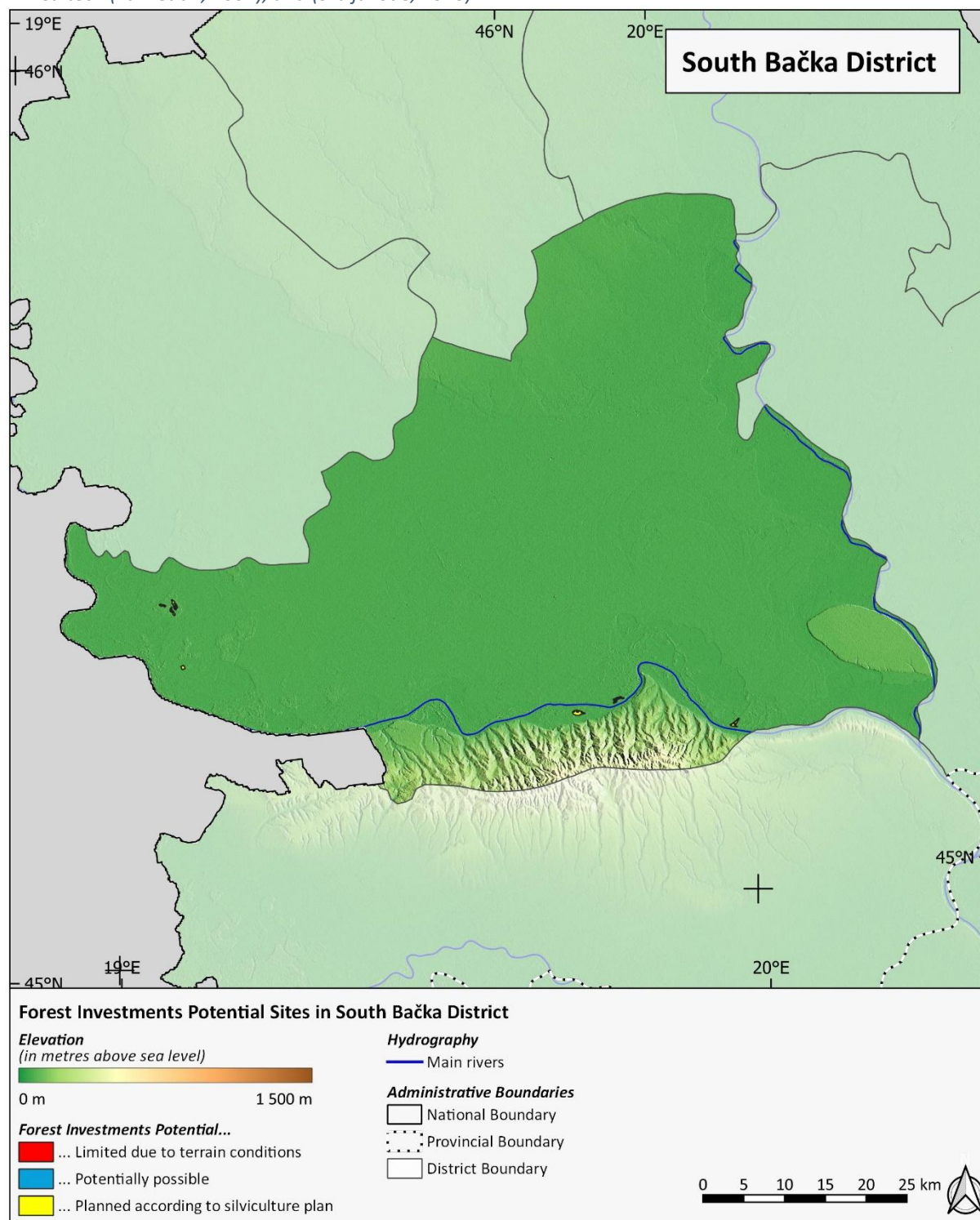
¹⁴ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 15 – Potential afforestation sites in the Raška District, provided by the AffSerb preliminary study¹⁵
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



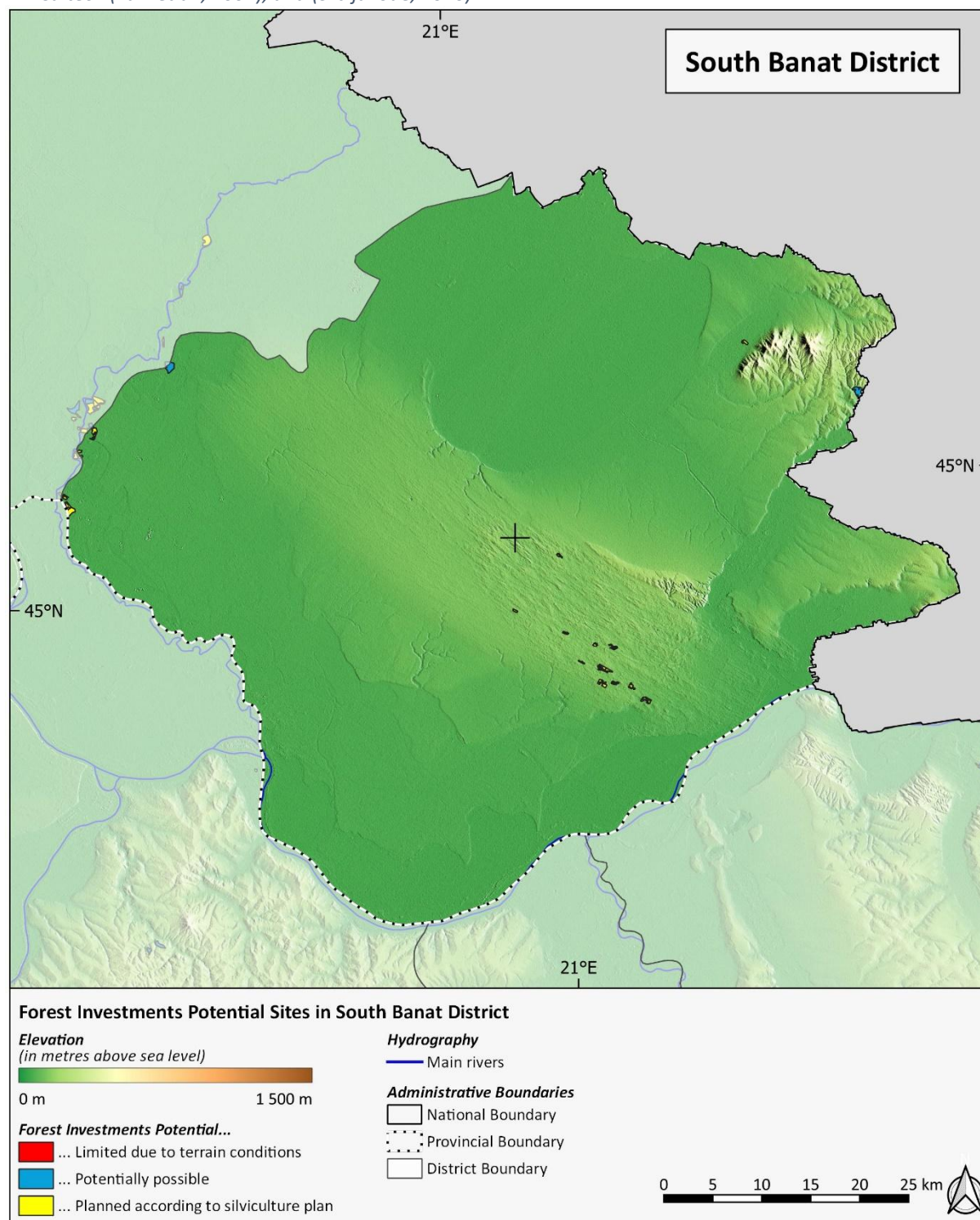
¹⁵ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 16 – Potential afforestation sites in the South Bačka District, provided by the AffSerb preliminary study¹⁶
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



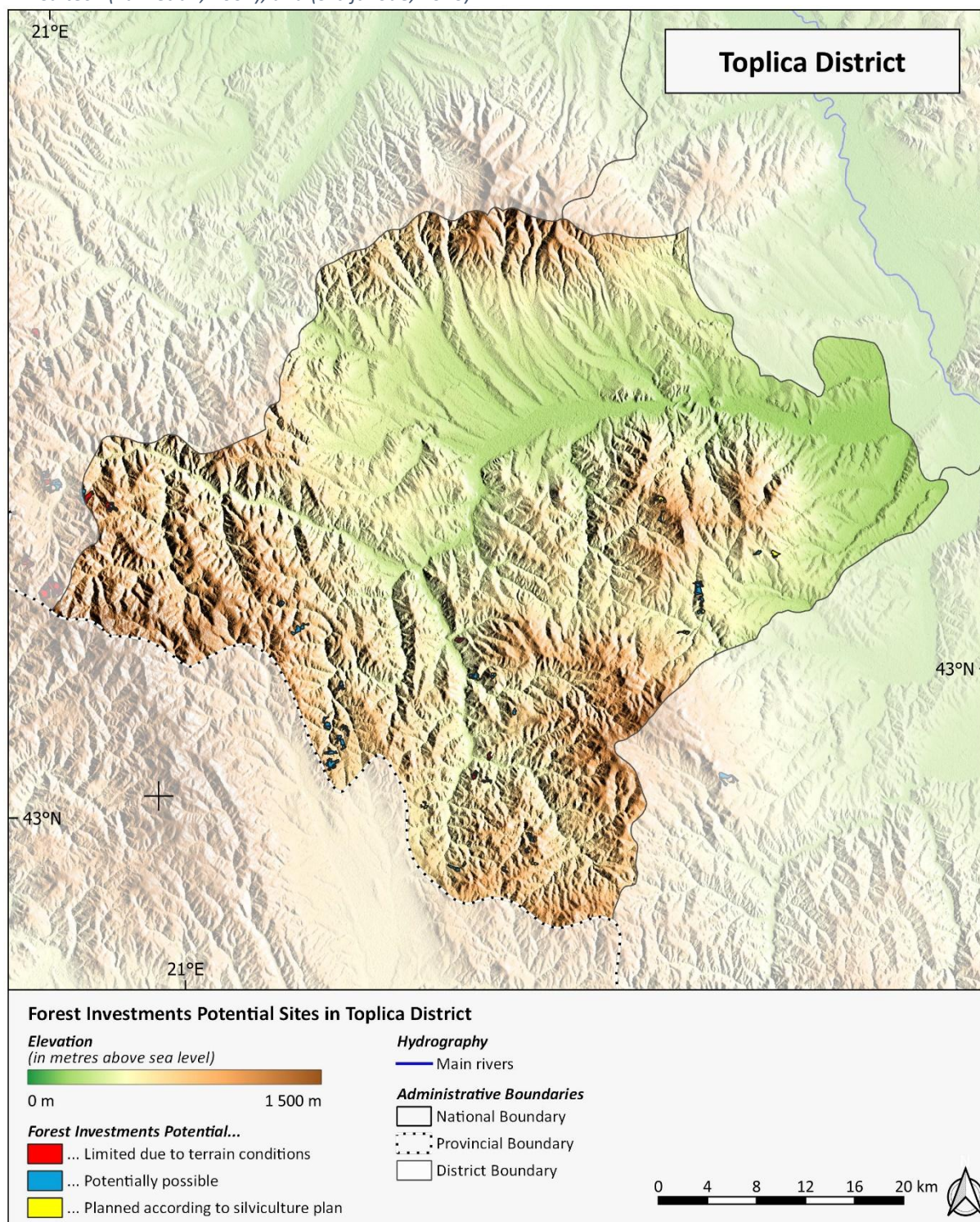
¹⁶ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 17 – Potential afforestation sites in the South Banat District, provided by the AffSerb preliminary study¹⁷
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



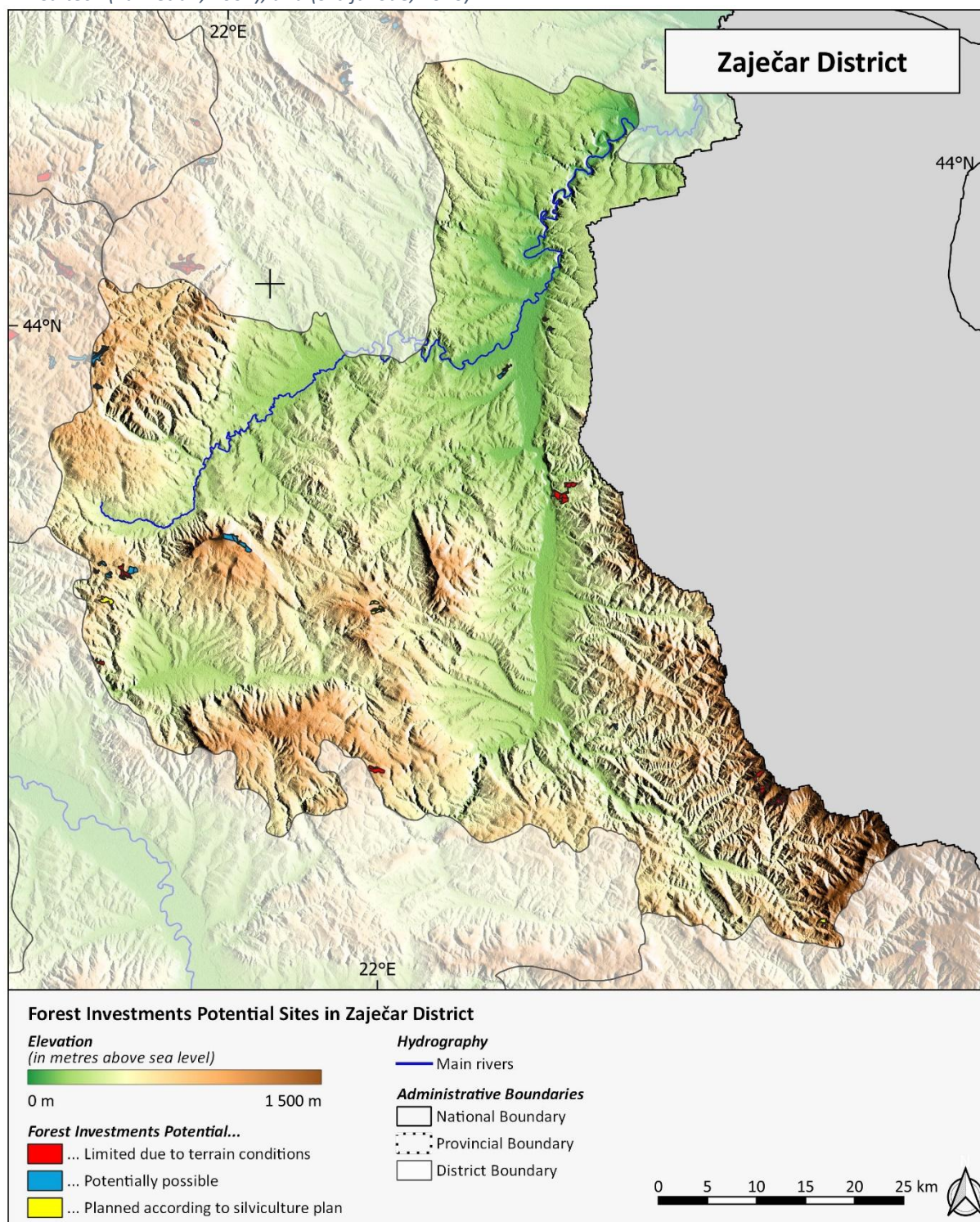
¹⁷ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 18 – Potential afforestation sites in the Toplica District, provided by the AffSerb preliminary study¹⁸
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



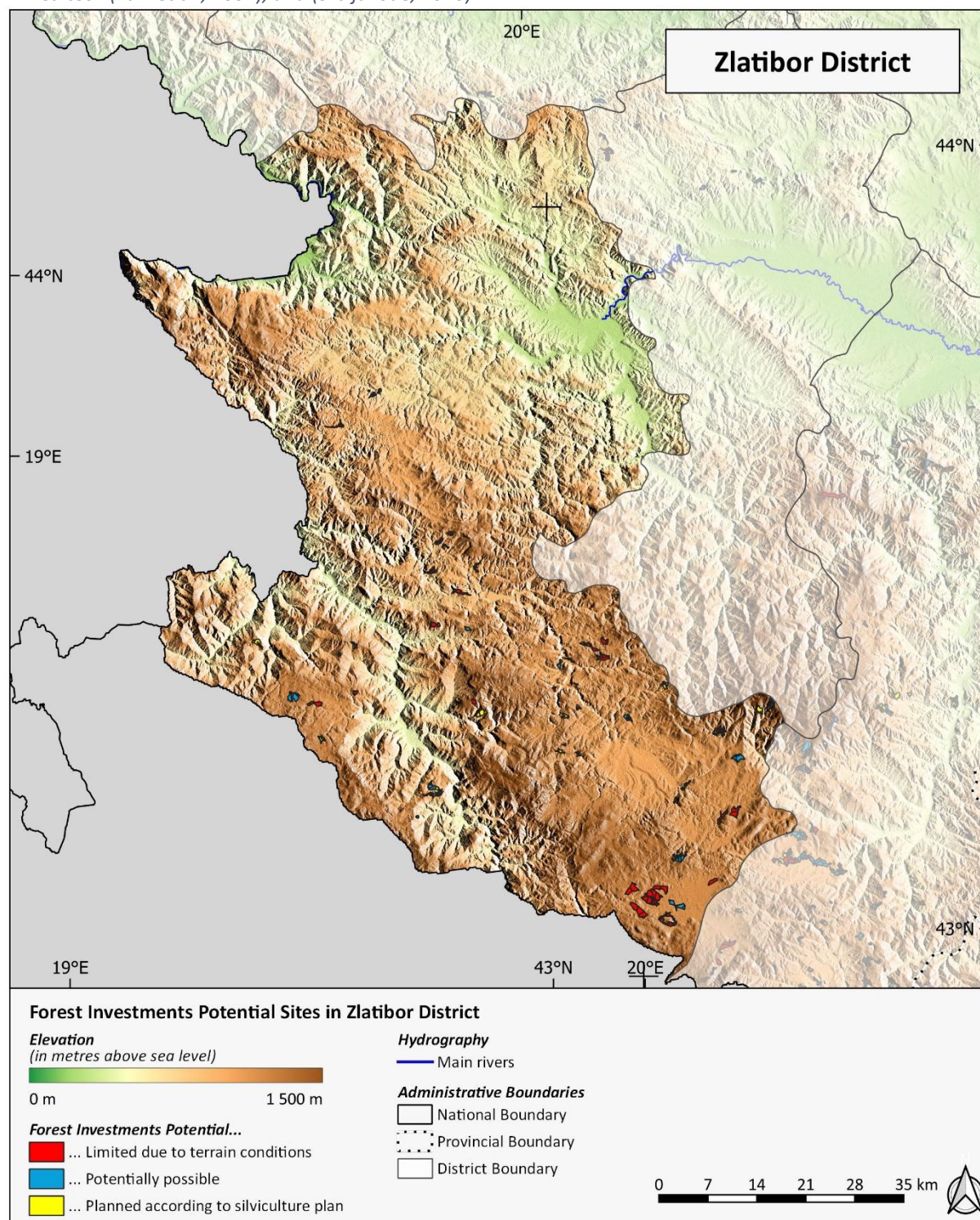
¹⁸ The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 19 – Potential afforestation sites in the Zaječar District, provided by the AffSerb preliminary study¹⁹
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



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Figure 20 – Potential afforestation sites in the Zlatibor District, provided by the AffSerb preliminary study²⁰
 Overlayed on a topographical and hydrological map. *Data source:* Forestry Institute in Belgrade, NASA / USGS / JPL-Caltech (Farr et al., 2007), and (Srbijavode, 2020).



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1. GHGs and related policies

1. With regard to the country's GHG emission profile²¹, without removals, total GHG emissions in Serbia amounted to 62,683 kt CO₂ in 2018, [TNC, 2020]. The energy sector²² is the main GHG emitter and represents 78% of total GHG emissions (2018 data, TNC, 2020) with 49,204 kt CO₂. The second largest GHG emitting sector is the Agriculture, Forestry and Land Use (AFOLU)²³ sector with around 7%, followed by the Industrial Processes and Product Use (IPPU) and the waste management sectors. Total GHG emissions have increased by 9% over the 2000-2018 period due to an increase of diesel and gasoline consumption in road transport [TNC, 2020]. The forestry sector contributed to CO₂ removals for an amount of 7.4% of Serbian's emissions equivalent [GFA, 2019], but at the same time CO₂ removals from the atmosphere in the whole LULUCF sector decreased by 19.4% between 2010 and 2015, due to the increased consumption of solid biomass (fuel wood) and the increased use of technical wood. In the business-as-usual scenario, total GHG emissions are expected to increase by 3.2% by 2030 and by 10.7% by 2050 (compared to 2010 levels). The biggest relative sectoral increase by 2050 is expected in the IPPU (+41.8%) and the transport sectors (+41.2%), followed by energy industries (+13.4%) and agriculture (+7.8%) [TNC, 2020].

2. In the framework of its Low Carbon Development Strategy, aligned with the Climate Change Law approved in 2021, Serbia developed different 4 GHG mitigation scenarios²⁴ (table 2). The policy recommends to follow the M2 pathway until 2030 as the most cost effective and socially fair solution. The pathway foresees the implementation of all the EU *acquis*²⁵ and to shift to higher ambitions by introducing a mix of measures under M2, M3 and M4 scenarios with gradual levels of actions and emission reduction objectives [GFA, 2019 p.20]. In this regard, the strategy declares as its general objective to reduce GHG emissions by 33% by 2030 and by at least 65% by 2050 (compared to 2010 levels). In order to achieve this, one of the most crucial goals is to increase the carbon sink of the forests by 17% by 2030 and by 22% by 2050 (compared to 2010). The Low Carbon Development Strategy gives a particular importance to the forestry sector as it offers clear and significant mitigation potentials and important socio-economic benefits but also because it is vulnerable and in need for adaptation measures as reported in each of the three National Communications²⁶. The TNC, 2020, developed 3 main categories of adaptation measures, based on Financial, Technological and Capacity building Needs, including: (1) Afforestation using location mapping and tree species adapted to climate change; (2) Introducing "Climate-Smart Forestry" approaches; and (3) Changing forest management practices following a Close-to-Nature-Forest-Management/Close-to-Nature-Forestry approach. Investment needs are estimated to be EUR 92 million per year up to 2030, mainly for reaching the proposed afforestation targets. In this regard and especially to reach the even more ambitious 2050 targets, it will also be essential to attract financing from the private sector, in particular through decarbonisation initiatives: local companies could for instance invest in afforestation activities

21 a) Government of Serbia, 2020. Third National Communication to the UNFCCC – final draft version; (b) Government of Serbia, 2019 - Draft Low carbon development strategy with action plan – Serbia; and (c) International Energy Outlook 2018. (

²² The highest share of share of GHG emissions comes from energy industries. Energy is largely rely on Coal, Natural Gas and Oil, (87% aggregated [IEA, 2018])

²³ GHG emissions in the AFOLU sector are mainly due to enteric fermentation and manure management: about 45% of those GHG come from direct and indirect emissions of CH₄ and N₂O.

²⁴ Identified as the increasingly ambitious scenarios M1, M2, M3 and M4. The M1 scenario is the baseline scenario plus the implementation of the EU-Emission Trading Scheme (EU-ETS). Since it has shown not to be able to allow penetration of RES by 2030 it has not been considered for further analysis in the frame of the Low Carbon Strategy

²⁵ Applicant countries are required to accept the *acquis* before they can join the EU. The EU's 'acquis' is the body of common rights and obligations that are binding on all EU countries, as EU Members. It is constantly evolving and comprises: the content, principles and political objectives of the Treaties legislation adopted in application of the treaties and the case law of the Court of Justice of the EU; declarations and resolutions adopted by the EU; measures relating to the common foreign and security policy; measures relating to justice and home affairs; international agreements concluded by the EU and those concluded by the EU countries between themselves in the field of the EU's activities. See <https://ec.europa.eu/environment/enlarg/candidates.htm> and <https://eur-lex.europa.eu/summary/glossary/acquis.html>

²⁶ Hydrology and water resources, forestry, agriculture and health care are considered as the most vulnerable sectors (SNC, 2017) and adaptation measures were developed for each sector accordingly.

and obtain carbon credits for neutralising emissions deriving from its own business practices. An important pre-requisite for such an approach is of course the implementation of a credible mechanism to monitor and verify investments, which the country has been lacking so far. The project will support national objectives by: (1) ensuring a higher survival rate of forestry investments thanks to the capacity development program; (2) establishing a source of forestry funding via the national offsetting opportunity for private sector operators; and (3) involving the private sector in the process. the project will work primarily with forest owners associations, grain producers associations, chamber of commerce and industry, and with municipalities to ensure: (a) a diversified set of forest investments' actors; (b) diversity of budget resources and (c) different types of forestry investments (shelterbelts and agroforestry) with private sector stakeholders to reduce forest dependency on state budget.

3. Based on the implementation of the described mitigation scenarios (M1, M2, M3 and M4) and in compliance with the requirements of the European Emission Trading Schemes (EU-ETS) requirements²⁷, Serbia is expected to achieve carbon neutrality by 2070, implying a significant increase in forest cover [TNC, 2020]. Nonetheless, institutional capacity and enabling conditions, in particular the establishment of national offsetting²⁸ / insetting²⁹ mechanisms as well as of a robust monitoring system, need to be strengthened (as part of the Instrument for Pre-Accession Assistance IPA II in Serbia, as outlined in table 3). All envisaged scenarios imply the implementation of the EU ETS, as minimum requirement³⁰. M2, M3, M4 also include additional measures with different target levels (including RES application for example), M4 being the highest level of mitigation expectations. The outlined emission reduction targets are also considered in the draft of the second/revised [NDC](#), with which Serbia is expected to step up significantly its climate mitigation targets. In fact, while the first NDC aimed at reducing GHG emission by 9.8% by 2030 (ref. 2010), the revised version foresees an emission reduction of 33.3% for the same time period. For this purpose, the document includes 14 mitigation measures, two of which are directly related to the objective to reach a 17% increase in carbon sink by 2030 also through the annual conversion of 7,000 ha of coppice forest to high forests and the annual afforestation of 5,000 ha, while four of the other measures aim at increasing the Energy Efficiency (EE) and the share of Renewable Energy Sources (RES) in the tertiary sector, industry³¹, households and district heating. Two further measures deal with EE measures in the residential and tertiary sectors, two with transport and two further measure address mitigation potentials in the agricultural sector. In addition, one measures aims at increasing the share of RES in energy production and one measure at the introduction of a CO₂ tax in the industry sector that shall gradually increase from 2022 onwards³².

Table 2: Mitigation Scenario in Serbia [TNC, 2020; GFA, 2019]

Scenario ³³	Target measures
Baseline Scenario BAU	All policies and measures implemented, adopted or planned after 2015 are excluded

²⁷ The EU ETS is the major EU Carbon market instrument to reduce greenhouse gas emissions cost-effectively, and is based on a "cap and trade" principle. As per the Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading (EU-ETS) Decision 406/2009/EC-Effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments, Serbia is expected to create the enabling conditions to implement the EU ETS system prior to its EU accession. See <https://www.klimatskepromene.rs/en/euclimate/emissions-trading-system/>

²⁸ A carbon offset is a reduction in emissions of carbon dioxide or other greenhouse gases made in order to compensate for ("offset") an emission made elsewhere [IPCC, 2018].

²⁹ Insetting is defined by the International Carbon Reduction and Offset Alliance as: the development of a carbon offset project within a company's own supply chain and supply chain communities

³⁰ Through the Law on climate change, adopted in March 2021, Serbia introduced MRV aspects of the ETS. However, trading aspects are not introduced and it is expected to apply trading mechanism once Serbia becomes the EU member state. The same Law introduces main aspects of the Effort sharing decisions. Emissions and removals from land use, emission and removals from land use change and forestry (LULUCF), which are covered by the Kyoto Protocol and from 2021 by the LULUCF Regulation.

³¹ The measure is foreseen to impact in particular the manufacturing industry

³² The CO₂ tax addresses plants above a certain size (TBD) in the following industrial sectors: (i) power and heat generation; (ii) energy-intensive industry sectors including oil refineries, production of steel and iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals; and (iii) production of nitric, adipic and glyoxylic acids and glyoxalin.

³³ The M1 scenario is the baseline scenario plus the implementation of the EU-Emission Trading Scheme (EU-ETS). Since it has shown not to be able to allow penetration of RES by 2030 it has not been considered for further analysis in the frame of the Low Carbon Strategy

M2 – with measures	Implementation of all EU <i>acquis</i> transposed and implemented: reduction of GHG emissions by 33.3% compared to 1990 levels by 2030
M3	EU 2030 targets achieved: reduction of GHG emissions by 40% compared to 1990 levels
M4 – with additional measures	Reduction of GHG emissions by 80% in 2050 compared to 1990 levels, aligned with the European Commission communication on climate neutrality.

4. Given that most of the GHG emissions are stemming from the energy sector, the expansion of renewable energy plays an important role for the country's efforts to mitigate its climate change impact and to achieve its development goals. As an EU candidate country, Serbia aligns its actions to EU-directives and policies and generally to the EU *acquis*, e.g. the 2030 Climate and Energy framework that sets as RES target a share of 32% of the final energy consumption. So far, Serbia has reached a share of 21.5% (2019). Biomass, mainly from forest resources (44%) and agricultural harvesting residues (48%), represents 63% of the total potential for RES in Serbia. It has to be noted that 67% of the total calculated technically feasible energy potential of forest resources are already utilized. It is therefore of utmost importance to utilize the potential of other biomass sources in particular agricultural harvest residues but also short rotation energy plantations where appropriate and, at the same time, increase the efficiency of wood biomass consumption.

5. In support to the implementation of the above mentioned policies, the Low Carbon Development Strategy outlines 5 Specific Objectives (SOs) to be reached for a climate resilient Serbian society. Two objectives deal with decreasing GHG emissions in EU-ETS sectors³⁴ (SO1: 15,0% GHG emissions decrease by 2030 and between 66,4% and 76,8% by 2050 compared to 2010) and non EU-ETS sectors (SO2: 9,7% GHG emissions decrease by 2030 and between 33,5% and 54,5% by 2050 compared to 2010). SO3 addresses the aforementioned need to increase the forest sink by 17% by 2030 and by at least 22% by 2050. SO4 aims at enhancing the climate resilience of the priority sectors of agriculture, water and forestry. Specific Objective 5 is the promotion of a climate neutral and climate resilient economy and society. It is crucial to identify feasible mechanisms for the decarbonisation of the industry, as a carbon intensive production could diminish the competitiveness of the Serbian economy in the long run. The Serbian industry is responsible for 69% of the country's GHG emissions, with the energy industry alone contributing to 52.6% followed by the IPPU with 9.5%³⁵ and the manufacturing and construction industries with 7.5% of GHG emissions. In the BAU scenario, industrial emissions are estimated to further increase by 9.8% until 2050 [TNC, 2020]. Therefore, the different sectoral policies set up emission reduction targets to be reached in the next decades (as reported in Table 9, and aligned with the mitigation target scenarios shown in Table 2), in particular through investments in EE and RES [GFA, 2019]. Such decarbonisation practices are also part of the EU Climate Action 2050 and the EU Green Deal. Nonetheless, the governance of the decarbonisation process is still in its initial phase and requires support to enable the country to reach its targets and to align its actions to the EU strategy.

6. In response to the above challenges and adverse impacts for forests and considering the national targets and international commitments of the Republic of Serbia (climate change mitigation and adaptation, and decarbonization), there is a pressing need to adapt the forestry sector, increase forest cover, enhance the sustainability of forest management and forest's ecosystem services, and to boost the decarbonization governance of the country to mitigate climate change impacts and increase carbon removals from forests to support the decarbonization path of the country. These measures will also bring a great range of co-benefits for the entire society³⁶, including the possibility for private sector operators to offset³⁷ part of their emissions and

³⁴ E.g. Electricity and heat generation, energy-intensive industry sectors including oil refineries, steel works, and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals.

³⁵ the IPPU the metal industry is responsible for 63%, the mineral industry and the chemical industry for 9.6% of emissions and 4.5% of emissions are attributable to "product uses as substitutes for ozone depleting substances"

³⁶ Reduced net emissions will benefit the whole Serbian society. Beneficiaries from the trainings and the incentives are local technicians, professionals, and representatives of the private sector. These will be specified later at design stage.

³⁷ The price of offsets is currently being studied. A detailed market analysis and pricing strategy for the country will be provided with the full funding proposal.

for the agricultural sector to benefit from forestry investments in the form of shelterbelts and windbreaks. Therefore, reducing the degradation of forests, introducing climate adaptive silviculture³⁸ practices and increasing the forest cover, including by establishing shelterbelts/windbreaks³⁹ in agricultural areas, is a national priority as it will contribute to both climate change adaptation and mitigation without compromising the livelihood of people and supporting the disaster risk reduction (DRR) actions of the Republic of Serbia including reductions in grey infrastructure needs and costs

7. Finally, forests are not only of environmental but also socio-economic importance as they are the main – often unique – source of heating and cooking energy for the rural population and for the poorest. It has to be highlighted in this regard that the average expenditure for energy accounts for about 16.7 % of the total household income and is hence higher than the threshold for energy poverty (= 10% of HH income to cover energy demand). Therefore, the need to satisfy the future fuel wood demand through a sustainable use of forest resources and to address at the same time forestry-decarbonization nexus⁴⁰ is evident. Without a strong and climate adaptive forestry sector the low carbon development and the renewable energy strategies of the country will remain incomplete and targets unmet.

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³⁸ Tailored to the Serbian context from the experience of the US Forest Department, of the Spanish, Italian and French forestry sector as well as from concrete experiences in Lebanon and Armenia where adaptation of forests is considered a series of practices and actions (from seedling to maintenance) needed to enhance the ability of forest ecosystems to adapt and survive in the projected climate scenario. These include: the preparation of drought resistant seedlings; the use of clear handling and planting procedures and specific maintenance protocols.

³⁹ Establishing shelterbelts/windbreaks will not only raise the share of forest cover where most needed (e.g: Vojvodina and Southern and Eastern Serbia [GFA, 2019; NAP report, 2020]), but also reduce the negative impact of wind erosion on agricultural production and prevents burying of drainage and irrigation canals.

⁴⁰ The forest-decarbonization nexus is the connection or series of connections linking forests and their state to the decarbonization process of Serbia.