



MONTENEGRO STATE AUDIT INSTITUTION

# From Paper to Orbit — and From Evidence to Action

An ESA-supported audit of illegal and excessive logging  
in Montenegro

A case study in Earth Observation, public accountability and  
the next generation of environmental protection

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# Montenegro – constitutional ecological state

**Montenegro has defined itself as the world's first ecological state since 1991, and has since placed sustainable development high on the public policy agenda.**

Montenegro is constitutionally defined as an ecological state (Article 1 of the Constitution). The Constitution guarantees the right to a healthy environment, access to environmental information, public participation and legal protection of environmental rights (Article 23). Everyone – especially the state – is obliged to preserve and improve the environment; failure of authorities is a violation of a constitutional right.

The Law on Environment and Law on Nature Protection operationalise these principles through the sustainable development obligation and lex specialis protection of natural values. Montenegro is one of the most forested countries in Europe, with a dense network of protected areas (5 national parks and 70 other protected sites).



NATURAL CAPITAL  
UNDER AUDIT



EVIDENCE  
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TERRITORY  
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ACCOUNTABILITY  
TO CITIZENS

# Forests in the SDG and EU Green Deal context

- 1 Forests are directly linked to **SDG 15, SDG 13, SDG 6 and SDG 8**.
- 2 Forests act as “**climate infrastructure**” – carbon sinks, water protection and ecosystem resilience.
- 3 For Montenegro, forests are central to **Chapter 27** on environment and climate change in EU accession.
- 4 EU **Forest Strategy 2030** links forest protection with emission reduction, biodiversity targets and climate neutrality by 2050.
- 5 Forest governance is a **development, integration and climate policy priority** – not only an environmental issue.



The European  
Green Deal

A bridge to a climate-neutral,  
biodiversity-rich and  
resilient Europe.



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# INTOSAI framework as our audit compass



Under Article 144, SAI Montenegro audits legality and performance in managing public resources.



The audit was grounded in the INTOSAI framework – ISSAI standards 3000, and GUID 3910 and 3920.



The approach was aligned with GUID 5200 series and GUID 5270 on sustainable development and corruption risk.



INTOSAI WGEA “Auditing Forests” guidance shaped the scope, criteria and environmental lens.



INTOSAI provides methodology – and professional confidence – for complex environmental audits.



(The INTOSAI guidance documents GUID 5200, GUID 5201 and GUID 5203 are currently in the process of being withdrawn from the INTOSAI Framework of Professional Pronouncements, following a decision by the FIPP in March 2026. The withdrawal is expected to take effect from January 2027, with updated WGEA guidance.)



# INTOSAI framework as our audit compass

International standards gave us the method.  
Earth Observation gave us independent evidence.

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**INTOSAI** gave the audit its compass —  
**ESA** helped us see beyond the horizon.



# Ecological cost of illegal and excessive logging



**1.** Only about one third of Montenegro meets strict forest criteria; around 41% of forests show fragmentation.



**2.** More than 67 native forest tree species and 9 forest habitats of European importance.



**3.** Loss of 587.1 km<sup>2</sup> of primary forest (2021–2024) increases uncontrolled runoff and erosion.



**4.** Estimated release of 32–43 million tonnes CO<sub>2</sub>-eq and €58.7–176.1 million per year in lost ecosystem services.



**5.** Illegal logging is a biodiversity, water, climate and public safety issue – not “just” a forestry issue.



## BASIC GEOGRAPHICAL CHARACTERISTICS OF MONTENEGRO

|  |                                 |                                                                                 |
|--|---------------------------------|---------------------------------------------------------------------------------|
|  | Position / Area                 | 13,812 km <sup>2</sup>                                                          |
|  | Location                        | Southeastern Europe, on the Adriatic coast                                      |
|  | Land boundaries                 | 1,446 km (Serbia, Bosnia and Herzegovina, Albania, Croatia)                     |
|  | Coastline                       | 293.5 km                                                                        |
|  | Population (2023)               | ~627,000                                                                        |
|  | Population density              | 45.4 people / km <sup>2</sup>                                                   |
|  | Total area of forest ecosystems | 1,329,000 ha (~48% of territory)                                                |
|  | Protected areas                 | 5 National Parks and 1 Nature Park                                              |
|  | Climate                         | Mediterranean (coast)<br>Continental (inland)                                   |
|  | Rivers and lakes                | Basin of the Adriatic Sea<br>Largest lake: Skadar Lake (= 370 km <sup>2</sup> ) |
|  | Elevation range                 | Sea level – 2,524 m (Durmitor)                                                  |



PROTECTING BIODIVERSITY



SECURING WATER RESOURCES



STRENGTHENING CLIMATE RESILIENCE



SAFEGUARDING PUBLIC SAFETY



# Performance audit of the implementation of environmental protection policy in Montenegro – **Illegal Logging**



## Audit Objective

The audit objective was to determine whether the audited entities had undertaken adequate activities within their respective mandates to prevent illegal logging.



## Main Audit Question

How effective are the activities undertaken by the competent authorities to prevent illegal logging?



## Sub-questions

1. Has a strategic and legal framework been established that provides a sound basis for undertaking effective activities to prevent illegal logging?
2. Do the competent authorities adequately plan and supervise the volume of logging, through prepared, implemented, and regularly updated forest management plans that reflect the scale and intensity of operations, clearly define long-term management objectives, and specify how those objectives are to be achieved; and do they implement measures to prevent illegal logging?
3. Do contractual arrangements ensure that forests are protected from activities incompatible with sustainable timber production?
4. Do the competent authorities carry out professional analyses on the basis of which concrete measures and actions, accompanied by adequate monitoring, are implemented to combat illegal logging?



# Satellite data as audit evidence



Satellite data were not a visual add-on, but an **additional source of audit evidence**.



With ESA ([https://www.esa.int/About\\_Us/ESRIN](https://www.esa.int/About_Us/ESRIN)) support, SAJ Montenegro received a composite satellite-based analysis from Geo Data, contracted by ESA, which applied the ACDC-EO approach using **Copernicus Sentinel and Landsat data**.



Two independent data works were compared: administrative records vs. satellite-detected forest loss.

**2021–2024: 2,117,310 m<sup>3</sup>** officially recorded  
vs. **–9,393,800 m<sup>3</sup>** estimated from satellite-based analysis.



The comparison is based on two independent sources: **AC/DC-EO satellite monitoring** and official Forestry Administration records.



Forest area loss detected in km<sup>2</sup> was converted into volume using an average growing stock of **160 m<sup>3</sup>/ha** from the 2011 forest inventory.



The gap suggests major **under-detection, under-reporting**, or weak control over illegal and excessive logging.



**Not a final proof of illegality – but a powerful risk signal and basis for deeper investigation.**



| Year         | Reduction of the area under forests [by all bases] in km <sup>2</sup> : application of AC/DC-EO technology | Conversion to m <sup>3</sup> (using 160 m <sup>3</sup> /ha) | Official data on the volume of felling of the Forestry Administration in m <sup>3</sup> | Difference (Satellite – Official) in m <sup>3</sup> |
|--------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------|
| 2021         | 133,1                                                                                                      | 3.529.600                                                   | 475.242                                                                                 | <b>3.054.358</b> ↓                                  |
| 2022         | 112,5                                                                                                      | 1.800.000                                                   | 550.830                                                                                 | <b>1.249.170</b> ↓                                  |
| 2023         | 118,9                                                                                                      | 1.902.400                                                   | 626.560                                                                                 | <b>1.275.840</b> ↓                                  |
| 2024         | 220,6                                                                                                      | 2.101.600                                                   | 464.378                                                                                 | <b>1.637.222</b> ↓                                  |
| <b>Total</b> | <b>587,1</b>                                                                                               | <b>9.333.600</b>                                            | <b>2.117.810</b>                                                                        | <b>7.215.790</b> ↓                                  |



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# From formal compliance to real conditions on the ground



1. Modern environmental audit checks if the state understands, measures, discloses, and controls ecological risks.



2. The formal framework exists – but the control system is fragmented and not fully effective.



3. Weak planning, supervision, and sanctioning; serious gaps in monitoring and data quality.



4. Official logging data (2017–2024) cannot be considered reliable; no adequate oversight and digital tools.



5. The system exists on paper – but does not assure that the state knows what is happening in its forests.



Missing “DŠ” mark on stump tag



Weak / barely visible hammer mark



Forest order not adequately established.



INDEPENDENT • OBJECTIVE • IMPACTFUL

MONTENEGRO



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# Triangulating documents, satellites and fieldwork



01

Audit evidence was built through triangulation: documents, satellite data and field verification.



02

In March 2025, 303 field points were visited using a mobile app and QGIS-based analysis.



03

Fieldwork validated satellite interpretations and refined risk maps and classifications.



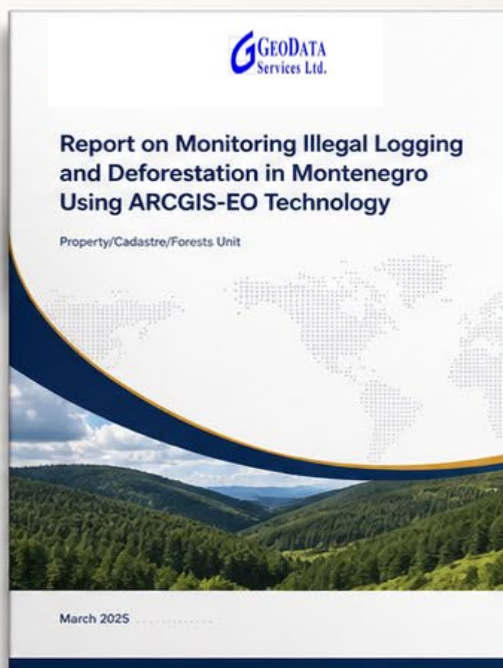
04

This strengthened the credibility and robustness of audit findings and recommendations.



05

The approach is aligned with emerging INTOSAI and WGEA guidance on geospatial evidence.



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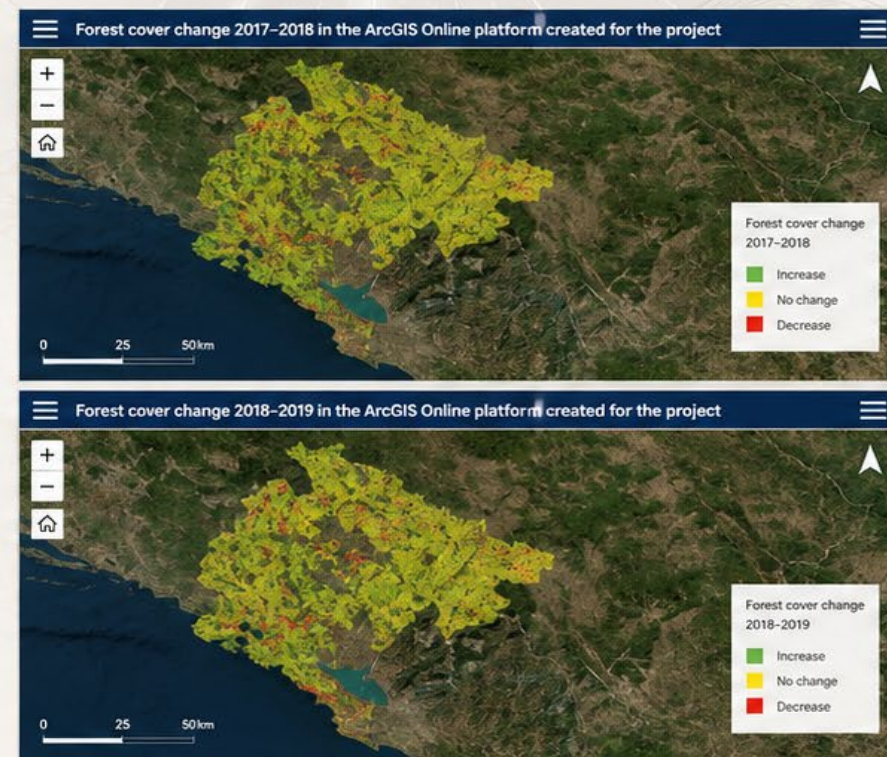
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DRŽAVNO TUŽILAŠTVO  
CRNE GORE

STATE PROSECUTOR'S OFFICE MONTENEGRO

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# Referral to the Supreme State Prosecutor's Office of Montenegro

Following the performance audit *Implementation of Environmental Protection Policy in Montenegro – Illegal Logging*, the State Audit Institution of Montenegro submitted the audit report and a follow-up response to the Supreme State Prosecutor's Office, outlining documented cases in which the audit identified indications of criminal offences and serious irregularities in the management of public natural resources and international donor funds in the forestry sector.



## Key matters communicated to the Prosecutor's Office

- ✓ Failure to carry out legally required strategic environmental assessments for forest management programmes, despite prior warnings from the Environmental Protection Agency, indicating possible negligence in office and abuse of official position.
- ✓ Lack of alignment of the forestry framework with relevant EU requirements, absence of timber traceability controls, and weak enforcement mechanisms, creating conditions for illegal timber trade and misuse of public resources.
- ✓ Non-use of the forest monitoring software developed under the FODEMO project, despite significant public investment, raising concerns of facilitation of illegal exploitation, corruption, and organised abuse.
- ✓ Outsourcing of planning and assessment functions to private entities, adoption of management programmes without the required environmental opinions, logging in protected areas, and substantial exceedance of permitted logging volumes.
- ✓ Weaknesses in institutional oversight, tax collection, concession debt recovery, and customs control, enabling private gain at the expense of the public interest.
- ✓ Evidence of severe environmental degradation, including in protected areas, supported by satellite-based analysis indicating forest loss substantially above official records and suggesting concealment of large-scale exploitation.



## Current status

On the basis of the documented findings, the State Audit Institution indicated the need for a comprehensive investigation in order to establish individual and institutional accountability. At present, prosecutorial inquiry activities are ongoing.





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# Looking ahead: the next generation of audit



Environmental audits need to become more **risk-based**, more **data-driven** and more **forward-looking**.



Climate, biodiversity, water, waste, public health and fiscal risk should be assessed as **interconnected systems**.



Geospatial tools, satellite imagery, artificial intelligence and environmental accounting will make audit evidence **stronger, more timely and more persuasive**.

## Environmental accounting: why it matters

- Measures the **value of nature** — from national resource stocks to ecosystem services and project-level impacts.
- UN-SEEA** is the key global framework, while **IPSASB** links environmental information with public-sector reporting.
- Helps governments see **natural assets, changes over time**, and the links between **the environment and the economy**.



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# Key messages — from paper to orbit

- A formally existing system did not prevent illegal and excessive logging in Montenegro.
- Satellite data, documents and fieldwork together revealed major discrepancies and hidden risks.
- ESA support was instrumental in uncovering the true scale of forest loss and strengthening evidence.
- Climate-related disclosure standards will further increase the importance of reliable environmental data.
- Environmental auditing is moving “from paper to orbit” — SAIs that master geospatial and AI-based methods will shape the future.





# ONE HUMAN MESSAGE

Across faiths and traditions, the words are different, but the human message is the same:  
Do not be ruled by fear. Stand with one another. Let compassion give us courage.  
Protect what has been entrusted to us for those who come after us.

HEBREW BIBLE — Psalm 23:4

גַּם כִּי־אֶלֶךְ בְּגִיַּא צַלְמוֹת לֹא־אֵירָא רָע כִּי־אַתָּה עִמָּדִי

"I will fear no evil, for You are with me."

QUR'AN — Taha 20:46

لَا تَخَافَا إِنِّي مَعَكُمَا أَسْمَعُ وَأَرَى

"Do not be afraid. I am with you."

BHAGAVAD GITA — 16:1

अभयं सत्त्वसंशुद्धिं ज्ञानयोगव्यवास्थितिः

"Fearlessness, purity of heart,  
steadfastness in wisdom."

GURU GRANTH SAHIB — Mool Mantar

ਨਿਰਭਉ ਨਿਰਵੈਰੁ

"Without fear, without hate."

BUDDHIST TRADITION — Dhajagga Sutta

बुद्धं धम्मं सद्दधं सरणं गच्छामि

"Take refuge in awakening, truth and community."

TAO TE CHING — Chapter 67

慈故能勇

"Through compassion, one finds courage."



# THANK YOU