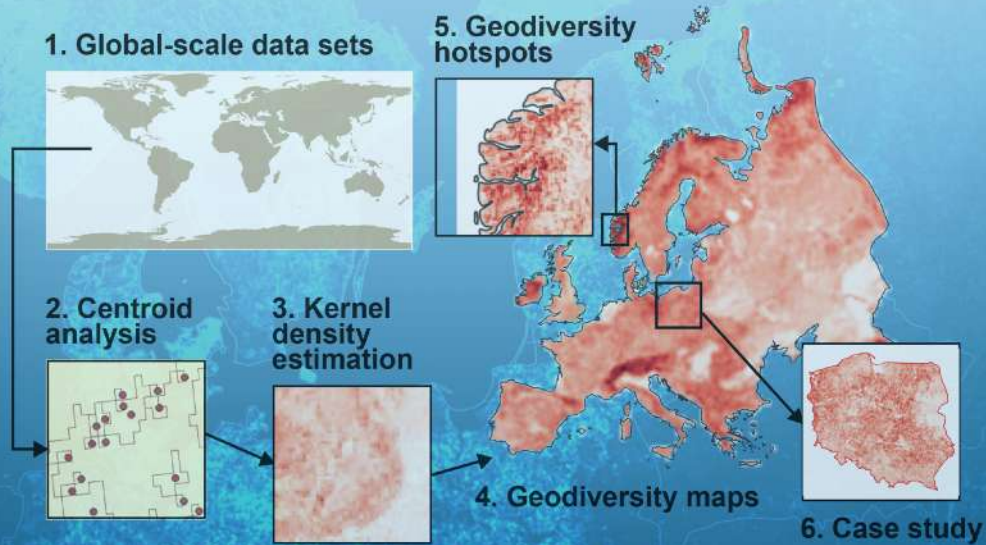




resources

Tracked for
Impact
Factor

CITESCORE
6.4



A Framework for Continental-Scale Analysis of Abiotic Diversity

Volume 12 • Issue 5 | May 2023



mdpi.com/journal/resources
ISSN 2079-9276

[Sign In / Sign Up \(/user/login\)](/user/login)[Submit \(https://susy.mdpi.com/user/manuscripts/upload?journal=resources\)](https://susy.mdpi.com/user/manuscripts/upload?journal=resources)

Search for Articles:

Advanced Search

[Journals \(/about/journals\)](/about/journals) / [Resources \(/resources\)](/resources) / [Editorial Board](#)

resources

**IMPACT
FACTOR**

3.3

[\(/journal/resources/stats\)](/journal/resources/stats)

CITESCORE

7.7

<https://www.scopus.com/sourceid/21100808642>

Journal Menu

► [Journal Menu](#)

- [Resources Home \(/journal/resources\)](/journal/resources)
- [Aims & Scope \(/journal/resources/about\)](/journal/resources/about)
- [Editorial Board \(/journal/resources/editors\)](/journal/resources/editors)
- [Reviewer Board \(/journal/resources/submission_reviewers\)](/journal/resources/submission_reviewers)
- [Topical Advisory Panel \(/journal/resources/topical_advisory_panel\)](/journal/resources/topical_advisory_panel)
- [Instructions for Authors \(/journal/resources/instructions\)](/journal/resources/instructions)
- [Special Issues \(/journal/resources/special_issues\)](/journal/resources/special_issues)
- [Topics \(/topics?query=&journal=resources&status=all&category=all\)](/topics?query=&journal=resources&status=all&category=all)
- [Topical Collections \(/journal/resources/topical_collections\)](/journal/resources/topical_collections)
- [Article Processing Charge \(/journal/resources/apc\)](/journal/resources/apc)
- [Indexing & Archiving \(/journal/resources/indexing\)](/journal/resources/indexing)
- [Most Cited & Viewed \(/journal/resources/most_cited\)](/journal/resources/most_cited)
- [Journal Statistics \(/journal/resources/stats\)](/journal/resources/stats)
- [Journal History \(/journal/resources/history\)](/journal/resources/history)
- [Journal Awards \(/journal/resources/awards\)](/journal/resources/awards)
- [Editorial Office \(/journal/resources/editorial_office\)](/journal/resources/editorial_office)

Journal Browser

► Journal Browser

volume
volume
issue
issue
Go

- > [Forthcoming issue \(/2079-9276/12/10\)](/2079-9276/12/10)
- > [Current issue \(/2079-9276/12/9\)](/2079-9276/12/9)

- [Vol. 12 \(2023\) \(/2079-9276/12\)](/2079-9276/12)
- [Vol. 11 \(2022\) \(/2079-9276/11\)](/2079-9276/11)
- [Vol. 10 \(2021\) \(/2079-9276/10\)](/2079-9276/10)
- [Vol. 9 \(2020\) \(/2079-9276/9\)](/2079-9276/9)
- [Vol. 8 \(2019\) \(/2079-9276/8\)](/2079-9276/8)
- [Vol. 7 \(2018\) \(/2079-9276/7\)](/2079-9276/7)
- [Vol. 6 \(2017\) \(/2079-9276/6\)](/2079-9276/6)
- [Vol. 5 \(2016\) \(/2079-9276/5\)](/2079-9276/5)
- [Vol. 4 \(2015\) \(/2079-9276/4\)](/2079-9276/4)
- [Vol. 3 \(2014\) \(/2079-9276/3\)](/2079-9276/3)
- [Vol. 2 \(2013\) \(/2079-9276/2\)](/2079-9276/2)
- [Vol. 1 \(2012\) \(/2079-9276/1\)](/2079-9276/1)



Editorial Board

Please note that the order in which the Editors appear on this page is alphabetical, and follows the structure of the editorial board presented on the MDPI website under information for editors: [editorial board responsibilities \(/editors#Editorial Board Responsibilities\)](#).



Members

Search by first name, last name, affiliatic

[Prof. Dr. Damien Giurco \(https://sciprofiles.com/profile/508\)](https://sciprofiles.com/profile/508)

[Website \(https://profiles.uts.edu.au/Damien.Giurco\)](https://profiles.uts.edu.au/Damien.Giurco)

Editor-in-Chief

Institute for Sustainable Futures, University of Technology Sydney, PO Box 123 Broadway, NSW 2007, Australia

Interests: mining and metals; urban water; backcasting; industrial ecology; life cycle assessment

[Special Issues, Collections and Topics in MDPI journals](#)

[Prof. Dr. Benjamin McLellan \(https://sciprofiles.com/profile/2546557\)](https://sciprofiles.com/profile/2546557)

[Website \(http://eecon.energy.kyoto-u.ac.jp/en/?page_id=338\)](http://eecon.energy.kyoto-u.ac.jp/en/?page_id=338)

Associate Editor

Graduate School of Energy Science, Kyoto University, Yoshida-honmachi, Sakyo-ku, Kyoto 606-8501, Japan

Interests: energy technology; resource policy; nexus; sustainability; sustainable development; hydrogen energy; criticality assessment; water; minerals

[Special Issues, Collections and Topics in MDPI journals](#)

[Prof. Dr. Eva Pongrácz \(https://sciprofiles.com/profile/764372\)](https://sciprofiles.com/profile/764372)

[Website \(https://www oulu.fi/university/researcher/eva-pong racz\)](https://www oulu.fi/university/researcher/eva-pong racz)

Associate Editor

Water, Energy and Environmental Engineering Research Unit, University of OULU, P.O. Box 4300, 90014 Oulu, Finland

Interests: sustainable development; circular economy; industrial ecology; municipal waste management; food waste; electronic waste; sustainable energy; energy transition

Special Issues, Collections and Topics in MDPI journals

Dr. Cara Beal (<https://sciprofiles.com/profile/616672>)

Website (<https://experts.griffith.edu.au/7842-cara-beal>)

Editorial Board Member

Cities Research Institute and School of Pharmacy and Medical Sciences, Griffith University, Brisbane, QLD 4222, Australia

Interests: water resource management; environmental health; water; sanitation hygiene (WASH); indigenous communities; systems thinking; digital transformation; water sciences and policy

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Volker Beckmann (<https://sciprofiles.com/profile/72260>)

Website (<https://rsf.uni-greifswald.de/lehrstuehle/wiwi/avwl/lehrstuhl-beckmann/personen/prof-dr-volker-beckmann-lehrstuhlinhaber/>)

Editorial Board Member

Faculty of Law and Economics & Institute of Botany and Landscape Ecology, Ernst-Moritz-Arndt-University Greifswald, Soldmann Str. 15, 17487 Greifswald, Germany

Interests: institutional change; institutional economics; environmental and resource economics; governance of natural resources; agricultural and land economics; conservation; technology adoption; sustainable land management

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Anđelka Belic

Website (http://polj.uns.ac.rs/sites/default/files/vode/cv/CV_Andjelka_Belic.pdf)

Editorial Board Member

Department for Water Management, Faculty of Agriculture, University of Novi Sad, Trg D. Obradovica 8, 21000 Novi Sad, Republic of Serbia

Interests: water resources management; water pollution control; water treatment by constructed wetlands; water quality; water use; self purification in stream waters; environmental impact assessment

Dr. Silvia Bianchelli (<https://sciprofiles.com/profile/1056061>)

Website

(<https://www.univpm.it/Entra/Engine/RAServePG.php/P/320710014196/idsel/711/docname/SILVIA%20BIANCHELLI>)

Editorial Board Member

Dipartimento di Scienze della Vita e dell'Ambiente, Università Politecnica delle Marche, Via Brecce Bianche, 60131 Ancona, Italy

Interests: marine ecology; biodiversity; ecosystem functioning; anthropogenic impact on marine ecosystems

Prof. Dr. Raimund Bleischwitz (<https://sciprofiles.com/profile/959485>)

Website (<https://www.ucl.ac.uk/bartlett/sustainable/people/prof-raimund-bleischwitz>)

Editorial Board Member

Chair Sustainable Global Resources, Head of Department Bartlett School Env, Energy & Resources, Faculty of the Built Environment, University College London, Institute for Sustainable Resources (ISR), Central House, 14 Upper Woburn Place, London, WC1H 0NN, UK

Interests: resource efficiency; resource nexus; circular economy; raw material conflicts; political economy, governance

Prof. Dr. Gian Andrea Blengini (<https://sciprofiles.com/profile/2153051>)

Website ([https://www.diati.polito.it/personale/scheda/\(nominativo\)/giovanni.blengini](https://www.diati.polito.it/personale/scheda/(nominativo)/giovanni.blengini))

Editorial Board Member

Politecnico di Torino – Department of Environment, Land and Infrastructure Engineering (DIATI), Corso Duca degli Abruzzi, 24-10129 Torino, Italy

Interests: Critical Raw Materials (CRMs); CRMs in circular economy; life cycle assessment

Prof. Dr. John Briggs (<https://sciprofiles.com/profile/13262>)

Website (<https://www.gla.ac.uk/schools/ges/staff/johnbriggs/>)

Editorial Board Member

School of Geographical and Earth Sciences, East Quadrangle, University of Glasgow, Glasgow, G12 8QQ, UK

Interests: natural resource management; rural development and environmental challenges in Africa; indigenous environmental knowledges

Dr. Jennifer Broadhurst

Website (<http://www.mineralstometals.uct.ac.za/mtm-people/core-leadership-team/jennifer-broadhurst>)

Editorial Board Member

Deputy Director, Minerals to Metals Initiative, Department of Chemical Engineering, University of Cape Town, P/Bag Rondebosch 7701, South Africa

Interests: tools and metrics for evaluating environmental and broader sustainability performance of primary metal production processes; characterisation and management of solid mineral wastes; acid rock drainage prediction and mitigation, value from waste, distribution behaviour and impacts of minor and trace elements across the entire ore-to-metal chain, development and application of trans-disciplinary approaches to the complex sustainability issues of relevance to the minerals industry

Dr. Diego Copetti (<https://sciprofiles.com/profile/336510>)

Website (https://www.irsacnr.it/wp/?page_id=1168&author=diego.copetti)

Editorial Board Member

CNR-Water Research Institute, 20861 Brugherio (MB), Italy

Interests: applied ecology; water quality; biogeochemistry; environmental monitoring and modelling; management of water resources; climate change impact on surface waters; sustainability; ecosystem services

Special Issues, Collections and Topics in MDPI journals

Dr. Michela Costa (<https://sciprofiles.com/profile/920029>)

Website (https://www.im.cnr.it/?page_id=948&lang=en)

Editorial Board Member

Istituto di Scienze e Tecnologie per l'Energia e la Mobilità Sostenibili, CNR STMS, Via Guglielmo Marconi, 4 – 80125 Naples, Italy

Interests: renewable energy systems; biomass thermo-chemical conversion; energy efficiency; waste heat recovery; computational fluid dynamics; modeling of reacting and non-reacting thermo-fluid systems; combustion kinetics

Special Issues, Collections and Topics in MDPI journals

Dr. Alessandro Galli (<https://sciprofiles.com/profile/65157>)

Website (http://www.footprintnetwork.org/en/index.php/GFN/page/our_team/)

Editorial Board Member

Director Mediterranean-MENA Program, Global Footprint Network, International Environment House 2, 7-9 Chemin de Balexert, 1219 Geneva, Switzerland

Interests: ecological footprint; human dependence on natural resources and ecosystem services; global environmental changes (including their socio-economic drivers); land use; resource management; sustainability

Prof. Dr. Bruce Glavovic (<https://sciprofiles.com/profile/9555>)

Website1 (<http://volcanic.massey.ac.nz/aboutus/staff/glavovic.html>) **Website2**

(<https://www.massey.ac.nz/massey/expertise/profile.cfm?stref=664630>)

Editorial Board Member

Resource and Environmental Planning Programme, Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand

Interests: natural hazards planning; coastal management; sustainability governance; climate change adaptation

Dr. Carlos Guedes Soares (<https://sciprofiles.com/profile/363336>)

Website (<https://www.cienciavita.pt/portal/en/411E-B911-1D2A>)

Editorial Board Member

Centre for Marine Technology and Ocean Engineering (CENTEC), Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001 Lisboa, Portugal

Interests: marine environment; ship dynamics; marine structures; safety and reliability

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Amir Hossein Hamidian (<https://sciprofiles.com/profile/85147>)

Website (<https://profile.ut.ac.ir/en/~a.hamidian/>)

Editorial Board Member

Department of Environmental Science and Engineering, Faculty of Natural Resources, University of Tehran, Karaj, Iran

Interests: environmental pollution; emerging pollutants; microplastics; nanoplastics; trace elements

Prof. Dr. Horia Hangan

Website (<https://ontariotechu.ca/experts/feas/horia-hangan.php>)

Editorial Board Member

Faculty of Engineering and Applied Science, Ontario Tech University, Oshawa, ON L1G 0C5, Canada

Interests: fluid mechanics; turbulence; wind engineering; atmospheric flows; aerodynamics; flow control

Prof. Dr. Kevin Hiscock

Website (<https://research-portal.uea.ac.uk/en/persons/kevin-hiscock>)

Editorial Board Member

School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, UK

Interests: groundwater resources assessment and management; climate change impacts on groundwater resources

Dr. Eleni Iacovidou (<https://sciprofiles.com/profile/209246>)

Website1 (<https://www.brunel.ac.uk/people/eleni-iacovidou>) **Website2 (<https://scholar.google.com/citations?user=f0OVXikAAAAJ&hl=en>)**

Editorial Board Member

Division of Environmental Sciences, College of Health, Medicine and Life Sciences, Brunel University London, Uxbridge UB8 3PH, UK

Interests: environmental governance; environmental management; sustainable management of resources and waste; systems thinking; (bio)plastics and (bio)plastic packaging waste management; circular economy models; food waste prevention and management; construction components reuse; e-waste repair; waste infrastructure; informal recycling systems; decision-making tool development; sustainability assessment and evaluation

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Carlo Ingrao (<https://sciprofiles.com/profile/522002>)

Website (<https://www.unifg.it/ugov/person/10775>)

Editorial Board Member

Department of Economics, University of Foggia, Via Romolo Caggese, 1 - 71121 Foggia, Italy

Interests: environmental sustainability; life cycle assessment; buildings energy efficiency

Special Issues, Collections and Topics in MDPI journals

Dr. Antonio A. R. Ioris (<https://sciprofiles.com/profile/241770>)

Website (<https://www.cardiff.ac.uk/people/view/522826-ioris-antonio>)

Editorial Board Member

School of Geography and Planning, Cardiff University, Glamorgan Building, King Edward VII Avenue, Cardiff CF10 3WA, UK

Interests: indigenous geography; indigenous peoples; agribusiness frontiers; environment and development; natural resources; water management; human geography; environmental governance

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Joanna Kulczycka (<https://sciprofiles.com/profile/1072601>)

Website (<https://skos.agh.edu.pl/osoba/joanna-kulczycka-5975.html>)

Editorial Board Member

Faculty of Management, AGH University of Science and Technology, Mickiewicza 30, 30-059 Cracow, Poland

Interests: circular economy; LCA; LCC; eco-innovation; management; raw materials

Special Issues, Collections and Topics in MDPI journals

Dr. Harry Lehmann (<https://sciprofiles.com/profile/13083>)

Website (<http://www.umweltbundesamt.de/uba-info/d-fach1.htm>)

Editorial Board Member

Federal Environmental Agency of Germany, Wörlitzer Platz 1, D-06844 Dessau, Germany

Interests: sustainability; resource productivity; sustainable energy supply (renewable energies); land use

Prof. Dr. Christa Liedtke

Website1 (<https://wupperinst.org/en/c/wi/c/s/cd/20/>) **Website2 (<https://id.folkwang-uni.de/team/prof-dr-christa-liedtke/>)**

Editorial Board Member

1. Director of the Division Sustainable Production and Consumption, Wuppertal Institute for Climate, Environment and Energy, 42004 Wuppertal, Germany

2. Professor for Sustainability Research in Design, Department of Industrial Design, Folkwang University of the Arts, 45239 Essen, Germany

Interests: sustainable consumption and production; design for sustainability and circularity

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Anna Littleboy (<https://sciprofiles.com/profile/2276848>)

Website (<https://smi.uq.edu.au/profile/2558/anna-littleboy>)

Editorial Board Member

Sustainable Minerals Institute, The University of Queensland, Brisbane, Queensland, Australia

Interests: resources; community and environment; strategic foresight; circular economy; responsible resource development; risk assessment; mine lifecycle; criticality; mine closure and regional transitions

Prof. Dr. Jun Liu

Website (https://edu.cags.ac.cn/#/dky/teacher-details/barId=szdw_bss/index=1/id=52c9bb5c842c954e01842c99356b0307)

Editorial Board Member

Institute of Mineral Resources, Chinese Academy of Geological Sciences, Beijing 100037, China

Interests: magmatic hydrothermal systems and alteration patterns; conceptual modelling of porphyry-skarn deposit system; orogeny and orogenic gold system; reduced magma and related gold mineralization; remote sensing and regional mineral exploration

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Bernd Markert

Website (<http://www.eisn-institute.de/team-members/prof-dr-bernd-markert/>)

Editorial Board Member

Prof. Dr. Kazuyo Matsubae

Website (http://db.tohoku.ac.jp/whois/e_detail/e07e46028c7a83b1c6780808558cd8d8.html)

Editorial Board Member

Graduate School of Environmental Studies, Tohoku University, 468-1, Aoba, Aramaki, Aoba-ku, Sendai, Miyagi, Japan

Interests: life cycle assessment; ecological footprint; supply chain risk; industrial ecology

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Norman Miller

Website (<http://geography.berkeley.edu/people/emeriti/norman-miller/>)

Editorial Board Member

Department of Geography, University of Berkeley, 507 McCone Hall, Berkeley, CA 94720, USA

Interests: hydroclimate and related processes; impacts, and adaptation

Displaying Editorial board member 1-30 on page 1 of 2.

Go to page [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#) [12](#) [13](#) [14](#) [15](#) [16](#) [17](#) [18](#) [19](#) [20](#) [21](#) [22](#) [23](#) [24](#) [25](#) [26](#) [27](#) [28](#) [29](#) [30](#)

Resources (</journal/resources>), EISSN 2079-9276, Published by MDPI

RSS (</rss/journal/resources>) **Content Alert** (</journal/resources/toc-alert>)

Further Information

Article Processing Charges (</apc>)

Pay an Invoice (</about/payment>)

Open Access Policy (</openaccess>)

Contact MDPI (</about/contact>)

Jobs at MDPI (<https://careers.mdpi.com>)

Guidelines

For Authors (</authors>)

For Reviewers (</reviewers>)

For Editors (</editors>)

For Librarians (</librarians>)

For Publishers (/publishing_services)

For Societies (</societies>)

For Conference Organizers (/conference_organizers)

MDPI Initiatives

Sciforum (<https://sciforum.net>)

MDPI Books (<https://www.mdpi.com/books>)

Preprints.org (<https://www.preprints.org>)

Scilit (<https://www.scilit.net>)

SciProfiles (<https://sciprofiles.com>)

[Encyclopedia \(https://encyclopedia.pub\)](https://encyclopedia.pub)

[JAMS \(https://jams.pub\)](https://jams.pub)

[Proceedings Series \(/about/proceedings\)](/about/proceedings)

Follow MDPI

[LinkedIn \(https://www.linkedin.com/company/mdpi\)](https://www.linkedin.com/company/mdpi)

[Facebook \(https://www.facebook.com/MDPIOpenAccessPublishing\)](https://www.facebook.com/MDPIOpenAccessPublishing)

[Twitter \(https://twitter.com/MDPIOpenAccess\)](https://twitter.com/MDPIOpenAccess)



Subscribe to receive issue release notifications and newsletters from MDPI journals

Select options ▼

Enter your email address...

Subscribe

© 1996-2023 MDPI (Basel, Switzerland) unless otherwise stated

[Disclaimer](#) **[Terms and Conditions \(/about/terms-and-conditions\)](/about/terms-and-conditions)**

[Privacy Policy \(/about/privacy\)](/about/privacy)

[Sign In / Sign Up \(/user/login\)](/user/login)[Submit \(https://susy.mdpi.com/user/manuscripts/upload?journal=resources\)](https://susy.mdpi.com/user/manuscripts/upload?journal=resources)

Search for Articles:

Advanced Search

[Journals \(/about/journals\)](/about/journals) / [Resources \(/resources\)](/resources) / [Volume 12 \(/2079-9271\)](/2079-9271) / [Issue 5](#)



**IMPACT
FACTOR**

CITESCORE

3.3

7.7

[\(/journal/resources/stats\)](/journal/resources/stats)

<https://www.scopus.com/sourceid/21100808642>

Journal Menu

► [Journal Menu](#)

- [Resources Home \(/journal/resources\)](/journal/resources)
- [Aims & Scope \(/journal/resources/about\)](/journal/resources/about)
- [Editorial Board \(/journal/resources/editors\)](/journal/resources/editors)
- [Reviewer Board \(/journal/resources/submission_reviewers\)](/journal/resources/submission_reviewers)
- [Topical Advisory Panel \(/journal/resources/topical_advisory_panel\)](/journal/resources/topical_advisory_panel)
- [Instructions for Authors \(/journal/resources/instructions\)](/journal/resources/instructions)
- [Special Issues \(/journal/resources/special_issues\)](/journal/resources/special_issues)
- [Topics \(/topics?query=&journal=resources&status=all&category=all\)](/topics?query=&journal=resources&status=all&category=all)
- [Topical Collections \(/journal/resources/topical_collections\)](/journal/resources/topical_collections)
- [Article Processing Charge \(/journal/resources/apc\)](/journal/resources/apc)
- [Indexing & Archiving \(/journal/resources/indexing\)](/journal/resources/indexing)
- [Most Cited & Viewed \(/journal/resources/most_cited\)](/journal/resources/most_cited)
- [Journal Statistics \(/journal/resources/stats\)](/journal/resources/stats)
- [Journal History \(/journal/resources/history\)](/journal/resources/history)
- [Journal Awards \(/journal/resources/awards\)](/journal/resources/awards)
- [Editorial Office \(/journal/resources/editorial_office\)](/journal/resources/editorial_office)

Journal Browser

► [Journal Browser](#)

volume
volume
issue
issue
Go

- > [Forthcoming issue \(/2079-9276/12/10\)](/2079-9276/12/10)
- > [Current issue \(/2079-9276/12/9\)](/2079-9276/12/9)

- [Vol. 12 \(2023\) \(/2079-9276/12\)](/2079-9276/12)
- [Vol. 11 \(2022\) \(/2079-9276/11\)](/2079-9276/11)
- [Vol. 10 \(2021\) \(/2079-9276/10\)](/2079-9276/10)
- [Vol. 9 \(2020\) \(/2079-9276/9\)](/2079-9276/9)
- [Vol. 8 \(2019\) \(/2079-9276/8\)](/2079-9276/8)
- [Vol. 7 \(2018\) \(/2079-9276/7\)](/2079-9276/7)
- [Vol. 6 \(2017\) \(/2079-9276/6\)](/2079-9276/6)
- [Vol. 5 \(2016\) \(/2079-9276/5\)](/2079-9276/5)
- [Vol. 4 \(2015\) \(/2079-9276/4\)](/2079-9276/4)
- [Vol. 3 \(2014\) \(/2079-9276/3\)](/2079-9276/3)
- [Vol. 2 \(2013\) \(/2079-9276/2\)](/2079-9276/2)
- [Vol. 1 \(2012\) \(/2079-9276/1\)](/2079-9276/1)

Resources, Volume 12, Issue 5 (May 2023) – 8 articles

Cover Story ([view full-size image \(/files/uploaded/covers/resources/big_cover-resources-v12-9276/12/5/59\)](/files/uploaded/covers/resources/big_cover-resources-v12-9276/12/5/59))

<https://www.mdpi.com/2079-9276/12/5/59> Publicly available global data sets are used to assess geodiversity of the European continent, including the diversity of landforms, lithology, soils, topography, and surface/underground water reservoirs. The framework consists of the following four main steps: 1) conversion of raster to vector (polygonal) layers; 2) location of geometric centres (centroids) of polygons that represent the spatial extent of a geodiversity element; 3) visualisation of the spatial density of centroids for a given variable (kernel density estimation); 4) generation of maps showing hotspots and coldspots representing the

expected number of centroids per unit area. The method allows for the detection of areas that exhibit high abiotic heterogeneity, but are not recognised for their conservation significance. [View this paper \(https://www.mdpi.com/2079-9276/12/5/59\)](https://www.mdpi.com/2079-9276/12/5/59)

- Issues are regarded as officially published after their release is announced to the [table of contents alert mailing list \(/journal/resources/toc-alert\)](/journal/resources/toc-alert).
- You may [sign up for e-mail alerts \(/journal/resources/toc-alert\)](/journal/resources/toc-alert) to receive table of contents of newly released issues.
- PDF is the official format for papers published in both, html and pdf forms. To view the papers in pdf format, click on the "PDF Full-text" link, and use the free [Adobe Reader \(http://www.adobe.com/\)](http://www.adobe.com/) to open them.

Order results

Publication Date

Publication Date

Result details

Normal

Normal

[Show export options](#) ▾

Open Access Article

↓ [./2079-9276/12/5/61/pdf?version=1684764511](/2079-9276/12/5/61/pdf?version=1684764511)

[Promoting Geosites on Web-Pages: An Assessment of the Quality and Quantity of Information in Real Cases \(/2079-9276/12/5/61\)](/2079-9276/12/5/61)

by

[Anna V. Mikhailenko \(https://sciprofiles.com/profile/author/RDRhSFVyOWV2TjRhdUg0SEtwV2FIOGluaFVlcmx1QzJGZr\)](https://sciprofiles.com/profile/author/RDRhSFVyOWV2TjRhdUg0SEtwV2FIOGluaFVlcmx1QzJGZr)

,
[Svetlana O. Zorina \(https://sciprofiles.com/profile/author/cjFTQ2s4VDhKTUIwKzNPRnluZitkZzg5SmxxalpoNU5qSEcx\)](https://sciprofiles.com/profile/author/cjFTQ2s4VDhKTUIwKzNPRnluZitkZzg5SmxxalpoNU5qSEcx)

,
[Natalia N. Yashalova \(https://sciprofiles.com/profile/author/UERBNVFPzZXYVFGZ29UUFNMUE5LOTNuOWwwRnpVd\)](https://sciprofiles.com/profile/author/UERBNVFPzZXYVFGZ29UUFNMUE5LOTNuOWwwRnpVd)
and

[Dmitry A. Ruban \(https://sciprofiles.com/profile/468157\)](https://sciprofiles.com/profile/468157)

Resources **2023**, *12*(5), 61; <https://doi.org/10.3390/resources12050061> (<https://doi.org/10.3390/resources12050061>) - 22
May 2023

Viewed by 711

Abstract Geological information present on web-pages determines the efficacy of the online marketing of geosites. In this paper, a new approach aimed at an easy and quick assessment of geosite-focused web-pages is proposed. It is based on scoring by several criteria reflecting the quality [...] [Read more.](#)

(This article belongs to the Special Issue [Geosites as Tools for the Promotion and Conservation of Geoheritage \(/journal/resources/special_issues/6O1NX46217\)](/journal/resources/special_issues/6O1NX46217).)

► [Show Figures](#)

https://pub.mdpi-res.com/resources/resources-12-00061/article_deploy/html/images/resources-12-00061-g001-550.jpg?1684764600 (https://pub.mdpi-res.com/resources/resources-12-00061/article_deploy/html/images/resources-12-00061-g002-550.jpg?1684764607) (https://pub.mdpi-res.com/resources/resources-12-00061/article_deploy/html/images/resources-12-00061-g003-550.jpg?1684764602)

https://pub.mdpi-res.com/resources/resources-12-00061/article_deploy/html/images/resources-12-00061-g004-550.jpg?1684764604

https://pub.mdpi-res.com/resources/resources-12-00061/article_deploy/html/images/resources-12-00061-g004-550.jpg?1684764604

Open Access Editorial

↓ [./2079-9276/12/5/60/pdf?version=1684457119](/2079-9276/12/5/60/pdf?version=1684457119)

[Integration of Water Quantity/Quality Needs with Socio-Economical Issues: A Focus on Monitoring and Modelling \(/2079-9276/12/5/60\)](/2079-9276/12/5/60)

by [Diego Copetti \(https://sciprofiles.com/profile/1828615\)](https://sciprofiles.com/profile/1828615)

Resources **2023**, *12*(5), 60; <https://doi.org/10.3390/resources12050060> (<https://doi.org/10.3390/resources12050060>) - 18

May 2023

Viewed by 768

Abstract Freshwater is essential for a multitude of different uses, including drinking supply, irrigation, and energy production [...] **Full article** (</2079-9276/12/5/60>)

(This article belongs to the Special Issue **Advances in Water Resource Monitoring and Modelling: Water Quantity and Quality Issues** (/journal/resources/special_issues/water_monitoring_modelling))

Open Access Article

[↓ </2079-9276/12/5/59/pdf?version=1684395656>](/2079-9276/12/5/59/pdf?version=1684395656) 

Quantifying Geodiversity at the Continental Scale: Limitations and Prospects (</2079-9276/12/5/59>)

by **Paweł Wolniewicz** (<https://sciprofiles.com/profile/1704485>)

Resources **2023**, *12*(5), 59; <https://doi.org/10.3390/resources12050059> (<https://doi.org/10.3390/resources12050059>) - 17

May 2023

Viewed by 922

Abstract Geodiversity, defined as the natural range of geological, geomorphological, hydrological, and soil features, has been explored in a growing number of studies at different spatial scales. However, most research efforts have been directed at analysing geodiversity at a fine-scale. Here, an estimation of [...] **Read more.**

(This article belongs to the Special Issue **Geodiversity Assessment: What, Why and How?** (/journal/resources/special_issues/geodiversity_assessment))

► **Show Figures**

([https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-ag-](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-ag-550.jpg?1684395763)

[550.jpg?1684395763](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g001-550.jpg?1684395733)) ([https://pub.mdpi-](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g001-550.jpg?1684395733)

[res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g002-550.jpg?1684395748](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g002-550.jpg?1684395748))

([https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g003-](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g003-550.jpg?1684395752)

[550.jpg?1684395752](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g003-550.jpg?1684395752)) ([https://pub.mdpi-](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g003-550.jpg?1684395752)

[res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g004-550.jpg?1684395763](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g004-550.jpg?1684395763)) ([https://pub.mdpi-](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g004-550.jpg?1684395763)

[res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g005-550.jpg?1684395744](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g005-550.jpg?1684395744))

([https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g006-](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g006-550.jpg?1684395758)

[550.jpg?1684395758](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g006-550.jpg?1684395758)) ([https://pub.mdpi-](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g006-550.jpg?1684395758)

[res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g007-550.jpg?1684395760](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g007-550.jpg?1684395760)) ([https://pub.mdpi-](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g007-550.jpg?1684395760)

[res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g008-550.jpg?1684395756](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g008-550.jpg?1684395756))

([https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g009-](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g009-550.jpg?1684395737)

[550.jpg?1684395737](https://pub.mdpi-res.com/resources/resources-12-00059/article_deploy/html/images/resources-12-00059-g009-550.jpg?1684395737))

Open Access Article

[↓ </2079-9276/12/5/58/pdf?version=1683709719>](/2079-9276/12/5/58/pdf?version=1683709719)

Contribution of Landscape Transformation in the Development of Heat Islands and Sinks in Urban and Peri-Urban Regions in the Chota–Nagpur Plateau, India (</2079-9276/12/5/58>)

by **Amit Kumar** (<https://sciprofiles.com/profile/25132>), **Manjari Upreti** (<https://sciprofiles.com/profile/3053467>),

Arvind Chandra Pandey (<https://sciprofiles.com/profile/25540>),

Purabi Saikia (<https://sciprofiles.com/profile/782604>) and

Mohammed Latif Khan (<https://sciprofiles.com/profile/2004209>)

Resources **2023**, *12*(5), 58; <https://doi.org/10.3390/resources12050058> (<https://doi.org/10.3390/resources12050058>) - 09

May 2023

Viewed by 979

Abstract Cities in the contemporary world are experiencing shifts in local climatic conditions that are primarily linked to rapid urban growth, carbon emissions, and environmental degradation. In the present study, land surface temperature (LST) in urban and peri-urban regions of the city of Ranchi [...] **Read more.**

► **Show Figures**

(https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g001-550.jpg?1683709809) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g002-550.jpg?1683709827) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g003-550.jpg?1683709816) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g004-550.jpg?1683709796) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g005-550.jpg?1683709819) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g006-550.jpg?1683709799) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g007-550.jpg?1683709831) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g008-550.jpg?1683709823) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g009-550.jpg?1683709814) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g010-550.jpg?1683709807) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g011-550.jpg?1683709825) (https://pub.mdpi-res.com/resources/resources-12-00058/article_deploy/html/images/resources-12-00058-g012-550.jpg?1683709804)

Open Access Article

[↓ \(/2079-9276/12/5/57/pdf?version=1683260233\)](#)

Economic Activities and Management Issues for the Environment: An Environmental Kuznets Curve (EKC) and STIRPAT Analysis in Turkey (/2079-9276/12/5/57)

by **Mortaza Ojaghlo** (<https://sciprofiles.com/profile/969664>),

Erginbay Ugurlu (<https://sciprofiles.com/profile/1151924>),

Marta Kadłubek (<https://sciprofiles.com/profile/2094762>) and

Eleftherios Thalassinos (<https://sciprofiles.com/profile/1193082>)

Resources **2023**, *12*(5), 57; <https://doi.org/10.3390/resources12050057> (<https://doi.org/10.3390/resources12050057>) - 30 Apr 2023

Cited by 2 (/2079-9276/12/5/57#metrics) | Viewed by 1416

Abstract The emission of air pollutants from energy production and consumption is a major cause of environmental problems. In addition, urbanisation and CO₂ emissions have become major environmental concerns that are closely related to climate change and sustainable economic growth. The purpose of [...] **Read more.**

(This article belongs to the Special Issue **Decision Making in Resources Management: Problems, Methods and Tools (/journal/resources/special_issues/decision_making_resources_management)**)

► **Show Figures**

(https://pub.mdpi-res.com/resources/resources-12-00057/article_deploy/html/images/resources-12-00057-g001-550.jpg?1683260299) (https://pub.mdpi-res.com/resources/resources-12-00057/article_deploy/html/images/resources-12-00057-g0A1-550.jpg?1683260296) (https://pub.mdpi-res.com/resources/resources-12-00057/article_deploy/html/images/resources-12-00057-g0A2-550.jpg?1683260297)

Open Access **Article**

[↓ \(/2079-9276/12/5/56/pdf?version=1682676980\)](#)

Strengthening Reclamation Obligation through Mining Law Reform: Indonesian Experience (/2079-9276/12/5/56)

by **Nurul Listiyani** (<https://sciprofiles.com/profile/2689893>), **M. Yasir Said** (<https://sciprofiles.com/profile/528862>) and

Afif Khalid (<https://sciprofiles.com/profile/author/YjIzWnRXTHg2VEJqM1I3emJLR2MzeINKTE9hYXN1dHBLSTU0RExo>)

Resources **2023**, *12*(5), 56; <https://doi.org/10.3390/resources12050056> (<https://doi.org/10.3390/resources12050056>) - 28 Apr 2023

Cited by 1 (/2079-9276/12/5/56#metrics) | Viewed by 1189

Abstract Reclamation can produce more value for the environment and create a far better situation than post-mining conditions. While the reclamation obligation policy is a great way to introduce a restorative approach to the environment, the

main problem is the disobedience of the mining [...] [Read more.](#)

► [Show Figures](#)

(https://pub.mdpi-res.com/resources/resources-12-00056/article_deploy/html/images/resources-12-00056-g001-550.jpg?1682677063) (https://pub.mdpi-res.com/resources/resources-12-00056/article_deploy/html/images/resources-12-00056-g002-550.jpg?1682677060) (https://pub.mdpi-res.com/resources/resources-12-00056/article_deploy/html/images/resources-12-00056-g003-550.jpg?1682677062) (https://pub.mdpi-res.com/resources/resources-12-00056/article_deploy/html/images/resources-12-00056-g004-550.jpg?1682677061) (https://pub.mdpi-res.com/resources/resources-12-00056/article_deploy/html/images/resources-12-00056-g005-550.jpg?1682677055) (https://pub.mdpi-res.com/resources/resources-12-00056/article_deploy/html/images/resources-12-00056-g006-550.jpg?1682677058)

Open Access Article

↓ (</2079-9276/12/5/55/pdf?version=1682661274>)

New Lime-Based Hybrid Composite of Sugarcane Bagasse and Hemp as Aggregates (</2079-9276/12/5/55>)

by [Arlen Zúniga](https://sciprofiles.com/profile/2857082) (<https://sciprofiles.com/profile/2857082>), [Rute Eires](https://sciprofiles.com/profile/2638159) (<https://sciprofiles.com/profile/2638159>) and [Raphaele Malheiro](https://sciprofiles.com/profile/883649) (<https://sciprofiles.com/profile/883649>)

Resources **2023**, *12*(5), 55; <https://doi.org/10.3390/resources12050055> (<https://doi.org/10.3390/resources12050055>) - 27

Apr 2023

Viewed by 1263

Abstract Bio-based materials help reduce the consumption of non-renewable resources, contributing to the development of sustainable construction. Industrial Hemp Concrete (IHC), which uses hemp stalk (HS) as an aggregate and a lime-based binder, is a bio-based material with various applications. This research developed a [...] [Read more.](#)

► [Show Figures](#)

(https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g001-550.jpg?1682661391) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g002-550.jpg?1682661384) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g003-550.jpg?1682661380) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g004-550.jpg?1682661389) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g005-550.jpg?1682661382) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g006-550.jpg?1682661401) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g007-550.jpg?1682661372) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g008-550.jpg?1682661379) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g009-550.jpg?1682661399) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g010-550.jpg?1682661396) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g011-550.jpg?1682661385) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g012-550.jpg?1682661392) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g013-550.jpg?1682661387) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g014-550.jpg?1682661397) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g015-550.jpg?1682661386) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g016-550.jpg?1682661374) (https://pub.mdpi-res.com/resources/resources-12-00055/article_deploy/html/images/resources-12-00055-g017-550.jpg?1682661373)

The Time-Varying Effects of Oil Shocks on the Trade Balance of Saudi Arabia (/2079-9276/12/5/54)

by **Mohamad Husam Helmi** (<https://sciprofiles.com/profile/2533645>),

Mohammed I. Abu Eleyan (<https://sciprofiles.com/profile/2810200>),

Abdurrahman Nazif Çatık (<https://sciprofiles.com/profile/2533742>) and

Esra Ballı (<https://sciprofiles.com/profile/author/aVVNWWN2dFB5REQ0OW5JN1VvOXpZeFZMbVdzWEh2ajBSOUNBaE>)

Resources **2023**, *12*(5), 54; <https://doi.org/10.3390/resources12050054> (<https://doi.org/10.3390/resources12050054>) - 25

Apr 2023

Cited by 1 (</2079-9276/12/5/54#metrics>) | Viewed by 1479

Abstract This study aims to analyze the impact of oil shocks on the external balance of Saudi Arabia, as one of the largest net oil-exporting countries. To this end, a time-varying parameter vector autoregression model (TVP-VAR) is estimated by using quarterly data covering the [...] **Read more.**

(This article belongs to the Special Issue **Security, Policy and Political Economy of Energy and Minerals** (/journal/resources/special_issues/Energy_Minerals))

► Show Figures

(https://pub.mdpi-res.com/resources/resources-12-00054/article_deploy/html/images/resources-12-00054-g001-550.jpg?1682436203) (https://pub.mdpi-res.com/resources/resources-12-00054/article_deploy/html/images/resources-12-00054-g002-550.jpg?1682436195) (https://pub.mdpi-res.com/resources/resources-12-00054/article_deploy/html/images/resources-12-00054-g003-550.jpg?1682436207)

(https://pub.mdpi-res.com/resources/resources-12-00054/article_deploy/html/images/resources-12-00054-g004-550.jpg?1682436198) (https://pub.mdpi-res.com/resources/resources-12-00054/article_deploy/html/images/resources-12-00054-g005-550.jpg?1682436201) (https://pub.mdpi-res.com/resources/resources-12-00054/article_deploy/html/images/resources-12-00054-g006-550.jpg?1682436205)

Show export options ▾

Displaying articles 1-8

[Previous Issue](#)

Volume 12, April (/2079-9276/12/4)

[Next Issue](#)

Volume 12, June (/2079-9276/12/6)

Resources (/journal/resources), EISSN 2079-9276, Published by MDPI

RSS (/rss/journal/resources) **Content Alert (/journal/resources/toc-alert)**

Further Information

Article Processing Charges (/apc)

Pay an Invoice (/about/payment)

Open Access Policy (/openaccess)

Contact MDPI (/about/contact)

Jobs at MDPI (https://careers.mdpi.com)

Guidelines

For Authors (/authors)

For Reviewers (/reviewers)

[For Editors \(/editors\)](#)

[For Librarians \(/librarians\)](#)

[For Publishers \(/publishing_services\)](#)

[For Societies \(/societies\)](#)

[For Conference Organizers \(/conference_organizers\)](#)

MDPI Initiatives

[Sciforum \(https://sciforum.net\)](https://sciforum.net)

[MDPI Books \(https://www.mdpi.com/books\)](https://www.mdpi.com/books)

[Preprints.org \(https://www.preprints.org\)](https://www.preprints.org)

[Scilit \(https://www.scilit.net\)](https://www.scilit.net)

[SciProfiles \(https://sciprofiles.com\)](https://sciprofiles.com)

[Encyclopedia \(https://encyclopedia.pub\)](https://encyclopedia.pub)

[JAMS \(https://jams.pub\)](https://jams.pub)

[Proceedings Series \(/about/proceedings\)](/about/proceedings)

Follow MDPI

[LinkedIn \(https://www.linkedin.com/company/mdpi\)](https://www.linkedin.com/company/mdpi)

[Facebook \(https://www.facebook.com/MDPIOpenAccessPublishing\)](https://www.facebook.com/MDPIOpenAccessPublishing)

[Twitter \(https://twitter.com/MDPIOpenAccess\)](https://twitter.com/MDPIOpenAccess)



Subscribe to receive issue release notifications and newsletters from MDPI journals

Select options ▼

Enter your email address...

Subscribe

© 1996-2023 MDPI (Basel, Switzerland) unless otherwise stated

[Disclaimer](#) [Terms and Conditions \(/about/terms-and-conditions\)](/about/terms-and-conditions)

[Privacy Policy \(/about/privacy\)](/about/privacy)

[Back to Top](#)[Top](#)



resources

IMPACT
FACTOR
3.3

CITESCORE
7.7

Article

Strengthening Reclamation Obligation through Mining Law Reform: Indonesian Experience

Nurul Listiyani, M. Yasir Said and Afif Khalid



<https://doi.org/10.3390/resources12050056>

Article

Strengthening Reclamation Obligation through Mining Law Reform: Indonesian Experience

Nurul Listiyani ¹, M. Yasir Said ^{2,*}  and Afif Khalid ¹

¹ Faculty of Law, Universitas Islam Kalimantan Muhammad Arsyad Al Banjari, Jl. Adhyaksa No. 2, Banjarmasin 70123, Indonesia; nurullistiyani5@gmail.com (N.L.)

² Justicia Belen Law Office, Jl. Brigjen Hasan Basry, Banjarmasin 70123, Indonesia

* Correspondence: mys.legal.correspondent@gmail.com

Abstract: Reclamation can produce more value for the environment and create a far better situation than post-mining conditions. While the reclamation obligation policy is a great way to introduce a restorative approach to the environment, the main problem is the disobedience of the mining companies in their reclamation obligation. Therefore, we focused on conceptualizing the strengthening of the reclamation obligation policy in the Mining Act based on the understanding of preventing environmental and social damage. This research is conducted in doctrinal legal studies to create a prescriptive result. Despite the 2020 Mining Act Revision, Indonesia is still facing the previous legal issue due to blind spots in the regulatory framework. Ranging from the continuous conflicts between the mining company and the local community to the problem of non-compliance with the reclamation policy, which has resulted in excavation holes that were left untreated and abandoned, which has created casualties over the years. We offer two major reforms in formulation to strengthen the reclamation obligation. First, is the need to reinforce the essence of “obligation” for IUP and IUPK holders to perform reclamation and post-mining with supervision, as in the Environmental Act. With this formulation, the placement of the reclamation fund by the company does not eliminate the company’s obligation to carry out reclamation and post-mining activities. Second, for the company to comply with placing reclamation and post-mining funds, it is crucial to implement a mandatory condition, whereby the placing of a reclamation guarantees fund is a requirement for approval of the mining plans and budgets (the RKAB), and Clean and Clear (CnC) Certification. Therefore, the reform will cause a shift and strengthen the values of obligation in post-mining reclamations.

Keywords: Indonesia; mining; reform; policy; reclamation

JEL Classification: K10; K23; K32; K42



Citation: Listiyani, N.; Said, M.Y.; Khalid, A. Strengthening Reclamation Obligation through Mining Law Reform: Indonesian Experience. *Resources* **2023**, *12*, 56. <https://doi.org/10.3390/resources12050056>

Academic Editor: Benjamin McLellan

Received: 31 December 2022

Revised: 4 April 2023

Accepted: 6 April 2023

Published: 28 April 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Environmental damage is one of the main national issues in developing countries besides slow economic development. Unresolved poverty, social inequality, regional disparities, and ecological damage occur due to the excessive exploitation of natural resources, and the dependence on food, energy, finance, and technology [1]. Moreover, deforestation and forest degradation are the major leading causes of global warming, being responsible for around 15% of global greenhouse gas emissions, which makes the loss of forests a major issue for climate change. As Figure 1 shows, in some countries—for example, Indonesia and Brazil, deforestation and forest degradation are the primary sources of national greenhouse gas emissions [2].

The irresponsible mining practice in Indonesia has resulted in deforestation and forest degradation, which has damaged forests and ecosystems. Most of the mining practices in Indonesia relate to surface mining, whereby, the company often converts forest into a mining site [3]. Compared with the low compliance of reclamation obligation, this is often

the cause of deforestation and degradation. Mining permits in Indonesia have reached 11 million hectares, of which, 4.5 million hectares are forest areas. Indonesia experienced the greatest damage to tropical forests due to the mining industry, contributing to 58.2 percent of the total deforestation [4].

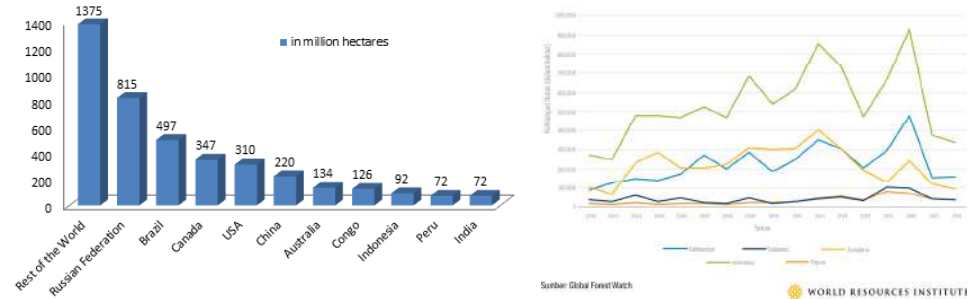


Figure 1. Global distribution of forests and Indonesia’s primary forest loss.

Mineral and coal mining often increases soil density, erosion, sedimentation, landslides, disruption of flora and fauna, and disruption of public health, which leads to microclimate change [5]. Meanwhile, the post-mining impacts have resulted in land morphology, topography, and landscape changes (the formation of landscapes on the post-mining sites is usually irregular, causing steep holes, and mounds of land that used heavy dumps), after which, the land becomes unproductive and potentially vulnerable to avalanches [6]. Undeniably, mining has a vital role in development by producing raw materials for industry, absorbing labor as a source of foreign exchange, and increasing local revenue. However, on the other hand, mining produces various adverse environmental impacts [7]. Mining activities have a high risk of environmental damage and create environmental justice issues, which have become a global concern [8]. Recent studies and analyses by Griscom et al. as shown in Figure 2 [9] estimate that stopping deforestation, restoring forests, and improving forestry practices are the most cost-effective ways to reduce 7 billion metric tons of carbon dioxide annually, which is equivalent to the emissions of 1.5 billion cars [10]. Therefore, reclamation must be completed on post-mining sites to restore the land’s function.

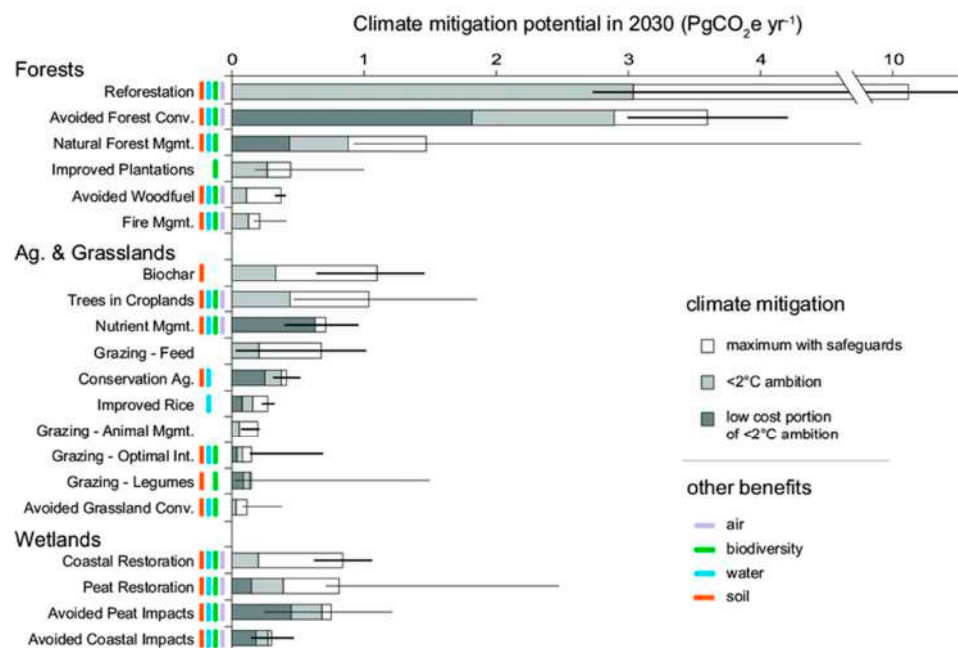


Figure 2. Climate mitigation potential in 2030.

Reclamation forces mining companies to restore the caused environmental losses. Land reclamation aims to repair the damage to post-mining ecosystems by improving soil fertility and planting lands at the surface. Moreover, land reclamation seeks to make the land more productive. Thus, reclamation can produce more value for the environment and create a far better situation than post-mining conditions. A good reclamation policy is a great way to introduce a restorative approach to the environment and support the REDD+ framework (Reducing Emissions from Deforestation and forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks (REDD+), is an essential part of the global efforts to mitigate climate change). REDD+ is a mechanism developed by parties to the United Nations Framework Convention on Climate Change (UNFCCC). It creates a financial value for the carbon stored in forests by incentivizing developing countries to reduce emissions from forested lands and invest in low-carbon options for sustainable development; developing countries would receive results-based payments for results-based actions. REDD+ goes beyond simply deforestation and forest degradation and includes the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks.

Before the Mining Law Reform, the major mining issue was the low levels of compliance by the License Holder (IUP) in conducting their reclamation and post-mining obligations [11]. Moreover, as seen in Figure 3, only 52 percent of the IUP holders fulfilled their obligation of the conditions in September 2017, meaning 48 percent of companies did not fulfill their reclamation and post-mining obligations [12]. In general, the main problem was disobedience relating to their reclamation obligations.

Reclamation and Post-Mining Compliance

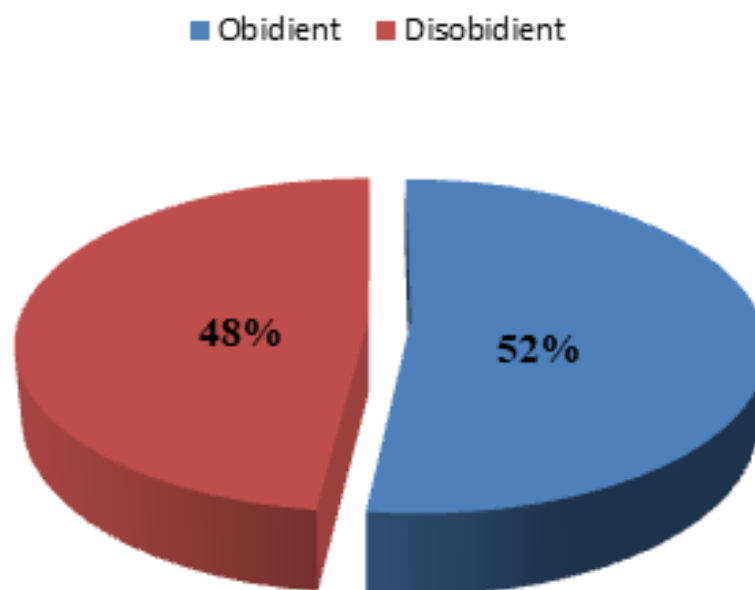


Figure 3. The Compliance Level of Reclamation.

Therefore, improving the compliance levels of the license holders through better regulations is required. Several Southeast Asian countries have introduced new mining laws to promote private-sector investment [13]. For instance, Indonesia recently entered a new Environmental Framework after a Mining Law Reform via Act 3/2020 (The New Mining Act) and Act 11/2020 (The Job Creation Law). Reform is necessary to prevent further damage to the environment in mining areas. After mining activities are completed, the site must be reclaimed immediately to avoid other potential damages. Thus, this research focuses on analyzing the post-mining law reform in Indonesia and conceptualizing the idea

of strengthening reclamation obligations in the Mining Act based on understanding high potential issues in reclamation obligations to prevent environmental and social damage.

2. Method

The method used in this study is doctrinal legal research [14]. Doctrinal legal research involves rigorous analysis and creative synthesis of multiple doctrinal strands. Doctrines are central to the juridical treatment of concepts because they collaborate with historical, comparative, analytical, and philosophical approaches [15]. We began with a preliminary study by problem identification in the current state of Indonesian mining law and practices, especially after the 2020 Mining Act Revision, with a perception that reclamation is an essential instrument in the exploitation of minerals and coal mining that aims to restore ex-mining sites. Following the study, an analysis was conducted of the regulatory framework present in the primary legal material, such as the Act 32/2009 on Environmental Protection and Management, Act 4/2009 on Mineral and Coal Mining, as revised by Act 3/2020, and Government Regulation 78/2010 on Reclamation and Post-Mining. The secondary legal material was library research, conducted by analyzing previous research and studies mentioned in the references. Then, we systematically studied the materials and performed a qualitative analysis based on legal reasoning and argumentation to create a prescriptive analysis result. The prescriptive research aims to produce ‘what ought to be’ in post-mining law reform in Indonesia.

3. Result and Discussion

3.1. Brief Historical Context on Mining Law in Indonesia

Before independence, Dutch colonials controlled the natural resources in Indonesia, including the minerals and mines. In 1989 through *Staatblad* 1989, and Number 214 promulgated *Indische Mijn Wet* (IMW) as *Mijnordonantie*, took effect from 1 May 1907, and regulates mining work safety (listed in Articles 365 to 612). Then, *Mijnordonantie* was revoked and updated to become *Mijnordonantie* 1930, which came into effect on 1 July 1930, thus, it no longer regulates the supervision of mining work safety, yet regulates itself in *Mijn Politie Reglemen* with *Staatblad* 1930 Number 314.

After Indonesia’s independence, the founding father established mining management regulations by issuing Government Regulations in Lieu of Law (Perpu) 37/1960 on Mining, which ended the 1989 *Indische Mijn Wet* (IMW). Still in the same year, 1960, the Government also issued the Perpu 44/1960 on Oil and Natural Gas. In addition, Act 5/1960, which relates to the Fundamental of Agrarian Regulations (UUPA), also implicitly regulates mining. In this era, the mining sector implemented a concession system, which gave companies mining rights and control of the land.

To accelerate economic development, Perpu 37/1960 was revoked and replaced with a new fundamental mining law: Act 11/1967 on Fundamental Mining Provisions, which came into effect on 2 December 1967. After the promulgation of this law, the legality of mining exploitation consisted of various forms of licenses, namely, the Mining Authority (KP), Contract of Work (KK), Contract of Work for Coal Mining Business (PKP2B), Regional Mining Permit (SIPD) for industrial minerals or group C minerals, and the People’s Mining Permit.

Forty-two years later, on 12 January 2009, the Parliament passed Act 4/2009 on Mineral and Coal Mining. The emergence of this law was a landmark that shifted three essential elements concerning mining law: the rule of law, the control of the state, and the legal relationship between the state and miners. Since the promulgation of this law, the legality of mining concessions has only been in permit forms, such as IUP, IUPK, and IPR.

This licensing instrument is important because it places the government in a controlling position, different from contracts/agreements, which sets the government in an equal position with the mining companies. In addition, the licensing function is repressive. Permits can function as instruments to address environmental problems, whereby the state

can obligate a business that obtains an environmental permit to carry out countermeasures for pollution or damage arising from its business activities.

On 12 May 2020, the House of Representatives passed the Bill of the new Mining Law. As of 10 June 2020, President Joko Widodo signed and passed Act No. 3/2020 as a revision of Act No. 4/2009 on Mineral and Coal Mining. Instead of fixing the issues faced by the old law, the new Mining Law removed the limit on the size of mining operations and allows for two automatic permit extensions of 20 years each. In addition, it effectively provides miners with bigger concessions and longer contracts, while with fewer environmental obligations due to the latest policy in Indonesia opting towards promoting EODB (Ease of Doing Business); hence, the 2020 Mining Act Revision and The Job Creation Law were enacted to loosen the requirements and obligations for business permits, including mining companies, despite the opposition from civil societies and environmental activists. Thus, aside from new regulation, the 2020 Mining Act Revision has not yet resolved the old legal issues related to permits, reclamation, protection of affected communities, and sanctions.

3.2. New Law, Old Challenges

The environmental ethics of used-oriented policy on natural resources in Indonesia is still morally debatable today [16,17]. The policy framework on sustainable resources should be within the understanding of harmony, balance, and sustainability of environmental functions [18]. Disruption of ecological functions can result in discontinued development. A sustainable environment is a goal in natural resources management to guarantee land use without reducing future environmental quality. As part of the environment, natural resources are “*all objects, powers, circumstances, functions of nature and living things, which are the results of natural processes, both in biological and non-biological, renewable and non-renewable*”. This concept distinguishes natural resources from biological, non-biological, renewable, and non-renewable resources. Thus, coal, as a mining product, is a non-renewable and non-biological resource. Furthermore, it is undeniable that coal provides many benefits to human life. Therefore, humans must continuously maintain coal availability through appropriate and integrated management.

The utility of natural resources is regulated by Article 33 (3) of the 1945 Constitution of the Republic of Indonesia, “The earth, water, and natural resources contained therein are controlled by the state and used for the greatest prosperity of the people”. The mandate of Article 33 (3) contains the maximum principle as the ground principle reflected in the word “greatest”. The purpose of Article 33 (3) in the Constitution is to limit State control, reflected in terms “for the greatest prosperity of the people”, which implies covering the entire generation of Indonesians. The exploitation of natural resources, generally at an early stage, is interpreted from an economic perspective through, merely, an economic approach. Then, modern policy should use natural resources beyond economic approaches by using the non-economic approach as a principle, which is inherent in sustainable management [19].

Jennifer McKay and Balbir Bhasin argue that ‘the mining industry in Indonesia is poised for a major reform effort necessary to sustain foreign direct investment and rescue the industry from serious decline’ [20]. However, our primary concerns are the land’s morphological changes and topography, the remaining untreated excavation holes, and the environment’s carrying capacity, which is damaged, such as polluted water and infertile soil. Furthermore, abandoning reclamation on ex-mining sites is irresponsible, and affects Indonesia’s environment, economy, and, more often, the people’s social aspect. The un-restored ex-mining sites create many conflicts between locals and mining companies. Many of the local communities on the mining sites are affected by environmental damage, often making them confront the company responsible, which creates more social conflicts and legal battles.

As the evidence shows, excavation holes in ex-mining sites have resulted in massive casualties over the years. From 2014–2018, JATAM (Mining Advocacy Network) recorded 140 victims, who died from drowning in ex-mining excavation holes that were left untreated. The excavation holes result from non-reclamation mining activities and have taken

casualties in 12 provinces in Indonesia, with 3033 holes from coal mining that are without any attempt of restoration [21].

Furthermore, the 2020 Mining Act Revision does not address continuous conflicts between the mining company and local people, such as land rights between the company and indigenous tribes, social conflict, and human rights violations (Jaringan Advokasi Tambang (The Mining Advocacy Network) assessed that most of all the mining companies that enter a region are always followed by conflicts between local communities, companies, and the government). A researcher from JATAM, Ki Bagus Hadikusuma, recorded 71 conflicts in the mining sector during 2014–2019. The conflict occurred between the local people who refused the application for a mining business permit by the company and the government. The case occurred in a land area of 925,748 hectares. Most conflicts occurred in the province of East Kalimantan (14 cases), followed by East Java (8 cases), and Central Sulawesi (9 cases). The conflict was mainly related to gold and coal mines. Furthermore, in 2019 alone, JATAM recorded several cases of criminal law misconduct related to mining activities, with two cases of an alleged assault that resulted in death, and four intimidations by thugs, allegedly, ordered by the owner of the mining company. The most criminal activities and attacks occurred in East Kalimantan and Central Java, followed by Bangka Belitung, Maluku, East Java, North Sumatra, West Sumatra, and South Kalimantan [22].

3.3. *The Shifting Authority, Power, and Affairs in Coal Mining Practices*

The 1945 Constitution is the source of the Government's authority and power in environmental control. Article 33 (3) of the 1945 Constitution of the Republic of Indonesia only acknowledges the state's power over energy if used for the greatest prosperity of the people. Jeremy Bentham's view on justice and ethics influences Article 33 (3) of the Constitution, so the State, which has the ultimate control over energy, is burdened by the obligation to provide for the people owing to their duty as a welfare state. However, quite the contrary is true, based on the analysis of the Indonesian Mining Act by Gandataruna and Haymon, who studied five significant elements of the legislation, their research found that the Indonesian Mining Act was unlikely to result in a mining industry that provides the maximum benefit to the Indonesian people [23]. The impact of mineral and coal extraction is often localized rather than national or global [24]. Even after the power struggle from colonialism, the founding fathers agreed upon a constitutional obligation of the State to control and utilize the national resources for the maximum prosperity of the people.

From a political perspective, the goal of using natural resources for socioeconomic development was stagnant until 1967, when Soeharto came to power with the New Order regime and introduced policies that supported a significant mining industry expansion. However, the combined effect of the financial crisis and domestic political unrest from 1997 until 1998 interrupted this process. Therefore, in 2009, the enactment of the Mining Act brought hope for the people, although, in practice, mineral and coal mining activities created further disputes. For example, the conflict in North Maluku Province between the Sawai and Tobelo Dalam Tribe and PT. Weda Bay Nickel and PT. Tekindo Energy. In Central Sulawesi, a dispute arose between the Podi Villagers v PT. Arthaindo Jaya Abadi. Furthermore, in West Sumbawa, the tension between the Tongo Sejong Villagers and PT Newmont Nusa Tenggara arose due to the local suffering from deforestation and water pollution. The decline in democracy [25] makes it more urgent that the Government takes a big step toward reforming the Mining Act, to ensure that mining companies comply with reclamation obligations based on the success criteria of restoration.

The Environment Law should be the umbrella for other environment-related laws, either via biological or non-biological natural resources (NR). To understand the practice of coal mining in Indonesia, it is essential to cover the authority that manages the natural resources. Environmental management involves general investigation, exploration, feasibility studies, construction, mining, processing and refining, transportation and sales, and post-mining activities. For integrated policing, therefore, all of the entire stages of activities in mining should also contain a principle of sustainability.

Authority, powers, and governmental affairs are three critical aspects of the thought process of administrative policymaking. Authority can be interpreted as the right or obligation to conduct one or several management functions, such as creating regulation, planning, organizing, managing, and supervising a particular object by the government. Moreover, Cheema and Rondinelli argued that it is more precise to use the term “authority” to interpret the government’s rights to manage natural resources [26]. In contrast, Hans Antlov uses “power” instead of “authority” [27]. Authority is one of the core conceptions in Global Administrative Law to enforce good governance values [28]. Authority, known as formal power, comes from the legislative (given by law) or executive administration (government affairs, according to Art 9 (2) of Act 23/2014, is divided into three parts: absolute affairs, concurrent affairs, and general affairs. Absolute affairs are governmental affairs that are fully the authority of the Central Government, which includes foreign policy, defense, security, justice, national monetary, fiscal, and religious. Subsequently, Art 9 (3) regulates that concurrent affairs are governmental affairs, which are divided between the Central Government and Regional (local) Government. The regional authority consists of mandatory and preferred government affairs. Furthermore, mandatory affairs consist of basic services and non-basic services).

In the case of the authority to issue mining permits, before Act 23/2014 on regional governments, most mining permits were issued by the district government. This authority has conditioned the local heads to become “small kings” in their area. With this authority, the issuance of mining permits was considered from economic values rather than sustainable values, which created further damage [29].

Since 2009, there have been several changes to the administration of mining permits in Indonesia. During 2009–2014, the issuance of mining permits fell under the Regent’s authority; during 2014–2020, the policy was revised so that the issuance of mining permits fell under the Governor’s authority.

After issuing the 2020 Mining Act Revision and the Job Creation Law, the authority shifted to a central authority, in this case, the Ministry of Energy and Mineral Resources and the Ministry of Investment. The change in authority from the regional to the central government certainly caused complexity in the management of mining licenses.

The transfer of management and licensing authority to the central government has implications for the regional authorities, which is an absolute priority. Thus, the question remains whether delegating authority and licensing to the central government was the right decision. Until now, the implementation of the previous Mining Act, which divided power over the control of minerals and coal to the provinces, has been substandard in supervising the mineral and coal mining business activities. Therefore, existing mining businesses are increasingly causing environmental damage due to discrepancies in the issuing of Mining Business Permits (IUP).

Applying a centralized authority within the mining industry, as regulated by the Mining Act Revision, has removed the authority of regional governments to issue Mining Business Permits (IUP). The return to a centralized system is regulated in the provisions of Article 35 in the Mining Act Revision, which reads: “*Mining business is carried out based on a Business Permit from the Central Government*”. Revision of the Mining Act also provides the central government with the authority to decide production volumes, sales volumes, and prices for metal minerals, certain types of non-metallic minerals or coal, and issuing permits for mining businesses. Regarding licensing, the types of licenses in the new law are divided into three types, namely, “*Mining Business Permits (IUP), Special Mining Business Permits (IUPK), and People’s Mining Permits (IPR)*”.

3.4. Parameter of Reclamation Policy

The essence of the rule of law is law enforcement beyond other affairs. Therefore, legislation is a significant part of creating the law for the nation. Legislation is one of the policy instruments (*beleids instrument*) essential to resolve and anticipate societal problems; even today, the legislation aims to direct people towards a better life [30]. Law, as a tool of

social control, also translates to preventing the government from acting arbitrarily. Similarly, in natural resources, the right to regulate, manage, and supervise natural resources is provided by the Constitution as the ground law in legal substance (In Hans Kelsen's *Stufenbau des Rechts* Theory, the ground law (*grundwet*) is used to describe the highest form of written law. However, it is important to notice that a ground law (*grundwet*) is different than the ground norm (*grundnorms*), which is the basis regulating norms that reflect the way of the people. For example, in Indonesia, the ground norm is Pancasila, which contains the five belief values of the Indonesian people: the all-powerful God; humanitarian and human rights; national unity; the teaching of deliberation and peace; the social justice for all). With Article 33 (3) of the 1945 Constitution, the laws and regulations for implementing control over natural resources should reflect the spirit of the welfare state (welfare state is the main utility theory in implementing the state's control over natural resources and energy. The modern rule of law is not only to protect the people but also to provide for social welfare. Therefore, the state through the government should actively play a role in creating jobs, financial security, food, and security for their society) [31]. Controlling natural resources also raises the responsibility for sustainable management, balanced by the roles and functions of all stakeholders, including NGOs and universities/research institutions. In addition, communities have roles that complement each other to create a sustainable environment in implementing mining law [32]. One aspect of the ideas of constitutional content is the legal policy of environmental management. Constitutional protection of individual environmental rights has two reasons. First, it becomes a strong basis for individuals to defend the environment from any damage that affects them. Second, it is the basis for demanding that the state realize these rights [33].

The Environmental Act regulates Control Activity carried out in the environmental conservation framework, including prevention, mitigation, and recovery. The recovery referred to in Article 54 of the Environmental Act as a form of control has the same meaning as the reclamation and post-mining activities referred to in the Mining Act. Article 1, Number 26 of the Mining Act, stipulates that reclamation is carried out throughout the mining stages to organize, restore, and improve the environment's and ecosystem's quality. While post-mining activities in Article 1, Number 27 are defined as planned, systematic, and continuing after the mining activities end to restore the natural environment and social functions, according to local conditions in all mining areas.

Mining companies should conduct reclamation on unused post-mining land inside and outside ex-mining areas. Land outside an ex-mining area includes (1) landfill; (2) stock-piling of raw materials; (3) transportation roads; (4) plant/processing/refining installation; (5) offices and housing; (6) ports/docks. Article 1, Point 26 of the Mining Act regulates the scope of reclamation activities, starting from exploration, land clearing, topsoil excavation and overburden, coal extraction, land management, revegetation, preparation of nurseries, and maintenance and evaluation of activities.

For the reclamation and post-mining activities to be performed successfully, several steps must be followed, from the approval of the reclamation plan and post-mining plan to the proposed changes. These stages are regulated by the Post-Mining Regulation, which requires permission from the Minister, Governor, or Regent/Mayor. At a later stage, holders of mining licenses should provide reclamation insurance funds and post-mining insurance funds. Figure 4 shows how the government sets policies for each IUP and IUPK holder to place funds as reclamation and post-mining insurance.

The fund placement is needed as insurance for each IUP and IUPK holder to restore ex-mining land following the designation agreed upon by the stakeholders in the context of sustainable development. The release or disbursement of funds is under the post-mining plan. The fund is placed annually through time deposits at government banks. The amount of post-mining insurance is calculated based on several costs as seen in the Table 1 below.

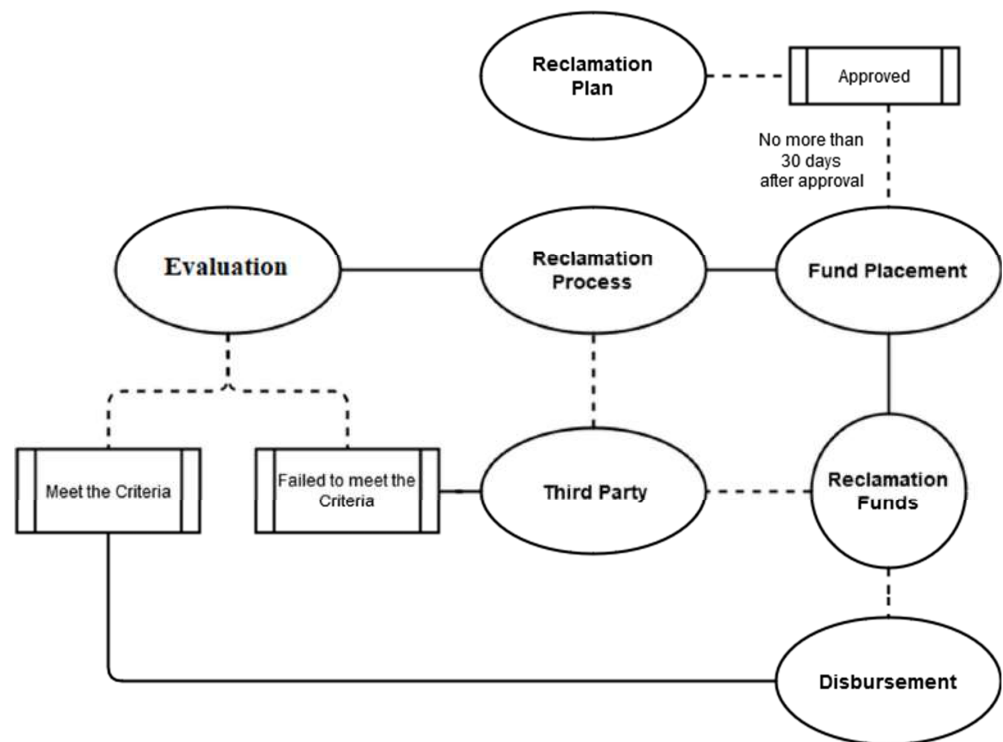


Figure 4. Reclamation stages.

Table 1. Detailed costs.

Category	Cost Includes
Direct costs	<ol style="list-style-type: none"> Demolition of buildings and supporting facilities that have not been used Reclamation of ex-mining sites, processing and refining facilities, and supporting facilities Handling of hazardous and toxic materials (B3) and hazardous and toxic waste Maintenance and care Monitoring Social, economic, and cultural aspects
Indirect costs	<ol style="list-style-type: none"> Mobilization and demobilization Activity planning Administration and profits of third parties as mine closure implementing contractors Supervision

The deposit is valid until all reclamation activities are declared completed by the Governor. Disbursement of deposits and their interest is conducted after the reclamation activities are completed, based on the reclamation plan approved and accepted by the Governor.

3.5. Reforming the Reclamation Obligation

Reclamation, usually known as land reclamation, is an attempt to repair and restore damages resulting from mining activities and to restore ecological function. Article 100 (1) of the Mining Act regulates the obligation of IUP and IUPK holders to provide reclamation funds. Subsequently, in Section 2, the Minister, Governor, or Regent/Mayor can determine a

third party to perform reclamation and post-mining. Meanwhile, the Reclamation and Post-Mining Regulation regulates that the holder of a mining permit must perform reclamation and post-mining without giving space to third parties to take action for reclamation and post-mining. A third party is only permitted to be appointed to perform reclamation and post-mining if the restoration result conducted by the permit holder does not meet the criteria of successful reclamation, which is stipulated by Article 33 of Reclamation and Post-Mining Regulation and reads: *“If based on the evaluation of the reclamation implementation report shows the reclamation result does not meet the criteria of success, Minister, Governor, or the Regent/Mayor by their authority may determine a third party to perform part or all of the reclamation activities using a reclamation fund placement”*. The disharmony regarding the role of third parties in reclamation can be seen in Article 100 of the Mining Act; by placing a reclamation and post-mining insurance fund, the permit holders can transfer their reclamation obligation to a third party appointed by the government. In comparison, the Reclamation and Post-Mining Regulation stipulates that reclamation and post-mining must be performed by the IUP and IUPK holders, which the government, then, evaluates before bringing in a third party.

Referring to Article 7 (1) of Law 12/2011 on lawmaking (Lawmaking Act), the meaning of legislation is: *“written law that contains general binding norms and is established or stipulated by state institutions or an authorized official through the procedures stipulated in the Laws and Regulations”*. In other words, the Mining Act must guide any mineral and coal mining legislation. Furthermore, based on Article 7 of the Lawmaking Act, the order of laws and regulations follows the hierarchy as seen in Figure 5.

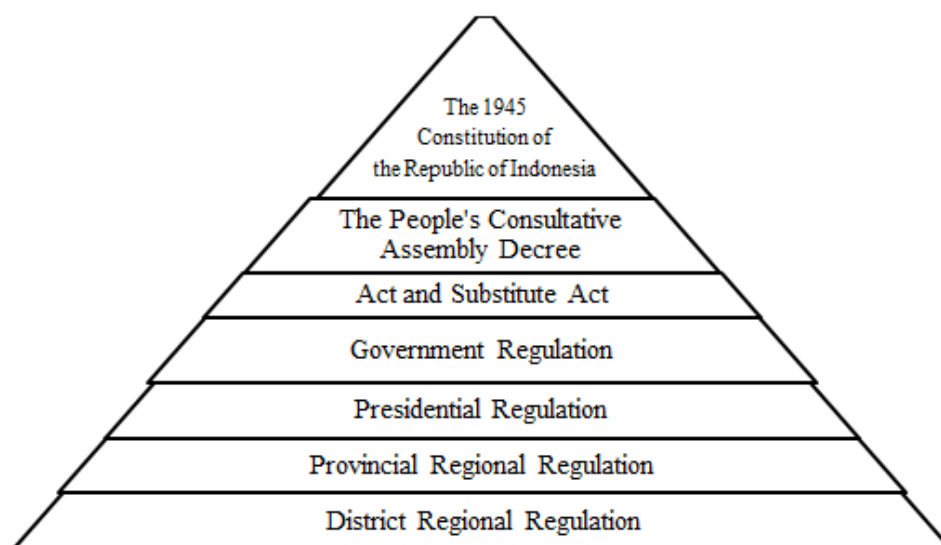


Figure 5. The hierarchy of legislation.

The legal force of the law follows the hierarchy (See Figure 5). In other words, based on the legislation order, Act 4/2009 as Revised in Act 3/2020 (Mining Act) has a higher force than Government Regulation No. 78/2010 (Reclamation and Post-Mining Regulation). Therefore, Government Regulation No. 78/2010 should not be conflicted with the Mining Act as the superior law.

The issue is that Government Regulation No. 78/2010 is arguably more effective in forcing reclamation by rigorously regulating the reclamation and post-mining obligatory for IUP and IUPK holders. Normative construction using natural resources, especially minerals and coal, shows diverse arrangements with different formulations. Management of natural resources, which generally includes planning, organizing, and actualizing, can be viewed as the stakeholders' aspirations. Activities in management can be used to perform legal interpretation, legal reasoning, and rational arguments for the formulations of each law.

The results of legal interpretation, reasoning, and rational-legal arguments can be used to harmonize the law. However, harmonizing the law will not automatically result in legal unification, because harmonious legal conditions are not normatively followed by a balanced implementation. Implementation of legal actions, legal relations, and legal consequences will also be unified if the stakeholders of natural resource management have the same perception of the normative aspects of legal harmonization. The same perception of harmonious law is the basis for realizing legal unification.

The Legislative Draft of the Environmental Act states that the conflict between natural resources and the environment is a conflict that has the characteristics of confronting frontally between those who have access to resources and more substantial power, with those who are access-disabled or at least have access to resources and less power. Environmental conflicts are generally caused by exploitation, which ignores the interests and rights of the community, justice, and environmental principles. As mentioned before, one of the causes of natural resource and environmental conflicts is the disharmony between the laws and regulations, both vertically and horizontally. Article 5 of the Lawmaking Act states that one of the principles that became a milestone in the creation of legislation is “the principle of clarity”. In the elucidation of the Lawmaking Act, the principle of clarity in the formulation of the law means that each legislation must fulfill the technical requirements of the preparation of legislation, through a systematic choice of words or terms, which are straightforward and easy to understand, to prevent any misinterpretation in their implementation. The principle of clarity in the formulation can be applied to reform the reclamation obligatory in the Mining Act and ensure that reclamation and post-mining become a non-transferable obligation to the third party. The reformation of the Mining Act, specifically on reclamation and post-mining obligations, must be performed to prevent the occurrence of multiple interpretations of the obligations and liability in reclamation and post-mining.

The first key formulation that needs to change in the Mining Act is to reinforce the essence of “obligation” for IUP and IUPK holders to perform reclamation and post-mining under supervision, as in the Environmental Act. Furthermore, Article 100 (2) should be changed as follows: *“The Minister, Governor or Regent/Mayor by their authority can determine the third party to help the IUP/IUPK holder in the reclamation and post-mining using the placement fund as referred to in paragraph (1), only if the reclamation result does not meet the criteria of success”*. With this formulation, in essence, the placement of the reclamation fund by the company does not eliminate the company’s obligation to carry out reclamation and post-mining activities with the procedures as seen in Figure 6.

The second key formulation is to implement a mandatory condition of placing the reclamation guarantees fund as a requirement for approval of the mining plans and budgets (the RKAB) and Clean and Clear (CnC) Certification. Nearly half of the mining companies are not paying into mandatory reclamation and post-mining funds managed by the government due to a series of blind spots in the Indonesian regulatory framework. Among these loopholes is a compulsory deposit the company must make to the government for reclamation and post-mining guarantees fund to obtain mining permits. However, the deposit is not a prerequisite for approval of their mining plans and budgets (the RKAB). Furthermore, it is the RKAB rather than the mining permits, which allows the mining companies to begin operating. Only six percent have deposited reclamation and post-mining funds with the government, according to the State Auditing Agency (BPK), and only twenty-one percent have deposited the reclamation fund. Furthermore, the government mandates a “clean and clear” certification for mining companies to confirm that they meet all legal requirements. However, carrying out reclamation obligations is not a requirement for obtaining the CnC certification. Consequently, many mining permit holders had secured a CnC certification without depositing reclamation and post-mining funds. It has enabled mining companies to continue to operate without having to rehabilitate their concessions, with no disincentives for non-compliance.

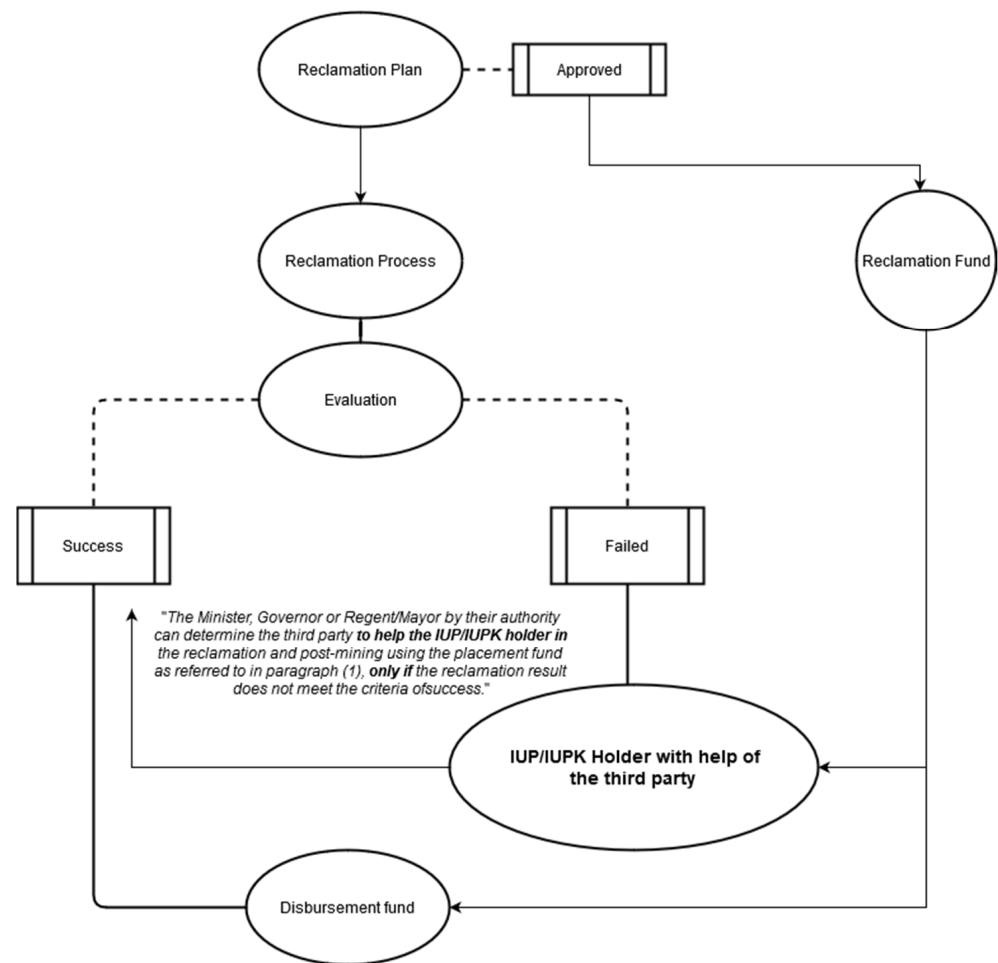


Figure 6. Reclamation obligation after the reform.

Strengthening the reclamation obligation is a step toward stronger law enforcement. In the current state, the Mining Law allows the company to transfer the reclamation responsibility to the third party, as long as they place the fund. A reform of the law will force the companies or permit holders to be liable for reclamation. Therefore, if they do not comply with the regulations, there will be no question as to the liability burden and the sanction can be imposed properly.

4. Conclusions

In summary, despite the 2020 Mining Act Revision, Indonesia still faces a previous legal issue due to blind spots in the regulatory framework. Ranging from the continuous conflicts, between the mining company and the local community, to cases of non-compliance with the reclamation policy has resulted in excavation holes that have remained untreated and abandoned, which has created casualties over the years. Therefore, we need two more major reforms to strengthen the reclamation obligation. First, is the need to reinforce the essence of "obligation" for IUP and IUPK holders to perform reclamation and post-mining under supervision, as in the Environmental Act. Implementing this formulation, the placement of the reclamation fund by the company does not eliminate the company's obligation to carry out reclamation and post-mining activities. Second, for the company to comply with the placing of reclamation and post-mining funds, it is crucial to put a mandatory condition of placing the reclamation guarantees fund, as a requirement for approval of the mining plans and budgets (the RKAB) and Clean and Clear (CnC) Certifications.

Author Contributions: Conceptualization, N.L. and M.Y.S.; methodology, N.L.; software, A.K.; validation, N.L., M.Y.S. and A.K.; formal analysis, M.Y.S.; investigation, N.L.; resources, N.L.; data curation, A.K.; writing—original draft preparation, M.Y.S.; writing—review and editing, M.Y.S.; visualization, N.L.; supervision, N.L.; project administration, M.Y.S.; funding acquisition, N.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Available in section “MDPI Research Data Policies” at <https://www.mdpi.com/ethics>.

Conflicts of Interest: The authors declare no conflict of interest.

References

- Magiera, S. Indonesia’s Investment Negative List: An evaluation for selected services sectors. *J. Bull. Indones. Econ. Stud.* **2011**, *47*, 195–219. [[CrossRef](#)]
- FAO, Global Forest Watch, and World Resource Institute. Indonesia Telah Mengurangi Penggundulan Hutan, tetapi Masalah Masih Ada. Available online: <https://wri-indonesia.org/id/wawasan/indonesia-telah-mengurangi-penggundulan-hutan-tetapi-masalah-masih-ada> (accessed on 11 November 2022).
- Susmiyati, H.R. Legal Construction of Post-Mining Reclamation in Indonesia. In Proceedings of the Joint Symposium on Tropical Studies (JSTS-19), Samarinda, Indonesia, 10 April 2021.
- Giljum, S.; Maus, V.; Kuschnig, N.; Luckeneder, S.; Tost, M.; Sonter, L.J.; Bebbington, A.J. A Pantropical Assessment of Deforestation Caused by Industrial Mining. *Proc. Natl. Acad. Sci. USA* **2022**, *119*, e2118273119. [[CrossRef](#)] [[PubMed](#)]
- Goudie, A.S.; Viles, H.A. *The Earth Transformed: An Introduction to Human Impacts on the Environment*; Wiley-Blackwell: Hoboken, NJ, USA, 2013; pp. 20–22.
- Listiyani, N. Konsep Perizinan Terpadu Sebagai Upaya Pencegahan Tindak Pidana Korupsi Sektor Pertambangan. *Lambung Mangkurat Law J.* **2018**, *3*, 19–36. [[CrossRef](#)]
- Effendi, A. Prinsip-Prinsip Pengelolaan Pertambangan Berbasis Lingkungan Berdasar Undang-Undang Dasar Negara Republik Indonesia Tahun 1945. *J. Konstitusi* **2012**, *1*, 84.
- Preston, B.J. Environmental Justice and Land Use Conflict: The Governance of Mineral and Gas Resource Development. *J. Energy Nat. Resour. Law* **2018**, *36*, 364–369. [[CrossRef](#)]
- Griscom, B.W.; Adams, J.; Ellis, P.W.; Houghton, R.A.; Lomax, G.; Miteva, D.A.; Schlesinger, W.H.; Shoch, D.; Siikamäki, J.V.; Smith, P. Natural Climate Solutions. *Proc. Natl. Acad. Sci. USA* **2017**, *114*, 11645–11650. [[CrossRef](#)] [[PubMed](#)]
- Minnemeyer, S.; Harris, N.; Payne, O. Pelestarian Hutan Dapat Mengurangi Emisi Karbon Setara dengan Emisi Semua Mobil di Bumi. World Resource Institute Indonesia. 25 January 2018. Available online: <https://wri-indonesia.org/id/blog/pelestarian-hutan-dapat-mengurangi-emisi-karbon-setara-dengan-emisi-semua-mobil-di-bumi> (accessed on 12 October 2022).
- Ariyono, B.G. Interviews on Kontan.co.id. 2017. Available online: <https://industri.kontan.co.id/news/iup-menolak-setor-dana-jaminan-reklamasi> (accessed on 11 December 2022).
- Ariyono, B.G. Interviews on Bisnis.com. Available online: <https://ekonomi.bisnis.com/read/20180114/44/726374/jaminan-reklamasi-pascatambang-masih-rendah> (accessed on 15 December 2022).
- Naito, K.; Otto, J.M.; Smith, D.N.; Myoi, H. Legal Aspects of Exploration and Mining: A Comparative Table of Mining Law in Asia. *J. Energy Nat. Resour. Law* **1999**, *17*, 1–12. [[CrossRef](#)]
- Fajar, M.; Ahmad, Y. *Dualisme Penelitian Hukum: Normatif dan Empiris*; Pustaka Pelajar: Yogyakarta, Indonesia, 2009; pp. 33–38.
- Bhat, P.I. Doctrinal Legal Research as a Means of Synthesizing Facts, Thoughts, and Legal Principles. In *Idea and Methods of Legal Research*; Oxford University Press: Oxford, UK, 2020; pp. 143–168.
- Said, M.Y.; Nurhayati, Y. Paradigma Filsafat Lingkungan Dalam Menentukan Arah Politik Hukum Lingkungan Hidup. *Al-Adl J. Huk.* **2020**, *12*, 39–60. [[CrossRef](#)]
- Bornemann, B.; Bernasconi, A.; Ejderyan, O.; Schmid, F.; Wäger, P.; Zingerli, C. Research on natural resources: The quest for integration revisited. *Ecol. Perspect. Sci. Soc.* **2017**, *26*, 16–21. [[CrossRef](#)]
- Simonovic, S.P.; Fahmy, H. A New Modeling Approach for Water Resources Policy Analysis. *Water Resour. Res.* **1999**, *35*, 295–304. [[CrossRef](#)]
- Abby, F.A.; Barkatullah, A.H.; Nurhayati, Y.; Said, M.Y. Forest Management Based on Local Culture of Dayak Kotabaru in the Perspective of Customary Law for a Sustainable Future and Prosperity of the Local Community. *Resources* **2019**, *8*, 78. [[CrossRef](#)]
- McKay, J.; Bhasin, B. Mining Law and Policy in Indonesia: Issues in Current Practice that Need Reform. *J. Energy Nat. Resour. Law* **2001**, *19*, 329–343. [[CrossRef](#)]
- Jaringan Advokasi Tambang (Mining Advocacy Network). “143 Anak Mati Sia-Sia di Lubang Tambang”. Available online: <https://www.jatam.org/2019/03/20/143-anak-mati-sia-sia-di-lubang-tambang/> (accessed on 9 October 2022).
- Hukumonline. “Jatam: Ada 71 Konflik Pertambangan Periode 2014–2019”. 7 January 2020. Available online: <https://www.hukumonline.com/berita/baca/lt5e14311f6aa5a/jatam--ada-71-konflik-pertambangan-periode-2014-2019?page=2> (accessed on 9 October 2022).

23. Gandataruna, K.; Haymon, K. A Dream Denied? Mining Legislation and the Constitution in Indonesia. *J. Bull. Indones. Econ. Stud.* **2011**, *47*, 221–231. [[CrossRef](#)]
24. Wälde, T. Environmental Policies Towards Mining in Developing Countries. *J. Energy Nat. Resour. Law* **1992**, *10*, 327–357. [[CrossRef](#)]
25. Power, T.P. Jokowi’s Authoritarian Turn and Indonesia’s Democratic Decline. *Bull. Indones. Econ. Stud.* **2018**, *54*, 307–338. [[CrossRef](#)]
26. Rondinelli, D.A.; Nellis, J.R.; Cheema, G.S. Decentralization in Developing Countries: A Review of Recent Experience. In *World Bank Staff Working Papers No. 581*; Management and Development Series No. 8; World Bank: Washington, DC, USA, 1984; pp. 5–46.
27. Antlov, H. Exemplary Centre, Administrative Periphery: Rural Leadership and the New Order in Java. In *Nordic Institute of Asian Studies Monograph Series, No.68*; Curzon Press: Richmond, VA, USA, 1995; p. 222.
28. Harlow, C. Global Administrative Law: The Quest for Principles and Values. *Eur. J. Int. Law* **2006**, *17*, 187–214. [[CrossRef](#)]
29. Listiyani, N. *Pengelolaan Lingkungan Hidup Yang Berkelanjutan Dalam Pemanfaatan Sumber Daya Batubara*; Atap Buku: Yogyakarta, Indonesia, 2017; p. 24.
30. Aziz, M. Aspek Konstitusional Pembentukan Peraturan Perundang-Undangan. *J. Konstitusi* **2006**, *3*, 120.
31. Said, M.Y.; Ifrani, S.D. *Pidana Kehutanan Indonesia*; Nusa Media: Bandung, Indonesia, 2019; pp. 81–82.
32. Irsan, H.; Mutiari, Y.L. Kebijakan Reklamasi Pascatambang Sebagai Bentuk Pengendalian Lahan Bekas Tambang Batubara Ditinjau Dari Kewenangan Otonomi Daerah di Sumatera Selatan. *Ejournal UNSRI* **2017**, *2*, 1–17. Available online: <https://ejournal.unsri.ac.id/index.php/jlsc/article/download/2597/1360> (accessed on 13 December 2022).
33. Listiyani, N.; Said, M.Y. Political Law on the Environment: The Authority of the Government and Local Government to File Litigation in Law Number 32 Year 2009 on Environmental Protection and Management. *Resources* **2018**, *7*, 77. [[CrossRef](#)]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.