DOCUMENT OF

MODULE HANDBOOK

MASTER'S PROGRAM

ENVIRONMENTAL SCIENCE

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PREFACE

This handbook for the Master's Program in Environmental Science at the Postgraduate School of Universitas Nusa Cendana has been developed as a comprehensive academic guide for students and lecturers throughout the learning process. It provides detailed information on the curriculum, course structure, teaching methods, and evaluation systems implemented in the program. By using this handbook, students can gain a clearer understanding of their academic and research paths based on their interests and areas of study, enabling them to navigate their education more effectively and systematically.

Designed with a structured approach, this handbook aims to help students easily access relevant academic information related to the Master's Program in Environmental Science. It outlines the program's vision, mission, and objectives, presents a list of courses along with their expected learning outcomes, and provides key academic regulations. Additionally, it includes essential guidelines for conducting research and writing a thesis, which are fundamental components in completing a master's degree. With this resource, students can better plan their academic journey and research activities.

As a program dedicated to addressing environmental challenges, the Master's Program in Environmental Science at Universitas Nusa Cendana focuses on tackling ecological issues, particularly in dryland and archipelagic regions. The curriculum integrates interdisciplinary approaches, aligning research efforts with environmental policies that emphasize practical and solution-oriented strategies. Through this framework, students are encouraged to develop sustainable environmental management solutions and contribute meaningfully to both communities and ecosystems.

We hope this handbook serves as a valuable tool for students and lecturers in facilitating their academic and research endeavors. Students are encouraged to make full use of this guide to support their learning experience and knowledge development. We also extend our sincere appreciation to all individuals who contributed to the creation of this handbook, including faculty members, educators, and administrative staff.

Ultimately, we aspire for this handbook to serve not only as an academic reference but also as a source of inspiration for students to delve deeper into environmental science. May this guide support students in achieving academic success and making a significant impact on environmental sustainability in the future.

Director PPs,

Prof. Drs. Tans Feliks, M.Ed, Ph.D
NIP. 19630711 198803 1 003

VISION OF THE STUDY PROGRAM

To become a globally-oriented and competitive provider of the Three Pillars of Higher Education (Tri Dharma Perguruan Tinggi) in the field of natural resource and environmental management, focusing on the **Semiringkai Archipelagic Region**, by 2027.

MISSION OF THE STUDY PROGRAM

1. To provide high-competency, globally-oriented education in the field of natural resource and environmental management in the **Semiringkai Archipelagic Region**.
2. To conduct high-quality research in the field of natural resource and environmental management in the **Semiringkai Archipelagic Region**.
3. To apply research findings in natural resource and environmental management in the **Semiringkai Archipelagic Region** for the benefit of society.

OBJECTIVES OF THE STUDY PROGRAM

1. To produce graduates with high academic competence, expertise, and skills in natural resource and environmental management in the **Semiringkai Archipelagic Region**, while demonstrating good social behavior as environmental Educators or Instructors, Researchers, Environmetal Experts, Entrepreuneurs, Envirinmental Consultans, or Environmetal Tecnocrats. This is reflected in the following qualifications:

    a. Ability to integrate knowledge in data input, processing, and interpretation for decision-making in natural resource and environmental management.
    b. Mastery of fundamental environmental science concepts.
    c. Mastery of basic principles in environmental planning and management.
    d. Capability to serve as planners in natural resource and environmental management.
    e. Ability to act as managers of natural resources and the environment.
    f. Functioning as innovators, motivators, and mediators in natural resource and environmental management, including environmental problem-solving.
    g. Capability to design, develop, and implement models for planning and managing natural resources and the environment.

2. To produce high-quality research and technological advancements in the field of natural resource and environmental management in the **Semiringkai Archipelagic Region**.
3. To carry out community service activities aimed at applying environmentally conscious science and technology in the **Semiringkai Archipelagic Region**, reinforcing the program's commitment to environmental education.

I. FUNDAMENTAL COURSES

STATISTICAL ANALYSIS

Module name		**Statistical Analysis**			
Module level, if applicable		1st Year			
Code, if applicable		IPSAL 61301			
Semester (s) in which the module is taught		1st Semester			
Person responsible for the module		Prof. Ir. Fredrik L Benu. M.Si.,Ph.D			
Lecturer		1. Prof. Ir. Fredrik L Benu. M.Si.,Ph.D 2. Dr. Ir. Johanna Suek, M.Si			
Language		Indonesian			
Relation to curriculum (compulsory/elective)		***Fundamental Courses***			
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload	
Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting) Assignment:120x14 Self-study: 120x14	1.400 1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380
Total Workload		136 hours			
Credit points		3 CU (ECTS = 4,8)			
Requirements according to the examination regulations		Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.			
Recommended prerequisites		-			
Related Course		-			

Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 1 : be able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public PLO 4 : be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work PLO 9 : be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems. **Course Learning Outcomes (CLO):** 1. be able to explain basic statistical concepts and their application in environmental data analysis. 2. be able to process and analyze environmental data using appropriate statistical methods. 3. be able to interpret statistical analysis results and use them for decision-making in environmental studies.
Content	1. **Introduction to Environmental Statistics** : Basic concepts, types of data, measurement scales, and the role of statistics in environmental research. 2. **Descriptive Statistics** : Data visualization, measures of central tendency, and measures of dispersion. 3. **Probability and Distributions** : Probability theory, normal distribution, and other relevant statistical distributions. 4. **Inferential Statistics** : Hypothesis testing, confidence intervals, and statistical significance. 5. **Regression and Correlation Analysis** : Linear and multiple regression, correlation coefficients, and their applications in environmental studies. 6. **Multivariate Analysis** : Principal Component Analysis (PCA), analisis jalur, cluster analysis, and factor analysis in environmental research. 7. **Time Series Analysis** : Trend analysis, seasonal variations, and forecasting environmental data. 8. **Spatial Statistics** : GIS-based statistical analysis and spatial data interpretation. 9. **Non-Parametric Statistics** : Alternative methods for non-normally distributed data.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Montgomery, D.C., & Runger, G.C. (2021). *Applied Statistics and Probability for Engineers*. Wiley. 2. Manly, B.F.J., & Navarro, A.B. (2020). *Introduction to Ecological Statistics*. *CRC* Press.

	3. Springer, T. (2021). *Environmental Data Analysis: An Introduction with Examples in R*. Springer. 4. Rong, Y. (2021). *Practical Environmental Statistics and Data Analysis*. ILM Publications. **Supporting references::** Research articles related to *Environmental Statistics and Data Analysis :* 1. Aslam, M., & Saleem, M. (2023). Chi-square test for imprecise data in consistency table. *Frontiers in Applied Mathematics and Statistics*. 2. Zhang, Y., & Wang, L. (2023). Statistical analysis of small business survival under the shock of COVID-19 based on Bayesian methods. *Frontiers in Environmental Science*. 3. Wang, H., & Zhang, L. (2022). Statistical assumptions and reproducibility in psychology: A simulation study. *Frontiers in Psychology*. 4. Chen, J., & Li, H. (2022). A survey of statistical methods for microbiome data analysis. *Frontiers in Applied Mathematics and Statistics*. 5. Kumar, S., & Singh, R. (2022). Statistical analysis of precipitation variations and its forecasting in Southeast Asia using ARIMA models. *Frontiers in Environmental Science*. 6. Liu, Y., & Chen, X. (2022). Statistical analysis and machine learning prediction of disease outcomes in COVID-19 and other pneumonias. *Frontiers in Cellular and Infection Microbiology*. *7.* Senhorelo, A.P., Sousa, E.F.d., Santos, A.R.d., Ferrari, J.L., Peluzio, J.B.E., Carvalho, R.d.C.F., Souza, K.B.d., & Moreira, T.R. (2024). *Application of Path Analysis and Remote Sensing to Assess the Interrelationships between Meteorological Variables and Vegetation Indices in the State of Espírito Santo, Southeastern Brazil*. MDPI.
Date of the last Amendment made	Every end of semester

RESEARCH METHODOLOGY

Module name			**Research Methodology**	
Module level, if applicable			1st Year	
Code, if applicable			IPSAL 62305	
Semester (s) in which the module is taught			2nd Semester	
Person responsible for the module			Prof. Ir. Fredrik L Benu. M.Si.,Ph.D	
Lecturer			1. Prof. Ir. Fredrik L Benu. M.Si.,Ph.D 2. Dr. Dwi Prasetyo, S.Kom., M.Si	
Language			Indonesian	
Relation to curriculum (compulsory/elective)			***Fundamental Courses***	
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload

Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting)	1.400
				Assignment:120x14 Self-study: 120x14	1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380
Total Workload		136 hours			
Credit points		3 CU (ECTS = 4,8)			
Requirements according to the examination regulations		Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.			
Recommended prerequisites		-			
Related Course		-			

Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 1 : be able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public PLO 4 : be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work PLO 9 : be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions PLO 11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems. **Course Learning Outcomes (CLO):** 1. Understand and explain fundamental principles, paradigms, and approaches in environmental research methodology. 2. Analyze and design appropriate research methods, including qualitative, quantitative, and mixed methods, for environmental studies. 3. Apply statistical and geospatial tools for data collection, processing, and analysis in environmental research. 4. Develop and present a structured research proposal, demonstrating critical thinking, ethical considerations, and scientific writing skills.
Content	1. Describe the philosophy and logic of scientific research in environmental studies. 2. Compare different research methodologies and their applications in environmental science. 3. Identify key research problems and formulate research questions and hypotheses. 4. Select appropriate data collection techniques, including surveys, field experiments, and remote sensing. 5. Utilize statistical software and GIS tools for environmental data analysis. 6. Interpret and synthesize research findings to support decision-making in environmental management. 7. Evaluate ethical considerations in environmental research, including plagiarism and data integrity. 8. Write and present a well-structured research proposal following academic standards.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Creswell, J.W. & Creswell, J.D. (2023). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. SAGE Publications. 2. Silverman, D. (2023). Qualitative Research: Theory, Method and

	Practice. SAGE Publications. 3. Leavy, P. (2020). Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches. Guilford Press. 4. Kumar, R. (2022). Research Methodology: A Step-by-Step Guide for Beginners. SAGE Publications. 5. Creswell, J.W. & Plano Clark, V.L. (2021). Designing and Conducting Mixed Methods Research. SAGE Publications. 6. Miles, M.B., Huberman, A.M., & Saldaña, J. (2020). Qualitative Data Analysis: A Methods Sourcebook. SAGE Publications. 7. Palinkas, L.A. & Zatzick, D.F. (2021). Mixed Methods Research in Disaster and Emergency Management. Oxford University Press. Supporting references: Research Science articles related to environmental science Research Methodology: 1. Arciszewski, T.J., Roberts, D.R., Mahaffey, A., & Hazewinkel, R.R.O. (2023). Distinguishing between research and monitoring programs in environmental science and management. *Journal of Environmental Studies and Sciences*, Springer. 2. Ikhsan, F.A., Kurnianto, F.A., Apriyanto, B., Nurdin, E.A., & Puji, R.P.N. (2019). The research based learning approach in Environmental Education. *IOP Conference Series: Earth and Environmental Science*, IOP Publishing. 3. Iksan, M., Yusuf, F.M., & Ardiyati, D.P.I. (2023). Environment-based Learning Media with Green Biochemistry Approach. *Jurnal Penelitian Pendidikan IPA*, Universitas Mataram. 4. Roudgarmi, P. (2011). Qualitative research for environmental sciences: A review. *Journal of Food, Agriculture & Environment*, WFL Publisher. 5. Herizal, Rassanjani, S., Afrijal, Mukhijral, & Wance, M. (2024). Systematic Literature Review: The Evolution of Adaptive Governance and Practice in the Context of the Environmental Crisis. Jurnal Ilmu Lingkungan, Universitas Diponegoro. Undip e-Journal 6. Angelita, D., Miarsyah, M., & Komala, R. (2023). Knowledge of Ecological Concepts, Environmental Concern, and Ecological Behavior: A Multiple Correlation Analysis. JPBI (Jurnal Pendidikan Biologi Indonesia), Universitas Negeri Malang. ResearchGate 7. Artika, W., Amalya, C. P., Safrida, Maulida, Afandi, & Ratna, L. (2023). Applying Environmental-STEM Approach on Pollution Issue Material to Enhance Students' Problem-Solving Skills. Jurnal Penelitian Pendidikan IPA, Universitas Mataram. JPPIPA Unram 8. Winardi, B., & Ajulian, A. Z. M. (2023). Quantifying the Impact of Renewable Energy Research on Environmental Sustainability. West Science Interdisciplinary Studies, West Science Press. West Science Press
Date of the last Amendment made	Every end of semester

ENVIRONMENTAL SCIENCE

<table>
<tr><td colspan="3">Module name</td><td colspan="3">Environmental Science</td></tr>
<tr><td colspan="3">Module level, if applicable</td><td colspan="3">1st Year</td></tr>
<tr><td colspan="3">Code, if applicable</td><td colspan="3">IPSAL 61202</td></tr>
<tr><td colspan="3">Semester (s) in which the module is taught</td><td colspan="3">1st Semester</td></tr>
<tr><td colspan="3">Person responsible for the module</td><td colspan="3">Prof. Philiphi de Rozari, S.Si, M.Si, M.Sc, Ph.D</td></tr>
<tr><td colspan="3">Lecturer</td><td colspan="3">1. Prof. Philiphi de Rozari, S.Si, M.Si, M.Sc, Ph.D
2. Prof. Ir. Marthen R. Pelokila, M.P.,Ph.D</td></tr>
<tr><td colspan="3">Language</td><td colspan="3">Indonesian</td></tr>
<tr><td colspan="3">Relation to curriculum (compulsory/elective)</td><td colspan="3">Fundamental Courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
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Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
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<tr><td colspan="3">Recommended prerequisites</td><td colspan="3">-</td></tr>
<tr><td colspan="3">Related Course</td><td colspan="3">-</td></tr>
</table>

Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 1 : be able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public PLO 3 : be able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management. PLO 6 : be able to learn for life and can keep up with the latest developments in environmental science and policy PLO 8 : have the necessary skills to manage data, convey information in the field of Environmental Science, and provide alternative solutions when needed PLO 10 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems. **Course Learning Outcomes (CLO):** 1. Understand the basic principles, theories, and techniques of remote sensing for environmental applications. 2. Analyze various remote sensing data and image processing techniques for environmental assessment. 3. Apply remote sensing methods for monitoring and managing environmental resources, particularly in dryland and archipelagic areas. 4. Evaluate the effectiveness of remote sensing technologies in solving environmental problems and decision-making.
Content	1. **Core Environmental Principles**: Key concepts of ecosystems, sustainability, and environmental dynamics. 2. **Pollution and Environmental Chemistry** : Chemical interactions in the environment, pollution sources, and control measures. 3. **Environmental Governance and Policy**: Legal frameworks, regulations, and policies at national and international levels. 4. **Climate Change Mitigation and Adaptation** : Causes, effects, and strategies for addressing climate change. 5. **Biodiversity and Ecosystem Conservation** : Management of ecosystems, conservation efforts, and ecological sustainability. 6. **Natural Resource Utilization** : Sustainable approaches to managing land, water, forests, and minerals. 7. **Environmental Impact Evaluation**: Methods and applications of Environmental Impact Assessment (EIA) in project planning. 8. **Green Technology and Sustainable Solutions** : Renewable energy, waste reduction, and eco-friendly innovations.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)

Reading list	**Main references:** 1. Naushad, R., Kaur, T., & Ghaderpour, E. (2021). Deep Transfer Learning for Land Use and Land Cover Classification: A Comparative Study. *arXiv preprint arXiv:2110.02580*. https://arxiv.org/abs/2110.02580 2. Sirmacek, B., & Vinuesa, R. (2021). Remote Sensing and AI for Building Climate Adaptation Applications. *arXiv preprint arXiv:2107.02693*. https://arxiv.org/abs/2107.02693 3. Pettorelli, N., Williams, J., Schulte to Bühne, H., & Crowson, M. (2024). Deep Learning and Satellite Remote Sensing for Biodiversity Monitoring and Conservation. *Remote Sensing in Ecology and Conservation*. https://zslpublications.onlinelibrary.wiley.com/doi/10.1002/rse2.195 4. Mitterwallner, V., Peters, A., Edelhoff, H., Mathes, G., Nguyen, H., Peters, W., Heurich, M., & Steinbauer, M. J. (2023). Automated Visitor and Wildlife Monitoring with Camera Traps and Machine Learning. *Remote Sensing in Ecology and Conservation*, 9(3), 236-247. https://zslpublications.onlinelibrary.wiley.com/doi/10.1002/rse2.214 5. Singer, D., Hagge, J., Kamp, J., Hondong, H., & Schuldt, A. (2024). Aggregated Time-Series Features Boost Species-Specific Differentiation of True and False Positives in Passive Acoustic Monitoring of Bird Assemblages. *Remote Sensing in Ecology and Conservation*, 10(3), 517-530. https://zslpublications.onlinelibrary.wiley.com/doi/10.1002/rse2.261 6. Ghoneim, E., Ralph, T., Onstine, S., El-Behaedi, R., El-Qady, G., Fahil, A., Hafez, M., Atya, M., Ebrahim, M., Khozym, A., & Fathy, M. (2024). The Egyptian Pyramid Chain Was Built Along the Now Abandoned Ahramat Nile Branch. *Communications Earth & Environment*, 5, 233. https://doi.org/10.1038/s43247-024-01123-7 7. Healey, C., Ghoneim, E., Loh, A. I., & You, Y. (2024). Predicting Land Cover Using a GIS-Based Markov Chain and Sea Level Inundation for a Coastal Area. *Land*, 13(6), 775. https://doi.org/10.3390/land13060775 8. Weng, Q., Fu, P., & Dengsheng, L. (2018). Understanding the Impacts of Land Use and Land Cover Change on Surface Temperature Using Remote Sensing. *Journal of Remote Sensing*, 10(5), 693. https://doi.org/10.3390/rs10050693 **Supporting references:** Research articles of statistical analysis related to Frontiers in Environmental Science : 1. Mohammed, M., Tutu, S. O., Adam, H. E., Koli, A. O., & Abdalla, A. N. O. (2021). Assessment of Climate Change Adaptation Strategies and Mitigation among Agrarian Communities in North Kordofan, Sudan. *Jurnal Ilmu Kehutanan*, 15(1), 42-51. https://doi.org/10.22146/jik.v15i1.1516 2. Hutton, A., Maud, K., Giggins, H., Skipp, M., & Verdon-Kidd, D. (2025). Are We Adequately Promoting Climate Change Adaptation to Address the Increasing Heatwaves Affecting the Elderly? *International Journal of Disaster Risk Science*. https://doi.org/10.1007/s13753-025-00620-x 3. Grasso, M. (2024). Economic Impacts of Climate Change: Assessing

	Monetary Losses and Mitigation Investments. *Time Magazine*. 4. Knauer, J. (2024). Simulating Vegetation-Climate Interactions: Implications for Climate Mitigation. *The Australian*. https://www.theaustralian.com.au/special-reports/research-magazine/juergen-knauer-is-our-leading-researcher-in-atmospheric-sciences/news-story/a760b86f8b48a3e073c7a0c2f5b00311
Date of the last Amendment made	Every end of semester

II. COMPULSORY COURSES

KARST ECOLOGY AND RESOURCE MANAGEMENT

Module name			Karst Ecology and Resource Management		
Module level, if applicable			1st Year		
Code, if applicable			IPSAL 61305		
Semester (s) in which the module is taught			1st Semester		
Person responsible for the module			Dr. Ir. Alfred O. M. Dima, M.Si		
Lecturer			1. Dr. Ir. Alfred O. M. Dima, M.Si 2. Dr. Refli, M.Sc 3. Dr. Ir. Ida Nurwiyana, M.Si 4. Dr. Hery Kota, ST., MT 5. Prof. Dr. Ir. Denik K, ST.,MT.		
Language			Indonesian		
Relation to curriculum (compulsory/elective)			***Compulsory Courses***		
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload	
Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting) Assignment:120x14 Self-study: 120x14	1.400 1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380
Total Workload		136 hours			
Credit points		3 CU (ECTS = 4,8)			
Requirements according to the examination regulations		Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.			
Recommended prerequisites		**Environmental Science**			
Related Course		-			

Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 3 : be able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management. PLO 6 :be able to learn for life and can keep up with the latest developments in environmental science and policy PLO 8 :be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions PLO 9 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. **Course Learning Outcomes (CLO):** 1. **Analyze Ecological Dynamics of Karst Systems** : Understand the geological, hydrological, and biological characteristics of karst ecosystems and their role in environmental sustainability. 2. **Evaluate Resource Utilization and Environmental Impacts** : Assess the interactions between karst environments and natural resource use, including biodiversity conservation, water resource management, and energy exploitation. 3. **Develop Sustainable Management Strategies** : Formulate approaches for the conservation and responsible management of natural resources in karst landscapes, integrating scientific, economic, and policy perspectives. 4. **Apply Ecological Principles to Real-World Problems** : Utilize case studies and research methodologies to address environmental challenges in karst regions, supporting sustainable development and ecosystem resilience.
Content	1. **Karst Ecosystem Formation and Characteristics** : Understanding the geological, hydrological, and ecological processes shaping karst landscapes. 2. **Biodiversity and Ecological Functions** : Examining the unique flora and fauna in karst ecosystems and their adaptations to extreme environmental conditions. 3. **Water Resource Management in Karst Regions** : Assessing groundwater dynamics, water quality, and sustainability challenges in karst aquifers. 4. **Human Impacts on Karst Ecosystems** : Analyzing the effects of mining, agriculture, tourism, and urban development on karst environments. 5. **Energy and Resource Utilization in Karst Landscapes** : Exploring the role of karst areas in energy production, including renewable and non-renewable resource extraction. 6. **Conservation and Restoration Strategies**: Developing methods for habitat protection, ecosystem restoration, and sustainable land use in karst regions. 7. **Environmental Policies and Governance** : Evaluating policy frameworks and legal instruments for karst ecosystem conservation and

	sustainable resource management. 8. **Case Studies and Applied Research** : Applying theoretical knowledge to real-world examples of karst conservation, land-use planning, and sustainable management practices.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Zhang, C., Li, P., & Wang, J. (2022). Characteristics of Karst Formations and Their Significance for Shale Gas Exploration. *Frontiers in Earth Science*. https://www.frontiersin.org/journals/earth-science/articles/10.3389/feart.2022.907685/full 2. Elliott, W. R. (2020). Creatures of the deep karst: The hidden biodiversity of subterranean ecosystems. *American Scientist*, 108(4), 228-235. https://www.americanscientist.org/article/creatures-of-the-deep-karst 3. Zagmajster, M., Malard, F., & Culver, D. C. (2021). Environmental specificity of karst cave habitats evidenced by diverse and predictable faunal assemblages. *BMC Ecology and Evolution*, 21, Article number: 48. https://doi.org/10.1186/s12862-021-01792-9 4. Fauna & Flora International. (2021). Our work in limestone habitats. https://www.fauna-flora.org/environments/limestone-habitats/ 5. Kresic, N., & Stevanovic, Z. (2022). Karst Aquifers: Characterization and Engineering. *Springer International Publishing*. https://doi.org/10.1007/978-3-030-67897-2 6. Hartmann, A., Goldscheider, N., Wagener, T., Lange, J., & Weiler, M. (2023). Karst Water Resources in a Changing World: Review of Hydrological Modeling Approaches. *Reviews of Geophysics*, 61(2), e2023RG000811. https://doi.org/10.1029/2023RG000811 7. Li, P., Qian, H., & Wu, J. (2020). Urbanization and Its Impact on Karst Groundwater Systems in Southwest China. *Journal of Hydrology*, 584, 124706. https://doi.org/10.1016/j.jhydrol.2020.124706 8. Zhu, H., Liu, L., & Zhang, J. (2022). Effects of Agricultural Practices on Soil Erosion and Water Quality in Karst Regions of Southwest China. *Agriculture, Ecosystems & Environment*, 319, 107551. https://doi.org/10.1016/j.agee.2021.107551 9. Zhou, Q., Jiang, Y., & Wang, S. (2021). Impacts of Human Activities on Karst Water Resources in Southwestern China: A Case Study in the Guizhou Province. *Environmental Earth Sciences*, 80(5), 193. https://doi.org/10.1007/s12665-021-09419-5 10. Kresic, N., & Stevanovic, Z. (2021). Advances in Karst Hydrogeology. *Springer International Publishing*. https://doi.org/10.1007/978-3-030-67897-2 **Supporting references:** 1. Research articles related to references provide contemporary insights into Karst Ecology and Resource Management from dryland and archipelago regions , such as :

	2. Zhou, W., & Beck, B. F. (2023). Engineering Issues in Karst and Carbonate Rock Terrains. *Environmental & Engineering Geoscience*, 29(1), 1-20. https://doi.org/10.2113/EEG-2298 3. Li, Y., Zhang, C., & Wang, S. (2024). Zoning strategies for ecological restoration in the karst region of Southwest China. *Frontiers in Environmental Science*, 12, Article 1369635. https://doi.org/10.3389/fenvs.2024.1369635 4. Zhou, D., & Zhang, L. (2023). Quantifying the biodiversity and ecosystem service outcomes of karst ecological restoration: A meta-analysis of South China Karst. *Ecological Indicators*, 145, 109678. https://doi.org/10.1016/j.ecolind.2023.109678 5. Nguyen, T. L., & Pham, H. T. (2022). Legal Instruments for Sustainable Resource Management in Vietnam's Karst Regions. *Journal of Environmental Law*, 34(3), 345-362. https://doi.org/10.1093/jel/eqac017 6. Zhou, D., & Zhang, L. (2023). Quantifying the biodiversity and ecosystem service outcomes of karst ecological restoration: A meta-analysis of South China Karst. *Ecological Indicators*, 145, 109678. https://doi.org/10.1016/j.ecolind.2023.109678 7. Wang, J., Li, R., & Huang, Y. (2024). Impact of typical land use expansion induced by ecological restoration and protection projects on landscape structure in the Lesser Khingan Mountains–Sanjiang Plain region. *Land*, 13(9), 1513. https://doi.org/10.3390/land13091513
Date of the last Amendment made	Every end of semester

MANAGEMENT OF NATURAL RESOURCES AND ENVIRONMENT

Module name			Management of Natural Resources and Environment		
Module level, if applicable			1st Year		
Code, if applicable			PSAL 61303		
Semester (s) in which the module is taught			First Semester		
Person responsible for the module			Dr. Ir. Agus A. Nalle, M.Si		
Lecturer			1. Dr. Ir. Agus A. Nalle, M.Si 2. Dr. Ir. Ida Nurwiyana, M.Si		
Language			Indonesian		
Relation to curriculum (compulsory/elective)			***Compulsory Courses***		
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload	
Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting) Assignment:120x14 Self-study: 120x14	1.400 1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380

Total Workload	136 hours
Credit points	3 CU (ECTS = 4,8)
Requirements according to the examination regulations	Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.
Recommended prerequisites	**Environmental Science**
Related Course	-
Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 6 :be able to learn for life and can keep up with the latest developments in environmental science and policy PLO 7 :be able to work independently and as part of a team, collaborating with others to achieve common goals PLO 8 :be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions PLO 9 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. **Course Learning Outcomes (CLO):** 1. **Understand Fundamental Concepts** : Explain the principles of natural resource management, environmental sustainability, and ecosystem dynamics. 2. **Apply Management Strategies** : Develop and implement strategies for conservation, restoration, and sustainable use of natural resources. 3. **Utilize Scientific and Technological Approaches**: Apply modern scientific methods, data analysis, and technology in resource management and environmental protection. 4. **Engage in Sustainable Development** : Integrate economic, social, and environmental perspectives in decision-making for sustainable resource management.
Content	1. **Fundamentals of Natural Resource Management** : Understanding the definition and categorization of natural resources, key principles of sustainability, environmental conservation strategies, and the dynamics of ecosystems. 2. **Approaches to Sustainable Resource Management** : Developing strategies for biodiversity conservation, ecological restoration of degraded environments, and sustainable utilization of forestry, agriculture, fisheries, and water resources. 3. **Scientific and Technological Innovations in Resource Management** : Utilizing Geographic Information Systems (GIS), remote sensing, environmental impact assessments (EIA), monitoring systems, artificial intelligence, and big data analytics for effective environmental decision-making. 4. **Energy Resources and Sustainability** : Differentiating between renewable and non-renewable energy sources, advancing sustainable energy transitions, improving resource efficiency, and mitigating environmental impacts from energy production. 5. **Biodiversity Protection and Wildlife Conservation** : Establishing and maintaining protected areas, safeguarding endangered species and their habitats, and addressing challenges related to human-wildlife

	interactions. 6. **Waste Management and Circular Economy Practices** : Implementing waste reduction, recycling, and reuse strategies, managing hazardous waste, and promoting circular economy models to enhance resource conservation. 7. **Climate Change Response and Adaptation Measures** : Reducing greenhouse gas emissions, lowering carbon footprints, applying adaptation strategies in resource-dependent sectors, and utilizing ecosystem-based solutions for climate resilience. 8. **Community Involvement and Stakeholder Partnerships** : Encouraging public participation in resource governance, incorporating indigenous knowledge and traditional ecological practices, and strengthening collaborations with NGOs and global organizations for sustainable environmental management.
Study and examination requirements and forms of examination	The Management of Natural Resources and Environment course evaluates students through exams and essays to assess their understanding, case studies and reports to develop problem-solving skills, projects and presentations to apply management strategies, fieldwork and research for hands-on experience, and discussions or oral exams to enhance critical thinking. These assessments ensure students gain both theoretical knowledge and practical skills in resource and environmental management.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Runge, M. C., Converse, S. J., Lyons, J. E., & Smith, D. R. (Eds.). (2020). *Structured Decision Making: Case Studies in Natural Resource Management*. Johns Hopkins University Press. Loring, P. (2020). *Finding Our Niche: Toward a Restorative Human Ecology*. Fernwood Publishing. 2. Doumergue, E., Ahmadnia, S., Hammond, M., & de Araújo Barbosa, C. (2024). *Natural Resource Management, Fragility, and Conflict Issues: Guidance Note for Country Climate and Development Reports*. World Bank. 3. Camacho, A. E., & Glicksman, R. L. (2019). *Reorganizing Government: A Functional and Dimensional Framework*. NYU Press. Springer, J. (2021). *Sustainable Resource Management: Global Trends, Visions, and Policies*. Springer International Publishing. 4. Sachs, J., Kroll, C., Lafortune, G., Fuller, G., & Woelm, F. (2021). *Sustainable Development Report 2021: The Decade of Action for the Sustainable Development Goals*. Cambridge University Press. https://doi.org/10.1017/9781009106559 5. Met, A. (2025). *Amplify: How to Use the Power of Connection to Engage, Take Action, and Build a Better World*. Penguin Random House. 6. Suthar, S., & Singh, P. (2021). *Solid Waste Management: Principles and Practice*. Springer. https://link.springer.com/book/10.1007/978-3-030-72389-9 7. Kumar, S., & Kumar, R. (2019). *Waste Management: An Introduction*. Wiley. https://www.wiley.com/en-

	us/Waste+Management%3A+An+Introduction-p-9781119509851 • **Supporting references:** Research articles related to references provide contemporary insights into natural resource management, environmental policies, and the impacts of human activities on ecosystems : 1. Smith, J. A., & Johnson, L. M. (2020). *Microplastics in Marine Ecosystems: Impacts on Biodiversity and Human Health.* Environmental Science Andriansyah, Sulastri, E., & Satispi, E. (2021). *The Role of Government Policies in Environmental Management*. Research Horizon. 2. Normalina, Hatta, M., Hafizianoor, & Hamdani. (2021). *Policy Analysis and Sustainable Environmental Development: Green Leadership in Natural Resource Management*. Review of International Geographical Education Online. 3. Akbal, M. (2017). *Harmonisasi Kewenangan Antara Pemerintah Pusat Dan Daerah Dalam Penyelenggaraan Otonomi Daerah*. SUPREMASI: Jurnal Pemikiran, Penelitian Ilmu-Ilmu Sosial, Hukum Dan Pengajarannya. 4. Azam, M., Alam, M. M., & Hafeez, M. H. (2018). *Effect of Tourism on Environmental Pollution: Further Evidence from Malaysia, Singapore, and Thailand*. Journal of Cleaner Production. 5. China, C. R., Maguta, M. M., Nyandoro, S. S., Hilonga, A., Kanth, S. V., & Njau, K. N. (2020). *Alternative Tanning Technologies and Their Suitability in Curbing Environmental Pollution from the Leather Industry: A Comprehensive Review*. Chemosphere. 6. Miao, C., Fang, D., Sun, L., & Luo, Q. (2017). *Natural Resources Utilization Efficiency under the Influence of Green Technological Innovation*. Resources, Conservation and Recycling. 7. Thacker, S., Adshead, D., Fay, M., Hallegatte, S., Harvey, M., Meller, H., & Hall, J. W. (2019). *Infrastructure for Sustainable Development*. Nature Sustainability. 8. Xu, X., Nie, S., Ding, H., & Hou, F. F. (2018). *Environmental Pollution and Kidney Diseases*. Nature Reviews Nephrology
Date of the last Amendment made	Every end of semester

MANAGEMENT OF COASTAL AREAS, SEA AND SMALL ISLANDS

Module name	Management of Coastal Areas, Sea and Small Islands
Module level, if applicable	1st Year
Code, if applicable	IPSAL 61304
Semester (s) in which the module is taught	1st Semester
Person responsible for the module	Prof. Dr. Chaterina A. Paulus, S.Pi.,M.Si
Lecturer	1. Prof. Dr. Chaterina A. Paulus, S.Pi.,M.Si 2. Prof. Philiphi de Rozari, S.Si,M.Si., M.Sc,Ph.D 3. Dr. Ismawan Tallo, S.Pi., M.Si
Language	Indonesian
Relation to curriculum (compulsory/elective)	***Compulsory Courses***

<table>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="2">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="4">Environmental Science</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="4">-</td></tr>
<tr><td colspan="2">Module objectives/intended learning outcomes</td><td colspan="4">Learning outcomes of the program of study assigned to this course:
PLO 1 : be able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public.
PLO 8 :be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions
PLO 9 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development.
PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.

Course Learning Outcomes (CLO):

1. Ecosystem and Environmental Challenges : Understand the principles of coastal, marine, and small island ecosystems, assessing human impacts, climate change, and natural disasters.
2. Sustainable Management Strategies : Develop conservation and resource management strategies for coastal, marine, and small islands using scientific and technological tools.
3. Governance and Community Involvement : Analyze policies and promote community-based management for coastal, marine, and small island sustainability.
4. Climate Resilience and Sustainable Development : Implement adaptation strategies, biodiversity conservation, and blue economy initiatives for coastal, marine, and small islands.</td></tr>
</table>

Content	1. **Introduction to Coastal, Marine, and Small Island Ecosystems** : Fundamental ecological principles, biodiversity, and physical characteristics of these environments. 2. **Human Impacts on Coastal, Marine, and Small Island Environments** : Effects of land use changes, pollution, overfishing, habitat destruction, and climate change. 3. **Sustainable Marine and Coastal Resource Management** : Conservation planning, fisheries management, coral reef restoration, and sustainable tourism. 4. **Policies and Governance in Coastal and Marine Management** : National and international regulations, legal frameworks, and enforcement mechanisms. 5. **Climate Change Adaptation and Disaster Risk Reduction** : Strategies for addressing sea-level rise, extreme weather, coastal erosion, and resilience-building. 6. **Biodiversity Conservation in Coastal, Marine, and Small Island Environments** : Protection of endangered species, marine protected areas, and habitat restoration. 7. **Blue Economy and Sustainable Development** : Exploring marine-based economic opportunities such as fisheries, aquaculture, renewable energy, and ecotourism. 8. I**ntegrated Coastal Zone and Small Island Management** : Holistic approaches combining ecological, economic, and social perspectives for long-term sustainability.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Le Tissier, M. (2020). "Unravelling the Relationship between Ecosystem-Based Management, Integrated Coastal Zone Management and Marine Spatial Planning." In T. O'Higgins, M. Lago, & T. DeWitt (Eds.), *Ecosystem-Based Management, Ecosystem Services and Aquatic Biodiversity* (pp. 277–293). Springer. 2. Sabai, D. (2023). "The Role of Integrated Coastal Management Approach in the Protection of Coastal and Marine Resources in the Eastern Coast of Tanzania." *Transylvanian Review of Systematical and Ecological Research*, 25(2), 77–92. 3. Ospina-Alvarez, A., de Juan, S., Davis, K. J., González, C., Navarrete, S. A., & Fernández, M. (2019). "Integration of Biophysical Connectivity in the Spatial Optimization of Coastal Ecosystem Services." *arXiv preprint* arXiv:1903.10322. 4. Le Tissier, M. (2020). "Unravelling the Relationship between Ecosystem-Based Management, Integrated Coastal Zone Management and Marine Spatial Planning." In T. O'Higgins, M. Lago, & T. DeWitt (Eds.), *Ecosystem-Based Management, Ecosystem Services and Aquatic Biodiversity* (pp. 277–293). Springer. 5. Sabai, D. (2023). "The Role of Integrated Coastal Management Approach in the Protection of Coastal and Marine Resources in the Eastern Coast of Tanzania." *Transylvanian Review of Systematical and*

	Ecological Research, 25(2), 77–92. **Supporting references:** Research articles related to references provide comprehensive insights into contemporary strategies and challenges in managing coastal and marine ecosystems , with a particular focus on community involvement and integrated approaches in Small Island : 1. Suyadi, Nugroho, D.A., Irawan, A., Pelasula, D., Ruli, F., Islami, M.M., Alik, R., Tala, D.J., Pay, L., Matuankotta, C., Leatemia, A.S., Naroli, I. (2021). Biodiversity in the coastal ecosystems of small islands and its conservation status. IOP Conference Series: Earth and Environmental Science. 2. Haeril, Purnomo, E.P. (2019). Management of Small-Sustainable Coastal and Island Areas Based on Collaborative Management (Case Study in Bima Regency, West Nusa Tenggara). Journal of Local Government Issues. 3. Short, A. (2024). 'We didn't want it': Wall divides beach town. News.com.au. 4. Murray, K. (2024). Hawaii is disappearing into the ocean faster than expected. SFGate. 5. Gates, D. (2024). 'Inflammatory' report's dire warning for Coast's beaches. Courier Mail. 6. Leaper, R., Calderan, S., Cooke, J. (2024). Reduce whale-ship strikes by making 2.6% of ocean surface safer, study says. The Guardian. 7. Farhan, A.R., Lim, S. (2020). Vulnerability assessment of small islands to tourism: The case of the Marine Tourism Park of the Gili Matra Islands, Indonesia. Global Ecology and Conservation. 8. Setyawan, E., Suharti, S., Subhan, B., Budiyanto, A., Yulianto, I., Erdmann, M.V. (2020). Coral reef resilience and community perception to support marine spatial planning in the Anambas Islands, Indonesia. Ocean & Coastal Management.
Date of the last Amendment made	Every end of semester

HUMAN ECOLOGY

Modul name	**Human Ecology**
Module level, if applicable	1st Year
Code, if applicable	IPSAL 62207
Semester (s) in which the module is taught	2nd Semester
Person responsible for the module	Dr.Hamzah Wulakada, M.Si
Lecturer	1. Dr.Hamzah Wulakada, M.Si 2. Dr. Basri K, M.Si
Language	Indonesian
Relation to curriculum (compulsory/elective)	***Compulsory Courses***

<table>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="2">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="4">Environmental Science</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="4">-</td></tr>
<tr><td colspan="2">Module objectives/intended learning outcomes</td><td colspan="4">Learning outcomes of the program of study assigned to this course:
PLO 5: be able to be aware of the social and cultural factors that influence environmental issues and be able to work effectively with diverse communities and stakeholders.
PLO 8 :be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions
PLO 9 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development.
PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.

Course Learning Outcomes (CLO):
1. Human-Environment Interactions : Analyze the relationships between humans and ecosystems, including environmental impacts, adaptation, and sustainability.
2. Socio-Ecological Systems and Resource Management:Evaluate socio-ecological dynamics and develop sustainable strategies for natural resource use.
3. Environmental Impact and Ethics : Assess human ecological footprints, environmental policies, and ethical considerations in ecological conservation.
4. Traditional Knowledge and Urban Challenges : Integrate indigenous wisdom in sustainable practices and address environmental issues in urbanization and industrialization.</td></tr>
</table>

Content	1. **Fundamentals of Human Ecology** : Exploring ecological principles, human dependence on the environment, and sustainability concepts. 2. **Human-Induced Environmental Transformations** : Investigating the effects of land-use changes, deforestation, pollution, and climate change on ecosystems. 3. **Resilience in Socio-Ecological Systems** : Understanding how communities adapt to environmental pressures while maintaining ecological stability. 4. **Sustainable Management of Natural Resources** : Implementing strategies for responsible use and conservation of forests, water, land, and biodiversity. 5. **Measuring Human Environmental Impact** : Assessing carbon footprints, resource consumption, and waste generation using scientific approaches. 6. **Environmental Governance and Ethical Perspectives** : Examining policies, laws, and ethical considerations in environmental decision-making. 7. **Traditional and Community-Based Conservation Practices** : Recognizing the role of indigenous knowledge in sustainable environmental management. 8. **Urbanization and Ecological Sustainability** : Evaluating the effects of urban expansion on natural systems and developing green infrastructure solutions.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Elijah Baker, 2024, "Ethical Implications of Environmental Policies and Practices," *International Journal of Philosophy*, Vol. 3, Issue 1. 2. B. L. Turner II, 2022, *The Anthropocene: 101 Questions and Answers for Understanding the Human Impact on the Global Environment*, Agenda Publishing. 3. Fikret Berkes, 2021, *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, Cambridge University Press. 4. Juliette Claire Young et al., 2021, "Community-Based Conservation for the Sustainable Management of Conservation Conflicts: Learning from Practitioners," *Sustainability*, 13(14), 7557. 5. Everton Cruz da Silva *et al.,* 2024, "The Importance of Traditional Communities in Biodiversity Conservation," *Biodiversity and Conservation*. **Supporting references:** Research articles related to references provide comprehensive insights into contemporary strategies and challenges into human ecology in dryland and small island : 1. Suyadi, Nugroho, D.A., Irawan, A., Pelasula, D., Ruli, F., Islami, M.M., Alik, R., Tala, D.J., Pay, L., Matuankotta, C., Leatemia, A.S., Naroli, I. (2021). Biodiversity in the coastal ecosystems of small islands and its conservation status. IOP Conference Series: Earth and Environmental ScRelevance of social-ecological systems in the Anthropocene. *Ecology and Society, 25*(3), 2. 2. Song, X.-P., Hansen, M. C., Stehman, S. V., Potapov, P. V., Tyukavina, A., Vermote, E. F., & Townshend, J. R. (2018). Global land change from 1982 to 2016. *Nature, 560*(7720), 639–643. 3. Biggs, R., Schlüter, M., Biggs, D., Bohensky, E. L., BurnSilver, S.,

	Cundill, G., ... & West, P. C. (2019). Toward principles for enhancing the resilience of ecosystem services. *Annual Review of Environment and Resources, 37*, 421–448. 4. Rockström, J., Edenhofer, O., Gaertner, J., & DeClerck, F. (2020). Planet-proofing the global food system. *Nature Food, 1*(1), 3–5. 5. Wiedmann, T., & Lenzen, M. (2018). Environmental and social footprints of international trade. *Nature Geoscience, 11*(5), 314–321. 6. Biermann, F., & Kim, R. E. (2020). The boundaries of the planetary boundary framework: A critical appraisal of approaches to define a "safe operating space" for humanity. *Annual Review of Environment and Resources, 45*, 497–521. 7. Garnett, S. T., Burgess, N. D., Fa, J. E., Fernández-Llamazares, Á., Molnár, Z., Robinson, C. J., ... & Watson, J. E. (2018). A spatial overview of the global importance of Indigenous lands for conservation. *Nature Sustainability, 1*(7), 369–374. 8. Seto, K. C., Golden, J. S., Alberti, M., & Turner, B. L. (2017). Sustainability in an urbanizing planet. *Proceedings of the National Academy of Sciences, 114*(34), 8935–8938
Date of the last Amendment made	Every end of semester

ENVIRONMENTAL PLANNING AND ADMINISTRATION

Module name		**Environmental Planning and Administration**			
Module level, if applicable		1st Year			
Code, if applicable		IPSAL 62208			
Semester (s) in which the module is taught		2nd Semester			
Person responsible for the module		Dr. Ir. Ida Nurwiani, M.Si			
Lecturer		1. Dr. Ir. Ida Nurwiani, M.Si 2. Dr. Ir. Agus A. Nalle, M.Si 3. Dr. Basri K, M.Si			
Language		Indonesian			
Relation to curriculum (compulsory/elective)		***Compulsory Courses***			
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload	
Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting) Assignment:120x14 Self-study: 120x14	1.400 1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380
Total Workload		136 hours			
Credit points		3 CU (ECTS = 4,8)			

Requirements according to the examination regulations	Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.
Recommended prerequisites	**Environmental Science**
Related Course	-
Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 1 : be able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public. PLO 6 :be able to learn for life and can keep up with the latest developments in environmental science and policy PLO 8 :be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions PLO 9 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. **Course Learning Outcomes (CLO):** 1. Analyze the interrelationships between population dynamics, environmental sustainability, and development processes. 2. Evaluate the environmental impacts of population growth and urbanization at local, regional, and global scales. 3. Formulate strategies and policies that integrate population management with sustainable environmental and development planning. 4. Communicate evidence-based solutions to address complex issues related to population, environment, and development using interdisciplinary approaches.

Content	**1. Introduction to Population, Environment, and Development :** Definitions, scope, and significance of the triad, Theoretical frameworks: Malthusian, Demographic Transition, Political Ecology;Global and national trends in population and development **2. Demographic Dynamics and Urbanization :** Population structure: age, sex, dependency ratios, Urban growth, slum development, and migration, Impacts of urbanization on land use and environmental services **3. Resource Use and Environmental Degradation :** Natural resource depletion: water, forests, land, and biodiversity, Pollution: air, water, and soil ; Ecological footprint and carrying capacity **4. Poverty, Inequality, and Sustainable Development :** Linkages between poverty and environmental degradation; Social vulnerability and access to resources; Inclusive development and the Sustainable Development Goals (SDGs) **5. Climate Change, Risk, and Human Vulnerability :** Climate-related impacts on health, livelihoods, and migration; Vulnerability assessment and adaptation strategies; Climate justice and equity in environmental policies **6. Gender, Health, and Population Policy :** Gender roles in resource management and decision-making; Reproductive health, education, and empowerment; Population policy and demographic planning **7. Environmental Governance and Development Planning :** Policy frameworks: national environmental regulations and global agreements; Institutional roles and governance mechanisms; Integrated environmental and development planning **8. Community-Based Approaches and Innovation :** Participatory planning and indigenous/local knowledge; Technology in population and environmental management (GIS, modeling); Case studies on successful local initiatives
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Christian N. Madu, 2023, *Environmental Planning and Management* (2nd Edition), WSPC (EUROPE). 2. Elizabeth A. Koebele, 2019, "Policy Learning in Collaborative Environmental Governance Processes," *Journal of Environmental Policy and Planning*, 21(3): 242-256. 3. Natalie Ulibarri et al., 2023, "Drivers and Dynamics of Collaborative Governance in Environmental Management," *Environmental*

Management, 71(3): 495-504.
4. Steven L. Yaffee, 2017, "Collaborative Decision Making: The Promise and Challenges of Citizen Engagement," *The George Wright Forum*, 34(3): 325-333.
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10. Le Tissier, M. (2020). "Unravelling the Relationship between Ecosystem-Based Management, Integrated Coastal Zone Management and Marine Christian N. Madu, 2023, *Environmental Planning and Management* (2nd Edition), WSPC (EUROPE).
11. Elizabeth A. Koebele, 2019, "Policy Learning in Collaborative Environmental Governance Processes," *Journal of Environmental Policy and Planning*, 21(3): 242-256.
12. Natalie Ulibarri et al., 2023, "Drivers and Dynamics of Collaborative Governance in Environmental Management," *Environmental Management*, 71(3): 495-504.
13. Steven L. Yaffee, 2017, "Collaborative Decision Making: The Promise and Challenges of Citizen Engagement," *The George Wright Forum*, 34(3): 325-333.

Supporting references:

1. Castellar, J. A. C., Popartan, L. A., Pueyo-Ros, J., Atanasova, N., Langergraber, G., Säumel, I., Corominas, L., Comas, J., & Acuña, V. (2021). Nature-based solutions in the urban context: terminology, classification and scoring for urban challenges and ecosystem services. *arXiv preprint arXiv:2105.07814*. https://arxiv.org/abs/2105.07814
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3. Shavazipour, B., & Sundström, L. E. (2024). Decision support for sustainable forest harvest planning using multi-scenario multiobjective robust optimization. *arXiv preprint arXiv:2405.16612*. https://arxiv.org/abs/2405.16612
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	Insights from the governance of England's waterways. *Journal of Environmental Planning and Management*, 60(4), 674-689. https://www.tandfonline.com/doi/abs/10.1080/09640568.2016.1176555 6. Earth System Governance Project. (2024). *Earth System Governance*. https://en.wikipedia.org/wiki/Earth_System_Governance_Project 7. Reynolds, K. M., Hessburg, P. F., Lakicevic, M., Povak, N. A., Salter, R. B., Sullivan, T. J., McDonnell, T. C., Cosby, B. J., & Jackson, W. (2023). Assessing impacts of sulfur deposition on aquatic ecosystems: A decision support system for the Southern Appalachians. *Ecosphere*, 14. https://en.wikipedia.org/wiki/Ecosystem_Management_Decision_Support 8. Le Monde. (2024). What's an effective climate policy? *Le Monde*. https://www.lemonde.fr/en/opinion/article/2024/09/13/what-s-an-effective-climate-policy_6725926_23.html
Date of the last Amendment made	Every end of semester

ENVIRONMENTAL IMPACT ANALYSIS

Module name		**Environmental Impact Analysis**			
Module level, if applicable		2nd Year			
Code, if applicable		IPSAL 63313			
Semester (s) in which the module is taught		3th Semester			
Person responsible for the module		Dr.Ir. Ida Nurwiani, M.Si			
Lecturer		1. Dr.Ir. Ida Nurwiani, M.Si 2. Dr. Refli. M.Sc			
Language		Indonesian			
Relation to curriculum (compulsory/elective)		***Compulsory Courses***			
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload	
Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting) Assignment:120x14 Self-study: 120x14	1.400 1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380
Total Workload		136 hours			
Credit points		3 CU (ECTS = 4,8)			
Requirements according to the examination regulations		Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.			

Recommended prerequisites	-
Related Course	-
Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 1 : Able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public. PLO 2 :be able to comply with ethical and professional standards in their research and practice, and able to identify and address ethical dilemmas that may arise in their work. PLO 8 :be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions PLO 9 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. **Course Learning Outcomes (CLO):** 1. **Core Principles of EIA** : Comprehend the fundamental concepts, regulatory frameworks, and methodologies used in environmental impact assessments. 2. **Assessment of Environmental Effects** : Examine and evaluate the environmental, social, and economic implications of various development projects. 3. **Mitigation and Environmental Management** : Design effective strategies for reducing, managing, and monitoring negative environmental impacts. 4. **Legal and Policy Frameworks**: Implement environmental policies, laws, and regulations at national and international levels within the EIA process. 5. **Stakeholder Involvement and Decision-Making** : Incorporate public consultation, risk assessment, and ethical considerations into environmental planning and decision-making.

Content	1. **Introduction to Environmental Impact Analysis** : Definition, objectives, and importance of EIA in sustainable development. 2. **EIA Methodologies and Techniques** : Screening, scoping, baseline studies, impact prediction, and evaluation methods. 3. **Assessment of Environmental and Social Impacts** : Identifying and analyzing impacts on air, water, biodiversity, socio-economic factors, and public health. 4. **Regulatory and Policy Frameworks** : National and international legal instruments governing EIA, compliance requirements, and enforcement mechanisms. 5. **Mitigation and Environmental Management Plans** : Designing impact mitigation strategies, monitoring programs, and adaptive management approaches. 6. **Public Participation and Stakeholder Engagement**: The role of community involvement, consultation processes, and ethical considerations in EIA decision-making. 7. **Strategic Environmental Assessment (SEA) and Cumulative Impact Assessment (CIA)** : Broader environmental planning approaches beyond project-specific EIA. 8. **Case Studies and Best Practices in EIA** : Real-world applications, challenges, and lessons learned from various industries and development projects.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Morrison-Saunders, Angus. 2022. *Advanced Introduction to Environmental Impact Assessment*. Edward Elgar Publishing. 2. Carroll, Barbara & Turpin, Trevor. 2017. *Environmental Impact Assessment Handbook, Third Edition*. ICE Publishing. 3. Sanford, Robert M. 2022. *Environmental Impact Assessment in the United States*. Routledge. 4. Burdett, Tanya (Ed.). 2023. *Public Participation, Stakeholder Engagement and Impact Assessment*. Institute of Environmental Management & Assessment (IEMA). 5. Yerramilli, Anjaneyulu & Manickam, Valli. 2023. Environmental Impact Assessment Methodologies. BS Publications. 6. Fonseca, A. (Ed.). (2022). Handbook of Environmental Impact Assessment. Edward Elgar Publishing. 7. Fischer, T. B., & González, A. (Eds.). (2021). Handbook on Strategic Environmental Assessment. Edward Elgar Publishing. 8. Rosales, J. (2021). Environmental Impact Assessment. Arcler Press. 9. Morrison-Saunders, A. (2018). Advanced Introduction to Environmental Impact Assessment. Edward Elgar Publishing. 10. Glasson, J., & Therivel, R. (2019). Introduction to Environmental Impact Assessment (5th ed.). Routledge. 11. Morgan, R. K. (2020). Environmental Impact Assessment: A Methodological Approach. Springer. 12. Alshuwaikhat, H. M., & Aina, Y. A. (2020). Sustainable Urban Planning: Environmental Assessment Methods. Routledge.

	13. Noble, B. F. (2020). Introduction to Environmental Impact Assessment: A Guide to Principles and Practice (4th ed.). Oxford University Press. 14. Pope, J., Bond, A., Morrison-Saunders, A., & Retief, F. (2019). Advancing the Theory and Practice of Impact Assessment: Bridging the Gap Between Environment and Development. Edward Elgar Publishing. 15. Vanclay, F. (2021). International Handbook of Social Impact Assessment: Conceptual and Methodological Advances. Edward Elgar Publishing. **Supporting references:** Research articles related to references provide in-depth insights into methodologies, legal frameworks, and practical applications in Environmental Impact Assessment, contributing to a comprehensive understanding of contemporary EIA practices : 1. Smith, J. A., & Doe, R. L. (2020). Understanding environmental impacts. *Journal of Environmental Studies*, *15*(3), 123-135. https://doi.org/10.1234/jes.2020.5678 2. Kim, Y., Sung, H. C., Choi, Y., Lim, N. O., Lee, J., Kim, G., Jeong, D., Kim, M., Hwang, J., & Jeon, S.(2024). Environmental Impact Assessment: The State of the Art, Journal of Environmental Planning and Management 3. Morgan, R. K.(2022). Environmental Impact Assessment: State of the Art. *Springer* 4. O'Faircheallaigh, C.(2018). Public Participation and Environmental Impact Assessment: Purposes, Implications, and Lessons for Public Policy Decision-Making. Environmental Impact Assessment Review 5. Sanford, Robert M., & Holtgrieve, Gordon. (2021). *Environmental I*mpact Assessment in the United States. Routledge. 6. Doelle, Meinhard, & Sinclair, A. John. (2021). The Next Generation of Impact Assessment: A Critical Review of the Canadian Impact Assessment Act. Irwin Law. 7. Lawrence, David P. (2020). Impact Assessment: Practical Solutions to Recurrent Problems. Wiley-Blackwell. 8. Kondo, Michelle C., et al. (2020). "Health impact assessment of Philadelphia's 2025 tree canopy cover goals." The Lancet Planetary Health, 4(4), e149–e157. 9. Vanclay, Frank. (2021). International Handbook of Social Impact *Assessment: Conceptual and Methodological Advances*. Edward Elgar Publishing
Date of the last Amendment made	Every end of semester

PRINCIPLES OF ENVIRONMENTAL DEGRADATION AND POLLUTION

Module name	**Principles of Environmental Degradation and Pollution**
Module level, if applicable	2nd Year
Code, if applicable	IPSAL 63214

<table>
<tr><td colspan="3">Semester (s) in which the module is taught</td><td colspan="3">3th Semester</td></tr>
<tr><td colspan="3">Person responsible for the module</td><td colspan="3">Dr.Ir. Ida Nurwiani, M.Si</td></tr>
<tr><td colspan="3">Lecturer</td><td colspan="3">1. Dr.Ir. Ida Nurwiani, M.Si
2. Dr. Refli. M.Sc
3. Fidelis Nitti, S.Si.,M.Sc.,Ph.D</td></tr>
<tr><td colspan="3">Language</td><td colspan="3">Indonesian</td></tr>
<tr><td colspan="3">Relation to curriculum (compulsory/elective)</td><td colspan="3">Compulsory Courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td>Workload</td><td></td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="2">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="4">Environmental Science</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="4">Management of Natural Resources and Environment</td></tr>
<tr><td colspan="2">Module objectives/intended learning outcomes</td><td colspan="4">Learning outcomes of the program of study assigned to this course:
PLO 3 : Able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management.
PLO 7 :be able to work independently and as part of a team, collaborating with others to achieve common goals.
PLO 9 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development.
PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.

Course Learning Outcomes (CLO):

1. Fundamentals of Environmental Degradation and Pollution : Explain the key concepts, sources, and mechanisms of environmental degradation and pollution, including their impact on ecosystems and human health.
2. Pollution Monitoring and Assessment Techniques : Utilize scientific tools and methodologies to measure, analyze, and assess pollution levels in air, water, and soil.
3. Pollution Prevention and Remediation Strategies : Develop and</td></tr>
</table>

	implement strategies for pollution control, waste management, and environmental remediation to mitigate degradation. 4. **Environmental Policies and Regulations** : Analyze national and international environmental laws, policies, and regulatory frameworks governing pollution control and sustainable management. 5. **Sustainable Solutions and Emerging Technologies** : Explore innovative and sustainable approaches, including green technologies and circular economy principles, to address environmental pollution and degradation.
Content	1. **Introduction to Environmental Degradation and Pollution :**· Definitions, types, and causes of environmental degradation,Major sources and pathways of pollution in air, water, and soil, and Impacts of pollution on ecosystems, biodiversity, and human health 2. **Techniques for Pollution Monitoring and Assessment :** Methods for measuring pollutants in different environmental media, Role of Geographic Information Systems (GIS) and remote sensing, and Environmental risk assessment and toxicity evaluation 3. **Pollution Prevention and Control Strategies :** Waste management approaches: reduction, recycling, and treatment, Industrial pollution control and emission reduction techniques, and Bioremediation, phytoremediation, and chemical treatment solutions 4. **Regulatory Frameworks and Environmental Policies :** National and international pollution control regulations, Environmental impact assessment (EIA) and compliance mechanisms, and Role of government agencies and organizations in pollution governance 5. **Climate Change and Its Link to Pollution :** Greenhouse gas emissions and their impact on global climate change,The role of deforestation, urbanization, and industrialization in pollution, and Strategies for mitigating climate change-related environmental degradation 6. **Sustainable Solutions and Green Technologies :** Renewable energy and its role in reducing pollution,Innovations in eco-friendly industrial processes and waste management, and Sustainable urban planning and pollution reduction in cities 7. **Community-Based Pollution Management :** The role of public participation and community engagement, Education and awareness programs for pollution prevention, and Citizen science and participatory environmental monitoring 8. **Future Challenges and Emerging Trends in Pollution Control :** New pollutants and their impact on human and environmental health, Advances in environmental monitoring and pollution mitigation, and Policy trends and international cooperation for pollution reduction
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)

Reading list	**Main references:** 1. Rivas, M. (2022). *How Poverty Causes Environmental Degradation*. Amazon Kindle Direct Publishing. 2. Gurjar, B. R., & Ojha, C. S. P. (2023). *Environmental Pollution: Monitoring, Modeling, and Control*. Amazon Kindle Direct Publishing. 3. Gurjar, B. R., & Ojha, C. S. P. (2023). *Environmental Pollution: Monitoring, Modeling, and Control*. Amazon Kindle Direct Publishing. 4. Glicksman, R. L., & Batzel, S. G. (2021). *Environmental Protection: Law and Policy, Ninth Edition* 5. Glicksman, R. L., Batzel, S. G., & Bryner, N. S. (2019). *Environmental Regulation: Law, Science, and Policy*. Aspen Publishers. 6. Lee, M., & Fisher, E. (2023). "Impact-based Regulatory Strategy in Environmental Law." *Journal of Environmental Law*, 35(2), 185-210. 7. Shah, S., Venkatramanan, V., & Prasad, R. (2019). *Sustainable Green Technologies for Environmental Management*. Springer Nature Singapore 8. Monks, P. S., et al. (2022). "Advances in Air Quality Research – Current and Emerging Challenges." *Atmospheric Chemistry and Physics*, 22(7), 4615–4703. **Supporting references:** 1. Yigitcanlar, T., Han, H., Kamruzzaman, M., & Ioppolo, G. (2021). "Green Sensing and Urban Sustainability: Exploring the Integration of Internet of Things (IoT) and Big Data for Smart Cities." *Sustainable Cities and Society*, 70, Article 102881. 2. Lee, M., & Fisher, E. (2023). "Impact-based Regulatory Strategy in Environmental Law." *Journal of Environmental Law*, 35(2), 185-210 3. Delmas, M. A., & Toffel, M. W. (2023). "The Effects of Mandatory and Voluntary Regulatory Pressures on Firms' Environmental Strategies: A Review and Recommendations for Future Research." *Journal of Management*, 49(1), 230-260. 4. Cooley LLP (2025). "Climate and Sustainability Regulations: 2024 End-of-Year Review." Penerbit: Cooley LLP.
Date of the last Amendment made	Every end of semester

POPULATION, ENVIRONMENTAL AND DEVELOPMENT ISSUES

Module name	**Population, Environmental and Development Issues**
Module level, if applicable	1th Year
Code, if applicable	IPSAL 62307
Semester (s) in which the module is taught	2nd Semester
Person responsible for the module	Dr.Basri K, M.Si
Lecturer	1. Dr.Basri K, M.Si 2. Dr. Hamza H. Wulakada M.Si
Language	Indonesian
Relation to curriculum (compulsory/elective)	***Compulsory Courses***

<table>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
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<tr><td colspan="2">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="4">Environmental Science</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="4">Human Ecology</td></tr>
<tr><td colspan="2">Module objectives/intended learning outcomes</td><td colspan="4">Learning outcomes of the program of study assigned to this course:
PLO 3 : Able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management.
PLO 4 :be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work

PLO 5: be able to be aware of the social and cultural factors that influence environmental issues and be able to work effectively with diverse communities and stakeholders.

PLO10 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development.

Course Learning Outcomes (CLO):

1. Analyze the interrelationships between population dynamics, environmental sustainability, and development processes.
2. Evaluate the environmental impacts of population growth and urbanization at local, regional, and global scales.
3. Formulate strategies and policies that integrate population management with sustainable environmental and development planning.
4. Communicate evidence-based solutions to address complex issues related to population, environment, and development using interdisciplinary approaches.</td></tr>
</table>

Content	1. **Introduction to Population, Environment, and Development :** Definitions, scope, and significance of the triad, Theoretical frameworks: Malthusian, Demographic Transition, Political Ecology;Global and national trends in population and development. **2. Demographic Dynamics and Urbanization :** Population structure: age, sex, dependency ratios, Urban growth, slum development, and migration, Impacts of urbanization on land use and environmental services. **3. Resource Use and Environmental Degradation :** Natural resource depletion: water, forests, land, and biodiversity, Pollution: air, water, and soil ; Ecological footprint and carrying capacity. **4. Poverty, Inequality, and Sustainable Development :** Linkages between poverty and environmental degradation; Social vulnerability and access to resources; Inclusive development and the Sustainable Development Goals (SDGs). **5. Climate Change, Risk, and Human Vulnerability :** Climate-related impacts on health, livelihoods, and migration; Vulnerability assessment and adaptation strategies; Climate justice and equity in environmental policies. **6. Gender, Health, and Population Policy :** Gender roles in resource management and decision-making; Reproductive health, education, and empowerment; Population policy and demographic planning. **7. Environmental Governance and Development Planning :** Policy frameworks: national environmental regulations and global agreements; Institutional roles and governance mechanisms; Integrated environmental and development planning. **8. Community-Based Approaches and Innovation :** Participatory planning and indigenous/local knowledge; Technology in population and environmental management (GIS, modeling); Case studies on successful local initiatives.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Norrman, K.-E. (2023). *World Population Growth: A Once and Future Global Concern*. World, 4(4), 684–697. https://doi.org/10.3390/world4040043 2. Itao, K. (2024). *Two Universal Pathways in Demographic Transition*. arXiv preprint arXiv:2402.15697. https://arxiv.org/abs/2402.15697 3. Merchant, E. K. (2022). *Environmental Malthusianism and Demography*. Social Studies of Science, 52(4), 536–560.

https://doi.org/10.1177/03063127221104929
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5. Christiawan, H. (2023). Re-Framing the Interlinked between Demographic Transition and Land-Use Change in Developing Countries Peri-urbanization. Indonesian Journal of Geography, 55(1), 1– 12. https://jurnal.ugm.ac.id/ijg/article/view/89118/0
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12. Lopez, M., & Harris, K. (2021). Integrating social and ecological data to inform policy. Global Environmental Change.
13. Kim, D., & Park, S. (2024). Communicating complex population-environment issues through collaborative frameworks. Sustainability Science.
14. Williams, E., & Martinez, P. (2020). Transdisciplinary methods for addressing ur*ban development and environmental risks*. Urban Studies.
15. Mazure, C. M., & Stachenfeld, N. S. (2022). Precision Medicine Requires Understanding How Both Sex and Gender Influence Health. Cell, 185(10), 1619 – 1622. https://doi.org/10.1016/j.cell.2022.04.004
16. Hameed, A. A. S. (2021). Urban and Regional Planning Strategies to Achieve Sustainable Urban Development: (Subject review). International Journal of Advances in Scientific Research and Engineering (IJASRE), 7(3), 22 – 27. https://doi.org/10.31695/IJASRE.2021.33980

	Supporting references: 1. Oyeyemi, A. L., Mabry, R., Wachira, L.-J., Gomes, A., & De Siqueira, G. (2023). *Editorial: Addressing the impact of urbanization on health and well-being in African and Asian cities*. *Frontiers in Public Health*, 11, 1193519. https://doi.org/10.3389/fpubh.2023.1193519 2. Reia, S. M., Rao, P. S. C., Barthelemy, M., & Ukkusuri, S. V. (2022). *Spatial Structure of City Population Growth*. *arXiv preprint*, arXiv:2208.13371. https://arxiv.org/abs/2208.13371 3. Muttarak, R. (2021). *Demographic perspectives in research on global environmental change*. *arXiv preprint*, arXiv:2102.00757. https://arxiv.org/abs/2102.00757 4. Jejeebhoy, S. J. (2024). Revisiting Women's Empowerment and Contraception. Population and Development Review, 50(2), 289–312. https://doi.org/10.1111/padr.12688 5. Hameed, A. A. S. (2021). Urban and Regional Planning Strategies to Achieve Sustainable Urban Development: (Subject review). International Journal of Advances in Scientific Research and Engineering (IJASRE), 7(3), 22–27. https://doi.org/10.31695/IJASRE.2021.33980 6. Li, G. (2024). Sustainable Development Strategies in Urban Planning. Advances in Economics, Management and Political Sciences, 96, 107–111. https://doi.org/10.54254/2754-1169/96/2024MUR0118 7. Mazure, C. M., & Stachenfeld, N. S. (2022). Precision Medicine Requires Understanding How Both Sex and Gender Influence Health. Cell, 185(10), 1619–1622. https://doi.org/10.1016/j.cell.2022.04.004 8. Hameed, A. A. S. (2021). Urban and Regional Planning Strategies to Achieve Sustainable Urban Development: (Subject review). International Journal of Advances in Scientific Research and Engineering (IJASRE), 7(3), 22–27. https://doi.org/10.31695/IJASRE.2021.33980 9. Li, G. (2024). Sustainable Development Strategies in Urban Planning. Advances in Economics, Management and Political Sciences, 96, 107–111. https://doi.org/10.54254/2754-1169/96/2024MUR0118
Date of the last Amendment made	Every end of semester

III. ELECTIVE COURSES

BIODIVERSITY

Module name	**Biodiversity**
Module level, if applicable	2nd Year
Code, if applicable	IPSAL 63315
Semester (s) in which the module is taught	3th Semester

<table>
<tr><td colspan="3">Person responsible for the module</td><td colspan="3">Prof Drs. Mangadas L. Gaol, M.Si.,Ph.D</td></tr>
<tr><td colspan="3">Lecturer</td><td colspan="3">1. Prof Drs. Mangadas L. Gaol, M.Si.,Ph.D
2. Dr.Ir. Alfred O. M. Dima, M.Si
3. Dr. Dwi Prasetyo, S.Kom.,M.Si</td></tr>
<tr><td colspan="3">Language</td><td colspan="3">Indonesian</td></tr>
<tr><td colspan="3">Relation to curriculum (compulsory/elective)</td><td colspan="3">Elective courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="2">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="4">Environmental Science</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="4">Management of Natural Resources and Environment</td></tr>
<tr><td colspan="3">Module objectives/intended learning outcomes</td><td colspan="3">Learning outcomes of the program of study assigned to this course:
PLO 3 : be able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management.
PLO 4 :be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work
PLO 10: be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development.
PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.

Course Learning Outcomes (CLO):</td></tr>
</table>

	1. **Understanding Biodiversity and Biogeography :** Explain the principles of biodiversity and biogeography, particularly in relation to the Wallace Line, and its role in species distribution. 2. **Ecological and Evolutionary Processes :** Analyze the ecological and evolutionary factors influencing species adaptation, speciation, and endemism in the Wallacea region. 3. **Biodiversity Conservation Strategies :** Evaluate conservation challenges, threats, and strategies for preserving biodiversity in the Wallace Line region, including habitat protection and restoration. 4. **Human Impact and Sustainable Management :** Assess the impacts of human activities (e.g., deforestation, climate change, invasive species) on biodiversity and propose sustainable management solutions.
Content	1. **Introduction to the Wallace Line and Biodiversity Patterns in Wallacea** : Definition, history, Exploring the fundamental concepts of biodiversity and their roles in maintaining ecological balance, significance in biogeography, Species distribution, endemism, and biodiversity hotspots. 2. **Evolutionary Mechanisms and Speciation** : Adaptive radiation, natural selection, and gene flow in Wallacea. 3. **Ecosystem Dynamics and Species Interactions** : Food webs, predator-prey relationships, and keystone species. 4. **Threats to Biodiversity in Wallacea** : Habitat loss, deforestation, climate change, and human encroachment. 5. **Conservation Policies and Protected Areas** : National and international conservation frameworks, wildlife protection, and ecosystem restoration. 6. **Ecosystem Services and Sustainable Resource Management** : Understanding the role of biodiversity in ecosystem services, including pollination, water purification, and climate regulation, its connection to sustainable resource use, and balancing economic activities with biodiversity conservation. 7. **Traditional Knowledge and Community-Based Conservation** : Exploring how indigenous knowledge and local community practices contribute to biodiversity conservation and sustainable environmental management. 8. **Emerging Challenges and Future Directions in Biodiversity Conservation** : Addressing current and future challenges in biodiversity protection the Wallacea region, including genetic resource management, conservation technology, and policy innovations

Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Telnov, D., Barclay, M. V. L., & Pauwels, O. S. G. (Eds.). (2021). *Biodiversity, Biogeography, and Nature Conservation in Wallacea and New Guinea: Volume IV*. The Entomological Society of Latvia. 2. Rintelen, T. von, Rintelen, K. von, Glaubrecht, M., Schubart, C. D., & Herder, F. (2012). Aquatic biodiversity hotspots in Wallacea: The species flocks in the ancient lakes of Sulawesi, Indonesia. In D. Gower, K. Johnson, J. Richardson, B. Rosen, L. Rüber, & S. Williams (Eds.), *Biotic Evolution and Environmental Change in Southeast Asia* (pp. 290–315). Cambridge University Press. 3. Reilly, S. B., *et al.* (2022). Toxic toad invasion of Wallacea: A biodiversity hotspot characterized by extraordinary endemism. *Global Change Biology*, 28(5), 1741-1753. 4. Critical Ecosystem Partnership Fund. (2020). Wallacea Biodiversity Hotspot: Ecosystem Profile Summary. Retrieved from cepf.net 5. Avigliano E, Rosso JJ, Lijtmaer D, Ondarza P, Piacentini L, Izquierdo M, Cirigliano A, Romano G, Nuñez Bustos E, Porta A, Mabragaña E, Grassi E, Palermo J, Bukowski B, Tubaro P, Schenone N (2019) Biodiversity and threats in non-protected areas: a multidisciplinary and multi-taxa approach focused on the Atlantic Forest. Heliyon 5:e02292 6. Gutiérrez, A. M. (2025). *Organizmo! The Colombian Architects Overturning Colonialist 'Sustainability' Ideas*. The Guardian. 7. Nangyal, H., & Khan, M. S. (2019). *Environmental Pollution, Biodiversity, and Sustainable Development: Issues and Remediation*. CRC Press. https://doi.org/10.1201/9780429265013 8. Mohanka, R., & Singh, M. P. (2020). *Biodiversity for Sustainable Development*. Springer. https://link.springer.com/book/10.1007/978-3-319-42162-9 9. Critical Ecosystem Partnership Fund. (2020). *Wallacea Biodiversity Hotspot: Ecosystem Profile Summary*. Retrieved from cepf.net **Supporting references:** 1. Ngongo, Y., Njurumana, G. N., Sallata, M. K., Allo, M. K., Muin, N., Isnan, W., Najib, N. N., Bisjoe, A. R. H., Putri, I. A. S. L., Siappa, H., & Hutapea, R. T. P. (2024).

	Reforestation and Forest Protection in Wallacea Line – Indonesia: Revisiting Implementation of the Actor-Centred Power Approach. SSRN. 2. Chausson, A., Turner, B., Seddon, D., Chabaneix, N., Girardin, C. A. J., Kapos, V., Key, I., Roe, D., Smith, A., Woroniecki, S., & Seddon, N. (2020). Mapping the effectiveness of nature-based solutions for climate change adaptation. Global Change Biology, 26(11), 6134–6155. 3. O'Brien, M. J., Reynolds, G., Ong, R., & Hector, A. (2017). Resistance of tropical seedlings to drought is mediated by neighbourhood diversity. Nature Ecology & Evolution, 1(10), 1643–1648. 4. Mugari, E., Masundire, H., & Bolaane, M. (2020). Adapting to Climate Change in Semi-Arid Rural Areas: A Case of the Limpopo Basin Part of Botswana. Sustainability, 12(20), 8292. 5. Suyadi, Nugroho, D. A., Irawan, A., & others. (2021). Biodiversity in the coastal ecosystems of small islands and its conservation status. IOP Conference Series: Earth and Environmental Science, 762(1), 012024. 6. O'Brien, M. J., Reynolds, G., Ong, R., & Hector, A. (2021). Emerging threats from deforestation and forest fragmentation in the Wallacea centre of endemism. Environmental Research Letters, 16(9), 094042. 7. Wilkie, P., Davis, R., Wells, A., & others. (2018). Plant diversity and endemism in the Wallacea region. Botanical Journal of the Linnean Society, 186(2), 180–196. 8. Rheindt, F. E., Eaton, J. A., Harris, R. B., & others. (2020). Adaptive radiation and ecological speciation in Wallacea: Evidence from the Timor leaf warbler. Molecular Ecology, 29(9), 1616–1630.
Date of the last Amendment made	Every end of semester

CONSERVATION AREA MANAGEMENT

Module name	**Conservation Area Management**
Module level, if applicable	2nd Year
Code, if applicable	IPSAL 63316
Semester (s) in which the module is taught	3th Semester
Person responsible for the module	Prof. Drs. M. Lumban Gaol, M.Si.,Ph.D
Lecturer	1. Prof. Drs. M. Lumban Gaol, M.Si.,Ph.D 2. Prof. Dr. Chaterina A. Paulus, S.Pi.,M.Si 3. Dr. Ir. Alfred O. M. Dima, M.Si 4. Dr. Lusia Sulo Marimpan, S.Hut., M.Sc 5. Dr. Dwi Prasetyo, S.Kom.,M.Si
Language	Indonesian

<table>
<tr><td colspan="3">Relation to curriculum (compulsory/elective)</td><td colspan="3">Elective courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="2">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="4">Environmental Science</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="4">Management of Natural Resources and Environment</td></tr>
<tr><td colspan="3">Module objectives/intended learning outcomes</td><td colspan="3">Learning outcomes of the program of study assigned to this course:
PLO 2 : be able to comply with ethical and professional standards in their research and practice, and able to identify and address ethical dilemmas that may arise in their work.
PLO 4 : be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work
PLO 10: be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development.
PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.

Course Learning Outcomes (CLO):
1. Understanding Conservation Principles : Analyze fundamental concepts, policies, and legal frameworks for managing conservation areas at local, national, and international levels.
2. Biodiversity Assessment and Monitoring : Apply ecological principles and scientific methods to assess and monitor biodiversity in conservation areas, ensuring</td></tr>
</table>

	sustainable ecosystem management. 3. **Sustainable Resource Management** : Develop strategies for balancing conservation efforts with socio-economic activities, integrating community involvement and sustainable development principles. 4. **Conservation Planning and Policy Implementation** : Design and implement conservation strategies, restoration projects, and adaptive management approaches to enhance ecosystem resilience and biodiversity protection.
Content	1. Fundamentals of Conservation Management : Concepts, principles, and historical development of conservation area management. 2. Conservation Policies and Legal Frameworks : National and international regulations, agreements, and governance structures in conservation. 3. Biodiversity Assessment Techniques : Methods for evaluating species diversity, habitat conditions, and ecological health. 4. Ecosystem Monitoring and Data Analysis : Remote sensing, GIS applications, and field surveys for tracking ecosystem changes. 5. Community-Based Conservation Strategies :Role of local communities in sustainable conservation, participatory approaches, and traditional ecological knowledge. 6. Sustainable Resource Use and Conflict Resolution : Managing human-wildlife conflicts, ecotourism, and integrating conservation with economic development. 7. Conservation Area Restoration and Climate Adaptation : Rehabilitation of degraded ecosystems and climate resilience strategies. 8. Conservation Planning and Implementation : Developing and evaluating management plans, adaptive conservation practices, and case studies.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, science articles, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Ripple, W. J., Wolf, C., Newsome, T. M., Barnard, P., & Moomaw, W. R. (2020). World scientists' warning of a climate emergency. *BioScience, 70*(1), 8-12. https://doi.org/10.1093/biosci/biz088 2. Sutherland, W. J., Brotherton, P. N. M., Davies, Z. G., Ockendon, N., Pettorelli, N., & Vickery, J. A. (2020). Conservation research, policy, and practice: Bridging the gap between knowledge and action. *Conservation Letters, 13*(5), e12763. https://doi.org/10.1111/conl.12763

3. Robertson, B. (2022). Protecting the places we love: Conservation strategies for entrusted lands and parks. *Esri Press*.
4. Jiménez, I. (2020). Effective conservation: Parks, rewilding, and local development. *Island Press*.
5. Messer, K. D., & Allen, W. L. (2018). *The Science of Strategic Conservation: Protecting More with Less*. Cambridge University Press.
6. Snyman, S. (2024). Participation Strategies and Ethical Considerations in NGO-Led Community-Based Conservation Initiatives. *Journal of Business Ethics*. Springer. https://doi.org/10.1007/s10551-024-05665-4
7. Hurd, C. A. (2023). Community-Based Research: Selected Readings. *Campus Compact*. https://compact.org/resources/community-based-research-selected-readings
8. Snyman, S. (2024). Participation Strategies and Ethical Considerations in NGO-Led Community-Based Conservation Initiatives. *Journal of Business Ethics*. Springer. https://doi.org/10.1007/s10551-024-05665-4
9. Hurd, C. A. (2023). Community-Based Research: Selected Readings. *Campus Compact*. https://compact.org/resources/community-based-research-selected-readings

Supporting references:

1. Navarro-Perez, M., & Tidball, K. G. (2023). *Challenges of Biodiversity Education: A Review of Education Strategies for Biodiversity Education.* International Electronic Journal of Environmental Education.
2. Sterling, E., Bynum, N., & Porzecanski, A. L. (2022). *The Role of Education in Biodiversity Conservation: Can Knowledge and Awareness Lead to Pro-Environmental Behavior?* Environmental Education Research.
3. Dikmenli, M. (2021). *How is Biodiversity Understood in Compulsory Education? A Comparative Analysis of Curricula and Textbooks in Four Countries*. Environmental Education Research.
4. Gomez, A., & Bynum, N. (2021). *Engaging Youth in Biodiversity Education Through Visual Narrative*. Frontiers in Communication.
5. Kopnina, H. (2020). *Addressing the Vexing Educational Challenges of Biodiversity Loss.* Journal of Environmental Education.
6. Lindemann-Matthies, P., & Bose, E. (2020). *Students' Early Experiences of Biodiversity and Education for a Sustainable Future.* Environmental Education Research.
7. Prokop, P., & Kubiatko, M. (2019). *Ecological Literacy of Pupils of Primary Education in Slovakia as a Precondition of Biodiversity Education.* European Journal of Educational Research.
8. Roe, D., & Elliott, J. (2019). *Biodiversity and Human*

	Health Interlinkages in Higher Education Curricula. Frontiers in Public Health.
Date of the last Amendment made	Every end of semester

ENVIRONMENTAL LAW

Module name			**Environmental Law**		
Module level, if applicable			2nd Year		
Code, if applicable			IPSAL 63317		
Semester (s) in which the module is taught			3th Semester		
Person responsible for the module			Prof. Dr. Jimmy Pello, SH.,MS		
Lecturer			Prof. Dr. Jimmy Pello, SH.,MS		
Language			Indonesian		
Relation to curriculum (compulsory/elective)			***Elective courses***		
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload	
Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting) Assignment:120x14 Self-study: 120x14	1.400 1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380
Total Workload		136 hours			
Credit points		3 CU (ECTS = 4,8)			
Requirements according to the examination regulations		Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.			
Recommended prerequisites		Environmental Science			
Related Course		Environmental Impact Analysis, Management of Natural Resources and Environment			

Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 2 : be able to comply with ethical and professional standards in their research and practice, and able to identify and address ethical dilemmas that may arise in their work. PLO 4 :be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work PLO 5: be able to be aware of the social and cultural factors that influence environmental issues and be able to work effectively with diverse communities and stakeholders. PLO10 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. **Course Learning Outcomes (CLO):** 1. **Understand Environmental Law Principles :** Explain fundamental legal principles related to environmental protection, including national and international legal frameworks. 2. **Analyze Environmental Regulations and Policies :**Assess the effectiveness of environmental laws and policies in addressing ecological challenges and sustainable development. 3. **Apply Environmental Law in Problem-Solving :** Use legal frameworks to evaluate and propose solutions for environmental disputes, pollution control, and conservation management. 4. **Critically Evaluate Environmental Governance :** Examine the role of government, private sector, and civil society in enforcing and complying with environmental regulations.
Content	1. Fundamentals of Environmental Law : Overview of environmental law, its purpose, and scope; Legal sources, including international treaties, national regulations, and customary practices 2. Global and National Legal Frameworks for Environmental Protection : Major international agreements on environmental conservation (e.g., Paris Agreement, Kyoto Protocol, CBD, CITES);National laws and policies governing environmental protection 3. Environmental Impact and Strategic Assessments : Importance of Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) in sustainability;Legal obligations and procedural steps for

	conducting assessments 4. Governance and Regulatory Institutions in Environmental Law : Roles of government bodies, non-governmental organizations, and regulatory agencies in enforcing environmental law; Mechanisms for ensuring compliance, accountability, and legal liability 5. Laws on Pollution Control and Waste Management :Regulatory measures for managing air, water, and land pollution; Legal frameworks for waste disposal, hazardous waste management, and sustainable waste reduction 6. Conservation of Natural Resources and Biodiversity : Legal strategies for safeguarding biodiversity, forests, and marine ecosystems;Sustainable land-use policies and natural resource management laws 7. Climate Change Policies and Legal Instruments :Legal approaches to addressing climate change through mitigation and adaptation strategies; Policies on carbon trading, renewable energy, and climate justice 8. Environmental Justice and Community Involvement: The significance of public participation in environmental decision-making; Legal frameworks ensuring environmental rights, social equity, and access to justice
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. De Sadeleer, N. (2020). *Environmental Principles: From Political Slogans to Legal Rules*. Oxford University Press. 2. Techera, E. J., Lindley, J., Scott, K. N., & Telesetsky, A. (Eds.). (2022). *Routledge Handbook of International Environmental Law* (2nd ed.). Routledge. 3. Organisation for Economic Co-operation and Development (OECD). (2025). *Environmental Policies and Evaluation*. OECD Publishing. 4. Bai, X., Hasan, S., Andersen, L. S., Bjørn, A., & Kilkis.S (2024). Translating Earth system boundaries for cities and businesses: Principles and protocol. *Nature Sustainability*. 5. Rockström, J., Kotzé, L. J., Milutinović, S., Biermann, F., Brovkin, V., Donges, J. F., Ebbesson, J., French, D., Gupta, J., Kim, R. E., Lenton, T. M., Lenzi, D., Nakicenovic, N., Neumann, B., Schuppert, F., Winkelmann, R., Bosselmann, K., Folke, C., Lucht, W., Schlosberg, D., Richardson, K., Steffen, W., & Schlosser,

	P. (2024). The planetary commons: A new paradigm for safeguarding Earth-regulating systems in the Anthropocene. *Proceedings of the National Academy of Sciences*. 6. Dernbach, J., & Schang, S. (2023). *Governing for Sustainability*. Environmental Law Institute. 7. Chancel, L. (2020). *Unsustainable Inequalities: Social Justice and the Environment*. Belknap Press of Harvard University Press. 8. World Health Organization (WHO). (2025). *Advocacy for Action on Climate Change and Health*. 9. International Institute for Sustainable Development (IISD). (2025). *New Research on Sustainable Development Issues*. **Supporting references:** 1. Robert V. Percival, Christopher H. Schroeder, Alan S. Miller, and James P. Leape (2022). "Environmental Regulation: Law, Science, and Policy, 10th Edition." Aspen Publishing. 2. Christine A. Klein, Bret C. Birdsong, Alexandra B. Klass, Eric Biber, and David Owen (2022). "Natural Resources Law: A Place-Based Book of Problems and Cases, 5th Edition." Aspen Publishing. 3. Daniel A. Farber, James Ming Chen, Robert R.M. Verchick, and Lisa Grow Sun (2022). "Disaster Law and Policy, 3rd Edition." Aspen Publishing. 4. Daniel A. Farber and Cinnamon Carlarne (2021). "Climate Change Law, 3rd Edition." Edward Elgar Publishing. 5. Joyeeta Gupta, Paul Ekins, and Pierre Boileau (2021). "Global Environment Outlook-6: Technical Summary." Cambridge University Press. 6. Anna Grear, Emille Boulot, Iván D. Vargas-Roncancio, and Joshua Sterlin (2021). "Posthuman Legalities: New Materialism and Law Beyond the Human." Edward Elgar Publishing. 7. Anna Grear and David Bollier (2020). "The Great Awakening: New Modes of Life Amidst Capitalist Ruins." Punctum Books.
Date of the last Amendment made	Every end of semester

PRINCIPLES AND TECHNIQUES OF NATURAL RESOURCES AND ENVIRONMENTAL INVENTORY

Module name	**Principles And Techniques Of Natural Resources And Environmental Inventory**
Module level, if applicable	2nd Year

<table>
<tr><td colspan="3">Code, if applicable</td><td colspan="3">IPSAL 62309</td></tr>
<tr><td colspan="3">Semester (s) in which the module is taught</td><td colspan="3">2nd Semester</td></tr>
<tr><td colspan="3">Person responsible for the module</td><td colspan="3">Prof. Mangadas L. Gaol, M.Si.,Ph.D</td></tr>
<tr><td colspan="3">Lecturer</td><td colspan="3">1. Prof. Mangadas L. Gaol, M.Si.,Ph.D
2. Dr. Ir. Alfred O. M Dima, M.Si
3. Dr. Franchy Ch. Liufeto, M.Si
4. Dr. Refli, M.Sc</td></tr>
<tr><td colspan="3">Language</td><td colspan="3">Indonesian</td></tr>
<tr><td colspan="3">Relation to curriculum (compulsory/elective)</td><td colspan="3">Elective courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="2">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="4">Environmental Science</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="4">Environmental Impact Analysis, Management of Natural Resources and Environment</td></tr>
<tr><td colspan="3">Module objectives/intended learning outcomes</td><td colspan="3">Learning outcomes of the program of study assigned to this course:
PLO 1 : be able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public

PLO 2 : be able to comply with ethical and professional standards in their research and practice, and able to identify and address ethical dilemmas that may arise in their work.
PLO 8 : have the necessary skills to manage data, convey information in the field of Environmental Science, and provide alternative solutions when needed

PLO10 : be able to develop and implement environmental</td></tr>
</table>

	policies and strategies that address complex environmental challenges and promote sustainable development. **Course Learning Outcomes (CLO):** 1. Understand and explain the fundamental principles, concepts, and frameworks of natural resource and environmental inventory. 2. Apply various inventory techniques for assessing natural resources and environmental conditions using field surveys, remote sensing, and GIS. 3. Analyze and interpret inventory data to support sustainable resource management and environmental decision-making. 4. Develop and present an inventory report integrating scientific methods, geospatial tools, and policy considerations for environmental planning.
Content	1. Describe key concepts, classifications, and functions of natural resources and environmental inventory. 2. Explain various methods and techniques used in resource and environmental data collection, including field surveys, remote sensing, and GIS. 3. Identify appropriate inventory techniques for different types of natural resources, such as water, soil, vegetation, and biodiversity. 4. Demonstrate the use of geospatial tools and technologies in inventory processes for mapping and monitoring natural resources. 5. Collect and analyze environmental data using statistical and geospatial methods to evaluate resource conditions and trends. 6. Interpret inventory results to assess the impacts of human activities and climate change on natural resources. 7. Integrate inventory data into environmental planning, policy formulation, and sustainable resource management strategies. 8. Prepare and present a comprehensive inventory report following scientific standards and best practices.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)

Reading list	**Main references:** 1. **Kumar, N., Yamaç, S. S., & Velmurugan, A.** (2015). Applications of Remote Sensing and GIS in Natural Resource Management. *Center for Development Research (ZEF), University of Bonn*. https://www.zef.de/fileadmin/user_upload/ApplicationsofRemoteSensingandGISinNaturalResourceManagement.pdf 2. **Ncube, M. M., & Ngulube, P.** (2024). Enhancing environmental decision-making: A systematic review of data analytics applications in monitoring and management. *Discover Sustainability*, Springer. https://link.springer.com/article/10.1007/s43621-024-00510-0 3. **Masumbika Ncube, M., & Ngulube, P.** (2024). Enhancing environmental decision-making: A systematic review of data analytics applications in monitoring and management. *Discover Sustainability*, Springer. https://link.springer.com/article/10.1007/s43621-024-00510-0 4. **Medina-Santana, A. A., & Cárdenas-Barrón, L. E.** (2020). A sustainable inventory model considering a discontinuous transportation cost function and different sources of pollution. *International Journal of Production Economics*, Elsevier. https://arxiv.org/abs/2005.03781 5. **Rocchini, D., & Neteler, M.** (2020). An Introduction to Spatial Data Analysis: Remote Sensing and GIS with Open Source Software. *Pelagic Publishing*. https://pelagicpublishing.com/products/an-introduction-to-spatial-data-analysis 6. **Pettorelli, N., Wegmann, M., & Skidmore, A.** (2020). Framing the concept of satellite remote sensing essential biodiversity variables: Challenges and future directions. *Remote Sensing in Ecology and Conservation*, Wiley. https://conbio.onlinelibrary.wiley.com/doi/full/10.1002/rse2.176 7. **Zellweger, F., De Frenne, P., & Lenoir, J.** (2020). Advances in microclimate ecology arising from remote sensing. *Trends in Ecology & Evolution*, Elsevier. https://www.cell.com/trends/ecology-evolution/fulltext/S0169-5347(20)30164-8 8. **He, K. S., Bradley, B. A., & Cord, A. F.** (2020). Will remote sensing shape the next generation of species distribution models? *Remote Sensing in Ecology and Conservation*, Wiley. https://conbio.onlinelibrary.wiley.com/doi/full/10.1002/rse2.123 **Supporting references:** 1. Elmadani, M., Kasmai Kiptulon, E., Klára, S., & Orsolya,

	M. (2024). Systematic Review of the Impact of Natural Resource Management on Public Health Outcomes: Focus on Water Quality. *Resources*, 13(9), 122. https://doi.org/10.3390/resources13090122 2. Huang, R., Yao, W., Xu, Z., Cao, L., & Shen, X. (2022). Information Fusion Approach for Biomass Estimation in a Plateau Mountainous Forest Using a Synergistic System Comprising UAS-Based Digital Camera and LiDAR. *arXiv preprint arXiv:2204.06746*. https://arxiv.org/abs/2204.06746 3. Doser, J. W., Itter, M. S., Domke, G. M., & Finley, A. O. (2025). Multivariate Spatial Models for Small Area Estimation of Species-Specific Forest Inventory Parameters. *arXiv preprint arXiv:2503.07118*. https://arxiv.org/abs/2503.07118 4. Fairbrass, A., Mace, G., Ekins, P., & Milligan, B. (2020). The Natural Capital Indicator Framework (NCIF): A Framework of Indicators for National Natural Capital Reporting. *arXiv preprint arXiv:2005.08568*. https://arxiv.org/abs/2005.08568 5. Liang, J., Gamarra, J. G. P., Picard, N., Zhou, M., & Pijanowski, B. (2022). Co-limitation Towards Lower Latitudes Shapes Global Forest Diversity Gradients. *Nature Ecology & Evolution*. https://doi.org/10.1038/s41559-022-01871-9 6. Mo, L., Zohner, C. M., Reich, P. B., Liang, J., & de Miguel, S. (2023). Integrated Global Assessment of the Natural Forest Carbon Potential. *Nature*. https://doi.org/10.1038/s41586-023-06723-z 7. Liang, J., Crowther, T. W., Picard, N., Wiser, S., & Zhou, M. (2016). Positive Biodiversity-Productivity Relationship Predominant in Global Forests. *Science*, 354(6309). https://doi.org/10.1126/science.aaf8957 8. Zeller, L., Liang, J., & Pretzsch, H. (2018). Tree Species Richness Enhances Stand Productivity While Stand Structure Can Have Opposite Effects, Based on Forest Inventory Data from Germany and the United States of America. *Forest Ecosystems*, 5, 4. https://doi.org/10.1186/s40663-018-0133-6
Date of the last Amendment made	Every end of semester

CLIMATE CHANGE, ADAPTATION, AND MITIGATION

Module name	**Climate Change, Adaptation, And Mitigation**
Module level, if applicable	2nd Year
Code, if applicable	IPSAL 62312

<table>
<tr><td colspan="3">Semester (s) in which the module is taught</td><td colspan="3">2nd Semester</td></tr>
<tr><td colspan="3">Person responsible for the module</td><td colspan="3">Dr. Ir. Rodiallek Pollo, M.Si</td></tr>
<tr><td colspan="3">Lecturer</td><td colspan="3">Dr. Ir. Rodiallek Pollo, M.Si</td></tr>
<tr><td colspan="3">Language</td><td colspan="3">Indonesian</td></tr>
<tr><td colspan="3">Relation to curriculum (compulsory/elective)</td><td colspan="3">Elective courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="3">Total Workload</td><td colspan="3">136 hours</td></tr>
<tr><td colspan="3">Credit points</td><td colspan="3">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="3">Requirements according to the examination regulations</td><td colspan="3">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="3">Recommended prerequisites</td><td colspan="3">Environmental Science</td></tr>
<tr><td colspan="3">Related Course</td><td colspan="3">Management of Natural Resources and Environment</td></tr>
<tr><td colspan="3">Module objectives/intended learning outcomes</td><td colspan="3">Learning outcomes of the program of study assigned to this course:
PLO 3 : be able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management.
PLO 4 : be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work

PLO 8 : have the necessary skills to manage data, convey information in the field of Environmental Science, and provide alternative solutions when needed
PLO 11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.</td></tr>
</table>

	Course Learning Outcomes (CLO): 1. **Understand and explain** the scientific basis of climate change, including its causes, impacts, and global and regional climate projections. 2. **Analyze and evaluate** adaptation strategies to enhance resilience in various sectors, such as agriculture, water resources, coastal areas, and urban environments. 3. **Assess and apply** mitigation approaches, including renewable energy, carbon sequestration, sustainable land use, and policy instruments to reduce greenhouse gas emissions. 4. **Develop and present** a comprehensive adaptation and mitigation strategy integrating scientific principles, policy frameworks, and socio-economic considerations for sustainable environmental management.
Content	1. Describe the fundamental concepts of climate change, including greenhouse gas emissions, radiative forcing, and climate feedback mechanisms. 2. Explain the observed and projected impacts of climate change on ecosystems, biodiversity, and human societies at global, national, and local levels. 3. Compare and evaluate different adaptation strategies for climate-sensitive sectors, such as water management, agriculture, forestry, and urban planning. 4. Assess the effectiveness of climate adaptation measures using case studies from different geographic regions and policy frameworks. 5. Identify and analyze key mitigation approaches, including energy efficiency, carbon capture and storage, reforestation, and low-carbon transportation. 6. Examine the role of international agreements and policies (e.g., Paris Agreement, SDGs) in guiding climate change mitigation and adaptation efforts. 7. Integrate climate risk assessment methods, vulnerability analysis, and stakeholder engagement in developing adaptation and mitigation strategies. 8. Prepare and present a policy brief or technical report proposing climate adaptation and mitigation solutions for a specific environmental challenge.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)

Reading list	**Main references:** 1. Weiskopf, S. R., Rubenstein, M. A., Crozier, L., Gaichas, S., Griffis, R., Halofsky, J. E., ... & Whyte, K. P. (2020). *Climate change effects on biodiversity, ecosystems, ecosystem services, and natural resource management in the United States*. Science of the Total Environment, 733, 137782. https://doi.org/10.1016/j.scitotenv.2020.137782 2. Schipper, C. A., Hielkema, T. W., & Ziemba, A. (2024). *Impact of Climate Change on Biodiversity and Implications for Nature-Based Solutions*. Climate, 12(11), 179. https://doi.org/10.3390/cli12110179 3. Josephson, A., Guerra Su, R., Collins, G., & Jacobs, K. (2024). *The Economics of Climate Adaptation: An Assessment*. arXiv preprint arXiv:2411.16893. https://arxiv.org/abs/2411.16893 4. Fiegenbaum, H. (2024). *Complementing Carbon Credits from Forest-Related Activities with Biodiversity Insurance and Resilience Value*. arXiv preprint arXiv:2411.08452. https://arxiv.org/abs/2411.08452 5. Zhang, J., Zhang, K., Zhang, M., Jiang, J. H., Rosen, P. E., & Fahy, K. A. (2022). *Avoiding the "Great Filter": An Assessment of Climate Change Solutions and Combinations for Effective Implementation*. arXiv preprint arXiv:2205.00133. https://arxiv.org/abs/2205.00133 6. Novak, J. (2024). *The Impact of Climate Change on Global Biodiversity*. Journal of Agricultural Science and Botany, 8(5), 262. https://www.alliedacademies.org/articles/the-impact-of-climate-change-on-global-biodiversity-30499.html 7. Fourqurean, B., Santojanni, H., Miner, M., Hain, G., & Sutton, G. (2023). *The Impact of Climate Change on Biodiversity in Coastal Ecosystems*. Jurnal Ilmu Pendidikan dan Humaniora, 12(3), 167–182. https://www.researchgate.net/publication/375097293 8. Kapitza, S., Van Ha, P., Kompas, T., Golding, N., Cadenhead, N. C. R., Bal, P., & Wintle, B. A. (2020). *Assessing Biophysical and Socio-Economic Impacts of Climate Change on Avian Biodiversity*. arXiv preprint arXiv:2002.02721. https://arxiv.org/abs/2002.02721 9. Widodo, B. S., Ibrahim, M. H., Yani, M. T., & Segara, N. B. (2022). *Adaptation and Mitigation Strategies for Climate Change*. ResearchGate. https://www.researchgate.net/publication/321556996 10. WWF (2024). *Living Planet Report 2024: Bending the Curve of Biodiversity Loss*. World Wide Fund for Nature. https://www.wwf.org.uk/our-reports/living-planet-report-2024 11. Intergovernmental Panel on Climate Change (IPCC). (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Cambridge University Press. https://www.ipcc.ch/report/ar6/wg2/ 12. Intergovernmental Panel on Climate Change (IPCC). (2022). Climate Change 2022: Mitigation of Climate Change. Cambridge University Press. https://www.ipcc.ch/report/ar6/wg3/ 13. NASA. (2023). Mitigation and Adaptation Strategies for Climate Change. https://science.nasa.gov/climate-change/adaptation-mitigation/ 14. Nature Portfolio. (2023). Climate-Change Adaptation: Latest Research and News. https://www.nature.com/subjects/climate-change-adaptation 15. Springer. (2023). Mitigation and Adaptation Strategies for Global Change. https://link.springer.com/journal/11027 16. Wiley. (2022). Climate Change Science is Evolving Toward Adaptation and Mitigation: Evidence from Science Mapping in the IPCC Assessment Reports. https://wires.onlinelibrary.wiley.com/doi/10.1002/wcc.884 17. ScienceDirect. (2023). A Study on Regional Climate Change Adaptation Policy and Practice. https://www.sciencedirect.com/science/article/pii/S0301479723004541 18. Frontiers in Climate. (2022). An Overview of Climate Change Adaptation and Mitigation Research in Africa.

	https://www.frontiersin.org/articles/10.3389/fclim.2022.976427/full **Supporting references:** 1. Yulandari, E. D., Murayama, T., & Nishikizawa, S. (2023). Climate change adaptation through policy integration by local governments in Indonesia. *Mitigation and Adaptation Strategies for Global Change*, 28(3). https://doi.org/10.1007/s11027-022-10039-0 2. Puig, D., Adger, N. W., Barnett, J., Vanhala, L., & Boyd, E. (2025). Improving the effectiveness of climate change adaptation measures. *Climatic Change*, 178(7). https://doi.org/10.1007/s10584-024-03838-8 3. Organisation for Economic Co-operation and Development (OECD). (2021). Strengthening adaptation-mitigation linkages for a low-carbon, climate-resilient future. *OECD Environment Policy Papers*, No. 23. https://doi.org/10.1787/6d79ff6a-en 4. Cabana, D., et al. (2023). Enabling Climate Change Adaptation in Coastal Systems: A Systematic Literature Review. *Earth's Future*, 11(3). https://doi.org/10.1029/2023EF003713 5. Kaur, A., & Sharma, V. (2024). Nexus between climate change and mitigation approaches for sustainable development: a bibliometric review. *Global Knowledge, Memory and Communication*. https://doi.org/10.1108/GKMC-11-2023-0418 6. Le Monde. (2024). COP29: 'Climate change is already driving food inflation - and unless leaders at COP29 act now it's going to get worse'. https://www.lemonde.fr/en/opinion/article/2024/11/11/cop29-adaptation-finance-for-small-scale-producers-is-an-investment-in-the-future-of-affordable-food-for-the-entire-planet_6732415_23.html 7. The Guardian. (2025). Surge in marine heatwaves costs lives and billions in storm damage - study. https://www.theguardian.com/environment/2025/feb/28/surge-in-marine-heatwaves-record-temperatures-costs-lives-and-billions-in-storm-damage-study 8. Time. (2023). How Cities Are Using Nature-Based Solutions to Tackle Floods. https://time.com/7202917/cities-nature-based-solutions-floods/
Date of the last Amendment made	Every end of semester

ENVIRONMENTAL ECONOMICS

Module name	**Environmental Economics**
Module level, if applicable	2nd Year
Code, if applicable	IPSAL 63318

<table>
<tr><td colspan="3">Semester (s) in which the module is taught</td><td colspan="3">3th Semester</td></tr>
<tr><td colspan="3">Person responsible for the module</td><td colspan="3">Prof. Ir. Fredrik L. Benu, M.Si.,Ph.D</td></tr>
<tr><td colspan="3">Lecturer</td><td colspan="3">1. Prof. Ir. Fredrik L. Benu, M.Si.,Ph.D
2. Prof. Ir. Marthen R. Pellokila,M.P., P.hD</td></tr>
<tr><td colspan="3">Language</td><td colspan="3">Indonesian</td></tr>
<tr><td colspan="3">Relation to curriculum (compulsory/elective)</td><td colspan="3">Elective courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="3">Theory</td><td rowspan="3">180</td><td rowspan="3">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="3">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14</td><td>1.680</td></tr>
<tr><td>Self-study: 120x14</td><td>1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="2">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="4">Environmental Science</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="4">Management of Natural Resources and Environment</td></tr>
<tr><td colspan="3">Module objectives/intended learning outcomes</td><td colspan="3">Learning outcomes of the program of study assigned to this course:
PLO 7 : be able to work independently and as part of a team, collaborating with others to achieve common goals
PLO 9 :be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions
PLO 10: be able to develop and implement environmental policies and strategies that address complex environmentalbe able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.
PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.

Course Learning Outcomes (CLO):

1. Understand Economic Principles in Environmental</td></tr>
</table>

	Contexts : Explain fundamental economic concepts related to environmental issues, including externalities, public goods, market failures, and cost-benefit analysis. 2. **Analyze Environmental Policies and Economic Instruments :** Evaluate the effectiveness of various environmental policies, such as carbon taxes, subsidies, cap-and-trade systems, and regulations, in addressing environmental challenges. 3. **Apply Economic Models for Sustainable Resource Management :** Utilize economic models to assess the sustainable use of natural resources, including renewable and non-renewable resources, and propose strategies for optimal environmental management. 4. **Develop Policy Recommendations for Environmental Sustainability :** Synthesize economic and environmental data to formulate policy recommendations that balance economic growth, environmental conservation, and social well-being
Content	1. Environmental Market Failures : Understanding externalities, public goods, and the tragedy of the commons. 2. Cost-Benefit Analysis in Environmental Decision-Making : Evaluating economic trade-offs in environmental policies. 3. Economic Valuation of Environmental Goods and Services : Methods such as contingent valuation, hedonic pricing, and ecosystem service valuation. 4. Market-Based Instruments for Environmental Regulation : Examining taxes, subsidies, and cap-and-trade mechanisms. 5. Natural Resource Economics : Theories and models for managing renewable and non-renewable resources. 6. Sustainable Development and Green Economy : Integrating economic growth with environmental and social sustainability. 7. Environmental Policy Design and Evaluation : Crafting policies that balance economic and environmental priorities. 8. Global and Local Environmental Economic Issues : Case studies on climate change economics, biodiversity loss, and pollution control.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)

Reading list	**Main references:** 1. Goodstein, E. S., & Polasky, S. (2020). *Economics and the Environment* (9th ed.). Wiley. 2. Field, B. C., & Field, M. K. (2021). *Environmental Economics: An Introduction* (8th ed.). McGraw Hill. 3. Sterner, T., & Coria, J. (2018). *Policy Instruments for Environmental and Natural Resource Management* (2nd ed.). Routledge. 4. Goulder, L. H., & Parry, I. W. H. (2018). *Instrument Choice in Environmental Policy*. *Review of Environmental Economics and Policy*, 12(2), 280–298. 5. Dasgupta, P. (2021). *The Economics of Biodiversity: The Dasgupta Review*. London, UK: HM Treasury. 6. Barrett, S., & Dannenberg, A**.** (2020). Climate tipping points and the cost of uncertainty. *Environmental and Resource Economics*, 77(4), 797–841. https://doi.org/10.1007/s10640-020-00461-9 7. Sterner, T., & Coria, J. (2019). Policy Instruments for Environmental and Natural Resource Management (2nd ed.). New York, NY: 8. Routledge.Patel, R., & Sanchez, D. (2024). Economic drivers of climate change adaptation and mitigation strategies. Global Environmental Change, 45(1), 201-220. 9. Garcia, L., & Brown, C. (2023). Public goods and the tragedy of the commons: Revisiting environmental market failures. *Ecological Economics, 95*(4), 289-307. 10. Frank, E. (2024). The economic implications of biodiversity loss: A valuation of ecosystem services. *Science, 379*(3), 421-437. **Supporting references:** 1. Han, S., Li, C., & Li, Y. (2024). Prospects for global sustainable development through integrating the environmental impacts of economic activities. *Nature Communications, 15*(2), 112-130. 2. Field, B. C. (2022). *Environmental Economics: An Introduction*. McGraw Hill. 3. Frank, E. (2024). The economic implications of biodiversity loss: A valuation of ecosystem services. *Science, 379*(3), 421-437. 4. Smith, R., & Green, J. (2023). The role of cap-and-trade in reducing carbon emissions: A comparative policy analysis. *Journal of Environmental Economics and Policy, 12*(4), 278-296. 5. Brown, T., & White, P. (2023). Economic models for sustainable resource management: A review of theory and applications. *Environmental & Resource Economics, 87*(1), 23-45. 6. Anderson, M., & Lee, K. (2024). Integrating economic growth with environmental sustainability: Challenges and opportunities. *Journal of Sustainable Development, 19*(2),

	98-115. 7. Williams, H. (2023). The effectiveness of environmental policies in achieving sustainability goals: A global perspective. *Journal of Environmental Policy and Governance, 15*(3), 134-156. 8. EPA. (2023). Research in Environmental Economics: Evaluating cost-benefit trade-offs in climate policy. *NCEE Working Paper Series, 56*(2), 1-20.
Date of the last Amendment made	Every end of semester

REMOTE SENSING

Module name			**Remote Sensing**		
Module level, if applicable			2nd Year		
Code, if applicable			IPSAL 63319		
Semester (s) in which the module is taught			3th Semester		
Person responsible for the module			Prof. Dr. Chaterina A. Paulus, S.Pi.,M.Si		
Lecturer			1. Prof. Dr. Chaterina A. Paulus, S.Pi.,M.Si 2. Dr. Dwi Prasetyo, S.Kom.,M.Si		
Language			Indonesian		
Relation to curriculum (compulsory/elective)			***Elective courses***		
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload	
Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting) Assignment:120x14 Self-study: 120x14	1.400 1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380
Total Workload		136 hours			
Credit points		3 CU (ECTS = 4,8)			
Requirements according to the examination regulations		Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.			
Recommended prerequisites		Environmental Science			
Related Course		Management of Natural Resources and Environment			

Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 3 : be able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management. PLO 8 : have the necessary skills to manage data, convey information in the field of Environmental Science, and provide alternative solutions when needed PLO 10: be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems. **Course Learning Outcomes (CLO):** 1. **Understand the Fundamentals of Remote Sensing :** Explain the principles of remote sensing, including electromagnetic radiation, sensor types, spatial, spectral, and temporal resolution, and data acquisition methods. 2. **Analyze and Process Remote Sensing Data :**· Apply image processing techniques such as classification, enhancement, and change detection to analyze environmental and land-use patterns. 3. **Apply Remote Sensing for Environmental Monitoring and Management :** · Utilize remote sensing technologies for applications such as deforestation assessment, water resource management, disaster risk reduction, and climate change analysis. 4. **Integrate Remote Sensing with GIS for Spatial Analysis and Decision-Making :**· Combine remote sensing data with Geographic Information Systems (GIS) to support spatial modeling, environmental planning, and sustainable resource managemen
Content	1. Electromagnetic Spectrum and Remote Sensing Principles : Understanding energy interactions with the Earth's surface, spectral signatures, and sensor characteristics. 2. Remote Sensing Platforms and Sensors : Overview of satellite, aerial, and UAV (drone) remote sensing technologies and their applications. 3. Image Preprocessing and Enhancement : Radiometric and geometric corrections, filtering; and contrast enhancement techniques. 4. Classification and Change Detection : Supervised and unsupervised classification methods, land cover change analysis; and environmental monitoring applications. 5. Remote Sensing for Land Use and Land Cover (LULC)

	Analysis : Assessing urbanization, deforestation, and agricultural changes using satellite data. 6. Remote Sensing Applications in Climate and Disaster Studies : Monitoring floods, droughts, wildfires; and temperature variations to support disaster risk management. 7. Integration of Remote Sensing and GIS : Combining spatial data, remote sensing imagery; and geostatistical methods for environmental assessment. 8. Decision Support Systems Using Remote Sensing Data : Using remote sensing outputs for policy-making, conservation planning; and sustainable resource management.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Campbell, J. B., Wynne, R. H., & Thomas, V. A. (2021). *Introduction to Remote Sensing* (6th ed.). Guilford Press. 2. Chuvieco, E. (2023). *Fundamentals of Satellite Remote Sensing: An Environmental Approach* (3rd ed.). Routledge. 3. Parry, J. (2022). *Remote Sensing: Data Analysis and Image Processing*. Murphy & Moore Publishing. 4. Richards, J. A., & Xiuping, J. (2022). *Remote Sensing Digital Image Analysis* (6th ed.). Springer. 5. McGee, J., & Lyons, S. S. (2024). *Exploring Image Processing with Open Drone Map*. Pressbooks. 6. Pettorelli, N., Williams, J., Schulte to Bühne, H., & Crowson, M. (2024). *Deep Learning and Satellite Remote Sensing for Biodiversity Monitoring and Conservation*. *Remote Sensing in Ecology and Conservation*. 7. Zhang, Y., Mao, J., Sun, G., Guo, Q., Atkins, J., Li, W., Jin, M., Song, C., Xiao, J., Hwang, T., Qiu, T., Meng, L., Ricciuto, D. M., Shi, X., Li, X., Thornton, P., & Hoffman, F. (2025). *Earth's Record-High Greenness and Its Attributions in 2020*. *Remote Sensing of Environment*. 8. Quigley, J. (2024). *Remote Sensing-Based Monitoring Networks for the Next Generation of Energy and Environmental Policymaking*. Kleinman Center for Energy Policy. 9. Pettorelli, N., Laurance, W. F., O'Brien, T. G., Wegmann, M., Nagendra, H., & Turner, W. (2018). *Satellite Remote Sensing for Applied Ecologists: Opportunities and Challenges*. *Journal of Applied Ecology*, 55(2), 450–460. 10. Ruiz, H. S., Sunarso, A., Ibrahim-bathis, K., Murti, S. A.,

	& Budiarto, I. (2020). *GIS-AHP Multi-Decision-Criteria-Analysis for the Optimal Location of Solar Energy Plants in Indonesia*. arXiv:2007.15351. 11. De Jong, T., Bromuri, S., Chang, X., Debusschere, M., Rosenski, N., Schartner, C., Strauch, K., Boehmer, M., & Curier, L. (2020). *Monitoring Spatial Sustainable Development: Semi-Automated Analysis of Satellite and Aerial Images for Energy Transition and Sustainability Indicators*. arXiv:2009.05738. 12. Nizeyimana, E. (2020). *Remote Sensing and GIS Integration*. In *Managing Human and Social Systems* (pp. 139–143). 13. Parry, J. (2022). *Remote Sensing: Data Analysis and Image Processing*. Murphy & Moore Publishing. **Supporting references:** Research articles related to references provide in-depth insights into methodologies and applications of integrating remote sensing with GIS to enhance spatial analysis and decision-making in the monitoring and management of drylands and archipelagos. : 1. Smith, J. A., & Doe, R. L. (2020). Understanding environmental impacts. *Journal of Environmental Studies*, *15*(3), 123-135. https://doi.org/10.1234/jes.2020.5678 2. Kim, Y., Sung, H. C., Choi, Y., Lim, N. O., Lee, J., Kim, G., Jeong, D., Kim, M., Hwang, J., & Jeon, S.(2024). Environmental Impact Assessment: The State of the Art, Journal of Environmental Planning and Management 3. Morgan, R. K.(2022). Environmental Impact Assessment: State of the Art. *Springer* 4. O'Faircheallaigh, C.(2018). Public Participation and Environmental Impact Assessment: Purposes, Implications, and Lessons for Public Policy Decision-Making. Environmental Impact Assessment Review 5. Sanford, Robert M., & Holtgrieve, Gordon. (2021). *Environmental I*mpact Assessment in the United States. Routledge. 6. Doelle, Meinhard, & Sinclair, A. John. (2021). The Next Generation of Impact Assessment: A Critical Review of the Canadian Impact Assessment Act. Irwin Law. 7. Lawrence, David P. (2020). Impact Assessment: Practical Solutions to Recurrent Problems. Wiley-Blackwell. 8. Kondo, Michelle C., et al. (2020). "Health impact assessment of Philadelphia's 2025 tree canopy cover goals." The Lancet Planetary Health, 4(4), e149–e157. 9. Vanclay, Frank. (2021). International Handbook of Social Impact *Assessment: Conceptual and Methodological Advances*. Edward Elgar Publishing
Date of the last Amendment made	Every end of semester

NATURAL RESOURCES MANAGEMENT AND IRRIGATION

Module name			**Natural Resources Management and Irrigation**		
Module level, if applicable			2nd Year		
Code, if applicable			IPSAL 63321		
Semester (s) in which the module is taught			3th Semester		
Person responsible for the module			Dr. Ir. Anthonius S. J Adu Tae, MP		
Lecturer			1. Dr. Ir. Anthonius S. J Adu Tae, MP 2. Prof. Dr. Ir. Denik Sri Krisnayanti, ST.,MT 3. Prof. Dr. Paul Tamelan, M.Si		
Language			Indonesian		
Relation to curriculum (compulsory/elective)			***Elective courses***		
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload	
Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting)	1.400
				Assignment:120x14 Self-study: 120x14	1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380
Total Workload		136 hours			
Credit points		3 CU (ECTS = 4,8)			
Requirements according to the examination regulations		Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.			
Recommended prerequisites		Environmental Science			
Related Course		Management of Natural Resources and Environment			

Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 3 : Able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management. PLO 8 :Have the necessary skills to manage data, convey information in the field of Environmental Science, and provide alternative solutions when needed PLO 10: Be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. PLO11 : Be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems. **Course Learning Outcomes (CLO):** 1. **Understand the Principles of Natural Resource Management :** Analyze the fundamental concepts, policies, and sustainable management strategies for natural resources; and focusing on ecological balance and conservation. 2. **Apply Sustainable Irrigation Techniques :** Evaluate and implement efficient irrigation systems that optimize water use while minimizing environmental impacts, especially in dryland and archipelagic regions. 3. **Assess the Impacts of Climate Change on Water Resources :** Examine how climate change affects water availability, hydrological cycles; and irrigation practices, and develop adaptive management strategies. 4. **Implement Eco-friendly and Technological Innovations in Irrigation :** Explore and apply modern irrigation technologies, water conservation techniques; and nature-based solutions for sustainable agricultural and environmental practices.
Content	1. Concepts and Theories of Natural Resource Management : Fundamental principles, ecological balance, and sustainability. 2. Policies and Regulations : National and international legal frameworks for natural resource conservation and utilization. 3. Water Resource Availability and Distribution : Hydrological cycles, water sources, and demand in different ecosystems. 4. Sustainable Irrigation Systems : Drip, sprinkler, and other water-efficient irrigation technologies. 5. Climate Change and Water Availability : Effects of temperature rise, extreme weather, and changing

	precipitation patterns. 6. Adaptive Strategies for Water Resource Management : Mitigation and adaptation measures in irrigation and watershed management. 7. Smart Irrigation and Water Conservation Technologies : IoT-based irrigation, automated systems, and precision agriculture. 8. Nature-based Solutions for Sustainable Water Management : Wetlands restoration, watershed protection, and eco-friendly engineering.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Sharma, A., & Singh, R. (2022). IoT-Based Smart Irrigation Systems: A Review. *Materials Today: Proceedings*, 50, 567-573. 2. Li, X., Zhang, Y., & Wang, J. (2024). Urban Water Infrastructure: A Critical Review on Climate Change Adaptation Strategies and Governance. *Journal of Cleaner Production*, 280, 124377. 3. Asadollahfardi, M. (2023). Review of Climate Change Adaptation Strategies in Water Management. *Journal of Hydrologic Engineering*, 28(5), 04023015. 4. Liu, X., Wang, Y., & Li, Z. (2023). How Does Agricultural Water Resources Management Adapt to Climate Change? A Review. *Water*, 15(22), 3991. 5. Runge, M. C., Converse, S. J., Lyons, J. E., & Smith, D. R. (Eds.). (2020). *Structured Decision Making: Case Studies in Natural Resource Management*. Johns Hopkins University Press. 6. Food and Agriculture Organization. (2020). *Nature-Based Solutions for Agricultural Water Management and Food Security*. FAO. 7. Bhardwaj, A. K., Kumar, R., Arora, S., & Singh, A. K. (2020). *Sustainable Natural Resource Management Paradigms and Research Priorities in Context to Indian Agriculture*. *Journal of Natural Resource Conservation and Management*, 1(1), 1-6. 8. Sharma, S., Beslity, J. O., Rustad, L., Shelby, L. J., Manos, P. T., Khanal, P., Reinmann, A. B., & Khanal, C. (2024). Remote Sensing and GIS in Natural Resource Management: Comparing Tools and Emphasizing the Importance of In-Situ Data. *Remote Sensing, 16*(22), 4161. 9. Porras Binayao, R., Lagapa Mantua, P. V., Pardillo Namocatcat, H. R. M., Bocboc Seroy, J. K. K., Sudaria, P.

	R. A. B., & Casicas Gumonan, K. M. V. (2024). *Smart Water Irrigation for Rice Farming through the Internet of Things*. arXiv preprint arXiv:2402.07917. 10. WiseConn. (2023). *Best Crops for Sustainable Irrigation Practices*. WiseConn. 11. Binayao, R. P., Mantua, P. V. L., Namocatcat, H. R. M. P., Seroy, J. K. K. B., Sudaria, P. R. A. B., & Gumonan, K. M. V. C. (2024). *Smart Water Irrigation for Rice Farming through the Internet of Things*. arXiv preprint arXiv:2402.07917. 12. Karar, M. E., Alotaibi, F., AL Rasheed, A., & Reyad, O. (2021). *A Pilot Study of Smart Agricultural Irrigation using Unmanned Aerial Vehicles and IoT-Based Cloud System*. arXiv preprint arXiv:2101.01851. **Supporting references:** Research articles related to these references offer comprehensive insights into the analysis and decision-making processes in Natural Resource Management and Irrigation, including successful case studies from dryland and archipelago regions: 1. Alqadhi, S., & Mallick, J. (2023). Artificial intelligence, machine learning and big data in natural resources management: A comprehensive bibliometric review of literature spanning 1975–2022. *Resources Policy*, 86, 104250. 2. Attri, M., Bharti, V., Nesar, N. A., Mehta, S., Bochalya, R. S., Bansal, K. K., & Sandhu, R. (2022). Improved irrigation practices for higher agricultural productivity: A review. *International Journal of Environment and Climate Change*, 12(9), 51-61. 3. Merza, N. A. R., Atab, H. A., Al-Fatlawi, Z. H., & Alsharifi, S. K. A. (2023). Effect of irrigation systems on rice productivity. *SABRAO Journal of Breeding and Genetics*, 55(2), 587-597. 4. Dirwai, T. L., Kanda, E. K., Senzanje, A., & Busari, T. I. (2024). Water resource management: IWRM strategies for improved water management. A systematic review of case studies of East, West, and Southern Africa. *PLoS ONE*, 19(5), e0304228. 5. Asif, Z., & Chen, X. (2023). Climate change impacts on water resources and sustainable water management strategies in North America. *Water*, 15(3), 510. 6. Liu, X., Wang, Y., & Li, Z. (2023). How does agricultural water resources management adapt to climate change? A review. *Water*, 15(22), 3991. 7. Sharma, A., & Singh, R. (2022). IoT-based smart irrigation systems: A review. *Materials Today: Proceedings*, 50, 567-573.
Date of the last Amendment made	Every end of semester

ENVIRONMENTAL MARKETS AND FINANCE

<table>
<tr><td colspan="3">Module name</td><td colspan="4">Environmental Markets and Finance</td></tr>
<tr><td colspan="3">Module level, if applicable</td><td colspan="4">2nd Year</td></tr>
<tr><td colspan="3">Code, if applicable</td><td colspan="4">IPSAL 63225</td></tr>
<tr><td colspan="3">Semester (s) in which the module is taught</td><td colspan="4">3th Semester</td></tr>
<tr><td colspan="3">Person responsible for the module</td><td colspan="4">Prof. Ir. Fredrik L. Benu, M.Si.,Ph.D</td></tr>
<tr><td colspan="3">Lecturer</td><td colspan="4">1. Prof. Ir. Fredrik L. Benu, M.Si.,Ph.D
2. Prof. Ir. Marthen R. Pellokila,M.P., P.hD</td></tr>
<tr><td colspan="3">Language</td><td colspan="4">Indonesian</td></tr>
<tr><td colspan="3">Relation to curriculum (compulsory/elective)</td><td colspan="4">Elective courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="3">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="3">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="3">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="3">Recommended prerequisites</td><td colspan="4">Environmental Science</td></tr>
<tr><td colspan="3">Related Course</td><td colspan="4">Management of Natural Resources and Environment</td></tr>
<tr><td colspan="3">Module objectives/intended learning outcomes</td><td colspan="4">Learning outcomes of the program of study assigned to this course:
PLO 1 : be able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public.
PLO 9 :be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions
PLO 10: be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development.
PLO11 : be able to analyze and evaluate environmental</td></tr>
</table>

	problems and develop creative solutions to overcome such problems. **Course Learning Outcomes (CLO):** 1. **Understand Environmental Market Mechanisms** : Explain key market-based instruments such as carbon trading, green bonds, and ecosystem services valuation in environmental management. 2. **Analyze Financial Strategies for Sustainability** : Assess financial tools, investment models, and funding mechanisms that support sustainable development and environmental conservation. 3. **Apply Economic and Financial Policies in Environmental Management** : Evaluate the effectiveness of environmental taxation, subsidies, and incentive programs in promoting sustainable resource use. 4. **Develop Sustainable Investment and Risk Management Plans** : Design financial strategies and investment frameworks that balance environmental conservation with economic growth while managing associated risks.
Content	1. Concepts of Environmental Markets : Definition, scope, and significance of environmental markets. 2. Market-Based Instruments : Carbon trading, green bonds, payment for ecosystem services, and biodiversity offsets. 3. Green Finance and Investment : Sustainable investment funds, ESG (Environmental, Social, and Governance) criteria, and impact investing. 4. Funding Mechanisms for Conservation: Public and private financing models, environmental grants, and international funding sources. 5. Environmental Taxation and Subsidies : Policies for pollution reduction, renewable energy incentives, and carbon pricing mechanisms. 6. Regulatory Frameworks and Compliance : Global and national environmental financial regulations and their impact on businesses. 7. Financial Risk Management in Environmental Projects : Identifying and mitigating financial risks in sustainability projects. 8. Strategic Planning for Sustainable Business Models : Integrating sustainability principles into corporate finance and investment planning.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)

Reading list	**Main references:** 1. Tao, H., Zhuang, S., Xue, R., Cao, W., Tian, J., & Shan, Y. (2022). Environmental Finance: An Interdisciplinary Review. *Technological Forecasting and Social Change*, 176, 121439. Elsevier. https://doi.org/10.1016/j.techfore.2021.121439 2. Alam, S., & Sosnovskikh, S. (Eds.). (2021). *Environmental Finance and Green Banking*. Routledge. https://doi.org/10.4324/9781003206194 3. Kramer, A., & Fusaro, P. C. (2025). *Energy and Environmental Project Finance Law and Taxation: New Investment Techniques*. Matthew Bender. https://store.lexisnexis.com/en-us/products/energy-environmental-project-finance-law-taxation-sku-us-ebook-04610-mobi.html 4. Chichilnisky, G., & Heal, G. (2011). *Environmental Markets: A Property Rights Approach*. Columbia University Press. https://cup.columbia.edu/book/environmental-markets/9780231115889 5. Alessi, L., Ossola, E., & Panzica, R. (2021). What Greenium Matters in the Green Bond Market? *The European Journal of Finance*, 27(4-5), 462-475. Taylor & Francis. https://doi.org/10.1080/1351847X.2020.1868887 6. Karpf, A., & Mandel, A. (2018). The Changing Value of the 'Green' Label on the US Municipal Bond Market. *Nature Climate Change*, 8(2), 161-165. Nature Publishing Group. https://doi.org/10.1038/s41558-017-0062-0 7. Flammer, C. (2021). Corporate Green Bonds. *Journal of Financial Economics*, 142(2), 499-516. Elsevier. https://doi.org/10.1016/j.jfineco.2021.01.010 8. Baker, M., Bergstresser, D., Serafeim, G., & Wurgler, J. (2018). Financing the Response to Climate Change: The Pricing and Ownership of US Green Bonds. *Brookings Papers on Economic Activity*, 2018(2), 249-319. Brookings Institution Press. https://doi.org/10.2139/ssrn.3275327 9. CCY. (2023). *Integrating ESG Principles into Financial Strategies*. CCY Corporate Sustainability Series 10. International Monetary Fund. (2024). *Embedded in Nature: Nature-Related Economic and Financial Risks and Policy Considerations*. International Monetary Fund. 11. Barker, R. (2024). The business case for the planet. *Financial Times*. (ft.com) 12. Nay, J. (2022). Climate-Contingent Finance. *arXiv preprint arXiv:2207.02064*. (arxiv.org) 13. Organisation for Economic Co-operation and Development. (2020). *Economic Instruments in Environmental Policy*. OECD Publishing. 14. Financial Stability Board. (2024). Stocktake on Nature-related Risks. *Financial Stability Board Publications*.

	(fsb.org) **Supporting references:** Research articles associated with these references provide in-depth perspectives on the analysis and decision-making processes in Environmental Markets and Finance, highlighting successful case studies : 1. Mehling, M. A., Metcalf, G. E., & Stavins, R. N. (2021). Linking heterogeneous climate policies (consistent with the Paris Agreement). *Environmental Law Reporter, 51*(3), 10326-10336. 2. United Nations Environment Programme Finance Initiative. (2024). Pioneering Holistic Sustainability Risk Management for Financial Institutions. *UNEP FI Publications*. 3. World Economic Forum. (2024). How Financial Institutions Can Assess Environmental Risk. *World Economic Forum Articles*. (weforum.org) 4. Zhao, D., Coyle, S., Sakti, A., & Botterud, A. (2022). Market mechanisms for low-carbon electricity investments: A game-theoretical analysis. *arXiv preprint arXiv:2212.06984*. 5. Schneider, L., & La Hoz Theuer, S. (2019). Environmental integrity of international carbon market mechanisms under the Paris Agreement. *Climate Policy, 19*(3), 386-400. 6. Advance Partners. (2021). *Financial Sustainability: What Is It & How to Achieve It*. Advance Partners. 7. CCY. (2023). *Integrating ESG Principles into Financial Strategies*. CCY Corporate Sustainability Series 8. International Monetary Fund. (2024). *Embedded in Nature: Nature-Related Economic and Financial Risks and Policy Considerations*. International Monetary Fund. 9. Barker, R. (2024). The business case for the planet. *Financial Times*. (ft.com) 10. Nay, J. (2022). Climate-Contingent Finance. *arXiv preprint arXiv:2207.02064*. (arxiv.org) 11. Organisation for Economic Co-operation and Development. (2020). *Economic Instruments in Environmental Policy*. OECD Publishing. 12. Financial Stability Board. (2024). Stocktake on Nature-related Risks. *Financial Stability Board Publications*. (fsb.org)
Date of the last Amendment made	Every end of semester

CLIMATE CHANGE POLICY

Module name	**Climate change policy**
Module level, if applicable	2nd Year
Code, if applicable	IPSAL 63222
Semester (s) in which the module is taught	3th Semester

<table>
<tr><td colspan="3">Person responsible for the module</td><td colspan="3">Dr. Ir. Roddialek Pollo, M.Si</td></tr>
<tr><td colspan="3">Lecturer</td><td colspan="3">Dr. Ir. Roddialek Pollo, M.Si</td></tr>
<tr><td colspan="3">Language</td><td colspan="3">Indonesian</td></tr>
<tr><td colspan="3">Relation to curriculum (compulsory/elective)</td><td colspan="3">Elective courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="2">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td>Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="2">Total Workload</td><td colspan="4">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="4">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="4">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="4">Environmental Science, Principles of Environmental Degradation and Pollution</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="4">Management of Natural Resources and Environment</td></tr>
<tr><td colspan="3">Module objectives/intended learning outcomes</td><td colspan="3">Learning outcomes of the program of study assigned to this course:
PLO 3 : be able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management.
PLO 4 : be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work

PLO 10: be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development.

PLO11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.</td></tr>
</table>

	Course Learning Outcomes (CLO): 1. **Understanding Climate Policy Frameworks** : Explain international and national climate policies, including agreements such as the Paris Agreement and their implementation at different governance levels. 2. **Policy Analysis and Evaluation** : Assess the effectiveness of climate policies using economic, environmental, and social impact analysis tools. 3. **Strategic Policy Development** : Design climate mitigation and adaptation policies considering scientific, economic, and social factors. 4. **Stakeholder Engagement and Governance** : Demonstrate the ability to engage stakeholders in climate policy decision-making, including governments, businesses, and communities.
Content	1. The fundamental concepts of climate change policy and the role of laws and regulations in climate mitigation and adaptation. 2. The impact and implementation of the paris agreement and national climate policies at various levels of governance. 3. The effectiveness of climate change policies using economic, environmental, and social impact analysis methods. 4. Challenges and opportunities in climate policy implementation based on global and national case studies. 5. Climate mitigation and adaptation policies based on scientific evidence and economic and social considerations. 6. The role of technological innovation and financial mechanisms in developing sustainable climate policies. 7. Stakeholder engagement strategies in climate policy-making, including governments, businesses, and civil society. 8. The effectiveness of climate governance in promoting collective action and cross-sector collaboration.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)

Reading list	**Main references:** 1. Dessler, A. E. (2021). *Introduction to Modern Climate Change* (3rd ed.). Cambridge University Press. 2. Farber, D. A., & Carlarne, C. P. (2023). *Climate Change Law* (2nd ed.). West Academic Publishing. 3. Betsill, M. M., & Corell, E. (2020). *NGO Diplomacy: The Influence of Nongovernmental Organizations in International Environmental Negotiations*. MIT Press. 4. Oberthür, S., & Groen, L. (2021). *Decarbonization in the European Union: Internal Policies and External Strategies*. Palgrave Macmillan. 5. Tol, R. S. J. (2019). *Climate Economics: Economic Analysis of Climate, Climate Change and Climate Policy* (3rd ed.). Edward Elgar Publishing. 6. Burch, S., & Harris, S. E. (2021). *Understanding Climate Change: Science, Policy, and Practice* (2nd ed.). University of Toronto Press. 7. Meckling, J. (2019). *Governing the Energy Transition: Reality, Illusion, or Necessity?*. Routledge. 8. Daniel Bodansky, Jutta Brunnée, and Lavanya Rajamani (2020). "International Climate Change Law." Oxford University Press. 9. Intergovernmental Panel on Climate Change (2023). "National and Sub-national Policies and Institutions." In Climate Change 2022: Mitigation of Climate Change. Cambridge University Press. 10. Intergovernmental Panel on Climate Change (2023). "Linking Global to Regional Climate Change." In Climate Change 2021: The Physical Science Basis. Cambridge University Press. 11. Albert Palazzo (2022). "Climate Change and National Security: Implications for the Military." Army University Press. 12. Joseph E. Aldy (2021). "Carbon Tax Review and Update." Review of Environmental Economics and Policy, 15(1), 1-22. **Supporting references:** These research articles offer comprehensive insights into climate change analysis and policy development, showcasing successful case studies : 1. Mehling, M. A., Metcalf, G. E., & Stavins, R. N. (2021). Linking heterogeneous climate policies (consistent with the Paris Agreement). Jonas Schnidrig, Matthieu Souttre, Arthur Chuat, François Maréchal, and Manuele Margni (2024). *"Between Green Hills and Green Bills: Unveiling the Green Shades of Sustainability and Burden Shifting through Multi-Objective Optimization in Swiss Energy System Planning."* arXiv. 2. Food and Agriculture Organization of the United Nations (2018). *"Cost-Benefit Analysis for Climate Change Adaptation Policies and Investments in the Agriculture Sector."* FAO Briefing Note. 3. Westman, L., Broto, V. C., & Huang, P. (2021).

	"Governing a Multilevel and Cross-Sectoral Climate Policy Implementation: Municipalities and Building Energy Efficiency in British Columbia, Canada." Environmental Policy and Governance, 31(1), 3-14. 4. Donatuto, J., Grossman, E.E., Konovsky, J., Grossman, S., & Campbell, L.W. (2020). *"Indigenous Community Health and Climate Change: Integrating Biophysical and Social Science Indicators." Environmental Science & Policy*, 108, 12-23. Elsevier. 5. International Carbon Action Partnership (ICAP) (2024). *"Emissions Trading Worldwide: Status Report 2024."* ICAP. 6. World Bank. (2023). *Reality Check: Lessons from 25 Policies Advancing a Low-Carbon Future*.
Date of the last Amendment made	Every end of semester

COMMUNITY EMPOWERMENT IN ENVIRONMENTAL MANAGEMENT

Module name			**Community Empowerment in Environmental Management**		
Module level, if applicable			2nd Year		
Code, if applicable			IPSAL 63223		
Semester (s) in which the module is taught			3th Semester		
Person responsible for the module			Prof. Ir. Fredrik L. Benu, M.Si.,Ph.D		
Lecturer			1. Prof. Ir. Fredrik L. Benu, M.Si.,Ph.D 2. Hamza H. Wulakada, SP.,M.Si		
Language			Indonesian		
Relation to curriculum (compulsory/elective)			***Elective courses***		
Types of teaching and learning	Class Size	Attendance time (minute per week per semester)	Forms of active participation	Workload	
Theory	180	2x50 (TM) 2x60 (TT) 2x60 (BM) Total 340 minutes	Lecture, assignment and self study	Lectures : 100 x 14 (meeting) Assignment:120x14 Self-study: 120x14	1.400 1.680 1.680
Practice	180	170 minutes	Laboratory and field work	Preparation, implementation, and reports:170x14	2.380
Total Workload		136 hours			
Credit points		3 CU (ECTS = 4,8)			

Requirements according to the examination regulations	Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.
Recommended prerequisites	Environmental Science
Related Course	Management of Natural Resources and Environment
Module objectives/intended learning outcomes	**Learning outcomes of the program of study assigned to this course:** PLO 1 : Able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management. PLO 5 : be able to be aware of the social and cultural factors that influence environmental issues and be able to work effectively with diverse communities and stakeholders. PLO 9: be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisionsment. PLO 10: be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. **Course Learning Outcomes (CLO):** 1. Understand the concept of community empowerment in environmental management, considering the characteristics of dryland and archipelagic ecosystems. 2. Analyze community empowerment strategies based on local wisdom in managing natural resources in tourism, dryland, and archipelagic areas. 3. Evaluate the effectiveness of environmental empowerment policies and programs implemented in dryland and archipelagic regions. 4. Design sustainable community empowerment models to improve socio-economic well-being and ecological resilience in dryland and archipelagic areas.

Content	1. Explain the fundamental concepts of community empowerment in the context of environmental management in dryland and archipelagic regions. 2. Identify challenges and opportunities in community empowerment in ecologically vulnerable areas such as drylands and archipelagos. 3. Analyze the role of local wisdom and traditional practices in supporting sustainable environmental management. 4. Compare various community empowerment approaches in managing natural resources in eco-tourism areas. 5. Evaluate policies and regulations related to community empowerment in environmental management at local, national, and global levels. 6. Analyze the social, economic, and ecological impacts of community empowerment programs in dryland and archipelagic regions. 7. Design empowerment strategies based on circular economy and eco-tourism to enhance community resilience in tourism areas. 8. Develop multi-stakeholder collaboration models in implementing community empowerment programs for sustainable environmental management.
Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Forrest, C. J., & Mays, R. H. (2008). *The Practical Guide to Environmental Community Relations*. Wiley. 2. Morrison-Saunders, A., & Retief, F. (2012). *Environmental Management: Readings and Cases*. SAGE Publications. 3. Barrow, C. J. (2005). *Environmental Management for Sustainable Development* (2nd ed.). Routledge. 4. Dale, A., & Newman, L. (2010). *Sustainable Community Development: From What's Wrong to What's Strong*. Springer. 5. Bryant, B., & Hockman, E. M. (1994). *Environmental Justice: Issues, Policies, and Solutions*. Island Press. 6. Lyon, T. P. (2010). *Good Cop/Bad Cop: Environmental NGOs and Their Strategies toward Business*. RFF Press. 7. Schweitzer, J., & Stephenson, M. (2007). *Righting the People Wrongs: A Collection of Essays on Environmental Justice in America*. American Bar Association. 8. Taylor, D. E. (2014). *Toxic Communities: Environmental Racism, Industrial Pollution, and Residential Mobility*.

	NYU Press. 9. Hecht, A. D. (2004). *International Environmental Governance: The Question of Effectiveness*. Rowman & Littlefield Publishers. 10. Ali, S. H. (2003). *Mining, the Environment, and Indigenous Development Conflicts*. University of Arizona Press. **Supporting references:** Research articles related to references offer a in-depth insights a robust foundation for Community Empowerment in Environmental Management in dryland semi arid and small island : 1. Hsu, Y.-C., Dille, P., Cross, J., Dias, B., & Sargent, R. (2018). Community-Empowered Air Quality Monitoring System. *arXiv preprint arXiv:1804.03293*. 2. Wolff, E., French, M., Ilhamsyah, N., Sawailau, M. J., & Ramirez-Lovering, D. (2021). Collaborating with Communities: Citizen Science Flood Monitoring in Urban Informal Settlements. *arXiv preprint arXiv:2112.07128*. 3. Danielsen, F., Jensen, P. M., Burgess, N. D., Coronado, I., & Holt, S. (2021). Testing Focus Groups as a Tool for Connecting Indigenous and Local Knowledge on Abundance of Natural Resources with Science-Based Land Management Systems. *Conservation Letters*, 14(2), e12726. 4. Johnson, N., Alessa, L., Behe, C., Danielsen, F., & Gearheard, S. (2021). The Contributions of Community-Based Monitoring and Traditional Knowledge to Arctic Observing Networks: Reflections on the State of the Field. *Arctic*, 74(1), 1-13. 5. Pulsifer, P. L., Laidler, G. J., Taylor, D. R. F., & Hayes, A. (2021). Towards an Indigenist Data Management Program: Reflections on Experiences Developing an Atlas of Sea Ice Knowledge and Use. *The Canadian Geographer/Le Géographe Canadien*, 65(1), 1-17. 6. Russell, D. E. (2021). Arctic Borderlands Ecological Knowledge Cooperative: Can Local Knowledge Inform Caribou Management? *Rangifer*, 41(1), 1-12. 7. Huntington, H. P. (2021). The Local Perspective. *Nature*, 594(7863), 9-9. 8. Pulsifer, P. L., Laidler, G. J., Taylor, D. R. F., & Hayes, A. (2021). Towards an Indigenist Data Management Program: Reflections on Experiences Developing an Atlas of Sea Ice Knowledge and Use. *The Canadian Geographer/Le Géographe Canadien*, 65(1), 1-17.
Date of the last Amendment made	Every end of semester

WASTE MANAGEMENT

<table>
<tr><td colspan="2">Module name</td><td colspan="5">Waste Management</td></tr>
<tr><td colspan="2">Module level, if applicable</td><td colspan="5">2nd Year</td></tr>
<tr><td colspan="2">Code, if applicable</td><td colspan="5">IPSAL 63225</td></tr>
<tr><td colspan="2">Semester (s) in which the module is taught</td><td colspan="5">3th Semester</td></tr>
<tr><td colspan="2">Person responsible for the module</td><td colspan="5">Dr. Refli, M.Sc</td></tr>
<tr><td colspan="2">Lecturer</td><td colspan="5">1. Dr. Refli, M.Sc
2. Dr. Ir. Alfred O. M. Dima, M.Si
3. Fidelis Nitti, S.Si., M.Sc., Ph.D</td></tr>
<tr><td colspan="2">Language</td><td colspan="5">Indonesian</td></tr>
<tr><td colspan="2">Relation to curriculum (compulsory/elective)</td><td colspan="5">Elective courses</td></tr>
<tr><td>Types of teaching and learning</td><td>Class Size</td><td>Attendance time (minute per week per semester)</td><td>Forms of active participation</td><td colspan="3">Workload</td></tr>
<tr><td rowspan="2">Theory</td><td rowspan="2">180</td><td rowspan="2">2x50 (TM)
2x60 (TT)
2x60 (BM)
Total 340 minutes</td><td rowspan="2">Lecture, assignment and self study</td><td>Lectures : 100 x 14 (meeting)</td><td>1.400</td></tr>
<tr><td>Assignment:120x14
Self-study: 120x14</td><td>1.680
1.680</td></tr>
<tr><td>Practice</td><td>180</td><td>170 minutes</td><td>Laboratory and field work</td><td colspan="2">Preparation, implementation, and reports:170x14</td><td>2.380</td></tr>
<tr><td colspan="2">Total Workload</td><td colspan="5">136 hours</td></tr>
<tr><td colspan="2">Credit points</td><td colspan="5">3 CU (ECTS = 4,8)</td></tr>
<tr><td colspan="2">Requirements according to the examination regulations</td><td colspan="5">Minimum attendance at lectures is 80% (in compliance with Undana regulations). The final grade is calculated as follows: Participatory activities 25%, Cases/Projects assignments: 25%, Other assignments: 10%, Quiz: 10%, mid-term exam: 15%, and Final exam: 15%. Theory: 70% and practical: 30%.</td></tr>
<tr><td colspan="2">Recommended prerequisites</td><td colspan="5">Environmental Science</td></tr>
<tr><td colspan="2">Related Course</td><td colspan="5">Management of Natural Resources and Environment</td></tr>
<tr><td colspan="3">Module objectives/intended learning outcomes</td><td colspan="5">Learning outcomes of the program of study assigned to this course:
PLO 1 : Able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management.
PLO 5 : be able to be aware of the social and cultural factors that influence environmental issues and be able to work effectively with diverse communities and stakeholders.
PLO 9: be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions.

PLO 10: be able to develop and implement environmental</td></tr>
</table>

	policies and strategies that address complex environmental challenges and promote sustainable development. PLO 11: be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems. **Course Learning Outcomes (CLO):** 1. **Waste Classification and Environmental Impact :** Identify different types of waste, their sources, and potential environmental and health impacts. 2. **Waste Treatment and Sustainable Management :** Apply appropriate waste treatment, recycling, and disposal technologies for effective waste management. 3. **Regulatory Framework and Policy Implementation :** Analyze national and international regulations, policies, and best practices in waste management. 4. **Community-Based Waste Management and Circular Economy :** Develop sustainable waste management strategies through community engagement and circular
Content	1. *Introduction to Waste Management :Definition, classification*, and *Sources of waste, and Impact of waste on the environment and human health* *2. Municipal, Industrial, and Hazardous Waste : Characteristics* and *Management of different types of waste and Case studies on waste issues in dryland and island regions* *3.* Waste Treatment Technologies : *Physical, chemical, and biological treatment methods* and *Innovative and sustainable waste processing techniques* *4.* Recycling and Circular Economy : *Waste reduction strategies and resource recovery* and *Circular economy principles and their applications in waste management* *5.* Regulatory Framework and Policies : *National and international waste management regulations* and *Policy implementation and compliance challenges* *6.* Community-Based Waste Management : *Role of communities in sustainable waste management* and *Case studies of successful community-led waste initiatives* 7. Waste-to-Energy Conversion : *Technologies for energy recovery from waste* and *Environmental and economic considerations of waste-to-energy projects* *8.* Sustainable Waste Management in Dryland and Island Ecosystems : *Challenges and opportunities in remote and resource-limited areas* and *Integrated approaches for managing waste in environmentally sensitive regions*

Study and examination requirements and forms of examination	Students must actively participate, complete assignments, and meet a 80% attendance requirement. Evaluation includes exams, assignments, presentations, and practical tests, focusing on understanding, data analysis, and statistical application in environmental studies.
Media employed	Text books, films, white board and slides (power point presentation)
Reading list	**Main references:** 1. Tietenberg, T., & Lewis, L. (2018). Environmental and Natural Resource Economics (11th ed.). Routledge. 2. Phaneuf, D. J., & Requate, T. (2017). A Course in Environmental Economics: Theory, Policy, and Practice. Cambridge University Press. Harris, J. M., & Roach, B. (2018). Environmental and Natural Resource Economics: A Contemporary Approach (4th ed.). Routledge. 3. Chancel, L. (2020). Unsustainable Inequalities: Social Justice and the Environment. Harvard University Press. 4. Saito, K. (2020). Capital in the Anthropocene. Shueisha. 5. Gupta, S. K., & Gupta, P. (2020). *Integrated Waste Management: An Introduction*. CRC Press. https://www.routledge.com/Integrated-Waste-Management-An-Introduction/Gupta-Gupta/p/book/9780367894966 6. Suthar, S., & Singh, P. (2021). *Solid Waste Management: Principles and Practice*. Springer. https://link.springer.com/book/10.1007/978-3-030-72389-9 7. Kumar, S., & Kumar, R. (2019). *Waste Management: An Introduction*. Wiley. https://www.wiley.com/en-us/Waste+Management%3A+An+Introduction-p-9781119509851 8. Tchobanoglous, G., & Kreith, F. (2022). *Handbook of Solid Waste Management*. McGraw-Hill Education. https://www.mheducation.com/highered/product/handbook-solid-waste-management-tchobanoglous-kreith/M9780071356237.html 9. Suthar, S., & Singh, P. (2021). *Solid Waste Management: Principles and Practice*. Springer. https://link.springer.com/book/10.1007/978-3-030-72389-9 10. Rahman, A., & Bagastyo, A. Y. (2021). Solid Waste Management in Island Communities: Case Study in Arjasa District, Kangean Island. *Journal of Environmental Management and Sustainability*, 5(3), 123-135 **Supporting references:** Research articles linked to the references offer valuable insights and a solid foundation for managing waste in semi-arid drylands and small island regions : 1. Kumar, V., & Chopra, A. K. (2022). Advances in

Biological Treatment of Industrial Wastewater: An Overview. *Environmental Technology & Innovation*, 27, 102417.

2. Zhang, C., Qian, Y., & Li, Y. (2023). Recent Advances in Physical and Chemical Treatment of Wastewater: A Review. *Journal of Environmental Management*, 302, 113975.

3. Circularise. (2024). *R-strategies for a circular economy*. Circularise. https://www.circularise.com/blogs/r-strategies-for-a-circular-economy
4. Future Recycling. (2024). *Circular economy | Resource recovery*. Future Recycling. https://futurerecycling.com.au/sustainability/circular-economy/

5. RoadRunner Recycling. (2024). *The regulatory complexity of waste & recycling in the U.S.* RoadRunner Recycling. https://www.roadrunnerwm.com/blog/the-regulatory-complexity-of-waste-and-recycling-in-the-us

6. Handy Can Dumpsters. (2024). *How community engagement leads to better waste solutions.* Environmental Sustainability Review, 12(1), 22-29. https://www.handycandumpsters.com/how-community-engagement-leads-to-better-waste-solutions

7. Abomohra, A. E.-F., Wang, Q., & Huang, J. (2022). *Waste-to-Energy: Recent Developments and Future Perspectives towards Circular Economy*. Springer. https://www.energystartups.org/books/waste-energy/
8. Kumar, S., et al. (2020). Solar energy for water purification: recent advances and future prospects. Environmental Science: Water Research & Technology, 10(4), 409-425.

9. Asian Development Bank. (2020). *Waste to Energy in the Age of the Circular Economy: Best Practice Handbook*. Asian Development Bank. https://www.adb.org/sites/default/files/institutional-document/659981/waste-energy-circular-economy-handbook.pdf

10. Yatoo, A. M., Kumar Gupta, P., & Pratap Singh, R. (Eds.). (2023). *Integrated Waste Management: Trends, Policies, and Perspectives*. CRC Press. https://www.taylorfrancis.com/books/edit/10.1201/9781003359326/integrated-waste-management-ali-mohd-yatoo-pankaj-kumar-gupta-rajeev-pratap-singh

11. Springer. (2023). *Sustainable Environmental Waste Management Strategies*. Springer.

	https://www.springer.com/series/59844
Date of the last Amendment made	Every end of semester

IV. FINAL PROJECT

COLLOQUIUM

Module name	**Colloquium**
Module level, if applicable	2nd Year
Code, if applicable	PPs 601
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	3th (threeth) or 4th (fourth)
Person responsible for the module	Head of the Study Programme
Lecturer(s)	Supervisor(s)
Language	Bahasa Indonesia
Relation to curriculum	Compulsary and elective course in the fourth year (2nd or 3thsemester) post graduate degree
Type of teaching, contact hours	150 minutes consultation and 180 minutes structured activities per week.
Workload	Total workload is 136 hours per semester, which consists of 150 minutes consultation per week, 180 minutes structured activities per week, 180 minutes individual study per week, in total is 16 weeks per semester.
Credit points	1CU (ECTS = 1,6)
Requirements according to the examination regulations	There is no specific exam. The student has to present and write a report of the research proposal
Recommended prerequisites	Students may apply for research proposal making activities if they have fulfill the following requirements and onditions: 1) students have accumulated a minimum of 47 credits with a GPA> 3,25 without C grades; pass the colloqium, Scientific Methods and Experiment Design 2) Students submit an application for the implementation of Thesis to the Assistant Directur I with academic transcripts attached which are validated with EPSBED/PDPT data. EPSBED/PDPT DATA; 3) students include post graduate thesis in the Study Plan Card (KRS) in the current semester semester; 4) during the implementation of research, students are allowed to take courses in accordance with the number of credits allowed;

Module objectives/intended learning outcomes	PLO 1 : be able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public.
	PLO 2: be able to comply with ethical and professional standards in their research and practice, and able to identify and address ethical dilemmas that may arise in their work. PLO 3 : be able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of ecosystem dynamics, climate change, pollution, and natural resource management. PLO 4 : be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work PLO 5 : be able to be aware of the social and cultural factors that influence environmental issues and be able to work effectively with diverse communities and stakeholders. PLO 6 : be able to learn for life and can keep up with the latest developments in environmental science and policy PLO 7 : be able to work independently and as part of a team, collaborating with others to achieve common goals PLO 8 : have the necessary skills to manage data, convey information in the field of Environmental Science, and provide alternative solutions when needed PLO 9 : be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions PLO 10 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. PLO 11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.
Content	Topic is appointed by supervisor(s) or student.
Study and examination requirements and forms of examination	The final grade will be decided by considering: 1. Content of the researche proposal (by the Examination Team) (30%) 2. The method used (by the Examination Team) (20%) 3. Language used in writing the research proposal: clarity and completeness (by the Examination Team) (20%) 4. Responsibility includes; Self-confidence, emotional maturity, ethics, and activeness during internship work (by the Examination Team) (30%)
Media employed	White Board, paper, Laptop/Computer

Reading List	Books or journals related to the topics.

THESIS

Module name	**Thesis**
Module level, if applicable	2nd Year
Code, if applicable	PPs 699
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	3th (threeth) or 4th (fourth)
Person responsible for the module	Head of the Study Programme
Lecturer(s)	Supervisor(s)
Language	Bahasa Indonesia
Relation to curriculum	Compulsary course in the fourth year (2nd or 3th semester) post graduate degree
Type of teaching, contact hours	150 minutes consultation and 180 minutes structured activities per week.
Workload	Total workload is 136 hours per semester, which consists of 150 minutes consultation per week, 180 minutes structured activities per week, 180 minutes individual study per week, in total is 16 weeks per semester.
Credit points	6 CU (ECTS = 13,8)
Requirements according to the examination regulations	There is no specific exam. The student has to present and write a report of the result.
Recommended prerequisites	Students may apply for bachelor thesis making activities if they have fulfill the following requirements and onditions: 5) students have accumulated a minimum of 47 credits with a GPA> 3,25 without C grades; pass the colloqium, Scientific Methods and Experiment Design 6) Students submit an application for the implementation of Thesis to the Assistant Directur I with academic transcripts attached which are validated with EPSBED/PDPT data. EPSBED/PDPT DATA; 7) students include post graduate thesis in the Study Plan Card (KRS) in the current semester semester; 8) during the implementation of research, students are allowed to take courses in accordance with the number of credits allowed;
Module objectives/intended learning outcomes	PLO 1 : be able to communicate complex environmental issues and research findings to a wide range of audiences, including policy makers, scientists, and the public.
	PLO 2: be able to comply with ethical and professional standards in their research and practice, and able to identify and address ethical dilemmas that may arise in their work. PLO 3 : be able to understand in depth the physical, chemical, and biological systems that support the environment. This includes knowledge of

	ecosystem dynamics, climate change, pollution, and natural resource management. PLO 4 : be able to understand holistically about environmental laws and regulations at local, national, and international levels, and be able to apply this knowledge in their work PLO 5 : be able to be aware of the social and cultural factors that influence environmental issues and be able to work effectively with diverse communities and stakeholders. PLO 6 : be able to learn for life and can keep up with the latest developments in environmental science and policy PLO 7 : be able to work independently and as part of a team, collaborating with others to achieve common goals PLO 8 : have the necessary skills to manage data, convey information in the field of Environmental Science, and provide alternative solutions when needed PLO 9 : be able to design and implement environmental research projects, collect and analyze data, and interpret results to make evidence-based decisions PLO 10 : be able to develop and implement environmental policies and strategies that address complex environmental challenges and promote sustainable development. PLO 11 : be able to analyze and evaluate environmental problems and develop creative solutions to overcome such problems.
Content	Topic is appointed by supervisor(s) or student.
Study and examination requirements and forms of examination	The final grade will be decided by considering: 5. Content of the Thesis (by the Examination Team) (30%) 6. The method used (by the Examination Team) (20%) 7. Language used in writing the internship Thesis: clarity and completeness (by the Examination Team) (20%) 8. Responsibility includes; Self-confidence, emotional maturity, ethics, and activeness during internship work (by the Examination Team) (30%)
Media employed	White Board, paper, Laptop/Computer
Reading List	Books or journals related to the topics.