MODULE HANDBOOK

DOCTORAL PROGRAM OF FORESTRY MULAWARMAN UNIVERSITY



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Samarinda, East Kalimantan

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Philosophy of Science

Faculty of Forestry

Mulawarman University

Module name	Philosophy of Science
Module level, if applicable	Doctoral
Code, if applicable	190401902W001
Subtitle, if applicable	
Courses, if applicable	Regular
Semester(s) in which the module is taught	I (one)
Person responsible for the module	Prof. Dr. H. Harihanto, M.S.
Lecturer	Prof. Dr. H. Harihanto, M.S. Dr. Muhammad Arifin, M.Hum.
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	
Recommended prerequisites	

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **CPL5/ILO5 (KU2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** 6. **CPL6/ILO6 (GS3)** - Manage data and information to support decision-making processes 7. **CPL7/ILO7 (GS4)** - Work and communicate in an international context **Cource Learning Outcome (CLO)** 1. **CLO 1:** Students are able to explain the basic concepts and approaches to scientific research, including the types of research and their objectives. 2. **CLO 2:** Students are able to conduct advanced literature searches and apply techniques to determine the relevance and currency of research themes. 3. **CLO 3:** Students are able to apply selected research methodologies to produce valid data and systematically and scientifically write the research findings.
Content	This course offers a comprehensive introduction to the fundamentals of philosophy and scientific inquiry. It begins by defining philosophy and its systematic framework, before exploring the nature of scientific knowledge, including its aspects and elements. The curriculum guides students in developing independent assignments that are directly related to their dissertation research plans, ensuring practical application of theoretical concepts. A significant portion of the course is dedicated to teaching scientific thinking, the research process, and the intricacies of research report writing. Additionally, the course covers the sources of knowledge, and compares the philosophical underpinnings with scientific approaches. The complete topic of each meeting is mentioned below: 1. Explaining the meaning and systematic framework of philosophy (1^{st}–2^{nd} sessions) → **CLO1** 2. Explaining scientific knowledge, its aspects, and its elements (3^{rd}–5^{th} sessions) → **CLO1**

<table>
<tr><td></td><td>3. Developing independent assignments related to dissertation research plans (6th–7th sessions) → CLO2
4. Midterm Exam (8th session) → Assessment
5. Explaining and formulating steps for scientific thinking, research processes, and research report writing (9th–11th sessions) → CLO3
6. Explaining the sources of knowledge and the comparison between philosophy and science (12th–13th sessions) → CLO1.
7. Explaining theories of truth, scientific methods, and scientific resources (14th–15th sessions) → CLO3.
8. Final Exam (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No.</th><th>Objects of Assessment</th><th>Forms of Assessment</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignment/Case Study</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Project</td><td>Report</td><td>25</td></tr>
<tr><td>4</td><td>Mid-semester test</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final semester test</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">TOTAL</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Lahjie AM. 2019. Materi Kuliah Metode Ilmiah. Fakultas Kehutanan Universitas Mulawarman
2. Nazir. 2003. Metode Penelitian. Ghalia Indonesia, Jakarta.
3. Bakhtiar A. 2013. Filsafat Ilmu. Rajawali, Jakarta
4. Banasuru A, 2012. Filsafat dan Filsafat Ilmu. Alfabeta, Bandung.
5. Sumantri JS, 2000. Filsafat Ilmu, sebuah pengantar popular. Pustaka Sinar Harapan, Jakarta
6. Sumantri JS, 1978. Ilmu dalam perspektif. Gramadia, Jakarta
7. Louis OK, 1953.Elements of Philosophy. The Ronald Press Company, New York.
8. Poedjawiatna, 1991. Tahu dan Pengetahuan. Rineka Cipta, Jakarta.
9. Surajiyo, 2005. Ilmu Filsafat Bumi. Aksara, Jakarta
10. Supomo K, 2006. Mengembangkan Logika. Penerbit PT Grahanusa Mediatama Raya, Jakarta.
11. Various other related scientific articles on the Philosophy of Science</td></tr>
</table>

Course Module

Research Methodology and International Publication

Faculty of Forestry

Mulawarman University

Module name	Research Methodology and International Publication
Module level, if applicable	Doctoral
Code, if applicable	1904019032W002
Subtitle, if applicable	
Courses, if applicable	Regular
Semester(s) in which the module is taught	I (one)
Person responsible for the module	Prof. Dr. Enos Tangke Arung, S.Hut., M.P.
Lecturer	Prof. Dr. Enos Tangke Arung, S.Hut., M.P. Prof. Dr. Rudianto Amirta, S.Hut., M.P. Ali Suhardiman, S.Hut., M.P., Ph.D
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week

	1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	
Recommended prerequisites	
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **CPL5/ILO5 (KU2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** 6. **CPL6/ILO6 (GS3)** - Manage data and information to support decision-making processes **Course Learning Outcome (CLO)** 1. **CLO 1:** Students are expected to explain and apply various concepts and methodologies of scientific research. 2. **CLO 2:** Students are expected to formulate logical and systematic hypotheses based on literature reviews, as well as effectively collect and analyze data. 3. **CLO 3:** Students are expected to compile and present research findings in the form of scientific publications that meet academic ethical standards and scientific professionalism.
Content	This course provides students with a comprehensive understanding of research methodology, covering basic concepts, literature review techniques, hypothesis formulation, data collection, and analysis. Students will learn how to identify relevant research themes, critically review scientific literature, and develop research hypotheses. A strong emphasis is placed on research ethics, ensuring integrity and responsibility in scientific work. The complete topic of each meeting is mentioned below: 1. Explaining the basic concepts of research (1st session) → **CLO1**

<table>
<tr><td></td><td>2. Conducting the latest literature review and determining the relevance of the research theme(2nd session) → CLO2
3. Formulating a hypothesis and conducting data collection and analysis (3rd–8th sessions) → CLO2
4. Midterm Exam (9th session) → Assessment
5. Formulating a hypothesis and conducting data collection and analysis (10th–11th sessions) → CLO2
6. Explaining research ethics (12th session) → CLO3
7. Explain and apply the procedures for preparing a final project and writing scientific articles (13th–15th sessions) → CLO3
8. Final Exam (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
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<tr><th>No.</th><th>Objects of Assessment</th><th>Forms of Assessment</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
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<tr><td colspan="3">TOTAL</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Wallwork A. English for writing research papers. Springer, 2011
2. Van de Stadt I. How to write world-class papers : from title to references and from submission to acceptance. Elsevier, 2010
3. Lisberger SG. How to write a world-class paper. Elsevier
4. Worldvice team. Scientific Writing : a verb tense review. www.wordvice.com
5. Singh YK. 2006. Fundamental of Research Methodology and Statistics.New Age International (P) Limited. 313 pp.
6. Bryman A. 2012. Social Research Methods. Oxford University Press. 766 pp.
7. Newton AC. 2007. Forest Ecology and Conservation. Oxford University Press. 471 pp.
8. Macfarlane. 2009. Researching with Integrity: The Ethics of Academic Enquiry. Taylor and Francis. 190 pp.
9. Fahutan Unmul. 2019. Panduan Penulisan Tesis untuk Fakultas Kehutanan.
10. Turabian KL. 2013. A Manual for Writers of Research Papers, Theses, and Dissertations. The University of Chicago Press. 288 pp.
11. Various other related scientific articles on the Research Methodology and International Publication</td></tr>
</table>

Course Module

Sociology of Humid Tropical Forestry

Faculty of Forestry

Mulawarman University

Module name	Sociology of Humid Tropical Forestry
Module level, if applicable	Doctoral
Code, if applicable	
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Dr. Emi Purwanti
Lecturer	1. Prof. Dr. Mustofa Agung Sardjono 2. Prof. Dr. Sigit Hardiwinarto 3. Dr. Emi Purwanti
Language	Indonesian
Relation to curriculum	
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points:

	2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **CPL2/ILO2 (A2) -** Internalize values, norms, and ethics in Knowledge **Knowledge (K)** 2. **CPL2/ILO2 (K1)** - Synthesize knowledge acquired from research findings with novelty and its implementation. 3. **CPL3/ILO3 (K2) -** Discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions. **General Skills (GS)** 4. **CPL4/ILO4 (GS1)** – Critically analyze the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches. **5. CPL5/ILO5 (GS2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics. **Specialized Skills (SS)** **6. CPL6/ILO6 (SS1)** - Manage data and information to support decision-making processes. **Course Learning Outcome (CLO)** 1. **CLO1:** Analyze forestry theories and concepts and their implications for forest resource management – Students will be able to critically assess and apply key forestry principles in sustainable resource management. 2. **CLO2:** Develop interdisciplinary research methodologies to enhance forest management effectiveness – Students will be able to integrate knowledge from multiple disciplines to improve forest conservation and utilization strategies.

	3. **CLO3:** Formulate innovative solutions based on scientific research in forestry – Students will be able to design and implement research-driven approaches to address forest management challenges. 4. **CLO4:** Evaluate national and international forestry policies and their impact on forest sustainability – Students will be able to analyze regulatory frameworks and assess their effectiveness in promoting environmental conservation. 5. **CLO5:** Publish research findings in reputable journals and contribute to international scientific forums – Students will be able to disseminate knowledge and engage in global discussions on forestry science and sustainability.
Content	This course is designed to equip students with a comprehensive understanding of the latest theories, concepts, and methodologies in forestry. Students will be encouraged to develop innovative research that contributes significantly to forestry science and policy. Additionally, the course integrates global case studies and the latest developments in forestry policy to enhance students' analytical and problem-solving skills in forest management. In detail contents: 1. Forestry Sociology Studies in the Context of Forest Communities – Understanding the relationship between society and forest resources. 2. Advanced Theories and Concepts in Forestry Sociology – Exploring sociological frameworks relevant to forest management. 3. Social and Economic Characteristics of Forest Communities – Examining livelihood patterns, cultural practices, and economic dependencies. 4. Social Structure and Its Connection to Forest Sustainability – Analyzing how societal organization impacts conservation and resource use. 5. Social Stratification and Economic Dynamics in Forest Areas – Understanding inequalities and economic shifts affecting forest-dependent populations. 6. Social Dynamics and Changes in Forest Communities – Investigating the evolution of social structures due to external and internal influences. 7. Rural-Urban Relations in Sustainable Forest Management – Examining interactions between rural forest communities and urban economies. 8. Mid-Semester Test 9. Evaluation of Social Programs in Forestry Communities – Assessing the effectiveness of initiatives aimed at community development and conservation. 10. Community Participation in Forest Management – Exploring mechanisms for involving local populations in sustainable forestry practices. 11. Community Outreach and Empowerment in the Forestry Sector – Strategies for capacity-building and enhancing local engagement. 12. Social Implications of Changes in Forestry Policy – Analyzing how policy shifts affect social structures and livelihoods.

<table>
<tr><td></td><td>13. Mitigating Social Impacts in Forest Management – Strategies for addressing social challenges in conservation and resource utilization.
14. Analysis and Evaluation of Social Forestry Policies – Reviewing governance frameworks and policy effectiveness.
15. Review and Learning Evaluation – Reflecting on key concepts and case studies.
16. Final Examination.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Lecture Participation</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Project</td><td>Presentation</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD</td></tr>
<tr><td>Reading list</td><td>1. Sardjono M.A., 2004. Mosaik Sosiologis Kehutanan: Masyarakat Lokal, Politik dan Kelestarian Sumberdaya, DEBUT Press. Debut Wahana Sinergi. Yogyakarta.
2. Soekanto, S., 1990. Sosiologi Suatu Pengantar, Rajawali Press.
3. Rudito B, Faniola M., Edisi Revisi. 2013. Social Mapping, Metode Pemetaan Sosial, Teknik Memahami Suatu Masyarakat atau Komuniti., Rekayasa Sains. Bandung.
4. Afrizal, M.A., 2018. Sosiologi Konflik, Indomedia Pustaka, Sidoarjo.
5. Nurman., Strategi Pembangunan Daerah.
6. Damsar., Indrayani., 2019. Pengantar Sosiologi Kapital. Prenadamedia Group. Jakarta.
7. Peraturan Rektor Nomor 06 Tahun 2018. Penyelenggaraan Pendidikan dan Pengajaran, Penelitian, dan Pengabdian Kepada Masyarakat.
8. Murdiyanto, E., Sosiologi Perdesaan. Edisi I – Yogyakarta: UPN “Veteran” Yogyakarta 2008.</td></tr>
</table>

Course Module

Characteristics of Wood as Construction Material

Faculty of Forestry

Mulawarman University

Module name	Characteristics of Wood as Construction Material
Module level, if applicable	Doctoral
Code, if applicable	190401903P017
Subtitle, if applicable	
Courses, if applicable	Regular
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Prof. Dr. Ir. Agus Sulistyo Budi
Lecturer	Prof. Dr. Ir. Agus Sulistyo Budi Dr. Ir. Isna Yuniar Wardhani, M.P.
Language	Indonesia, English
Relation to curriculum	
Type of teaching, contact hours	
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments

	- 42 hours for individual study
Credit points	3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	
Recommended prerequisites	
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **Specialized Skills** 4. **CPL6/ILO6 (GS3)** - Manage data and information to support decision-making processes **Course Learning Outcome (CLO)** 1. **CLO 1 :** Students are able to correlate the properties of wood with the requirements for wooden construction materials. 2. **CLO 2 :** Students are able to develop engineered materials based on the properties of wood. 3. **CLO 3:** Students are able to manage data on wood to develop engineered wood products as construction materials.
Content	This course provides students with a comprehensive understanding of wood structure, properties, and applications in construction. Students will explore wood formation at the molecular level, analyze its strength and essential characteristics as a construction material, and assess the differences in reaction wood properties. The course covers wood treatments, engineered wood products, and their suitability for structural applications, as well as the compatibility of joints and fastening tools with various wood types. The complete topic of each meeting is mentioned below: 1. Students are able to analyze the formation of wood structure in trees 1st–2nd sessions) → **CLO1**. 2. Students are able to correlate the molecular structure of wood with its strength properties (3rd–4th sessions) → **CLO1**. 3. Students are able to analyze the essential properties of wood as a construction material (5th–6th sessions) → **CLO1** 4. Students are able to analyze the properties of reaction wood (7th–8th sessions) → **CLO1.**

<table>
<tr><td></td><td>5. Students are able to analyze wood treatments for construction purposes (9th session) → CLO2.
6. Students are able to analyze the properties of engineered wood for structural materials (10th session) → CLO2.
7. Students are able to relate the types of wood to various kinds of constructions (11th–13th sessions) → CLO1.
8. Students are able to synthesize the compatibility of joints and fastening tools with different types of wood (14th–16th sessions) → CLO3 .</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No.</th><th>Objects of Assessment</th><th>Forms of Assessment</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Practicum</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignment/Case Study</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Project</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-semester test</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final semester test</td><td>Written test</td><td>25</td></tr>
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</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Shmulsky, R and P.D. Jones. 2019. Forest Products and Wood Science An Introduction. Seventh edition. John Wiley & Sons Ltd. UK
2. Schweingruber, F.H. 2007. Wood Structure and Environment. Springer-Verlag Berlin Heidelberg.
3. Kollmann, F.F.P and W.A. Cote. 1984. Principles and Wood Science Technology: I. Solid Wood. Springer –Verlag. New York
4. Wood handbook—Wood as an engineering material. 2010. Madison, U.S. Department of Agriculture, Forest Service, Forest Products Laboratory
5. Zwerger, K. 2011. Wood and Wood Joints . Birkhäuser GmbH, Basel, Switzerland
6. Handbook 1: Timber Structures. 2008. Leonardo da Vinci Pilot Project
7. Kollmann, F.F.P., E.W. Kuenzi and A.J. Stamm. 1975. Principles and Wood Science Technology: II. Wood Based Materials. Springer –Verlag. Berlin – Heidelberg.
8. BSN, 2013. SNI 7973, Spesifikasi desain konstruksi kayu.
9. Various other related scientific articles on the Characteristics of Wood as Construction Material</td></tr>
</table>

Course Module

Biodeterioration and Building Protection

Faculty of Forestry

Mulawarman University

Module name	Biodeterioration and Building Protection
Module level, if applicable	Doctoral
Code, if applicable	190401903P022
Subtitle, if applicable	
Courses, if applicable	Regular
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Dr. Ir. Isna Yuniar Wardhani, M.P.
Lecturer	Dr. Isna Yuniar Wardhani, M.P. Dr. Erwin, S.Hut., M.P.
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	

Recommended prerequisites	
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation **General Skills** 3. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 4. **CPL5/ILO5 (KU2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Course Learning Outcome (CLO)** 1. **CLO 1 :** Students are able to explain the basic concepts, philosophy, and general approaches to biodeterioration and building protection. 2. **CLO 2 :** Students are able to analyze the relationship between construction design and biodeterioration and develop effective control strategies. 3. **CLO 3 :** Students are able to formulate and explain the management of wooden building protection against biological, chemical, and physical factors causing biodeterioration.
Content	This course delves into the deterioration and protection of buildings, focusing specifically on biodeterioration factors affecting construction materials. It begins by examining the philosophical and practical aspects of building protection, progressing to analyze how design choices influence material deterioration. Detailed discussions include management strategies against biological, chemical, and physical deteriorations, particularly in wooden structures, with sessions dedicated to understanding the specific deterioration processes caused by fungi, bacteria, termites, and wood-boring beetles. The course emphasizes the detection, analysis, and economic implications of deteriorated wood, alongside exploring biological control methods. A midterm and final exam ensure that students have a comprehensive understanding of the material.The complete topic of each meeting is mentioned below: 1. Introducing Vision and Mission of the Lecture Contract, Introduction of the Lecturer Course, Delivery of the Course Plan (1^{st} session) → **General Orientation** 2. Explain the philosophy, deterioration, and protection of buildings (2^{nd}–3^{rd} sessions) → **CLO1**. 3. Explain the relationship between design/construction and the biodeterioration of building materials (4^{th}–5^{th} sessions) → **CLO2**.

<table>
<tr><td></td><td>4. Identify and explain the management of wooden building protection against biological, chemical, and physical factors (6th-7th sessions) → CLO3
5. Midterm Exam (8th session) → Assessment
6. Understand and comprehend the characteristics and processes of wood deterioration, enabling them to differentiate the specific characteristics caused by each microbial agent (fungi and bacteria) (9th-10th sessions) → CLO3.
7. Understand and comprehend the characteristics and processes of wood deterioration, enabling them to differentiate the specific characteristics caused by termites (11th session) → CLO3.
8. Understand and comprehend the relationships and interactions among causative agents of wood deterioration and techniques for detecting and analyzing deteriorated wood and its economic impact (12th session) → CLO3.
9. Understand and comprehend important considerations in biological control methods for wood deterioration (13th session) → CLO3.
10. Understand and comprehend the characteristics, forms, and processes of wood deterioration caused by wood-boring beetle attacks (14th-15th sessions) → CLO3.
11. Final Exam (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No.</th><th>Objects of Assessment</th><th>Forms of Assessment</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Practicum</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignment/Case Study</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Project</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-semester test</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final semester test</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">TOTAL</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Anonim. 1985. Standard for The Assurance of Quality of Batch Drying of Timber. Timber Research and Development Association. Buckinghamshire.
2. Anonim. 1994. EDG-Recommendation. Assesment of Drying Quality of Timber. Editor : Dr. J. Welling. Commission of The European Communities. Hamburg.
3. Boone, R.S; C.J. Kozlik; P.J. Bois and E.M. Wengert. 1988. Dry Kiln Skedul for Commercial Woods. Temperate and Tropical. General Technical Report FPL-GTR-57. Forest Products Laboratory. Forest Service. Department of Agriculture. United States.
4. C. Clausen, F. Green. 1998. Immunodiagnostic Wood Decay Test. USDA Forest Service. Madison.</td></tr>
</table>

	5. Campbell NA, JB Reece dan LG Mitchell. 2002. Biologi (Terjemahan). Edisi Kelima. Jilid I dan Jilid II 6. F.W.M.R. Schwarze, J. Engels, C. Mattheck. 2000. Fungal Strategies of Wood Decay in Trees. Springer-Verlag. Berlin. 7. Highley TL. 1999. Biodeterioration of Wood. Wood Handbook: Wood as an Engineering Material. USDA Forest Service. Madison. 8. Nandika D, Y Rismayadi dan F. Diba. 2003. Rayap: Biology dan Pengendaliannya. Universitas Muhammadiyah Surakarta. Surakarta. 9. O. Schmidt. 2006. Wood and Tree Fungi: Biology, Damage, Protection, and Use. Springer-Verlag. Berlin. 10. Pratt, G.H. 1986. Timber Drying Manual. Second Edition. Revised by C.H.C. Turner. Princes Risborough Laboratory. Building Research Establishment. Department of the Environment. Buckinghamshire. 11. R.A. Eaton and M.D.C. Hale. 1993. Decay, pest and protection. Chapman & Hall. London. 12. Raven PH, RF Evert and SE Eichhorn. 1998. Biology of Plants. Sixth Edition. 13. Shigo L.A. 1989. A New Tree Biology: Facts, Photos, and Philosophies on Trees and Their Problems and Proper Care. 14. Spotts RA and M. Serdani. 2005. New High-Technology Methods to Solve Old Decay Problem. 15. Willeitner, H. & W. Liese. 1992. Wood Protection in Tropical Countries. GTZ GmbH.

Course Module

Technology of Aromatic Plant Processing

Faculty of Forestry

Mulawarman University

Module name	Technology of Aromatic Plant Processing
Module level, if applicable	Doctoral (Ph.D)
Code, if applicable	220401902P037
Subtitle, if applicable	Processing and Application of Aromatic Plant Products
Courses, if applicable	Technology of Aromatic Plant Processing
Semester(s) in which the module is taught	
Person responsible for the module	Prof. Harlinda Kuspradini, M.P.
Lecturer	Prof. Dr. Harlinda Kuspradini, M.P. Dr. Ir. Enih Rosamah
Language	Indonesia, English
Relation to curriculum	Elective course
Type of teaching, contact hours	Lectures, seminars, practical sessions, discussions, and independent research.
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6

	2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	Completion of all assignments, midterm, and final exam
Recommended prerequisites	Background in forest science or equivalent field of study
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **ILO1 (A1)** - Internalize values, norms, and ethics **Knowledge (K)** 2. **ILO2 (K1)** - Able to synthesize knowledge acquired from research findings with novelty and its implementation **General Skills (GS)** 3. **ILO4 (GS1)** - Able to criticize the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches. **Specialized Skills (SS)** 4. **ILO6 (SS1)** - Able to manage data and information to support decision-making processes. **Course Learning Outcome (CLO)** 1. **CLO1:** Demonstrate a deep understanding and ethical responsibility in conducting research on aromatic plant processing technology, ensuring sustainability and compliance with scientific integrity. **ILO1 (A1)** 2. **CLO2:** Synthesize and integrate advanced research findings on extraction techniques, bioactive compounds, and industrial applications of aromatic plants to develop novel processing technologies. **ILO2 (K1)** 3. **CLO3:** Critically evaluate and refine the philosophical foundations, theoretical frameworks, and research methodologies in aromatic plant processing using interdisciplinary, multidisciplinary, and transdisciplinary approaches. **ILO4 (GS1)** 4. **CLO4:** Demonstrate expertise in managing and analyzing complex datasets in aromatic plant processing, utilizing advanced statistical models and decision-making tools for product development and quality assurance. **ILO6 (SS1)**
Content	This course explores advanced processing techniques for aromatic plants, focusing on extraction, refinement, and quality assessment. Students will critically analyze traditional vs. modern methods, assess processing parameters, and apply scientific testing for product evaluation. Emphasizing research-driven and interdisciplinary

<table>
<tr><td></td><td>approaches, this course integrates sustainability, innovation, and commercialization strategies. Designed for doctoral students in forestry and bioproducts, it equips them with expertise in data-driven decision-making and technological advancements in aromatic plant processing.
1. Contract Introduction to Aromatic Plant Products (1st session) → CLO1 & CLO2
2. Traditional vs. Modern Processing Techniques (2nd-4th sessions) → CLO2, CLO4
3. Midterm Exam (8th session) → Assessment
4. Analysis of Processing Parameters (9th-11th sessions) → CLO4, CLO5
5. Product Testing and Evaluation (12th-14th sessions) → CLO4, CLO5
6. Synthesizing Applications (15th session) → CLO2, CLO4
7. Final Exam (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
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<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Project</td><td>Presentation</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>PowerPoint slides, multimedia videos, scientific journals, laboratory equipment for testing simulations, and discussion forums.</td></tr>
<tr><td>Reading list</td><td>1. Handa, S.S., et al. Extraction Technologies for Medicinal and Aromatic Plants. International Centre for Science and High Technology, 2008.
2. Hunter, M. Essential Oils: Art, Agriculture, Science, Industry, and Entrepreneurship. Nova Science, 2009.
3. Li, Y., et al. Essential Oils: From Conventional to Green Extraction. SpringerBriefs in Green Chemistry, 2014.
4. Cannon, J.B., et al. “Modification of Yield and Composition of Essential Oils by Distillation Time.” Industrial Crops and Products, 2013.
5. Tembe, M., et al. “Yield Dependency Parameters for Essential Oils Extraction Techniques.” IJRASET, 2018.
6. Tongnuanchan, P., Benjakul, S. “Essential Oils: Extraction, Bioactivities, and Their Uses for Food Preservation.” Journal of Food Science, 2014.</td></tr>
</table>

	7. Any additional source related to the subject.

Course Module

Medicinal Plant Technology and Products

Faculty of Forestry

Mulawarman University

Module name	Medicinal Plant Technology and Products
Module level, if applicable	Doctoral
Code, if applicable	220401902P038
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The subject is available throughout all academic semesters
Person responsible for the module	Prof. Dr. Enos Tangke Arung, S.Hut., M.P.
Lecturer	Prof. Dr. Enos Tangke Arung, S.Hut., M.P. Prof. Dr. Irawan Wijaya Kusuma, S.Hut., M.P.
Language	Indonesia
Relation to curriculum	Compulsory Course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS

	Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **ILO1 (A1)** – Internalize scientific values, norms, and ethics **Knowledge (K)** 2. **ILO2 (K1)** - Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2)** - Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **Specific Skills (SS)** 4. **ILO6 (SS1)** - Able to manage data and information to support decision-making processes **Content Learning Outcome (CLO)** 1. **CLO1**: Students are able to understand and differentiate types of tropical medicinal plants. **ILO2 (K1).** 2. **CLO2**: Students are able to analyze the advantages and disadvantages of processing techniques for tropical medicinal plants. **ILO3 (K2).** 3. **CLO3**: Students are able to analyze and select processing methods for medicinal plant products from different plant parts (leaves, bark, stems, flowers). **ILO6 (SS1).** 4. **CLO4**: Students are able to analyze parameters that influence the results and quality of medicinal plant products. **ILO6 (SS1).** 5. **CLO5**: Students are able to test processed medicinal plant products. **ILO6 (SS1).** 6. **CLO6**: Students are able to synthesize the utilization of processed medicinal plant products. **ILO1 (A1).**
Contents	This course provides students with a comprehensive understanding of tropical medicinal plants, focusing on their classification, characteristics, processing techniques, and applications. Students will explore the advantages and disadvantages of different processing methods and analyze the impact of processing parameters on product

<table>
<tr><td></td><td>quality. The course covers the utilization of medicinal plants for various applications, including leaves, bark, stems, and flowers, while also introducing testing methods to assess quality and effectiveness. Additionally, students will engage in research discussions, case studies, and innovation-driven projects to synthesize knowledge for real-world applications. Assessments include a midterm examination, research presentations, and a final examination, ensuring a well-rounded learning experience in medicinal plant processing and utilization.

1. Introduction to Tropical Medicinal Plants (1st session) → CLO1
2. Classification and Characteristics of Tropical Medicinal Plants (2nd session) → CLO1
3. Techniques for Processing Medicinal Plants: Overview and Comparison (3rd session) → CLO2
4. Analysis of Advantages and Disadvantages of Processing Methods (4th session) → CLO2
5. Processing Medicinal Plant Products: Leaves and Bark (5th session) → CLO3
6. Processing Medicinal Plant Products: Stems and Flowers (6th session) → CLO3
7. Midterm Examination (UTS) (7th session) → Assessment
8. Parameters Affecting the Quality and Results of Medicinal Plant Products (8th and 9th sessions) → CLO4
9. Techniques for Testing Processed Medicinal Plant Products (10th session) → CLO5
10. Utilization of Processed Medicinal Plant Products: Case Studies (11th and 12th sessions) → CLO6
11. Innovations in Processing and Utilization of Medicinal Plants (13th session) → CLO6
12. Research and Article Discussions on Medicinal Plant Processing (14th session) → CLO3
13. Research Presentation and Group Discussions (15th session) → CLO6
14. Final Examination (UAS) (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
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<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
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<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Project</td><td>Presentation</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
</table>

Reading list	1. Heyne, 1985. Tumbuhan Berguna Indonesia 2. Plant Resources of South-East Asia No. 12(1-3). Medicinal and Poisonous Plants 1 by L. S. de Padua; N. Bunyapraphatsara; R. H. M. J. Lemmens 3. Sahat J.T.D, Nisaa A.D, Yulita K, Boiga, Rahma, 2007. Tumbuhan Berhasiat Obat Taman Nasional Kutai. Balai Taman Nasional Kutai 4. Yulita K, Edy P, Asep S, 2013. Tumbuhan Obat Taman Nasional Kutai (Edisi Perdu). Balai Taman nasional Kutai 5. Noorcahyati, 2012. Tumbuhan Berkhasiat Obat Etnis Asli Kalimantan. Balai Penelitian Teknologi Konservasi SDA 6. Journal Ilmiah terkait (Journal of Ethnopharmacology, Journal of Etnobiology and Ethnomedicine, Planta medica 7. S.S. Handa, S.P.S. Khanuja, G. Longo, and D.D. Rakesh. Extraction Technologies for Medicinal and Aromatic Plants. International Centre for Science and High Technology Trieste, 2008 8. Additional articles related to subject

Course Module

Processing and Utilization Technology of Fiber

Faculty of Forestry

Mulawarman University

Module name	Processing and Utilization Technology of Fiber
Module level, if applicable	Doctoral
Code, if applicable	220401902P039
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The subject is available throughout all academic semesters
Person responsible for the module	Dr. Wiwin Suwinarti, M.P.
Lecturer	Dr. Wiwin Suwinarti, M.P. Prof. Dr. Rudianto Amirta, M.P.
Language	Indonesia
Relation to curriculum	Compulsory Course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester

	1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **ILO1 (A1) -** Internalize scientific values, norms, and ethics **Knowledge (K)** 2. **ILO2 (K1) -** Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2) -** Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **Specific Skills (SS)** 4. **ILO6 (SS1) -** Able to manage data and information to support decision-making processes **Content Learning Outcome (CLO)** 1. **CLO1**: Students are able to critically analyze and synthesize advanced fiber processing technologies through the evaluation of scientific articles and research publications in fiber-based industries. **ILO2 (K1).** 2. **CLO2**: Students are able to evaluate and discuss innovative fiber utilization technologies for bioenergy production by engaging in critical reviews of recent journal articles and case studies. **ILO3 (K2).** 3. **CLO3**: Students are able to design and lead research projects, supported by thorough literature reviews and discussions, to contribute to advancements in sustainable fiber processing and bioenergy utilization. **ILO6 (SS1).** 4. **CLO4:** Students are able to demonstrate ethical responsibility and sustainability awareness in fiber-based industry practices and bioenergy research. **ILO1 (A1).**
Contents	This course provides an in-depth exploration of fiber processing technologies and their utilization in various industries, including bioenergy applications. Students will gain a strong foundation in fiber properties and characteristics, enabling them to critically analyze fiber processing methods, innovations, and industrial applications. The course also emphasizes sustainability, ethical considerations, and research-driven advancements in fiber-based industries. Through scientific article reviews, case studies, and group discussions, students will develop critical thinking and problem-solving skills necessary for evaluating fiber processing technologies and

<table>
<tr><td></td><td>bioenergy utilization. Assessments include a midterm examination, research presentations, and a final examination to ensure a comprehensive understanding and application of fiber technology concepts. List below:

1. Introduction to Fiber Processing and Utilization (1st session) → CLO1
2. Properties and Characteristics of Fibers (2nd and 3rd sessions) → CLO1
3. Fiber Processing Technologies (4th and 5th sessions) → CLO1
4. Fiber Utilization in Fiber-Based Industries (6th and 7th sessions) → CLO2
5. Midterm Examination (UTS) (8th session) → Assessment
6. Fiber Utilization in Bioenergy (9th and 10th sessions) → CLO2
7. Innovations and Future Trends in Fiber Processing and Utilization (11th session) → CLO2
8. Article Discussions on Fiber Technology and Bioenergy (12th and 13th sessions) → CLO3
9. Case Studies in Industrial Applications of Fiber Processing (14th session) → CLO3
10. Research Presentation and Group Discussions (15th session) → CLO4
11. Final Examination (UAS) (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
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<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Kolowski, R. and M.M. Talarczyk. 2020. Handbook of Natural Fibres 2nd Edition Volume 1. Woodhead Publishing.
2. Kolowski, R. and M.M. Talarczyk. 2020. Handbook of Natural Fibres 2nd Edition Volume 2. Woodhead Publishing.
3. Fanguiero, R and S. Rana. 2015. Natural Fibres: Advances In Science and Technology Towards Industrial Applications. Springer.
4. Dahiya, A. 2020. Bioenergy. 2nd Edition. Biomass to Biofuel and Waste To Energy. Academic Press.
5. Dahiya, A. 2014. Bioenergy. 1st Edition. Biomass to Biofuels. Academic Press.
6. Love, J. And J.A. Bryant. 2017. Biofuels and Bioenergy. John Wiley & Sons Ltd.</td></tr>
</table>

	7. Kaltschmitt, M. And H. Hofbauer. 2019. Biomass Conversion and Biorefinery. Hybrid-Springer. 8. Zhang, B. And Y. Wang. 2013. Biomass Processing, Conversion And Biorefinery. Nova. 9. Jurnal Tentang Serat, Bioenergi dan Konversi Biomassa 10. Additional articles which related to subjects

Course Module

Biorefinery

Faculty of Forestry

Mulawarman University

Module name	Biorefinery
Moduel level, if applicable	Doctorate
Code, if applicable	220401902P040
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Prof. Dr. Rudianto Amirta
Lecturer	1. Prof. Dr. Rudianto Amirta 2. Dr. Wiwin Suwinarti 3. Retno Wulandari, Ph.D
Language	Indonesia
Relation to curriculum	Compulsory course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of sessions per semester 16 sessions (14 sessions for learning activity, 1 session for mid-semester, 1 session for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6

	2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **ILO1 (A1) -** Internalizing values, norms, and ethics in Knowledge **Knowledge (K)** 2. **ILO2 (K1) -** Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2) -** Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **Specific Skills (SS)** 4. **ILO6 (SS1) -** Able to manage data and information to support decision-making processes **Content Learning Outcome (CLO)** 1. **CLO1:** Students can explain the concepts and principles of biorefinery in a good manner. **ILO2 (K1) and ILO1 (A1) .** 2. **CLO2:** Students are able to develop technology and processes for biorefinery. **ILO3 (K2)**. 3. **CLO3:** Students can evaluate the economic and environmental impacts of biorefinery. **ILO6 (SS1).** 4. **CLO4:** Students are able to produce scientific research in the field of biorefinery. **ILO3 (K2)**.
Content	This course on Biorefinery provides an in-depth exploration of the various technologies and processes involved in converting biomass into energy, fuels, and high-value chemicals. Students will gain a comprehensive understanding of the concepts, principles, and classifications of biorefineries. The course begins with an overview of the potential of biomass as a resource for renewable energy production. It then progresses through detailed studies of the main conversion technologies including thermochemical (pyrolysis, gasification, and combustion), biochemical (fermentation and enzymatic hydrolysis), and physicochemical (extraction and purification) methods. The course also covers the production of key biofuels such as bioethanol, biogas, and biodiesel, and explores the generation of platform chemicals and high-value products from biomass. A significant component of the curriculum is the application of Life Cycle Assessment (LCA) to evaluate the environmental impact and sustainability of biorefinery processes. The course includes a midterm examination to assess

<table>
<tr><td></td><td>students' understanding and ability to apply their knowledge practically. List are:

1. Contract and Introduction to Biorefinery: Concepts, Principles, and Classification (1st session) → CLO1
2. Biomass Potential for Biorefinery (2nd session) → CLO1
3. Thermochemical Conversion Technologies: Pyrolysis, Gasification, and Combustion (3rd session) → CLO2
4. Biochemical Conversion Technologies: Fermentation and Enzymatic Hydrolysis (4th session) → CLO2
5. Physicochemical Conversion Technologies: Extraction and Purification (5th session) → CLO2
6. Production of Bioethanol, Biogas, and Biodiesel (6th session) → CLO2
7. Platform Chemicals and High-Value Products (7th session) → CLO2
8. Midterm Examination (UTS) (8th session) → Assessment
9. Life Cycle Assessment (LCA) in Biorefinery (9th session) → CLO3
10. Economic and Environmental Analysis of Biorefinery Processes (10th session) → CLO3
11. Advanced Research Methods in Biorefinery (11th session) → CLO4
12. Case Studies on Biorefinery Innovations (12th session) → CLO4
13. Proposal Development for Biorefinery Research (13th session) → CLO4
14. Sustainable Biorefinery Practices for Climate Change Mitigation (14th session) → CLO3
15. Group Presentations: Research and Application in Biorefinery (15th session) → CLO4
16. Final Examination (UAS) (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
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<tr><td>3</td><td>Project</td><td>Presentation</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD</td></tr>
<tr><td>Reading list</td><td>1. Clark, J. H., & Deswarte, F. E. I. (2015). Introduction to Chemicals from Biomass. Wiley.</td></tr>
</table>

	2. Kamm, B., Gruber, P. R., & Kamm, M. (2006). Biorefineries - Industrial Processes and Products: Status Quo and Future Directions. Wiley-VCH. 3. Pandey, A., & Larroche, C. (2013). Biomass, Biofuels, Biochemicals: Bio-refinery Processes. Elsevier. 4. Lange, J. P. (2018). Sustainable Biorenewable Resources. Wiley-VCH. 5. Additional articles that support the subject.

Course Module

Site-Level Silvicultural Decision

Faculty of Forestry

Mulawarman University

Module name	Site-Level Silvicultural Decision
Module level, if applicable	Doctorate
Code, if applicable	220401903P044
Subtitle, if applicable	-
Courses, if applicable	Regular
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Prof. Dr. Ir. Marjenah, M.P.
Lecturer	Prof. Dr. Ir. Marjenah, M.P. Kiswanto, S.Hut., M.P., Ph.D.
Language	Indonesia
Relation to curriculum	Compulsory course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	Credit points: 3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week

	1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **ILO1 (A1)** - Internalizing values, norms, and ethics in Knowledge **Knowledge (K)** 2. **ILO2 (K1)** - Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2)** - Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **Specialized Skills (SS)** 4. **ILO6 (SS1) -** Able to manage data and information to support decision-making processes **Content Learning Outcome (CLO)** 1. **CLO1:** Students are able to develop knowledge and make decisions about silvicultural practices at the site level. **ILO6 (SS1).** 2. **CLO2:** Students are able to identify and analyze characteristics of tropical rainforests and their ecosystems. **ILO2 (K1).** 3. **CLO3:** Students are able to evaluate and analyze silvicultural techniques, including TPTI, SILIN, and residual stand management. **ILO6 (SS1).** 4. **CLO4:** Students are able to design and formulate sustainable forest management and agroforestry systems. **ILO3 (K2).** 5. **CLO5:** Students are able to develop silviculture applications for climate change mitigation and forest restoration. **ILO6 (SS1).**
Content	This course provides an in-depth understanding of silvicultural principles, techniques, and decision-making processes essential for sustainable forest management. Students will explore the biological and ecological characteristics of tropical rainforests, as well as various silvicultural systems such as TPTI and SILIN. The course emphasizes practical applications, including residual stand management, logging techniques, and agroforestry methods. A strong focus is placed on land

<table>
<tr><td></td><td>tenure systems, socio-economic factors in forest management, and the role of silviculture in climate change mitigation. Through advanced forest management planning, case studies, and research projects, students will develop skills necessary for designing and implementing sustainable forestry practices.
1. Contract and Introduction to Silviculture, Decision-Making, and Land Ownership (1st session) → CLO1
2. Characteristics, Biological, and Ecological Needs of Tropical Rainforests (2nd session) → CLO2
3. Silvicultural Techniques I: TPTI and SILIN Systems (3rd and 4th sessions) → CLO3
4. Residual Stand Management and Logging Techniques (5th session) → CLO3
5. Sustainable Forest Management and Agroforestry Methods (6th and 7th sessions) → CLO4
6. Midterm Examination (UTS) (8th session) → Assessment
7. Forest/Biophysical Socio-Economic and Land Tenure Systems (9th session) → CLO1
8. Silviculture Applications for Climate Change Mitigation (10th session) → CLO5
9. Advanced Silviculture Strategies: Designing Forest Management Plans (11th and 12th sessions) → CLO4
10. Research on Silvicultural Practices: Case Studies and Projects (13th session) → CLO4
11. Research Presentation and Group Projects (14th and 15th sessions) → CLO4
12. Final Examination (UAS) (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of the learning process are following scheme 5 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Laboratory Practice/Fieldwork</td><td>Participation, Group Project Report</td><td>20</td></tr>
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<tr><td>Reading list</td><td>1. Lampercht, H, 1996. Pertimbangan Silvikultur Di Wilayah Tropik. Silvikultur Hutan Alam di Indonesia. Fakultas Kehutanan Universitas Mulawarman. Samarinda.
2. Oldeman, R. A. A. 1990. Forests: Elements of Silvology. Springer-Verlag_Berlin Heidelberg. New York
3. Soekotjo. 2009. Teknik Silvikultur Intensif (SILIN). Gadjah Mada University Press. (Cetakan pertama). Yogyakarta.</td></tr>
</table>

4. Weidelt, H.J, 1995 Silvikultur Hutan Alam Tropika. Fakultas Kehutanan Universitas Mulawarman. Samarinda.
5. Whitmore, T.C. 1984. Tropical Rain Forest of The Far East (2nd ed.). Clarendon Press, Oxford. 352 hal.
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7. Weatherspoon. C.P. 1996. Fire-Silviculture Relationship in Sierra Forest. UtahState University.pp. 1167 – 1176
8. Guilley, E., J. C. Herve., and G. Nepveu. 2004. The Influence of Site Quality, Silviculture and Region on Wood Density Mixed Model in Querqus petraea Liebl. Forest Ecology and Management. Elsevier. Pp. 111 – 121.
9. Mitchell, R. J., J. K. Hiers., J. J. O'Brien., S. B. Jack., and R. T. Engstrom. 2006. Silviculture That Sustain: The Nexus Between Silviculture, frequent, Prescribed Fire, and Conservation of Biodiversity in Longleaf Pine Forests of the Southeasten United Stated. Can. J. For. Res. 36: 2724 – 2736.
10. Navratil, S. 1995. Minimizing Wind Damage in Alternative Silviculture Systems in Boreal Mixedwoods. Canadian Forest Service. Canada. 81 p.
11. Sendak, P. E., J. C. Brissette., and R. M. Frank. 2003. Silviculture Affect Composition, Growth, and Yields and Mixed Northern Conifers: 40-year Results from the Penobscot Experimental Forest. Can. J. For. Res.33. 2116 – 2128.
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13. Long, J. N. T. J. Dean., and S. D. Roberts. 2004. Linkages Between Silviculture and Ecology: Examination of Several Important Conceptual Models. Forest Ecology and Management 200 (2004) 249 - 261. Elsevier.
14. Timbal, J. and G. Aussenac. 1996. An Overview of Ecology and Silviculture of Indigenous Oaks in France. Ann. Sci. For (1996) 53. 649 – 661.
15. Shepperd, W. D., and M. A. Battaglia. 2002. Ecology, Silviculture, and Management of Black Hills Ponderosa Pine. USDA Forest Service. 112 p.
16. Baker, J. B., M. D. Cain., J. M. Guldin., P. A. Murphy., and M. G. Shelton. 1996. Uneven-Aged Silviculture for the Loblolly and Shortleaf Pine Forest Cover Types. USDA Forest Service. 75 p.

Course Module

Development of Honeybee Cultivation and Products

Faculty of Forestry

Mulawarman University

Module name	Development of Honeybee Cultivation and Products
Module level, if applicable	Doctorate
Code, if applicable	220401902P045
Subtitle, if applicable	-
Courses, if applicable	Regular
Semester(s) in which the module is taught	The subject is available throughout all academic semesters
Person responsible for the module	Dr.rer.nat. Harmonis, S.Hut., M.Sc.
Lecturer	Prof. Dr. Irawan Wijaya Kusuma, S.Hut., M.P. Dr. Syafrizal, M.P.
Language	Indonesia
Relation to curriculum	Compulsory course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester

	1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **ILO1 (A1)** - Internalize scientific values, norms, and ethics **Knowledge (K)** 2. **ILO2 (K1)** - Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2)** - Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **General Skills (GS)** 4. **ILO4 (GS1)** - Able to criticize the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **ILO5 (GS2)** - Able to demonstrate academic leadership in resource management for independently compiling a dissertation, and possessing scientific ethics **Content Learning Outcome (CLO)** 1. **CLO1:** Students are able to analyze development disparities and the biological and ecological needs of honey bees. **ILO2 (K1).** 2. **CLO2:** Students are able to evaluate habitat requirements and implement breeding systems for honey bees. **ILO3 (K2).** 3. **CLO3:** Students are able to develop strategies for sustainable beekeeping systems and evaluate their implementation. **ILO4 (GS1).** 4. **CLO4:** Students are able to manage honey bee colonies and address pest and disease issues effectively. **ILO5 (GS2).** 5. **CLO5:** Students are able to determine suitable products and apply appropriate processing and preservation technologies. **ILO2 (K1).** **6. CLO6:** Students are able to evaluate product quality and develop beekeeping businesses. **ILO5 (GS2).**
Content	This course provides students with a comprehensive understanding of beekeeping, covering both theoretical and practical aspects. The course begins with an introduction to the history and development of beekeeping, followed by the taxonomy, biology, and ecology of different honey bee species, including *Apis dorsata, A. cerana, A. mellifera*,

<table>
<tr><td></td><td>and Meliponini. Students will learn about honey bee products, their market potential, and breeding systems to enhance colony management. Key topics include feeding management, habitat requirements, pest and disease control, and sustainable harvesting techniques. Additionally, the course explores processing, preservation, and standardization of honey bee products, preparing students for commercial and entrepreneurial opportunities in beekeeping. Students will engage in case studies, research presentations, and hands-on experience to apply their knowledge in real-world settings. Assessment methods include a midterm and final examination, ensuring students develop both academic and practical proficiency in sustainable beekeeping practices.

1. Contract and Introduction to Beekeeping: History and Development (1st session) → CLO1
2. Taxonomy, Biology, and Ecology of Honey Bees (Apis dorsata, A. cerana, A. mellifera, Meliponini) (2nd and 3rd sessions) → CLO1
3. Honey Bee Products: Types, Benefits, and Market Potential (4th session) → CLO5
4. Honey Bee Breeding Systems and Colony Management (5th and 6th sessions) → CLO2
5. Feeding Management and Habitat Requirements for Honey Bees (7th session) → CLO2
6. Midterm Examination (UTS) (8th session) → Assessment
7. Pest and Disease Management in Honey Bees (9th session) → CLO4
8. Harvesting Techniques for Honey Bee Products (10th session) → CLO5
9. Processing, Preservation, and Packaging of Honey Bee Products (11th session) → CLO5
10. Product Standardization for Honey Bee Products (12th session) → CLO6
11. Beekeeping Business Development and Entrepreneurship (13th and 14th sessions) → CLO6
12. Research Presentation and Case Studies in Beekeeping (15th session) → CLO3
13. Final Examination (UAS) (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of the learning process are following scheme 5 in the Academic Regulations of Mulawarman University:
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</table></td></tr>
<tr><td>Media employed</td><td>Laptop, LCD, STAR</td></tr>
</table>

Reading list	1. Adey, M., P. Walker, P.T. Walker (1986) Pest Control Safe for Bees: A Manual and Directory for The Tropics and Subtropics. International Bee Research Association, London. 2. Anonim (1995) Pengenalan dan Pemanfaatan Jenis-jenis Produk Lebah Madu. Kanwil Departemen Tenaga Kerja Propinsi Sulawesi Selatan dan Lembaga Penelitian Universitas Hasanuddin, Ujung Pandang. 3. Anonim (1995) Teknik Budidaya Lebah Madu Apis cerana Fabr. Kanwil Departemen Tenaga Kerja Propinsi Sulawesi Selatan dan Lembaga Penelitian Universitas Hasanuddin, Ujung Pandang. 4. Anonim (1995) Teknik Pengemasan dan Pemasaran Berbagai Jenis Produk Lebah Madu. Kanwil Departemen Tenaga Kerja Propinsi Sulawesi Selatan dan Lembaga Penelitian Universitas Hasanuddin, Ujung Pandang. 5. Anonim (2005) Teknik Budidaya Lebah Madu Unggul Apis mellifera L. Pusat Penelitian Lebah Madu, Lembaga Penelitian UNHAS, Makassar. 6. Bailey, L. (1981) Honey Bee Pathology. Academic Press Inc. London. 7. Banaszak J (2000) Pollinating insects (Apoidea) from "Puszcza Zielonka" Landscape Park, Poland. In: Banaszak J (ed.) Ecology of Forest Islands. Bydgoszcz Pedagogical University Press, Bydgoszcz. 8. Berthold Jr., R. (1993) Beeswax Crafting. Wicwas Press, Cheshire, Connecticut USA. 9. Borror et al., (1992). Pengenalan Pelajaran Serangga (Terjemahan). Gadjah Mada University Press, Yogyakarta. 10. Bradbear, N. (2003) Beekeeping and sustainable livelihoods. Agricultural Support Systems, FAO, Rome. 11. Corlett, R.T. Honeybees in Natural Ecosystems. In Honeybees of Asia; Hepburn, H.R., Radloff, S.E., Eds.; Springer-Verlag Berlin: Heidelberg, Germany, 2011; pp. 215-226. 12. Coulson, R.N. and J.A. Witter, (1984). Forest Entomology (Ecology and Management), A Wiley-Interscience Publication, New York. 13. Crane, E. (1990) Bees and Beekeeping: Science, Practice, and World Resources. Ithaca, NY: Cornell Univ. Press/Cornstock. 14. Graham, J.M. (Ed.) (1992) The Hive and the Honey Bee. Dadant & Sons, Hamilton, IL. 15. Harmonis (2005) Usaha Perlebahan dalam Percepatan Pengembangan Ekonomi Masyarakat di Sulawesi Selatan. Prosiding Seminar Nasional MAPEKI VIII: 156–160. 16. Harmonis, M. Sutisna, D. Mardji, R.E. Iskandar (2007) Potensi dan Prospek Pengembangan Usaha Perlebahan di Kalimantan Timur. Rimba Kalimantan 12 (1): 25–34. 17. Hilmi, M., Bradbear, N. & Mejia, D. (2011). Beekeeping and sustainable livelihoods. Food and Agriculture Organisation of the United Nations. Rural Infrastructure and Agro-Industries Division, Rome, Italy. 18. Jacobs W, Renner M (1988) Biologie und Ökologie der Insekten. Fischer Verlag, Stuttgart.

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20. Mraz, C. (1995) Health and The Haneybee. Queen City Publications, Burlington, Vermont.
21. Nugroho, R.B. dan R.C.H. Soesilohadi (2014). Identifikasi Macam Sumber Pakan Lebah Trigona sp. (Hymenoptera: Apidae) di Kabupaten Gunung Kidul. Biomediaka 7(2): 42 – 45.
22. Oldroyd, B.P., Nanork, P., 2009. Conservation of Asian honey bees. Apidologie 40, 296–312.
23. Preston-Mafham, R. and K. Preston-Mafham, (1996). The Natural History of Insects. The Crowood Press, Ramsbur.
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29. Smith, F.G. (1960) Beekeeping in The Tropics. Longmans, New York.
30. Verma, L.R. and U. Partap (1993) The Asian Hive Bee, Apis cerana, as Pollinator in Vegetable Seed Production. International Centre for Integrated Mountain Development. Kathmandu, Nepal.
31. Vijayakumar, K., M. Muthuraman and R. Jayaraj (2012) Predation of stingless bees (Trigona iridipennis: Apidae, Meliponinae) by centipede (Scolopendra hardwicki : Chilopoda: Scolopendramorpha). IJALS 5(2): 156–159.
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33. Waring C., Jump D.R. (2004) Rafter beekeeping in Cambodia with Apis dorsata, Bee World 84, 14– 18.
34. Wattanachaiyingcharoen, W. and T. Jongjitvimol (2007) First Record of the Predator, Pahabengkakia piliceps Miller, 1941(Reduviidae, Harpactorinae) in the Stingless Bee, Trigona collina Smith, 1857 (Apidae, Meliponinae) in Thailand. The Natural History Journal of Chulalongkorn University 7(1): 71-74
35. Zayed A. (2009) Bee genetics and conservation, Apidologie 40, 237–262.

Course Module

Silviculture Techniques for Degraded Land

Faculty of Forestry
Mulawarman University

Module name	Silviculture Techniques for Degraded Land
Module level, if applicable	Doctoral
Code, if applicable	220401903P047
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in which the module is taught	Odd/Even Semesters
Person responsible for the module	Prof. Dr. Ir. Marjenah, M.P.
Lecturer	1. Prof. Dr. Ir. Marjenah, M.P. 2. Prof. Dr. Ir. Paulus Matius, M.Sc.
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	**3 SKS / 4.8 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **ILO-1** - Internalize values, norms, and ethics **Knowledge** 2. **ILO-2** - Synthesize knowledge obtained from research results with its novelty and implementation 3. **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions

	General Skills 4. **ILO-4** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **ILO-5** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Content Learning Outcome (CLO)** **Knowledge** **CLO-1 :** Able to identify critical land based on soil, flora, and fauna, as well as evaluate concepts and designs for ecosystem restoration **Special Skills** **CLO2:** Able to design rehabilitation techniques for degraded land using a vegetative approach combined with physical, mechanical, and chemical techniques **CLO4:** Able to design and analyze monitoring and evaluation of ecosystem recovery, including land ecosystems, structural components, and diverse system interactions**.** **General Skills** **CLO3:** Able to analyze and synthesize the economic potential of degraded land after rehabilitation, both in a production-oriented and conservation-oriented approach. **Attitude** **CLO5:** Able to analyze the causes of degradation, key characteristics, and distribution of land ecosystems**,** perform synthesis of rehabilitation-reclamation-revegetation for degraded land**,** and assess ecological impacts on flora and fauna as well as the level of ecosystem degradation**.**
Content	This course explores silvicultural techniques for restoring degraded land, focusing on land identification, rehabilitation, reclamation, and revegetation strategies**.** Students will analyze forest and land restoration processes, post-mining land recovery, marginal land management, and productivity improvement techniques. The course also covers species selection, planting design, maintenance strategies, and monitoring methods to ensure successful revegetation. Through lectures, case studies, and practical analysis**,** students will develop the skills to design and implement effective forest restoration strategies. 1. Presentation of the Semester Learning Plan (RPS), course contract, and introductory materials. (1^{ST} meeting) **(CLO-1)** 2. Students are able to develop knowledge of silvicultural techniques on degraded land for forest development. (2^{nd}) **(CLO-1)** 3. Students are able to identify the characteristics of degraded land**.** (3^{rd}) **(CLO-1)** 4. Able to develop knowledge of land restoration and rehabilitation.. (4^{th}) **(CLO-2)** 5. Able to analyze the implementation techniques for reclamation and revegetation**.** (5^{th}) **(CLO-2)** 6. Able to analyze the implementation techniques for reclamation and revegetation**.** (6^{th}) **(CLO-2)** **7.** Able to analyze the stages of forest and land restoration after mining**..** (7^{th}) **(CLO-5)**

<table>
<tr><td></td><td>8. Mid-Term Exam (8th)
9. Able to design concepts for improving land productivity. (9th) (CLO-3)
10. Able to analyze and formulate the concept of marginal land. (10th) (CLO-3)
11. Able to analyze and formulate forest restoration principles.. (11th) (CLO-4)
12. Able to analyze and formulate the stages of the restoration process.. (12th) (CLO-4)
13. Able to analyze and formulate the criteria for rehabilitation plant species.. (13th) (CLO-4)
14. Able to design planting layouts and planting techniques. (14th) (CLO-5)
15. Able to design maintenance patterns and monitoring strategies for the success of revegetation on degraded land. (15th) (CLO-5)
16. Final Exam (16th)</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
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<tr><td>Reading list</td><td>1. Anonym. 2018. KEGIATAN REKLAMASI BEKAS AREA TAMBANG. PT Nusantara Berau Coal
2. Riswan, U. Harun, C. Irsan. 2015. Keragaman Flora di Lahan Reklamasi Pasca Tambang Batubara PT BA Sumatera Selatan. Jurnal Manusia dan Lingkungan Vol. 22 No. 2 Juli 2015. P. 160 – 168
3. Gunawan, W. 2014. Rehabilitasi dan Restorasi Kawasan Hutan: Menyelaraskan Prinsip dan Aturan (Contoh Kasus: Model Kebijakan Kawasan Hutan Konservasi). Balai Penelitian Konservasi SDA Badan Penelitian dan Pengembangan Kehutanan. Kementerian Kehutanan.
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</table>

	7. Kamilia, I. dan Nawiyanto. 2015. Kerusakan Hutan dan Munculnya Gerakan Konservasi di Lereng Gunung Lamongan, Klakah 1999 – 2013. Publika Budaya. Vol 1 (3) Maret 2015. 8. Moniaga, V.R.B. 2011. Analisis Daya Dukung Lahan Pertanian. ASE Volume 7 No. 2 Mei 2011. 61 – 68. 9. Barri, M.F., A.A. Setiawan., A.R. Oktaviani., A.P. Prayoga., dan A.C. Ichsan. 2018. Deforestasi Tanpa Henti. "Potret Deforestasi di Sumatera Utara, Kalimantan Timur, Maluku Utara. Forest Watch Indonesia. Bogor. 10. Peni, R. 2009. Degradasi dan Pencemaran Lingkungan. Ilmu Lingkungan. 11. Bab. 3. Deforestasi dan Degradasi Hutan. 12. Samadhi, N. 2018. Usaha Penurunan Angka Deforestasi dalam Rangka Mendukung Pencapaian Target SDG. Lokakarya Hutan dan deforestasi. Jakarta, 29 Januari 2018. 13. Sitorus, S. R. P., O. Haridjaya., A. Iswati., dan D.R. Panuju. 2009. Pengembangan Metodologi Untuk Identifikasi Tingkat Degradasi Lahan di Lahan Kering Mendukung Pendayagunaan Lahan Terlantar untuk Keperluan Pertanian. Seminar Hasil-hasil Penelitian. Bogor, 22 – 23 Desember 2009. 14. Lampercht, H, 1996. Pertimbangan Silvikultur Di Wilayah Tropik. Silvikultur Hutan Alam di Indonesia. Fakultas Kehutanan Universitas Mulawarman. Samarinda. 15. Oldeman, R. A. A. 1990. Forests: Elements of Silvology. Springer-Verlag_Berlin Heidelberg. New York 16. Soekotjo. 2009. Teknik Silvikultur Intensif (SILIN). Gadjah Mada University Press. (Cetakan pertama). Yogyakarta. 17. Weidelt, H.J, 1995 Silvikultur Hutan Alam Tropika. Fakultas Kehutanan Universitas Mulawarman. Samarinda. 18. Whitmore, T.C. 1984. Tropical Rain Forest of The Far East (2nd ed.). Clarendon Press, Oxford. 352 hal. 19. Tata, H.L. dan A. Sasmianto.2016. Prospek Paludikultur Ekosistem Gambut Indonesia. Forda Press. Bogor.

Course Module

Protected Area Management Strategy

Faculty of Forestry
Mulawarman University

Module name	Protected Area Management Strategy
Module level, if applicable	Doctoral
Code, if applicable	220401902P052
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in which the module is taught	Odd/Even Semesters
Person resposible for the module	Prof. Dr. Marlon I. Aipassa, M.Agr.
Lecturer	1. Prof. Dr. Marlon I. Aipassa, M.Agr. 2. Prof.Dr.Wawan Kustiawan, M.Agr.Sc 3. Dr.Yaya Rayadin, M.P.
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for
Credit points	**2 SKS / 3.2 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **ILO-1** - Internalize values, norms, and ethics **Knowledge**

	2. **ILO-2** - Synthesize knowledge obtained from research results with its novelty and implementation 3. **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **ILO-4** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary 5. **ILO-5)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** 6. **ILO-6** - Manage data and information to support decision-making processes **Content Learning Outcome (CLO)** **Knowledge and Special Skills** **CLO1**: Able to explain, analyze, and design the utilization, protection/security, and intervention control in protected area management. **CLO3**: Able to evaluate and formulate alternative solutions for issues and specific case management in protected area management **General Skills** **CLO2**: Able to develop institutional management for protected areas.
Content	This course provides an in-depth exploration of protected area management, focusing on its utilization, conservation, intervention control, and institutional development. Students will learn about fundamental definitions, classifications, policies, and management strategies for protected areas, including opportunities, challenges, and constraints in their implementation. The course also covers alternative management actions, zoning development, community empowerment, and monitoring techniques to enhance protected area sustainability. Additionally, students will engage in case study evaluations and solution formulation for specific management challenges.By integrating analysis, synthesis, and strategic planning, students will develop the ability to design effective protected area management plans that balance ecological conservation with sustainable use. 1. Presentation of the Semester Learning Plan (RPS) for the Protected Area Management Strategy course, course contract, and introductory materials. (1ST meeting) **(CLO-1)** 2. Basic definitions, objectives, targets, and scope of protected area management (2nd) **(CLO-1)** 3. Classification of protected area management in relation to policies on protected area designation. (3rd) **(CLO-1)** 4. Classification of area management from the perspective of protected area management. (4th) **(CLO-1)** 5. Analysis and evaluation of opportunities, challenges, and constraints in protected area management (5th) **(CLO-1)** 6. Analysis and evaluation of alternative actions for protected area management. (6th) **(CLO-3)** 7. Synthesis related to the development and enhancement of protected areas. (7th) **(CLO-2)**

<table>
<tr><td></td><td>8. Mid-Term Exam (8th)
9. Synthesis of area management, including inventory, identification, monitoring, evaluation, and community empowerment in buffer zones. (9th) (CLO-2)
10. Analysis, design, and development of models for the utilization and protection of protected areas (10th) (CLO-1)
11. Control measures, intervention, rehabilitation, and institutional development for protected area management. (11th) (CLO-2)
12. Evaluation of issues and handling of specific cases in protected area management. (12th) (CLO-3)
13. Formulating alternative solutions for specific cases in protected area management. (13th) (CLO-3)
14. Developing specific zoning based on the primary functions of designated protected areas. (14th) (CLO-1)
15. Designing a management plan for protected areas based on objectives, functions, and conservation efforts. (15th) (CLO-1)
16. Final Exam (16th)</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Studies</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Projects:</td><td>Report</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Term Exam</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Exam</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Lilik Budi Prasetyo. 2017. Pendekatan Ekologi Lanskap Untuk Konservasi Biodiversitas. Fakultas Kehutanan Institut Pertanian Bogor Kampus Darmaga.
2. Indrawan, M., R. B. Primack, J. Supriatna. 2007. Biologi Konservasi. Yayasan Obor Indonesia. Jakarta.
3. MacKinnon, J., K. MacKinnon, G. Child, dan J. Thorsell. 1993. Pengelolaan Kawasan Yang Dilindungi di Daerah Tropika. Gajah Mada University Press. Yogyakarta
4. Keith, D. and E. Nicholson. 2019. The IUCN Global Ecosystem Typology. IUCN Ecosystem Red List Thematic Group.
5. Anthony, R.E.S., John, M.F., dan Graeme, C., 2006. Wildlife Ecology, Conservation, and Management. Second Edition. Blackwell Publishing.
6. Cunningham, W.P. dan Saigo B.W. 1999. Environmental Science.Wm. C. Brown Publishers. London Dharam P.A (Ed.). 2014. Integrated Pest Management: Current Concepts and Ecological Perspective. Elsevier Inc
7. World Conservation Strategy. IUCN, UNEP, WWF, FAO dan Unesco</td></tr>
</table>

	8. MacKinnon, J., K. MacKinnon, G. Child, dan J. Thorsell. 1993. Pengelolaan Kawasan yang Dilindungi di Daerah Tropika. 9. Hastuti, S. (2021). *Pengelolaan Kawasan Hutan Lindung di UPT Kesatuan Pengelolaan Hutan (KPH) V Mata Allo Kabupaten Enrekang. Jurnal KIMAP*, 2(1), 172–184.Mansourian, S., & Vallauri, D. (2014). *Forest Restoration in Landscapes: Beyond Planting Trees.* Springer. 10. Rogi, M. N. N., Lambonan, M. L., & Gerungan, C. A. (2024). *Penegakan Hukum terhadap Perizinan Kawasan Hutan Lindung Danau Linouw Resort PT. Karyadeka Alam Asri di Kota Tomohon. Lex Privatum*, 14(3).Suding, K.N. (2011). *From Climate Change to Conservation and Restoration Ecology: A Future Research Agenda.* Journal of Ecology, 99(6), 1383-1395 11. Sari, D. P. (2024). *Pengelolaan Kehutanan Ditinjau Berdasarkan Undang-Undang No. 41 Tahun 1999 Menyoroti Aspek-Aspek dalam Hukum Administrasi Negara. Jurnal Demokrasi*, 1(3), 218–224 12. Sukmawati, D., & Sari, D. P. (2024). *Nilai Ekonomi Pengelolaan Hutan Lindung Blok Kawae KH. Maria/RTK 25 BKPH Soppeng Selatan. Jurnal Manajemen Hutan Tropika Lestari*, 1(1), 1–10 13. Other Reference/Article related about *Management Strategy of Protected Area*

Course Module

Degraded Land Rehabilitation

Faculty of Forestry

Mulawarman University

Module name	Rehabilitasi Lahan Terdegradasi (Degraded Land Rehabilitation)
Module level, if applicable	Doctoral
Code, if applicable	220401903P053
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in which the module is taught	Odd/Even Semesters
Person responsible for the module	Triyono Sudarmadji
Lecturer	1. Chandradewana Boer 2. Triyono Sudarmadji 3. Wahjuni Hartati 4. Syahrinudin
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	**3 SKS / 4.8 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **ILO-1** – Internalize values, norms, and ethics **Knowledge**

	2. **ILO-2** - Synthesize knowledge obtained from research results with its novelty and implementation 3. **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **ILO-4** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **ILO-5** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** 6. **ILO-6** - Manage data and information to support decision-making processes **Course Learning Outcome (CLO)** **Knowledge** **CLO-1:** Able to identify critical land based on soil, flora, and fauna, as well as evaluate concepts and designs for ecosystem restoration. **CLO-2:** Able to design rehabilitation techniques for degraded land using a vegetative approach combined with physical, mechanical, and chemical techniques. **CLO-5:** Able to analyze the causes of degradation, key characteristics, and distribution of land ecosystems, perform synthesis of rehabilitation-reclamation-revegetation for degraded land, and assess ecological impacts on flora and fauna as well as the level of ecosystem degradation **Special Skills** **CLO-3:** Able to analyze and synthesize the economic potential of degraded land after rehabilitation, both in production-oriented and conservation-oriented approaches. **General Skills** **CLO-4:** Able to design and analyze monitoring and evaluation of ecosystem recovery, including land ecosystems, structural components, and diverse system interactions.
Content	The *Degraded Land Rehabilitation* course discusses the concepts, theories, and applications of rehabilitating degraded land. Students will understand the factors causing ecosystem damage, methods for characterizing critical land, and rehabilitation techniques encompassing vegetative, civil/physical, mechanical, and chemical approaches. Additionally, this course covers the evaluation of ecological impacts on flora and fauna and the economic potential of post-rehabilitation land for conservation and production purposes. Through interdisciplinary, multidisciplinary, and transdisciplinary approaches, students will critically assess the philosophy, theory, and research methodologies related to land rehabilitation. This course also emphasizes data and information management to support decision-making in ecosystem recovery. Students will develop academic leadership skills in designing, implementing, and evaluating rehabilitation techniques and ecosystem management for degraded land. 1. Understanding the study materials of Degraded Land Rehabilitation (1ST meeting) **(CLO-1)** 2. Analyzing causes of damage, key characteristics, and distribution of damaged ecosystems (2nd) **(CLO-5)**

<table>
<tr><td></td><td>3. Synthesizing rehabilitation, reclamation, and revegetation of degraded land (3rd) (CLO-5)
4. Analyzing ecological impacts on flora and fauna and levels of land damage (4th) (CLO-5)
5. Identifying and characterizing critical land based on soil, flora, and fauna (5th) (CLO-1)
6. Assessing concepts and designs for recovering degraded ecosystems (6th) (CLO-1)
7. Designing rehabilitation techniques for degraded land using vegetative approaches (7th) (CLO-2)
8. Mid-Term Exam (8th)
9. Designing rehabilitation techniques for degraded land using civil/physical, mechanical, and chemical approaches (9th) (CLO-2)
10. Analyzing and synthesizing the economic potential of degraded land post-rehabilitation for conservation purposes (10th) (CLO-3)
11. Analyzing and synthesizing the economic potential of degraded land post-rehabilitation for production purposes (11th) (CLO-4)
12. Designing and analyzing monitoring and evaluation of degraded land ecosystem recovery (12th) (CLO-4)
13. Designing and analyzing ecosystem management based on the completeness of major ecosystem components in degraded land (13th) (CLO-4)
14. Summarizing and analyzing ecosystem management alternatives for degraded land (14- 15th) (CLO-4)
15. Final Exam (16th)</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
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2. Foth, H.D. Dasar Dasar Ilmu Tanah. Edisi VII. GajahMada Press, Yogyakarta. 781 h.
3. Anonim, 1993. Petunjuk Teknis Evaluasi Lahan. Pusat Penelitian Tanah dan Agroklimat Kerjasama dengan Proyek Pembangunan Penelitian Pertanian Nasional. Badan Penelitian dan Pengembangan Pertanian. Departemen Pertanian. Bogor.
4. Heathcote, Isobel W.. 1998. Integrated Watershed Management, Principles and Practice. John Wiley & Sons, Inc. New York.</td></tr>
</table>

	5. Troeh,F.R., Hobbs, J. A., dan Donahue R.,L., 1980. Soil and water Conservation for Productivity and Environmental Protection. Prentice-Hall, Inc., Engelwood Cliffs, New Jersey. 07632 6. Morgan, R.P.C. 2005. Soil Erosion and Conservation. Third Edition. Blackwell Publishing. 7. Arsyad, S., 2010. Konservasi Tanah dan Air. Edisi Kedua IPB Press, Bogor. 8. Kementerian Lingkungan Hidup dan Kehutanan, 2014. Undang Undang No. 37 Tahun 2014 Tentang Konservasi Tanah dan Air, Jakarta 9. Other Reference/Article related about *Degraded Land Rehabilitation*

Course Module

Upstream Watershed Management

Faculty of Forestry

Mulawarman University

Module name	Upstream Watershed Management
Module level, if applicable	Doctoral
Code, if applicable	220401903P056
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in which the module is taught	Odd/Even Semesters
Person responsible for the module	Triyono Sudarmadji
Lecturer	1. Sigit Hardwinarto 2. Triyono Sudarmadji
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	**3 SKS / 4.8 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **ILO-1** - Internalize scientific values, norms, and ethics **Knowledge** 2. **ILO-2** - Synthesize knowledge obtained from research results with its novelty and implementation 3. **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions

	General Skills 4. **ILO-4** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **ILO-5)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** 6. **ILO-6** - Manage data and information to support decision-making processes 7. **ILO-7 -** Work and communicate in an international context **Content Learning Outcome (CLO)** **<u>Knowledge</u>** **CLO-1**: Able to analyze and classify upper watersheds as providers and regulators of water, ecosystem functions, and prevention of degradation **<u>General Skills</u>** **CLO-2**: Able to detail and combine responses to climate change, management strategies and policies, and manage community participation in upper watershed management. **<u>Attitude:</u>** **CLO-3:** Able to design adaptation strategies for water resource management, predict uncertainties caused by climate change factors, and link hydrological modeling with climate change threats and anthropogenic pressures, abstract and demonstrate the impacts of deforestation on the hydrological cycle, erosion, sedimentation, and runoff, assess causes of landslides, and manage ecosystems in the upper watershed **<u>Specials Skills</u>** **CLO-4:** Able to summarize upper watershed management plans based on conservation principles while utilizing ecosystem services in the upper watershed/mountainous regions.
Content	This course focuses on the management and conservation of upper watersheds, emphasizing their role as key providers and regulators of water resources and ecosystem functions. Topics covered include climate change responses, water resource management strategies, the impacts of deforestation on the hydrological cycle, and the design of ecosystem management plans. The course also explores the application of hydrological modeling and adaptation strategies to address climate change threats and anthropogenic pressures, with a particular focus on community participation and sustainable management practices. Case studies, including the assessment of watershed degradation and strategies for ecosystem preservation, are central to the learning process. Students will be equipped with the skills to summarize watershed management plans, prioritize conservation needs, and apply management frameworks that balance economic and ecological benefits. 1. Understanding the study materials of Montane Watershed Management (1ST meeting) **(CLO-1)** 2. Classifying upper watersheds as providers and regulators of water resources and ecosystem functions for degradation prevention (2nd) **(CLO-1)**

<table>
<tr><td></td><td>3. Detailing and combining responses to climate change factors (3rd) (CLO-2)
4. Analyzing strategies and policies for management and community participation in upper watershed management (4th) (CLO-2)
5. Designing adaptation strategies for water resource management and predicting climate change impacts (5th) (CLO-3)
6. Adapting strategies for managing the impacts of climate change on water governance (6th) (CLO-3)
7. inking hydrological modeling with climate change threats (7th) (CLO-3)
8. Mid-Term Exam (8th)
9. Linking hydrological modeling with anthropogenic threats and pressures (9th) (CLO-3)
10. Abstracting and demonstrating the impact of deforestation on the hydrological cycle (10th) (CLO-3)
11. Abstracting and demonstrating the impact of deforestation on erosion-sedimentation and runoff events (11th) (CLO-3)
12. Assessing the main causes of floods and landslides (12th) (CLO-3)
13. Designing ecosystem management systems for protection and utilization in the upper watershed region (13th) (CLO-4)
14. Summarizing upper watershed management plans based on soil and water conservation principles (14th) (CLO-4)
15. Summarizing opportunities for utilizing ecosystem services in the upper watershed region (15th) (CLO-4)
16. Final Exam (16th)</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Practical</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignments/Case Studies</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Projects:</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-Term Exam</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final Exam</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
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<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Agasssi, M. 1996. Soil Erosion: Conservation and Rehabilitation. Marcel Dekker, Inc. New York.
2. Anonim, 1993. Petunjuk Teknis Evaluasi Lahan. Pusat Penelitian Tanah dan Agroklimat Departemen Pertanian. Bogor.
3. Arsyad, S. 2010. Konservasi Tanah dan Air. Penebit IPB, Bogor.
4. Asdak, C. 1995. Hidrologi dan Pengelolaan Daerah Aliran Sungai (DAS). Gadjah Mada University Press. Yogyakarta.
5. Birdges, M.E. ect. 2001. Response to Land Degradation. Science Publisher Inc.
6. Brooks, KX, P. F. Folliott, H.M. Gregersen, dan J.L. Thames. 1992. Hydrology and the Management of Watersheds. Iowa State Univ. Press, Ames, Iowa, USA.
7. Foth, H.D. Dasar Dasar Ilmu Tanah. Edisi VII. GajahMada Press, Yogyakarta. 781 h.</td></tr>
</table>

	8. Harjowigeno, S.1993.Ilmu Tanah.Edisi Revisi. PT Mediya Tama Sarana Perkasa, Jakarta. 233 h. 9. Kartasapoetra, A.G. 1989. Kerusakan Tanah Pertanian dan Usaha Untuk Merehabilitasinya. Bina Aksara, Jakarta. 235 h. 10. Kartasapoetra,G., Kartasapoetra, A.G. dan Sutedjo, M.M., 2000. Teknologi Konservasi Tanah dan Air. Penerbit Rineka Cipta, Jakarta 11. Kepmenhut Nomor: 7211/Kpts-II/2002 tentang Pedoman Penyusunan Master Plan Rehabilitasi Hutan dan Lahan (MP-RHL) Daerah. 12. Lal, R. (ed.), 1997. Integrated Watershed Management in The Global Ecosystem. SWC Society. CRC Press. Boca Raton, London, New York, Washington, DC. 13. Lal, R., W.H. Blum, C. Valentine, B.A. Stewart. 1998. Methods for Assessment of Soil Degradation. Advances in Soil Science. CRC Press. 14. Nugroho,S.P. 2000. Minimalisasi Lahan Kritis melalui Pengelolaan Sumberdaya Lahan dan Konservasi Tanah dan Air secara Terpadu. 15. Permenhut: P.32/2009, P.39/2009, P.39/2010, P.4/2011, P.12/2012, P.32/2009, P.60/2014. 16. Permenhut: P.32/2009, P.39/2009, P.39/2010, P.4/2011, P.12/2012, P.32/2009, P.60/2014. 17. Rahim, S. E., 2000. Pengendalian Erosi Tanah dalam Rangka Pelestarian Lingkungan Hidup. Bumi Aksara Jakarta. 18. Sanchez, P.A. 1993. Sifat dan Pengelooan Tanah Tropika. Jilid 2. ITB, Bandung. 303 h. 19. Seta, A.K., 1991. Konservasi Sumberdaya Tanah dan Air. Penerbit Kalam Mulia, Jakarta. 20. Suprayogi, S., S. Purnama, D. Darmanto. 2015. Pengelolaan Daerah Aliran Sungai. UGM Press. ISBN: 979-420-866-3. 21. Suripin, 2002. Pelestarian Sumberdaya Tanah dan Air. Penerbit ANDI. Yogyakarta. 22. Undang-Undang Nomor 41 Tahun 1999. 23. Peraturan Pemerintah Republik Indonesia Nomor 23 Tahun 2021 tentang Penyelenggaraan Kehutanan. 24. Peraturan Menteri Kehutanan Nomor P.61/Menhut-II/2014 tentang Monitoring dan Evaluasi Pengelolaan Daerah Aliran Sungai. 25. Peraturan Menteri Kehutanan Nomor P.17/Menhut-II/2014 tentang Tata Cara Pemberdayaan Masyarakat Dalam Kegiatan Pengelolaan Daerah Aliran Sungai. 26. Peraturan Pemerintah Republik Indonesia Nomor 37 Tahun 2012 Tentang Pengelolaan DAS. 27. Peraturan Menteri Kehutanan Republik Indonesia Nomor : P. 60/ Menhut-II/2013 tentang Tata Cara Penyusunan dan Penetapan Rencana Pengelolaan Daerah Aliran Sungai. 28. Other Reference/Article related about *Montaneus Watershed Management)*

Course Module

Conservation of Natural Resources and Ecosystem

Faculty of Forestry

Mulawarman University

Module name	Conservation of Natural Resources and Ecosystem
Module level, if applicable	Doctoral
Code, if applicable	
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in which the module is taught	Odd/Even Semesters
Person responsible for the module	Triyono Sudarmadji
Lecturer	1. Chandradewana Boer 2. Triyono Sudarmadji 3. Rachmat B.Suba 4. Yaya Rayadin
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	**2 SKS / 3.2 ECTS** Credit points: Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1**. ILO-1** - Internalize scientific values, norms, and ethics **Knowledge** 2. **ILO-2** - Synthesize knowledge obtained from research results with its novelty and implementation 3. **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **ILO-4** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **ILO-5** -Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Course Learning Outcome (CLO)** **<u>Knowledge</u>** **CLO1**: Provide knowledge and skills to summarize the definition and scope of natural resources (NR), their classification and characteristics, as well as strategies for the utilization and conservation of NR; analyze and synthesize the scope of ecology, concepts, and disturbances to ecosystems. **<u>General Skills</u>** **CLO-3:** Analyze biodiversity in Indonesia and globally, the causes and processes of biodiversity degradation, ex-situ and in-situ conservation, handling productivity, stability, sustainability, and equity issues in ecological systems that support eco-development for terrestrial and aquatic environments. **CLO-2**: Design ecosystem conservation strategies, analyze the level of damage to forest ecosystems and their environment; assess and evaluate the utilization and conservation of biodiversity, environmentally-conscious development models, and the dignity of natural resource utilization. **CLO-5**: Analyze and design efforts to restore degraded ecosystems, including biological conservation and rehabilitation of degraded landscapes, as well as evaluate environmental economic policies in development. **<u>Attitude</u>** **CLO-4:** Analyze the vulnerability and typology of ecosystems in development in Indonesia, as well as analyze the causes and processes of landscape degradation.
Content	This course explores the principles of natural resource and ecosystem conservation, covering their classification, characteristics, and sustainable utilization strategies. Students will analyze ecological concepts, ecosystem disturbances, and forest ecosystem degradation. The course also examines biodiversity conservation at national and global levels, including ex-situ and in-situ conservation methods.

<table>
<tr><td></td><td>Additionally, students will assess the vulnerability and typology of ecosystems, the causes of landscape degradation, and strategies for ecosystem restoration. The course integrates environmental economic policy analysis to support sustainable development. Learning activities include theoretical discussions, case studies, and practical evaluations, with mid-term and final assessments to measure comprehension and application.
1. Presentation of the Semester Learning Plan (RPS) for the Natural Resource and Ecosystem Conservation course along with the learning contract (1ST meeting) (CLO-1)
2. Definition and scope of natural resources (NR), classification and characteristics, and strategies for utilization and conservation (2nd) (CLO-1)
3. Analysis and synthesis of the scope of ecology, concepts, and disturbances to ecosystems (3rd) (CLO-1)
4. Analysis and design of ecosystem conservation strategies for natural resources (4th) (CLO-2)
5. Analysis of forest ecosystem damage and its environment (5th) (CLO-2)
6. Evaluate the utilization and conservation of biodiversity, environmentally-conscious development models, and the dignity of natural resource utilization (6th) (CLO-2)
7. Analysis of biodiversity in Indonesia and globally, and the causes and processes of biodiversity degradation (7th) (CLO-3)
8. Mid-Term Exam (8th)
9. Designing ex-situ and in-situ conservation, addressing productivity, stability, sustainability, and equity in ecological systems supporting eco-development (9th) (CLO-3)
7. Analysis of the vulnerability and typology of ecosystems in development activities (10th) (CLO-4)
8. Analysis of the causes and processes of landscape degradation (11th) (CLO-4)
9. Synthesis of various causes and processes of landscape degradation (12th) (CLO-4)
10. Designing alternative ecosystem restoration strategies for landscapes (13th) (CLO-5)
11. Analyze and design efforts to restore degraded ecosystems, including biological conservation and rehabilitation of degraded landscapes (14th) (CLO-5)
12. Analysis and design of environmental economic policy evaluations in land development (15th) (CLO-5)
13. Final Exam (16th)</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Studies</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Projects:</td><td>Report</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Term Exam</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Exam</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
</table>

Media employed	Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR
Reading list	1. Harjowigeno, S.1993.Ilmu Tanah. Edisi Revisi. PT Mediya Tama Sarana Perkasa, Jakarta. 233 h. 2. Foth, H.D. Dasar Dasar Ilmu Tanah. Edisi VII. GajahMada Press, Yogyakarta. 781 h. 3. Anonim, 1993. Petunjuk Teknis Evaluasi Lahan. Pusat Penelitian Tanah dan Agroklimat Kerjasama dengan Proyek Pembangunan Penelitian Pertanian Nasional. Badan Penelitian dan Pengembangan Pertanian. Departemen Pertanian. Bogor. 4. Heathcote, Isobel W.. 1998. Integrated Watershed Management, Principles and Practice. John Wiley & Sons, Inc. New York. 5. Troeh,F.R., Hobbs, J. A., dan Donahue R.,L., 1980. Soil and water Conservation for Productivity and Environmental Protection. Prentice-Hall, Inc., Engelwood Cliffs, New Jersey. 07632 6. Morgan, R.P.C. 2005. Soil Erosion and Conservation. Third Edition. Blackwell Publishing. 7. Arsyad, S., 2010. Konservasi Tanah dan Air. Edisi Kedua IPB Press, Bogor. 8. Kementrian Lingkungan Hidup dan Kehutanan, 2014. Undang Undang No. 37 Tahun 2014 Tentang Konservasi Tanah dan Air, Jakarta. 9. Undang Undang No. 5 Tahun 1990 Tentang : Konservasi Sumberdaya Alam Hayati Dan Ekosistemnya Oleh : PRESIDEN REPUBLIK INDONESIA Nomor : 5 TAHUN 1990 (5/1990) Tanggal : 10 AGUSTUS 1990 (JAKARTA) 10. Alikodra, HS. 2012. Konservasi Sumberdaya Alam dan Lingkungan: Pendekatan Ecosophy Bagi Penyelamatan Bumi 11. Anthony, R.E.S., John, M.F., dan Graeme, C., 2006. Wildlife Ecology, Conservation, and Management. Second Edition. Blackwell Publishing. 12. Cunningham, W.P. dan Saigo B.W. 1999. Environmental Science.Wm. C. Brown Publishers. London Dharam P.A (Ed.). 2014. Integrated Pest Management: Current Concepts and Ecological Perspective. Elsevier Inc. 13. Indrawan, M., R. B. Primack, J. Supriatna. 2007. Biologi Konservasi. Yayasan Obor Indonesia. Jakarta. IUCN. 1980. 14. World Conservation Strategy. IUCN, UNEP, WWF, FAO dan Unesco 15. Kementerian Perencanaan Pembangunan Nasional / BAPPENAS. 2016. Indonesia Biodiversity Strategy and Action Plan 2015-2025. 16. MacKinnon, J., K. MacKinnon, G. Child, dan J. Thorsell. 1993. Pengelolaan Kawasan yang Dilindungi di Daerah Tropika. Gajah Mada University Press. Yogyakarta 17. Other Reference/Article related about *Conservation of Natural Resources and Ecosystem*

Course Module

Technique and Impact of Harvesting

Faculty of Forestry

Mulawarman University

Module name	Technique and Impact of Harvesting
Module level, if applicable	Doctorate
Code, if applicable	220401903P023
Subtitle, if applicable	-
Courses, if applicable	Regular
Semester(s) in which the module is taught	The subject is available throughout all academic semesters
Person responsible for the module	Prof. Dr. Yosep Ruslim, M.Sc.
Lecturer	Prof. Dr. Yosep Ruslim, M.Sc. Ali Suhardiman, S.Hut., M.P., Ph.D.
Language	Indonesia
Relation to curriculum	Elective Course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of: - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	Credit points: 3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)**

	1. **ILO1 (A1) -** Internalizing values, norms, and ethics in Knowledge **Knowledge (K)** 2. **ILO2 (K1) -** Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2) -** Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **General Skills (GS)** 4. **ILO4 (GS1) -** Able to criticize the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **ILO5 (GS2) -** Able to demonstrate academic leadership in resource management for independently compiling a dissertation, and possessing scientific ethics **Specific Skills (SS)** 6. **ILO6 (SS1) -** Able to manage data and information to support decision-making processes **Content Learning Outcome (CLO)** 1. **CLO1:** Students are able to analyze harvesting techniques, their impacts, and perform cost and financial feasibility analyses of forest harvesting activities. **ILO6 (SS1).** 2. **CLO2:** Students are able to evaluate and develop sustainable forest harvesting plans, including Reduced Impact Logging (RIL) and its comparison to conventional methods. **ILO3 (K2).** 3. **CLO3:** Students are able to analyze logging activities and forest degradation as sources of carbon emissions, using satellite imagery and emission estimation methods. **ILO2 (K1).** 4. **CLO4:** Students are able to understand and apply forestry economic concepts, including production costs, market dynamics, and time value of money calculations. **ILO4 (GS1).** 5. **CLO5:** Students are able to calculate and assess carbon emissions and uncertainties from harvesting activities, including felling, skidding, hauling, and logging waste. **ILO5 (GS2).**
Content	This course provides students with an in-depth understanding of forest harvesting techniques, their environmental and economic impacts, and sustainability considerations. The course begins with an introduction to harvesting operations, their scope, and cost analysis, progressing towards carbon emissions from logging activities, topographic influences on harvesting, and comparisons between Reduced Impact Logging (RIL) and conventional methods. Students will explore the role of satellite data in monitoring forest degradation and learn carbon accounting methodologies, including the Gain-Loss and Stock-Difference approaches. The course also covers forestry economics, including cost analysis, financial feasibility, and

<table>
<tr><td></td><td>timber pricing models, equipping students with the ability to assess the profitability and sustainability of forest harvesting. Through case studies, research presentations, and practical applications, students will develop critical analytical skills to support decision-making in modern forestry practices. The course includes a midterm and final examination to assess students' understanding and application of the concepts.

1. Contract and Introduction to Forest Harvesting and Its Impacts (1st session) → CLO1
2. Techniques and Scope of Forest Harvesting and Cost Analysis in Forest Harvesting (2nd and 3rd sessions) → CLO1
3. Carbon Emissions from Logging Activities (4th session) → CLO3
4. Influence of Landscape Potential and Topography on Harvesting Techniques (5th session) → CLO1
5. Reduced Impact Logging (RIL) vs. Conventional Harvesting Methods (6th and 7th sessions) → CLO2
6. Midterm Examination (UTS) (8th session) → Assessment
7. Forest Degradation from Logging Infrastructure and Satellite Data Analysis (9th session) → CLO3
8. Carbon Emission Estimation Using Gain-Loss and Stock-Difference Methods (10th session) → CLO5
9. Calculating Carbon Emissions from Felling, Skidding, Hauling, and Logging Waste (11th session) → CLO5
10. Introduction to Forestry Economics: Production, Demand, and Marginal Analysis (12th session) → CLO4
11. Cost Analysis: Fixed and Variable Resources, Time Value of Money (13th session) → CLO4
12. Financial Feasibility Theory and Calculations in Forest Harvesting & Annual Net Revenue and Timber Pricing Models (14th session) → CLO1
13. Research Presentation and Discussion on Forest Harvesting (15th session) → CLO2
14. Final Examination (UAS) (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of the learning process are following scheme 5 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Laboratory Practice/Fieldwork</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignment/Case Study</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Project</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Laptop, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Agus F, I. Santosa, S. Dewi, P. Setyanto, S. Thamrin, Y. C. Wulan, F. Suryaningrum (eds.). 2013. Pedoman Teknis Penghitungan Baseline</td></tr>
</table>

Emisi dan Serapan Gas Rumah Kaca Sektor Berbasis Lahan: Buku I Landasan Ilmiah. Badan Perencanaan Pembangunan Nasional, Republik Indonesia. Jakarta. Tersedia di http://ranradgrk.bappenas.go.id/rangrk/admincms/downloads/publications/Pedoman_teknis_penghitungan_baseline_emisi_dan_serapan_GRK_sektor_berbasis_lahan 1.pdf. Diakses pada 16 Januari 2019.

2. Brown, N, C, 1958, Logging. The principles and methods of timber harvesting in the United States and Canada, John Wiley & Sons, Inc, New York.
3. Elias. 2002. Wood harvesting damages, regeneration, and growth in the residual stand of dipterocarpa forest (A case study in the forest concession area of PTNarkata Rimba, East Kalimantan, Indonesia); In Book 1 Reduced Impact Logging. IPB Press, Bogor, Indonesia.
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5. Ellis PW, Gopalakrishna T, Goodman RC, Putz FE, Roopsind A, Umunay PM, Zalman J, Ellis EA, Mo K, Gregoire TG, and Griscom BW. 2019a. Reduced-impact logging for climate change mitigation (RIL-C) can halve selective logging emissions from tropical forest. Forest Ecology and Management 438:255-266.
6. Ellis EA, Montero SA, Gomez IUH, Montero JAR, Ellis PW, Rodriguez-Ward D, and Reyes PB. 2019b. Reduced-impact logging practices reduce forest disturbance and carbon emissions in community managed forest on the Yucatan Peninsula, Mexico. Forest Ecology and Management 437:396-410.
7. Griscom, B., Ellis P, Putz F., Halperin J. 2011. Emissions and Potential Emissions Reductions from Logging Concessions of East Kalimantan, Indonesia.
8. Griscom, B., Ellis P, Putz F. 2014. Carbon Emissions Performances of Commercial Logging in East Kalimantan, Indonesia. Global Change Biology 20: 923-937. Doi:10.1111/gcb.12386
9. Griscom, BW, Ellis PW, Burivalova Z, Halperin J, Marthinus D, Runting RK, Ruslandi, Shoch D, and Putz EF. 2019. Reduced-impact logging in Borneo to minimize carbon emissions and impacts on sensitive habitats while maintaining timber yields. Forest Ecology and Management 438:176-185.
10. Goodman RC, Aramburu MH, Gopalakrishna T, Putz FE, Gutierrez N, Alvarez JLM, Aguilar-Amuchastegui N, and Ellis PW. 2019. Carbon emissions and potential emissions reductions from low-intensity selective logging in southwestern Amazonia. Forest Ecology and Management 439:18-27.
11. Healey, J. R., Price, C. and Tay, J. 2000. The cost of carbon retention by reduced impact logging. Forest Ecology and Management Journal. 139, 237-255.
12. Hertianti, E. 2005. Studi penyaradan kayu dengan sistem monokabel (Mesin Pancang) di kampung Sungai Linuq Kecamatan Tabang

Kabupaten Kutai Kertanegara. [tesis]. Samarinda: Program Pasca Sarjana Unmul. Samarinda.
13. Holmes T. P., Boltz, F., dan Carter, D. R. 2001. Financial indicators of reduced impact logging performance in Brazil. FAO. Bangkok. Tahiland. Di dalam: International Conference Proceedings, Kuching, Malaysia, 26 Februari – 1 Maret 2001. hlm 141-150.
14. Jalal, S.P. 2002. Studi penyaradan kayu dengan sistem Kabel (Studi kasus di areal PT. Sumalindo Lestari Jaya II. Long Bagun Kaltim). [tesis]. Samarinda:Program Pasca Sarjana Universitas Mulawarman
15. John, J. S., Barreto, P. and Uhl, C. 1996. Logging damage during planned and unplanned logging operations in the eastern Amazon. Forest Ecology and Management Journal, hlm. 59-77.
16. Muhdi. 2008. Dampak pemanenann kayu dengan sistem reduced impact logging terhadap pemadatan tanah di Kalimantan Barat. Journal Rimba Kalimantan. Juni 2008, hlm. 42-45.
17. Pinard, M.A., Putz, F. E. and Tay, J. 2000. Lessons learned from the implementation of reduced impact logging in hilly terrain in Sabah, Malaysia. International Forestry Review Journal. hlm. 33-39.
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20. Putz, F.E., Zuidema, P. A., Pinard. M.A., Boot, R.G.A., Sayer, J.A., Sheil. D., Sist, P., Elias and Vanclay, J. K. 2008b. Improved tropical forest management for carbon retention. Perspective, PLOS Ecology Journal.
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22. Putz FE, Baker T, Griscom BW, Gopalakrishna T, Roopsind A, Umunay PM, Zalman J, Ellis EA, Ruslandi, Ellis PW. 2019. Intact forest in selective logging landscape in the tropics. Frontiers in forest and global change. 2(30): 1-10.
23. Ruchanda, A. 1993. Studi komposisi dan struktur tegakan sebelum dan sesudah pemanenann kayu dengan sistem silvikultur tebang pilih tanam Indonesia (TPTI) di Areal HPH PT. Narkata Rimba (Alas Kusuma Grup) Kalimantan Timur.
24. Ruslim, Y., Hinrichs. A. dan Sulistioadi, B. 2000. Studi implementasi reduced impact tractor logging. SFMP Document No. 01b.
25. Ruslim Y. Petunjuk Teknis pembuatan topografi. SFMP Document No. 10a.
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27. Ruslim, 2013. Petunjuk Teknis Penggunaan Mesin Pancang Tarik (Monocable Winch). Kementrian Kehutanan Jenderal Bina Usaha Kehutanan Direktorat Bina Usaha Hutan alam.

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31. Sist, P. and Ferreira, F. N. 2007. Sustainability of reduced-impact logging in Eastern Amazon. Forest Ecology and Management Journal. 243, 199-209.
32. Tinambunan, D. 2008. Teknologi tepat guna dalam pemanenann hutan di Indonesia: perkembangan, keunggulan, kelemahan dan kebijakan yang diperlukan untuk optimalisasi pemanfaatannya. Jurnal analisis kebijakan kehutanan, Vol. 5. No. 2, Agustus 2008: hlm. 59-76.
33. Umunay PM, Gregoire TG, Gopalakrishna T, Ellis PW, Putz FE 2019. Selective logging emissions and potential emission reductions from reduced-impact logging in the Congo Basin. Forest Ecology and Management 437: 360-371
34. Yu A, Gallagher T, Mitchell D, O'neal B. 2016. Application of a Small-Scale Equipment System for Biomass Harvesting. Small scale Forestry.
35. Zalman J, Ellis PW, Crabbe S, and Roopsind A. 2019. Opportunities for carbon emissions reduction from selective logging in Suriname. Forest Ecology and Management 439:9-17.

Course Module

Economic and Social Analysis of Forest Management

Faculty of Forestry

Mulawarman University

Module name	Economic and Social Analysis of Forest Management
Module level, if applicable	Doctoral
Code, if applicable	
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Prof. Dr. Rujehan, MP
Lecturer	1. Prof. Dr. Mustofa Agung Sardjono 2. Prof. Dr. Rujehan, M.P. 3. Dr. Hut. Rochadi Kristiningrum, S.P., M.P.
Language	Indonesian
Relation to curriculum	Matriculation, compulsory for non-forestry background
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 3 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 5.4 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **CPL2/ILO2 (A2) -** Internalize values, norms, and ethics in Knowledge **Knowledge (K)** 2. **CPL2/ILO2 (K1) -** Synthesize knowledge acquired from research findings with novelty and its implementation. 3. **CPL3/ILO3 (K2) -** Discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions. **General Skills (GS)** 4. **CPL4/ILO4 (GS1)** – Critically analyze the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches. **5. CPL5/ILO5 (GS2) -** Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics. **Specialized Skills (SS)** **6. CPL6/ILO6 (SS1)** - Manage data and information to support decision-making processes. **Course Learning Outcome (CLO)** 1. **CLO1:** Understand and analyze the theoretical concepts of forestry economics – Students will be able to explain the scope, objectives, and paradoxes of forestry, as well as apply various forestry economic models, financial planning, and business approaches in forest management. 2. **CLO2:** Apply economic and financial assessment methods to forestry projects – Students will be able to identify and evaluate project inputs and outputs, apply concepts of time preference and interest rates (compounding, discounting, sinking fund, capital recovery), and calculate nominal return rates in forestry investments. 3. **CLO3:** Evaluate the financial feasibility of forest-related projects – Students will be able to conduct economic and financial analyses using Payback Period, Net Present Value (NPV), Net Benefit-Cost Ratio (Net B/C), and Internal Rate of Return (IRR) to assess the viability of forestry projects. 4. **CLO4:** Analyze the concepts, regulations, and implementation of Social Forestry – Students will be able to explain the definition,

<table>
<tr><td></td><td>objectives, and schemes of Social Forestry, interpret the Indicative Map of Social Forestry Areas (PIAPS), and understand relevant policies and regulations.
5. CLO5: Develop strategies for the application and implementation of Social Forestry schemes – Students will be able to assess the procedural aspects of Social Forestry applications and analyze its implementation, including stakeholder engagement and sustainability strategies.</td></tr>
<tr><td>Content</td><td>The Economic and Social Analysis of Forest Management course is a compulsory course for doctoral students in Forestry Science with a credit weight of 3 SKS (2-1). This course enables students to explain the theoretical concepts of forest economics along with relevant models, analyze the time value of money in forest-related projects or activities, and assess the financial feasibility of forest stands. Additionally, students will understand the definition, objectives, and schemes of Social Forestry, including the Indicative Map of Social Forestry Areas (PIAPS) and its governing regulations, as well as the procedures for applying for Social Forestry schemes and their implementation. Learning activities are conducted through classroom lectures and practical sessions, with assessments based on student participation in lectures, class discussions and Q&A sessions, discipline and attendance, mid-term and final exams, and structured assignments.

In details:
1. Theoretical Concepts of Forestry Science – Scope and objectives, forestry paradox, forestry economic models, financial aspects, and business approach planning in forestry.
2. Project Identification and Assessment – Evaluating input and output; time preference concepts; interest rates: compounding, discounting, sinking fund, capital recovery, compounding for annual interest rate (i), present worth/value of annuity, and nominal return rate.
3. Economic and Financial Analysis – Understanding the differences and similarities in economic and financial analysis, including Payback Period, Net Present Value (NPV), Net Benefit-Cost Ratio (Net B/C), and Internal Rate of Return (IRR).
4. Mid-Semester Test
5. Social Forestry – Definition, objectives, and schemes.
6. Indicative Map of Social Forestry Areas (PIAPS) – Regulations governing social forestry.
7. Application Procedures for Social Forestry Schemes – Implementation of social forestry programs.
8. Final Examination</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Lecture Participation</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
</table></td></tr>
</table>

	3	Project	Presentation	25
	4	Mid-Semester Test	Written test	15
	5	Final Examination	Written test	25
	Total			100
Media employed	Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR			
Reading list	1. Lahjie AM. 2016. Teknik Agroforestri. Samarinda: Mulawarman University Press. 2. Lahjie AM, Lepong A, Simarangkir BDAS, Kristiningrum R, Ruslim Y. 2018. Community forest management: Comparison of simulated production and financial returns from agarwood, tengkawang and rubber trees in West Kutai, Indonesia. Biodiversitas 19(2). 3. Lisna A, Lahjie AM, Simarangkir BDAS, Yusuf S, Ruslim Y. 2017. Agroforestry System Biodiversity of Arabica Coffe Cultivation in North Toraja District, South Sulawesi, Indonesia. Biodiversitas 18(2). 4. Winarni B, Lahjie AM, Simarangkir BDAS, Yusuf S, Ruslim Y. 2017. Tengkawang cultivation model in community forest using agroforestry systems in West Kalimantan, Indonesia. Biodiversitas 18 (2). 5. Musmuliadi, Lahjie AM, Simarangkir BDAS, Yusuf S, Ruslim Y. 2017. Bioeconomic and Enviromental Valuation Of Dipterocarp Estate Forest Based on Local Wisdom in Kutai Kartanegara, Indonesia. Biodiversitas. 6. Sukirno S. 2013. Pengantar Ekonomi Mikro. Edisi Keempat: Jakarta: Raja Grafindo 7. Husnah, S dan Suwarsono. 1999. Studi Kelayakan Proyek. UPP AMP YKPN, Yogyakarta 8. Van Gardingen PR, McLeish MJ, Philips PD, Fadilah D, Tyrie G, Yasman I. 2003. Financial and ecological analysis of management options for logged-over dipterocarp forest in Indonesia Borneo. For Ecol Manag 183: 1-29. 9. Dingga E. 2014. On a possible predictor of the cyclical position of the economy. Procedia Econ Financ 8, 254-261. 10. Pearce DW, Moran D. 1994. The economic value of biodiversity. Earth scan, London 11. Saragih, B. 2011. Economic value of non-timber forest products among Paser Indigenous People of East Kalimantan. Belanda: University of Leiden 12. Kristiningrum R, Lahjie A, Masjaya, Yusuf S., Ruslim Y. 2019. Species diversity, stand productivity, aboveground biomass and economic value of mangrove ecosystem in Mentawir Village, East Kalimantan, Indonesia. Biodiversitas 20 (10): 2848-2857.[Indonesian]. 13. Ardiansyah. 2017. Perhutanan Sosial: Pengertian, Skema, PIAPS dan Implementasi. https://foresteract.com/perhutanan-sosial/3/			



Course Module

Physiological Forest Pathology

Faculty of Forestry

Mulawarman University

Module name	Physiological Forest Pathology
Module level, if applicable	Doctoral
Code, if applicable	190401902P034
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Dr.rer.nat. Harmonis, S.Hut., M.Sc.
Lecturer	1. Dr.rer.nat. Harmonis, S.Hut., M.Sc. 2. Dr. Ir. Djumali Mardji, M.Agr.
Language	Indonesian
Relation to curriculum	Matriculation, compulsory for non-forestry background
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **CPL1/ILO1 (A1) -** Internalizing values, norms, and ethics in Knowledge **Knowledge (K)** 2. **CPL2/ILO2 (K1) -** Synthesize knowledge acquired from research findings with novelty and its implementation.

	3. **CPL3/ILO3 (K2) -** Discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions. **General Skills (GS)** 4. **CPL4/ILO4 (GS1)** – Critically analyze the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches. **5. CPL5/ILO5 (GS2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics. **Specialized Skills (SS)** **6. CPL6/ILO6 (SS1)** - Manage data and information to support decision-making processes. **Course Learning Outcome (CLO)** 1. **CLO1:** Analyze and identify the physiological effects of various pathogen-induced stresses on plants – Students will be able to assess how different pathogens impact plant physiology, including biochemical and structural changes. 2. **CLO2:** Evaluate key factors influencing fungal reproduction and proliferation – Students will be able to analyze environmental and biological conditions that determine fungal growth and reproductive success. 3. **CLO3:** Examine the infection processes and consequences of viral and fungal pathogens – Students will be able to assess the mechanisms of pathogen invasion, plant defense responses, and the resulting impact on plant health and productivity. 4. **CLO4:** Develop strategic measures for preventing and managing pathogen attacks – Students will be able to propose effective prevention and control strategies to mitigate the effects of plant diseases caused by pathogens.
Content	This course covers Forest Disease Classification, the Effects of Pathogens on Plant Physiological Functions, Spore Production in Fungi, Fungal Spore Germination, Fungal and Viral Infections in Hosts, Plant Defense Systems Against Pathogen Attacks, and Predisposition (*Pradisposisi*). The detail of the contents is below: 1. Forest Disease Classification – Causes, symptoms, and resulting damage. 2. Impact of Pathogens on Plant Physiological Functions – Plant responses to environmental conditions and temperature stress. 3. Impact of Pathogens on Plant Physiological Functions (Continued) – Plant responses to oxygen deficiency and light stress.

<table>
<tr><td></td><td>4. Impact of Pathogens on Plant Physiological Functions (Continued) – Plant responses to herbivory and the effects of infection on host cells.
5. Impact of Pathogens on Plant Physiological Functions (Continued) – Photosynthesis and respiration in diseased plants.
6. Impact of Pathogens on Plant Physiological Functions (Continued) – Transpiration, water and nutrient translocation, and plant reproduction in infected plants.
7. Mid-Semester Exam.
8. Spore Production in Fungi – Effects of air temperature, humidity, light, oxygen, hydrogen ion concentration, carbon, nitrogen, and vitamins.
9. Fungal Spore Germination – Germination process and influencing factors.
10. Fungal and Viral Infections in Hosts – Infection process, pathogen chemical weapons, enzymatic degradation of cell wall and cell contents, microbial toxins, and their effects on host plants.
11. Plant Defense Systems Against Pathogens – Passive and active defense mechanisms.
12. Predisposition (Pradisposisi) – Factors affecting plant susceptibility to disease.
13. Final Examination.</td></tr>
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<tr><td>Reading list</td><td>1. Abeygunawardena, D.V.W. and R.K.S. Wood. 1957. Factors affecting the germination of sclerotia and mycelial growth of Sclerotium rolfsii Sacc.
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</table>

Dalam: “Physiological plant pathology”, (R. Heitefuss and P.H. Williams, eds.). h 51-85. Springer-Verlag Berlin, Heidelberg.
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Module name	Biodiversity and Potential Utilization of Butterflies
Modul level, if applicable	Doctoral
Code, if applicable	190401902P035
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Dr.rer.nat. Harmonis, S.Hut., M.Sc.
Lecturer	1. Dr.rer.nat. Harmonis, S.Hut., M.Sc. 2. Dr. Ir. Djumali Mardji, M.Agr.
Language	Indonesian
Relation to curriculum	Matriculation, compulsory for non-forestry background
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **CPL1/ILO1 (A1) -** Internalizing values, norms, and ethics in Knowledge **Knowledge (K)** 2. **CPL2/ILO2 (K1) -** Synthesize knowledge acquired from research findings with novelty and its implementation.

	3. **CPL3/ILO3 (K2) -** Discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions. **General Skills (GS)** 4. **CPL4/ILO4 (GS1)** – Critically analyze the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches. **5. CPL5/ILO5 (GS2) -** Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics. **Specialized Skills (SS)** **6. CPL6/ILO6 (SS1) -** Manage data and information to support decision-making processes. **Course Learning Outcome (CLO)** 1. **CLO1: Analyze factors influencing butterfly biodiversity** – Students will be able to assess ecological, environmental, and anthropogenic factors that impact butterfly species diversity and distribution. 2. **CLO2: Evaluate habitat management systems for butterflies in tropical forest ecosystems** – Students will be able to examine and assess various habitat conservation and restoration strategies to support butterfly populations. 3. **CLO3: Design habitat management systems to preserve butterfly biodiversity** – Students will be able to develop conservation strategies for butterflies, particularly species with conservation status, ensuring their long-term survival within forest ecosystems. 4. **CLO4: Develop sustainable utilization strategies for butterfly biodiversity** – Students will be able to design approaches for leveraging butterfly biodiversity in ways that benefit human welfare while maintaining ecosystem sustainability.
Content	This course covers butterfly biodiversity and biogeography, conservation status, feeding habits, and host plants, as well as habitat types, climatic factors, and taxonomic, morphological, anatomical, biological, and ecological characteristics of butterflies. Additionally, the course explores the roles and potential utilization of butterflies as pollinators, bioindicators, and strategies for butterfly farming and development. The detail of the contents are below: 1. Butterfly Biodiversity and Biogeography – Distribution patterns and diversity of butterfly species. 2. Conservation Status and Characteristics – Threat levels, protection efforts, and conservation strategies.

<table>
<tr><td></td><td>
3. Taxonomic and Morphological Characteristics of Butterflies – Key families: Nymphalidae, Papilionidae, Pieridae, Lycaenidae, Hesperiidae, Riodinidae.
4. Anatomical Characteristics of Butterflies – Comparative anatomy across butterfly families: Nymphalidae, Papilionidae, Pieridae, Lycaenidae, Hesperiidae, Riodinidae.
5. Biological and Ecological Characteristics of Butterflies – Life cycle, behavior, and ecological interactions of Nymphalidae, Papilionidae, Pieridae, Lycaenidae, Hesperiidae, Riodinidae.
6. Mid-Semester Exam.
7. Habitat Types – Ecosystem types, succession stages, elevation gradients, and latitudinal gradients affecting butterfly distribution.
8. Feeding and Host Plants – Feeding patterns, food types (herbivorous, frugivorous, geophagic), and protective host plants.
9. Role as Pollinators – Taxonomic pollinator groups, pollination targets, pollination spectrum, and introduction of pollinators.
10. Butterflies as Bioindicators – Role in ecosystem monitoring, identification of bioindicator species, and indicator taxa.
11. Butterfly Farming and Utilization – Concepts of butterfly educational gardens, specimen utilization, and contributions to conservation efforts.
12. Final Examination.
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<tr><td>Reading list</td><td>

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2. Banaszak J (2000) Pollinating insects (Apoidea) from “Puszcza Zielonka” Landscape Park, Poland. In: Banaszak J (ed.) Ecology of Forest Islands. Bydgoszcz Pedagogical University Press, Bydgoszcz
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</td></tr>
</table>

1001–1012
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Module name	Management of Forest Productivity
Module level, if applicable	Doctoral
Code, if applicable	220401903P024
Subtitle, if applicable	
Courses, if applicable	Regular
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	
Lecturer	
Language	Indonesia, English
Relation to curriculum	Elective Courses
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	
Recommended prerequisites	
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 3. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches

<table>
<tr><td></td><td>4. CPL5/ILO5 (KU2) - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics

Course Learning Outcome (CLO)
1. CLO 1 :. Students will be able to understand and articulate the fundamental concepts of forest productivity management, setting a foundation for advanced topics in the course.
2. CLO 2 : Students will demonstrate the ability to apply silvicultural techniques effectively in field settings to address ecological factors and enhance forest productivity.
3. CLO 3 : Students will integrate modern information technology tools into forest productivity management, showcasing their ability to use IT to optimize operations and decision-making processes.</td></tr>
<tr><td>Content</td><td>The "Management of Forest Productivity" course is designed to equip students with the essential knowledge and practical skills necessary for effective forest productivity management. Starting with the basic concepts of forest management, students will explore ecological factors influencing forest productivity. The course progresses with practical applications of silvicultural techniques in field settings, assessing student understanding through hands-on experience. It further delves into advanced topics such as the integration of information technology in forest management, balancing conservation efforts with productivity, and understanding the impacts of climate change on forest ecosystems. The complete topic of each meeting is mentioned below:

1. Understanding the basic concepts of forest productivity management (1st session) → CLO1.
2. Analyzing ecological factors that influence forest productivity (2nd session) → CLO1.
3. Applying silvicultural techniques in field practice (3rd-4th sessions) → CLO2.
4. Assessing understanding and application of the concepts taught (5th session) → CLO1, CLO2.
5. Implementing pest control strategies to enhance productivity (6th-7th sessions) → CLO2.
6. Midterm Exam (8th session) → Assessment
7. Integrating information technology in forest productivity management (9th-10th sessions) → CLO3.
8. Explaining the balance between conservation and forest productivity (11th session) → CLO1, CLO2.
9. Analyzing the impact of climate change on forest productivity (12th-13th sessions) → CLO1, CLO3.
10. Developing adaptation and mitigation strategies in forest management (14th-15th sessions) → CLO2, CLO3.
11. Final Exam (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:

<table><tr><th>No.</th><th>Objects of Assessment</th><th>Forms of Assessment</th><th>Quantity (%)</th></tr></table></td></tr>
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<tr><td></td><td>
<table>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Practicum</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignment/Case Study</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Project</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-semester test</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final semester test</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">TOTAL</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>

Chazdon et al. 2019. Restoring Forests as a Means to Many Ends. Science, 365(6448), 24-25. DOI: 10.1126/science.aax9539.
Davis, et al. 2018. Forest Management. Springer, New York. ISBN: 978-3-030-12381-7.
Gibson et al .2011. Primary Forests Are Irreplaceable for Sustaining Tropical Biodiversity. Nature, 478(7369), 378-381. DOI: 10.1038/nature10425.
Hartig, et al .2020. Applied Silviculture for the 21st Century. Cambridge University Press, Cambridge. ISBN: 978-1-107-11925-3.
Lindenmayer et al. 2006. Conservation and Management of Forests and Its Impacts on Biodiversity. Annual Review of Ecology, Evolution, and Systematics, 37, 431-455. DOI: 10.1146/annurev.ecolsys.36.102003.152629.
Magnusson et al .2005. Tropical Forest Management and Conservation of Biodiversity: An Overview. Conservation Biology, 19(1), 7-16. DOI: 10.1111/j.1523-1739.2005.00377.x.
Ricketts et al. 2010. Indigenous Lands, Protected Areas, and Slowing Climate Change. PLoS Biology, 8(3), e1000331. DOI: 10.1371/journal.pbio.1000331.
Sayer et al .2013. Ten Principles for a Landscape Approach to Reconciling Agriculture, Conservation, and Other Competing Land Uses. Proceedings of the National Academy of Sciences, 110(21), 8349-8356. DOI: 10.1073/pnas.1210595110.
Various other related scientific articles on the Landscape Ecology and Modelling

</td></tr>
</table>



Course Module

Utilization and Management Strategy of Protected Forest

Faculty of Forestry
Mulawarman University

Module name	Utilization and Management Strategy of Protected Forest
Modul level, if applicable	Doctoral
Code, if applicable	220401903P027
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in wich the module is taught	Odd/Even Semesters
Person resposible for the module	Prof. Dr. Ir. Rujehan, MP
Lecturer	1. Prof. Dr. Ir. Rujehan, MP 2. Ir. Sukartiningsih, M.Sc., Ph.D.
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	**3 SKS / 4.8 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** **1. ILO-1** - Internalize scientific values, norms, and ethics **Knowledge** 2. **ILO-2** - Synthesize knowledge obtained from research results with its novelty and implementation 3. **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **ILO-4** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **ILO-5)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Content Learning Outcome (CLO)**

	Knowledge **CLO1**: Able to master the general concepts of Protected Forests and Their Functions, the Relationship Between Forests and Local Communities, Human Well-being and Economy, Deforestation and Forest Degradation, Natural Resource Conservation, and Sustainable Forest Management with a New Paradigm**.** **CLO-2**: Able to explain the History of Management and Biophysical Conditions of Protected Forests (Case Study: Sungai Wain Protected Forest)**,** including management history and biophysical conditions**.** **CLO-3:** Able to explain the Economic Motives for Utilizing Protected Forests and the Resulting Ecosystem Impacts (Case Study: Sungai Wain Protected Forest). **CLO-4:** Able to explain the Biological and Ecological Benefits of Protected Forests contained within the protected forest ecosystem. **General Skills** **CLO-5**: Able to conduct an Economic Valuation of Protected Forests (Case Study: Sungai Wain Protected Forest), including: Revenue from Biological Components, Revenue from Ecological Components, Revenue from Agricultural Activities, and Contribution to Income**.** **CLO-6:** Able to develop and analyze Strategies for Preserving Economic and Non-Economic Benefits of Protected Forests using SWOT Analysis (Strengths, Weaknesses, Opportunities, and Threats) and Analytical Hierarchy Process (AHP) Strategy Analysis**.** **Attitude** **CLO-7:** Able to create an Implementation Strategy for the Management and Conservation of Protected Forests**,** covering Framework for Preserving Economic Benefits, Framework for Preserving Non-Economic Benefits, and an Alternative Operational Strategy Plan to Achieve Economic and Non-Economic Balance of the Area (Case Study: Sungai Wain Protected Forest).
Content	This course focuses on the management and conservation of protected forests, emphasizing their roles in ecosystem function, biodiversity, and human well-being. Students will explore the history, biophysical conditions, and economic motives behind the utilization of protected forests, with a case study on the Sungai Wain Protected Forest. The course also covers the ecological and biological benefits of protected forests and provides skills for conducting economic valuations of these areas. Students will learn strategies for preserving both economic and non-economic benefits of protected forests using tools like SWOT analysis and the Analytical Hierarchy Process (AHP). By the end of the course, students will be equipped to analyze and develop sustainable management strategies for protected forest ecosystems. 1. General Concepts of Protected Forests and Their Functions, the Relationship Between Forests, Local Communities, and Human Well-being and Economy (1^{ST} meeting) **(CLO-1)** 2. Deforestation and Forest Degradation, Natural Resource Conservation, and Sustainable Forest Management with a New Paradigm (2^{nd}) **(CLO-1)** 3. History of Management and Biophysical Conditions of Protected Forests (3^{rd}) **(CLO-2)** 4. Economic Motives for Area Utilization and the Resulting Ecosystem Impacts (4^{th}-5th) **(CLO-3)** **5.** Biological and Ecological Benefits of Protected Forests (6^{th}) **(CLO-4)**

<table>
<tr><td></td><td>6. Mid-Term Exam (7th)
7. Revenue Analysis from Biological Components, Revenue from Ecological Components, Agricultural Income, and Contribution of Revenue from Protected Forest Utilization (8th-9th) (CLO-5)
8. Protected Forest Management Strategies Using SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats)) (10th-11th) (CLO-6)
9. Strategic Prioritization of Issues Derived from SWOT Analysis Through Analytical Hierarchy Process (AHP) for Protected Forest Management (12th-13th) (CLO-6)
10. Planning Concepts and Implementation of a Framework for Preserving Economic and Non-Economic Benefits, as well as Alternative Operational Strategy Plans to Achieve Economic and Non-Economic Balance in the Area (14th-15th) (CLO-7)
11. Final Exam (16th)</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
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<tr><td>5</td><td>Mid-Term Exam</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final Exam</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
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<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Arikunto, S. 1993. Manajemen Penelitian. Rineka Cipta. Jakarta. pp. 645
2. Awang, S. A. 2003. Politik Kehutanan Masyarakat. Center for Critical Social Studies dan Kreasi Wacana Yogyakarta. Yogyakarta. pp. 300
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8. Buyinza, M. 2010. Ecological and Socio-Economic Contribution of Mt. Elgon Forest Park, Eastern Uganda. Jurnal Ilmu Kehutanan</td></tr>
</table>

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14. Indayati. A. 2009. Kontribusi Pemanfaatan Hutan Adat Terhadap Peningkatan Kondisi Sosial-ekonomi Masyarakat Desa Umaq Bekuay Kabupaten Kutai Kartanegara. Skripsi Fakultas Kehutanan Universitas Mulawarman, Samarinda. pp. 89
15. Irwanto. 2006. Prespektif Silvika dalam Keanekaragaman Hayati dan Silvikultur.
16. Junus, H.M. 1984. Dasar Umum Ilmu Kehutanan. Buku I: Hutan dan Fungsi Hutan. Badan Kerjasama Perguruan Tinggi Negeri Indonesia Bagian Timur, Ujung Pandang.
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21. Lestari, W. 2006. Kajian Praktek-praktek Pemanfaatan Lahan oleh Masyarakat di Sekitar Kawasan Hutan Lindung Bontang (HLB). Skripsi Program Sarjana pada Jurusan Manajemen Hutan Fakultas Kehutanan Universitas Mulawarman, Samarinda. pp. 83
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Desa-Desa Perbatasan di Kalimantan Timur. Aditya Media, Yogyakarta.
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32. Raharjo D. Y. dan U. Pradhan. 2000. Pengelolaan Sumberdaya Hutan Berbasis Masyarakat: Wacana atau Pilihan. pp. 11
33. Rahayu S., Susiarti S., dan Y. Purwanto. 2007. Kajian Pemanfaatan Tumbuhan Hutan Non Kayu oleh Masyarakat Lokal di Kawasan Konservasi PT. Wira Karya Sakti Sungai Tapa, Jambi. Journal Biodiversitas Volume 8, Nomor 1 Halaman: 73-78.
34. Rahmawaty. 2004. Tinjauan Aspek Pengembangan Hutan Rakyat. Fakultas Pertanian Jurusan Kehutanan Universitas Sumatera Utara, Medan. pp. 9
35. Rangkuti, F. 2006. Analisis SWOT Teknik Membedah Kasus Bisnis. PT. Gramedia Pustaka Utama, Jakarta. pp. 188
36. Riyanto, G. 2006. Orde Politik dan Kebijakan Pengelolaan Hutan di Indonesia. Masyarakat (Jurnal Sosiologi), Edisi: Vol. XIII. No. 2. Des-2006. Tema: Pembangunan Sosial dan Lingkungan. LabSosio-Pusat Kajian Sosiologi FISIP UI, Jakarta. pp. 216
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Course Module

Valuation of Tropical Forest Ecosystem

Faculty of Forestry

Mulawarman University

Module name	Valuation of Tropical Forest Ecosystem
Modul level, if applicable	Doctoral
Code, if applicable	220401903P030
Subtitle, if applicable	-

Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Prof. Dr. Rujehan, MP
Lecturer	Prof. Dr. Rujehan, MP
Language	Indonesian
Relation to curriculum	Matriculation, compulsory for non-forestry background
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	Management of Natural Resources and Environment, Economic Valuation of Forestry
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **CPL2/ILO2 (A2) -** Internalize values, norms, and ethics in Knowledge **Knowledge (K)** 2. **CPL2/ILO2 (K1) -** Synthesize knowledge acquired from research findings with novelty and its implementation. 3. **CPL3/ILO3 (K2) -** Discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions. **General Skills (GS)**

	4. **CPL4/ILO4 (GS1)** – Critically analyze the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches. **5. CPL5/ILO5 (GS2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics. **Specialized Skills (SS)** **6. CPL6/ILO6 (SS1)** - Manage data and information to support decision-making processes. **Course Learning Outcome (CLO)** 1. **CLO1:** master and analyze **Basic Ecosystem Concepts**, including the introduction to tropical forest ecosystems, characteristics of tropical forest ecosystems, and the role of tropical forest ecosystems in environmental sustainability. 2. **CLO2:** explain and evaluate **Ecosystem Conditions** by studying methods for evaluating tropical forest ecosystem conditions, indicators of tropical forest ecosystem conditions (e.g., tree density, species diversity), and analyzing tropical forest ecosystem conditions using field data and remote sensing. 3. **CLO3:** explain and analyze **Factors Affecting Ecosystems**, including biotic factors (e.g., invasive species, species composition changes), abiotic factors (e.g., climate change, pollution), and interactions between biotic and abiotic factors. 4. **CLO4:** explain and analyze **Impacts of Ecosystem Changes**, including the impact of tropical forest ecosystem changes on biodiversity, water and soil quality, and local communities. 5. **CLO5:** develop **Conservation and Management Strategies**, including conservation strategies for tropical forest ecosystems, sustainable tropical forest management, and the role of local communities in conserving and managing tropical forest ecosystems. 6. **CLO6:** evaluate and analyze **Case Studies**, such as the evaluation of tropical forest ecosystems in Indonesia, evaluation of tropical forest ecosystems in other countries, and discussions on case study results. 7. **CLO7:** explain and establish **Appropriate Research Methods**, covering elements such as research methods for tropical forest ecosystem evaluation, research design for ecosystem evaluation, and data analysis for tropical forest ecosystem evaluation.
Content	This course discusses Basic Ecosystem Concepts, Ecosystem Condition Evaluation, Factors Affecting Ecosystems, Ecosystem Change Impacts, Conservation and Management Strategies, Case Studies, and Research Methods.

<table>
<tr>
<td></td>
<td>This course includes practical sessions. Evaluation and assessment are based on attendance, discipline in submitting assignments, honesty, and other affective aspects, in addition to the results of mid-term (UTS) and final exams (UAS) and structured assignments.
Lectures are conducted face-to-face or online according to the scheduled timetable. The topics include:
1. Introduction to Tropical Forest Ecosystems
2. Characteristics of Tropical Forest Ecosystems
3. The Role of Tropical Forest Ecosystems in Environmental Sustainability
4. Methods for Evaluating Tropical Forest Ecosystem Conditions
5. Indicators of Tropical Forest Ecosystem Conditions (e.g., tree density, species diversity, etc.)
6. Analysis of Tropical Forest Ecosystem Conditions Using Field Data and Remote Sensing
7. Biotic Factors (e.g., invasive species, species composition changes)
8. Abiotic Factors (e.g., climate change, pollution)
9. Interactions Between Biotic and Abiotic Factors
10. Impacts of Tropical Forest Ecosystem Changes on Biodiversity
11. Impacts of Tropical Forest Ecosystem Changes on Water and Soil Quality
12. Impacts of Tropical Forest Ecosystem Changes on Local Communities
13. Conservation Strategies for Tropical Forest Ecosystems
14. Sustainable Management of Tropical Forests
15. The Role of Local Communities in Conserving and Managing Tropical Forest Ecosystems
16. Case Study: Evaluation of Tropical Forest Ecosystems in Indonesia
17. Case Study: Evaluation of Tropical Forest Ecosystems in Other Countries
18. Case Study: Economic Valuation of Tropical Forest Ecosystems
19. Analysis and Discussion of Case Study Results
20. Research Methods for Evaluating Tropical Forest Ecosystems
21. Research Design for Evaluating Tropical Forest Ecosystems
22. Data Analysis for Evaluating Tropical Forest Ecosystems</td>
</tr>
<tr>
<td>Study and examination requirements and forms of examination</td>
<td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Lecture Participation</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Project</td><td>Presentation</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table>
</td>
</tr>
</table>

Media employed	Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR
Reading list	# Book 1. Pearce, D. W., & Turner, R. K. (1990). Economics of Natural Resources and the Environment. Johns Hopkins University Press. 2. Freeman, A. M. (2003). The Measurement of Environmental and Resource Values: Theory and Methods. Resources for the Future. 3. Barbier, E. B. (2011). Capitalizing on Nature: Ecosystems as Natural Assets. Cambridge University Press. # Journal 1. Costanza, R., et al. (1997). The value of the world's ecosystem services and natural capital. Nature, 387(6630), 253-260. 2. Daily, G. C., et al. (2000). The value of nature and the nature of value. Science, 289(5478), 395-396. 3.MEA (Millennium Ecosystem Assessment). (2005). Ecosystems and Human Well-being: Synthesis. Island Press. # Reports and Documents 1. IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services). (2019). Global Assessment Report on Biodiversity and Ecosystem Services. 2. World Bank. (2018). The Economic Benefits of Ecosystem Restoration. # Online Souce 1. IUCN (International Union for Conservation of Nature). (n.d.). Ecosystem Services. 2. UNEP (United Nations Environment Programme). (n.d.). Ecosystem Services.

Course Module

Wooden Building Construction

Faculty of Forestry

Mulawarman University

Module name	Wooden Building Construction
Modul level, if applicable	Doctoral
Code, if applicable	220401902P033
Subtitle, if applicable	
Courses, if applicable	Regular

Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Dr. Isna Yuniar Wardhani
Lecturer	Dr. Isna Yuniar Wardhani Prof. Dr. Edy Budiarso
Language	Indonesia, English
Relation to curriculum	Elective Course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	
Recommended prerequisites	
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches **Course Learning Outcome (CLO)** 1. **CLO 1 :** Students are able to relate the theory of wooden building construction to existing wooden building designs.

<table>
<tr><td></td><td>2. CLO 2: Students are able to provide solutions for designing wooden buildings in tropical regions.
3. CLO 3 : Students are able to work effectively to solve problems.</td></tr>
<tr><td>Content</td><td>This course is designed to provide integrated knowledge and skills in selecting, analyzing, and designing wood-based buildings. Students will learn about applicable national standards, such as SNI 7973-2013, for designing wooden buildings and bridges. The course content includes the selection of wood according to standards, analysis of wood and engineered wood properties, as well as the design of simple wooden buildings and bridges. Additionally, the course teaches how to calculate permissible stresses in wooden building elements and synthesize the requirements for wood/engineered wood for structural applications. This course is ideal for students who wish to delve into the field of wooden building construction with relevant theoretical and practical applications. The complete topic of each meeting is mentioned below:

1. Able to select wood for construction based on existing standards (1st-2nd session) → CLO 1.
2. Able to analyze the properties of wood and engineered wood for wooden buildings (3rd-4th session) → CLO 1.
3. Able to design wooden buildings referring to Indonesian National Standard 7973-2013 (5th-6th session) → CLO 1 & CLO 2.
4. Able to create a simple wooden building design (one-story) (7th-9th session) → CLO 1, CLO 2, & CLO 3.
5. Able to design wooden bridges (10th-11th session) → CLO 1, CLO 2, & CLO 3.
6. Able to synthesize the requirements for wood/engineered wood for wooden buildings (12th-13th session) → CLO 1 & CLO 3.
7. Able to calculate permissible stresses in the elements of wooden buildings (14th-16th session) → CLO 1 & CLO 3.</td></tr>
<tr><td>Study and examination requirements and forms of

examination</td><td>Evaluation and assessment of learning achievement based on:

<table>
<tr><th>No.</th><th>Objects of Assessment</th><th>Forms of Assessment</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Practicum</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignment/Case Study</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Project</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-semester test</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final semester test</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">TOTAL</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Shmulsky, R and P.D. Jones. 2019. Forest Products and Wood Science An Introduction. Seventh edition. John Wiley & Sons Ltd. UK
2. Borgström, E. (Ed) Design of timber structures Structural aspects of timber construction. Volume 1 EDITION 2:201.</td></tr>
</table>

	ISBN 978-91-980304-8-8. Publisher Swedish Forest Industries Federation 3. Thelandersson, S. and H. J. Larsen. 2003. Timber Engineering. John Wiley &. Sons, LTD. ISBN 0-470-84469-8 4. Kollmann, F.F.P. and W.A. Côte, Jr. 1984. Principles of Wood Science and Technology. Vol.I. Solid Wood. Springer-Verlag. Berlin 5. USDA. 2010. Wood hand book. Wood as an engineering materials. Forest Products Laboratory. Madison 6. Gupta, R. 2014. Principles of Structur Al Design Wood, Steel, and Concrete. Second Edition. Taylor & Francis Group, LLC. ISBN -13: 978-1-4665-5233-3 7. Gupta, R. 2014. Principles of Structur Al Design Wood, Steel, and Concrete. Second Edition. Taylor & Francis Group, LLC. ISBN -13: 978-1-4665-5233-3 8. Various other related scientific articles on the Wooden Building Construction

Course Module

Tree Biology

Faculty of Forestry
Mulawarman University

Module name	Tree Biology
Modul level, if applicable	Doctoral
Code, if applicable	220401902P034
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Dr. Erwin S.Hut., M.P

Lecturer	Dr. Erwin S.Hut., M.P
Language	Indonesia
Relation to curriculum	Elective Course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **ILO1 (A1)** – Internalize scientific values, norms, and ethics **Knowledge (K)** 2. **ILO2 (K1)** - Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2)** - Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **General Skills (GS)** 4. **ILO4 (GS1)** - Able to criticize the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches **Content Learning Outcome (CLO)** 1. **CLO1:** Students are able to synthesize the latest forestry research for practical innovation and implementation. **ILO2 (K1)**. 2. **CLO2:** Students are able to develop new scientific concepts and scientific arguments in forestry. **ILO3 (K2).** 3. **CLO3:** Students are able to critique and apply forestry research theories and methodologies in an interdisciplinary manner. **ILO3 (GS1).** 4. **CLO4:** Students are able to manage and analyze forestry data to support decision-making. **ILO3 (GS1).** 5. **CLO5:** Students are able to demonstrate ethical conduct and a commitment to sustainable forestry practices. **ILO1 (A1)**.

<table>
<tr><td>Content</td><td>This course on Tree Biology offers a comprehensive exploration of the biological aspects of trees, spanning their anatomy, physiology, and ecological roles within forest ecosystems. Initially, students are introduced to the basic anatomy and morphology of trees during the first two meetings, setting a foundation that supports more complex topics. Subsequent classes delve into the core physiological processes of photosynthesis, respiration, and transpiration. The course progresses to examine ecological interactions and symbiosis, highlighting the integral roles trees play in maintaining forest ecosystems. Attention is then shifted to the economic perspectives of trees, discussing timber and non-timber forest products across two separate sessions. Advanced methodologies, such as GIS and remote sensing, are explored to equip students with modern research techniques relevant to tree biology. The curriculum also addresses tree management strategies and the impact of climate change on tree physiology. The complete topic of each meeting is mentioned below:

1. Contract and Introduction to Tree Biology, Anatomy and Morphology (1st and 2nd sessions) → CLO1
2. Tree Physiology I & II, Photosynthesis, Respiration and Transpiration (3rd and 4th sessions) → CLO1
3. Ecological Interactions of Trees & Symbiosis in Forest Ecosystems (5th and 6th sessions) → CLO1
4. Tree Benefits I, Timber Products (7th session) → CLO4
5. Midterm Examination (UTS) (8th session) → Assessment
6. Tree Benefits II, Non-Timber Forest Products (NTFPs) (9th session) → CLO4
7. Tree Variations Across Ecosystems (10th session) → CLO2
8. Advanced Tree Biology Research Techniques I & II, GIS and Remote Sensing (11th and 12th sessions) → CLO3
9. Tree Management Strategies and Climate Change (13th and 14thsessions) → CLO3
10. Research Presentation (15th session) → CLO2
11. Final Examination (UAS) (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Project</td><td>Presentation</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
</table>

Reading list	1. DESCH, H.E. and Dinwodie (1981): Timber its Structure, Properties and Utilisation. Timber Press Forest Grove. Oregon. 2. SHIGO, L. ALEX (1989): A New Tree Biology (=NTB). (Facts, Photos, And Philosophies On Trees And Their Problems and Proper Care. Durham. USA. 3. HIGHLEY TL (1999). Biodeterioration of Wood. Department of Agriculture. Forest Service. USA 4. SCHMIDT O (2006). Wood and Tree Fungi: Biology, Damage, Protection , and Use. Springer-Verlag. Berlin 5. Biological sciences, Plant Anatomy. CD 6. Additional articles which related to the subject

Course Module

Wood Ultrastructures

Faculty of Forestry
Mulawarman University

Module name	Wood Ultrastructures
Modul level, if applicable	Doctorate
Code, if applicable	220401903P035
Subtitle, if applicable	-
Courses, if applicable	Regular
Semester(s) in which the module is taught	The subject is offered every semester
Person responsible for the module	Dr. Erwin, S.Hut., M.P.
Lecturer	Dr. Erwin, S.Hut., M.P.
Language	Indonesia
Relation to curriculum	Elective Course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of: - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	Credit points: 3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **ILO1 (A1)** – Internalize scientific values, norms, and ethics **Knowledge (K)** 2. **ILO2 (K1)** - Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2)** - Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **General Skills (GS)** 4. **ILO4 (GS1)** - Able to criticize the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches **Content Learning Outcome (CLO)** 1. **CLO1**: Students are able to understand and analyze the microstructure and ultrastructure of wood, including cell types, shapes, and proportions. **ILO2 (K1).** 2. **CLO2**: Students are able to evaluate and interpret the microfibril structure of wood cell walls, including differences in normal wood, compression wood, and juvenile wood. **ILO3 (K2).** 3. **CLO3**: Students are able to assess factors influencing wood conductivity, strength, and durability, including tylosis, extractives, and cell wall components such as lignin, cellulose, and hemicellulose **ILO2 (K1).** 4. **CLO4**: Students are able to apply advanced microscopic techniques such as TEM and SEM to investigate and analyze the ultrastructure of wood for research and practical applications. **ILO4 (GS1).** 5. **CLO5**: Students are able to synthesize knowledge of wood ultrastructure for applications in research, materials technology, and environmental context. **ILO2 (K1).** 6. **CLO6**: Students demonstrate a commitment to sustainable forestry practices and ethical research methods when working with wood and forest resources **ILO1 (A1)**.

Content	This course delves into the detailed study of wood microstructure and ultrastructure, offering students an in-depth understanding of wood cell anatomy and its implications for both the environment and industry. Starting with a foundational overview of wood microstructure, the course progresses through specific cell types, their proportions, and structural features like pitting systems and perforation plates. Detailed exploration of microfibril structures and their variations provides insights into wood's mechanical properties and conductivity. A significant component of the course involves hands-on training in advanced microscopy techniques, such as Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM), equipping students with practical skills essential for modern wood research. Applications of wood ultrastructure in environmental science and material technology are also covered, alongside current research trends in the field. The course culminates with student presentations and group discussions, allowing for the synthesis and sharing of knowledge. Assessments include a midterm and a final examination to evaluate students' understanding and application of course material. The complete topic of each meeting is mentioned below: 1. Course Introduction and Learning Contract (1st session) 2. Introduction to Wood Microstructure (2nd session) 3. Cell Types and Proportions in Wood Microstructure (3rd session) 4. Pitting Systems and Perforation Plates in Wood Cells (4th session) 5. Microfibril Structure of Wood Cell Walls (5th session) 6. Differences and Implications of Wood Microfibril Variations (6thsession) 7. Wood Conductivity: Structural Contributions (7th session) 8. **Midterm Examination (UTS) (8th session)** 9. Wood Cell Wall Components: Lignin, Cellulose, and Hemicellulose (9th session) 10. Advanced Techniques in Wood Ultrastructure Analysis (10thsession) 11. Practical Use of TEM and SEM in Wood Research (11th session) 12. Wood Ultrastructure in Environmental Applications (12th session) 13. Wood Ultrastructure in Material Technology and Industry (13thsession) 14. Research Trends in Wood Ultrastructure (14th session) 15. Student Presentations and Group Discussions (15th session) 16. **Final Examination (UAS) (16th session)**

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of the learning process are following scheme 5 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Laboratory Practice/Fieldwork</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignment/Case Study</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Project</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Laptop, LCD</td></tr>
<tr><td>Reading list</td><td>

Bruce, H. W. and Evert, R. F. (2023). Wood Microbiology: Structure, Function, and Applications. Springer Nature.
Chaffey, N. (2021). Wood Formation in Trees: Cell and Molecular Biology Techniques. Taylor & Francis.
Jones, H. G. and Smith, W. K. (2022). Plant Biology and Biotechnology: Wood Structure and Function. Academic Press.
Wiedenhoeft, A. C. (2024). Microscopic Wood Anatomy: Structural Diversity and Functional Ecology. Springer.
Falcon-Lang, H. J. (2020). Wood Microstructures: Technology and Applications. Elsevier.
Ruel, K. and Barnoud, F. (2019). Lignocellulosic Fibers and Wood Handbook: Renewable Materials for Today's Environment. Wiley.
Thomas, B., and Murphy, D. J. (2021). Plant Microtechniques and Protocols. Springer.
Goldstein, J. I. et al. (2023). Scanning Electron Microscopy and X-ray Microanalysis. Springer.
Schwarze, F. W. M. R. (2022). Wood Decay Under the Microscope. CABI.
Additional information from broad articles related to the subject.
</td></tr>
</table>

Course Module

Improvement of Wood Quality

Faculty of Forestry

Mulawarman University

Module name	Improvement of Wood Quality
Modul level, if applicable	Doctoral
Code, if applicable	220401902P041
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Prof. Dr. Ir. Edy Budiarso
Lecturer	Prof. Dr. Ir. Edy Budiarso Dr. Ir. Enih Rosamah, M.Sc. Dr. Ir. Isna Yuniar Wardhani, M.P.
Language	Indonesia
Relation to curriculum	Elective Course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** **1. ILO1 (A1) -** Internalize scientific values, norms, and ethics **Knowledge (K)** 2. **ILO2 (K1) -** Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2)** - Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **General Skills (GS)** 4. **ILO4 (GS1)** - Able to criticize the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches **Content Learning Outcome (CLO)** 1. **CLO1**: Students will internalize and apply ethical standards and principles in conducting research on wood quality improvement, ensuring that all experiments and methodologies uphold the highest ethical standards. **ILO1 (A1)** 2. **CLO2**: Students will synthesize and integrate new research findings on wood properties and improvement techniques to innovate and enhance the practical applications of wood products. **ILO2 (K1)** 3. **CLO3**: Students will develop and defend new scientific concepts and arguments concerning wood quality, based on their research and experiments, contributing to the body of knowledge in wood science. **ILO3 (K2)** 4. **CLO4**: Students will critically analyze and evaluate various research methodologies in wood quality improvement, applying an interdisciplinary approach to assess and refine these methods. **ILO4 (GS1)**
Content	The Improvement of Wood Quality course provides advanced knowledge and skills for enhancing wood quality through innovative research and modern technology. It emphasizes ethical research applications, integration of new scientific findings, and critical analysis of methodologies in wood science. This course is ideal for those specializing in wood technology or forest management and benefits industry professionals seeking advanced

<table>
<tr><td></td><td>expertise in wood improvement practices. The complete topic of each meeting is mentioned below:
1. Contract and Understanding Basic Concepts of Wood Quality Improvement (1st session) → CLO1
2. Analyzing Factors Influencing Wood Properties and Quality (2nd session) → CLO1
3. Applying Wood Modification Techniques in Field and Laboratory Practice (3rd-4th sessions) → CLO2
4. Assessing Understanding and Application of Taught Concepts in Wood Quality Research (5th session) → CLO1, CLO2
5. Implementing Wood Preservation and Protection Strategies to Enhance Durability (6th-7th sessions) → CLO2
6. Midterm Exam (8th session) → Assessment
7. Integrating Information Technology in Wood Quality Monitoring and Management (9th-10th sessions) → CLO3
8. Explaining the Balance Between Wood Utilization, Sustainability, and Quality Enhancement (11th session) → CLO1, CLO2
9. Analyzing the Impact of Climate Change on Wood Quality and Long-Term Performance (12th-13th sessions) → CLO1, CLO3
10. Developing Adaptation and Mitigation Strategies for Sustainable Wood Quality Improvement (14th-15th sessions) → CLO2, CLO3
11. Final Exam (16th session) → Assessment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Project</td><td>Presentation</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Hill, C. A. S. (2006). Wood modification: Chemical, thermal, and other processes. John Wiley & Sons.
2. Rowell, R. M. (2012). Handbook of wood chemistry and wood composites. CRC Press.
3. Shmulsky, R., & Jones, P. D. (2019). Forest products and wood science: An introduction. Wiley.
4. Bowyer, J. L., Shmulsky, R., & Haygreen, J. G. (2012). Forest products and wood science. John Wiley & Sons.
5. Esteves, B., & Pereira, H. (2009). Wood modification by heat treatment: A review. BioResources, 4(1), 370-404.</td></tr>
</table>

	6. Singh, T., Dawson, B. S., & Waghorn, R. (2018). Advances in wood preservation technologies. *Forests, 9*(8), 471. 7. Hein, P. R. G. (2015). Applications of near-infrared spectroscopy (NIRS) in wood science and technology. *Wood Science and Technology, 49*(5), 849-878. 8. Ramage, M. H., Burridge, H. C., Busse-Wicher, M., Fereday, G., Reynolds, T., Shah, D. U., & Scherman, O. (2017). The wood from the trees: The use of timber in construction. *Renewable and Sustainable Energy Reviews, 68*, 333-359. 9. Sohngen, B., & Sedjo, R. (2021). Impacts of climate change on forest product markets: Implications for wood quality. *Forest Policy and Economics, 124*, 102395. 10. Lindner, M., Maroschek, M., Netherer, S., Kremer, A., Barbati, A., Garcia-Gonzalo, J., & Lexer, M. J. (2010). Climate change impacts, adaptive capacity, and vulnerability of European forest ecosystems. *Forest Ecology and Management, 259*(4), 698-709.

Course Module

Stand Nutrient Dynamics

Faculty of Forestry

Mulawarman University

Module name	Stand Nutrient Dynamics
Module level, if applicable	Doctoral
Code, if applicable	
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Dr. Syahrinudin
Lecturer	1. Dr. Syahrinudin 2. Dr. Wahjuni Sri Hartati
Language	Indonesia
Relation to curriculum	
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **CPL1/ILO1 (A1) -** Internalizing values, norms, and ethics in Knowledge **Knowledge (K)** 2. **CPL2/ILO2 (K1) -** Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (K2) -** Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **General Skills (GS)** 4. **CPL4/ILO4 (GS1) -** Able to criticize the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches. **Specialized Skills (SS)** **5. CPL6/ILO6 (SS1)** - Manage data and information to support decision-making processes. **Content Learning Outcome (CLO)** 1. **CLO1:** Analyze the relationship between vegetation structure and composition with nutrient dynamics in forest ecosystems. 2. **CLO2:** Examine the role of biotic and abiotic factors in the nutrient cycle of forest stands. 3. **CLO3:** Develop ecosystem-based nutrient management strategies to support forest sustainability. 4. **CLO4:** Evaluate the impact of climate change on nutrient cycles and forest productivity. 5. **CLO5:** Design sustainable nutrient utilization models for agroforestry and forest rehabilitation systems.
Content	This course explores the dynamics of nutrient cycling in forest stands through an ecological and plant physiological approach. The main focus includes vegetation formation, forest structure, and composition based on climatic and edaphic conditions, as well as interactions between biotic and abiotic factors in forest ecosystem nutrient cycles. Designed to equip students with a deep understanding of nutrient circulation principles, this course also emphasizes nutrient management strategies for sustainable forest ecosystems. The complete topic is mentioned below: 1. Vegetation formation in forest ecosystems: climatic climax and edaphic climax. 2. Climatic climax vegetation structure and composition: dessert and meadow; savanna and steppe; monsoon forest; tropical rainforest.

<table>
<tr><td></td><td>3. Edaphic climax vegetation structure and composition: mangrove forest; coastal forest; swamp forest; riparian forest; peat forest, heath forest.
4. Mid-semester exam
5. Nutrient distribution system in the tropics: mangrove forest, coastal forest, swamp forest, riparian forest, peat forest, heath forest, monsoon forest, tropical rainforest.
6. Nutrient cycling system in the tropics: mangrove forest, coastal forest, swamp forest, riparian forest, peat forest, heath forest, monsoon forest, tropical rainforest.
7. Impacts of climate change and other external threats on forest nutrient cycles.
8. Review and learning evaluation.
9. Final Examination.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
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</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Brady, N.C. & Weil, R.R. 2017. The Nature and Properties of Soils. Pearson Education.
2. Marschner, P. 2012. Marschner’s Mineral Nutrition of Higher Plants. Academic Press.
3. Chapin, F.S., Matson, P.A., & Vitousek, P. 2011. Principles of Terrestrial Ecosystem Ecology. Springer.
4. Schlesinger, W.H. & Bernhardt, E.S. 2020. Biogeochemistry: An Analysis of Global Change. Academic Press.</td></tr>
</table>

Course Module

Photosynthesis and Relations Water

Faculty of Forestry
Mulawarman University

Module name	Photosynthesa and Relation Water
Modul level, if applicable	Doctoral
Code, if applicable	220401903P043
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in wich the module is taught	Odd/Even Semesters
Person resposible for the module	Dr.Hetty Manurung, M.Si.
Lecturer	1. Prof. Dr. Ir.Deddy Hadrianto, M.Agr 2. Dr.Hetty Manurung, M.Si.
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	**3 SKS / 4.8 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **ILO-1** - Internalize scientific values, norms, and ethics **Knowledge** 2. **ILO-2** - Synthesize knowledge obtained from research results with its novelty and implementation 3. **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills**

	4. **ILO-4 -** Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches **5. ILO-5** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Content Learning Outcome (CLO)** **Knowledge** **CLO-1:** Understanding the principles of photosynthesis and water regulation in forest plants. **General Skill:** **CLO-2:** Analyzing environmental factors and plant adaptations to water stress **Special Skills:** **CLO-3:** Applying methods and technology in measuring photosynthesis and water efficiency **Attitude:** **CLO-4:** Evaluating the implications of photosynthesis and water household in sustainable forest management.
Content	This course examines the fundamental principles of photosynthesis and water regulation in forest plants, focusing on their roles in plant productivity, adaptation, and forest sustainability. Topics include photosynthetic mechanisms (C3**,** C4, CAM), water absorption, transport, transpiration, stomatal regulation, and plant responses to drought and climate change**.** Students will explore advanced measurement techniques such as gas exchange analysis, remote sensing, and GIS-based vegetation monitoring**.** The course also emphasizes the application of photosynthesis and water management in agroforestry, forest restoration, and climate resilience**.** Through lectures, case studies, and seminars**,** students will develop analytical skills to integrate physiological and ecological principles into sustainable forest management. 1. Introduction: Photosynthesis and Water Household in Forest Plants (1ST meeting) **(CLO-1)** 2. Leaf Structure and Function in Photosynthesis (2nd) **(CLO-1)** 3. Fundamental Photosynthesis Processes: Light Reactions and Dark Reactions (3rd) **(CLO-1)** 4. Environmental Factors Affecting Photosynthesis in Forests (4th) **(CLO-2)** 5. Photosynthesis in Different Types of Forest Plants (C3, C4, and CAM) (5th) **(CLO-2)** 6. Mechanisms of Water Absorption, Transport, and Distribution in Forest Plants (6th) **(CLO-1)** **7.** Stomatal Regulation and Water Use Efficiency (WUE) (7th) **(CLO-3)** 8. Mid-Term Exam (8th) 9. Transpiration and Water Loss in Forest Plants (9th) **(CLO-2)** 10. Adaptation of Forest Plants to Drought and Water Stress (10th) **(CLO-2)** 11. Integration of Photosynthesis and Water Household in Primary Productivity (11th) **(CLO-4)**

<table>
<tr><td></td><td>12. Impact of Climate Change on Photosynthesis and Plant Water Household (12th) (CLO-4)
13. Technology and Methods for Measuring Photosynthesis and Water Efficiency (13th) (CLO-3)
14. Applications of Photosynthesis and Water Management in Sustainable Forestry (14th) (CLO-4)
15. Seminar and Case Study Presentation (15th) (CLO-4)
16. Final Exam (16th)</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Practical</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignments/Case Studies</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Projects:</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-Term Exam</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final Exam</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
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<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2018). Plant Physiology and Development (6th ed.). Sinauer Associates.
2. Hopkins, W. G., & Hüner, N. P. (2008). Introduction to Plant Physiology (4th ed.). Wiley.
3. Larcher, W. (2003). Physiological Plant Ecology (4th ed.). Springer.
4. Lambers, H., Chapin III, F. S., & Pons, T. L. (2008). Plant Physiological Ecology (2nd ed.). Springer.
5. Nobel, P. S. (2009). Physicochemical and Environmental Plant Physiology (4th ed.). Academic Press.
6. Farquhar, G. D., von Caemmerer, S., & Berry, J. A. (1980). A biochemical model of photosynthetic CO_2 assimilation in leaves of C3 species. Planta, 149(1), 78-90.
7. Flexas, J., & Medrano, H. (2002). Drought-inhibition of photosynthesis in C3 plants: Stomatal and non-stomatal limitations revisited. Annals of Botany, 89(2), 183-189.
8. Chaves, M. M., Flexas, J., & Pinheiro, C. (2009). Photosynthesis under drought and salt stress: Regulation mechanisms from whole plant to cell. Annals of Botany, 103(4), 551-560.
9. Berry, J., & Björkman, O. (1980). Photosynthetic response and adaptation to temperature in higher plants. Annual Review of Plant Physiology, 31(1), 491-543.
10. Zhu, X. G., Long, S. P., & Ort, D. R. (2010). Improving photosynthetic efficiency for greater yield. Annual Review of Plant Biology, 61, 235-261.
11. IPCC (2019). Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse</td></tr>
</table>

Gas Fluxes in Terrestrial Ecosystems. Intergovernmental Panel on Climate Change.
12. Körner, C. (2015). Paradigm shift in plant growth control. *Current Opinion in Plant Biology, 25*, 107-114.
13. Way, D. A., & Yamori, W. (2014). Thermal acclimation of photosynthesis: On the importance of adjusting photosynthetic capacity to growth temperature. *New Phytologist, 199*(3), 748-764.
14. Reich, P. B., & Oleksyn, J. (2004). Global patterns of plant leaf N and P in relation to temperature and latitude. *Proceedings of the National Academy of Sciences, 101*(30), 11001-11006.
15. Beer, C., Reichstein, M., Tomelleri, E., et al. (2010). Terrestrial gross carbon dioxide uptake: Global distribution and covariation with climate. *Science, 329*(5993), 834-838.
16. Sperry, J. S. (2003). Evolution of water transport and xylem structure. *International Journal of Plant Sciences, 164*(S3), S115-S127.
17. Brodribb, T. J., & Holbrook, N. M. (2003). Stomatal closure during leaf dehydration, correlation with other leaf physiological traits. *Plant Physiology, 132*(4), 2166-2173
18. Sack, L., & Holbrook, N. M. (2006). Leaf hydraulics. *Annual Review of Plant Biology, 57*, 361-381.
19. Buckley, T. N. (2019). How do stomata respond to water status? *New Phytologist, 224*(1), 21-36.
20. Katul, G. G., Manzoni, S., Palmroth, S., & Oren, R. (2010). A stomatal optimization theory to describe the effects of atmospheric CO_2 on leaf photosynthesis and transpiration. *Annals of Botany, 105*(3), 431-442.

Course Module

Conservation Strategy Of Biological Resources

Faculty of Forestry
Mulawarman University

Module name	Conservation Strategy of Biological Resources
Modul level, if applicable	Doctoral
Code, if applicable	220401902P051
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in wich the module is taught	Odd/Even Semesters
Person resposible for the module	Dr. Rachmat Budiwijaya Suba, M.Sc.
Lecturer	1. Prof. Dr. Ir. Paulus Matius, M.Sc. 2. Dr. Rachmat Budiwijaya Suba, M.Sc. 3. Dr. Yaya Rayadin, S.Hut., M.P.
Language	Indonesia, English
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for
Credit points	**2 SKS / 3.2 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** **ILO-1** – Internalize values, norms, and ethics in Knowledge **Knowledge** **ILO-2-** Synthesize knowledge obtained from research results with its novelty and implementation **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions

	General Skills **ILO-4 -** Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches **ILO-5** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** **ILO-6:** Manage data and information to support decision-making processes **Course Learning Outcomes (CLO)** **Knowledge** **CLO-1**: Understanding the basic concepts of biological resource conservation and ecological principles in conservation. **CLO-2**: Analyzing various threats to biological resources and their implications for biodiversity **General Skills** **CLO-3**: Applying conservation strategies and policies based on an ecosystem approach and environmental monitoring technologies **Attitude** **CLO-4:** Evaluating the implementation of conservation policies and the role of communities and the economic sector in conservation efforts
Content	This course explores the principles, strategies, and policies of biological resource conservation. Students will analyze threats to biodiversity, including deforestation, habitat fragmentation, and climate change, while learning conservation management approaches such as ecosystem restoration, in-situ and ex-situ conservation, and biodiversity monitoring. The role of stakeholders, environmental policies, and sustainable development in conservation efforts will also be examined. By the end of the course, students will be able to evaluate conservation strategies and develop solutions for biodiversity preservation. 1. Introduction to Biological Resource Conservation and Ecological Principles in Conservation (1ST meeting) **(CLO-1)** 2. Deforestation and Land Degradation, Habitat Fragmentation, Climate Change, and Its Impact on Biodiversity (2nd) **(CLO-2)** 3. Overexploitation of Natural Resources and Invasive Species. (3rd) **(CLO-2)** 4. Conservation Area Management Strategies and Ecosystem Rehabilitation and Restoration (4th) **(CLO-3)** 5. Conservation of Rare and Endangered Species, Environmental-Based Spatial Planning, and Local Wisdom-Based Resource Management (5th) **(CLO-3)** 6. Theoretical Approaches to In-Situ and Ex-Situ Conservation, Community-Based Conservation, and Ecosystem-Based Approaches. (6th) **(CLO-3)** 7. Biodiversity Monitoring Technologies, Population and Habitat Analysis, and Species Introduction and Translocation Techniques (7th) **(CLO-3)** 8. Mid-Term Exam (8th) 9. National and International Regulations Related to Conservation (9th) **(CLO-4)**

<table>
<tr><td></td><td>10. The Role of Government, NGOs, and Communities in Conservation, Global Agreements, and Commitments to Climate Change (10th) (CLO-4)
11. Payment for Environmental Services Mechanisms, Ecotourism as a Conservation Strategy, and the Role of the Private Sector and Philanthropy in Conservation (11th) (CLO-4)
12. Environmental Awareness and Conservation Education (12th) (CLO-4)
13. The Role of Media in Disseminating Conservation Issues and the Involvement of Youth and Local Communities (13th) (CLO-4)
14. Successes and Failures of Conservation in Indonesia and the World, and Sustainable Landscape Management (14th) (CLO-4)
15. Conservation Ethics in Resource Exploitation, the Impact of Sustainable Development on Conservation, and Strategies to Address Global Climate Change (15th) (CLO-4)
16. Final Exam (16th)</td></tr>
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2. Primack, R. B. (2014). Essentials of Conservation Biology (6th ed.). Sinauer Associates.
3. Sodhi, N. S., & Ehrlich, P. R. (2010). Conservation Biology for All. Oxford University Press.
4. Wilson, E. O. (2016). Half-Earth: Our Planet's Fight for Life. Liveright Publishing.
5. Hunter, M. L., & Gibbs, J. P. (2007). Fundamentals of Conservation Biology (3rd ed.). Blackwell Publishing.
6. Mace, G. M., Norris, K., & Fitter, A. H. (2012). Biodiversity and ecosystem services: A multi-layered relationship. Trends in Ecology & Evolution, 27(1), 19-26.
7. Laurance, W. F., Sayer, J., & Cassman, K. G. (2014). Agricultural expansion and its impacts on tropical nature. Trends in Ecology & Evolution, 29(2), 107-116.
8. Brooks, T. M., Mittermeier, R. A., Mittermeier, C. G., et al. (2002). Habitat loss and extinction in the hotspots of biodiversity. Conservation Biology, 16(4), 909-923.</td></tr>
</table>

	9. Watson, J. E. M., Dudley, N., Segan, D. B., & Hockings, M. (2014). The performance and potential of protected areas. *Nature, 515*(7525), 67-73. 10. Visconti, P., Bakkenes, M., Baisero, D., et al. (2016). Projecting global biodiversity indicators under future development scenarios. *Conservation Letters, 9*(1), 5-13. 11. IPBES (2019). *Global Assessment Report on Biodiversity and Ecosystem Services*. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 12. IUCN (2020). *The IUCN Red List of Threatened Species: Summary Statistics*. International Union for Conservation of Nature. 13. Convention on Biological Diversity (CBD). (2020). *Global Biodiversity Outlook 5*. Secretariat of the Convention on Biological Diversity. 14. Turner, W., Spector, S., Gardiner, N., Fladeland, M., Sterling, E., & Steininger, M. (2003). Remote sensing for biodiversity science and conservation. *Trends in Ecology & Evolution, 18*(6), 306-314. 15. Balmford, A., Green, R. E., & Jenkins, M. (2003). Measuring the changing state of nature. *Trends in Ecology & Evolution, 18*(7), 326-330. 16. Other Reference/Article related about *Conservation Strategy of Biological Resources*

Course Module

Wildlife Habitat Management

Faculty of Forestry
Mulawarman University

Module name	Wildlife Habitat Management
Modul level, if applicable	Doctoral
Code, if applicable	220401903P054
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in wich the module is taught	Odd/Even Semesters
Person resposible for the module	Dr. Yaya Rayadin, S.Hut., M.P.
Lecturer	1. Dr.Ir.Chandradewana Boer, M.Sc 2. Dr.Rachmat Budiwijaya Suba, M.Sc. 3. Dr.Yaya Rayadin, S.Hut., M.P.
Language	Indonesia
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	**3 SKS / 4.8 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **ILO-1** – Internalize values, norms, and ethics **Knowledge** 2. **ILO-2** - Synthesize knowledge obtained from research results with its novelty and implementation

	3. **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **ILO-4** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **ILO-5)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Content Learning Outcome (CLO)** **Knowledge** **CLO-1:** Able to analyze landscape ecology and habitat dynamics and their implications for the sustainability of tropical wildlife populations. **General Skills** **CLO-2:** Able to identify, evaluate, and apply inventory and monitoring methods for wildlife habitats in tropical ecosystems. **CLO-4**: Able to compile and present case study results on tropical wildlife habitat management critically and systematically. **Attitude:** **CLO-3:** Able to understand, analyze, and develop wildlife habitat management strategies based on policies, regulations, and technology applications.
Content	This course focuses on the management of tropical wildlife habitats, emphasizing landscape ecology, habitat dynamics, and their implications for wildlife sustainability. Topics include the impact of habitat fragmentation, the role of ecological corridors, and strategies for managing high conservation value areas in plantation and forest landscapes. Students will learn to assess and monitor wildlife habitats, develop management strategies based on policies, regulations, and technology, and apply these strategies to mitigate the impacts of climate change and deforestation. The course also includes case studies, practical applications, and the development of management plans to conserve tropical wildlife habitats effectively. 1. Introduction to the Course: Management of Tropical Wildlife Habitat (1ST meeting) **(CLO-4)** 2. Landscape Ecology Concepts and How Habitat Dynamics Influence Wildlife Populations (2nd) **(CLO-1)** **3.** Case Study on Landscape Management, Habitat Dynamics, Wildlife Corridors, and Area Connectivity (3rd) **(CLO-1)** 4. Management of High Conservation Value Areas (HCVA) in Oil Palm Plantation Landscapes (4th) **(CLO-3)** 5. Management of High Conservation Value Areas (HCVA) in Industrial Plantation Forest Landscapes (5th) **(CLO-3)** 6. Habitat Fragmentation Concepts and Their Impact on the Sustainability of Tropical Wildlife Populations (6th) **(CLO-1)** 7. Case Study and Practical Model Review to Understand Habitat Fragmentation Concepts and Their Impact on Tropical Wildlife Populations (7th) **(CLO-1)** 8. Mid-Term Exam (8th) 9. Habitat Inventory and Monitoring Methods and Habitat Preference Studies (9th) **(CLO-2)**

<table>
<tr><td></td><td>10. The Role of Vegetation in Wildlife Habitat Balance (10th) (CLO-1)
11. Functions and Management Strategies of Ecological Corridors in Mitigating Habitat Fragmentation (11th) (CLO-3)
12. Examples and Models Related to Corridor Development and Biodiversity Park Development Models (12th) (CLO-3)
13. Policies and Regulations in Wildlife Habitat Management (13th) (CLO-3)
14. Technology in Wildlife Habitat Conservation (14th) (CLO-3)
15. Seminar and Presentation of Case Study Results (15th) (CLO-4)
16. Final Exam (16th)</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
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<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Practical</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignments/Case Studies</td><td>Group Presentation</td><td>15</td></tr>
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</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td></td><td>1. Atmoko, T., et al. (2021). Praktik Terbaik Pengelolaan Habitat Satwa Terancam Punah dalam Skala Bentang Alam: Sebuah Pembelajaran dari Kawasan Ekosistem Esensial Wehea-Kelay.
2. Fadhella, R., et al. (2023). Peran dan Pengelolaan Ekowisata Satwa Liar Non Penangkaran Kawasan Punggualas di Taman Nasional Sebangau Kabupaten Katingan. Jurnal Ilmiah Pariwisata, 28(1), 100-112.
3. Harefa, M. S., et al. (2024). Konservasi Satwa Liar: Tantangan dan Strategi Pengelolaan. Journal of Laguna Geography, 20.
4. Zulfa, M., et al. (2022). Pengelolaan dan Konservasi Satwa Berbasis Kearifan Lokal di Taman Nasional Alas Purwo. Jurnal Sosiologi Dialektika Sosial, 8(2), 74-84.
5. Suryandari, R., et al. (2024). Mitigasi Satwa Liar di Koridor Ekologi Taman Nasional Gunung Halimun Salak. Cendekia: Jurnal Ilmu Pengetahuan, 4(3), 272-280.
6. Hanif, F. (2021). Upaya Perlindungan Satwa Liar Indonesia melalui Instrumen Hukum dan Perundang-undangan. Jurnal Hukum Lingkungan Indonesia, 2(2), 29–48.
7. Sholihat, A. (2024). Preferensi Habitat Mamalia di Wilayah Agroforestri Desa Cipaganti, Garut, Menggunakan Kamera Jebak. Skripsi, Universitas Padjadjaran.
8. Balai Besar Taman Nasional Bukit Barisan Selatan. (2024). Roadmap Penelitian Taman Nasional Bukit Barisan Selatan.
9. Situmorang, M. T. N. (2024). Mitigasi Satwa Liar di Koridor Ekologi Taman Nasional Gunung Halimun Salak. Cendekia: Jurnal Ilmu Pengetahuan, 4(3), 271–277.</td></tr>
</table>

10. Pusat Pendidikan dan Pelatihan Sumber Daya Manusia Lingkungan Hidup dan Kehutanan. (2024). *Monitoring dan Identifikasi Peredaran Secara Online Satwa Liar Dilindungi.*
11. Yayasan Konservasi Alam Nusantara. (2021). *Praktik Terbaik Pengelolaan Habitat Satwa Terancam Punah dalam Skala Bentang Alam: Sebuah Pembelajaran dari Kawasan Ekosistem Esensial Wehea-Kelay.*
12. Fadhella, R., et al. (2023). *Peran dan Pengelolaan Ekowisata Satwa Liar Non Penangkaran Kawasan Punggualas di Taman Nasional Sebangau Kabupaten Katingan. Jurnal Ilmiah Pariwisata*, 28(1), 100–112.
13. Harefa, M. S., et al. (2024). *Konservasi Satwa Liar: Tantangan dan Strategi Pengelolaan. Journal of Laguna Geography*, 20.
14. Suryandari, R., et al. (2024). *Mitigasi Satwa Liar di Koridor Ekologi Taman Nasional Gunung Halimun Salak. Cendekia: Jurnal Ilmu Pengetahuan*, 4(3), 272–280.

Course Module

Ecology of Tropical Large Mammals and Primates

Faculty of Forestry

Mulawarman University

Module name	Ecology of Tropical Large Mammals and Primates
Modul level, if applicable	Doctoral
Code, if applicable	220401903P055
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in which the module is taught	Odd/Even Semesters
Person resposible for the module	Dr. Yaya Rayadin, S.Hut., M.Sc
Lecturer	1. Dr.Ir.Chandradewana Boer, M.Sc 2. Dr.Rachmat Budiwijaya Suba, M.Sc. 3. Dr.Yaya Rayadin, S.Hut., MP
Language	Indonesia
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	**3 SKS / 4.8 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** **ILO-1** – Internalize scientific values, norms, and ethics **Knowledge**

	ILO-2- Synthesize knowledge obtained from research results with its novelty and implementation **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** **ILO-4 -** Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches **ILO-5** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** **ILO-6:** Manage data and information to support decision-making processes **Content Learning Outcome (CLO)** **Knowledge** **CLO1:** Able to explain the basic concepts of ecology and behavior of large mammals and tropical primates, including the importance of biodiversity conservation. **Special Skills** **CLO2:** Able to analyze the morphological, physiological, and behavioral adaptations of large mammals and tropical primates in various ecosystems (terrestrial, arboreal, aquatic). **CLO4:** Able to design and present research findings or case studies related to the ecology and behavior of large mammals and tropical primates based on scientific literature.. **General Skills** **CLO3:** Able to evaluate anthropogenic impacts on populations and habitats of large mammals and tropical primates and develop evidence-based conservation strategies.
Content	This course explores the ecology, behavior, and conservation of large mammals and tropical primates across various ecosystems. Students will study their morphological, physiological, and behavioral adaptations to terrestrial, arboreal, and aquatic environments. The course covers biodiversity conservation, anthropogenic impacts on habitats, and conservation strategies based on scientific research. Key topics include the biogeography of Sumatra and Borneo's tropical forests, ecological impacts of industrial and mining activities, and research methods for monitoring these species. Students will engage in case studies and presentations, applying their knowledge to real-world conservation issues. By the end of the course, students will be equipped to evaluate and design conservation strategies for large mammals and tropical primates. 1. Introduction to the ecology of large mammals and tropical primates (1ST meeting) **(CLO-1)** 2. Diversity and characteristics of large mammals and tropical primates (2nd- 3rd) **(CLO-1)**

<table>
<tr><td></td><td>3. Morphological and physiological adaptations of large mammals and tropical primates tropis (4th) (CLO-2)
4. Conservation ecology of large mammals and tropical primates (5-6th) (CLO-3)
5. Biogeographical review of Sumatra and Borneo tropical forests and their relation to the behavior of large mammals and tropical primates (7th) (CLO-1)
6. Mid-Term Exam (8th)
7. Anthropogenic impacts on populations and habitats of large mammals and tropical primates (9-10th) (CLO-5)
8. Research trends and monitoring techniques for large mammals and tropical primates (11-12th) (CLO-4)
9. Ecology of mammals and primates in industrial plantation forests (13th) (CLO-1)
10. Ecology of mammals and primates in mining areas (14th) (CLO-1)
11. Seminar and presentation of case study results on the ecology and conservation of large mammals and tropical primates based on reputable international journal literature (CLO-4)
12. Final Exam (16th)</td></tr>
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<tr><td>2</td><td>Laboratory Practice/Field Work</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignments/Case Studies</td><td>Group Presentation</td><td>15</td></tr>
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<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Cahyani, D.A., et.al. (2024). Identifikasi Jenis Mamalia di Kawasan Taman Nasional Gunung Halimun Salak Pada Jalur Citalahab dan Cikaniki. Jurnal Biologi dan Pembelajarannya, 11(1), 18–28
2. Maulana, A., & Iskandar, E. (2019). Tingkah Laku Anakan Monyet Ekor Panjang (Macaca fascicularis) di Pusat Primata Schmutzer, Taman Margasatwa Ragunan, Jakarta. Jurnal Primatologi Indonesia, 16(2), 25–32
3. Magfirah, U. (2023). Analisis Perilaku Sosial Affiliative dan Agonistic Orangutan Sumatera (Pongo abelii) di Stasiun Penelitian Ketambe Aceh Tenggara sebagai Referensi Mata Kuliah Etologi. Skripsi, Universitas Islam Negeri Ar-Raniry, Banda Aceh
4. Putri, N. A., et al. (2023). Perbedaan Mamalia di Sulawesi dan di Sumatera dari Sudut Pandang Keanekaragaman Hayati dan Endemisme. Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan Wilayah Pesisir, 1(1), 1–8.
5. Santosa, Y., et al. (2023). Inventory of Mammal Species Using Camera Trap in Nagari Pondok Parian Forest Area, Pesisir Selatan, West Sumatra. Serambi Biologi, 8(2), 212–223.</td></tr>
</table>

	6. Santika, T., et al. (2023). *Insights from 20 Years of Mammal Population Research in Indonesia.* ResearchGate. 7. Kurniawan, A., & Winarno, G. D. (2020). *Ekologi Hewan.* Eureka Media Aksara. 8. Balai Besar Taman Nasional Bukit Barisan Selatan. (2024). *Stasiun Penelitian Way Canguk: 20 Tahun Penelitian dan Konservasi*. 9. Various related articles about Ecology of Tropical Large Mammals and Primates

Course Module

Management of Natural Resources and Environment

Faculty of Forestry

Mulawarman University

Module name	Management of Natural Resources and Environment
Module level, if applicable	Doctoral
Code, if applicable	220401902P057
Subtitle, if applicable	
Courses, if applicable	Regular
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Prof. Dr. Ir. Marlon I. Aipassa, M.Agr
Lecturer	Prof. Dr. Ir. Marlon I. Aipassa, M.Agr Dr. Yaya Rayadin, S.Hut., M.P.
Language	Indonesia
Relation to curriculum	Elective Courses
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	
Recommended prerequisites	

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **CPL5/ILO5 (KU2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** 6. **CPL6/ILO6 (GS3)** - Manage data and information to support decision-making processes 7. **CPL7/ILO7 (GS4)** - Work and communicate in an international context **Course Learning Outcome (CLO)** 1. **CLO 1 :**.Students will be able to analyze development policy frameworks in East Kalimantan and identify strategic issues related to regional development, including green economic transformation and sustainable natural resource management. 2. **CLO 2 :** Students will be able to apply concepts and principles of natural resource management (water, forests, and land) and environmental protection within the context of sustainable development, including decarbonization efforts and blue carbon inventory. 3. **CLO 3 :** Students will be able to evaluate sustainable development policies and plans, such as the development of the Nusantara Capital City and tropical forest management policies for community welfare, and provide evidence-based recommendations.
Content	The course Management of Natural Resources and Environment discusses sustainable development with a case study of East Kalimantan, covering policy frameworks, regional strategic issues, green economic transformation, land use, water resource and protected forest management, tropical forest management policies, the development of the Nusantara Capital City, as well as decarbonization efforts and blue carbon inventory. Assessment is conducted through midterm and final exams. 1. Policy Framework for East Kalimantan Development **(1st–2nd sessions) → CLO1**

<table>
<tr><td></td><td>2. Strategic Issues Related to Regional Development in East Kalimantan (3rd session) → CLO1
3. Economic Transformation from Non-Renewable Resources to Renewable Resources (Green Economy) (4th–5th sessions) → CLO3
4. Land Use, Natural Resource Utilization, and Environmental Protection (6th–7th sessions) → CLO2.
5. Midterm exam(8th sessions)→ Assessment .
6. Water Resource Management within the Watershed and Protected Forest Management Framework (9th–10th sessions) → CLO2.
7. Tropical Forest Resource Development Policy for Community Welfare (11th–12th sessions) → CLO3.
8. Development of Nusantara Capital City (13th–14th sessions) → CLO1 & CLO3.
9. Strengthening the Implementation of Environmental Protection and Management Plans in East Kalimantan: Decarbonization, Blue Carbon Inventory (15th session) → CLO2
10. Final Exam (16th session) → Assessment</td></tr>
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<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press.
2. MEA. 2005. Ecosystems and Human Well-being: Synthesis. Island Press.
3. Daily, G. C.1997. Nature's Services: Societal Dependence on Natural Ecosystems. Island Press.
4. Barrow, C. J. 2006. Environmental Management for Sustainable Development. Routledge.
5. Lindenmayer, D. & Burgman, M. 2005. Practical Conservation Biology. CSIRO Publishing.
6. Pearce, D. W., Markandya, A., & Barbier, E. B. 1989. Blueprint for a Green Economy. Earthscan
7. Sayer, J. & Maginnis, S. 2005. Forests in Landscapes: Ecosystem Approaches to Sustainability. Earthscan.</td></tr>
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	8. Scherr, S. J., & McNeely, J. A. 2008. *Biodiversity Conservation and Agricultural Sustainability: Toward a New Paradigm of 'Ecoagriculture'.* Island Press. 9. IPCC Reports (Intergovernmental Panel on Climate Change) – *Climate Change and Resource Management.* 10. FAO (Food and Agriculture Organization) Reports – *State of the World's Forests.* 11. World Bank .2021. *The Changing Wealth of Nations 2021: Managing Assets for the Future.* 12. Government of Indonesia. 2020. *Policy Framework for East Kalimantan Development.* 13. UNEP (United Nations Environment Programme). *Decarbonization and Blue Carbon Management Reports.*

Course Module

Management of Conservation Areas

Faculty of Forestry

Mulawarman University

Module name	Management of Conservation Areas
Modul level, if applicable	Doctoral
Code, if applicable	220401902P058
Subtitle, if applicable	
Courses, if applicable	Regular
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Dr. Rachmad B. Suba, S.Hut., M.Sc.
Lecturer	Dr. Rachmad B. Suba, S.Hut., M.Sc. Dr. Ir. Triyono Sudarmadji, M.Agr Dr. Yaya Rayadin, S.Hut., MP
Language	Indonesia, English
Relation to curriculum	Elective Course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	
Recommended prerequisites	

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **CPL5/ILO5 (KU2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** 6. **CPL7/ILO7 (GS4)** - Work and communicate in an international context **Cource Learning Outcome (CLO)** 1. **CLO 1 :** Students are able to explain the history of the conservation movement, basic concepts of biodiversity, and types of conservation areas, including the philosophy of conservation, characteristics of tropical biodiversity, flag and umbrella species, as well as rarity and endemism. 2. **CLO 2:** Students are able to analyze and design conservation area management, including zoning, efficiency techniques, and conservation area management models, by considering biological and non-biological aspects as well as extreme weather conditions. 3. **CLO 3 :** Students are able to identify threats to conservation areas both internally and externally, and design solutions based on collaboration and partnerships involving international relations related to protected wildlife, species diversity, and genetic diversity.
Content	The "Conservation Area Management" course provides students with a comprehensive understanding of the principles and practices essential for managing conservation areas effectively. Starting with the foundational concepts and standards of conservation area management, the curriculum explores the history of conservation movements, types of conservation areas, and in-depth discussions on biodiversity, including tropical biodiversity, flag species, and concepts of rarity and endemism. It progresses to examine biological and non-biological conservation strategies, zoning management, legal frameworks, and the interplay between central and regional authorities in conservation efforts. The course also covers practical aspects of conservation such as in-situ and ex-situ conservation methods, captive breeding, and strategic partnerships necessary for successful conservation management. The complete topic of each meeting is mentioned below:

<table>
<tr>
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<td>
1. Master and understand the subject matter of Conservation Area Management (PKK) and its competency standards (1st session) → CLO1
2. Explain the history of the conservation movement and the types of conservation areas (2nd session) → CLO 1.
3. Explain the concept and definition of biodiversity, as well as identify its characteristics and conservation status (3rd session) → CLO 1.
4. Explain and identify the characteristics of tropical biodiversity, flag and umbrella species, as well as rarity and endemism (4th session) → CLO 1.
5. Understand, master, and explain the concepts of biological and non-biological conservation, as well as the impact of extreme weather conditions (5th session) → CLO 2.
6. Able to develop descriptions and analyze the characteristics of in-situ and ex-situ conservation, as well as captive breeding (6th session) → CLO 2.
7. Able to design area management, zoning, and efficiency techniques for the management of conservation areas and zoning systems (7th session) → CLO 2.
8. Able to design zoning divisions and zoning management models for conservation areas (8th session) → CLO 2.
9. Midterm Exam (9th session) → Asessment
10. Able to explain the working relationships and authority in the management of conservation areas (and protected areas) between the central and regional governments (10th session) → CLO 3.
11. Able to explain the legal basis and legitimacy of zoning distribution, as well as analyze the authority of conservation area management between the central and regional governments (11th session) → CLO 3.
12. Able to select and determine target species for management, including endemism, rarity, and common species (12th session) → CLO 3.
13. Able to understand the concept and implementation of partnerships and collaboration in the management of conservation areas (educational and research forests) (13th session) → CLO 3.
14. Able to understand various threats to the existence of conservation areas, both direct and indirect, as well as from internal and external sources (14th session) → CLO 3.
15. Able to understand various international relations concerning protected wildlife, species diversity, and genetic diversity (15th session) → CLO 3.
16. Final Exam (16th session) → Assessment.
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<tr><td colspan="3">TOTAL</td><td>100</td></tr>
</table>
</td>
</tr>
</table>

Media employed	Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR
Reading list	1. Pengelolaan Kawasan Konservasi (John Mackinnon) 2. Mengapa Hutan Tropis bisa Rusak. 2011. (Chandra Boer). Makindo Grafika, Yogyakarta 3. Orangutanku Tersayang. 2012. (Chandra Boer). Gramedia, Jakarta 4. Rekreasi Alam. 1999. (Chandra Boer). Diktat Kuliah 5. Maintaining Biodiversity in Forest Ecosystems. 1999. (Malcom L. Hunter JR). Cambridge University Press 6. Global Biodeversity Strategy. 1992. WRI, IUCN dan UNEP, FAO dan UNESCO 7. Creative Conservation. 1994. PJS. Olney, GM. Mace dan ATC. Feistner 8. Biological Diversity. The coexistence of species on changing landscapes. 1994. (Michael A. Huston). Cambridge University Press 9. Various other related scientific articles on the Management of Conservation Areas

Course Module

Restoration of Conservation Area

Faculty of Forestry

Mulawarman University

Module name	Restoration of Conservation Area
Modul level, if applicable	Doctoral
Code, if applicable	220401902P059
Subtitle, if applicable	
Courses, if applicable	Regular
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person resposible for the module	
Lecturer	
Language	Indonesia, English
Relation to curriculum	Elective Courses
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	
Recommended prerequisites	
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1) -** Internalize values, norms, and ethics **Knowledge**

	2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **CPL5/ILO5 (KU2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** 6. **CPL6/ILO6 (GS3)** - Manage data and information to support decision-making processes 7. **CPL7/ILO7 (GS4)** - Work and communicate in an international context **Cource Learning Outcome (CLO)** 1. **CLO 1 :**. Students will demonstrate an in-depth understanding of the definitions and fundamental principles of ecosystem restoration. They will be able to explain various approaches and methods used in restoration, including identifying factors that influence restoration success. 2. **CLO 2 :** Students will be able to interpret and apply national and international policy frameworks related to ecosystem restoration. Additionally, they will engage in identifying ethical issues and community involvement strategies to empower local communities in conservation restoration projects. 3. **CLO 3 :** Students will develop practical skills to draft inclusive and sustainable restoration plans, apply survey and mapping techniques in restoration projects, and evaluate the effectiveness of various restoration methods used. They will also be skilled in managing resources and mitigating conflicts during restoration projects.
Content	The Conservation Area Restoration course is designed to provide an in-depth understanding of the definitions and basic principles of ecosystem restoration, various approaches and methods used, and factors influencing the success of restoration. This program includes the analysis of restoration case studies across different biomes, national and international policies related to restoration, and ethical issues in conservation area restoration. Students will also learn about resource management, conflict mitigation, community involvement, and empowerment of local communities, as well as the application of the latest technologies in restoration areas. 1. Understanding definitions and basic principles of ecosystem restoration (1st session) → **CLO1** 2. Explaining various approaches and methods in ecosystem restoration (2nd session) → **CLO1**

<table>
<tr><td></td><td>3. Identifying factors influencing the success of restoration (3rd session) → CLO1
4. Analysis of restoration case studies across different biomes (4th session) → CLO1
5. Understanding national and international policy frameworks related to restoration (5th session) → CLO2
6. Identifying ethical issues in conservation area restoration (6th session) → CLO2
7. Community involvement and empowerment of local communities (7th session) → CLO2
8. Midterm Exam (8th session) → Assesment
9. Resource management and conflict mitigation (9th session) → CLO3
10. Writing and publication of restoration research findings (10th session) → CLO3
11. Drafting inclusive and sustainable restoration plans (11th session) → CLO3
12. Applying survey and mapping techniques in restoration (12th session) → CLO3
13. Implementing the latest technology in restoration areas (13th session) → CLO3
14. Evaluating the effectiveness of restoration methods (14th session) → CLO3
15. Training and capacity building for local stakeholders (15th session) → CLO3
16. Final Exam (16th session) → Assesment</td></tr>
<tr><td>Study and examination requirements and forms of

examination</td><td>Evaluation and assessment of learning achievement based on:

<table>
<tr><th>No.</th><th>Objects of Assessment</th><th>Forms of Assessment</th><th>Quantity (%)</th></tr>
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</table>
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<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Allison, S. K. 2012. Ecological Restoration and Environmental Change: Renewing Damaged Ecosystems. Routledge.

2. Andel et al. 2012. Restoration Ecology: The New Frontier. Wiley-Blackwell.

3. Clewell et al. 2013. Ecological Restoration: Principles, Values, and Structure of an Emerging Profession. Island Press.</td></tr>
</table>

	4. Hakkenberg, D. P. 2019. *Ethics in Restoration Ecology: A Guide for Professional Conduct*. Society for Ecological Restoration. 5. Moss, B. 2010. *A Guide to the Restoration of Nutrient-Enriched Shallow Lakes*. Wiley. 6. Palmer, M. et.al. 2016. *Foundations of Restoration Ecology*. Island Press. 7. Rieger et al. 2013. *Project Planning and Management for Ecological Restoration*. Island Press. 8. Aronson et al. 2007. *Restoring Natural Capital: Science, Business, and Practice*. Island Press. 9. Restoration Ecology: Repairing the Earth's Ecosystems in the New Millennium. 2000. *Restoration Ecology Journal*, 8(2), 115-120. 10. "Technological Advances in Restoration Ecology". 2015. *Journal of Applied Ecology*, 52(3), 599-607. 11. Community Involvement in Restoration: Approaches, Benefits, and Challenges. 2018. *Ecological Management & Restoration*, 19(2), 123-130. 12. Various other related scientific articles on the Landscape Ecology and Modelling

Course Module

Forest Management

Faculty of Forestry

Mulawarman University

Module name	Forest Management
Modul level, if applicable	Doctoral
Code, if applicable	190401602P074
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Prof. Dr. Rujehan, MP
Lecturer	1. Prof. Dr. Rujehan, MP 2. Dr. Setiawati, MP 3. Heru Herlambang, S.Hut. MP. Ph.D.
Language	Indonesian
Relation to curriculum	Matriculation, compulsory for non-forestry background
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **CPL1/ILO1 (A1) -** Internalizing values, norms, and ethics in Knowledge **Knowledge (K)** 2. **CPL2/ILO2 (K1) -** Synthesize knowledge acquired from research findings with novelty and its implementation. 3. **CPL3/ILO3 (K2) -** Discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions. **General Skills (GS)** 4. **CPL4/ILO4 (GS1)** – Critically analyze the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches. **5. CPL5/ILO5 (GS2) -** Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics. **Specialized Skills (SS)** **6. CPL6/ILO6 (SS1)** - Manage data and information to support decision-making processes. **7. CPL7/ILO7 (SS2)** - Work and communicate in an international context. **Course Learning Outcome (CLO)** 1. **CLO1:** Master theoretical concepts and fundamental principles of forest management in tropical environments. 2. **CLO2:** Conduct studies on the development of science and technology in the field of forestry and tropical environments. 3. **CLO3:** Select and apply methods for problem-solving in the field of forestry in tropical environments. 4. **CLO4:** Demonstrates responsible performance in forestry and tropical environmental expertise.
Content	The description should clearly indicate the weighting of the content and the level. 1. Basic Management Concepts, including: Definition and Meaning, Principles of Management, Levels of Management, Management Functions 2. History of Forest Management in Indonesia, including: Pre-Colonial Period, Colonial Period, Post-Independence Period

<table>
<tr><td></td><td>
3. Definition and Scope of Forest Management, including: Objectives and Functions of Forest Management; Technical, Social, Economic, and Environmental Aspects of Forest Management; New Paradigms in Forest Management.
4. Forest Management Concepts, including: Normal Forest Stand Structure, Sustainability Principles, Growth Increment (Riap), Rotation and Harvesting Cycles.
5. Even-Aged and Uneven-Aged Forest Management.
6. Yield Regulation and Forest Planning, including: Yield Regulation, Fully Structured Forest Planning, Measurement of Growing Stock, Harvesting Quota, Impact of High and Low Logging Intensity, Determining Harvest Volume.
7. Determination of Rotation, including: Factors Affecting Rotation, Types of Rotation, Determining Rotation Based on Maximum Production Volume.
8. Mid-Semester Examination.
9. Forest Land and Stand Assessment, including: Definition, Land Expectation Value (Factors Determining Forest Land Value and Assessment of Even-Aged Forest Stands), Stand Assessment (Cost and Revenue Estimation, Structured Forest Assessment), Stumpage Value (Calculation Methods for Stumpage Value).
10. Forestry and Forest Organizations, including: Forestry Organizations, Forest Organizations.
11. Forest Management Unit (FMU) Concept as a Management Unit.
12. Community-Based Forest Management Units, including: Forest Cultivation Area (KBK), Non-Cultivated Forest Area (KBNK), Case Studies.
13. Various Indicators of Sustainable Forest Management (Production, Ecology, and Socio-Economics), including: Sustainable Production Forest Management (PHPL), Sustainable Plantation Forest Management (PHTL).
14. Final Examination.
</td></tr>
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<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Lecture Participation</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
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<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>
1. Anonymous. 2014. Pengelolaan Hutan Berbasis Masyarakat (Status Kini dan Masa Depan). Forum Nasional untuk Hutan dan Masyarakat, Jakarta.
</td></tr>
</table>

2. Davis, L.S., K.N. Johnson. 1986. Forest Management (Third Edition). McGraw-Hill Book Company. New York, St. Louis, San Francisco, Auckland, Bogota Hamburg, London, Madrid, Mexico, Montreal, New Delhi, Panama, Paris, Sao Paulo, Singapore, Sydney, Tokyo, Toronto.
3. Jerram, M.R.K. 1935. A Text-Book on Forest Management, Chapman & Hall Ltd. London.
4. Junus, M. (Koordinator). 1984. Dasar-dasar Umum Ilmu Kehutanan. Badan Kerjasama Perguruan Tinggi Negeri Indonesia Bagian Timur, Ujung Pandang.
5. Kuncoro, I. 1995. Diktat Manajemen Hutan. Laboratorium Politik Ekonomi dan Sosial Kehutanan, Jurusan Manajemen Hutan, Fakultas Kehutanan Universitas Mulawarman, Samarinda.
6. Manullang. 1988. Dasar-dasar Manajemen. Ghalia Indonesia, Jakarta.
7. Nanang, M., G.S. Devung (Editor). 2004. Local People in Forest Management and The Politics of Participation. Indonesia Country Report. Institute foe Global Environmental Strategies (IGES), Kanagawa, Japan.
8. Poedjorahardjo. 1980. Manajemen Hutan. Pusat Pendidikan Kehutanan Cepu. Direksi Perum Perhutani, Cepu.
9. Raharjo D. Y. dan U. Pradhan. 2000. Pengelolaan Sumberdaya Hutan Berbasis Masyarakat: Wacana atau Pilihan. pp. 11
http://www.damarnet.org/download/makalah%20Seminar%20PSHBM-DAMAR.pdf
10. Rujehan. 2009. Dasar-dasar Manajemen (Buku Ajar). Program Pascasarjana Universitas Brawijaya, Malang.
11. Rujehan. 2019. Pengantar Manajemen Hutan. Mulawarman University Press, 2019
12. Sagala, P. 1984. Mengelola Lahan Kehutanan Indonesia. Yayasan Obor Indonesia, Jakarta.
13. Sardjono, M.A. 2004. Mosaik Sosiologis Kehutanan (Masyarakat Lokal, Politik dan Kelestarian Sumberdaya). DEBUT Press, Yogyakarta.
14. Sardjono, M.A. 2006. Beberapa Catatan Kebijakan dan Implementasi Pengelolaan Hutan Berbasis Masyarakat (CBFM) di Indonesia. Paper Presented at PHBLM (Pengelolaan Hutan Berbasis Lingkungan dan Masyarakat) Workshop, JAVLEC, Yogyakarta.
15. Simon, H. 1994. Merencanakan Pembangunan Hutan untuk Strategi Kehutanan Sosial. Yayasan Pusat Studi Sumberdaya Hutan. Yogyakarta.
16. Supratman, S. Alam. 2009. Manajemen Hutan (Bahan Ajar). Laboratorium Kebijakan dan Kewirausahaan Kehutanan, Fakultas Kehutanan Universitas Hasanuddin, Makassar.
17. Suwandhi, I. 2016. Mengenal Sistem Sertifikasi Pengelolaan Hutan Lestari di Indonesia. http://ichsansuwandhi.blogspot.com/2016/02/mengenal-sistem-sertifikasi-pengelolaan.html
18. Terry. 1960. Principles of Management, third edition Richard D. Irwin, Inc. Homewood, Illinois.
19. Wenger, Karl F. 1984. Forestry Handbook 2nd Edition.

	20. Williams, M.R.W. 1981. Decision Making in Forest Management. Research Studies Press, Toronto. 21. Wirakusumah, S. 2003. Sumberdaya Hutan (Suatu Telaah Ekonomi). Universitas Indonesia. UI-Press, Jakarta

Silviculture

Faculty of Forestry

Mulawarman University

Module name	Silviculture
Modul level, if applicable	Doctoral
Code, if applicable	
Subtitle, if applicable	-
Courses, if applicable	Regular
Semester(s) in which the module is taught	I
Person resposible for the module	Prof. Dr. Ir. Marjenah, M.P.
Lecturer	1. Prof. Dr. Ir. Marjenah, M.P. 2. Kiswanto, S.Hut., MP., Ph.D
Language	Indonesia, English
Relation to curriculum	*matriculation*
Type of teaching, contact hours	*Direct instruction, discussion, and assignment*
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consists of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-

Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches 5. **CPL5/ILO5 (KU2)** - Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics **Specialized Skills** 6. **CPL6/ILO6 (GS3)** - Manage data and information to support decision-making processes **Cource Learning Outcome (CLO)** **CLO 1** Students are able to master theoretical concepts and fundamental principles of science and technology in Silviculture. **CLO 2** Students are able to plan, execute, organize, and evaluate activities in Silviculture. **CLO 3** Able to select and apply appropriate instruments, processes, and methods for Basic silvicultural techniques correctly.
Content	The Silviculture course covers the principles and techniques of forest cultivation, including aspects of regeneration, growth, and stand maintenance to achieve sustainable forest management objectives. The course materials include fundamental silvicultural concepts, techniques for seedling production, planting, maintenance, and harvesting, with due consideration of ecological, economic, and social aspects. This course also integrates the latest technological approaches and field practices to support the planning and implementation of silviculture in various tropical forest ecosystems. The description should clearly indicate the weighting of the content and the level. 1. Learning contract and explanation of the course syllabus (RPS) (1st session) → **General**

<table>
<tr><td></td><td>2. Understand and be able to explain the definition of Silviculture. (CLO-1)
3. Understand and explain about the silvicultural techniques and systems. (CLO-2)
4. Understand and describe about the nursery management. (CLO-2)
5. Understand and explain about the seed treatment techniques and criteria for high-quality seeds and seedlings. (CLO-2)
6. Understand and explain about the site preparation techniques for dense plantations and row/intercropping plantations. (CLO-2)
7. Understand and explain about the forest plantation techniques. (CLO-3)
8. Understand and explain about the young tree maintenance. (CLO-3)
9. Understand and explain about the pruning. (CLO-3)
10. Understand and explain about the tapping and poisoning techniques and explain the thinning techniques. (CLO-2)
11. Understand and explain about the tree selection techniques. (CLO-2)
12. Understand and explain about the intensive silviculture techniques. (CLO-2)
13. Understand and explain about the agroforestry. (CLO-2)
14. Understand and explain about the basic principles of silviculture and fundamental silvicultural systems in Indonesia. (CLO-3)</td></tr>
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<tr><td>Reading list</td><td>1. Smith, D. M., Larson, B. C., Kelty, M. J., & Ashton, P. M. S. (1997). The Practice of Silviculture: Applied Forest Ecology. 9th Edition. New York: John Wiley & Sons.
2. Nyland, R. D. (2016). Silviculture: Concepts and Applications. 3rd Edition. Long Grove, IL: Waveland Press.
3. Smith, W. B., Miles, P. D., Perry, C. H., & Pugh, S. A. (2009). Forest Resources of the United States. U.S. Department of Agriculture.</td></tr>
</table>

	4. Evans, J. (1992). *Plantation Forestry in the Tropics: Tree Planting for Industrial, Social, Environmental, and Agroforestry Purposes*. Oxford: Clarendon Press. 5. FAO (Food and Agriculture Organization). (2000). *Silvicultural Systems*. Rome: FAO. 6. Rondolph, B., & Munandar, A. W. (2013). *Sistem Silvikultur di Indonesia*. Yogyakarta: Gadjah Mada University Press. 7. Nambiar, E. K. S., & Sands, R. (1993). *Productivity of Forests in Tropical Countries: Achieving Sustainable Management Through Intensive Silviculture*. Dordrecht: Springer. 8. Vanclay, J. K. (1994). *Modelling Forest Growth and Yield: Applications to Mixed Tropical Forests*. Wallingford: CAB Internasional. 9. Willan, R. L. (1985). *A Guide to Forest Seed Handling: With Special Reference to the Tropics*. Rome: FAO.

English

Faculty of Forestry

Mulawarman University

Module name	English
Modul level, if applicable	Doctoral
Code, if applicable	190401602W001
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Wilma Prafitri, M.Pd.
Lecturer	Wilma Prafitri, M.Pd.
Language	English
Relation to curriculum	Matriculation, compulsory for non-forestry background
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 2 Credit = 1.6 x 2 = 3.2 ECTS
Requirements according to the examination regulations	• Attendance at least 75% • Completion of assignments and quizzes • Participation in discussions and group activities
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)**

	1. **CPL1/ILO1 (A1) -** Internalizing values, norms, and ethics in Knowledge **Knowledge (K)** 2. **CPL2/ILO2 (K1) -** Synthesize knowledge acquired from research findings with novelty and its implementation. 3. **CPL3/ILO3 (K2) -** Discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions. **General Skills (GS)** 4. **CPL4/ILO4 (GS1)** – Critically analyze the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches. **5. CPL5/ILO5 (GS2) -** Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics. **Specialized Skills (SS)** **6. CPL6/ILO6 (SS1)** - Manage data and information to support decision-making processes. **7. CPL7/ILO7 (SS2) -** Work and communicate in an international context. **Course Learning Outcome (CLO)** 1. **CLO1:** Students can synthesize the latest forestry research for practical innovation and implementation. 2. **CLO2:** Students can develop new scientific concepts and scientific arguments in forestry. 3. **CLO3:** Students can criticize and apply forestry research theories and methodologies in an interdisciplinary manner. 4. **CLO4:** Students are able to manage and analyze forestry data to support decision-making. 5. **CLO5:** Students can demonstrate ethical conduct and a commitment to sustainable forestry practices. 6. **CLO6:** Students can work and communicate in an international context.
Content	This course is designed to help students deal with communication in English in a wide variety of different contexts. Each lesson is equipped with grammar practices and communicative tasks. Various topics discussed in this course are related to students‘ life, important events and culture In addition, students are also introduced to Mulawarman University English Proficiency Test MU-EPT a test to measure

<table>
<tr><td></td><td>students‘ English proficiency provided by Mulawarman University. The complete topic of each meeting is mentioned below:
1. Course description and objectives, Evaluation, Learning Contract, and Diagnostic Test.
2. A Person’s Daily Routine, Writing About Your Free Time Activity, Grammar Focus: Present, Continuous, Present Simple, Time Expressions, and Word Order.
3. Discussing news about Saving Lives Obtained from Newspapers, Articles, Etc; Reading a Heroic Story; Grammar Focus: Past Simple and Past Continuous Tense.
4. Listening and Reading The Work of The Famous Artist; Discussing The Work with Groups; Grammar Focus: Past Tense.
5. Giving personal opinions about the most challenging job; Reading an Article about Sports Starts’ Life; Grammar Focus: Present Perfect and Past Simple.
6. Types of Celebrations, The Description of A Traditional Wedding, Discussing about Wedding Ceremonies and Customs According to Different Ethnic Groups (Javanese, Dayak, Banjar, etc.), Language Focus: Request and Obligation. Grammar Focus: Modal Verbs.
7. Midterm Examination (UTS).
8. Short Conversation and Question and Response
9. Long Conversation.
10. Independent and Dependent Clauses.
11. Part of Speech.
12. Vocabulary section (synonym, to+ infinitive, passive voice).
13. Reading comprehension.
14. Final Examination (UAS).</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
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2. Oshima, A., & Hogue, A. (2016). Writing Academic English. Pearson.
3. Bailey, S. (2018). Academic Writing: A Handbook For International Students. Routledge.</td></tr>
</table>

	4. Oxford Advanced Learner's Dictionary. Materials from LMS And MU-EPT Preparation Resources.

Course Module

Landscape Ecology and Modelling

Faculty of Forestry

Mulawarman University

Module name	Landscape Ecology and Modelling
Modul level, if applicable	Doctoral
Code, if applicable	220401903P025
Subtitle, if applicable	
Courses, if applicable	Regular
Semester(s) in wich the module is taught	The course is available in all active teaching semesters
Person resposible for the module	Ali Suhardiman, Ph.D
Lecturer	Ali Suhardiman, Ph.D
Language	Indonesia, English
Relation to curriculum	Elective Courses
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	
Recommended prerequisites	

Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **CPL1/ILO1 (S1)** - Internalize values, norms, and ethics **Knowledge** 2. **CPL2/ILO2 (P1)** - Synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (P2)** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions **General Skills** 4. **CPL4/ILO4 (KU1)** - Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches **Cource Learning Outcome (CLO)** 1. **CLO 1 :**. Students are able to understand the Conceptual and Theoretical aspects of Landscape Ecology 2. **CLO 2 :** Students are able to understand Landscape Modeling Skills and GIS Usage 3. **CLO 3 :** Students are capable of conducting Independent Research Development and Scientific Writing
Content	The course "Landscape Ecology and Modelling" explores the fundamental concepts of landscape structure, function, and dynamics. Students engage in critical analysis of landscape ecology theories within the context of biodiversity conservation, examine the interplay between ecological processes and landscape patterns, and apply these concepts to global and anthropogenic changes. The course integrates practical sessions using GIS software for landscape simulation, remote sensing data for ecological modeling, and field research to validate theoretical models. This curriculum is designed to equip students with the skills to develop spatial models predicting landscape changes and their impacts on biodiversity, making it ideal for those interested in advanced ecological research and conservation strategies.The complete topic of each meeting is mentioned below: 1. Understand and explain the basic concepts of landscape ecology, including structure, function, and landscape dynamics (1st session) → **CLO 1**. 2. Critical analysis of landscape ecology theories in the context of biodiversity conservation (2nd session) → **CLO 1**. 3. Identify and discuss the interactions between ecological processes and landscape patterns(3rd session) → **CLO 1**. 4. Apply landscape ecology concepts in the context of global and anthropogenic changes (4th session) → **CLO 1**. 5. Develop spatial models to predict landscape changes and their effects on biodiversity (5th session) → **CLO 2**. 6. Application of GIS techniques in landscape analysis for conservation (6th session) → **CLO 2**. 7. Integration of remote sensing data in landscape ecological modeling (7th session) → **CLO 2**.

<table>
<tr><td></td><td>8. Midterm Exam (8th session) → Assesment
9. Critical evaluation of existing models and adjustment of models based on field data (9th session) → CLO 3.
10. Simulate landscape change scenarios using GIS software (10th session) → CLO 2.
11. Design research proposals that integrate theory and application in landscape ecology (11th session) → CLO 3.
12. Conduct field research to collect data relevant to landscape ecology theories (12th session) → CLO 3.
13. Analyze research data using appropriate statistical methodologies and interpretation (13th session) → CLO 3.
14. Write scientific articles for publication in peer-reviewed journals based on landscape ecology research (14th session) → CLO 3.
15. Present research findings (15th session) → CLO 3.
16. Final Exam (16th session) → Assesment</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No.</th><th>Objects of Assessment</th><th>Forms of Assessment</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Practicum</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignment/Case Study</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Project</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-semester test</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final semester test</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">TOTAL</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>1. Turner, M. G., Gardner, R. H., & O'Neill, R. V. 2015. Landscape Ecology in Theory and Practice: Pattern and Process. New York, NY: Springer.
2. Dramstad, W. E., Olson, J. D., & Forman, R. T. T. 1996. Landscape Ecology Principles in Landscape Architecture and Land-Use Planning. Washington, D.C.: Island Press.
3. Bolstad, P. 2008. GIS Fundamentals: A First Text on Geographic Information Systems. White Bear Lake, MN: Eider Press.
4. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. 2015. Remote Sensing and Image Interpretation. Hoboken, NJ: John Wiley & Sons.
5. Wu, J., & Hobbs, R. (Eds.). 2007. Models in Landscape Ecology and Planning. New York, NY: Springer.
6. Farina, A. 2006. Principles and Methods in Landscape Ecology: Toward a Science of Landscape. Dordrecht: Springer.</td></tr>
</table>

	7. Forman, R. T. T. 1995. *Land Mosaics: The Ecology of Landscapes and Regions*. Cambridge, UK: Cambridge University Press. 8. Gergel, S. E., & Turner, M. G. (Eds.). 2017. *Learning Landscape Ecology: A Practical Guide to Concepts and Techniques*. New York, NY: Springer. 9. Grant, W. E., & Swannack, T. M. 2008. Ecological Modelling: Understanding and Managing Our Complex Environment. Amsterdam: Elsevier. 10. Pickett, S. T. A., Cadenasso, M. L., & Grove, J. M. 2004. Resilient Cities: Meaning, Models, and Metaphor for Integrating the Ecological, Socio-economic, and Planning Realms. Landscape and Urban Planning, 69(4), 369-384. 11. Various other related scientific articles on the Landscape Ecology and Modelling

Course Module

Forest Policy

Faculty of Forestry

Mulawarman University

Module name	Forest Policy
Modul level, if applicable	Doctoral
Code, if applicable	
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	The course is available in all active teaching semesters
Person responsible for the module	Prof. Dr. Ir. Mustofa Agung Sardjono
Lecturer	1. Prof. Dr. Ir. Mustofa Agung Sardjono 2. Prof. Dr. Ir. Sigit Hardwinarto, M.Agr. 3. Dr. Emi Purwanti, S.Hut., M.Si. (+) Visiting Professor/Guest Lecturer (special occasions, e.g. 2024: Dr)
Language	Indonesia
Relation to curriculum	
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 79.3 hours per semester, which consist of : - 23.33 hours for lecture - 28 hours for structured assignments - 28 hours for individual study
Credit points	Credit points: 2 SKS / 3.2 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 1 Credit = 1.6 x 2 = 1.6 ECTS 2 Credit = 1.6 x 2 = 3.2 ECTS 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-

Recommended prerequisites	This course is particularly essential for doctoral students (S3) conducting dissertation research on topics related to Forest Sociology, Forestry Policy and Legislation, and Social Forestry. Its significance lies in the fact that social aspects of forestry remain relatively new and have a limited portion in forestry higher education curricula. By integrating policy and legislative analysis with social dimensions of forestry, this course equips students with critical insights and research competencies needed to address contemporary forestry governance and community-based forest management challenges.
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **CPL1/ILO1 (A1) -** Internalize values, norms, and ethics in Knowledge **Knowledge (K)** 2. **CPL2/ILO2 (K1) -** Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **CPL3/ILO3 (K2) -** Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **General Skills (GS)** 4. **CPL5/ILO5 (GS2) -** Demonstrate academic leadership in resource management to independently formulate research plans and possess scientific ethics. **Content Learning Outcome (CLO)** 1. **CLO1:** Justify the role of forestry policies and legislation as a fundamental basis for forest resource management in Indonesia, considering development dynamics and national priorities. 2. **CLO2:** Establish the link between development dynamics, including the need for changes and global commitments, with the formulation and revision of forestry and environmental policies. 3. **CLO3:** Synthesize key aspects requiring policy, regulatory, and legislative updates based on actual cases at the national and global levels. 4. **CLO4:** Analyze the content of forestry legislation using theoretical and practical insights, demonstrating the ability to critique and propose improvements in the hierarchy and substance of forestry, environmental, and related sector policies.
Content	The Forestry Policy and Current Legislation course serves as a continuation of the Advanced Forestry Policy and Legislation course at the master's level. At the doctoral level (S3), the course focuses on various forestry and environmental policies and legislation, considering both national dynamics and global (world forestry) perspectives. This course equips doctoral students with a strong theoretical foundation, enhances their critical analytical skills, and enables them to formulate

<table>
<tr><td></td><td>research proposals relevant to policy and legislative developments in the forestry and environmental sectors. The content is mentioned below:

1. Review of the Scope of Politics, Policy, Legislation, and Forestry Law – Fundamental concepts and frameworks.
2. Review of the Hierarchy of Legislation and Principles of Law in Indonesia – Legal structures and implementation principles.
3. Brief History of Policy Development and Institutional Dynamics in Indonesian Forestry – Evolution of forestry governance and regulatory changes.
4. Political Reform and Its Impact on the Democratization of Forest Governance in Indonesia – The role of decentralization and policy shifts in forest management.
5. Social Forestry: Community Involvement in State Forest Tenure – Legal frameworks and participatory forest management models.
6. TORA (Agrarian Reform and Land Redistribution): Expanding Community Access to Forest Land – Land tenure rationalization and policy implications.
7. Mid-Semester Evaluation / Mid-Term Exam (Covering Topics 1-7)
8. Forest Management Units (FMU): Optimizing Forest Management at the Local Level – Strategies for decentralized forest governance.
9. Omnibus Law and Multi-Business Forestry: Revitalizing the Forestry Sector? – Policy integration and legal reforms.
10. FOLU Net Sink: Forestry Sector Support for Global Climate Commitments – Sustainable forest management in carbon reduction strategies.
11. Focused Group Discussion (FGD) on National and Global Forestry and Environmental Dynamics – Indonesia's response to global forestry challenges.
12. Review of Topics 1-14: Key Issues and Field Observations – Comparative analysis of policies and practical applications in forestry management.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on scheme 1 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Assignments/Case Study</td><td>Group Presentation</td><td>25</td></tr>
<tr><td>3</td><td>Project</td><td>Presentation</td><td>25</td></tr>
<tr><td>4</td><td>Mid-Semester Test</td><td>Written test</td><td>15</td></tr>
<tr><td>5</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
</table>

Reading list	1. Kartodihardjo, H. (Ed.). 2013. Kembali ke Jalan Lurus. Kritik Penggunaan Ilmu dan Praktek Kehutanan Indonesia. Yogyakarta: FORCI Development bekerjasama dengan Tanah Air Beta 2. Nugraha A. dan Murtijo. 2005. Antropologi Kehutanan. Serpong, Tangerang: Wana Aksara 3. Richards, P. W. 1952. The Tropical Rain FOrests. Cambridge: University Press 4. Sardjono, M. A. 2004. Mosaik Sosiologis Kehutanan: Masyarakat Lokal, Politik dan Kelestarian Sumberdaya. Yogyakarta: Debut Press 5. Whitmore, T. C. 1975. Tropical Rain Forest of the Far East. Oxford: Clarendon Press 6. Zakaria, R. Y. 2024. Adat, Kelas, dan Indigenitas. Gerakan Masyarakat Adat di Indonesia. Jakarta: PT. Gramedia. 7. Midgley, J. 1995. Social Development. The Development Perspective in Social Welfare. London: SAGE Publication Ltd. 8. Wollenberg, E., D. Edmunds, L. Buck, J. Fox, S. Brodt. 2001. Social Learning IN Community Forest. Bogor: Center for International FOrestry Research (in cooperation with the East-West Center 9. Zakaria, R. Y. 2018. Etnografi Tanah Adat. Konsep-Konsep Dasar dan Pedoman Kajian Lapangan. Bandung: Agrarian Resource Center and PUSTAKA

Course Module

Wood Preservation Technology

Faculty of Forestry
Mulawarman University

Module name	Wood Preservation Technology
Modul level, if applicable	Doctoral
Code, if applicable	220401903P032
Subtitle, if applicable	-
Courses, if applicable	
Semester(s) in wich the module is taught	Odd/Even Semesters
Person resposible for the module	Dr. Ir. Isna Yuniar Wardhani, M.P.
Lecturer	Dr. Ir. Isna Yuniar Wardhani, M.P.
Language	Indonesia
Relation to curriculum	Compulsory
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of : - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	**3 SKS / 4.8 ECTS** Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude** 1. **ILO-1** – Internalize values, norms, and ethics **Knowledge** 2. **ILO-2-** Synthesize knowledge obtained from research results with its novelty and implementation 3. **ILO-3** - Discover and develop scientific conceptions with novelty value, and develop scientific arguments as scientific solutions

	General Skills 4. **ILO-4 -** Critically analyze the philosophy, theory, and research methodology in forestry and the moist tropical environment sciences through interdisciplinary, multidisciplinary, and transdisciplinary approaches **Course Learning Outcome (CLO)** **<u>Knowledge</u>** **CLO1:** Students are able to relate wood properties to the quality and adhesive durability of wood and wood biocomposites **<u>General Skills</u>** **CLO2:** Students are able to develop wood adhesive technology using natural materials **<u>Attitude</u>** **CLO3:** Students are able to manage data on wood adhesives to develop engineered wood/biocomposite products**.**
Content	This course focuses on the study of adhesives and their application in wood technology. Students will explore various types of adhesives, their properties, and how to identify them. They will examine the development of environmentally friendly wood adhesion technologies using natural materials and understand their relevance to the wood industry, considering different wood types . The course also covers the compatibility of adhesive characteristics with wood types in solid wood processing and biocomposite industries . Students will conduct tests to assess the strength and durability of adhesives used in wood and biocomposite materials , while relating environmental factors to these properties . They will analyze the suitability of industry standards for testing adhesive durability and determine appropriate adhesives for wood joints. The course includes a mid-term and final exam to assess student knowledge and practical application. **1.** Students able to identify various types of adhesives based on their properties (1ST meeting) **(CLO-1)** 2. Students able to analyze the development of environmentally friendly wood adhesion technology using natural materials (2nd-3rd) **(CLO-2)** **3.** Students able to relate wood adhesion technology to the needs of the wood industry according to the type of wood used (4th-5th) **(CLO-1**) 4. Students able to analyze the compatibility of adhesive characteristics with the type of wood used in solid wood processing and biocomposite industries (6th-7th) **(CLO-1)** 5. Mid-Term Exam (8th) 6. Students able to conduct tests on the strength and adhesive durability of wood and biocomposites (9th-10th) **(CLO-1)** 7. Students able to relate environmental factors to the strength and adhesive durability of processed wood products (11-12th) (**CLO-1)** 8. Students able to analyze the suitability of standards used in testing the strength and adhesive durability of wood and biocomposites (13-14th) (**CLO-3)** 9. Students able to analyze suitable adhesives for wood joints (15th) (**CLO-3)** 10. Final Exam (16th)

<table>
<tr><td>Study and examination requirements and forms of examination</td><td>Evaluation and assessment of learning achievement based on:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Practical</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignments/Case Studies</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Projects:</td><td>Report</td><td>15</td></tr>
<tr><td>5</td><td>Mid-Term Exam</td><td>Written test</td><td>15</td></tr>
<tr><td>6</td><td>Final Exam</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Class, Ms. Powerpoint, Ms. Word, Computer, LCD, STAR</td></tr>
<tr><td>Reading list</td><td>

1. Shmulsky, R and P.D. Jones. 2019. Forest Products and Wood Science An Introduction. Seventh edition. John Wiley & Sons Ltd. UK
2. Kollmann, F.F.P., E.W. Kuenzi and A.J. Stamm. 1975. Principles and Wood Science Technology: II. Wood Based Materials. Springer –Verlag. Berlin – Heidelberg
3. Pizzi. A. 1983. Wood Adhesives, Wood, Chemistry and Technology. Mercel Dekker, Inc. New York and Basel.
4. Wood handbook—Wood as an engineering material. 2010. Madison, U.S. Department of Agriculture, Forest Service, Forest Products Laboratory
5. Schweingruber, F.H. 2007. Wood Structure and Environment. Springer-Verlag Berlin Heidelberg.
6. Kollmann, F.F.P and W.A. Cote. 1984. Principles and Wood Science Technology: I. Solid Wood. Springer –Verlag. New York
7. Augustin, M. 2008. Handbook – Timber Structural. Ch. 4 Wood Adhesives
8. Forest Products Laboratory. 1999. Wood handbook —Wood as an engineering material. Ch 9. Adhesives Bonding of Wood Materials. U.S. Department of Agriculture Forest Service, Madison
9. Forest Products Laboratory. 2010. Wood handbook Centennial Edition —Wood as an engineering material. Ch 10. Adhesives with Wood Materials. U.S. Department of Agriculture Forest Service, Madison.
10. Mittal, K.L. 2015. Progress in Adhesion and Adhesives. Ch. Synthetic Adhesives for Wood, Chemistry and Technology by A. Pizzi. Wiley, Massachusetts
11. Rowell. M. 2013. Handbook of Wood Chemistry and Wood Composites. 2th Ed. CRC. London
12. Haygreen, J.G & J.L. Bowyer. 1996. Forest Products and Wood Science, An Introduction. IOWA State University / AMES
13. Other papers from International Journal related to Wood Preservation Technology

</td></tr>
</table>

Course Module

Biotechnology Application of Forest Breeding

Module name	Biotechnology Application of Forest Breeding
Modul level, if applicable	Doctorate
Code, if applicable	220401903P046
Subtitle, if applicable	-
Courses, if applicable	Regular
Semester(s) in which the module is taught	The subject is offered every semester
Person responsible for the module	Ir. Sukartiningsih, M.Sc., Ph.D.
Lecturer	Ir. Sukartiningsih, M.Sc., Ph.D. Dr. Sutedjo
Language	Indonesia
Relation to curriculum	Elective Course
Type of teaching, contact hours	Direct instruction, discussion, and assignment
Workload	Number of meetings per semester 16 meetings (14 meetings for learning activity, 1 meeting for mid-semester, 1 meeting for final examination) For this course, students are required to meet a minimum of 119 hours per semester, which consist of: - 35 hours for lecture - 42 hours for structured assignments - 42 hours for individual study
Credit points	Credit points: 3 SKS / 4.8 ECTS Details: 1 Credit = 170 min / week 1 Credit = 170 min x 14 week = 2380 min / semester 1 Credit = 39.7 h / semester 1 ECTS = 25 h/ Semester 1 Credit = 1.59 » 1.6 3 Credit = 1.6 x 3 = 4.8 ECTS
Requirements according to the examination regulations	-
Recommended prerequisites	-
Module objectives/intended learning outcomes	**Intended Learning Outcome (ILO)** **Attitude (A)** 1. **ILO1 (A1)** - Internalizing values, norms, and ethics in Knowledge **Knowledge (K)**

	2. **ILO2 (K1) -** Able to synthesize knowledge acquired from research findings with novelty and its implementation 3. **ILO3 (K2) -** Able to discover and develop scientific conceptions with novelty value, and able to develop scientific arguments as science solutions **General Skills (GS)** 4. **ILO4 (GS1) -** Able to criticize the philosophy, theory, and methodology of research in forestry and moist tropical environment studies through interdisciplinary, multidisciplinary, and transdisciplinary approaches **Content Learning Outcome (CLO)** 1. **CLO1**: Students are able to internalize values, norms, and ethics in biotechnology research for plant breeding to produce sustainable innovations. ILO1 (A1) 2. **CLO2**: Students are able to synthesize and apply the latest research findings in biotechnology for plant breeding to enhance productivity and plant resilience. ILO2 (K1) 3. **CLO3**: Students are able to design and develop new scientific concepts in biotechnology for plant breeding and formulate scientific arguments based on empirical evidence. ILO3 (K2) 4. **CLO4**: Students are able to critically evaluate the philosophy, theories, and methodologies in biotechnology research for plant breeding and integrate interdisciplinary, multidisciplinary, and transdisciplinary approaches. ILO4 (GS1). **5. CLO5**: Students are able to manage and analyze data from biotechnology research for plant breeding to support decision-making in agriculture and forestry. ILO4 (GS1).
Content	This course delves into the use of biotechnology in forest breeding, focusing on genetic engineering, tissue culture, and molecular markers to enhance forest productivity and sustainability. Students will learn through lectures, hands-on labs, and case studies, exploring topics such as genome editing, pest and disease management, and the integration of advanced technologies like GIS in forest management. The curriculum emphasizes both the practical application and ethical considerations of biotechnological interventions in forestry. The course concludes with student presentations and a final examination to assess understanding and application of biotechnological strategies in forest breeding. The complete topic of each meeting is mentioned below: 1. Introduction to Biotechnology in Forest Breeding (1st session) → CLO1 2. Genetic Engineering Techniques in Forest Species (2nd session) → CLO1 3. Tissue Culture and Clonal Propagation (3rd session) → CLO2 4. Molecular Markers in Forest Genetics (4th session) → CLO2 5. Field Application of Silvicultural Biotechniques (5th session) → CLO2

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<tr><td></td><td>
6. Genome Editing and Its Implications (6th session) → CLO3
7. Biotechnological Strategies for Pest and Disease Resistance (7th session) → CLO2
8. Midterm Exam (8th session) → Assessment
9. Environmental Stress Adaptation through Biotechnology (9th session) → CLO3
10. Conservation and Sustainable Use of Forest Genetic Resources (10th session) → CLO1
11. Advanced Genomic Tools for Forest Breeding (11th session) → CLO3
12. Case Studies in Forest Biotechnology (12th session) → CLO2
13. Student Research Presentations (13th session) → CLO3
14. Workshop on Writing Scientific Articles in Forest Biotechnology (14th session) → CLO3
15. Final Project Presentations (15th session) → CLO3
16. Final Exam (16th session) → Assessment
</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>
Evaluation and assessment of the learning process are following scheme 5 in the Academic Regulations of Mulawarman University:
<table>
<tr><th>No</th><th>Objects of Evaluation/Assessment:</th><th>Forms of E/A</th><th>Quantity (%)</th></tr>
<tr><td>1</td><td>Affective</td><td>Participation</td><td>10</td></tr>
<tr><td>2</td><td>Laboratory Practice/Fieldwork</td><td>Participation, Group Project Report</td><td>20</td></tr>
<tr><td>3</td><td>Assignment/Case Study</td><td>Group Presentation</td><td>15</td></tr>
<tr><td>4</td><td>Project</td><td>Report</td><td>15</td></tr>
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<tr><td>6</td><td>Final Examination</td><td>Written test</td><td>25</td></tr>
<tr><td colspan="3">Total</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>Media employed</td><td>Laptop, LCD</td></tr>
<tr><td>Reading list</td><td>
1. Fenning, T. (Ed.). (2018). Challenges and Opportunities for the World's Forests in the 21st Century. Springer.
2. This book provides a comprehensive overview of modern forest biotechnology, including genetic engineering and conservation strategies.
3. Bonga, J. M., & Aderkas, P. von. (2014). In Vitro Culture of Trees. Springer.
4. Focuses on the techniques and applications of in vitro culture in tree breeding, essential for students studying tissue culture and clonal propagation.
5. Neale, D. B., & Kremer, A. (2011). Forest tree genomics: Growing resources and applications. Nature Reviews Genetics, 12(2), 111-122. https://doi.org/10.1038/nrg2931
6. Reviews the genetic tools and resources available for forest tree genomics research, including molecular markers and genome sequencing.
</td></tr>
</table>

	7. Ahuja, M. R., & Jain, S. M. (Eds.). (2017). Genetic diversity and erosion in plants: Case histories. *Springer.* https://doi.org/10.1007/978-3-319-25954-3 8. Discusses the genetic diversity and erosion issues in forest plants, providing insights into conservation genetics and biotechnological applications. 9. Burdon, R. D., & Libby, W. J. (2006). Genetically modified forests: From Stone Age to modern biotechnology. *Forest Ecology and Management, 227*(1-2), 196-202. https://doi.org/10.1016/j.foreco.2006.02.049 10. Explores the history and development of genetically modified forests, evaluating the ecological and economic impacts of genetic modifications. 11. Sedjo, R. A. (2014). The promise of forest biotechnology. *American Journal of Agricultural Economics, 96*(2), 502-516. https://doi.org/10.1093/ajae/aat054 12. Provides an economic perspective on the potential benefits and risks of forest biotechnology, focusing on productivity and sustainability.