Course syllabus

Spatial Planning

Marzo – Julio 2025

Term VII

Professor

Carrión Puelles, Naldi Susan

I. General course information

Subject:	**Spatial Planning**		
Pre-requisite:	Geographical Information Systems	**Code:**	7964
Precedent:	does not apply	**Semester:**	2025-1
Credits:	3	**Term:**	VII
Weekly Hours:	4	**Course type:**	On-Campus
Program(s):	Mandatory unit Environmental Management Engineering	**Course Coordinator:**	Mayra Arauco Livia marauco@esan.edu.pe

II. Summary

The Spatial Planning course provides an in-depth exploration of the theories, methodologies, and tools used in the analysis and management of land use and territorial development. Students will gain a comprehensive understanding of spatial planning at multiple scales—national, regional, and local—emphasizing the intersection of environmental, social, and economic factors.

A key focus of this course is governance, examining how institutions, policies, and decision-making structures shape territorial planning processes. Students will analyze the role of national and local governments, regulatory bodies, and international organizations in guiding spatial planning strategies, ensuring sustainable development, equity, and resilience.

This course also places special emphasis on the use of innovative technologies to address contemporary planning challenges. Students will explore smart city concepts, geospatial technologies (GIS, remote sensing), digital twins, and big data analytics, understanding how these tools enhance urban and rural planning, disaster risk reduction, infrastructure management, and resource allocation.

Throughout the course, students will apply their knowledge through:

- A Midterm Presentation: Analyzing demographic and economic conditions in a selected Peruvian region, linking findings with territorial planning strategies.
- A Capstone Project (developed outside class hours): A comprehensive analysis of a protected area in Peru, with a focus on spatial planning tools, ecological-economic zoning (EEZ), and sustainability strategies.

By the end of the course, students will be equipped with the skills to integrate governance structures, advanced spatial technologies, and sustainability principles into spatial planning practices.

III. Course Objectives

By the end of this course, students will be able to:

1. Understand and apply spatial planning principles, tools, and methodologies.

2. Analyze territorial dynamics using demographic, economic, and environmental indicators.
3. Interpret and evaluate Peruvian territorial planning legislation and its practical applications.
4. Use GIS and smart technologies to model land-use changes, population growth, risk assessments, and urban innovation strategies.
5. Evaluate governance structures in spatial planning, understanding the role of institutions, policies, and decision-making frameworks.
6. Assess smart city applications and innovative technologies to address urban and rural planning challenges.
7. Develop and propose spatial planning strategies that integrate governance, sustainability, and technology-driven solutions.
8. Communicate findings effectively through reports, presentations, and interactive spatial mapping.

IV. Learning Outcomes

By the end of this course, students will be able to:

- Understand and apply spatial planning principles, tools, and methodologies.
- Analyze territorial dynamics using demographic, economic, and environmental indicators.
- Interpret and evaluate Peruvian territorial planning legislation and its practical applications.
- Use GIS and smart technologies to model land-use changes, population growth, risk assessments, and urban innovation strategies.
- Evaluate governance structures in spatial planning, understanding the role of institutions, policies, and decision-making frameworks.
- Assess smart city applications and innovative technologies to address urban and rural planning challenges.
- Develop and propose spatial planning strategies that integrate governance, sustainability, and technology-driven solutions.
- Communicate findings effectively through reports, presentations, and interactive spatial mapping.

V. Methodology

The course adopts a blended learning approach, combining theoretical lectures with practical exercises, case studies, and discussions to facilitate a deep understanding of spatial planning concepts. The teaching methodology is designed to engage students actively aiming that by the end of this course, students will be able to:

1. Understand and apply spatial planning principles, tools, and methodologies.
2. Analyze territorial dynamics using demographic, economic, and environmental indicators.
3. Interpret and evaluate Peruvian territorial planning legislation and its practical applications.
4. Use GIS and smart technologies to model land-use changes, population growth, risk assessments, and urban innovation strategies.
5. Evaluate governance structures in spatial planning, understanding the role of institutions, policies, and decision-making frameworks.
6. Assess smart city applications and innovative technologies to address urban and rural planning challenges.

7. Develop and propose spatial planning strategies that integrate governance, sustainability, and technology-driven solutions.
8. Communicate findings effectively through reports, presentations, and interactive spatial mapping.

VI. Assessment

The evaluation system is comprehensive and continuous with the objective of promoting learning in the student. The final grade is composed of Continuous Evaluation (CE) (70%), and Final work report and presentation (30%).

The continuous evaluation average is based on the student's learning process follow up: Participation & Discussion, GIS and Data Analysis Exercises, Real-World Case Studies & Policy Analysis and a Midterm Capstone Project. The weighted average of these marks results in the corresponding score detailed in the following table:

CONTINOUS ASSESSMENT AVERAGE (CAA) 70%		
Component	**Description**	**Weight (%)**
Participation & Discussions	Assessed through engagement, collaboration, and quality of contributions.	15%
GIS and Data Analysis Exercises	Includes Capstone **3rd & 5th Deliverables**, plus in-class **spatial analysis tasks**.	20%
Real-World Case Studies & Policy Analysis	Includes Capstone **1st & 4th Deliverables**, **plus smart cities workshop**.	25%
Midterm Project Presentation	**Demographic and Economic Analysis** of a Peruvian region, linking spatial planning strategies.	20%

Participation should be structured and measurable using the following criteria:

Evaluation Criteria	**Description**	**Weight (%)**
Class Engagement	Contribution to discussions, case study reviews, and debates.	40%
Preparedness	Completing assigned readings before class and contributing insights.	20%
Collaboration	Active involvement in peer reviews and group activities.	20%
Quality of Contributions	Relevance, depth, and critical thinking applied to discussions.	20%

How will be track It?

- Rubrics for Class Discussions – Evaluating the depth and quality of contributions.
- Online Reflections (Short Posts or Summaries) – Students summarize key takeaways from discussions.
- Peer Feedback – Students provide input on each other's engagement in debates and activities.

In terms of the capstone project will be divided into five (05) deliverables as follows:

Capstone Deliverable	Category for Evaluation	Justification
1st Deliverable: Selection of a Protected Area & EEZ Analysis	**Real-World Case Studies & Policy Analysis**	Evaluates how students assess territorial planning policies.
2nd Deliverable: Demographic and Economic Analysis of a Peruvian region, linking spatial planning strategies	**Midterm Project Presentation**	Evaluates how students assess social and economic integration with territorial planning processes
3rd Deliverable: GIS-Based Land Use Change Analysis	**GIS and Data Analysis Exercises**	Requires spatial analysis using GIS techniques.
4th Deliverable: Ecosystem Services Identification & Valuation	**Real-World Case Studies & Policy Analysis**	Examines planning methodologies linked to sustainability.
5th Deliverable: Risk Assessment for Local Communities	**GIS and Data Analysis Exercises**	Uses spatial mapping to assess vulnerability and hazards.

The final exam will be the final capstone project report and presentation, that would be held during the final week. This one will include linked previous capstone's deliverables with sustainable development goals (impacts and contributions) and outline developing strategies that could be proposed to improve the protected area territorial management.

Final Evaluation 30%		
Component	**Description**	**Weight**
Capstone Project – Final Report & Presentation	**Comprehensive strategic plan for a protected area (report and presentation).**	30%

The Final Grade (FG) is calculated using the following formula:

FA = (0,70 x CAA) + (0,30 x FP)

Where:
FA = Final Average
CAA = Continuous assessment average
FP = Final Presentation

VII. Program Content

WEEK	CONTEND	ACTIVITIES / EVALUATION
FOUNDATIONS OF SPATIAL PLANNING & DATA ANALYSIS		
1°	**Foundations of Spatial Planning** ◆ **Lecture:** • Introduction to Spatial Planning: Definition, goals, and importance.	**Interactive Activities:** ◆ **Video Analysis** **Spatial Planning and Spatial Development?** https://youtu.be/KPlSzF7ODhc

<table>
<tr><td rowspan="3">March 17 th to 22 th</td><td>• Governance in Spatial Planning: Role of institutions in shaping land-use decisions.
• Key Spatial Planning Terms: Land, Territory, Spatial Planning, Territorial Ordering, and Development.</td><td>Discussion: The Role of Planning in Sustainable Development (students analyze key takeaways).
◆ Digital Poll (Mentimeter):
What is the most important factor in spatial planning?
◆ Exercises & Assignments:
Short Reflection (Individual): How has spatial planning influenced my city or town?</td></tr>
<tr><td>Historical Foundations & Ancient Principles
◆ Lecture:
• Historical Evolution of Spatial Planning: Ancient civilizations and territorial organization.
• Ancient Principles of Spatial Planning:
Zoning – Establishing spatial boundaries.
Hierarchy – Decentralization and governance.
Integration – Connectivity and communication axes.
◆ Case Studies:
• Mesopotamia: The first urban civilization – water management & zoning.
• Greek Polis: Early models of regional spatial structures & hierarchy.
• Roman Empire: Road networks & integration of distant territories.
• Inca Empire: Territorial organization, productive systems, and regulatory devices.</td><td>Interactive Activities:
◆ Group Discussion:
Which ancient civilization had the most effective spatial planning system?
Students will:
- Present their selected ancient civilization's spatial planning model.
- Identify which territorial aspects (productive system, innovation, regulatory devices, active space) were present.
- Debate whether those principles still influence modern spatial planning.
◆ Mapping Exercise:
Students identify historical spatial planning principles on ancient cultures. This activity will allow students to visually analyze and interpret ancient spatial planning strategies by working with historical maps and identifying key planning principles:
- Zoning – How different areas were designated for living, working, agriculture, or religious purposes.
- Hierarchy – How governance structures influenced city organization (centralized vs. decentralized).
- Integration – How infrastructure, transportation, and communication networks connected spaces.
Identification (20 minutes)
Each group marks and labels the following on their map:
- Zoning: Residential, religious, military, and agricultural zones.
- Hierarchy: Centers of power (palaces, government buildings) vs. periphery.
- Integration: Trade routes, water systems, and defensive walls.
◆ Presentation & Discussion (15 minutes)
- Groups present their findings (3-5 minutes each).
- Questions for discussion:
- How do ancient planning strategies compare to modern cities?
- What aspects remain relevant today?
◆ Exercise/Assignment:
• Research Task for Week 2: Student selects an ancient civilization and analyzes how zoning, hierarchy, and integration were applied. They must also identify productive systems, innovative means, regulatory devices, and active spaces in that civilization.</td></tr>
<tr><td colspan="3">FROM ANCIENT PRINCIPLES TO MODERN SPATIAL PLANNING</td></tr>
<tr><td>2°</td><td>Historical Foundations & Ancient Principles
◆ Student Presentations on Ancient Spatial Planning:</td><td>◆ Interactive Activities:
• Live Discussion:
- Which ancient civilization had the most effective spatial planning?
- Do we still use these principles today? How?</td></tr>
</table>

March 24th to 29th	• Each student presents their **chosen ancient civilization**, focusing on: How zoning, hierarchy, and integration were applied Identification of productive systems, innovative means, regulatory devices, and active spaces Maps or diagrams to visually explain spatial organization ◆ **Lecture:** • How Ancient Planning Principles Still Influence Today • Comparing Ancient & Modern Spatial Planning: Mesopotamian cities → Early zoning laws Greek Polis → Urban centers and public spaces Roman Empire → Road networks and infrastructure Inca Empire → Integration of productive systems and sustainability	• **Mapping Exercise:** - Using maps of ancient and modern cities, students identify similarities and differences in zoning, hierarchy, and integration. • Reflection (Individual): - What lessons can modern urban planning learn from ancient civilizations?
	Zoning, Land-Use Planning & Modern Best Practices ◆ **Lecture:** • Fundamentals of zoning and land-use planning • Urban vs. Rural Land Allocation – How spatial planning guides development • International Best Practices **European Smart Growth Models** – Sustainable urban expansion - **Thailand & National Spatial Planning** – Long-term frameworks - **Germany & Sustainable Development Plans** – Integrating economy, environment, and social equity - **Peruvian Spatial Planning** – Existing frameworks and challenges	◆ **Case Study Analysis:** • **Land-use zoning issues in Arequipa, Cusco, and the Amazon** • **Comparison of zoning models** in Peru, Europe, and Asia • **Discussion:** Why do some countries succeed in spatial planning while others struggle? ◆ **Interactive Activities:** • **GIS Hands-on:** Students analyze **urban expansion and zoning policies in Peruvian cities** using **ArcGIS or Google Earth**. • **Role-Playing Exercise:** - Students take on roles as **urban planners, government officials, and environmental activists** - They **debate how to apply zoning best practices** in a hypothetical city ◆ **Exercises & Assignments:** • **Mapping Exercise:** Each student selects a **Peruvian city** and identifies its **zoning challenges**, creating a **GIS map or annotated satellite image**. • **Group Report:** Students analyze a **real-world city** and propose **zoning improvements** based on international best practices.
PERUVIAN SPATIAL PLANNING LEGISLATION & GOVERNANCE		
3° March 31st to April 5th	**Peruvian Spatial Planning Legislation & Governance** ◆ **Lecture:** • **Key Spatial Planning Laws & Policies in Peru:** - *Política de Ordenamiento Territorial y Gestión del Suelo*	◆ **Interactive Activities:** • **Case Study:** Students analyze a **regional PRDC or ZEE plan** and discuss its effectiveness. • **Debate:** Is Peruvian spatial planning truly decentralized? – Students argue for or against the **multi-level governance approach**. ◆ **Exercises & Assignments:**

	- *Plan Nacional de Desarrollo Urbano 2040* - *Decreto Supremo Nº 042-2023-PCM* (General Government Policy 2023) - *Ministry of Environment's Role (DL Nº 1013)* – Environmental conservation and land-use planning. • **National & Regional Planning Instruments:** - **PRDCs (Planes Regionales de Desarrollo Concertado)** - **Ecological-Economic Zoning (ZEE) and its role in land-use planning** - **CEPLAN's National Development Strategic Plan & Vision 2050**	• **Policy Review (Group Work):** Students summarize and present **one key Peruvian spatial planning law or policy**.
	Territorial Management & Peruvian Planning Instruments ◆ **Lecture:** • **Territorial Planning & Management in Peru:** - Relationship between **Ordenamiento Territorial (OT) & Gestión Territorial (GT)** - Land-use classification & zoning instruments in Peru. - Integration of **risk management, climate change adaptation, and economic development**. • **Comparison with International Approaches:** - **Germany:** Sustainable urban development frameworks. - **Colombia:** Land-use and territorial planning decentralization. - **Thailand:** Integrated national spatial planning strategies.	◆ **Interactive Activities:** • **GIS Hands-on Exercise:** Students **analyze and map** land-use classifications in different Peruvian regions using **ZEE maps**. • **Discussion:** "How does Peru's approach to territorial management compare to international best practices?" ◆ **Exercises & Assignments:** • **Mapping Exercise (Individual Task):** Students select a **Peruvian region** and identify **land-use classification issues and potential planning solutions**.
TERRITORIAL CONFLICTS, PLANNING CHALLENGES & GOVERNANCE		
4° April 7 th to 12th	**Causes & Consequences of Territorial Conflicts** ◆ **Lecture:** • **Understanding Territorial Conflicts:** - Causes: Informal settlements, land tenure issues, industrial zones near protected areas. - Consequences: Social inequalities, environmental degradation, economic inefficiencies. • **Case Study: Major Territorial Conflicts in Peru** - Tía María Project (Arequipa) – Mining vs. agricultural land use conflicts.	◆ **Interactive Activities:** • **Video & Discussion:** *Urban Expansion and Its Consequences – Learning from Global Failures.* https://youtu.be/Sv5QitqbxJw?si=Uv0JXn4Ipvc28aqA Infrastructure Expansion and Its Consequences https://youtu.be/Xaj1Gj7oXFM?si=Epmm6Jxxk3Wcvuj3 Agricultural Expansion and Its Consequences https://youtu.be/J3ddnPiuHtA?si=sFfkeHQXUWfyYwUp What happens when cities or economic activities expand without planning? • **Comparative Analysis:** Students **compare Peruvian land-use conflicts with international cases (e.g., Brazil's Amazon land disputes, China's urban relocation policies).** ◆ **Exercises & Assignments:**

	- Bagua (Amazon region) – Indigenous land rights vs. government development plans. - Lima's Informal Settlements – Unplanned urban expansion and infrastructure challenges.	• **Group Report:** Analyze a **spatial conflict in Peru** and: - Identify **stakeholders and their interests**. - Assess **governance mechanisms** used for resolution. - Propose **alternative solutions based on international best practices**.
	Governance & Stakeholder Analysis in Conflict Resolution ◆ **Lecture:** • **Governance in Spatial Planning & Conflict Resolution:** - Understanding **actors in spatial planning** (government, private sector, civil society). - **Multi-level governance models** and decision-making processes. - **Good governance principles** for stakeholder participation in land-use conflicts. • **Stakeholder Analysis & Power Mapping** - Identifying key actors in territorial conflicts (Government, NGOs, Private Sector, Communities). - Understanding power dynamics in conflict resolution processes.	◆ **Interactive Activities:** • **Role-Playing Simulation:** - Students take on roles as **government officials, community leaders, business owners, and NGOs**. - They **negotiate solutions for a land-use conflict case study** (e.g., mining vs. agricultural land use). ◆ **Exercises & Assignments:** • **Group Report:** Analyze a **spatial conflict in Peru** and: - Identify **stakeholders and their interests**. - Assess **governance mechanisms** used for resolution. - Propose **alternative solutions based on international best practices**.
INTRODUCTION TO ZONING AND REGIONAL PLANNING INITIATIVES IN PERU		
5° April 14 th to 16th	◆ **Lecture:** • **Fundamentals of Zoning** - Zoning types: **Urban, rural, industrial, conservation zones**. - The relationship between zoning and territorial ordering. - **Peruvian zoning background**: *Decreto Supremo Nº 087-2004-PCM* – Peru's first regional planning initiative. • **Peru's National Context:** How zoning has been applied at regional levels (e.g., **Loreto, San Martín, Arequipa**). • **The legal basis for EEZ development** and its integration into Peru's spatial planning system.	◆ **Interactive Activities:** • **Case Study Discussion:** How zoning has shaped development in a **Specific Region in Peru.** • Debate: Is Peru's zoning system prepared to face urban sprawl and rural-urban migration pressures?" They **negotiate solutions for a land-use conflict case study** (e.g., mining vs. agricultural land use). ◆ **Assignments:** • **Prepare for Week 6**: - Students review an EEZ document from any Peruvian region via MINAM's Geoportal to prepare for the next presentation. - Capstone Kick-off: Introduce 1st Capstone Deliverable (Selection of Protected Area).
ECOLOGICAL-ECONOMIC ZONING (EEZ) & APPLICATION IN PERU AND INTERNATIONAL MODELS		
6° April 21st to 26th	◆ **Lecture:** • **What is EEZ?** - Principles and objectives of **EEZ for sustainable land-use management**. - Difference between **traditional zoning vs. EEZ** (integration of ecological and economic criteria).	◆ **Interactive Activities:** • **GIS Hands-on:** Students use **Peru's MINAM Geoportal** to explore approved EEZ layers (e.g., priority conservation zones, economic use zones). • **Discussion:** "How does EEZ improve decision-making compared to conventional zoning?" ◆ Assignments: • **Short individual reflection:** How can EEZ contribute to resolving land-use conflicts in Peru?

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<tr><td></td><td>- Decreto Supremo Nº 087-2004-PCM and MINAM's role in EEZ governance.
- Case Study: EEZ implementation in Madre de Dios & Loreto.</td><td>• https://youtu.be/Iu9SuL62168?si=SniubLoxOySL5Xv-</td></tr>
<tr><td></td><td>🔷 Lecture:
• EEZ Applications Worldwide
- Brazil – EEZ for Amazon protection and sustainable development.
- Colombia – EEZ integrated into national territorial ordering.
- Thailand & Indonesia – EEZ in coastal planning.
• Governance and Implementation Challenges – Balancing economic interests, conservation, and social equity.
• Linking EEZ to Protected Areas Planning (Capstone Focus)</td><td>🔷 Interactive Activities:
• Capstone Project Activity:
- Students present their selected Protected Area (for Capstone) and compare:
✅ Regional EEZ priorities vs. the Protected Area's strategic objectives.
- Peer feedback session to refine the scope of each Capstone project.
🔷 Assignments:
• Submit 1st Capstone Deliverable (Draft): Preliminary Protected Area selection & EEZ analysis.</td></tr>
<tr><td colspan="3">REGIONAL ECONOMIC DYNAMICS & INTRODUCTION TO DEMOGRAPHIC FORECASTING</td></tr>
<tr><td>7°

April 28th to May 3rd</td><td>🔷 Lecture:
• RM N° 156-2016-MINAM: Legal framework for analyzing regional economic dynamics in spatial planning.
• What are Regional Economic Dynamics?
- Identifying productive sectors in Peruvian regions (agriculture, mining, services).
- The relationship between demography, labor markets, and economic specialization.
• Governance implications:
- How spatial planning decisions respond to economic structures and trends.</td><td>🔷 Capstone Project Introduction:
2nd Capstone Deliverable Launch:
• Students will select a province within their Protected Area and start analyzing its demographic and economic dynamics.
🔷 Assignments:
• Review official datasets (INEI or MINAM) to collect census and economic data for their chosen province.</td></tr>
<tr><td colspan="3">DEMOGRAPHIC FORECASTING & HISTORICAL TRENDS ANALYSIS</td></tr>
<tr><td>8°

May 5th to 10th</td><td>Demographic Forecasting Techniques
🔷 Lecture:
• Population Forecasting Techniques:
- Arithmetic Method
- Geometric Method
- Incremental Increase Method
- Comparative Overview
• Indicators to Forecast:
- Gender distribution
- Birth & death rates
- Urban vs. rural population trends
- Migration flows
- Population aging</td><td>🔷 Hands-On Exercise:
• Students will apply at least two methods (arithmetic + geometric) to forecast 2030 and 2050 population trends for their selected province.
• AI-Based Hands-On Exercise
🔷 Assignment:
Students prepare an initial population projection report based on 2 methods.</td></tr>
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	• **Introduction to AI for data visualization**: How AI (e.g., Claude, ChatGPT, or others) can: - Generate **population projection graphs** - Create **historical trend visualizations** - Suggest **data narratives** from simple input tables	
	Linking Demography with Economic and Natural Factors 🔷 **Lecture:** • **Historical Evolution Timeline (Economic & Demographic):** - Identifying **economic booms and recessions** linked to demographic shifts. - **Natural phenomena** (El Niño, droughts, etc.) and their demographic impact. • **How to connect forecasts with spatial planning:** - Adjusting **land use, public services, and infrastructure plans** based on population projections. - **Peruvian case studies** (e.g., urbanization in Piura vs. depopulation in Andean highlands).	🔷 **Interactive Activities:** • **Timeline Workshop:** Students create a **timeline linking demographic trends, economic cycles, and key environmental events** for their province. • **GIS Mapping (Optional):** Students visualize projected population distribution using **QGIS or ArcGIS**. 🔷 **Capstone Progress:** • Students will **present a draft of their demographic and economic analysis** for peer feedback. 🔷 **Assignments:** • **Submit the 2nd Capstone Deliverable Draft:** - **Demographic projections for 2030 & 2050** - **Economic activities linked to population trends** - **Identification of major natural factors affecting projections**
MIDTERM PRESENTATIONS & INTRODUCTION TO LAND-USE AND LAND COVER (LU/LC)		
9° May 12th to 17th	**Midterm Presentations** 🔷 **Activity:** • **Student Presentations (Midterm Evaluation):** Each student/group presents their **demographic and economic analysis** of a Peruvian province, covering: - Demographic forecasting for 2030 and 2050 - Economic dynamics and trends - Relationship with spatial planning challenges (urbanization, rural depopulation, etc.)	🔷 **Peer Feedback & Instructor Review:** • Class provides feedback on **clarity of data interpretation, use of forecasting methods, and territorial implications**. 📌 **Deliverable:** Midterm presentation needs to be uploaded to our university platform.
	Land-Use and Land Cover (LU/LC) Based on RM N° 081-2016-MINAM 🔷 **Lecture:** • **What is Land-Use and Land Cover (LU/LC)?** - Definitions and distinctions between **land use** (how land is utilized) and **land cover** (physical characteristics of the surface).	🔷 **Interactive Activities: Map Interpretation Exercise:** • Students **analyze LU/LC classification maps** (from **MINAM's Geoportal**) to identify: - Urban zones - Productive lands - Forests and protected areas - Water bodies and degraded areas 🔷 **Group Discussion:** How LU/LC data influences spatial planning decisions (e.g., zoning changes, conservation priorities). 🔷 **Assignment for Next Week:**

	- Why LU/LC is critical for **spatial planning** and **territorial management**. • **Legal Framework: Resolución Ministerial RM N° 081-2016-MINAM** – Guidelines for the classification of **LU/LC units in Peru**. • **Application in Peru:** - Case Study: **LU/LC applications in regional planning instruments**	Students select the province or region of their protected area (Capstone) and begin to: • **Collect LU/LC data** (via official sources like **GeoServidor MINAM**). • Dive into **LU/LC change analysis using GIS tools (QGIS or MINAM's Geoportal)** • Work with **satellite imagery for temporal comparison** (e.g., 2000 vs. 2020) • Connect this to **spatial planning decisions** related to protected areas. • **Prepare for a land-use change analysis** as part of the **3rd Capstone Deliverable**. • **Identify land-use change trends** (e.g., deforestation, agricultural expansion, urbanization). • **Measure surface change** (%) in each LU/LC class.
LAND-USE & LAND COVER CHANGE DETECTION + GIS		
10° May 19th to 24th	**Land-Use Change & Remote Sensing Applications** 🔷 **Lecture:** • **Land-Use & Land Cover Change (LUCC):** - Key concepts: LUCC as a driver of **ecosystem degradation, urbanization, and land conversion**. - **LUCC impacts** on protected areas and regional development. - Why LUCC monitoring is essential for **spatial planning** and risk management. • **Best Practices (FAO & UNEP):** - FAO's **Guidelines for Land Cover Classification System (LCCS)**. - UNEP's **Global Land Outlook** recommendations for sustainable land-use management. - Tools for monitoring LUCC (satellite imagery, remote sensing platforms, open GIS portals).	🔷 **Case Studies:** **LUCC analysis in Peru:** • Example of **deforestation in Madre de Dios**. • **Urban sprawl in Lima's periphery** from 2000 to 2020. 🔷 **Discussion Prompt:** • How does LUCC influence zoning updates and protected area management?
	🔷 **3rd Capstone Project Presentation:** **Task 1:** • Students use **MINAM's Geoportal** and/or **QGIS** to download and visualize **satellite imagery** for their selected protected area (2 timeframes, e.g., 2000 and 2020). **Task 2:** • Apply **supervised or unsupervised classification techniques** (or simplified manual interpretation) to:	🔷 **Group Reflection:** • What land-use dynamics are most critical for the protected area? • How can these insights help to **refine EEZ and spatial planning decisions**?

	- **Identify land-use change trends** (e.g., deforestation, agricultural expansion, urbanization). - **Measure surface change** (%) in each LU/LC class.	
ECOSYSTEM SERVICES ASSESSMENT (ESA) & SPATIAL PLANNING APPLICATIONS		
11° May 26th to 31st	**Introduction to Ecosystem Services (ES) & Policy Framework** 🔷 **Lecture:** • **Ecosystem Services Concepts**: - Definition of ecosystem functions and ecosystem services. - Types of ES according to the **Millennium Ecosystem Assessment**: ○ **Provisioning services** ○ **Regulating services** ○ **Cultural services** ○ **Supporting services:** From ecosystem functions to benefits for society. • **Peruvian Legal Framework:** - RM N° 311-2015-MINAM: ES definition and national applications. - **MERESE (Law N° 30215)** – Payment for Ecosystem Services scheme. - **RM N° 136-2015-MINAM**: Ecosystem conservation in spatial planning.	🔷 **Case Study Discussion:** • Costa Rica's **Pago por Servicios Ambientales** model (PSA). • **Fukuoka City, Japan** – Water ecosystem conservation fund. 🔷 **Interactive Activities:** • **Ecosystem Services Mapping Exercise** – Students identify and map key ES (e.g., water regulation, carbon sequestration) in their Capstone protected area using **LU/LC data + MINAM Geoportal**.
	ESA in Decision-Making & ESA for Spatial Planning 🔷 **Lecture:** • **ESA for Planners:** - Why ES assessments are critical for **spatial planning, environmental impact assessments (EIA), and conservation instruments**. - ESA as a tool to identify **synergies and trade-offs** (e.g., urban expansion vs. carbon sinks). - Prioritizing ES in protected areas to guide **land-use decisions**. • **International Methodologies & Tools:** - **The Ecosystem Services Cascade Framework** - Overview of **ARIES**, **TESSA**, and **InVEST** tools for ecosystem services modeling. - **Basic monetary valuation approaches** (qualitative and quantitative methods for ESA).	🔷 **Interactive Activities:** • **Group Exercise:** - Teams conduct a **trade-off analysis** of two ES in their Capstone protected area (e.g., timber production vs. biodiversity conservation). - Students discuss which ES should be prioritized based on the protected area's zoning, socio-economic needs, and sustainability goals. 🔷 **Capstone Progress:** Students start defining the **list of ecosystem services relevant to their protected area** and draft the structure for **Deliverable 4** (ESA-based classification and valuation plan).

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<tr><th colspan="3">MAPPING ECOSYSTEM SERVICES & CAPSTONE PRESENTATIONS</th></tr>
<tr><td rowspan="2">12°

June
2nd to
6th</td><td>GIS for Ecosystem Services & Trade-Off Visualization
🔷 Lecture:
• Spatial Mapping of Ecosystem Services:
- How to map provisioning, regulating, and cultural services in protected areas using GIS layers.
- Identifying ES hotspots and areas of potential conflict (e.g., agriculture vs. carbon sinks).
- Introduction to spatial multi-criteria analysis (SMCA) for prioritizing ES areas.
• Best Practices:
- UNEP-WCMC approach to ES mapping and its link with protected area planning.
- Case example: Colombia’s ES zoning methodology in the Orinoco region.</td><td>🔷 GIS Workshop:
• Students use QGIS or MINAM Geoportal to map at least two ecosystem services layers within their Capstone protected area (e.g., water provisioning + erosion control).
• Create basic trade-off maps overlaying conflicting land uses (e.g., timber extraction vs. watershed protection zones).</td></tr>
<tr><td>🔷 Capstone Presentations:
Each group presents their Ecosystem Services Assessment & Mapping for their protected area, focusing on:
• Classification of ecosystem services
• Preliminary valuation approaches (qualitative or quantitative)
• Spatial mapping outputs (LU/LC overlays, ES trade-off zones)</td><td>🔷 Peer Feedback Session:
• Students comment on each other's maps and ESA findings.
• Class discusses how ES maps could inform future zoning or EEZ updates in protected areas.
📌 Assignments:
Refine GIS outputs and prepare for the Capstone’s final risk assessment phase (Deliverable 5).</td></tr>
<tr><th colspan="3">COASTAL ECOSYSTEMS + DISASTER RISK MANAGEMENT (PERU LEGAL FRAMEWORK)</th></tr>
<tr><td>13°

June
9th to
14th</td><td>Coastal-Marine Ecosystems & Territorial Planning
🔷 Lecture:
• RM N° 311-2015-MINAM: Technical guidelines for coastal-marine ecosystem studies.
• Coastal-marine zones as strategic areas in Peruvian spatial planning.
- Key habitats (wetlands, dunes, estuaries, mangroves, sandy beaches)
- Territorial relevance of coastal dynamics (e.g., sediment transport, erosion, climate variability)
• Characterization protocols (based on uploaded materials):
- Coastal environment & geomorphology
- Oceanographic and hydrographic parameters
- Sediment transport & erosion dynamics</td><td>🔷 Interactive Activities:
• Case Study: LU/LC and coastal dynamics in Piura, Lima, or Tumbes.
• Impact of coastal land-use conflicts in Tumbes (mangrove degradation) and Lima (urban sprawl on coastal dunes).
• Students conduct a qualitative coastal-marine characterization for their Capstone protected area (if applicable).
🔷 Interactive Activities:
Role-Playing Exercise:
• Simulate a negotiation between local governments, port authorities, and conservationists over coastal land-use plans.
• Mapping coastal ecosystem services: Students identify ecosystem services and conflict zones (e.g., infrastructure near conservation areas) for their Capstone Protected Area (if applicable to coastal regions).</td></tr>
</table>

	- Anthropogenic impacts (infrastructure and land use) • Coastal-marine **ecosystem services** and their integration in spatial planning. • **Conflicts in coastal zones** (urban expansion, erosion, industrial projects). • Climate change impacts on **coastal resilience**.	
	Hazard & Vulnerability Assessment 🔷 **Lecture:** • **RM N° 008-2016-MINAM** methodology for **risk assessment** in spatial planning. • **PLANAGERD** objectives for integrating DRM into Peruvian territorial plans. • Concepts: - **Hazard typology** (geological, hydrometeorological, anthropogenic) - **Exposure, sensitivity, and adaptive capacity** - Vulnerability dimensions and assessment at **community & ecosystem level**	🔷 **GIS Exercise:** Students map **hazard zones** using **MINAM's Geoportal**, identifying areas of **critical vulnerability** in their Capstone protected areas. Students map **critical hazard zones** in their Capstone areas using the **MINAM Risk Geoportal**, focusing on coastal or inland risk profiles. 🔷 **Discussion:** How should DRM be incorporated into protected area zoning and management plans?
MULTI-RISK SCENARIO MODELING		
	Multi-Risk Scenario Modeling 🔷 **Lecture:** • **Multi-hazard scenario building:** - Assessing combined risks (e.g., floods + landslides + droughts). - Integrating **climate change trends** into risk scenarios. - Evaluating exposure across different **LU/LC units** (urban vs. natural zones).	🔷 **Workshop:** Students build **two risk maps** for their Capstone area: • **Current multi-risk scenario** • **Future scenario under climate change projections (2050 or 2070)**
14° June 16th to 21st	**Mitigation Strategies & Capstone Work** 🔷 **Lecture:** • **Disaster risk mitigation strategies:** - Nature-based solutions (e.g., ecosystem restoration for flood control) - Land-use restrictions in risk-prone areas - Linking **risk reduction with EEZ and zoning instruments**. • **SDG Integration:** How DRM contributes to **SDG 11 (Sustainable Cities)** and **SDG 13 (Climate Action)**.	🔷 **Capstone Workshop:** Students finalize **Deliverable 5**: • Hazard and vulnerability maps • Risk prioritization • **Prevention and mitigation strategies** for communities linked to the protected area.
APPLIED RISK EXERCISE + INSTITUTIONAL AND NORMATIVE FRAMEWORKS		
15°	**Applied Risk Exercise**	🔷 **Discussion:**

June 23th to 28th	◆ **Workshop:** • Students will apply a **full risk evaluation matrix** to their Capstone areas, covering: - **Hazard classification** - **Exposure assessment** - **Vulnerability analysis** - **Risk quantification** - **Identification of critical areas** within protected areas or buffer zones.	• How risk maps will guide zoning adjustments and planning interventions.
	Regulatory and Institutional Tools (RM N° 136-2015-MINAM & RM N° 159-2015-MINAM) ◆ **Lecture:** • **RM N° 136-2015-MINAM:** *Procedimiento Técnico y Metodológico para el Estudio Especializado de Normativa y Políticas con Incidencia Territorial*. Identifying national, regional, and local regulations impacting spatial planning. • **RM N° 159-2015-MINAM:** *Procedimiento Técnico y Metodológico para el Estudio Especializado de Análisis de Capacidad Institucional*. Institutional capacity assessment and governance evaluation for effective spatial planning.	◆ **Interactive Exercise:** Students will apply these two methodologies to their Capstone cases to: • Map **key regulatory frameworks** relevant to their protected area. • Assess the **institutional strengths and weaknesses** affecting territorial management.
	Sustainable Urban Forms + Sistema Nacional de Centros Poblados (SINCEP) ◆ **Lecture:** • **Sustainable Urban Forms:** Concepts of **Neo-Traditional Development**, **Urban Containment**, **Compact Cities**, **Transit-Oriented Development**, and **Eco-Cities**. Case studies: **Rosslyn-Ballston Corridor (USA)** and **Seaside, Florida (New Urbanism)**. • **Sistema Nacional de Centros Poblados (SINCEP):** Territorial organization principles and categories (macro-systems, systems, subsystems). SINCEP's role in sustainable regional and urban development planning (Decreto Supremo N° 022-2016-VIVIENDA).	◆ **Interactive Exercise:** Students will select a Peruvian city or province and **apply SINCEP criteria** to propose sustainable spatial organization alternatives.
SMART CITIES & FINAL PRESENTATION		
16°	◆ **Lecture:**	◆ **Workshop – Smart City Planning Exercise: Case Study (e.g., Lomas de Lúcumo or COVID-19**

June 30th to July 5th	• **Smart Cities Concept:** Definition and origins and Smart City frameworks. Smart Cities in Latin America: Challenges and opportunities.	**post-pandemic planning):** Students will design a **territorial plan integrating smart solutions** (IoT, digital twins, community engagement, etc.) to enhance urban resilience and sustainability. ◆**Discussion:** • How can smart city principles be adapted to **rural or protected areas**?
	◆ **Final Capstone Project Presentations** • Students will present their **final Capstone Deliverable (Deliverable 6)**, covering: Territorial diagnosis Land-use and land cover change Ecosystem services Risk analysis Final strategies to improve protected area management and their alignment with **SDGs**.	◆ **Peer Review & Final Reflection:** • Discussion on the integration of **spatial planning tools** with **climate action**, **disaster resilience**, and **governance frameworks**.

VIII. Bibliography

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Digital Platforms and Eucational Tools
Video Plataforms: Mentimeter y Miro.

IX. Laboratory Support

- Programa Mendeley
- Web browser
- Ilwis
- QGis

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