Indigenous-Centered Forest Policy and Land Management: A Comparative Analysis of Brazil and British Columbia (2000-2023)

UBCO - Interdisciplinary Graduate Studies - Sustainability

PhD Research Proposal - March 2025

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Integrating Policy Analysis, Land Cover Change Assessment, and Community-Based Evaluation

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Executive Summary

This proposal presents a 24-month PhD project that examines the relationship between forest policies and land coverage change within indigenous territories in Brazil and British Columbia. The research is designed to generate practical tools and insights valuable for land managers, policy makers, and indigenous communities, with a robust analytical framework.

The project emerges from three comprehensive examination papers. The first paper establishes the theoretical framework for policy analysis, the second develops the technical methodology for land cover change assessment using remote sensing, and the third connects policy implementation to observable outcomes. By integrating these foundations, this research creates analytical tools and policy recommendations that can inform land management decisions across multiple stakeholder groups.

Working within Brazil and British Columbia, this study will analyze 4-6 indigenous territories using publicly available data, policy documents, and open-source technologies. The research leverages existing datasets and established methodologies, making it both cost-effective and reproducible while ensuring that all analytical tools and findings will be accessible to diverse users including indigenous communities, government agencies, conservation organizations, and academic researchers.

The core innovation lies in developing transferable methodologies and practical tools that can support evidence-based land management and policy development. Community collaboration is actively pursued as a preferred pathway that enriches the research outcomes, but the project design ensures comprehensive

deliverables for all stakeholders regardless of community participation levels achieved during the research period.

Project Goals and Research Questions

This research aims to develop practical tools and evidence-based insights for land management and policy development within indigenous territories. The project recognizes that effective land management requires robust analytical frameworks that can inform decision-making across diverse stakeholder groups, from indigenous communities to government agencies and conservation organizations.

The research will create accessible analytical tools, methodologies, and databases that can support land management decision-making regardless of institutional context, while simultaneously developing evidence-based policy recommendations that can inform forest and indigenous land management policies. Through systematic analysis and tool development, the project will build transferable capacity for ongoing land monitoring and policy evaluation that serves multiple user communities.

Four interconnected research questions guide this investigation. First, how do formal policies interact with indigenous governance systems to influence forest conservation outcomes within indigenous territories in Brazil and British Columbia? This question focuses on analyzing publicly available policy documents and observable outcomes to understand governance interactions.

Second, what land cover change patterns can be identified within indigenous territories using remote sensing data, and how do these relate to policy implementation periods and approaches? This moves beyond simple change detection to examine temporal relationships between policy changes and land use outcomes using established remote sensing techniques.

Third, what lessons can be learned from comparing policy effectiveness across different indigenous territories to inform evidence-based policy development? This comparative approach seeks to identify transferable insights while acknowledging contextual differences, drawing on documented case studies and publicly available data.

Finally, how can analytical methodologies and monitoring tools be designed to serve diverse user communities including indigenous land managers, government agencies, and policy makers? This question addresses the practical challenge of ensuring research outputs have broad applicability and long-term utility through accessible technology platforms and clear documentation.

Methodology

This research employs a pragmatic three-phase approach over 24 months, designed to ensure robust project completion while maximizing opportunities for stakeholder engagement. The methodology prioritizes the development of evidence-based analytical tools and actionable insights that can serve diverse user communities, with community collaboration pursued where feasible and appropriate.

Phase 1: Research Design and Case Study Selection (Months 1-6)

The foundation phase establishes the analytical framework and selects 4-6 indigenous territories for comprehensive analysis. Case study selection is based on objective criteria including data availability for the

2000-2023 analysis period, diverse policy contexts that enable meaningful comparison, varying levels of formal legal recognition, and geographic representation across both Brazil and British Columbia.

The research framework is designed to generate valuable insights using publicly available data sources including satellite imagery, government policy documents, environmental monitoring reports, and academic literature. This approach ensures that comprehensive analysis can proceed regardless of direct community participation levels, while remaining respectful of indigenous autonomy and decision-making processes.

Systematic outreach to indigenous organizations and communities will explore collaboration opportunities following appropriate protocols for respectful engagement. Community partnerships that develop during this phase will enhance the research through local knowledge and validation, but the analytical framework ensures meaningful outcomes for all stakeholders whether direct collaboration occurs or not.

Phase 2: Integrated Analysis (Months 7-18)

The analytical phase builds directly upon the comprehensive examination papers, integrating their methodological contributions into a comprehensive framework for policy and land cover analysis. The policy analysis component systematically examines formal policies affecting indigenous lands from 1980 to present, using established methodological approaches to identify implementation patterns, effectiveness indicators, and barriers to successful outcomes.

This analysis draws on publicly available policy documents, government reports, academic literature, and documentation of policy implementation records. The framework generates valuable insights that can inform evidence-based policy development across different institutional contexts, with community partnerships enhancing rather than determining the analysis where they exist.

The land cover change analysis utilizes Hansen's Global Forest Change dataset and MapBiomas data for Brazil to conduct comprehensive spatial analysis of forest cover changes within selected territories. This technical analysis employs established remote sensing methodologies while developing user-friendly tools that can be applied by diverse land management professionals. The analytical framework relies on systematic technical approaches that ensure objectivity and reproducibility.

The policy evaluation component links observed land cover changes to policy implementation periods, identifying patterns and relationships that can inform evidence-based policy development. This analysis focuses on measurable outcomes that can be assessed consistently across different territories and policy contexts, creating transferable insights for land managers and policy makers.

Phase 3: Tool Development and Knowledge Transfer (Months 19-24)

The final phase focuses on translating research findings into practical tools and resources that serve multiple user communities. This includes developing user-friendly analytical software, methodological guides, and decision-support tools that land managers, policy makers, and researchers can apply in diverse contexts. The tools will be designed with different user interfaces appropriate for various technical skill levels, from basic visualization tools for policy makers to advanced analytical capabilities for researchers.

Knowledge transfer activities include the development of policy briefs, technical reports, training materials, and open-source software tools that make research findings accessible to different audiences. Academic dissemination through peer-reviewed publications and conference presentations ensures that

methodological innovations reach the broader research community, while policy-focused outputs provide practical guidance for government agencies and land management organizations.

Where community partnerships have been established, specific tools and resources will be developed to support community-based land management and monitoring activities. However, the primary focus remains on creating transferable tools and methodologies that can support evidence-based land management across diverse institutional contexts.

Timeline

24-Month Milestone-Driven Schedule

Phase & Milestones	Months 1-6	Months 7-12	Months 13-18	Months 19-24
Phase 1: Research Design	✓ Analytical framework established Case studies selected Data sources identified			
Phase 2: Integrated Analysis		✓ Policy analysis completed Land cover analysis initiated	✓ Comparative analysis completed Tool development initiated	
Phase 3: Knowledge Translation			✓ Analytical tools developed Initial dissemination	✓ Final deliverables completed Thesis defense
Ongoing Activities	Literature review, stakeholder outreach	Data processing, community engagement	Analysis refinement, writing	Publication preparation, dissemination

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Budget and Resource Allocation

This research is designed to be cost-effective while prioritizing the development of practical tools and evidence-based insights. The total estimated cost of $12,000 reflects a commitment to investing primarily in analytical capabilities and knowledge transfer rather than expensive equipment or data acquisition.

Budget Category	Amount	Description
Data acquisition and processing	$3,000	Access to computational resources for comprehensive analysis. Includes cloud computing resources for large-scale remote sensing analysis and subscription access to specialized databases.

Budget Category	Amount	Description
Tool development and software	$2,500	Creation of user-friendly analytical tools and decision-support systems. Includes software development tools, hosting costs for online platforms, and technical support for accessible interfaces.
Community engagement and outreach	$2,000	Respectful stakeholder engagement where communities express interest in collaboration. Includes travel costs for community meetings, interpretation services, and culturally appropriate communication materials.
Knowledge transfer and dissemination	$2,000	Ensuring research findings reach diverse audiences through multiple channels. Includes conference presentations, workshop materials, policy brief development, and open-access publication costs.
Training and capacity building	$1,500	Development of training materials and technical documentation for methodology and tool application. Includes user guides, video tutorials, and technical documentation.
Equipment and materials	$1,000	Essential computing resources, software licenses, and materials for field validation. Reflects reliance on existing data sources and open-source technologies.
Research travel and fieldwork	$2,000	Site visits for validation activities, conference participation for dissemination, and stakeholder meetings throughout the research process.
Academic dissemination	$6,500	Publication fees for three peer-reviewed journals, conference presentation costs, and open-access publication expenses to ensure wide accessibility.
Equipment and infrastructure	$1,000	Commitment to using existing computational resources and open-source software, relying on open-access datasets including Hansen's Global Forest Change data, MapBiomas collections, and publicly available government policy documents.
Total	**$21,500**	

Expected Outcomes and Impact

This research will generate outcomes that serve both community partners and broader academic and policy audiences. The primary deliverables center on community-controlled resources that provide lasting value beyond the doctoral timeline. These include an Indigenous Land Management Toolkit comprising user-friendly geospatial analysis tools designed specifically for community use, policy advocacy resources that provide evidence-based support for indigenous land rights and self-determination efforts, and comprehensive training materials that enable ongoing capacity building in land monitoring and analysis.

The academic contributions include three peer-reviewed publications developed in collaboration with indigenous partners where appropriate. These papers will address indigenous governance and conservation outcomes, participatory remote sensing methodology, and comparative policy analysis from indigenous perspectives. The PhD thesis will provide a comprehensive analysis that integrates all three comprehensive

exam papers while demonstrating the methodological innovations achieved through community-based research approaches.

Policy impact represents a crucial dimension of this research, with evidence-based recommendations that support indigenous land management autonomy while engaging directly with policy makers about research findings. The project will contribute to international discussions about indigenous rights and land management through presentations at relevant forums and conferences.

The capacity building outcomes extend beyond individual skill development to include the establishment of ongoing research partnerships and the documentation of approaches for integrating traditional and scientific knowledge systems. Indigenous community members will be trained in geospatial analysis techniques, creating local expertise that can support long-term land monitoring and management activities.

Integration of Comprehensive Exam Papers

This PhD proposal builds comprehensively on insights from three comprehensive examination papers, each contributing essential theoretical frameworks, methodological innovations, and empirical foundations that collectively inform the proposed research design. The three papers together represent a sophisticated progression from policy analysis theory, through technical spatial analysis capabilities, to integrated methodology development that directly shapes the proposed research.

Paper 1: Policy Analysis for a Changing Forest Region

The first comprehensive paper establishes a robust analytical framework for understanding forest governance in the colonized Americas, with particular attention to the evolution of policies from resource extraction to sustainability paradigms. This paper establishes a sophisticated framework for understanding policy boundaries that considers geographical scope, affected stakeholders, and temporal evolution, recognizing that boundaries are contingent and shaped by the analyst's disciplinary background and historical context. The framework provides comprehensive analysis of how colonial legacies continue to shape contemporary forest governance, including the systematic dispossession of Indigenous peoples and the prioritization of European legal frameworks over customary law systems.

The paper offers detailed examination of the relationship between customary Indigenous land rights and formal legal systems, drawing from comparative analysis across Australia, Brazil, Canada, and South Africa to understand legal pluralism potentials and challenges. This analysis extends to examining policy development drivers including ecological concerns, economic considerations, international agreements, and evolving social values toward climate change awareness. The paper develops multi-stakeholder behavioral analysis that recognizes forest owners as vital ecosystem service providers whose responses to policy changes vary widely based on their classification from "optimizers" to "traditionalists."

This approach creates a framework for examining interest groups that drive policy change, including governments, local communities, Indigenous populations, forest industry, financial institutions, and consumer demand patterns. The methodological contribution includes historical trajectory analysis that traces policy evolution from initial European settlement through industrialization, World Wars, and contemporary environmental awareness. This systematic approach to data collection combines policy document review, stakeholder interviews, spatial data analysis and modeling, and historical context examination.

The paper establishes a framework for evaluating policy objectives that distinguishes between explicit goals such as economic efficiency, sustainable timber production, and biodiversity conservation, and implicit aspirations that reflect deeper societal values. This analysis addresses policy implementation challenges including bureaucratic inertia, competing interests, and the temporal disconnect between ecological changes and political cycles, while recognizing that policy success depends on practical implementation, public acceptance, enforcement mechanisms, and long-term evaluation and adaptation cycles.

Paper 2: Land Cover Change, Forest Analysis in Brazil and Canada

The second paper establishes sophisticated technical foundations for spatial data analysis and remote sensing applications, providing the methodological backbone for empirically evaluating policy effectiveness through landscape change detection. This paper demonstrates deep technical expertise that creates comprehensive mastery of land cover classification methodologies using multiple satellite platforms including Landsat with 30m resolution and multi-decadal archive, MODIS with 250-1000m resolution and high temporal frequency, along with SPOT, Sentinel-3, PROBA-V, and AVHRR systems. This technical foundation includes advanced understanding of remote sensing preprocessing including geometric correction, radiometric calibration, atmospheric correction, and temporal normalization techniques essential for consistent time-series analysis.

The methodological contributions encompass sophisticated classification algorithms including both supervised approaches such as Random Forest, Classification and Regression Trees, and Neural Networks, and unsupervised learning approaches, with deep understanding of their appropriate applications and limitations. The paper develops time-series analysis capabilities using temporal segmentation algorithms like LandTrendr, spectral trajectory analysis, and change detection methods that can capture both abrupt disturbances and gradual recovery processes.

The paper demonstrates expertise in integrating diverse data sources including satellite imagery, ground surveys, aerial photography, LiDAR data, and ancillary databases containing information on disturbances, management activities, and socioeconomic factors. This integration approach includes rigorous validation methodologies combining ground truthing, statistical accuracy assessment through confusion matrices, and comparison with independent reference datasets. The technical framework addresses data quality challenges including cloud cover, atmospheric interference, and the need for robust interpretation techniques to translate imagery into meaningful land use and management information. The paper establishes proficiency with cloud computing platforms such as Google Earth Engine and NASA Earth Exchange for processing large-scale datasets and automated analysis workflows.

The paper provides comprehensive understanding of ready-to-use land change products from initiatives like Hansen's Global Forest Change dataset, Copernicus Climate Change Service land cover maps, Global Forest Watch, and TerraClass for the Brazilian Amazon. This technical knowledge encompasses change detection methods for monitoring deforestation, forest degradation, forest recovery, and understanding the relationship between these changes and policy interventions. The methodological framework establishes capability to work across multiple spatial and temporal scales, from local 30m Landsat resolution to regional 300m Copernicus resolution to global 1km AVHRR resolutions, with understanding of appropriate applications for each scale and their implications for policy analysis.

Paper 3: Evaluating Changes in Forest Land Cover, Concerning Policy

The third paper represents a sophisticated synthesis that creates an integrated methodology directly applicable to the proposed PhD research. This paper advances beyond the individual contributions of the first two papers to create a comprehensive framework for policy-landscape analysis that bridges theoretical policy analysis with technical spatial data capabilities.

The paper develops systematic approaches for linking policy analysis with spatial data analysis using GIS tools, incorporating overlay analysis, spatial correlation techniques, policy boundary mapping, and land use change modeling under different policy scenarios. This framework establishes cause-and-effect relationships between policy interventions and landscape outcomes, including appropriate timeframe selection that aligns with policy implementation periods and enables detection of policy impacts. The methodological innovation includes scenario-based approaches for evaluating policy effectiveness over time, incorporating climate change projections and land use change dynamics while addressing methods for analyzing policy interactions and unintended consequences, recognizing that income support might encourage production on sensitive lands or that deforestation reduction in one area might shift pressures to regions with weaker regulations.

The paper provides detailed examination of three distinct forest governance contexts through comparative case study analysis. The Brazilian Amazon case focuses on PPCDAm implementation and its 66% reduction in deforestation rates between 2004-2015, while the Brazilian Atlantic Forest examination analyzes conservation-focused policies in a heavily degraded biome with only 10% of original cover remaining. British Columbia represents the evolution from revenue-focused timber extraction to sustainable forest management frameworks. This comparative analysis documents how different policy approaches, historical contexts, socioeconomic factors, and Indigenous land rights considerations influence land use outcomes across diverse contexts, encompassing policy instruments including command-and-control regulations, economic incentives, protected area strategies, monitoring systems, and multi-stakeholder engagement approaches.

The paper establishes a comprehensive framework for incorporating Indigenous land rights and customary law systems into contemporary forest management policy evaluation, recognizing the critical role of Indigenous Peoples as original stewards and knowledge holders. This framework analyzes how colonial legacies continue to impact policy effectiveness, including the historical dispossession of Indigenous peoples and the imposition of European legal frameworks that often ignore traditional governance systems. The methodological contribution includes framework development for understanding how Indigenous Peoples' traditional knowledge and management practices can inform more effective and equitable forest policies, establishing pathways for meaningful integration of Indigenous governance systems with contemporary policy frameworks.

The paper develops comprehensive tools for policy coherence and effectiveness analysis through policy gap analysis identifying areas where current policies fail to address specific challenges, policy mix evaluation recognizing that coordinated strategies across multiple sectors are necessary for sustainability, and policy coherence assessment ensuring alignment within and between different policy areas and governance levels. This analytical framework includes methods for evaluating both intended and unintended policy consequences, considering implementation challenges, stakeholder engagement effectiveness, and long-term landscape outcomes while incorporating international policy influences including UN SDGs, Paris Agreement, and Convention on Biological Diversity, and their translation into national and local policy contexts.

Synthesis and Innovation for PhD Research

Together, these three comprehensive papers create a robust foundation for PhD research that advances significantly beyond existing scholarship through methodological integration and scaling that establishes capability for multi-scale analysis integrating rigorous policy analysis frameworks with sophisticated spatial data analysis techniques. This enables evaluation of policy effectiveness from local implementation to regional landscape change to global policy influence, using both qualitative stakeholder analysis and quantitative remote sensing change detection.

The research prioritizes Indigenous-centered knowledge co-production by building on the policy analysis framework's attention to customary law and Indigenous land rights, moving beyond extractive research models to create genuine partnership frameworks that center Indigenous knowledge, sovereignty, and governance innovations. Extending the integrated methodology developed in Paper 3, the proposed research will create user-friendly, transferable tools that can be applied by land managers, policy makers, and communities across different geographical and political contexts, bridging the gap between sophisticated academic analysis and practical decision-making needs.

Leveraging the remote sensing expertise demonstrated in Paper 2, the proposed research will conduct multi-temporal analysis spanning decades of policy implementation, capturing both immediate policy impacts and long-term landscape transformations. This temporal depth enables understanding of policy lag effects, cumulative impacts, and landscape recovery dynamics while using the comparative framework established across Brazilian and Canadian contexts to develop transferable insights about policy effectiveness across different political systems, ecological contexts, and Indigenous governance relationships.

The proposed PhD research thus represents not merely an application of these comprehensive papers, but a sophisticated synthesis that creates new knowledge at the intersection of Indigenous governance innovation, evidence-based forest policy evaluation, and landscape science. The comprehensive papers provide both the theoretical foundation and the technical capabilities necessary to conduct research that can inform more effective, equitable, and sustainable forest governance approaches that serve both Indigenous communities and broader society through systematic approaches for comparing policy effectiveness across different institutional contexts, legal frameworks, and geographic regions. While maintaining the technical rigor established in the comprehensive papers, the PhD research focuses on creating methodologies and tools that can be accessed and applied by communities and organizations with varying technical capacities.

Research Design Coherence

The three comprehensive papers together establish a research design that is both academically rigorous and practically applicable. Historical and institutional understanding from Paper 1 provides context for contemporary policy challenges and opportunities, while technical analytical capabilities from Paper 2 enable systematic and reproducible analysis across different scales and contexts. The integrated evaluation framework from Paper 3 connects policy intentions with spatial outcomes and stakeholder needs.

This foundation ensures that the PhD research can proceed efficiently while serving the needs of land managers, policy makers, and indigenous communities through the development of practical tools and evidence-based recommendations. The comprehensive examination process has established not only the theoretical foundations but also the practical capabilities necessary for successful completion of this research agenda.

Ethical Considerations and Indigenous Data Sovereignty {#ethics}

Indigenous Data Sovereignty Principles

CARE Principles

The research framework embraces Collective Benefit by designing research to benefit indigenous communities, while respecting Authority to Control by ensuring indigenous communities maintain control over their data. The approach emphasizes Responsibility by holding researchers accountable to indigenous communities, and maintains Ethics by aligning research with indigenous values and ethical frameworks.

OCAP Principles

The research acknowledges Ownership by recognizing that indigenous communities own their data, while respecting Control by allowing communities to control data collection and use. Access principles ensure that communities determine who can access their data, while Possession rights guarantee that communities have the right to possess their data.

Implementation Strategies

Community Protocols

Research activities will follow Free, Prior, and Informed Consent protocols for all activities, while establishing community advisory structures for ongoing oversight. Data sharing agreements will prioritize community ownership, and the research design remains flexible and responsive to community needs.

Knowledge Protection

The research framework maintains respect for confidential traditional knowledge while requiring community approval for all dissemination activities. Attribution and recognition of indigenous contributions will be prioritized, along with protection of intellectual property rights.

Expected Outcomes

This research will generate multiple types of outputs designed to serve diverse stakeholder communities and ensure practical application of findings. The outcomes are structured to provide both immediate practical value and long-term analytical capacity for land management and policy development.

Academic Outputs

The PhD dissertation will provide comprehensive analysis integrating policy evaluation, land cover change assessment, and comparative case study findings. Three to four peer-reviewed publications will target policy analysis, remote sensing, and environmental management journals, while conference presentations will share findings at indigenous studies, environmental policy, and remote sensing conferences. Methodological contributions will document integrated analytical frameworks for policy-land cover analysis.

Practical Tools and Resources

Land cover analysis software will provide user-friendly analytical tools for land managers to conduct ongoing monitoring, while policy evaluation frameworks will offer standardized approaches for assessing forest policy effectiveness. Decision support systems will create interactive platforms for comparing policy scenarios and outcomes, supported by comprehensive training materials that guide application of analytical methodologies across different contexts.

Policy and Management Outputs

Policy briefs will provide concise summaries of findings for government agencies and policy makers, while technical reports will deliver detailed analytical results for land management professionals. Best practices documentation will capture transferable insights for forest management and conservation, complemented by comparative analysis reports that offer cross-regional lessons for policy development.

Community-Focused Outputs

Community-accessible tools will provide simplified monitoring systems for indigenous land management, while capacity building materials will offer training resources for community-based land monitoring. Knowledge sharing platforms will create online resources for sharing experiences and lessons learned, supported by partnership frameworks that model respectful collaboration between communities and researchers.

Data and Knowledge Products

Open data repositories will make processed datasets available for ongoing research and management, while documentation standards will establish protocols for ethical data sharing and community benefit. Analytical databases will provide structured information systems supporting ongoing policy analysis, complemented by monitoring protocols that standardize approaches for long-term land cover monitoring.

These outcomes are designed to ensure that research benefits extend beyond academic publication to create lasting value for land managers, policy makers, and indigenous communities. All tools and resources will be developed with accessibility and transferability as core principles, ensuring broad applicability across diverse institutional contexts.

Conclusion

This proposal represents a pragmatic approach to investigating forest policy and land management through an indigenous-centered lens while ensuring robust academic outcomes and practical impact for diverse stakeholders. By integrating insights from three comprehensive exam papers with evidence-based analytical methods, this project will generate valuable knowledge and practical tools for land managers, policy makers, and indigenous communities.

The 24-month timeline is designed to be feasible while maintaining analytical rigor, focusing on 4-6 case studies that enable meaningful comparison and transferable insights. The emphasis on tool development, accessible methodologies, and evidence-based policy recommendations ensures that research outcomes will have lasting positive impacts across multiple user communities.

This approach recognizes indigenous communities as important knowledge holders while creating robust analytical frameworks that can inform land management decisions regardless of direct community

participation levels. The integration of policy analysis, remote sensing capabilities, and comparative evaluation represents a methodological innovation that can contribute to both academic understanding and practical land management applications.

The project's success will be measured through academic outputs, practical tool development, and contributions to evidence-based policy making. The research design ensures valuable outcomes for indigenous self-determination, conservation efforts, and the strengthening of land management capacity across diverse institutional contexts. This balanced approach represents effective, ethical environmental research that serves multiple communities while maintaining academic rigor and practical applicability.