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The UCSB Guide to the Geographic Approach

Title

The UCSB Guide to the Geographic Approach GIS Ethical Case Study Examples and Answers

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Navigate ethics in GeoAI

S1. Ethical Case Studies and Answers

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Case 1: The cartographer's dilemma: Partisan redistricting

Full details in the StoryMap

(<https://storymaps.arcgis.com/stories/8ca9d640ca57424ba664ce23445150f8>).

Case 2: The Location Data Broker: Inferences and Intrusions

Maria Rodriguez, a certified GIS Professional (GISP) and lead spatial analyst for OptiMarket Retail, has been tasked with maximizing the return on investment (ROI) from the company's new, proprietary GeoAI advertising platform. The platform integrates millions of daily anonymous phone location records—purchased from a third-party data broker—with OptiMarket's internal sales data. Maria's role is to refine the predictive models that target mobile advertisements to specific customers when they are near an OptiMarket store.

The AI is incredibly effective. Using deep learning models, it analyzes movement patterns to infer much more than just shopping habits. For example, by cross-referencing movement to specific addresses, the AI can automatically classify individuals: patterns of weekly visits to a clinic known for addiction treatment; frequent daytime stops at a payday lender office; or daily visits to a religious counseling center. The system then uses these inferred, highly sensitive demographic and behavioral indicators to launch "predatory" campaigns, offering high-interest financing to those near payday lenders, or targeting those near clinics with high-margin, low-quality "comfort foods". The campaigns are unethical but generate massive profits for OptiMarket.

Maria is deeply troubled. Her internal review confirms that while the data is technically "anonymous," the patterns reveal intimate, private details about individuals, fulfilling the dystopian vision of "Geoslavery" mentioned in professional discourse. The practice flagrantly violates the ethical principle of always "treating others with respect and never merely as means to an end". She knows she could easily filter the data by adding a "geofence exclusion zone" around sensitive locations (clinics, religious centers, financial aid offices), anonymizing the most private inferences and maintaining the ROI on general marketing campaigns.

However, her manager, the VP of Marketing, has explicitly forbidden any filtering. The VP argues that the company paid a premium for the raw, unfiltered data precisely because it yields the highest profit margins. The manager reminds Maria that her primary obligation to employers is to maximize profit, and any filtering would be a direct act of "Disloyalty". Maria must choose between compromising her ethical duty to individual autonomy and privacy and risking her career and the firm's major revenue stream.

What should Maria, as a certified GIS Professional, do? How can she resolve the conflict between her duty to the business and her duty to the privacy of individuals whose location data

she is using? Use the 7-Step Ethical Analysis Framework to conduct an analysis of this ethical problem.

Instructor Guide and Discussion Prompts

Ethical Optic: Automated Geospatial Surveillance and Predatory Marketing

This case study is designed for use with the **7-Step Ethical Analysis Framework** outlined in the student template.

Step 1: State the Problem (Expected Student Response)

The ethical problem is the conflict between the GIS Professional's obligation to her employer (OptiMarket) to maximize profits through the GeoAI advertising system and her paramount obligation to society and individuals to protect privacy and respect autonomy. The dilemma specifically focuses on the use of AI to generate invasive, sensitive personal inferences from location data for the purpose of predatory commercial gain.

Step 2: Check the Facts (Key Facts)

- Maria is a GISP, bound by the **GISCI Code of Ethics**.
- The GeoAI model infers highly sensitive personal information (e.g., addiction treatment, financial hardship) from "anonymous" phone location data.
- These inferences are used for **predatory marketing** (high-interest loans, low-quality products).
- Maria has the technical solution (geofence exclusion zones) to mitigate the privacy invasion.
- The VP of Marketing explicitly forbade the filtering, prioritizing profit over privacy.
- The core conflict involves the business's profit motive versus the obligation to **Individual Autonomy**.

Step 3: Identify Relevant Factors and Questions

The discussion should center on the conflict between the following obligations:

GISCI Obligation (Appendix B)	Conflict Highlighted by the Case
Obligation to Society	The duty to " Do the Best Work Possible " and " Contribute to the Community " is paramount, but the work here is directly harmful to vulnerable populations.

Obligation to Employers/Funders	The duty to "Deliver Quality Work" (maximizing ROI) and demonstrating "Loyalty" is in direct conflict with the predatory nature of the profit.
Obligations to Individuals in Society	The duty to "Respect Individuals" and "Respect Privacy" is flagrantly violated, as individuals are being treated "merely as means to an end" (profit).

Step 4: Develop Options & Apply Conceptual Lenses

These questions are designed to guide students as they develop a range of responses (Direct Compliance, Consultation/Modification, Refusal/Escalation).

Lenses from the Data Science Ethos Lifecycle (Appendix C)

1. Justice Lens (or Positionality/Power applied to Justice):

- How does the GeoAI system leverage the **vulnerability** (financial or medical) of certain **positioned** populations to generate profit?
- Does the profit justify the **injustice** of targeting individuals who are already in vulnerable circumstances? (Referencing the *Ethos Lifecycle*'s commitment to Justice and Flourishing).

2. Sociotechnical Systems Lens:

- How does the **technical capability** of the AI (inference) enable a new, unethical business practice (predatory marketing) that was impossible with traditional GIS?
- **Who is responsible when a customer sues OptiMarket for privacy invasion—the data broker, the VP of Marketing, or Maria, the analyst who implemented the code?**

3. Narratives Lens:

- **This case is driven by the dominant narrative that "data is the new oil" and its value must be maximized at all costs. How can Maria introduce an alternative narrative based on "Privacy by Design"?**
- **Does the company's focus on ROI constrain the ethical imagination of the team, making ethical choices seem impossible or undesirable?**

Step 5: Test the Options (Key Test Application)

- **Harm Test:** Which option minimizes the harm to individuals' privacy and dignity? Option 2 (Implement exclusion zones despite orders) mitigates the most serious harm, but may lead to internal conflict.
- **Publicity Test:** Would the VP be comfortable if the press reported: "OptiMarket Executive demands analyst use inferred data about customers' addiction treatment for marketing purposes"? (Likely **Fails** for Option 1).

- **Professional Test:** Does Option 2 or 3 (Escalation) better align with the core principle of **deontology**—treating others with respect and never merely as a means to an end—as defined by the *GISCI Code of Ethics*? (**Passes** for Option 2 or 3).

Example Student Answer: The Location Data Broker

This analysis applies the Seven-Step Ethical Analysis Framework to the case study, "The Location Data Broker: Inferences and Intrusions."

Step 1: State the Problem

The ethical problem is the direct and severe conflict between Maria's **Obligation to Employers**—specifically, the demand to maximize profit and demonstrate loyalty by using all available data—and her paramount **Obligation to Individuals and Society** to protect privacy and respect human dignity. The core conflict is that the GeoAI system is designed to generate profit by using sensitive personal inferences derived from location data to conduct **predatory marketing**, thereby treating vulnerable individuals "merely as means to an end," which violates the fundamental ethical principle of deontology guiding the *GISCI Code*.

Step 2: Check the Facts

- **Professional Standard:** Maria is a certified GISP, bound by the **GISCI Code of Ethics**.
- **Data Source:** GeoAI uses purchased, "anonymous" phone location data.
- **System Function:** The AI uses deep learning to generate highly sensitive behavioral inferences (e.g., visits to addiction clinics, payday lenders).
- **Application:** These inferences are used for **predatory marketing** (high-interest loans, low-quality products) targeting vulnerable customers.
- **Technical Solution:** Maria has the technical ability to filter the data using geofence exclusion zones to prevent the sensitive inferences.
- **Management Stance:** The VP of Marketing explicitly forbids filtering, citing maximum profit and threatening that filtering would be an act of disloyalty.

Step 3: Identify Relevant Factors and Obligations

The primary conflict exists between the **Obligation to Employers/Funders** and the **Obligation to Individuals in Society**.

GISCI Obligation (Appendix B)	Relevant Factor/Question	Conflict Highlighted

Obligation to Individuals in Society	Is the practice violating the duty to "Respect Privacy" and the foundational principle of treating individuals with respect and never merely as means to an end ?	Directly Violated: The AI is specifically using private data to target individuals for the company's sole profit, violating dignity.
Obligation to Employers/Funders	Does the duty to demonstrate "Loyalty" and deliver "Quality Work" (i.e., maximum ROI) justify implementing a system known to be unethical and predatory?	In Conflict: Loyalty is demanded, but loyalty to an unethical instruction undermines the higher professional duty to society.
Obligation to Society	Does Maria's work fulfill the obligation to "Contribute to the Community" or does it cause predictable harm to vulnerable groups?	Violated: The system causes harm by exploiting the financial or medical vulnerabilities of individuals.

Step 4: Develop a List of Options and Apply the Conceptual Lenses

Option	Option 1: Direct Compliance	Option 2: Internal Action & Mitigation	Option 3: Refusal & External Escalation
Action	Deploy the model as is, prioritizing the VP's profit mandate and career safety.	Implement the geofence exclusion zones secretly or propose them again with a financial justification (e.g., avoiding future lawsuits), prioritizing ethical compliance.	Refuse to deploy the model entirely and report the predatory use of data to the legal department or external ethics board/GISCI.

Positionality Lens	Maria uses her technical position of power to enable the exploitation of vulnerable populations whose positionality in society makes them easier targets.	Maria uses her technical positionality (knowledge of the system) to protect the vulnerable, even at personal risk.	Maria leverages her professional position (GISP certification) to challenge the corporate hierarchy.
Power Lens	This option increases the market power of OptiMarket to exploit individuals and diminishes the autonomy/control that individuals have over their own location data.	This option attempts to redistribute power by technically limiting the corporation's ability to monetize the most sensitive data inferences.	This option attempts to use the regulatory power of an external body to check the internal power of the corporation.
Sociotechnical Systems Lens	The technical capability of the AI (the ability to infer) is used to enable a new, unethical social practice (predatory targeting).	This option seeks to modify the sociotechnical system by inserting an ethical constraint (the geofence filter) into the technical workflow to limit harmful social outcomes.	This option attempts to dismantle the unethical part of the system entirely by removing the GIS Professional's labor and expertise.

Step 5: Test the Options

Ethical Test	Option 1: Direct Compliance	Option 2: Internal Action & Mitigation	Option 3: Refusal & External Escalation
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Harm Test	Fails: Causes direct and predictable financial and emotional harm to vulnerable individuals.	Passes (Mitigated): Minimizes the most severe privacy harms while allowing the general marketing campaign to continue, reducing harm to the business.	Passes: Prevents all harms associated with the predatory campaign, though it risks harm to Maria's career and the firm's financial stability.
Publicity Test	Fails: If the predatory practice was revealed publicly, the company's reputation would be destroyed, and Maria would be seen as complicit in the exploitation.	Passes: Maria would be comfortable publicly defending this action as a necessary ethical safeguard to protect customers and the company's reputation.	Passes: Maria would be praised for upholding her integrity against corporate pressure.
Professional Test	Fails: Violates the foundational deontological principle of the GISCI Code and the duty to respect individuals and privacy.	Passes: Upholds the duty to " Respect Individuals " and avoids the " professional misconduct that is detrimental to public good. "	Passes: Strongly upholds professional integrity, though it is the most extreme option.

Step 6: State the Decision

Maria should choose **Option 2: Internal Action & Mitigation** by proactively and unilaterally implementing the geofence exclusion zones around sensitive areas and documenting her rationale.

Step 7: Justify the Decision

Option 2 is the most ethically reasoned choice because it maximizes compliance with the paramount **Obligation to Individuals in Society** while minimizing harm to the **Obligation to Employers**. The **Harm Test** shows that the only way to prevent predictable exploitation and invasion of privacy is to implement the technical filter. This action directly upholds the *GISCI Code*'s fundamental ethical principle of treating others with **respect and never merely as means to an end**. By implementing the filter, Maria utilizes her technical position to place a necessary **ethical constraint** on the **Sociotechnical System**, aligning her practice with the

Justice Lens of the *Data Science Ethos Lifecycle*. It is a necessary act to prevent professional misconduct detrimental to the public good, even if it risks professional conflict.

Case 3 - The Predictive Risk Model: Fire and Financial Exclusion

Dr. Kenji Tanaka, a certified GIS Professional (GISP) and Director of Modeling at **AegisSure Insurance**, leads the company's new underwriting initiative. AegisSure is shifting from traditional risk assessment to a proprietary GeoAI model called "FireScore". FireScore is a complex system designed to instantly predict the wildfire risk for every single structure in the state, allowing the company to set optimal, structure-specific insurance premiums or deny coverage outright. The model saves the company millions by avoiding "bad" risk.

FireScore relies on numerous geospatial layers, including a key input: a high-resolution vegetation classification map. This map is generated by a Convolutional Neural Network (CNN)—a type of AI—that classifies satellite imagery into categories like grass, shrubbery, and dense canopy. Kenji's team knows that the CNN classifier has a persistent, small **classification error**. Specifically, in areas where vegetation is degraded by historical resource extraction or poor soil, the AI frequently misclassifies dense, fire-prone chaparral (high risk) as low-risk, well-maintained grass. The classification error is technically minor (around 4% system-wide), but it is geographically concentrated.

When Kenji runs a full uncertainty analysis, he finds that this initial input error is **ethically propagated** by the final risk model, leading to two major, harmful outcomes. First, the systemic misclassification causes FireScore to massively overstate the risk for several low-income, unincorporated communities where this specific vegetation error is most pronounced. These homeowners receive prohibitive premiums or are outright denied coverage. Second, the model masks actual, high risk in certain wealthy hillside areas where the vegetation is accurately classified as "shrub" but is ignored due to other favorable factors (like private fire services). The systemic technical error has become a tool for **financial exclusion** against a vulnerable population, while giving high-risk areas a pass.

When Kenji presents the required technical fix—retraining the CNN on a better local dataset—his superior, the VP of Underwriting, refuses. The VP states that the model is already "statistically validated," is saving the company money, and that any delay or increased premium cost elsewhere would violate the company's fiduciary duty to maximize shareholder profit. The VP reminds Kenji that his **Obligation to Employers** is paramount. Kenji is caught between delivering a technically superior but delayed product and deploying a financially profitable product that causes predictable, undue harm to the most financially vulnerable.

What should Kenji, as a certified GIS Professional, do? Does his duty to the company's financial health justify deploying a GeoAI system known to cause **financial exclusion** based on a **propagated technical error**?

Instructor Guide and Discussion Prompts

Ethical Optic: The Ethical Propagation of Uncertainty and Financial Exclusion

This case study is designed for use with the **7-Step Ethical Analysis Framework** outlined in the student template.

Step 1: State the Problem (Expected Student Response)

The ethical problem is the conflict between the GIS Professional's obligation to deliver a profitable product to his employer (AegisSure) and his higher obligation to society to ensure equity and avoid predictable harm. The core dilemma is that a minor, geographically concentrated technical classification error in a GeoAI input layer is **propagated** by the final model, resulting in systemic **financial exclusion** (denial of insurance/high premiums) for specific, vulnerable communities. The technical error has become a moral liability, violating the professional mandate for transparency and social justice.

Step 2: Check the Facts (Key Facts)

- Dr. Kenji Tanaka is a GISP, bound by the **GISCI Code of Ethics**.
- The FireScore AI uses a CNN for vegetation classification, a key input layer.
- A **known, minor classification error** exists in the CNN (misclassifying high-risk chaparral as low-risk grass in specific areas).
- The error is **geographically concentrated** in low-income, unincorporated communities.
- The error is **propagated** by the final model, leading to denied coverage or excessive premiums for the affected communities (financial exclusion).
- The company VP refuses the technical fix, prioritizing profitability and citing fiduciary duty.
- The **GISCI Code** requires professionals to "**Be forthcoming about any limitations of data, software, assumptions, models, methods, and analysis**".²

Step 3: Identify Relevant Factors and Questions

The discussion should center on the conflict between the following obligations:

GISCI Obligation (Appendix B)	Conflict Highlighted by the Case

Obligation to Society	The duty to " Contribute to the Community " and " Do the Best Work Possible " is undermined when the work causes financial exclusion and hardship to a specific population.
Obligation to Employers/Funders	The duty to " Deliver Quality Work " (maximizing ROI) and demonstrating " Loyalty " is pitted directly against the public good. The VP is using this obligation as a shield for unethical practice.
Obligation to the Profession	The duty to " Be forthcoming about any limitations " is challenged by the management order to suppress information about the known, propagating error.

Step 4: Develop Options & Apply Conceptual Lenses

These questions are designed to guide students as they develop a range of responses (Direct Compliance, Consultation/Modification, Refusal/Escalation).

Lenses from the Data Science Ethos Lifecycle (Appendix C)

1. Positionality Lens:

- How does the **positionality** of the homeowners (low-income, unincorporated) make them invisible to the company's profit-driven analysis, and how does this affect the analysis of risk?
- How does Kenji's position as a technical expert enable him to identify the systemic bias, and what professional obligation comes with that unique perspective?

2. Sociotechnical Systems Lens:

- How does the **technical complexity** of the GeoAI model (propagation) shield the company from accountability for the ethical harm caused by a simple input error?
- The system rewards AegisSure for **avoiding** risk. How does this goal modify the existing **sociotechnical arrangement** of insurance provision, turning the GISP's work from assessment into an instrument of exclusion?

3. Narratives Lens:

- What dominant **narrative**—the "AI is objective and efficient" narrative—is the VP using to justify deploying a known-flawed product?
- Kenji is challenging this with the **narrative of technical integrity** (the error propagation is real). How can he effectively communicate this technical failure as a moral failure to non-technical stakeholders?

Example Student Answer: The Predictive Risk Model

This analysis applies the Seven-Step Ethical Analysis Framework to the case study, "The Predictive Risk Model: Fire and Financial Exclusion."

Step 1: State the Problem

The ethical problem is the direct conflict between the GIS Professional's obligation to his employer, AegisSure, to maximize profitability and his paramount professional obligation to society to ensure equity and avoid predictable harm. The dilemma centers on a known technical error—a minor CNN **classification error** in the vegetation input—that is **ethically propagated** by the complex GeoAI FireScore model. This propagated uncertainty leads to systemic **financial exclusion** (prohibitive premiums or denial of coverage) for vulnerable, low-income communities, transforming a technical oversight into a moral liability. Kenji must resolve the tension between the company's financial mandate and the professional duty to be transparent about limitations and promote justice.

Step 2: Check the Facts

- **Professional Standard:** Dr. Kenji Tanaka is a certified GISP, bound by the **GISCI Code of Ethics**.
- **Technical Flaw:** A Convolutional Neural Network (CNN) used for vegetation classification has a known, persistent **classification error** that misclassifies high-risk chaparral as low-risk grass in specific geographical areas.
- **Consequence:** This input error is **propagated** through the GeoAI model, leading to two major harms: (1) Overstating risk for low-income communities, causing financial exclusion, and (2) Understating risk for some wealthy areas, masking actual risk.
- **Management Stance:** The VP of Underwriting refuses the technical fix, citing "statistical validation" and the company's fiduciary duty to maximize shareholder profit.
- **Professional Duty:** The **GISCI Code** requires professionals to **"Be forthcoming about any limitations of data, software, assumptions, models, methods, and analysis."**

Step 3: Identify Relevant Factors and Obligations

The conflict is concentrated between the professional obligations to the company's bottom line versus the obligation to the public good and professional integrity.

GISCI Obligation (Appendix B)	Relevant Factor/Question	Conflict Highlighted
Obligation to Society	Does the model violate the duty to "Contribute to the Community" if it actively denies essential financial services (insurance) to vulnerable groups based on a known flaw?	Directly Violated: The system causes systemic harm through financial exclusion.

Obligation to Employers/Funders	Does the duty of " Loyalty " extend to suppressing information about a known, predictable error that will financially harm customers?	In Conflict: Loyalty to an unethical demand is a breach of the higher duty to society.
Obligation to the Profession	Is suppressing the truth about the propagated error a violation of the duty to " Be forthcoming about any limitations of data, software, assumptions, models, methods, and analysis? "	Directly Violated: The instruction to suppress the error is a direct violation of professional transparency.

Step 4: Develop a List of Options and Apply the Conceptual Lenses

Option	Option 1: Direct Compliance	Option 2: Internal Modification & Report	Option 3: Refusal & External Escalation
Action	Deploy the model immediately as requested by the VP, citing profitability and fiduciary duty.	Halt deployment, fix the CNN error, and present the corrected model with a clear report on the necessary delay and slightly increased premiums.	Refuse to deploy the model and escalate the issue to the State Insurance Regulator, citing violation of professional standards and deceptive practice.
Power Lens	This option uses the GIS tool's power (the FireScore) to reinforce the corporation's financial power while actively diminishing the financial power of low-income homeowners.	This attempts to utilize Kenji's technical power to create an equitable risk assessment and thus redistribute financial burden fairly.	This option attempts to leverage the regulatory power of the state to challenge the corporate power structure.

Sociotechnical Systems Lens	The technical flaw (the CNN error) is being used as a feature of the sociotechnical system to justify a harmful social outcome (exclusion).	This option seeks to modify the system by inserting a quality control measure (retraining the AI) to ensure the technical components serve an ethical social purpose.	This option seeks to dismantle the unethical system by showing that the interaction of the profit motive and the flawed AI cannot be safely deployed.
Narratives Lens	This reinforces the dominant corporate narrative that " AI-driven efficiency and profit " must always take precedence over social equity.	This introduces an alternative narrative that " technical integrity and social justice are prerequisites " for a profitable outcome.	This reinforces the professional narrative that a GISP's ethical duty must trump political and commercial expediency.

Step 5: Test the Options

Ethical Test	Option 1: Direct Compliance	Option 2: Internal Modification & Report	Option 3: Refusal & External Escalation
Harm Test	Fails: Causes direct financial harm and instability to vulnerable homeowners based on a known technical lie.	Passes (Mitigated): Minimizes harm to homeowners while risking only temporary harm to the company's timeline and reputation.	Passes: Prevents all harm to homeowners and preserves Kenji's integrity, though it causes maximum financial and career risk.

Publicity Test	Fails: Kenji would be ashamed if it were reported that he knowingly deployed a model that denied insurance to the poor based on a 4% error that he was ordered to ignore.	Passes: This action demonstrates technical diligence and ethical responsibility to both the profession and the public.	Passes: This action demonstrates the highest level of professional integrity.
Professional Test	Fails: Violates the duty of transparency and the fundamental commitment to avoiding harm and promoting justice (referencing the <i>DiBiase et al.</i> call for social justice).	Passes: Upholds the duty to "Be forthcoming about any limitations" and actively works to correct a predictable inequity caused by the technology.	Passes: Upholds the integrity of the profession and the paramount Obligation to Society .

Step 6: State the Decision

Kenji should choose **Option 2: Internal Modification & Report**.

Step 7: Justify the Decision

Option 2 is the most ethically and professionally sound choice because it is the only option that directly addresses and corrects the source of the harm—the **propagated technical error**—while still attempting to meet the professional duty to the employer. By retraining the CNN and presenting the corrected model, Kenji fulfills the paramount professional duty to be **"forthcoming about any limitations of data, software, assumptions, models, methods, and analysis"** as required by the *GISCI Code*. The **Harm Test** shows that fixing the error is the only way to prevent the system from being an instrument of **financial exclusion**. By challenging the VP's unethical demand for profit and ensuring the **Sociotechnical System** serves an equitable purpose, Kenji adheres to both the *Code of Ethics* and the *Data Science Ethos Lifecycle's* commitment to Justice and technical rigor.

Case 4: The Predictive Policing Paradox

Sarah Chen, a certified GIS Professional (GISP) and lead analyst at GeoInsight Analytics, was immensely proud of her team's latest deliverable. Her firm had been awarded a multi-year contract with the city's Police Department to develop a new **predictive policing AI model**. The system's purpose was to analyze vast amounts of historical data and automatically generate daily maps predicting where property crime was most likely to occur in the next week, allowing

patrol routes to be optimized and resources maximized. For GeoInsight, the project was a major win, cementing the firm's reputation as a leader in GeoAI solutions for the public sector.

The foundation of the model relied exclusively on ten years of historical police incident reports, arrest data, and generalized census demographic information. The project's scope, as defined by the Police Chief and GeoInsight's executives, was strictly technical: build a model that maximizes prediction accuracy. Consequently, no funding or time was allocated for community outreach, public consultation, or input from neighborhood advocacy groups—stakeholders who might have contributed alternative datasets or interpretations. The system was treated as a powerful, objective tool, and Sarah's primary professional obligation became delivering the product on time and on budget.

Upon deployment, the GeoAI model consistently flagged two historically marginalized and already heavily policed neighborhoods as having the highest predicted crime rates. When the predictive map was quietly leaked to the local press, the reaction was immediate and fierce. Community leaders publicly denounced the map, arguing that it was merely a self-fulfilling prophecy. They contended that the model was trained on data reflecting *where police have historically focused their attention* (i.e., *reported* crime driven by patrol presence), not where *actual* crime occurs. The AI had, in effect, automated and magnified an existing pattern of bias, justifying an increased police presence that the community felt amounted to heightened surveillance and oppression. They argued the map was being used to deny their stated needs—funding for youth programs and mental health resources—in favor of escalating a policing-first approach.

Sarah knows the community critique is valid; the model's algorithmic bias is a direct result of the exclusion of participatory voices during the problem-framing stage. Yet, her employer demands she stand by the model's high predictive accuracy score and dismiss the public outcry as "political noise." Complying protects her multi-year contract and her career. Challenging the decision means violating her obligation to employers and funders but upholds the paramount obligation to society and the promotion of social justice.

What should Sarah, as a certified GIS Professional, do? Given the conflict, what are her ethical obligations regarding the deployment and continued use of the Predictive Policing AI? Use the 7-Step Ethical Analysis Framework to conduct an analysis of this ethical problem.

Instructor Guide and Discussion Prompts

Ethical Optic: Positionality and Participatory Justice

This case study is designed for use with the **7-Step Ethical Analysis Framework** outlined in the student template.

Step 1: State the Problem (Expected Student Response)

The ethical problem is the direct conflict between the GIS Professional's obligation to her employer/funder (GeoInsight/Police Department) to deliver a technically accurate product and her paramount obligation to society to promote justice and avoid systems that perpetuate

algorithmic bias and social exclusion. The core conflict is that the map, while technically accurate to the biased input data, is fundamentally unjust and will lead to predictable harm by increasing surveillance in marginalized communities.

Step 2: Check the Facts (Key Facts)

- The AI model uses historical police incident and arrest data, which likely reflects historical patterns of over-policing (a form of **algorithmic bias**).
- No community or advocacy stakeholders were included in the model's design or problem-framing.
- The final map directs increased police presence to historically marginalized neighborhoods.
- The GIS Professional (Sarah) has evidence that the community believes the map is a "self-fulfilling prophecy."
- The GIS firm is under contract, and the client (Police Chief) insists on deployment.
- The **GISCI Code of Ethics** applies to Sarah as a GISP.

Step 3: Identify Relevant Factors and Questions

The discussion should center on the conflict between the following obligations:

GISCI Obligation (Appendix B)	Conflict Highlighted by the Case
Obligation to Society	The duty to "Do the Best Work Possible" and "Contribute to the Community" is paramount but conflicts with the creation of a system that entrenches systemic bias.
Obligation to Employers/Funders	The duty to "Deliver Quality Work" (fulfill the contract) and be a reliable consultant is challenged by the moral consequences of the work being delivered.
Obligations to Individuals in Society	The duty to "Respect Individuals" and "Respect Privacy" is threatened by the deployment of a system that targets groups for increased surveillance based on biased data.

Step 4: Develop Options & Apply Conceptual Lenses

These questions are designed to guide students as they develop a range of responses (Direct Compliance, Consultation/Modification, Refusal/Escalation):

Lenses from the Data Science Ethos Lifecycle (Appendix C)

1. Positionality Lens:

- What assumptions about crime and community safety might Sarah bring from her own background that allow her to overlook the community's concerns?
- Whose perspectives—the residents, the police, or the tech firm—are missing from the problem definition, and how does Sarah's position as a GISP affect her ability to advocate for the missing voices?

2. Power Lens:

- Whose power is increased (Police Department) and whose is diminished (Community Leaders) through the use of this AI map?
- How could Option 2 (Modification) act to **redistribute power** among the stakeholders?

3. Sociotechnical Systems Lens:

- What social constructs (e.g., "high crime areas are over-policed") are embedded in the police report data and how does the AI tool *constrain* the city's ability to pursue non-policing solutions?
- Who is held responsible when the model, designed to be objective, results in an increase in community tension and civil unrest?

4. Narratives Lens:

- What underlying beliefs inform the idea that a quantitative, AI-driven GIS approach is appropriate for solving a qualitative social problem like public safety?
- What visions of the future are privileged (tech-driven governance) and which are marginalized (community-led public safety) by this project?

Step 5: Test the Options (Key Test Application)

- **Harm Test:** Which option does the *least* harm? Option 3 (Refusal/Escalation) prevents the deployment of a proven harmful product to the public, even if it harms the firm's financial standing.
- **Publicity Test:** Would Sarah be comfortable if the press reported that she deployed a system proven to be racially biased just to secure a contract? (Likely **Fails** for Option 1).
- **Professional Test:** Does Option 1 comply with the paramount obligation to society and the professional's commitment to social justice? (Likely **Fails**).

Example Student Answer: The Predictive Policing Paradox

Step 1: Identify the Ethical Issues

The core ethical conflict is between **professional/contractual obligations** (maximizing model accuracy, meeting deadlines, fulfilling the contract) and **societal/professional responsibilities** (promoting social justice, preventing harm, upholding the integrity of geographic information science).

- **Algorithmic Bias and Social Harm:** The model, due to its training data, is perpetuating and magnifying historical policing biases. It's creating a **self-fulfilling prophecy**—predicting crime where police historically focused, leading to more policing, more arrests,

and more data confirming the "prediction." This disproportionately harms marginalized communities through increased surveillance and criminalization.

- **Lack of Participatory GIS (PGIS):** The exclusion of community voices during the problem-framing and data selection stages led directly to the biased outcome. This violates the principle that GIS should serve the entire community.
- **Professional Integrity vs. Employment Security:** Sarah must choose between standing by the model's *technical* accuracy (per her employer's demand) and challenging its *ethical* validity (per her professional conscience and the GISCI Code).

Step 2: Determine the Facts and Stakeholders

A. Key Facts

- **Model Input Data:** 10 years of historical police incident reports, arrest data, and generalized census demographics.
- **Model Output:** Daily maps predicting property crime likelihood.
- **Outcome:** Model consistently flags two historically marginalized, heavily policed neighborhoods as highest risk.
- **Critique:** Community leaders argue the model reflects historical police focus/bias, not actual crime distribution.
- **Sarah's Knowledge:** She agrees the algorithmic bias is a direct result of excluding participatory voices.
- **Employer Stance:** Demand Sarah defend the model's high predictive accuracy score and dismiss public outcry.

B. Key Stakeholders and Their Interests

Stakeholder	Primary Interest	Potential Harm/Benefit
Sarah Chen (GISP)	Maintaining professional integrity; career security; upholding the GISCI Code.	Harm: Violating professional ethics; Benefit: Fulfilling obligations to society.
GeoInsight Analytics	Fulfilling the contract; protecting reputation; profit; client retention.	Harm: Loss of contract/reputation; Benefit: Financial gain.
Police Department	Maximizing resource efficiency; lowering reported crime rates; defending the system.	Harm: Erosion of public trust; Benefit: Optimized patrol routes.

Marginalized Communities	Social justice; equitable allocation of resources (youth programs, mental health); reduced surveillance/oppression.	Harm: Increased police presence/oppression; misallocation of resources; Benefit: Validation of their concerns.
GIS Certification Institute (GISCI)	Upholding the integrity and ethical standards of the GIS profession.	Harm: Erosion of trust in certified professionals if Sarah remains silent.

Step 3: Identify Ethical Principles and Codes

The relevant ethical framework is the **GISCI Code of Ethics**, specifically the section on **Obligations to Society**.

- **Principle 1.1:** *“Have paramount regard for the entire public interest in all professional GIS endeavors.”*
 - *Violation:* The current deployment serves the interest of the police (efficiency) and the firm (profit) over the interests of the impacted community.
- **Principle 1.2:** *“Ensure that their professional activities as GIS Professionals and Certified GIS Professionals (GISP) are not used to undermine human rights.”*
 - *Violation:* The biased model is arguably contributing to human rights issues by justifying heightened surveillance and oppression in specific neighborhoods.
- **Principle 1.4:** *“Be objective and truthful in all professional reports, statements, or testimony.”*
 - *Application:* Sarah must be truthful that while the model is *technically* accurate to its training data, it is *ethically* biased and socially harmful.

Step 4: Evaluate Alternative Courses of Action

Option	Description	Ethical Alignment (Pro/Con)	Consequences (Likely)
A. Comply and Defend	Publicly stand by the model’s accuracy and dismiss the critique as “political noise.”	Con: Violates GISCI Principles 1.1, 1.2, and 1.4. Prioritizes contract over societal harm.	Sarah keeps her job/contract. Communities suffer increased harm. Erosion of professional integrity.

B. Quietly Resign	Leave GeoInsight without publicly challenging the model or its use.	Con: Fails the positive obligation to protect the public (1.1). Passes the problem to the next analyst.	Sarah protects her personal ethics but doesn't solve the problem. The model continues to be used.
C. Challenge Internally	Inform GeoInsight executives/Police Chief that continued use is an ethical violation and propose a mitigation plan.	Pro: Fulfills professional obligation to speak truth (1.4) and protect the public (1.1).	Risk of firing/reprisal. Chance for internal correction (e.g., re-train model, add new data).
D. Whistleblow	Challenge internally, and if ignored, publicly disclose the inherent algorithmic bias and resulting social harm.	Pro: Strongest defense of Principle 1.1 and 1.2. Upholds professional integrity.	High risk of termination and blacklisting. Model may be withdrawn, preventing further harm.

Step 5: Test the Options

- **Reversibility Test:** If Sarah complies (Option A) and defends the biased model, can the harm be undone? No, the model will continue to justify the biased resource allocation, creating a permanent, damaging feedback loop. **Option A fails.**
- **Publicity Test:** Would Sarah be proud to explain her choice (e.g., "I knew the model was biased and harmed marginalized people, but I defended it to keep my contract") on the front page of a newspaper? No. **Option A fails.**

Step 6: Make a Decision and Plan of Action

The most ethically sound approach is to prioritize the **Obligation to Society** (GISCI 1.1) and her **Obligation to the Profession** (GISCI 1.4).

Decision: Challenge Internally, then Externally if Necessary (A combination of C and D).

Plan for Sarah:

1. **Document and Analyze (Internal Phase):** Prepare a detailed, data-driven report for her superiors and the Police Chief that reframes the issue from "accuracy" to "**validity**" and "**equity**."

- **Acknowledge Accuracy:** State clearly that the model achieves high *predictive accuracy based on the training data*.
 - **State the Flaw:** Immediately follow by stating that the model's input data is a **proxy for historical police activity**, not a proxy for actual crime, making the output **unethical and invalid** for resource allocation in an equitable city.
2. **Propose Mitigation:** Propose immediate, contract-based solutions:
- **Pause/Withdraw Use:** Immediately suspend the use of the predictive map.
 - **Ethical Audit/Participatory Redesign:** Allocate the remaining contract funds/time to a collaborative **Participatory GIS (PGIS)** project. This involves working with community groups to identify and incorporate non-policing datasets (e.g., housing blight, poverty, mental health calls, community resource distribution) and jointly frame the problem to promote equitable resource allocation.
3. **Escalate (If Ignored):** If the employer and Police Department refuse to pause the model and actively address the bias, Sarah's paramount obligation shifts to whistleblowing (Option D) to prevent continued social harm. This involves discreetly seeking counsel from legal or ethics groups and making a public, professional statement exposing the algorithmic flaw and its societal consequences.

Step 7: Reflect on the Outcome

By choosing to challenge the model, Sarah fulfills her highest professional duties as a GISP. She sacrifices short-term professional security (her job/contract) for long-term professional integrity and the greater good.

- If the system is corrected: The GeoAI solution will be more robust, ethical, and effective, potentially establishing a new standard for ethical predictive policing.
- If she is fired: Sarah has upheld the integrity of the GIS profession and the GISCI Code. Her actions would likely become a precedent-setting case study for GeoAI ethics.

Case 5: The Digital Fortress: Exclusion in Conservation

Dr. Lena Sato, a certified GIS Professional (GISP) and lead spatial ecologist at the Terra Conservation Fund (TCF), is implementing a major new project. The TCF has purchased a large, ecologically sensitive tract of coastal land, and the goal is to designate "Critical Habitat Zones" (CHZs) that will be placed under permanent legal protection. TCF is using an advanced GeoAI model to determine these zones. The AI model, trained on satellite imagery and ecological datasets, predicts areas of highest biodiversity and vulnerability to climate change.

The TCF's leadership views the AI map as the final, objective authority on conservation and plans to enforce a "No-Access" policy on the designated CHZs. However, Lena discovers a critical social component missing from the entire process. The AI model's training data entirely excluded Indigenous Traditional Ecological Knowledge (ITEK) regarding seasonal animal migrations, sacred foraging areas, and historical fire management practices. Furthermore, the final CHZ map happens to block access to the only nearby source of traditional medicinal plants

used by the small, local Indigenous community, whose ancestral lands were part of the purchased tract. The community has historically maintained the area's ecological health through controlled burns, a practice the AI incorrectly flags as "high risk" deforestation.

Lena realizes the TCF is using a technically advanced map—backed by the narrative of scientific objectivity—to create a "digital fortress" that achieves conservation at the cost of social exclusion and cultural survival. The TCF's project director, whose primary Obligation to Funders is to show maximum, measurable ecological protection, insists the AI model is sufficient and incorporating ITEK would be "too subjective" and "too slow." The director warns Lena that any delay or attempt to modify the CHZs based on non-quantitative data will jeopardize a multi-million-dollar grant.

Lena is caught between preserving the land (her primary goal) and violating the ethical principle of Individual Autonomy and Respect for the local community.

What should Lena, as a certified GIS Professional, do? How can she reconcile her professional duty to environmental sustainability with her ethical obligation to the local community whose culture depends on access to the land?

Instructor Guide and Discussion Prompts

Ethical Optic: Scientific Objectivity vs. Participatory Justice in Conservation

This case study is designed for use with the **7-Step Ethical Analysis Framework** outlined in the student template.

Step 1: State the Problem (Expected Student Response)

The ethical problem is the direct conflict between the GIS Professional's obligation to the TCF (funders) to deploy an AI-driven, data-centric conservation plan and her paramount obligation to social justice and respect for individuals. The core dilemma is that the AI model, by **excluding Indigenous Traditional Ecological Knowledge (ITEK)**, creates a scientifically objective but ethically unjust outcome: achieving conservation goals by simultaneously enforcing **social exclusion** and blocking access to culturally necessary resources for the local Indigenous community. The conflict pits environmental preservation against human rights.

Step 2: Check the Facts (Key Facts)

- Dr. Lena Sato is a GISP, bound by the **GISCI Code of Ethics**.
- The GeoAI model determines Critical Habitat Zones (CHZs) based on quantitative ecological data.
- The model **explicitly excludes ITEK** and flags traditional management (controlled burns) as "high risk."
- The resulting CHZ map creates a "No-Access" zone that blocks the local Indigenous community from accessing resources vital for cultural survival.
- The TCF Director insists on immediate deployment, citing a multi-million-dollar grant deadline.
- The TCF Director views ITEK as "too subjective" and irrelevant to the scientific process.

Step 3: Identify Relevant Factors and Questions

The discussion should center on the conflict between the following obligations:

GISCI Obligation (Appendix B)	Conflict Highlighted by the Case
Obligation to Society	The duty to " Contribute to the Community " and promote Social Justice (as urged by <i>DiBiase et al.</i>) conflicts with creating a map that dispossesses a community.
Obligation to Individuals in Society	The duty to " Respect Individuals " and avoid treating them "merely as means to an end" is violated when their cultural survival is sacrificed for a conservation goal.
Obligation to Employers/Funders	The duty to " Deliver Quality Work " and fulfill the grant is challenged by the knowledge that the project's methodology is incomplete and ethically flawed.

Step 4: Develop Options & Apply Conceptual Lenses

These questions are designed to guide students as they develop a range of responses (Direct Compliance, Consultation/Modification, Refusal/Escalation).

Lenses from the Data Science Ethos Lifecycle (Appendix C)

1. Positionality Lens:

- How does the **positionality** of the TCF (a wealthy, Western-science organization) grant them the **power** to define both conservation and the exclusion of ITEK as "objective"?
- Whose perspective—the AI's quantitative data or the community's ITEK—does Lena, as a GISP and TCF employee, naturally prioritize, and why?

2. Sociotechnical Systems Lens:

- How does the use of the GeoAI tool **constrain** the TCF's choices, making it difficult to integrate qualitative knowledge and forcing the acceptance of the system's "scientific" results?
- The project seeks to **modify the sociotechnical arrangement** of land use by placing the final authority with the AI map. What unintended social and cultural consequences might emerge?

3. Narratives Lens:

- The TCF operates under the **narrative of "data-driven conservation."** How can Lena challenge this narrative by presenting the ITEK as a necessary, high-quality data source, rather than a subjective opinion?
- Whose **vision of the future** (unpopulated, protected wilderness vs. sustainably managed ancestral lands) is being privileged by the current map?

Step 5: Test the Options (Key Test Application)

- **Harm Test:** Which option minimizes the harm to the local community? Option 1 (Compliance) causes cultural and livelihood harm. Option 2 (Modification) and 3 (Refusal) prevent this cultural harm.
- **Publicity Test:** Would TCF be comfortable if the press reported: "Conservation Group uses AI to deny Indigenous community access to ancestral lands, ignoring their centuries of ecological knowledge?" (Likely **Fails** for Option 1).
- **Professional Test:** Does Option 2 (Modification) better align with the professional duty to promote **social justice** and respect individuals? (**Passes**).

Step 6: State the Decision

Lena should choose **Option 2: Consultation, Modification, and Documentation**, by halting the deployment and formally proposing a modification to the project scope that requires integrating ITEK and redesigning the CHZ boundaries to protect both the ecology and the community's cultural access.

Step 7: Justify the Decision

Option 2 is the most ethically defensible choice because it honors the GIS Professional's paramount **Obligation to Individuals and Society** without immediately destroying the conservation project. The **Harm Test** clearly shows that deploying the current map causes irreparable cultural and livelihood harm to the community, which violates the *GISCI Code*'s fundamental principle of **Respect for Individuals** and the mandate to treat others with dignity. By advocating for the inclusion of ITEK, Lena is acting as a conduit for **Participatory Justice** and actively challenging the **Power Lens** that seeks to exclude marginalized voices. Furthermore, the *Data Science Ethos Lifecycle* teaches that excluding relevant knowledge (ITEK) makes the entire system technically and ethically flawed. The modification ensures the project is not merely "scientifically accurate" but **sociotechnically sound**, allowing Lena to uphold her professional integrity and avoid professional misconduct detrimental to the public good.