

2026 IM²C Protecting Wildlife at Scale



National parks, including large **wildlife** reserves, play a critical role in protecting endangered plant and animal species, yet often their size and terrain make continuous monitoring difficult. Reserves such as Etosha National Park in Namibia span thousands of square kilometers and include open savanna, salt pans, waterholes, road networks, and multiple access points. Despite the presence of trained rangers, limited personnel and resources make it challenging to prevent illegal activities such as poaching and unauthorized entry. Technologies, including, but not limited to aerial drones, satellites, fixed monitoring systems, and AI-assisted detection, offer opportunities to support ranger efforts. However, these tools also require coordination, staffing, and thoughtful deployment to be effective. Conservation organizations must decide how to balance human patrols and technology to provide meaningful protection across space and time.

The International Mission for Monitoring Conservation (IMMC) has asked your team to develop a modeling approach to help guide protection strategies for large wildlife reserves and national parks, beginning with Etosha National Park as a case study.

Your Task

The IMMC seeks a modeling-based approach to inform protection planning for Etosha National Park, a large and complex wildlife reserve. Your work should consider how limited human and technological resources can be coordinated to protect wildlife across the park over time, and how “protection” can be defined and measured in a realistic, practical, and quantitative way.

Requirements

1. Conservation priorities and defining protection

Identify and prioritize the major conservation challenges faced by the park, noting that risks may differ by species, habitat, location, or type of threat including both human-driven and natural threats (for example, poaching, habitat disruption such as forest fires, or human–wildlife interaction). Using these priorities, clearly define what it means, in practical terms, for wildlife in the park to be “protected”. Your definition may vary across species or regions and should be quantitatively measurable within your modeling approach.

2. Resource allocation model

Develop a mathematical model to allocate protection resources, including both existing resources and those newly identified by your team, such as personnel, patrols, monitoring technologies, or other interventions, to address your identified conservation priorities. Your modeling approach should account for limited resources, geographic considerations, and uncertainty, and should emphasize strategic deployment rather than complete coverage.

3. Protection over time and staffing need

Use your modeling approach to analyze how well the park is protected over time and to estimate the number of human personnel required to maintain your chosen level of protection. A detailed cost analysis is not required, but consideration of resource use, feasibility, and practicality is expected.

4. Sensitivity and scenario analysis

Investigate how changes in assumptions or available resources affect your strategy. For example, consider how reduced personnel, fewer technological assets, or altered patrol schedules influence protection.

5. Model strengths and limitations

Discuss the strengths and limitations of your approach, including assumptions that may restrict its applicability.

6. Adaptation to other protected areas

Demonstrate how your modeling approach can be adapted for use at two other national parks or wildlife reserves located on different continents. The IMMC asks your team to provide an adaptation plan that addresses the following:

- Which components of your model structure would remain unchanged?
- Which inputs or parameters would need to be modified (for example, terrain and mobility, access points, road networks, threat types, species priorities, or detection capabilities)?
- What types of data would be required to calibrate these modified inputs?
- How you would expect protection metrics and recommended resource deployments to shift under the new conditions?

7. Communication Deliverable: Letter to the IMMC

Write a two-page, non-technical letter to the IMMC clearly communicating your approach, recommendations, and key insights. Your letter should be accessible to decision-makers without technical backgrounds. One of the two pages may contain, if you choose, one visual graphic to help communicate your strategy.

Submission Format

Your PDF submission paper must be typed and in English with at least 12-point font size using page size: A4 with margins at least 1.5cm (OR) page size: Letter with margins at least 0.6in. For detailed information about IM²C submission guidelines and the general expectations for each portion of your solution please review the [Full Submission Guidelines](#).

Your PDF submission should consist of:

- One-page Summary Sheet.
- One-page Table of Contents.
- *Letter to the IMMC* (maximum two pages, nontechnical)
- Complete solution (maximum 20 pages)
- Reference List.
- [AI Use Report](#) (if used).
- The following items do not count toward the 24-page limit: Reference List, Appendices and [AI Use Report](#) (if used).

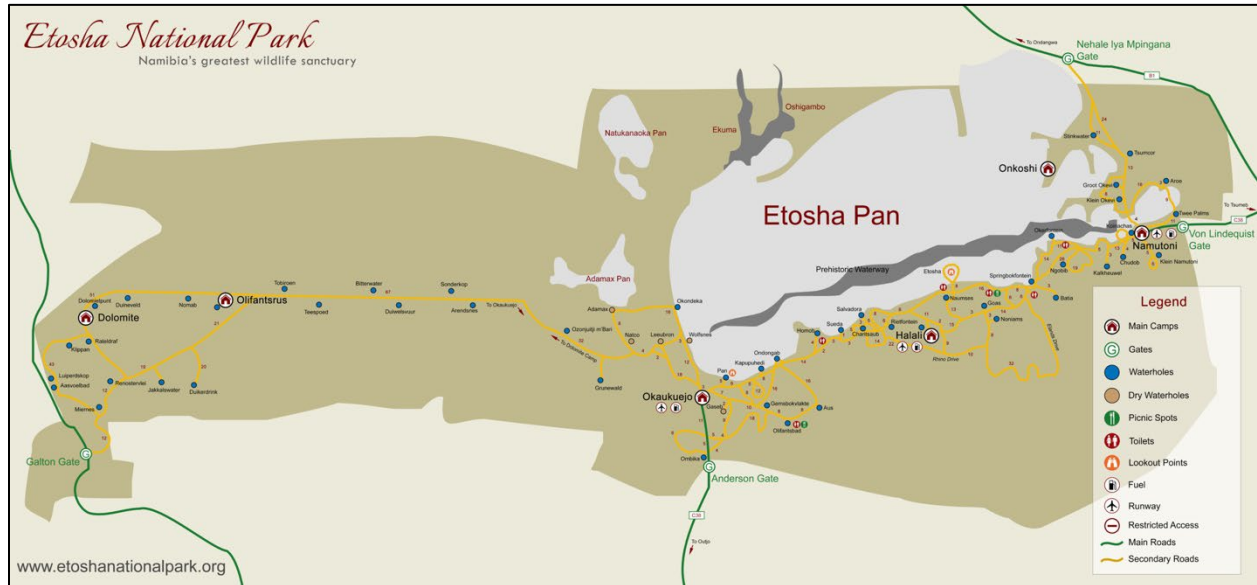
Note on AI/LLM usage: There is no specific required minimum page length for a complete IM²C submission. We permit the careful use of AI such as ChatGPT, although their use is not necessary to create a solution to this problem. Teams that use any generative AI tools must follow the [IM²C AI use policy](#) and include an AI Use Report at the end of the PDF submission. If no AI Use Report is included, the team is affirming that no generative AI or large language model tools were used at any stage of the work. The AI Use Report does not count toward the 24-page limit.

Note on presenting your solution: Teams may find it helpful to include visual or structured elements to support and clearly communicate essential aspects of their modeling approach and proposed solutions. Examples include: a map or table summarizing protection metric(s) across the park over time; an illustration of how resources such as patrols, personnel, or monitoring technologies are allocated; at least one sensitivity or robustness analysis; or a brief comparison identifying which components of the model remain unchanged and which must be modified when adapting the approach to other reserves. Any such elements that teams wish the judges to consider should be included within the main solution document and therefore count toward the 24-page limit.

Etosha National Park Maps

<https://www.etoshanationalpark.org/map>

<https://www.etoshanationalpark.org/media/Etosha-Map-2025.jpg>



Glossary

Wildlife: animals and plants that grow independently of people, usually in natural conditions.

2026 IM²C

Protecting Wildlife at Scale – Background information for Etosha National Park

The following information is provided to help teams start to understand and explore qualitative and quantitative aspects of Etosha National Park. All values are approximate* and are intended to support modeling, not to constrain assumptions. Teams may refine or add data as long as all additions and sources are clearly justified within their solution. It is expected that teams may encounter more specific data, alternative estimates, or sources that do not fully agree, and that such differences will be thoughtfully incorporated into their modeling choices.

Etosha National Park — Reference Dataset

| Category | Approximate Values | Notes |
|-----------------|------------------------|---|
| Park Area | 22,935 km ² | Etosha is one of the largest wildlife reserves in Africa. |
| Annual Visitors | ~200,000 | Typical pre-pandemic order of magnitude estimate. |
| Length of Roads | 3,551 km of roads | Including gravel and dirt routes for access/patrol. |

Wildlife (Examples)

| Species / Group | Status or Feature | Notes |
|--------------------|-------------------------------------|---|
| Mammal Species | 114 species | Includes large and small mammals. |
| Bird Species | More than 400 species | Resident and migratory bird species. |
| Black Rhinoceros | Endangered | Etosha contains a large black rhino population; poaching is an ongoing issue. |
| Elephants | Abundant | ~2,500 elephants estimated in the broader surrounding ecosystem. |
| Lions | Present | Part of key predator community. |
| Leopards, Cheetahs | Present (less common) | Part of key predator community. |
| Plains Herbivores | Zebras, springbok, oryx, kudu, etc. | Common prey species |

Human Resources & Management

| Resource Type | Approx. Value | Notes |
|-----------------------|---------------|--|
| Park Staff (Ministry) | 295 personnel | Ministry of Environment and Tourism staff stationed in Etosha. |
| Fence Perimeter | ~850 km | Park boundary fencing supports management. |

Threat Context (Reference)

| Issue | Description |
|--------------------------|---|
| Poaching Pressure | Reports suggest significant rhino poaching since 2022. |
| Natural Events | Wildfires have impacted large portions of the park in recent years. |

Geographic/Physical Features

| Feature | Approx. Value / Description | Notes |
|---------------------------|---------------------------------|---|
| Etosha Pan | ~4,800 km ² salt pan | Central, seasonally dramatic feature. |
| Main Terrain Types | Savanna, salt pan, grassland | Ecosystem influences animal movement. |
| Waterholes | 86 (natural & man-made) | Important sites for wildlife aggregation. |

*Values as well as information on this page was obtained from a variety of sources, including but not limited to information published by the Republic of Namibia's Ministry of Environment, Forestry & Tourism.

2026 IM²C Full Submission Guidelines

Teams may use any inanimate source of data, materials, computers, software, references, websites, books, etc. Be sure to credit all sources used.

Teams may not use any person (other than team members) to discuss or obtain ideas for solving their problem **nor may they seek help in obtaining an answer from the teams' advisor or anyone else**. Any team that discusses the problem with anyone in a position to supply them with information reflecting experience or professional expertise will be disqualified. The relevant issue is one of intent: each team of students is expected to develop all of its substantive analysis without the help of others.

Partial solutions are acceptable. There is no passing or failing cutoff score, nor will numerical scores be assigned. The IM²C judges are primarily interested in a teams' approach and methods.

The solution must consist entirely of written text and possibly figures, charts, or other written material only. No non paper support such as computer disks or applications will be accepted.

Each page of the solution should contain the team control number and the page number at the top of the page; we suggest using a page header on each page for example: Team # 2024000 page 6 of 13.

The names of the students, advisor, or institution must not appear on any page of the solution. The solution must not contain any identifying information other than the team Control Number.

Teams should keep in mind the following guidelines while preparing their solution papers:

- Conciseness and organization are extremely important. Key statements should present major ideas and results.
- Present a clarification or restatement of the problem as appropriate.
- Present a clear exposition of all variables, assumptions, and hypotheses.
- Present an analysis of the problem, motivating or justifying the modeling to be used.
- Include a design of the model. Discuss how the model could be tested.
- Discuss any apparent strengths or weaknesses to your model or approach.
- Incorporate lengthy derivations, computations, or illustrative examples in appendices. Summarize these in the main report. Results must be explicitly stated in the body of the report.

Your PDF solution should include:

- **One page Summary Sheet.**

The Audience for the summary sheet is anyone unfamiliar with the problem. Hence, in your own words briefly outline the problem, the main solution approach, and your conclusion.

To write a good summary, imagine that a reader may choose whether to read the body of the paper based on your summary. Thus, a summary should clearly describe your approach to the problem and, most prominently, what your most important conclusions were. The summary should inspire a reader to learn the details of your work. Your concise presentation of the summary should inspire a reader to learn the details of your work.

- **One page Table of Contents.**

This allows the reader to easily find various parts of your solution, especially if they chose not to read though in order (as is typical when reading long reports).

- **(No more than) two-page *Letter to the IMMC* with your recommendations.**

Write a letter of no more than two pages addressed to the IMMC that clearly communicates your modeling approach, recommendations, and key insights. The purpose of this letter is to summarize the most important aspects of your work for decision makers without technical backgrounds, highlighting your conclusions, rationale, and implications rather than detailed mathematical analysis.

- **Twenty-page (maximum) report** communicating the essential aspects of your solution.

- The specifications of a complete solution:

- A4, margins at least 1.5cm (OR) Letter, margins at least 0.6in
- Papers must be typed and in English.
- At least 12-point font size.
- **Note that (excluding references, appendices and AI Use Report see below) you have a maximum of 24 pages to communicate your solution.** Your summary sheet, letter to the decision makers, visual graphic, and your table of contents all count towards the 24-page limit (excluding references, appendices and AI Use Report) of your solution.

***Compliance:** Failure to meet these specifications or attempts to circumvent them may result in a lower designation or disqualification.*

- **Reference List, Appendices, and AI Use Report.**

A list of references, any appendices, and the AI Use Report, **do not count** toward the 24-page limit and should appear after your completed solution. You should not make use of unauthorized images and materials whose use is restricted by copyright laws. Ensure you cite the sources of all ideas and materials (data, images, etc.) so it is clear to the reader what ideas and mathematical work was completed by your team and where you are building in ideas of others.

Use of Large Language Models and Generative AI Tools in the IM²C

This policy is motivated by the rise of artificial intelligence (AI) tools, including large language models (LLMs), generative AI, mathematics software, translation software, code-copilots, auto-complete technologies, and other AI-assisted technologies. The policy aims to provide greater transparency and guidance to teams, advisors, and judges. This policy applies to all aspects of student work, from research and development of models (including code creation) to the written report, even translations from a teams' preferred language into English. Since these emerging technologies are quickly evolving, IM²C will refine this policy as appropriate.

Teams must be open and honest about all their uses of AI tools, including embedded AI (e.g., mathematics software, translation software, code-copilots, and other AI assisted auto-complete technologies, etc.). The more transparent a team and its submission are, the more likely it is that their work can be fully trusted, appreciated, and correctly used by others. These disclosures aid in understanding the development of intellectual work and in the proper acknowledgement of contributions. Without open and clear citations and references of the role of AI tools, it is more likely that questionable passages and work could be identified as plagiarism and disqualified.

Solving the problems does not require the use of AI tools, although their responsible use is permitted. IM²C recognizes the value of AI tools as productivity tools that can help teams in preparing their submission; to generate initial ideas for a structure, for example, or when summarizing, paraphrasing, language polishing etc. There are many tasks in model development where human creativity and teamwork is essential, and where a reliance on AI tools introduces risks. Therefore, we advise caution when using these technologies for tasks such as model selection and building, assisting in the creation of code, interpreting data and results of models, and drawing scientific conclusions.

It is important to note that AI tools have limitations and are unable to replace human creativity and critical thinking. IM²C advises teams to be aware of these risks if they choose to use AI tools:

- **Objectivity:** Previously published content containing racist, sexist, or other biases can arise in AI-generated text, and some important viewpoints may not be represented.
- **Accuracy:** AI tools can 'hallucinate' i.e. generate false content, especially when used outside of their domain or when dealing with complex or ambiguous topics. They can generate content that is linguistically but not scientifically plausible, they can get facts wrong, and they have been shown to generate citations that don't exist. Some AI tools are only trained on content published before a particular date and therefore present an incomplete picture.
- **Contextual understanding:** AI tools cannot apply human understanding to the context of a piece of text, especially when dealing with idiomatic expressions, sarcasm, humor, or metaphorical language. This can lead to errors or misinterpretations in the generated content.

Training data: AI tools require a large amount of high-quality training data to achieve optimal performance. In some domains or languages, however, such data may not be readily available, thus limiting the usefulness of any output.

Guidance for teams

Teams are required to:

1. **Clearly indicate the use of AI tools**, including large language models (LLMs), generative AI, mathematics software, translation software, code-copilots, auto-complete technologies, and other AI-assisted technologies **in their report**, including which model was used and for what purpose. Please use **inline citations** and the **reference section**. Also append the Report on Use of AI Tools (described below) after your 24-page solution.
2. **Verify the accuracy, validity, and appropriateness** of the content and any citations generated by AI tools and correct any errors or inconsistencies.
3. **Provide citation and references, following guidance provided here**. Double-check citations to ensure they are accurate and are properly referenced.
4. **Be conscious of the potential for plagiarism** since AI tools may reproduce substantial text from other sources. Check the original sources to be sure you are not plagiarizing someone else's work.

**IM²C will take appropriate action
when we identify submissions likely prepared with
undisclosed use of such tools.**

Citation and Referencing Directions

Think carefully about how to document and reference whatever tools the team may choose to use. A variety of style guides are beginning to incorporate policies for the citation and referencing of AI tools. Use inline citations and list all AI tools used in the reference section of your 24-page solution.

Whether or not a team chooses to use AI tools, the main solution report is still limited to 24 pages. If a team chooses to utilize AI, following the end of your report, add a new section titled Report on Use of AI. This new section has no page limit and will not be counted as part of the 24-page solution. Examples (this is *not* exhaustive – adapt these examples to your situation):

Report on Use of AI Tools

1. Baidu Fanyi, *Baidu Translate* (Sep 10, 2025 version)
Uploaded entire paper written in Mandarin to be translated into English.
2. OpenAI *ChatGPT* (Nov 5, 2023 version, ChatGPT-4)
Query: *<insert the exact wording you input into the AI tool>*
Output: *<insert the complete output from the AI tool>*
3. OpenAI *Ernie* (Nov 5, 2023 version, Ernie 4.0)
Query: *<insert the exact wording you input into the AI tool>*
Output: *<insert the complete output from the AI tool>*
4. GitHub *CoPilot* (Jan 16, 2024 version)
Auto-completions for code used in preparing our models.