# 看2020 ICM

**Problem E: What is the Cost of Environmental Degradation?**

**2020年ICM**

**问题E：环境退化的成本是多少？**

Economic theory often disregards the impact of its decisions on the *biosphere* or assumes unlimited resources or capacity for its needs. There is a flaw in this viewpoint, and the environment is now facing the consequences. The biosphere provides many natural processes to maintain a healthy and sustainable environment for human life, which are known as *ecosystem services*. Examples include turning waste into food, water filtration, growing food, pollinating plants, and converting carbon dioxide into oxygen.

经济理论常常无视其决策对生物圈的影响，或假定其需求无限的资源或能力。这种观点存在缺陷，现在环境正面临后果。生物圈提供了许多自然过程来维持人类生命的健康和可持续环境，这被称为生态系统服务。例如，将废物变成食物，进行水过滤，种植食物，给植物授粉以及将二氧化碳转化为氧气。

However, whenever humans alter the ecosystem, we potentially limit or remove ecosystem services. The impact of local small-scale changes in land use, such as building a few roads, sewers, bridges, houses, or factories may seem negligible. Add to these small projects, large-scale projects such as building or relocating a large corporate headquarters, building a pipeline across the country, or expanding or altering waterways for extended commercial use. Now think about the impact of many of these projects across a region, country, and the world. While individually these activities may seem inconsequential to the total ability of the biosphere’s functioning potential, cumulatively they are directly impacting the *biodiversity* and causing *environmental degradation*.

但是，只要人类改变了生态系统，我们就有可能限制或取消生态系统服务。土地使用的局部小规模变化（例如修建一些道路，下水道，桥梁，房屋或工厂）的影响似乎可以忽略不计。除了这些小型项目之外，还包括大型项目，例如，建造或搬迁大型公司总部，在全国范围内建设管道，或扩展或更改水路以扩展商业用途。现在考虑一下其中许多项目对地区，国家和世界的影响。虽然这些活动似乎似乎与生物圈功能潜力的总能力无关紧要，但累积地它们直接影响生物多样性并造成环境退化。

Traditionally, most land use projects do not consider the impact of, or account for changes to, ecosystem services. The economic costs to *mitigate* negative results of land use changes: polluted rivers, poor air quality, hazardous waste sites, poorly treated waste water, climate changes, etc., are often not included in the plan. Is it possible to put a value on the environmental cost of land use development projects? How would environmental degradation be accounted for in these project costs? Once ecosystem services are accounted for in the cost-benefit ratio of a project, then the true and comprehensive *valuation* of the project can be determined and assessed.

传统上，大多数土地利用项目都不考虑生态系统服务的影响或说明生态系统服务的变化。 减轻土地使用变化的负面结果的经济成本：污染的河流，空气质量差，危险废物场所，废水处理不当，气候变化等，通常不包括在计划中。 是否可以对土地利用开发项目的环境成本进行估价？ 在这些项目成本中如何考虑环境恶化？ 一旦在项目的成本效益比中考虑了生态系统服务，就可以确定和评估项目的真实和全面的评估。

Your ICM team has been hired to create an ecological services valuation model to understand the true economic costs of land use projects when ecosystem services are considered. Use your model to perform a cost benefit analysis of land use development projects of varying sizes, from small community-based projects to large national projects. Evaluate the effectiveness of your model based on your analyses and model design. What are the implications of your modeling on land use project planners and managers? How might your model need to change over time?

您的ICM团队已受聘创建生态服务评估模型，以在考虑生态系统服务时了解土地使用项目的真实经济成本。 使用您的模型对大小不同的土地使用开发项目（从小型社区项目到大型国家项目）执行成本收益分析。 根据您的分析和模型设计评估模型的有效性。 您的建模对土地使用项目规划人员和管理人员有何影响？ 您的模型可能需要随着时间的变化而变化吗？

Your submission should consist of:

One-page Summary Sheet,Your solution of no more than 20 pages, for a maximum of 21 pages with your summary. Judges expect a complete list of references with in-text citations, but may not consider appendices in the judging process.

Note: Reference list and any appendices do not count toward the 21-page limit and should appear after your completed solution.

您提交的内容应包括：

一页摘要表，您的解决方案不超过20页，最多带摘要21页。 法官希望获得带有文本引用的参考文献的完整列表，但可能不会考虑评审过程中的附录。

注意：参考列表和任何附录不会计入21页的限制，应在完成解决方案后出现。

## References:

Chee, Y., 2004. An ecological perspective on the valuation of ecosystem services. Biological Conservation 120, 549-565.

Costanza, R., d’Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O’Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., van den Belt, M., 1997. The value of the world’s ecosystem services and natural capital. Nature 387, 253– 260.

Gómez-Baggethuna, E., de Groot, R., Lomas, P., Montesa, C., 1 April 2010. The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes. Ecological Economics 69 (6), 1209-1218.

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Richmond, A., Kaufmann R., Myneni, R., 2007, Valuing ecosystem services: A shadow price for net primary production. Ecological Economics 64, 454-462.

Yang, Q., Liu, G., Casazza, M., Campbell, E., Giannettia, B., Brown, M., December 2018. Development of a new framework for non-monetary accounting on ecosystem services valuation. Ecosystem Services 34A, 37-54.

## Data sources:

US based data: [https://www.data.gov/ecosystems](https://www.data.gov/ecosystems/)/

Satellite data: [https://www.ncdc.noaa.gov/data-access/satellite-data/satellite-data-](https://www.ncdc.noaa.gov/data-access/satellite-data/satellite-data-access-datasets) [access](https://www.ncdc.noaa.gov/data-access/satellite-data/satellite-data-access-datasets)-datasets

## Glossary:

**Biodiversity** - refers to the variety of life in an ecosystem; all of the living organisms within a given area.

**Biosphere** - the part of the Earth that is occupied by living organisms and generally includes the interaction between these organisms and their physical environment.

**Ecosystem** - a subset of the biosphere that primarily focuses on the interaction between living things and their physical environment.

**Ecosystem Services** – the many benefits and assets that humans receive freely from our natural environment and a fully functioning ecosystem.

**Environmental Degradation** – the deterioration or compromise of the natural environment through consumption of assets either by natural processes or human activities.

**Mitigate** – to make less severe, painful, or impactful.

**Valuation** - refers to the estimating or determining the current worth of something.

词汇表：

生物多样性-指生态系统中生命的多样性； 给定区域内的所有生物。

生物圈-地球上被活生物体占据的部分，通常包括这些生物体与其物理环境之间的相互作用。

生态系统-生物圈的一个子集，主要关注生物与其物理环境之间的相互作用。

生态系统服务–人类从我们的自然环境和功能完善的生态系统中免费获得的众多收益和资产。

环境退化–通过自然过程或人类活动消耗资产而导致的自然环境恶化或损害。

缓解–减轻重度，痛苦或影响。

估价-指估计或确定某物的当前价值。