EcoHack for Restoration Ecology

Hackathon Application Ideas

1. Intelligent Chatbots
    a. Provide personalization recommendations
    b. Chat with an ecologist
    c. Chat with research papers
    d. Incorporate evidence
    e. Incorporate information on reliability of results
2. Convert Research Papers into Presentation Slide Decks
3. Data Analysis and Visualization
    a. Summarize data findings
        i. compute topic models and display
        ii. generate summaries in various writing styles: lay or scientific
    b. Generate visualizations based on data trends
    c. Provide natural language explanations of complex datasets
4. Build a knowledge graph of findings in ecology
    a. Identify information extraction targets
        i. Build Comparisons on ORKG https://orkg.org/
    b. extract information about causal and mechanistic models (metadata for the model repository)
    c. Detect concept/term ambiguity (e.g., what does the term “enemy” mean in different contexts—for instance, consider “enemy release hypothesis”)
5. Search interfaces including
    a. fair and diverse results
        i. rank results by preferences:
            1. Temporal features
            2. Location features
            3. Discipline features
        ii. label differences in sources (e.g. scientific paper, grey literature)
    b. query builder (automated (?) template generation and translation to SPARQL
6. Tools for synthesizing research papers
    a. detect ecosystems (and put them on a map)
        i. Taxonomy of ecosystems (e.g. based on https://iucn.org/resources/publication/iucn-global-ecosystem-typology-20)
    b. extract models/variables
    c. detect species and link them to ontologies (images?)
    d. summarize papers for different target audiences: lay people (see biolaysumm)
7. Tools for incorporating results from grey literature
    a. collate results from both scientific and grey literature retaining information on the sources
8. IPBES reports, summarizing the global state of biodiversity

    Tasks to consider: topic modeling, chatbot or Q&A over the reports

    a. e.g. Assessment Report on Land Degradation and Restoration https://www.ipbes.net/assessment-reports/ldr

i. Full report https://zenodo.org/records/3237393#.Yx7djnaxWUk

9. Futzy 2.0 (contact: Tim Alamenciak)
   a. support for Fuzzy Cognitive Maps (FCM) extensions (delay, conditional,...)
   b. merging 2 FCMs
10. Developing an ontology for ecology/invasion biology using LLMs
   a. Input: hypothesis' statements, availale abstracts (PDF) as well as excel files from hi-knolwedge
   b. Using LLMs to extract relevant terms from available resources (term extraction)
   c. Using LLMs to reuse bioportal to check availability to concept reuse or define a new concepts
   d. Build hierarchy between concepts
   e. Build relations between concepts
   f. Finally evaluate the developed ontology by matching it with INBIO

Resources

Scientific Papers Corpus. Consider compiling a corpus of scientific papers as data for your project. Here are some resources and examples to get you started.

Example papers with relevant keywords for restoration ecologists: 1. Facets Journal Article (2022), and 2. Ecological Restoration Research Review (2020) **|** Sources for building your corpus: 1. Web of Science, 2. Unpaywall, and 3. ASK.ORKG Semantic Neural Search API

These tools and references can help you gather and analyze relevant scientific literature for your hackathon project! 📚🌿

The following list comprise other forms of data to build your hackathon application on:

https://toolkit.ewater.org.au/Tools/Eco-Evidence

https://environmentalevidence.org/ceeder-search/

https://github.com/OpenKnowledgeMaps

https://hi-knowledge.org/

https://www.conservationevidence.com/

https://www.epa.gov/ecodiver/about-ecodiver

https://www.epa.gov/ecodiver/ecodiver-resources

https://biolaysumm.org/ (dataset of biomedical research articles with lay summaries)

https://zenodo.org/records/6575865 (BiodivNERE-Gold standard corpora for named entity recognition and relation extraction in the biodiversity domain; accompanying paper: https://bdj.pensoft.net/article/89481/instance/7788834/)

Hypothesis corpus: 1) Taxonomy of hypotheses https://v2020.hi-knowledge.org/invasion-biology/, 2) Publications. a) Abstract-Level annotated Corpus Paper:

https://aclanthology.org/2022.wiesp-1.5/ b) Span-level annotated Corpus Paper: https://link.springer.com/chapter/10.1007/978-3-031-63536-6_2

Invasion Biology Ontology https://bioportal.bioontology.org/ontologies/INBIO | Think of building something similar for Restoration Ecology

BioPortal https://bioportal.bioontology.org/

BioDiv portal https://biodivportal.gfbio.org/

LLM-generated definitions of concepts in invasion biology

https://www.britishecologicalsociety.org/applied-ecology-resources/ | Think of transfer to Restoration Ecology

Hackathon Application Workflows

1. Given a collection of research & practitioner questions in restoration ecology, implement one or more of the following workflows: 1) Implement a search workflow that retrieves relevant documents to a given question. Test your system over each question in the collection, then analyze and evaluate the results. 2) Implement an answering workflow that answers the given question from the top-ranked search results in a paragraph. 3) Implement a chat workflow that allows the user to follow-up with more questions over the search results
    a. Tools to consider using https://github.com/jannisborn/paperscraper, https://www.llamaindex.ai/
2. Design a slide deck generation workflow for research papers in restoration ecology.
    a. Tool to consider using https://marp.app/
3. Design a workflow that extracts information from research papers in restoration ecology and builds an ORKG comparison of the contributions of research. E.g., https://orkg.org/comparison/R58002
    a. Tools to consider using https://github.com/jannisborn/paperscraper, https://www.llamaindex.ai/

Brainstorming Help: Existing Applications as Idea Impulses

Consider the following tools and applications and see if they inspire ideas:

https://papeg.ai/#

https://restor.eco

https://globalrestoreproject.com/

Derive inspiration from another field—

Check out this paper that presents 14 hackathon ideas implemented in Material Sciences/Chemistry https://arxiv.org/abs/2306.06283 . See if some of them can be applied in the context of the restoration ecology domain for EcoHack.

Another related hackathon event list of team submissions https://gainforest.notion.site/2ed5a0c7a7df47b98a78280941cb1079?v=30c06413a4b4477d8f7db310a3eacd68 . Please note this hackathon event tackles the problem of invasion biology and the focus of EcoHack is restoration ecology.

Get creative and draw inspiration from other domains, but remember—the coolest prizes go to solutions that tackle challenges in restoration ecology head-on! 🌿✨