

Incorporating Computational Sustainability into AI Education through a Freely-Available, Collectively-Composed Supplementary Lab Text



Douglas H. Fisher
Vanderbilt University

Bistra Dilkina
Cornell University

Eric Eaton
Bryn Mawr College

Carla Gomes
Cornell University



Summary

- We have initiated a free online lab textbook entitled Artificial Intelligence for Computational Sustainability: A Lab Companion
- It is a collection of self-contained chapters, sections, and exercises that explore sustainability applications of AI
- Material is designed to supplement an existing AI course
- Instructors can easily “snip out” sections or exercises from the lab companion for use in their courses
- The textbook is community-developed through WikiBooks, so anyone can contribute to the project.

Artificial Intelligence for Computational Sustainability: A Lab Companion



Preamble

This laboratory companion is designed to introduce students of artificial intelligence (AI) to problems of environmental and societal sustainability, together with projects and problem sets at the intersection of AI and sustainability. The lab text can accompany any primary AI textbook, or can be used independently, though the material in it will typically assume selected knowledge of AI at an undergraduate level. The material in the text is organized primarily around AI topics, and includes explanatory and illustrative material concerning specific sustainability problems, together with *projects* (of several weeks duration), *assignments* (of duration on the order of a week) and *exercises* . . .

Organization

Artificial Intelligence for Computational Sustainability:
A Lab Companion

WIKIBOOKS
Open books for an open world

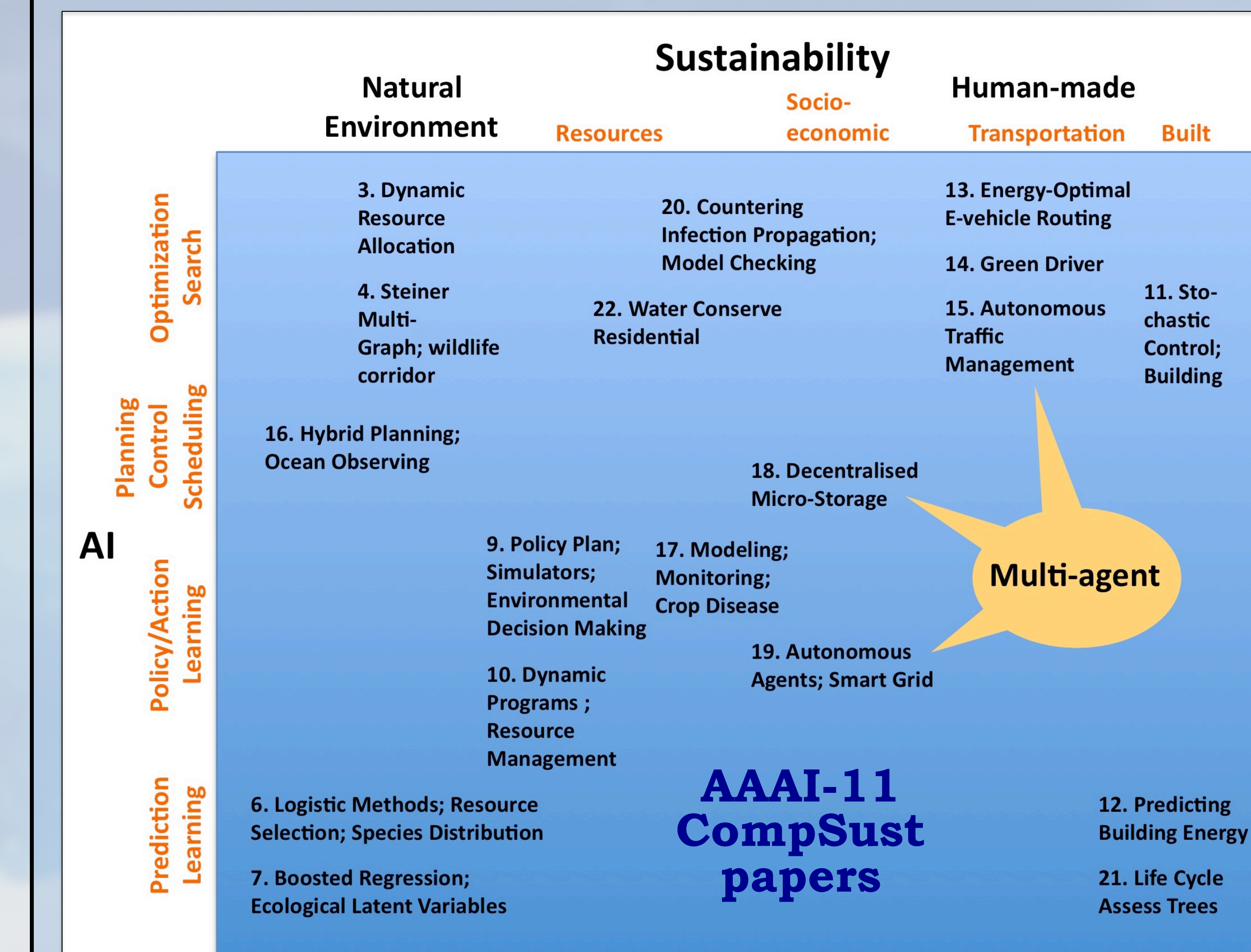
Please see how you can contribute: [Guide for Contributors](#)

0. Preface for educators and learners
1. Introduction to Computational Sustainability

| AI Chapters | Sustainability Chapters |
|--|--|
| 2. State Space Search | 11. Agriculture |
| 3. Constraint-Based Reasoning and Optimization | 12. Behavior and Consumerism |
| 4. Knowledge Representation | 13. Biodiversity and Conservation |
| 5. Reasoning Under Uncertainty | 14. Climate and Ocean modeling and observation |
| 6. Machine Learning for Prediction | 15. Design, Life-Cycle, and Materials |
| 7. Deterministic Planning and Problem Solving | 16. Energy, including Smart Grids |
| 8. Planning Under Uncertainty | 17. Fresh Water Ecosystems and Resources |
| 9. Machine Learning for Planning and Problem Solving | 18. Transportation and Urban Design |
| 10. Multi-Agent Systems | |

- Indexed by both AI topics and sustainability topics
- Each section and exercise contains background material on the relevant sustainability topics

Examples of AI for Computational Sustainability



- Many AI concepts addressed at the undergraduate level can be applied to problems in sustainability
- The lab companion includes exercises of varying durations and difficulties

Project Goals

| | | | |
|-------------------|--|--|---|
| Broaden education | Encourage free and open literature on sustainability | Build the computational sustainability community | Serve as a model for lab companions in other fields |
|-------------------|--|--|---|

How You Can Contribute



- We need your help! Currently, the textbook is incomplete, and needs volunteers to contribute content
 - You can contribute as much or as little as you like
 - You do not need to contribute entire sections or exercise – just write what you have and the community will fill in the rest
- Contributing is easy! You don't even need a WikiBooks account
 - Visit the lab companion WikiBooks site via the URL below
 - Locate the page you wish to modify, and click *Edit*. That's it!

Desired Characteristics of the Lab Companion

portable, a supplement to any primary textbook and other resources

online and freely available, for use in courses world-wide, as well as for use in broader impact plans by research teams/projects

compartmentalized into self-contained sections/exercises

interlinked with other resources (e.g., Wikipedia articles, textbooks, online courses and lectures, online research papers)

community-developed, evolving as projects, assignments, and explanatory material at the intersection of computing and sustainability evolve

multi-perspective, indexed by both AI and sustainability themes