UBC SUSTAINABILITY SCHOLARS PROGRAM REPORT

Developing a Sustainability Assessment Model for the UBC Farm - Historical Impact Databases & Mapping

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Xuesi Shen

MSc Resources, Environment & Sustainability Candidate, IRES, UBC

Background

UBC farm, located at the South of the University of British Columbia campus, is a 60-acre teaching, research and community farm aiming at fundamentally transforming local and global food systems towards a more sustainable, food-secure future. At the current location, since the late 1990s, faculty, staff, students and community members have worked together to develop the farm and promote a vision of sustainable agriculture and forestry.

Hitherto, the UBC farm has been serving as not only an agricultural production base, but also as a cultural landscape and research & education centre. As the farm moves towards achieving sustainability targets, it becomes more urgent to provide systematic, valid and consistent farm data for researchers, students, staff, decision-makers and other community members. High quality and systematically collected data will contribute to scientific research, farm management and decision making. Analyses of long-term data from the UBC Farm can yield deeper understanding and improve insight on the effectiveness of farm management operations as they relate to a range of outcomes including urban agricultural production, ecosystem services, and community engagement.

Data has been collected by farm staff on basic operational activities over the last decade, and numerous faculty- and student-led research projects have also developed assessments of other aspects of the farm's activities and outcomes. To date, these data have not yet been comprehensively organized and assessed. The limited capacity of farm staff to collect, analyze and verify the data has restricted a systematic approach to collection and use of farm-based data. Given that, it is worthwhile to develop a systematic framework to analyze and evaluate the UBC farm database and provide suggestions on future data tracking.

Concept map: UBC farm system

The UBC farm, compared with other intensively managed and diversified farms, is a highly integrated farm system allowing for the manipulation of a wholly contained food system. It covers food production to processing to consumption across an agricultural and forested landscape. Multiple factors and constructs in agriculture, economy, ecology, culture and society are involved in this 'seed to plate' mode. To help clarify the farm system components and relationships between them, we first develop a concept map (Appendix I) in this study.

Concept mapping is a graphical tool that visualizes concepts and the relationships among different constructs, which can facilitate researchers' understanding of the interactions of constructs and enable identification of the relationship and data comparison (Baugh, N., McNallen, A., & Frazelle, M. 2014, Daley, B. 2004, Wheeldon, J., & Faubert, J. 2009).

As shown in Appendix 1, the constructs in the farm system can be classified into three types: inputs, outputs and environmental and social impacts. The farm inputs include water, land, energy, fertilizer, seeds, pesticides, funding and facilities. For each type of input, certain concepts and factors are listed to describe or specify it. For instance, fuel and electricity are the primary energy usages in the farm. Fuel is mainly used for running machinery and transportation while electricity is used for building daily operations and pumps. The output of the farm comprises agricultural production, nutrition output, revenue, events and activities, research output and online outreach. Similar to input concepts, output concepts are detailed with related factors. Events, for instance, are classified into five types, including academic events, private events, practicum programs, volunteer programs and children's education programs. Environmental impacts on biodiversity, water and social influences on food security and resilience are also included in the map. Links between concepts indicates the relationships between them. The concept map shows the components, the correspondence between input and output, as well as the complex interactions within the farm. By translating data into diagrammatic form and emphasizing links and relationships, the map helps elicit information and foregrounding key points from the background noise.

Data evaluation

Given the development of the concept map of farm system, we then build a data index and evaluation sheet under the framework. The UBC farm data server contains hundreds of GB of files and some of them are repetitive or redundant. Although the earliest records in the farm server dates back to 1990s or even earlier, we mainly focus on data within 15 years in this study. For each factor or concept, the data are evaluated

by state of completeness, timeliness and understandability.

Completeness is a measure of comprehensiveness. It assesses whether the items recorded are adequate to describe the concept. Take seeding logs as an example, an ideal log contains seeding date, crop name, amount, seeding methods and so on. As seeding involves labor, land use and finance, a complete record should also include usage of labor, land and money. Missing data, such as blanks in an excel sheet, lowers the data quality and utility for future analyses.

Timeliness reflects whether the data is updated regularly and in a timely manner. Time span is also included as an evaluation criteria of timeliness. Data with longer time spans are considered of higher quality as they may provide a time-series view of the conditions of the concept.

Usability represents the ease with which the data may be understood and accessed. High usability indicates the data required are clear, accessible and at an appropriate level of precision for analysis. It means the data description, classification satisfy requirements and are easy to understand.

The evaluation rates the three criteria scaling from 1 (low quality) to 5 (high quality) on each of the three criteria (completeness, timeliness, and usability). The average of the three rates is the final grade for the data. Level 5 indicates that the data is complete or with minor missing data, easily comprehended, and regularly updated. Level 1, however, suggests the data is either incomplete, hard to understand or small in time span.

In order to display the data quality of the UBC farm, we revised the original concept map (Appendix II). The fill color of the factors (e.g., irrigation, crop rotation, birds, etc.) represents the data quality. It is noticeable that while the farm has been keeping a good record of water, land use, pest control, there's few data focusing on the energy input of the farm and only a few data about the farm biodiversity. Comparing with the input data, data of output are recorded more comprehensively. Specifically, harvest, sales and financial records are of the best quality.

The evaluation sheet also provides an index of files for each concept, in preparation for the next phase of the project, which is to develop an analytical database and inventory for a long-term socio-ecological monitoring station at the UBC Farm. It could benefit later researchers and students who are interested in conducting analyses of social and ecological processes at the UBC farm.

Conclusions

The study displays a new concept map and helps clarify the framework of the UBC farm system. Although the map is developed to describe a particular case, the UBC

farm, the framework and methodology could be adapted to apply to broader agri-environmental landscapes. The farm historical data evaluation contributes to bridge the gap between abstract research concepts and real farm data. With the description of data quality and the index of files, the project provides researchers, students, staffs and community members with better access to farm historical data.

Based on the data evaluation results, researchers who are interested in the interactions or relationships among water, land use, pest management, yields and sales, finance, research and events outreach could take the UBC farm as a good site for case study. For instance, the yield and sales records may support research on the relationship between crop diversity and farm resilience to market fluctuations, which is a follow-up research that we are currently working on. However, currently stored data at the UBC farm server related to energy use, biodiversity and facilities and equipment (buildings, tools, hoop houses, etc.) are unsatisfactory and may not be of sufficient quality to support rigorous research. This also notifies the farm the deficiency of current data tracking. Currently, the financial record is of the best quality among all the data. It is possible that the farm keeps better financial record not only for the farm itself but also for coordination with the campus financial system. But it is also necessary to measure and track other factors correctly and sufficiently as they are of great research value and will contribute to building the UBC farm as a living laboratory for researchers to make new discoveries, a testing ground for better agricultural practices and a sustainable, environmental-friendly urban agriculture, forestry and food system.

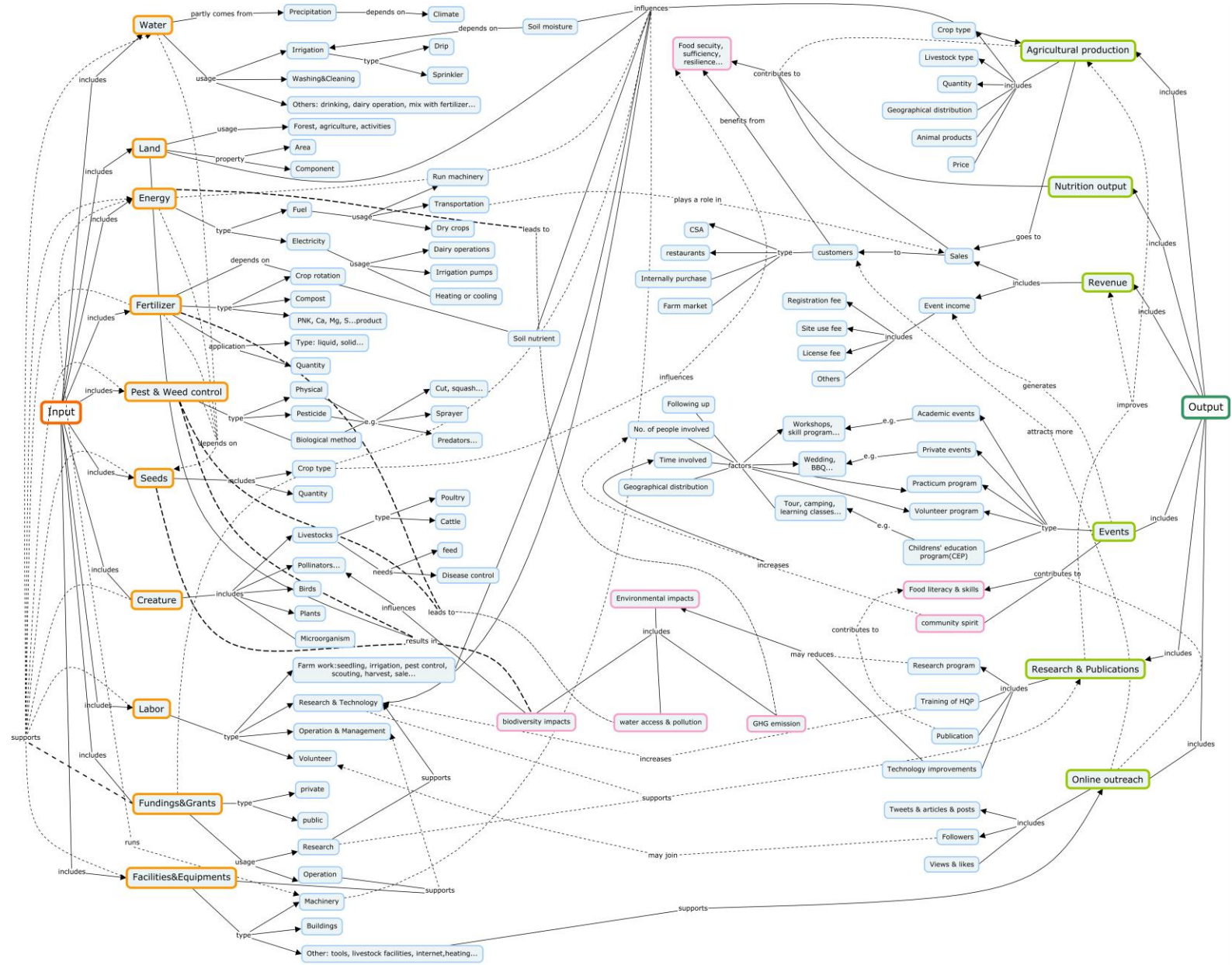
References

Baugh, N., McNallen, A., & Frazelle, M. (2014). Concept Mapping as a Data Collection and Analysis Tool in Historical Research. The Qualitative Report, 19(13), 1-10.

Daley, B. (2004). Using concept maps in qualitative research. Paper presented at Concept maps: Theory, methodology, technology. Pamplona, Spain. Retrieved from http://cmc.ihmc.us/papers/cmc2004-060.pdf

Wheeldon, J., & Faubert, J. (2009). Framing experience: Concept maps, mind maps, and data collection in qualitative research. International Journal of Qualitative Methods, 8(3), 68-83.

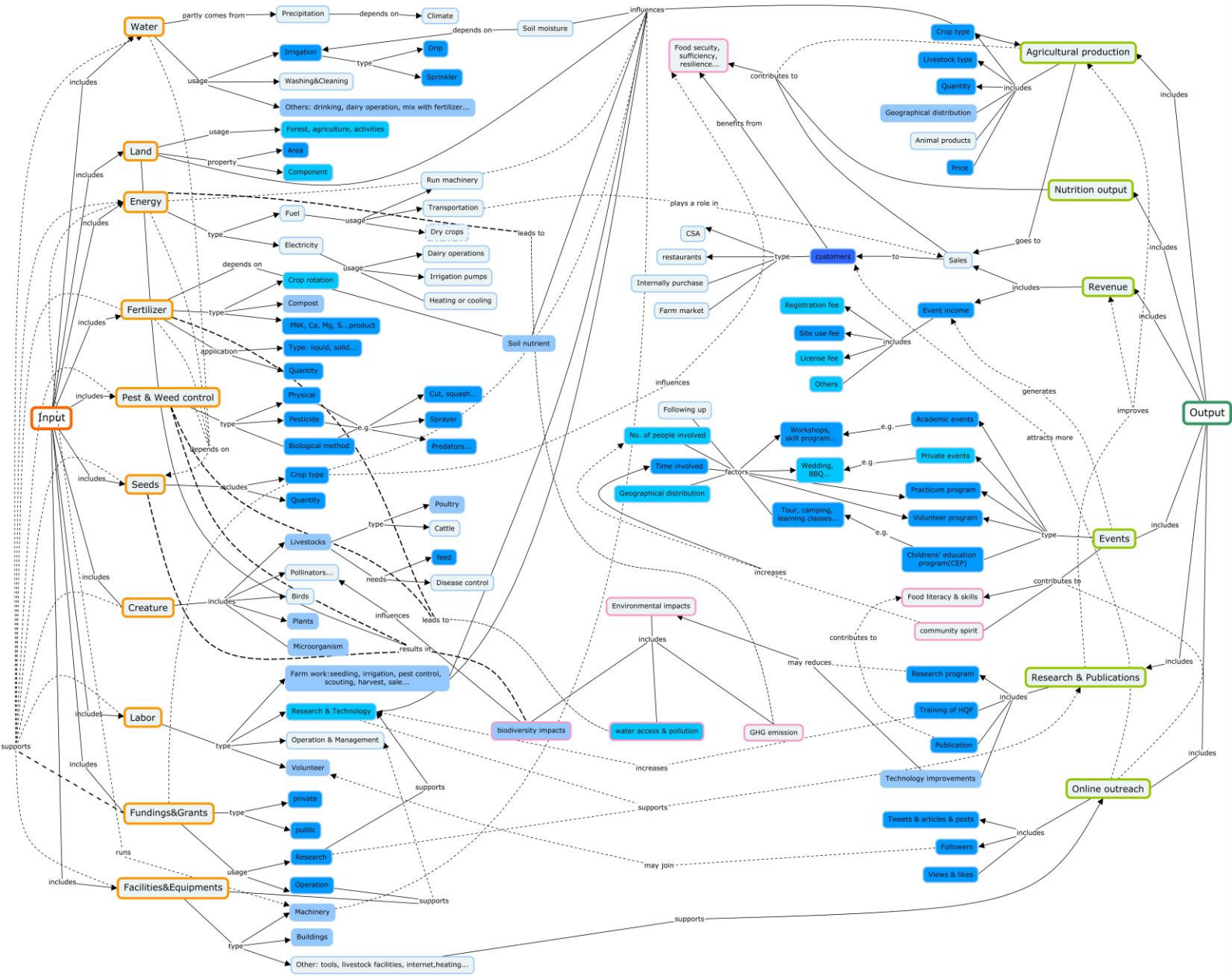
Appendix I UBC Farm Concept Map



Border Color	Input	Output	Environmental and social influences	Details of a concpet

Note: The line between concepts represent the relationship between them. To make the map more easy to read, some dash lines are used. However, they are of the same meanings as the full lines.

Appendix II UBC Farm Concept Map (Data quality)



Border Color	Input	Output	Environmental and social influences	Details of a concpet	
Fill color	Rate 5	Rate 4	Rate 3	Rate 2	Rate 1

Note: The line between concepts represent the relationship between them. To make the map more easy to read, some dash lines are used. However, they are of the same meanings as the full lines.