Big Sandy, Montana: Built on Sand or Food? (Module 1) Teaching Notes

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Abstract

The present teaching manual outlines the first module of a two-course (two-semester) junior to senior standing case study, where each module corresponds to one course. Module one is applicable in research method courses in interdisciplinary majors such as Food Systems or Agroecology, while module two is useful for courses with an emphasis in a systems-thinking and community interventions. At the end of both modules, students should be able to identify the socio-environmental factors that impact a rural food system and how they interact at different scales. The case deals with Big Sandy, an agricultural town in Montana. Although Montana has experienced economic growth in different economic sectors, rural towns such as Big Sandy have not benefitted from this trend. Young people especially tend to abandon these communities. One reason therefore is a notably unbalanced food system: in Big Sandy, most of the town is dedicated to the (mono)cropping of wheat; yet, 40% of its inhabitants lack access to affordable food. Bob Quinn, a local farmer and businessman, is the big exception: he produces organically, experiments with unusual crop rotations and other innovations, and has built an internationally successful food business. Apart from increasing the students' awareness about challenges of rural communities in an era of industrialized agriculture, module one of this case study deals with the selection of an appropriate research methodology to identify the stakeholders in Big Sandy's food system (as well as their motives). Depending on the total number of students, the module can be implemented in 7-9 classes. It includes pedagogical tools such as concept mapping, a jig-saw activity, and a debate. Students will produce oral presentations and a research agenda. Module two builds on this agenda. There, we emphasize the socio-environmental system within Big Sandy: How can Bob Quinn's farming practices impact other stakeholders to develop a more sustainable food system in Big Sandy? How may such a food system increase the attractiveness of the town for young people?

Author's note

We appreciate your feedback so that we can constantly improve our case study. If you use this case in your courses, please complete this short survey.

Acknowledgements

Contents

1. Topical areas

Food Systems; Research Methods; Rural Development; Agroecology; Sustainability

2. Applicability

<u>Courses</u>: 3rd and 4th year college students of a program with an interdisciplinary focus (e.g., food systems, environmental studies, community health, agroecology, agricultural economics, rural development).

<u>Education level</u>: Junior-senior standing.

<u>Prerequisites</u>: Introduction to food systems and sustainability concepts, moderate background in plant biology and ecology or similar field as well as in community health/nutrition.

3. Type/method

Analysis case.

4. Background

The present case study is the result of the strong commitment of Montana State University (MSU) to rural communities in Montana, which (apart from education) consists in suggesting and developing sustainable solutions for the actual challenges these communities are facing. Succeeding requires active listening, participatory research, systems-thinking, and collective action. MSU's *Sustainable Food and Bioenergy Systems* major trains its students in these skills. We selected Big Sandy as an example for rural communities in Montana because it struggles with challenges (outmigration of the youth, unbalanced food system) which are prevailing in numerous small agricultural towns of the state. On the other hand, due to the successful work of organic farmer Bob Quinn, Big Sandy counts with a spark of hope for young people and a potential exit strategy. Bob Quinn also supports the case study by attending our courses and sharing his point of view about the challenges and the future of Big Sandy with our students. Additionally, Bob Quinn and other farmers of the region collaborate with MSU in many fields. We identified the courses SFBS 327, *Measure Innovation in Food Systems* (for implementing Module 1), and SFBS 466, *Food System Resilience, Vulnerability and Transformation* (Module 2) as ideal places to carry out our case study.

5. Pedagogical strategy

The present case study is based on the principles of [Socio-environmental Synthesis](link) (SES). Pedagogical tools such as [Concept maps](link) and [Jigsaw](link), commonly applied in SES, are used.

6. Duration and context

The case study will be implemented during two semesters in two different courses. It is divided into two modules, one for each course. Module one will be developed in 5-7 classes (depending on the total number of students); it includes concept mapping, a jig-saw activity, and a debate; oral presentations and a research agenda are gradable products of these activities. Module two is implemented in four classes and includes concept mapping as well as a role play; a problem-solution-tree is the final, gradable product (Figure 1).
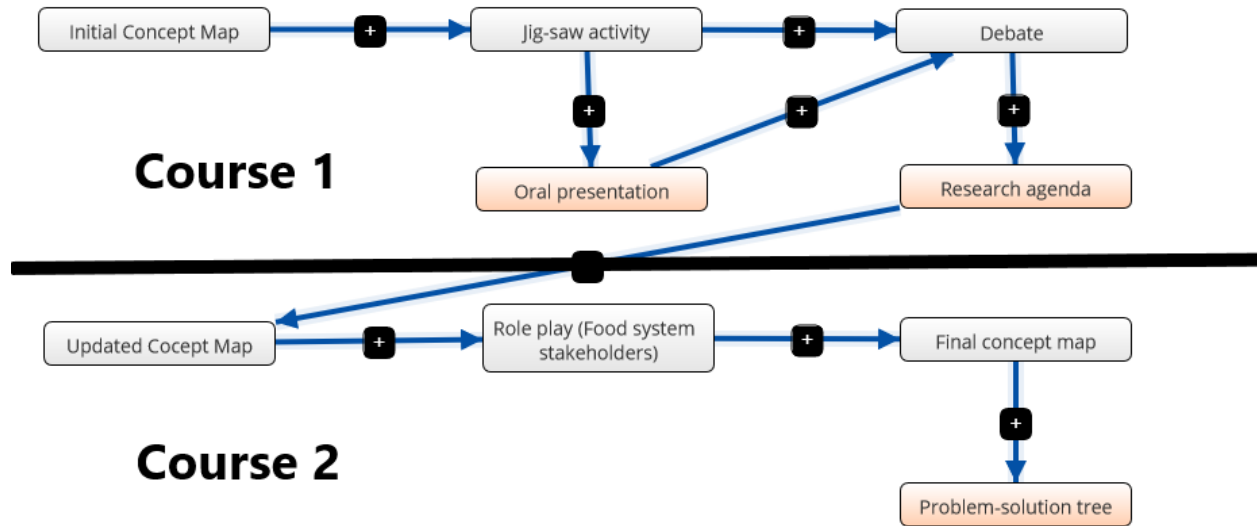
Figure 1: Chronological development of the case study divided into two modules (each module corresponds to a semester-long course); grey components represent learning activities, pink components graded products.

7. Learning objectives and goals

The present case study module has six general learning objectives and is designed to facilitate three learning outcomes, which are aligned to specific (gradable) assignments and to the universal learning goals of SES.

<u>Learning Objectives</u>

Students will:

- deal with the challenges of rural communities in Montana;
- develop appropriate research methods to identify stakeholders in a rural community;
- systematically analyze the interactions between stakeholders, (internal and external) socio-economic as well as environmental factors;
- develop a research agenda;
- identify the scale dimensions of a socio-environmental system;
- design and apply a communication strategy adapted to different target communities.

<u>Learning Outcomes</u>

Upon completing Module 1 of the present case study, students will be able to:

  I.   apply an appropriate methodology to identify stakeholders of a local food system, their motives as well as external and internal factors that intervene in this system;

  II. analyze how different stakeholders and factors interact within a food system at different scales;

 III. communicate results effectively in a professional and culturally aware manner to potential stakeholders.

Table 1: Alignment of case study learning outcomes with correspondent activities and products, SESYNC's socio-environmental (S-E) synthesis goals, and generic program learning outcomes for Sustainable Food Systems (SFS) Majors.

Case study learning outcome	Case study activity/product	S-E Synthesis goal	SFS program learning outcome
I. Research methodologies	Jig Saw, research agenda	Co-develop research questions and conceptual models in inter-or trans-disciplinary teams	Investigate food systems issues by engaging with diverse ways of knowing and applying appropriate methods and methodologies.
II. Systems thinking	Concept map (will be advanced in Module 2)	Understand the structure and behavior of socio-environmental systems	Analyze food systems issues using a transdisciplinary systems approach.
III. Communication	Oral presentation	Find, analyze, and synthesize existing data, ideas (e.g. frameworks or models), or methods.	Communicate effectively in oral, written, and visual formats.

8. Classroom Management

The module involves six different classroom activities (Figure 2), which can be implemented in seven to nine classes of a semester-long course.

Figure 2: Module 1 classroom activities, components and duration.

I. Case introduction

Duration: 30 minutes, 1 class

Required material: Printed sheets (Big Sandy Intro Story, Sustainability Index Handout) or laptops

The detailed introduction of the case should occur during the second or third class meeting. The case study will be utilized as a way to learn about sustainable food system research methodologies. Students will focus on one of the four areas of sustainable food systems: environment; economics; social/cultural; and human health (see: Sustainability Index Handout).

Students will be given the story's introduction (<u>see: Big Sandy Intro Story</u>) which follows a recent college graduate who is deciding whether she should return to a small agricultural community to take over her father's conventional wheat farm or to move elsewhere.

II. Concept map

Duration: 130 minutes, 2 classes

Concept maps (CM) will be applied in both modules of the case study but with different purposes. While we will use CM in module two as a presentation tool, in module one, CM are used to visualize the students' perception and initial collective understanding of this food system (based on the introduction and short datasets they will be provided with). Their main purpose is to foster discussion among the students, to stimulate critical self-assessment, and to highlight missing sources of information.

In module two, an updated concept map is used to resume what was learned in module one (also considering the integration of new students to the course). At the end of module two, a final CM serves to highlight the socio-environmental interactions in Big Sandy's food system based on what was identified during both courses- the starting point for the final product: the problem solution tree.

These maps are no end-product but a starting point of the case study. Hence, they can be constantly updated and refined. The instructor may reuse the initial CM at later stages of the case study.

The students will work on the concept work in three stages: warm-up, preparation (both in one class), and implementation (next class).

Part 1 – Warm-up activity

Duration: 30 minutes

This activity serves to increase the students' sensibility regarding the diversity of livelihoods even in a small community such as Big Sandy but also to self-assess their understanding of the reality of living in a rural town.

A) Students break up into groups, with 3-4 students in each group. Each group member is assigned to consider the daily routine of a different community member of Big Sandy, e.g. a farmer, a single mother, a young child. After a short preparation of approx. 10 minutes, each student presents to the group their perception of a typical day of the respective resident of Big Sandy. The instructor determines the presentation format (oral presentation, written agenda, drawings, or a mini-roleplay). In any case, the presentations should be short.

B) Then, the group discusses the pertinence of each presentation and selects a student to share the main outcomes of their discussion with the other teams.

Part 2 – Preparation

Duration: 40 minutes + homework

Required material: Printed sheets (3 documents) or laptops

A) The students will be presented an example around the question "How will I decide if I should go camping with my friends this weekend?" (<u>see: Sample Concept Map</u>). Then, students individually prepare a similar concept map addressing the question "When I was a child, who and what determined which food I ate?". They have 15 minutes and cannot use more than ten nodes.

Maintaining the groups from the warm-up, they discuss the design of everybody's map (15 minutes).

B) All students receive the following datasets:

- Agriculture in the Golden Triangle of Montana
- Big Sandy Factsheet

Homework: Students are assigned searching for additional information about Big Sandy, emphasizing data about its food environment, organic farming, and farmer Bob Quinn.

Part 3 – Implementation

Duration: 60 minutes

Required material: Post-its, flipchart paper, markers

A) Students continue in the same groups and develop a concept map around the question "Who are stakeholders in Big Sandy's food system?" As a first step, they sum up ideas using post-its for both, nodes and action phrases (25 minutes).

B) Then, they try to group the nodes and add arrows to the action phrases. They also prepare a short presentation, explaining their concept map. Based on potential ambiguities and missing context, they update the map by moving the post-its (10 minutes).

C) Finally, they draw the final concept map using a flipchart paper and prepare a 5-minute explanation of their map, which they later share with their peers. Subsequently, each group discusses the other groups' maps and considers the need for updates of their own map. If necessary, a new version must be drawn (10-15 minutes).

III. Jig-saw activity

Duration: 90 minutes, 1-2 classes

Part 1 – Introduction

Duration: 30 minutes + homework

Required material: Printed sheets (Sustainability Index Handout) or laptops

A) Students get back into their established groups from concept mapping process, with each student within the group choosing one area of sustainability to research, per the sustainability index (see: Sustainability Index Handout): economics, environment, social/cultural, and health.

B) Students read through the case study again, this time focusing on their area of sustainability. They are encouraged to think about the following questions:

- What kind of information is given in regard to their particular area?
- Does the provided information tell the entire story? What other pieces of information would be helpful to know? (students refer to the sustainability index)
- How would they go about finding the missing pieces of information? Are they available online? Or is further research necessary?

C) Students discuss the questions within their group. Once finished, each group informally presents their thoughts with the entire class.

Homework: Students brainstorm a potential research question for their area of sustainability, that pertains to the overall research question.

Part 2 – Research Question and Methods

Duration: 60 minutes + homework

Required material: Printed sheets (Experimental Design Worksheet) or laptops

A) At the beginning of the following class, students briefly share their specific research questions to the class, allowing some time for feedback from their classmates. Next, the students get into their case study groups to discuss each of their research questions. Following the Experimental Design Worksheet, each group comes up with one primary research question and four secondary research questions that support the primary research question. Secondary research questions should pertain to the four areas of sustainability assigned to each group.

B) The groups work now through their research methods to answer each secondary question. Do their methods give them the appropriate data? How do they know? Are their methods feasible?

C) After each group has discussed their research questions and methods, two groups join to share each of their results and any questions or concerns they may have. Encourage the students to work through these questions or concerns together, before asking for assistance from the instructor!

Homework: Students prepare an oral presentation where they outline their research proposal in a 10-minute visual presentation (PowertPoint, Prezi, KeyNote, etc.). Presentations should cover the following areas:

- Background / statement of the problem
- Primary & secondary research questions
- Methodology
  - Methods
  - Timeline
  - Potential data analysis strategies
- So, what? Reasons for research

IV. Oral presentations

Duration: > 60 minutes - depending on how many groups are present, 1-2 classes

Required material: laptops and other material required for projecting a presentation.

A) Each group now presents their research projects to the class (every group member should present orally), followed by a short question/answer period. Groups will present as if they were pitching their research ideas to a funding agency.

B) After each presentation, the instructor encourages the audience to ask thoughtful questions during the Q&A section. Potential questions include:

- Did the group's methodology answer the primary and secondary research questions?
- Is the research feasible? Did they have a realistic timeline?
- How would the research impact Big Sandy and the larger farming community?

If time allows, after the groups have presented, students will debate on which research project seemed the most feasible, applicable, and interesting. If time does not allow, students will debate in the following class period.

V. Debate

Duration: 20-30 minutes, 1 class

Using the instructor as a moderator, each group will explain why their research project should be selected for potential funding. Allowing some time for a debate or back-and-forth between groups, students will cast a vote on who's project should win. The instructor will also cast a separate vote. After all of the student votes have been tallied, the instructor will reveal who they thought had the best research plan. If congruent, the winning group will be hailed the winner. If not, students will again defend their answer, coming to a final consensus.

VI. Research agenda

Duration: 30 minutes, 1 class (continuation in a subsequent class if appropriate) + homework

Required material: Research Agenda Template

A) Introduce the concept of a research agenda. For the purpose of this case study, explain that research agendas are a starting point to map out a potential research project with colleagues and peers. They are a beneficial foundation document to use when writing a research proposal, which is a formally written plan required by granting agencies. For the purpose of the case study, the research agenda will be used as an outline for each of the groups' hypothetical research.

Explain that a research agenda should address the following questions/areas:

- What is the intended purpose of the study?
- Why is the work important?
- Primary and secondary research questions
  - Hypothesis
- Aims and objectives
- Research design
  - Methods
  - Timeline
  - Potential data analysis strategies

The research agenda does not need to be formally written up. It can include bullet points and notes. While the research agenda for this case study is informal, the research agenda should demonstrate a full understanding of the problem/issue the research is addressing, include well-written hypotheses, aims, and objectives, as well as a thought out and feasible research design. An appropriate hypothesis should be direct, provide insight into the research question, and be testable and measurable. Every hypothesis should be:

- Fact-driven
- Measurable
- Testable
- Clearly stated

Examples of well-written hypotheses:

1. The diversion of food waste from the Montana State University dining halls offsets the university's carbon footprint by 100lbs of carbon per year.
2. Introducing a cover crop rotation into a wheat-fallow organic system increases the amount of soil organic matter within the soil profile.
3. Building school gardens decreases the rate of childhood obesity at K-5th elementary schools.

Examples of poorly written hypotheses:

1. Adding compost makes plants healthier.
2. Organic farming is better for wheat stem sawfly management.

3. Locally grown produce tastes better than produce grown from far away.

For each hypothesis, there should be an accompanying aim and objective.

- Aims are broad statements of the desired outcome, or general intentions, from testing each hypothesis. They should entail the goal of testing the hypothesis, not how the hypothesis will be tested.
- Objectives are subsidiary to aims. They explain the steps that are going to be taken to answer the research question(s) and emphasize how the aims are going to be accomplished. Objectives are highly focused, feasible, and deal with the immediate project outcomes.

Refer to [Writing Your Research Plan](#) for more details regarding a research plan, including potential examples to provide for students.

Students will have class time for each group to start on their research agendas. Groups will finish their research plans as homework and turn them in during the next class period.

B) Once all groups have decided on which project idea is the most feasible, applicable, and interesting, the instructor will create a shared document for all the students to access. The winning group will upload their research agenda to the shared document. During class, or as a homework assignment, the students will discuss any potential amendments they would make to make to increase the success of the research project. If necessary, the amendments will be added to the research proposal.

9. Assessment

The assessment of Module 1 will be based on two student deliverables: one oral presentation and one research agenda (which will be carried out in classroom activities of the same name). While the oral presentation allows to evaluate the students individually, the research agenda generates grades per teams of 3-4 students (Table 2).

Table 2: Gradable student deliverables, mode of evaluation, and applied assessment criteria.

Student deliverable	Evaluation	Assessment criteria
Oral presentation	Individual (oral performance) Per team (further criteria)	Attitude, oral performance, visual presentation, competency, content (please see rubric: Appendix A, Table 3)
Research agenda	Per team	Writing style and format, competency, content (please see rubric: Appendix A, Table 4)

10. Suggested modifications

This case study (Module 1) includes six different classroom activities:

- Case introduction
- Concept map
- Jig-saw activity
- Oral presentations
- Debate
- Research agenda

The case is centered on food systems in small communities of rural Montana and can be implemented as it is by higher-education institutions in the region. Modifications of the case, emphasizing in rural communities in other parts of the US, are feasible and easily accomplishable. They would imply an adaptation of the intro story and all related student handouts. The subsequent activities are all congruent with the intro story and may require minor adaptations. There is also the possibility to limit the case study to the concept map and/or the jig-saw activity. Oral presentations, debate, and research agenda constitute a set of pedagogical activities with a logical sequence and should not be implemented separately.

11. References

Ahmed, S., Downs, S., & Fanzo, J. (2019). Advancing an Integrative Framework to Evaluate Sustainability in National Dietary Guidelines. *Frontiers in Sustainable Food Systems, 3*(76). doi:10.3389/fsufs.2019.00076

Big Sandy Medical Center. (2018). *Community Health Needs Assessment.* Retrieved from Big Sandy:

Daly, C., Widrlechner, M. P., Halbleib, M. D., Smith, J. I., & Gibson, W. P. (2012). Development of a new USDA plant hardiness zone map for the United States. *Journal of Applied Meteorology and Climatology, 51*(2), 242-264.

Deaton, M. W., Cynthia; Weng, Yen-Chu (2016). *Concept Mapping: A Technique for Teaching about Systems and Complex Problems.* Retrieved from Annapolis, MD: https://www.sesync.org/concept-mapping-a-technique-for-teaching-about-systems-and-complex-problems

Dietrich, E. (2018, November 17, 2018). Where the jobs are: Montana's economic landscape, visualize. *Montana Free Press.* Retrieved from https://montanafreepress.org/2018/11/17/where-the-jobs-are-montanas-economic-landscape-visualized/

Haynes, G. (2009). Outlook for Montana Agriculture. *Montana Business Quarterly, 47*(1), 29.

Montana Department of Agriculture & USDA National Agricultural Statistics Service. (2019). *Montana Agriculture Statistics 2018.* Retrieved from Helena, MT: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwjptcGUxIjkAhUFJDQIHXsxDegQFjAAegQIARAC&url=https%3A%2F%2Fwww.nass.usda.gov%2FStatistics_by_State%2FMontana%2FPublications%2FAnnual_Statistical_Bulletin%2F2018%2FMontana-Annual-Bulletin-2018.pdf&usg=AOvVaw0f9EriCQMHdXdS0MFpDWq3

Natural Resources Conservation Service (NRCS) Montana. (2011). Montana Conservation Stewardship Program (CSP) 2010-01 Geographic Area Map | Retrieved from https://www.nrcs.usda.gov/wps/portal/nrcs/mt/programs/financial/csp/nrcs144p2_056083/

Pickton, M. (2013). Writing your research plan. Retrieved from http://nectar.northampton.ac.uk/5703/1/Pickton20135703.pdf

Shume, T., Stander, E., & Sutton-Grier, A. (2016). *The jigsaw method and cooperative learning.* Retrieved from Annapolis, MD:

State of Montana. (2018). Montana's Economic Performance. Retrieved from https://mslservices.mt.gov/legislative_snapshot/Economy/Default.aspx

Stephens, C. M. (2015). Raising Grain in Next Year Country: Dryland Farming, Drought, and Adaptation in the Golden Triangle, Montana.

US Census Bureau. (2011). Census of Population and Housing. Retrieved from https://web.archive.org/web/20150426102944/http://www.census.gov/prod/www/decennial.html

US Climate Data. (2019). Climate Big Sandy - Montana. Retrieved from https://www.usclimatedata.com/climate/big-sandy/montana/united-states/usmt0025/2019/1

Whitlock, C., Cross, W., Maxwell, B., Silverman, N., & Wade, A. (2017). Montana climate assessment. *Montana Institute on Ecosystems, Montana State University, and University of Montana, Bozeman and Missoula, Montana, USA.*

12. Appendices

A) Assessment tasks and criteria

Oral presentation

Table 3: Rubric for the assessment of the oral presentation.

Parameter	Outstanding	Good	Adequate	Needs Improvement
Attitude	Demonstrates enthusiasm about the subject.	Shows certain passion about the topic.	Shows little enthusiasm about the topic.	Is uninterested in the subject.
Oral presentation	Holds attention of entire audience, rarely looks at notes.	Holds attention of audience (e.g., common eye contact) but needs notes.	Reads mostly from notes or screen.	Reads everything from notes or screen.
	Speaks lively, varies tone and volume, maintains audience interested.	Speaks with certain variation but audience is occasionally distracted.	Speaks without variation or too silent, audience is distracted.	Speaks in low volume and a monotonous tone, audience disengages.
	Is poised and controlled.	Is not poised but calm.	Is nervous.	Is indifferent, insecure, uncontrolled.
Visual presentation	Presentation is clearly legible, diversified, "exciting", and includes relevant content.	Presentation is not overloaded and "interesting".	Presentation is partially overloaded or incomplete and unclear.	Presentation is unclear, incomplete or overloaded.
	Presentation has a comprehensible sequence and is clearly structured among key points.	Presentation has a widely logic sequence and emphasizes key points.	Presentation has no clear structure.	Presentation is confusing, unstructured.
Competency	Demonstrates full knowledge of the issue, can answer all (teacher and class) questions.	Is generally comfortable with information; is competent with expectable questions but needs time for unexpected queries.	Is only capable of answering basic questions; is uncomfortable with information.	Does not show knowledge about the subject; cannot answer questions.

Content	Lays out problem and purpose well and relates them to the case.	Provides widely clear purpose and problem; but the "wider picture" (relation to the case) is lacking.	Attempts to present the problem and purpose; unclear relation to the case.	Does not present the problem and its significance for the case.
	Sources of external information are clearly evidenced and referenced.	External information is entirely highlighted but not correctly referenced.	External information is only partially highlighted and incorrectly referenced.	Sources of external information are not evidenced, probability of plagiarism.
	Presents accurate information.	Presents accurate but partially irrelevant information.	Presents insufficient or widely irrelevant information.	Presents no pertinent information.
	Provides pertinent examples and facts.	Offers useful examples and facts but parts are unnecessary or incomplete.	Presents mainly unnecessary or weak examples and facts.	Provides no fact-supported data.
	The conclusion is based on the presented content and refers to the context of the case.	The conclusion is based on the content and fairly relates to the case.	The conclusion is only somewhat based on the content and shows no strong relation to the case.	There is no actual conclusion.
	Provides plausible and applicable solutions.	Provides widely plausible and applicable solutions.	Provides unclear solutions.	Provides no solutions.

Research agenda

Table 4: Rubric for the assessment of the research agenda.

Parameter	Outstanding	Good	Adequate	Needs Improvement
Writing style and format	The format meets all requirements, the agenda gives a professional impression.	The format meets all basic requirements, but the agenda looks partially unprofessional.	The format meets only some requirements; the agenda looks relatively unprofessional.	The format is not related to the original indications and gives an unprofessional impression.
	There are no misleading or distracting spelling and grammar mistakes.	There are no seriously distracting spelling and grammar mistakes.	There is a considerable number of spelling and grammar mistakes.	The agenda is full of unacceptable mistakes.
	The used style is precise but not unscientific.	The style is correct but not highly appropriate for a research plan.	The used style is too extensive for a research agenda or unscientific.	The used style is both, not appropriate for a research agenda and unscientific.
Competency	Demonstrates full knowledge of the issue.	Demonstrates dedication to the issue, thus some details are incorrect.	Demonstrates little dedication to the issue and, consequently, poor knowledge.	Demonstrates ignorance of the issue.
Content	Contains concisely organized information.	Most information is organized.	Parts of the information are unorganized and unstructured.	No clear structure identifiable.
	Content evidences in-depth analysis and original thoughts.	Content evidences solid analysis and rather original ideas.	Content reveals a low amount of reflection and reasoning.	Content reveals poor analysis and little reflection.
	Includes accurate information.	Includes accurate but partially irrelevant information.	Includes insufficient or widely irrelevant information.	Includes no pertinent information.
	Suggests an appropriate methodology.	Identifies an appropriate theoretical framework but the methodology lacks in depth.	Suggests a widely inappropriate methodology.	Suggestions are not based on a clear methodology.

Sources of external information are clearly evidenced and referenced.	External information is entirely highlighted but not correctly referenced.	External information is only partially highlighted and incorrectly referenced.	Sources of external information are not evidenced, probability of plagiarism.
The suggested solutions are feasible regarding costs and amount of work.	The suggested solutions are widely feasible.	The suggested solutions are somehow feasible.	The suggested solutions are not feasible.
The agenda is synchronized with the methodology.	The agenda is not well synchronized with the methodology.	The agenda is not synchronized with the methodology.	There is no intent to convert the methodology into a feasible working plan.

B) Additional Resources

Student materials:

1) Big Sandy Intro Story
2) Sample Concept Map
3) Agriculture in the Golden Triangle
4) Big Sandy Factsheet
5) Sustainability Index Handout
6) Experimental Design Worksheet
7) Research Agenda Template

Useful weblinks:

Big Sandy (official website)

Montana Climate Assessment

Montana Agriculture Census per County

The Economy of Rural Montana, Montana Department of Labor Research

Photos of the Golden Triangle

Photos of Chouteau County

Bob Quinn