Big Sandy, Montana: Built on Sand or Food?
(Module 2)
Student Handouts

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Introduction

- *What do you think life is like in a rural town within the Northern Great Plains (NGP)?*

- *Where would you get your food?*

- *What would you do for employment?*

- *What opportunities and concerns might you have as a resident?*

Figure 1: Winter wheat harvesting in the Golden Triangle of Montana. © Havre Herald

In Module 2 of our case study, we would like to relate the challenges of Big Sandy's food system to those faced in rural towns of an entire region, the Northern Great Plains (NGP).

Comprising of five states (Montana, Wyoming, North Dakota, South Dakota, and Nebraska), life can be very different in the NGP than that of other, more populous regions of the United States (US). Unlike its urban counterparts, agriculture is integral to the economic vitality of the NGP and has deep historical and cultural roots.

NGP agriculture contributes heavily to national food production and security. However, the NGP

Figure 2: A typical agricultural landscape in the Northern Great Plains. © Massive Science

as a region is more relevant as a producer of primary resources for the food industry rather than for producing actual food; most bread made of NGP wheat is produced outside the ecoregion, and most calves born in the NGP are transported out of the region for slaughter. Agriculture, therefore, is specialized in providing commodities for national and (increasingly) international large-scale food production. This is compounded by the average farm size increasing, while the number of landowners decreases. As common in modern, industrialized farming systems, monocropping and industrial livestock farming are the prevailing system because they allow a high degree of mechanization and efficiency. The result is fewer farmers operating larger and larger farm businesses. The diversity of produced generated food commodities is consequently low.

Since mechanized agriculture requires few persons to work on a farm, many young people in the rural NGP have migrated to the larger cities outside of the region. Less rural population also means less markets for local food retailers. Therefore, while agriculture remains a large part of the economy and the societal systems of the rural NGP, low access to food is a problem all over the area. The lack of agricultural diversity compounded by the lack of diverse economic opportunities has created an environment that has low *food sovereignty*, the rate of people producing their own food, and high rates of *food insecurity*, the rate of people having access to appropriate food independent from where it is produced.
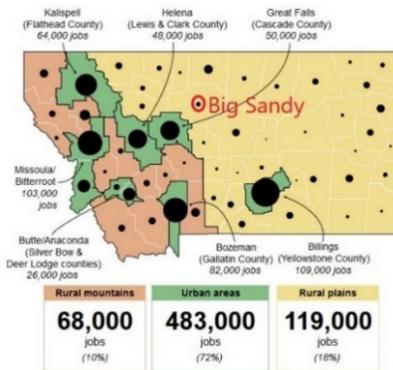
Figure 3: Montana, jobs per county 2016. *© Montana Business Quarterly*

Specifically in Montana, while the state has seen a period of economic growth during the last decade, it is mostly contributed to seven scattered urban regions, where 72% of the state's jobs are located (Figure 3). The economic benefits from these urban areas are not equally shared among Montana's more rural areas. For example, farming is considered a low-pay (-10% since 2009) and low-growth (-5%) sector of Montana's economy. An example of this trend can be seen in Big Sandy, a small agricultural town located in northern Montana.

As a rural town, Big Sandy faces many of the hardships experienced in other rural towns across the NGP: low access to food, a lack of health care options and economic opportunities, and a struggling food environment. This begs the question, what is the *food environment* like in the NGP? And how can the food environment be changed into one that is thriving and diverse?

Food Environment vs. Food System

A *food environment* is at the intersection of the wild food system and the built food system and includes food that is available, desirable, affordable, and convenient to consumers. The physical food environment describes a person's or community's interface with the food system, or in simple words, the places where one has access to food. The physical food environment consists of all available food within a community, including, but not limited to, wild and harvested edible foods, restaurants, grocery stores, convenience stores, food recourse centers, and school meals. The food environment directly impacts a consumer's choices and habits, as the availability of food directly determines consumption. A food environment is different than a food system. A *food system* is a combination of the availability and quality of food, along with the environmental, health, economic, political, social, and cultural impacts of food.

Your Task

In this case study, you will be presented with data on Big Sandy and the food environment of the NGP. Your goal is to conceptualize these issues and propose a realistic solution to improve the food environment in the area.

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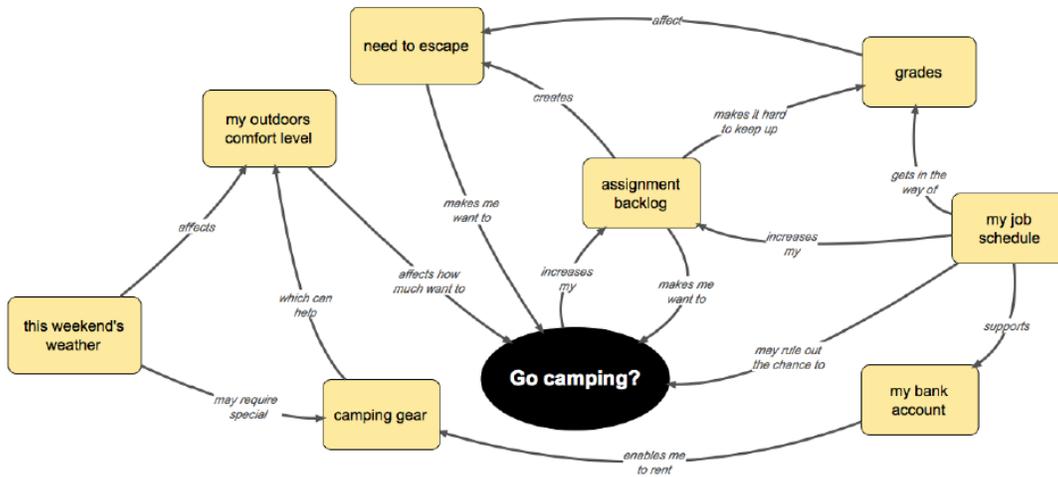
Sample Concept Map

Figure 1: Concept map that addresses the question "How will I decide if I should go camping with my friends this weekend?"

- The main question is shown prominently in the large black oval near the center.
- Each node (oval or rectangle) either has an arrow leading into it or out of it.
- There are no "unconnected" nodes.
- the arrows are labeled with verb phrases (action phrases) that describe the relationship between the two connected nodes.

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Big Sandy, Montana

- County: Chouteau County
- Location: 48°10′40″N 110°6′53″W
- ZIP Code: 59520
- Area: 1.14 km^2

- Ecological region: Northern Great Plains Steppe
- Climate: Koeppen BSk (cold semi-arid climate or cold steppe climate) characterized by warm, very dry summers and cold, snowy winters as well as strong diurnal (day-night) temperature variations
- Average temperature: 7,35° C
- Annual precipitation: 341 mm

- Inhabitants: 571, estimated for 2018 (53% female; 93% white, 3% Native Americans, 4% others; 1% Hispanics), a 7% decline since 2011 census
- Median age: 46 (increasing)
- Total households: 276 (58% family households)
- Average household size: 2,12 persons
- Vacant/abandoned housing units: approx. 60

- Agriculture: Predominantly dryland wheat in monocropping arrangement
- Unemployment rate: 3%

- Median household income: $36,000 (35% of inhabitants earn less than $20,000)
- For 40% of the people (following 2018 survey), access to affordable food is a concern.
- Further concerns of inhabitants: Health, employment, education, housing
- 1 medical center with acute hospital care
- 78% of the households include at least one person without health insurance.

- Number of grocery stores: 1
- Number of churches: 4

Figure 1: Downtown Big Sandy © Big Sandy Mountaineer

Figure 2: Rows of young winter wheat sprouting up from a field near Big Sandy, Montana © Todd Klassy

Figure 3: Big Bud 747, the proud of Big Sandy © YouTube

- Weekly newspaper: Big Sandy Mountaineer

- Attractions: [Big Bud 747](), the world's largest farm tractor; Historical Museum

- Notable people: Jon Tester, senator; Bob Quinn, organic farmer and businessman; Jeff Ament, musician (Pearl Jam)

Figure 4: Senator Tester on his farm in Big Sandy © NY Times

Figure 5: Bob Quinn, a successful organic farmer and businessman © AgWeek

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Agriculture in the Northern Great Plains

The US Northern Great Plains (NGP) is an ecoregion that extends to five states: Montana (MT), North Dakota (ND), South Dakota (SD), where they occupy the larger part of the state area, as well as smaller parts of Nebraska (NE) and Wyoming (WY). The NGP are currently experiencing a transition in agricultural land use, mainly the **conversion of grassland to annual crops**.

To date, **rainfed row crop agriculture** is dominant in the **eastern NGP**, while **irrigated cropland and grazing** lands are prevailing in the **central NGP**. Grazing land is also most common in the **western NGP** (where Big Sandy lies) but **dryland agriculture** is **expanding** in this region.

The overall contribution to of the NGP farms to US agriculture is considerable: 72% of durum, 71% of spring, and 30 % of winter wheat are produced in the NGP. Also, 48% of the US barley production comes from the NGP, as well as 49% of dry beans and lentils, 84% of sunflower seed, 22% of cattle, and 18% of sheep and lambs.

The Golden Triangle

The "Golden Triangle" is an area of Montana known for intensive dryland grain production. It represents a large part of north-central Montana. The Golden Triangle is limited by the cities of Havre, Conrad, and Great Falls (Figure 1). Today, approximately 5000 farms (number decreasing) cover over 14 million acres of agricultural land in the Golden Triangle.
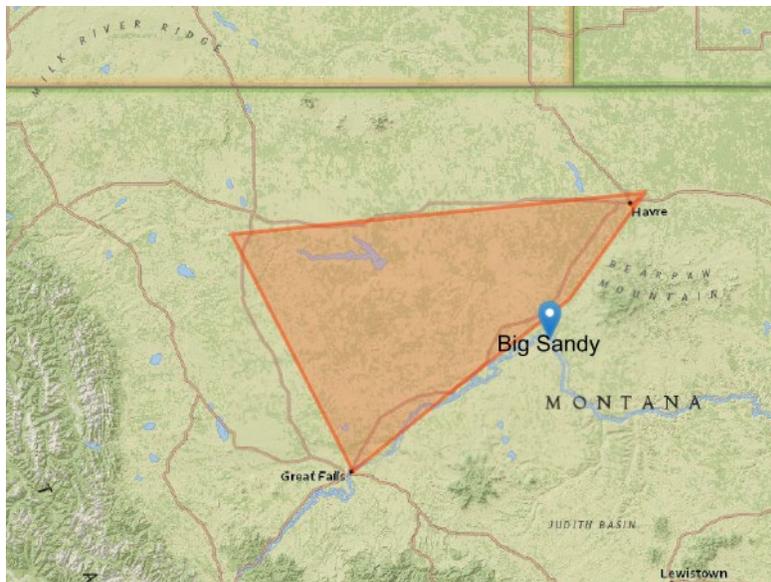

Figure 1: Ubication of the Golden Triangle area in north-central Montana. © NatGeo Mapmaker

Most parts of the Golden Triangle, including Big Sandy, are part of **Hardiness Zone 3b**. Smaller areas belong to the zones 3a or 4a. The soils in the Golden Triangle are widely deep, loamy, and well-drained, and are known as Scobey soils.

Dryland management of small grains characterizes the agricultural landscape of the Golden Triangle: **Winter and spring wheat** are the most common crops. With considerable

annual fluctuations, the Golden Triangle produces wheat on more than 2,4 million acres (> 970 000 ha), where winter wheat grown on 60% of the area. The total annual wheat production is over 90 million bushels (2,4 million t). Some of Montana's wheat is milled locally, but most of it is shipped out of the state and exported to Asia. Wheat production is usually part of crop rotations including legumes, oil seeds, and alternate fallow years.

Barley is the second most important crop in the Golden Triangle. It is produced on around 500 000 acres (> 200 000 ha), followed by **lentils** on 250 000 acres (> 100 000 ha). Other common crops include (alfalfa) hay, safflower, durum wheat, chickpeas, and dry peas. Animal production is less important than in other parts of Montana and the NGP.

Climate change and NGP agriculture

Climate models for the NGP predict a **warmer climate**, **decreasing rainfall during the summer**, more extreme rainfall events causing **flooding**, and **rising atmospheric CO_2** concentrations. Precisely, temperature increases of 1°-2°C by 2050 are expected. This tendency would principally allow longer growing seasons. However, while livestock production may benefit from this development, higher crop yields are only expected at a few isolated microregions (especially because weed and invasive species will benefit more from the new climate conditions than crop plants).

For Montana, temperature increases (mainly during the nighttime) are predicted to be even stronger than in other parts of the NGP, while precipitation changes may be less severe.

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Big Sandy, Montana: Built on Sand or Food? (Module 2)

The Food Environment of the Northern Great Plains

The food environment is defined as all food that is available, desirable, affordable, and accessible within a given region, and includes both wild edible foods and the built food system (please see introduction for more). Below is the data detailing the state of the food environment in the Northern Great Plains (NGP). When available, the average percentage was calculated for the NGP region and compared across the United States (US) average. When the raw numbers could not be analyzed across national numbers, the average percentages were broken up by state.

Household Food Insecurity
According to the United States Department of Agriculture (USDA), food insecurity is defined as reduced quality, variety, or desirability of diet, <u>with a minimal reduction in food intake</u>. Very low food insecurity is defined as <u>frequently reducing food intake or disrupting eating patterns</u> due to a lack of monetary and food resources. Food insecurity is most commonly measured through household surveys, using social and economic indicators.

Table 1. Average percentage of household food insecurity and very low food insecurity per state within the NGP, 2013-2015.

State	Household average of food insecurity, 2013 - 2015	Household average of very low food insecurity, 2013-2015
Montana	12.2%	5.6%
Nebraska	15.9%	6.2%
North Dakota	14.1%	4.9%
South Dakota	11.5%	4.5%
Wyoming	13.2%	5.3%

Food Access
The USDA's Economic Research Service defines low food access as at least 500 individuals or over 33% of the population living 1 mile or more from a grocery store, supermarket, supercenter, or any other source of healthy food in an urban area and <u>10 miles or more in a rural area</u>.

Table 2. Average percentage of population with low food access across the NGP and the US in 2015.

Region	Low Food Access, 2015
Northern Great Plains	24.04%
United States	18.77%

WIC Participation
The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is designed to help women, infants, and children who are at a nutritional risk and are at a low income status. Women may apply if they are pregnant, post-partum (up to six months), or breastfeeding (up to infant's first birthday). Infants and children can qualify up to the infant's first birthday and the child's fifth birthday. Before qualification, potential participants must see a healthcare professional to determine if they are at a nutritional risk, such as, but not limited to: anemic, underweight, have a poor diet, or poor pregnancy outcome.

Table 3. The average percentage of WIC participants across the NGP and the US, 2015.

Region	WIC participants, 2015
Northern Great Plains	1.93%
United States	2.47%

National School Lunch Program Participation
The National School Lunch Program is a federal program meant to assist children who do not have adequate access to healthy and nutritious food. Any child under 18 years of age who attends a school that offers free or reduced lunch can participate in the National School Lunch Program. The amount a student pays depends on their family's income and school districts collect applications for participation at the beginning of every school year. However, students who are already participating in SNAP, or are homeless, foster youth, migrants, or have run away from their homes/living situations are automatically considered eligible. High poverty schools, identified as schools with 40% or more participation in free lunches, are able to circumvent applications and offer free breakfast and lunch to all students. Schools are reimbursed for the expenses from the federal government.

Table 4. The average percentage of National School Lunch Program participants across the NG and the US in 2015.

Region	% National School Lunch Program participants out of total population, 2015
Northern Great Plains	11.16%
United States	9.35%

Restaurant Type and Total Expenditures
Calculated at the county level, with data from the US Census Bureau, restaurant type is broken up into two categories: fast-food restaurants and full-service restaurants. Fast-food restaurants are identified where patrons order and pay for their food before eating. Full-service restaurants are identified where food service is provided to patrons, who order, are served while seated, and pay after eating.
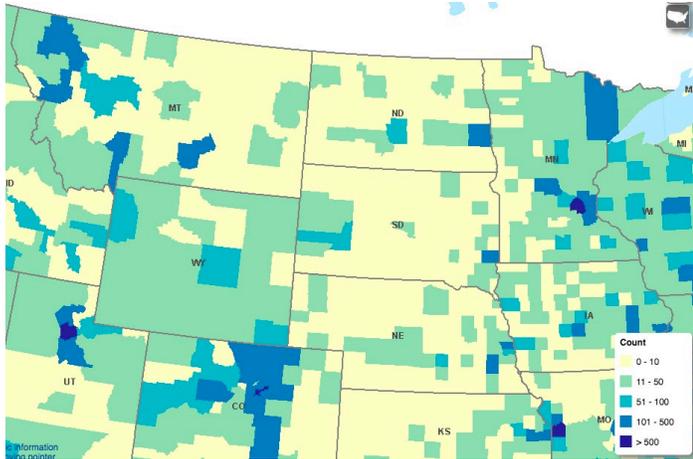
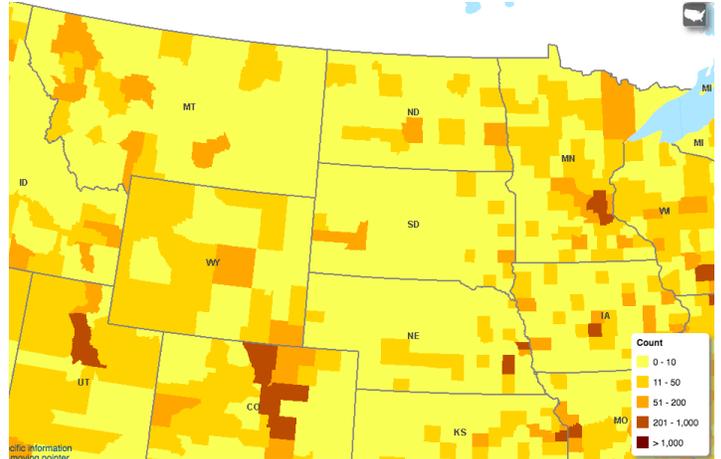Figure 1: Density of full-service restaurants in the NGP. © USDA

Figure 2: Density of fast-food restaurants in the NGP. © USDA

Table 6. The total expenditures per capita for fast-food and full-service restaurants by NGP states in 2012.

State	Expenditures per capita, full-service, 2012 (USD)	Expenditures per capita, fast food, 2012 (USD)
Montana	$770.13	$513.38
Nebraska	$567.01	$568.81
North Dakota	$727.66	$585.34
South Dakota	$589.67	$534.30
Wyoming	$706.68	$598.03

Local Food

Farmers' markets were identified as a retail outlet where two or more venders sold agricultural products directly to consumers. Vegetable farms were defined as farms that sold vegetables, potatoes, or melons. To be considered a food hub, operations simply had to self-identify as a food hub.
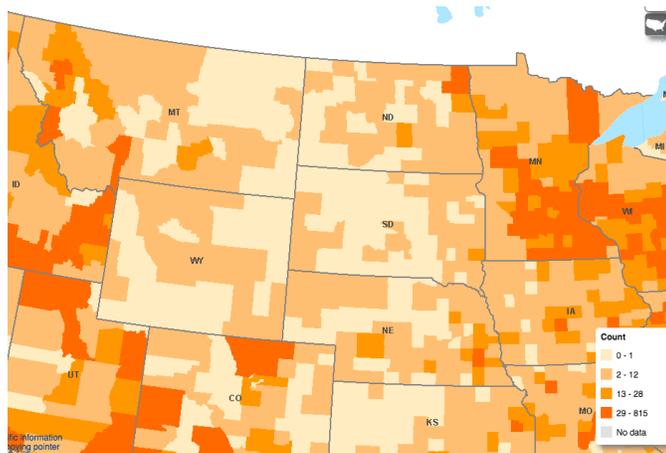

Figure 3: Density of vegetable farms in the NGP. © USDA

Table 7. Total number of farmers' markets (2016), vegetable farms (2012), and food hubs (in 2016) in the NGP compared to the US.

Region	Total number of farmers' markets, 2016	Total number of vegetable farms, 2012	Total number of food hubs, 2016
Northern Great Plains	321 (one for every 16,200 inhabitants)	1293 (one for every 4000 inhabitants)	5 (one for every 1,040,000 inhabitants)
United States	8599 (one for every 30,000 inhabitants)	8741 (one for every 30,000 inhabitants)	173 (one for every 1,502,000 inhabitants)

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Problem-solution trees
Purpose and elaboration

Problem-solution trees help find solutions by mapping out the anatomy of cause and effect relationships around an issue in a similar way as a concept map, but with more structure.

The first step is the development of the **problem tree** (sometimes also conflict tree). Initially, the core problem has to be discussed, identified, and defined in a few keywords. The problem can be broad, as the problem tree will help break it down. The problem will be the tree's trunk. Next, the causes of the problem will be identified and then visualized as tree roots. The diverse causes should be grouped in main- and subcategories. Their interaction is presentable in the form of the root branching. If we use problem-solution trees in real-life fieldwork, this process involves the participation of highly diverse community members. Corresponding to the logic of the roots, the consequences will eventually be visualized as tree branches. The final product is a problem tree as in Figure 1.

The way branches and roots are ramified is critical for developing a meaningful problem-tree. Helpful questions may include:

- Which causes and consequences are getting better, which are getting worse and which are staying the same?
- Which causes are easiest / most difficult to address?
- What are the most serious consequences?

To develop a basic structure of the tree before painting it, a pre-identification table (Table 1) can be helpful. As a second step before painting (or alternative to the table), the diverse causes and consequences can be summarized on post-its (preferably as pairs of causes and consequences so that they facilitate a cause-and-effect relationship) and then can be grouped as a tree.
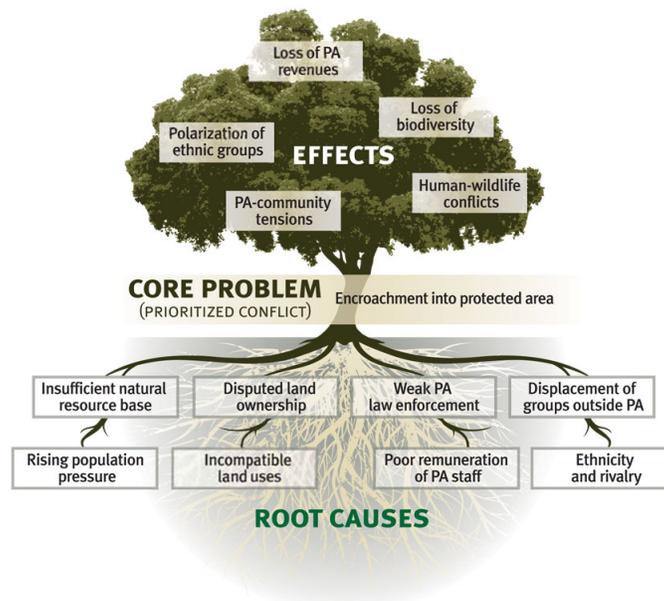

Figure 1: Sample problem tree based on the issue of invasion into protected areas © IISD.

Table 1: Sample table for pre-identification of the root, trunk, and branches of the problem-solution-tree.

	Problem tree		Solution tree	
Root	Causes		Activities	
Trunk	Main Problem		Main goal	
Branches	Consequences		Specific goals	

The **solution tree** should establish a direct relationship with the elements present on the previously developed problem tree. The solution to the main problem is placed on the trunk of the solution tree. Then, an assessment is made about what is achieved and what is still necessary with this resolution. The result is the specific solution goals, which will form the branches of the tree. They should correspond to the branches of the problem tree. Finally, the roots of the solution tree are determined as actions to be implemented to achieve the specific goals. In community fieldwork, this is the most challenging part of the process and requires the participation of all involved stakeholders. Even in the classroom, this is a tricky process. Figure 2 exemplifies a potential solution tree.
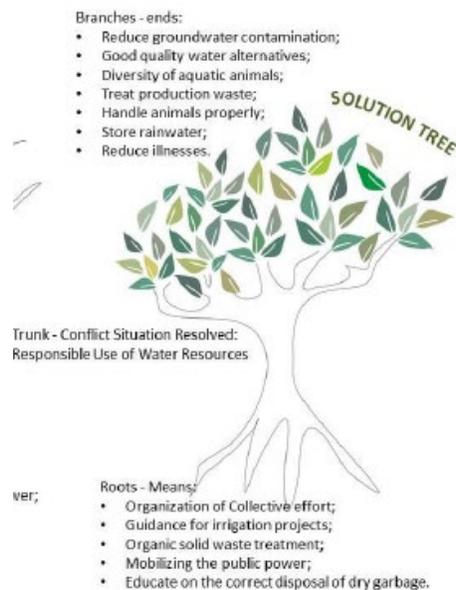

Figure 2: Sample problem tree based on the management of resources in a rural community
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