Pedagogical Power
Higher Education's Role in Shaping Agricultural Approaches

A scholarly summary presented by
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Abstract

This research capstone acknowledges and examines the role of higher education in making large scale changes to global/local issues such as the inevitable externalities of the United States' conventional agricultural system. It utilizes a framework built from the UN Sustainable Development Goals (SDGs) as a guide to analyze sustainable agricultural systems and their application within undergraduate higher education institutions. This situated case study explores the possibilities for higher education to alter agricultural systems through a deeper dive into the curricula and pedagogy at Oregon State University's Agricultural Sciences College. In this case study, I conduct a core curriculum analysis against the SDG ideals, along with in-depth interviews and surveys with an OSU professor, current students studying in the agriculture department, and alumni who have gone to work within the agricultural sector. The findings showcase some discrepancies between the OSU and SDG understanding of sustainable agriculture and what topics ought to be taught. This research also uncovers that while both curricula content and pedagogy are significant to learning, the influential power of higher education in shifting student career paths and mindsets, ultimately stems from professor pedagogy and classroom culture.

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Introduction

How can higher education act as a means to alter conventional agricultural systems?

Since the industrial revolution in the early 19th century, the dominant food production systems in the US could be described in one word: intensive. It is characterized by large-scale intensive monocultures (cultivation of only one crop in a given area), the application of high quantities of agrichemicals, as well as the maximization of land and labor productivity through technologies and mechanized systems. Conventional agriculture has been one of the driving factors in regard to deforestation (Berry 2015), water pollution (Brundtland Commission 1987), methane and CO2 emissions (EPA 2015), and soil degradation (Carson 1962, Lal 2015). However, since the 1960s with the publication *Silent Spring* shedding additional light on these realities, alternative movements to this dominant system have developed. Such movements can be seen in the form of organic, permaculture, regenerative agriculture, low-impact agriculture, and polycultures. These alternatives challenge conventional agricultural systems through advocating for a switch to food production which recognizes the needs and importance of lower-input systems, soil health, climate change, seed/crop diversity and surrounding ecosystems (Edwards et al. 1990, Holmgren 2002).

When searching for ways to rebuild complex systemic issues, such as US food production, education is often one of the first solutions proposed. From the beginnings of formal institutions, the foundational goals of education sought by philosophers, students, and societies within the United States, were centered around education's capabilities to influence social structures and generations for the means of democratic citizenship (Dewey 1923) or social liberation (Freire 2000). Formal and informal education has played a major role in the historic transformation of older slash-and-burn systems to industrial/technological intensive ones (conventional or westernized). On the other hand, it has also aided in the transition to more traditional approaches such as organic, permaculture, no-till, etc. (alternative). Education within the agricultural sector has also allowed for the spread of westernized knowledge such as the cultivation of seed varieties with the highest yields, labor/time-saving technologies, the science of soil composition and health, and adaptive systems for climate change.

This research examines educational establishments directly as systems of transformation. Thus, it remains important to focus on the educational level which targets those who have the ability to directly apply knowledge with newfound political influence, i.e. the undergraduate level (LaCharite 2016). Higher education has the unique ability to touch on both the individual and institutional scales through behavioral change and politics. The undergraduate level is the ideal niche for environmental/agricultural education to be explored, as it is without the constraints of standardized tests and set curriculum like that of K-12 or the highly specialized curricular aspects of graduate education. In this setting, undergraduate agricultural education can be found taking form in school gardens, on or ex situ farms, agriculture-related major/minors, agriculture-related courses, and/or campus workshops.

In recent conversations surrounding the intersection of contemporary agriculture and education,

sustainable development has begun to make its way to the forefront, providing an applicable framework. This framework came in the form of the United Nations Sustainable Development Goals (UN SDGs). These goals are meant to serve as an international set of milestones and were created as a guide for countries to address major world issues, which also account for the needs of economic and social development. The second goal calls for the promotion of 'sustainable agriculture' through embracing small-scale food producers, resilient agricultural practices which help maintain ecosystems and adapt to climate change, and a larger genetic diversity of seeds and cultivated plants (UNDP 2015). Additionally, the twelfth goal, 'responsible consumption and production', asks for environmentally sound management of chemicals (such as pesticides/herbicides), and alternations to education to include global citizenship education and education for sustainable development (UNDP 2015). Many of the objectives set by the UN SDGs utilize education as a key transformational tool needed to achieve them, as they cannot realistically be accomplished without the common outcomes of education: policy and behavioral change. Thus, it is important to understand the ability of higher education to implement the UN SDG goals and ideals in regard to agricultural and horticultural practices.

This capstone research analyzes the university's role/effectiveness in making large scale changes such as to conventional agricultural systems. If the degree to which universities possess influence is truly significant, it demonstrates that this is where we as a society should focus our finances, policies and standards in order to transition to alternative food production methods. If higher education is not however able to reach and influence the desired demographic of those within the agricultural sector in order to make these adjustments, focus should then shift towards the institutions which might.

Background

Higher Education

Foundationally, higher education has often been viewed as having the power/capabilities to cultivate democratic citizens who communicate and learn to advance society and our place in it (Dewey 1923), as well as prepare students to realistically live in their current environment (Dewey 1897). Education has also been thought to be a tool to achieve liberation, giving the oppressed a critical consciousness through dialogue and change (Freire 2000). In this sense, the purpose of education is providing the ability to ask good questions that break social norms and structures. On the other hand, other foundational educational thinkers see major contradictory goals in the US education system, such as democratic equality, social efficiency, and social mobility (Labaree 1997). These historic educational goals provide a fundamental foundation that guides the investigation into the extent to which US higher education is able to fulfill its variety of responsibilities.

Similar to the central thinkers Dewey, Freire, and Labaree, many modern-day perspectives see the role and responsibilities for higher education as a useful tool for making large scale change. In the context of climate change and environmental issues, the pressure is placed on universities to properly prepare future citizens to act within democratic processes to combat and mitigate negative effects (Scott 2010). In order for the educational standards in universities to be transformative, it is

often argued that they must derive from roots of social justice and environmental preservation, rather than those which promote consumerism and corporate profiteering (Andrzejewski 2009). Many educators thus place the challenge onto higher education institutions to teach and critique the concepts of sustainability, sustainable development and environmental issues, making the argument that education must adopt these topics in a formal way (Cullingford 2004).

Environmental education is viewed as fundamentally interdisciplinary, as it encompasses aspects of the social, political, biological, moral and historical realms. It, therefore, has the specific duty to teach "responsible citizenship behavior", and cultivate generations of students who are motivated to find solutions, care for the environment, and transform the destructive systems in place (Burch 2018). In the context of agriculture, higher education can either adopt these topics as vocational tools and extension methods (Barrick 1993) or create programs which leaders seek out for critical analysis of the world's food production systems (BANR 2009). When addressing dilemmas within the conventional system, we must be careful not to fall into classic deficit model thinking (i.e. ignorance is the only barrier for change). Rather, higher educational institutions and pedagogy need to move forward towards the co-production of knowledge to foster dialogue for a more comprehensive truth, through continued listening and evolving.

Sustainable Development

Sustainable development can be defined as that which finds the balance between human welfare, production and distribution of goods, and ecological systems/resources (Whitehead 2018). It is described as one of the core principles in governance as well as the dominant model for effective development worldwide. Sustainable development is commonly referred to as the perfect balance between both the analytical framework for how the world operates, as well as a "normative blueprint for how the world should be" (Whitehead 2018). The interdisciplinarity of sustainable development is often cited, as it is thought to only be achievable when research and knowledge is effectively communicated across fields and provides methods to build these connections (Ruttan 1994). Some theorists believe that when sustainable development is applied in the form of a framework or model, it has the power to be a globalizing political program that could reform the educational system (Sauvé 2005). However, some models have been critiqued for their vague and overarching goals, their potential inability to meet the demands of growing populations, as well as not meeting food production needs (Baldwin 2015, Granatstein 2007). Some of these models in question include the Ecological Footprint, the Life Cycle Assessment, and the Environmental Impact Quotient.

The current recognized dominant model for sustainable development is provided by the United Nations in their Sustainable Development Goals (UN SDGs), which too have been critiqued along similar lines. Despite this, the UN SDGs are still the most notable model for making any scale of change in the name of sustainable development and offer some noteworthy large goals in regard to altering conventional agricultural systems that can be applied in many contexts. The UN SDGs were created by the UN during the 2012 Earth Summit (Rio+20) with 180 participating nations. These goals strived to reaffirm nation leaders' commitment to Agenda 21 (the first implementation of sustainable development introduced in the 1992 Earth Summit), work towards global improvement

in green economic growth, and build off of the previous framework of the Millennium Development Goals. They were set as a universal framework aiming to tackle large scale global issues such as poverty, hunger, education, health care, gender inequality, climate change, world peace, and protecting natural resources/ecosystems, while at the same time obtaining economic growth.

Within the lofty 17 primary goals are 169 slightly more direct targets with 244 indicators (methods of measurement) to be achieved within countries by 2030. They were created so that all entities, including businesses, individuals and local governments could act alongside countries (a one size-fits-all model). For example, Goal 2 strives to "end hunger, achieve food security and improved nutrition, and promote sustainable agriculture" (UNDP 2015). This primary goal has eight targets for 2030 which include ensuring access to food, eliminating malnutrition, doubling the agricultural productivity of small-scale farm producers, maintaining the genetic diversity of seeds/crops, increasing investment in rural infrastructure, removing trade restrictions in world agricultural markets, and ensuring the price volatility within food commodity market places. Target 2.4 in particular directly calls for alternatives to conventional food production systems.

> Target 2.4: *By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.*

Contemporary Agriculture

For the context of this research, the term 'contemporary agriculture' encompasses systems which both fall under the category of conventional or westernized (such as monocropping and pesticide/herbicide use), and systems which fall under the category of alternative (such as organic, biodynamic farming and regenerative). During the early 19th century alongside the Industrial Revolution, agriculture across the US adopted technological advancements which aided its transformation into today's conventional system (Cronon 1991). Conventional farming refers to systems which prioritize economic profit, political/commercial interest and productivity over crop quality, soil and environmental health. This method of agriculture is often labeled by other scholars and writers with phrases such as 'industrial', 'intensive', 'commercial', 'large-scale', 'agri-business', an "exploiters' revolution" (Berry 2015) and/or "man's war against nature" (Carson 2002).

Although conventional agriculture in the US has in fact been successful in producing massive quantities of food for the growing population (the unequal distribution of said food is an entirely different story), it comes with a variety of many pressing externalities. The popular techniques and the constant drive for efficiency and profit, often create and perpetuate many adverse effects such as greenhouse gas emissions, pollution of clean water sources through chemically contaminated runoff into lakes and rivers, as well as leaching of salts into groundwater and a rise in the water table ("Agricultural Land"). The United States Environmental Protection Agency noted that in 2017 the US alone emitted 6,457 million metric tons of CO2 equivalent (translating into 14,205.4 billion pounds). The agricultural sector is responsible for the release of 581,130,000 metric tons (9%) of

those emissions into the atmosphere (EPA 2017). Additionally, heavily worked fields are subject to soil degradation, a loss of soil humus and porosity, and soil becoming less retentive of water. It also leads to a greater dependence on pesticides, herbicides, and chemical fertilizers. Globally, 33% of earth's land surface is considered to be degraded. Degradation reverses the capacity for soil to act as a carbon sink, and instead releases carbon and methane into the atmosphere (Lal 2015).

If we are to look at agriculture as a means to either combat climate change and environmental degradation, or at least as a system which does not heavily contribute to it, alternatives to the conventional system must be considered. Alternative agriculture is a broader category which refers to any farming method that does not conform or utilize methods practiced in conventional systems. Some examples of alternative production methods include, biodynamic farming, organic, permaculture, low-impact agriculture, polyculture, hydroponics, aquaponics, aeroponics, regenerative agriculture, agroforestry, no-till farming, adaptive agriculture and urban agriculture. In these alternative systems, the driving question is no longer, 'How quickly crops can produce?', but rather a set of questions which aim to understand the land's carrying capacity and ability to dependably produce without diminishing the land or crops.

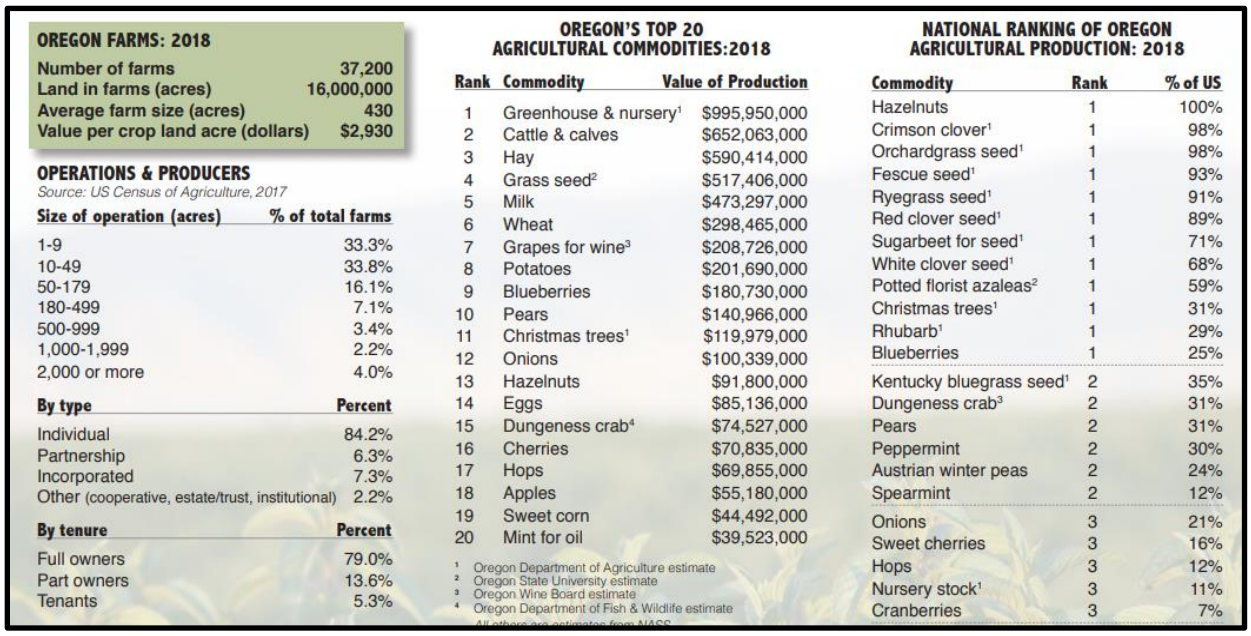
Alternative agricultural practices however, are not without their own hurdles. Some scholars critique certain methods' capability to meet population demands for food production, as well as the cost efficiency and subsequent material use. As an example, for California's strawberry farmers who produce 88% of the US strawberries, growing in soil (rather than soilless systems like hydroponics) is extremely beneficial for the quality of the crop (Guthman 2018). However, the preferred California soil also houses many harmful diseases and insects which require methods of eradication. While farmers recognize the movement and consequences of agrichemicals (Carson 2002), the switch to alternative systems may serve to threaten and put many farms out of business because of financial inability to build needed infrastructure. While the recent rise of indoor farming can reduce the distance from farm to market (limiting CO2 emissions) when located next to major cities, they can also be materially intensive. Alternative systems are further complicated with potentially limited abilities to meet global demand, for they inevitably call for smaller-scale farms (Edwards 1990).

Nevertheless, the UN SDG framework sees alternatives (despite their tradeoffs), as a better option for soil health, water use/pollution, and greenhouse gas emissions, than typical conventional methods. These goals call for the support of sustainable and small-scale food producers globally and for the proper education in such methods. This capstone research utilizes these goals as a roadmap for achieving the ends of lower environmental impact within the US farm sector. To fully understand the role of education in achieving these goals, this capstone situates research within a university widely recognized for its agricultural program.

Research

Situated Context: Oregon State University

Sixty-four percent of land in the state of Oregon is dedicated to use within the agricultural sector, equating to 16.4 million acres (ODA 2015). As of 2018, Oregon ranked as the #1 producer of hazelnuts, crimson, red and white clover for seed, grass seed, sugar beet for seed, azaleas, Christmas trees, rhubarb and blueberries (Figure 1). Agriculture also serves to be extremely valuable and influential within Oregon's economy, with its farm gate value at $5.7 billion, (Sorte et al 2015). Oregon's agricultural sector has taken large strides in order to be a leader in alternative farming practices. Of the total 16.4 million areas of farmland, 195,000 acres are certified as organic farms - ranking Oregon 6th in the US (Sorte et al 2015). It is due to this significant agricultural prominence that this state was selected as an ideal site for further analysis.



OREGON FARMS: 2018

Number of farms	37,200
Land in farms (acres)	16,000,000
Average farm size (acres)	430
Value per crop land acre (dollars)	$2,930

OPERATIONS & PRODUCERS

Source: US Census of Agriculture, 2017

Size of operation (acres)	% of total farms
1-9	33.3%
10-49	33.8%
50-179	16.1%
180-499	7.1%
500-999	3.4%
1,000-1,999	2.2%
2,000 or more	4.0%

By type	Percent
Individual	84.2%
Partnership	6.3%
Incorporated	7.3%
Other (cooperative, estate/trust, institutional)	2.2%

By tenure	Percent
Full owners	79.0%
Part owners	13.6%
Tenants	5.3%

OREGON'S TOP 20 AGRICULTURAL COMMODITIES:2018

Rank	Commodity	Value of Production
1	Greenhouse & nursery[1]	$995,950,000
2	Cattle & calves	$652,063,000
3	Hay	$590,414,000
4	Grass seed[2]	$517,406,000
5	Milk	$473,297,000
6	Wheat	$298,465,000
7	Grapes for wine[3]	$208,726,000
8	Potatoes	$201,690,000
9	Blueberries	$180,730,000
10	Pears	$140,966,000
11	Christmas trees[1]	$119,979,000
12	Onions	$100,339,000
13	Hazelnuts	$91,800,000
14	Eggs	$85,136,000
15	Dungeness crab[4]	$74,527,000
16	Cherries	$70,835,000
17	Hops	$69,855,000
18	Apples	$55,180,000
19	Sweet corn	$44,492,000
20	Mint for oil	$39,523,000

[1] Oregon Department of Agriculture estimate
[2] Oregon State University estimate
[3] Oregon Wine Board estimate
[4] Oregon Department of Fish & Wildlife estimate
All others are estimates from NASS

NATIONAL RANKING OF OREGON AGRICULTURAL PRODUCTION: 2018

Commodity	Rank	% of US
Hazelnuts	1	100%
Crimson clover[1]	1	98%
Orchardgrass seed[1]	1	98%
Fescue seed[1]	1	93%
Ryegrass seed[1]	1	91%
Red clover seed[1]	1	89%
Sugarbeet for seed[1]	1	71%
White clover seed[1]	1	68%
Potted florist azaleas[2]	1	59%
Christmas trees[1]	1	31%
Rhubarb[1]	1	29%
Blueberries	1	25%
Kentucky bluegrass seed[1]	2	35%
Dungeness crab[3]	2	31%
Pears	2	31%
Peppermint	2	30%
Austrian winter peas	2	24%
Spearmint	2	12%
Onions	3	21%
Sweet cherries	3	16%
Hops	3	12%
Nursery stock[1]	3	11%
Cranberries	3	7%

Figure 1: Oregon agricultural commodity breakdown. Compiled by Oregon Department of Agriculture as of October 2018.

More specifically, I focus on the Willamette Valley of Oregon, which encompasses Benton, Clackamas, Lane, Linn, Marion, Multnomah, Polk, Washington and Yamhill counties. The Willamette Valley in particular is described by the National Climatic Data Center as the most diversified agricultural area in Oregon, with a mild climate, long growing seasons and abundant moisture. Additionally, the Willamette Valley is home to many fertile soils such as the Jory series (abasalt-based volcanic soil) which is characterized by: a surface layer of organic material, a subsurface layer of dark reddish-brown silty clay loam, upper subsoil of dark reddish-brown clay, and a lower subsoil of red clay. Jory soil is known by farmers for creating an ideal setting for the growing many crops such as hazelnuts, wine, Christmas trees and grass seed (USDA 2020). For

these reasons, much of the land within the Willamette Valley is dedicated to agricultural use (Figure 2), producing 170 various crops.

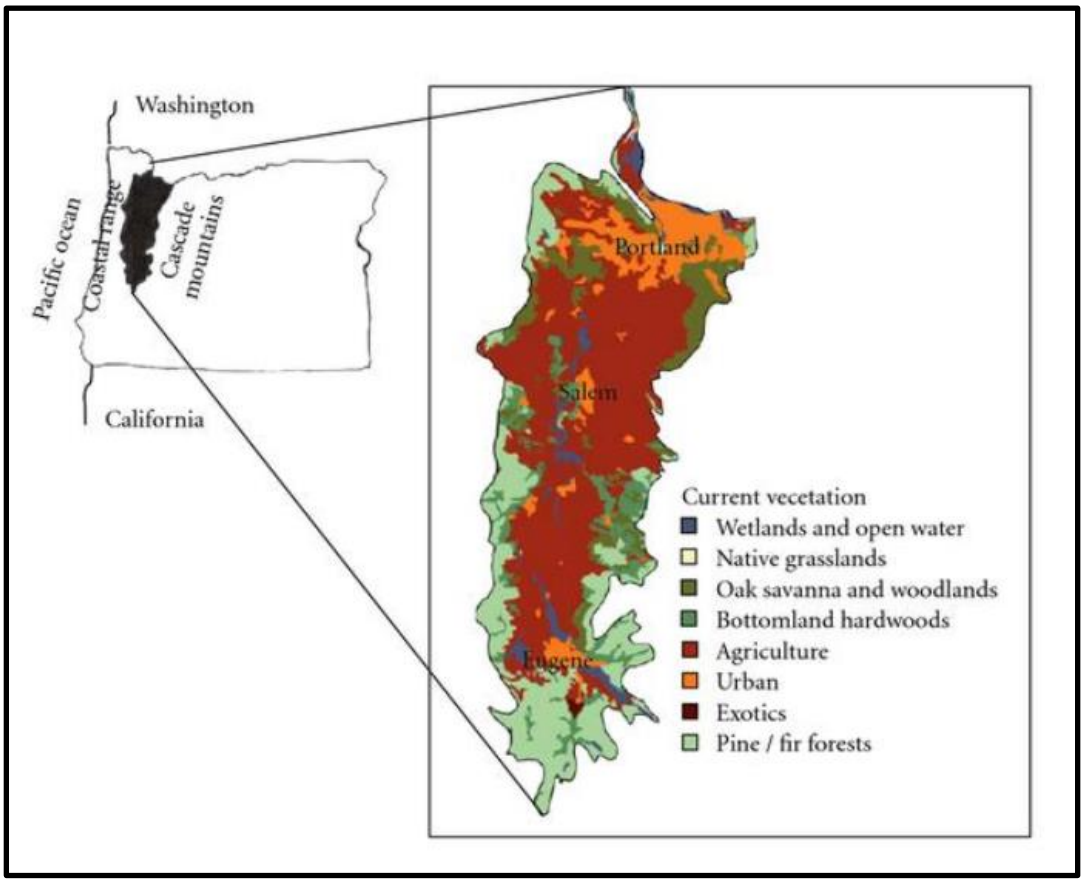


Figure 2: Map of the Willamette Valley in western Oregon showing agricultural, wooded, and urban landscapes (Rao 2010)

This research is centralized more specifically on a prominent university situated within the Willamette Valley, recognized for its agricultural program and extension research facilities. Oregon State University (OSU), educates around 30,000 students every year, with over 2,600 students and 250 faculty situated within the Agricultural Sciences College. This college offers a plethora of undergraduate and graduate majors, minors, certifications and research opportunities in related subjects such as: Crop and Soil Science, Horticulture, Sustainability, Natural Resource and Environmental Law and Policy, as well as Biological & Ecological Engineering and Permaculture. The agricultural college within OSU tailors its curricula towards "solving the most complex agricultural and natural resource problems faced in Oregon, our nation and across the globe" (OSU 2020), and thus serves as a perfect context to study the degree of influence on college alumni and students.

Methodology

To what extent does OSU's Agricultural Sciences College shape the ways in which alumni and students approach agriculture?

This case study and related focus question do a deeper dive into understanding the degree of influence that higher education has upon agriculturalists, if any. If change is to be made within the agricultural sector to incorporate ideals of sustainable development, then it is important to start by analyzing the key actors and influencers of those who work within it. If agricultural schools are in fact a form of effective change-making and prove to shape the ways in which alumni and students from these programs practice and think about agriculture, then nations should reevaluate where their development initiatives are - and move towards enhancing and advocating for more inclusive pedagogy and curricula. In the case that they are not however, next steps are needed to discover what the key influencers actually are. Prior to my case study, this question had not been widely researched. Thus, it proved to be all the more important to begin the conversation.

My research does a cross comparison analysis of OSU's Agricultural Sciences Department in relation to the United Nations Sustainable Development Goals (UN SDGs). For the reason that the UN SDGs are quite extensive (17 goals with 169 targets and 244 indicators), I created a set of search terms in order to compile those which were directly relevant to agriculture. I used these search terms to narrow down the goals in which these terms were used and recorded them within an Excel sheet (Table 1).

SEARCH TERMS	#	Goal 2	Goal 3	Goal 5	Goal 12	Goal 13	Goal 15
"Agriculture"/"Agricultural"	17	✓		✓			
"Farming"/"Farm"	5	✓					
"Food"	16	✓			✓	✓	
"Seed"/"Seeds"	2	✓					
"Plant"/"Plants"	4	✓					
"Soil"	4	✓	✓		✓		✓

Table 1: Breakdown of the UN SDG goals for which the language of the search terms was present.

Some of the UN SDGs in which the search terms were present however, were not directly related to my topic. For example, indicator 13.2.1 mentions food, but in the context of international policy reform, calling for the increase in the number of countries that adopt climate actions "in a manner that does not threaten food production". In cases such as these, I went through and pulled out only the targets, indicators and goals which were capable of being directly translated into classrooms as well as into the local agricultural. The usable related UN data leftover turned out to be in the form of four targets and five indicators within Goal 2 (Zero Hunger) and one target and indicator within Goal 12 (Responsible Consumption and Production). From there, I was then able to pull out the eight main concepts called for in these actions towards zero hunger. For example, goal 2.4 was consolidated into concept 4 'Sustainable Farming' and concept 5 'Climate Resilient Farming'. These concepts were then broken down even further and turned into a set of underlying ideals which the

UN SDGs embed into their language. The ideals within this study are 'Equity/Access', 'Land Productivity', 'Sustainable/Resilient Farming', 'Soil Health', and 'General Diversity'. In the example of goal 2.4: concepts 4 and 5 were combined into the ideal titled 'Sustainable/Resilient Farming' (Table 2).

GOAL #	TARGETS	INDICATORS	CONCEPTS	IDEALS
Goal 2	**2.1** By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round **2.3** By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment. **2.4** By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality. **2.5** By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.	**2.1.2** Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES) **2.3.1** Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size **2.3.2** Average income of small-scale food producers, by sex and indigenous status **2.4.1** Proportion of agricultural area under productive and sustainable agriculture **2.5.1** Number of plant and animal genetic resources for food and agriculture secured in either medium or long-term conservation facilities	**1.** Equity/Access **2.** Small-Scale Production **3.** Productivity **4.** Sustainable Farming **6.** Climate Resilient Farming **7.** Soil Health/Quality **8.** Genetic Diversity of Seeds, Plants & Animals	**1.** Equity/Access **2.** Land Productivity **3.** Sustainable/Resilient Farming **4.** Soil Health **5.** General Diversity

Table 2: Sample of the methodology behind creating the UN SDG ideals.

Next, utilizing a somewhat similar process, I consolidated data from OSU's Agricultural Sciences College. Like the UN SDGs, this agricultural college is also quite extensive in its departments, programs, majors, minors, certifications and offered courses. In order to identify only the usable related courses, I narrowed my search only to look at majors within the college that were directly associated with food cultivation concepts such as Agricultural Sciences and Soil Sciences. I excluded all minors and certifications, as well as any major indirectly related to agriculture such as Botany (as it focuses on the structures and function of plants in general, rather than plants in application or in the context of crop production). I also excluded any majors which focused on animals such as Animal and Rangeland Sciences, for the reason that the SDG 2 and 12 do not include livestock or animal husbandry in their targets.

This elimination left only four majors which were subjected to further analysis: Agricultural Sciences, Agronomy (a concentration within the Crop and Soil Science program), Sustainable Horticulture Production, and Sustainability (Table 3).

Agricultural Edcuation and General Agriculture		Crop and Soil Science Department		Horticulture		Sustainability
Agricultural Sciences	M	Crop and Soil Science	M	Horticulture	M	Sustainability
Agricultural Sciences	m	Crop Science	m	Entomology	m	Sustainability
Agricultural Sciences and Natural Resources	m	Soil Science	m	Horticulture	m	
Comparative International Agriculture	m			Turf and Landscape Management	m	
Leadership	m					

INCLUDED MAJORS	EXCLUDED MAJORS	REASON FOR EXCLUSION	EXCLUDED ALL MINORS
Agricultral Sciences	Animal Sciences	Animals	
Crop and Soil Science	Rangeland Sciences	Animals	
Horticulture	Agricultural and Food Business Management	Not Directly Agriculture	
Sustainability	Environmental Economics and Policy	Not Directly Agriculture	
	Biological Data Sciences	Not Agriculture	
	Botany	Not Agriculture	
	Fisheries and Wildlife Sciences	Animals	
	Food Science and Technology	Not Directly Agriculture	

Table 3: Breakdown of majors within the OSU Agricultural Sciences College which were included within the case study and those which were excluded.

Every core course (required and elective) within these four majors that were available to students was documented in an Excel spreadsheet, along with their subsequent course descriptions. This sample allowed for a greater understanding of the content which agriculture students and alumni had the opportunity to learn, as well as a gauge of the embedded idealized and popular concepts within these OSU departments. Between 1 to 4 concepts were then derived from each course description from a descriptive analysis of the curriculum content and language. The concepts pulled from the OSU curriculum were then categorized according to related UN SDG ideals using the reference of similar UN SDG related concepts (Table 4).

It must be noted that this methodology and content analysis is limited to only the course descriptions and therefore is solely representative of the points mentioned in the provided summary. It does not account for the variance from professor to professor or give an all-encompassing picture of the day to day curriculum details and classroom discussions. However, this course description analysis does shed light on the largest key topics in a course (which is arguably where the most important concepts are listed) and thus still provide demographics useful for a valid educational assessment. Additionally, I made the decision to analyze curriculum content rather than pedagogy for the bounds of this study, as course descriptions are the only form of information accessible to the general public.

SDG IDEALS	SDG RELATED CONCEPTS	OSU RELATED CONCEPTS
EQUITY/ACCESS	Secure and equal access to nutritious food year round, land, productive resources, inputs, knowledge, financial services and markets	International Impact of Economic/Social Structures Role of Indigenous Peoples Food Security Allocation of Natural Resources
PRODUCTIVITY	Double the agricultural productivity and incomes of small-scale food producers & Agricultural practices that increase productivity and production	Agricultural Technology Managing Cropping Systems Cultivar & Seed Performance Irrigation Efficiency Environmental Manipulation
SUSTAINABILITY/ RESILIENCY	Sustainable food production systems that maintain ecosystems & Climate resilient agricultural practices	Ecosystem Sustainability Community Sustainability Climate Resiliency Permaculture Organic Farming & Horticulture
SOIL HEALTH	Improve land and soil quality & Environmentally sound management of agrichemicals and waste	Soil Nutrient Cycles Soil Management/Testing Soil Fertility
DIVERSITY	Genetically diversified seeds and plants	Biodiversity Seed Diversity/Variety Crop/Plant Diversity

Table 4: UN SDG ideals alongside their related and included concepts from the UN SDGs and OSU courses.

The related concepts listed in Table 4 determined the basis and criteria for the evaluation of OSU's agricultural college. The 68 chosen OSU courses were further categorized according to which UN SDG ideals were present in the highlighted course concepts. In the case that multiple ideals were present, that course received two categorizations. In the case that no ideals were present, that course was marked with 'NONE', and not categorized (Table 5).

It must be further noted that the methodological choice of using the UN SDG as the framework for the criteria which defines sustainable agriculture, comes with its own set of limitations. The UN SDGs incorporate a condensed list of categories which include the inherent biases of those in power who initially created it, and thus leaves some subjects out. Despite this however, the use of the UN SDG framework provided this case study with clear popular concepts with which to easily compare to OSU curricula.

CORE UNDERGRAD COURSES	COURSE DESCRIPTION	MAJOR	CONCEPTS	SDG IDEALS	
Agricultural and Food Management	Economic and business principles applied to the management of firms in agricultural and food industries, including farms, ranches and nurseries, agricultural input suppliers, packers, shippers, processors and food manufacturers and distributors; firm-level goal setting, information management and financial analysis.	Ag Sci	1. Economics and Business 2. Management of Industries 3. Financial Analysis	NONE	
Information Technology in Agriculture	Using information technology in agriculture and agribusiness; practical experience with computer programs applicable to all agricultural disciplines.	Ag Sci	1. Technology 2. Agribusiness	LAND PRODUCTVITY	
Writing in Agriculture	Students will synthesize their knowledge in various areas of agricultural sciences and analyze how current issues impact the agriculture industry, explore careers in agriculture, and develop their written communication skills. Students will share their ideas and demonstrate their learning primarily in writing.	Ag Sci	1. Impact of Current Issues 2. Agricultural Careers 3. Communicating/Writing	EQUITY/ACCESS	
Soil Science	Introduction to the chemical, physical and biological nature of soils. Examines how soils function in terms of plant growth, nutrient supply, the global carbon cycle, ecological habitat, and water purification. Community-based learning projects provide hands-on experience with fundamental soil science principles and the impact of human activities on soil quality and sustainability.	Ag Sci	1. Soil Quality 2. Carbon Cycle & Nutrients 3. Impact of Human Activity 4. Sustainability	SOIL QUALITY	SUSTAINABILITY/ RESILIENCY

Table 5: Sample of UN SDG categorization system for OSU core undergraduate courses by major.

The final step after categorization of this data was the creation of a numerical ranking system which evaluated OSU courses based on the presence or absence of the concepts and ideals present within the UN SDGs. This ranking system uses a percent system (percent of courses with UN SDG ideals present divided by the overall major course count) as well as a color-coded scoring scale from 0-5 to tell the story of what is actually taught to students by the OSU agricultural program in terms of alternative agriculture (Table 6).

I supplemented this evaluative and broad methodology with the personal accounts of current students within these majors, alumni who now work within the agricultural sector and a professor who teaches within the agriculture college. These pertinent actors answered a series of qualitative questions in the form of extensive research surveys (for students) and intensive research interviews (for the professor and alumni). The survey and alumni interview questions targeted the ways in which OSU's agriculture department had or had not influenced ideas surrounding agriculture, sustainability, and career paths. The questions within the professor interview on the other hand, inquired about the degree of intentional implementation of UN SDGs into the course curriculum, the power of pedagogy, and personal embedded ideals and biases inherently brought into the classroom (see Appendix).

Results & Discussion

Curriculum Analysis

CURRICULUM SCORING SYSTEM	0	1	2	3	4	5
%	0%	1-20%	21-40%	41-60%	61-80%	81-100%

Table 6: % scoring system used to rate OSU's agriculture curriculum.

This curriculum scoring system categorizes and color codes results on a scale of 0-5. Majors which receive the lower scores (0%- 40%) are shaded with red (0), orange (1) and yellow (2), while those which receive higher scores (41% and higher) are shaded in light green (3), medium green (4) and dark green (5). Scores/ratings are given based on the %UN SDG ideal inclusion within course descriptions relative to the total number of core courses required within a given major.

SDG RATING BY MAJOR	TOTAL #	EQUITY/ACCESS	PRODUCTIVITY	SUSTAINABILITY / RESILIENCY	SOIL HEALTH	DIVERSITY	OVERALL SCORE (AVERAGE)
AGRICULTURAL SCIENCES	18	2	1	1	1	0	1
AGRONOMY	14	1	2	0	2	2	2
SUSTAINABLE HORTICULTURE	24	1	2	3	1	1	1
SUSTAINABILITY	12	3	0	4	0	2	2

Table 7: UN SDG ratings given to OSU majors scored and color coded between (0-5) based on UN SDG ideal system.

Table 7 shows that the major with the strongest rating for Equity & Access is Sustainability with 58% (7/10) of courses incorporating the ideals into curriculum (the second highest rating within all of the majors). On the other hand, the lowest ratings in this category are in Agronomy (7%) and Sustainable Horticulture (4%) each at 1 with only one course incorporating aspects of this UN SDG ideal into the curriculum. In a complete contrast, Agronomy and Sustainable Horticulture happen to be the majors with the strongest ratings for Productivity, each given a score of 2. Of the core Agronomy courses, 5 of 14 (36%) highlight land/crop productivity. Additionally, 7/24 Sustainable Development core courses (29%) highlight productivity in their course descriptions. The lowest scores in Productivity however fall in the major of Sustainability as 0 of the 12 core courses mention any concepts pertaining to this ideal.

Table 7 also reveals Sustainability as the major with the strongest ratings for Sustainability & Resiliency, with 67% (8/12) of the major's core courses emphasizing these ideals in the course descriptions. This score is the highest of all majors and of all UN SDG ideals. Sustainable Horticulture also scored high in this category at a 3 (42%) where 10 of 24 courses incorporate these concepts. This score is the third highest of all of the majors. The lowest rating in this category is Agronomy, with 0 of the 14 core courses mentioning any aspect of this ideal.

The major with the strongest rating for Soil Health is Agronomy, ranked at a 2, as 29% (4/14) courses highlight aspects of soil health or quality in the description despite the fact that the major is within the department crop and soil science. The lowest ratings for Soil Health are the Sustainability major with a score of 0, with 0/12 (0%) of courses mentioning this ideal. The major with the strongest rating for Diversity is Agronomy with a rating of 2, with 5/14 (36%) courses highlighting the general and genetic diversity of plants, animals and/or seeds within agricultural systems. Surprisingly on the other end, 0% of Agricultural Sciences course descriptions mentioned diversity in any form.

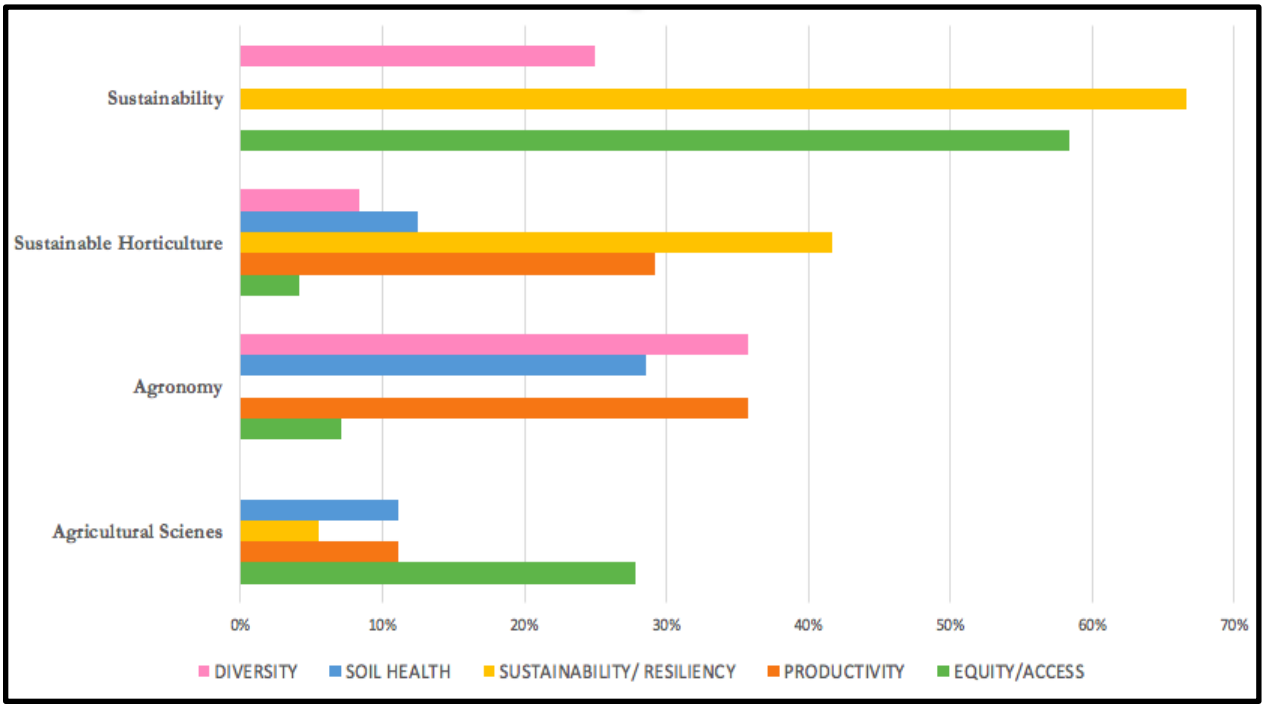


Figure 1: UN SDG ideal ratings given according to OSU major by %.

In total, Productivity is tied for the second highest rating of the UN SDG ideals at 2, as 21% (14/68) of all core agricultural courses integrate these ideals into the classroom. Equity & Access is tied for the second highest ranking of 2, as only 21% (14/68) of all core agricultural courses integrate the ideals. On average the Soil Health rating is the lowest of all UN SDG ideals scored at mere 1 (13%). Sustainability & Resiliency is the highest ranking of all the UN SDG ideals, rated at a 2 as 28% (19/68) total core agricultural courses integrate these ideals into the classroom. Diversity is rated at a 1, as only 10 of the 68 (15%) core courses within the majors incorporate aspects of seed, crop and animal diversity/variety into their curriculum.

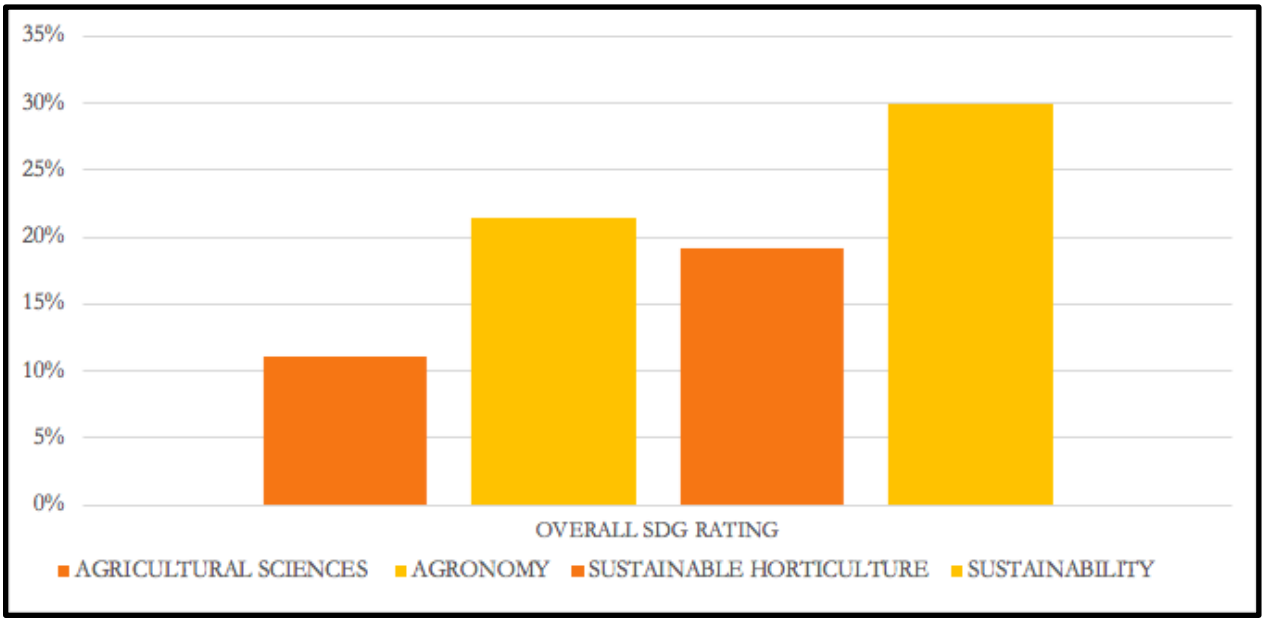


Figure 2: Overall UN SDG ratings according to OSU major.

On average, Sustainability is ranked as the highest major with 30% of its courses mentioning UN SDG ideals, with Agronomy coming in second at 21%. Sustainable Horticulture came in third place with 19% and Agricultural Sciences was ranked the lowest with a mere 11%. The total overall average OSU Agricultural College UN SDG rating falls at 19% which equates to a relatively unimpressive score of 1. However, it is noteworthy to point out that despite this low score, **66%** (45 of 68) of the total core courses within the four sampled majors at OSU's Agricultural Sciences College do in fact teach between 1-3 concepts highlighted in the UN SDG ideals.

The major results for Equity/Access and Productivity are relatively unsurprising, as horticulture and agronomy are not traditionally known for emphasizing the social factors of equitable access to nutritious foods and indigenous knowledge more than they are focused on the physical production and science of plants and crops. The subject of sustainability on the other hand, is known as one which switches the conversation from the intensity and production of plants to the general social impact and long-term relationship between humans and food. This being said, it is unsurprising that the Sustainability major scored high in Equity/Access and low in Productivity.

What remains surprising is the general percent scores for Sustainability and Horticulture within the ideal of Sustainability/Resiliency. Despite the fact that these majors were the two highest rankings within the ideal, for areas of study with the same name, I expected a higher percent of courses to incorporate these concepts in the course descriptions. These results in particular show a discrepancy between what the UN SDGs and OSUs Agriculture Sciences College each highlight as the important criteria for the agricultural ideal. If there is in fact a clear and universal understanding for what sustainability meant, both of these rankings would be rated a 5.

Qualitative Discussion: Interviews & Surveys

The qualitative results from the student surveys and alumni/professor interviews (see Appendix) show similar patterns to those found in the curriculum analysis. 100% of the student survey responses (6) within the agricultural college idealize alternative methods to agriculture such as sustainability, resiliency, smaller-scale farming and organic. In response to the question, *in your ideal world, what does the future of US agriculture look like?* 83% of students (5/6) used the word sustainable (or a derivative of it). Student 5 summarized the overall ideals nicely by saying, "No monocultures, greater emphasis on sustainable practices and working with the environment rather than against it, responsible use of GMO and similar technologies to augment food production". When asked, *what are the most important topics you have learned thus far relating to agriculture?* the same results were gathered: 83% of students found the concepts within the UN SDG ideal Sustainability/Resiliency the most important topics in their college courses. Some of the specific topics listed include but are not limited to soil science, sustainable soil management, organic horticulture and organic pest/weed/disease management.

Finally, when asked about general perspectives on the UN SDGs and the alternative practices which they idealize, students responded with overarching support: 100% of them conveying some form of admiration for them. Despite this appreciation for alternative methods however, 3/5 students also expressed some skepticism about the ability for these practices implemented at a larger scale. Student 3 said, "I support most alternative agricultural practices, and I would love to see them use more often. At the same time, I see that most of these practices limit our ability to improve crop yields and support a growing need for food. There will have to be some sort of balance as we progress into the future". This sentiment was also shared by Student 5 who mentioned, "If these practices can be reliably scaled up to feed a rapidly expanding population, then they are what we should be pursuing. I support sustainable practices, but I'm not sure how practical they will end up being on a wider scale given their products (organic, free-range, etc.) often end up much pricier than products of conventional agriculture. If the price issue can be worked out and they can reliably produce enough food, these practices might end up saving us". However, despite this critique, 100% of the student respondents said that they plan to advocate and/or incorporate alternative methods in their line of work post-graduation.

To understand what advocacy and incorporation looks like post-graduation, I spoke with two graduates from the agricultural college who currently work within the agricultural sector. The first interview was with an alumnus named Alder who works as a field representative for the seed trade company Weaver See of Oregon. Weaver distributes cover crops and forages (AA Oilseed Radish, AA Daikon Radish, Frost Master Winter Peas, Forage Peas, Dundale Peas, Forerunner Triticale, Magnum Oats, Forage Turnips, Fava beans, and Riley Tetraploid Annual Ryegrass) as well as vegetables and sprouts. Weaver also highlights organic/sustainable practices on the home page of their website. Alder works directly with farmers, making recommendations for improving soil quality and seed harvests with organic techniques such as pushing cover crops to have something on the soil year-round as well as doing mycorrhizal injections into their soils.

In the interview, Alder mentioned that before attending OSU, because his father was in the solar industry, his idea of sustainability was limited to the context of technology. It wasn't until taking soil science his sophomore year however, that his eyes opened to the role of agriculture in environmental degradation. He now defines sustainable agriculture as, "a planned out form of agriculture which looks at a systems approach and management for future use such as crop-rotation, soil enrichment and looking at fungi in soil". Alder spoke of a specific soil science course taught by Professor Cassidy, as one that had a life altering effect on him in realizing the ability for agriculture to act as a way to promote sustainability ideas.

My second interview was with alumnus Mitch, who works as a greenhouse manager at a soil and fertilizer manufacturer called Aurora Innovations Inc. On their website Aurora describes themselves as a company which provides "superior organic gardening products so you and our planet will be healthier and happier". Mitch is in charge of quality control such as testing soils and fertilizers in the greenhouse, and the research and development of new products. In the summer, he runs a no-charge CSA for all employees (commonly an acronym for community-supported agriculture) which instead of community-supported, is corporate-supported (through Aurora). In his CSA everything is organic, and he has recently implemented a full crop rotation.

The most important concepts learned within his agricultural courses were methods of using land in a way that improves it rather than depleting it such as crop rotation, tilling methods and reducing fertilizer input. Additionally, similar to Alder, Mitch also pointed directly at the soil science class with Professor Cassidy as a course which significantly changed him. Before attending college, Mitch saw soil as nothing more than useless dirt, whereas now he sees soil as the foundation for absolutely everything and dedicated his life to it. When asked to elaborate on the importance of soil science and the role of this professor, Mitch responded, "as a class, soil science is comparable to other agricultural classes. However, James Cassidy is not comparable. He has great teaching methods, he makes it fun and hands on, and his enthusiasm rubs off on you".

Mitch's answer struck me as particularly significant, as he indicated that the defining reason soil science was so impactful on this life path, was the instructor's **pedagogy**. In light of this, I interviewed Professor Cassidy to further understand his teaching methods, course curricula, and embedded ideals concerning agriculture. Cassidy obtained his graduate degree in soil science from OSU, and now serves as the senior instructor for soil science and sustainable/organic agriculture. During his time at OSU, he also started the student-run farm on campus called OSU Organic Growers Club, for which he now acts as a faculty advisor. He sees the ideal future of agriculture as a system which moves away from tillage and mega industry (conventional) to a "truly sustainable approach that is least harmful to soil and borrows from both conventional and organic methods, incorporating tech, machinery, info systems and genetics". In the classroom, Cassidy says that he always incorporates ideas from the UN SDGs into curricula, teaching about organic farming/gardening, food security, and scale.

Within his position within the agricultural college, he considers himself an outlier in his ways of teaching. He views his role as a professor in higher education as a micro-influencer; providing

information to students with the goal of igniting a sense of passion and excitement regarding soil. Cassidy's teaching style is fairly untraditional and personal. He does not believe in strict rules, regulations or expectations besides requiring students to follow what they are passionate about. He does not punish students for being late or put them into the mold of a 'good student' and views his D students as some of his best. All of this being said, he emphasized that he too is still a student in the classroom and is constantly excited to be learning from them.

Summary of Findings

The results of this case study shed light on the influential ability of higher education curricula and pedagogy to shape the way students and alumni approach pressing issues such as those found within US agriculture. While the overall OSU agricultural sciences college UN SDG rating sits at a low score of 1, the 66% of courses which do incorporate 1-3 of these ideals in the course description prove to play a large role in the lives of the alumni and students within the bounds of this study. In large part this can be traced back to pedagogical power, and the embedded ideals of professors teaching curriculum material. In this research, Professor Cassidy was the key actor which shaped the careers, life paths, and ways of thinking for Alder and Mitch, and most likely many other current/former students.

The curricula analysis outcomes showcase the disparities between definitions and understandings of what sustainability means in the context of agriculture between the UN SDGs, OSU, and scholars. For example, while the average score of Sustainability is the highest of all majors, it is absent of the ideas valued greatly within the UN SDGs (soil health and productivity). With this being said, it is unnecessary that every major and curriculum be all inclusive and interdisciplinary, as there may be a higher quality of teaching and learning when courses target fewer concepts and do a dive deeper. Just because the Sustainability major does not highlight soil health or productivity in the description of any of their required courses, it does not make the content any less impactful or important for students to learn in regard to agriculture.

Implications

As conveyed in this UN Sustainable Development Goal analysis, OSU's Agricultural Sciences College has proven to shape the ways in which students and alumni within the program approach agriculture to the extent of generating changes and/or enhancement of career paths, causing alterations to on the ground implementation of alternative agricultural practices, and personal investment in alternative movements such as regenerative and organic. These results are attributed to a combination of specific professor pedagogy as well as highlighted curricula content which complicates and promotes a conversation concerning conventional vs. alternative agriculture systems/practices in relation to soil, economics, and ecological health.

Admittedly these findings are slightly limited by this methodological approach, as there is no such thing as one universal standard for sustainable agriculture, despite UN SDGs efforts to create it. There are subjects which are intrinsically missing from the UN SDGs that are deemed important in

OSUs understanding, for which I did not take the time to critique in this study. It must also be acknowledged that some of these limitations stem from the methodological choice of conducting a content-based assessment rather than a pedagogy-based assessment, which may have resulted in alternative understandings of my framing and focus questions. Despite these limitations however, this case study highlights significant insights into the influential capabilities of OSU's Agricultural Sciences College on current students and alumni in regard to attitudes and application of alternatives to conventional agriculture, in a way that had never been done before.

Comparisons and Generalizations

Information concerning higher education's impact on alumni is typically collected through research surveys, in which complex human experiences are manipulated into measurable quantitative economic data. A notable example of this is the U.S. Office of Education, which has sent out a national survey every year since the 1970s, along with the census bureau. The goal of the National Survey of College Graduates (NSCG) is to provide officials general information about the career paths and education of US citizens. Data is collected on current employment (position title, salaries, work activities, number of hours worked), certifications and licenses, educational background, demographic information and reasons for pursuing education. These statistics are then categorized and sent off for analysis. Surveys such as the NSCG and others such as the National Opinion Research Center Alumni Survey (which also tracks career pathways), are popularly cited justifications for the validity of higher education, as they allow for the widest possible pool of data. Surveys like this are not without their limitations, as they fail to provide a complete accurate representation of realities and motivations behind choosing certain career paths and/or any reformation of perspective. It is because of these perceived limitations, that my case study's methodology went a different direction in data collection, additionally incorporating curricula analysis and in-depth interviews with professors and alumni, which ask the question, 'why?'.

When the UN SDGs are used as an education framework, they are often examined in relation to the learning of younger students, rather than of higher education and alumni, and certainly not scrutinized for the ways in which they define sustainable agriculture. A graduate student from Middle East Technical University conducted a study in 2019 for their thesis research, which used the UN Sustainable Development Goals as an analysis tool of middle school science curriculum and science textbooks. This particular study employed these goals to do a content analysis to present if the objectives were being met within the curricula and textbooks. Embedded into this research however, is the assumption that the movement, Education for Sustainable Development, successfully equips students to "handle challenges of the global world" (Tatlilioğlu 2019). This study differs from my own not only in the targeted demographic, but also in its failure to critique the ways in which subjects are portrayed in classrooms, the determined standards which make up definitions, and the true ability for curricula changes which meet these standards to influence students to engage in said global challenges.

These research findings may lead into a much larger debate between what truly matters in higher education: the curricula or the professor. The conclusions reached in this case study are ones which some could argue is intuitive, with the answer found somewhere in between. Pedagogy is the vehicle

with which content is conveyed, and the course curriculum provides the basic understanding and life knowledge. Without one, the other loses its power. The real significance of this conclusion however, is where I believe the influencing power stems from. A professor's pedagogy and classroom culture have the ability to transform important curricula concepts into life changing ones. Pedagogy is the difference between passively taking a course in which students learn about agricultural issues and taking a course in which students are inspired to do something about them.

Next Steps and Further Research

This case study is first of its kind and can be used as a foundation to inform and assist universities, extension schools, researchers and anyone who aims to understand the ways in which education can influence and inspire. Although the scale at which OSU directly reaches individuals remains small and these few alumni are not capable of altering agricultural systems alone, the spread of knowledge within communities and institutions of alumni who choose to go into policy, outreach, education, and entrepreneurship roles, can be much larger. Additionally, if other universities adopt and utilize sustainability frameworks within department curriculum, the effects would reach a wider range of people and could lead to wider policy changes, etc. If repeated, the UN SDG ratings of similar studies may greatly vary depending on included and excluded variables and chosen major departments. The one guaranteed constant however, is the overarching degree of influencing power that effective pedagogy and great professors hold across all levels of education, majors, and geographic locations.

These findings can and should be used as a roadmap for a greater comprehension of the powers of pedagogy in sustainable agriculture. Students who wish to conduct related studies may want to look at other universities with agricultural programs throughout Oregon, the US, and globally, to test if there are comparable outcomes to my own. Further research may also repeat this thesis' methodology utilizing a framework other than the UN SDGs, to provide an alternative set of criteria for determining and defining sustainable agriculture. Additionally, I recommend that other case studies look in depth at syllabi content rather than just the course descriptions, to remove some of the limitations of generalization of which this study experienced. The ways in which agriculture can be altered are not limited to those produced within higher education institutions which are inherently only accessible to a narrowed population. There is additionally a great deal of power within policies and journalism that should be explored and may provide important insight for answering the various ways in which education can alter conventional agricultural systems.

Appendix

Professor Interview Questions

- What is your background with agriculture/How did you get into teaching it?
- In an ideal world, what would the future of US agriculture look like to you?
- In your eyes, what is the purpose of higher education?
- What does sustainable agriculture mean to you?
- What concepts do you find most important to incorporate into your course curricula? How do students generally respond to these topics?
- Would you say that most professors teaching agricultural sciences at OSU share your perspectives on the importance of the curriculum that you choose? Or are you one of the few?
- Do you teach students any aspects addressed in the UN sustainable development goals such as 'resilient/sustainable agriculture' and/or 'maintaining the genetic diversity of seeds'?
- Do you find any current farmers seeking out the OSU program to further their knowledge in your classrooms?

Alumni Interview Questions

- What was your major/minor in school?
- What did your journey look like post-college? How did you get to where you are today?
- In an ideal world, what would the future of US agriculture look like to you?
- In your opinion, what were the most important/influential topics that you learned from agricultural related courses?
- Did any courses/professors change your perspective on agricultural practices/methods? If so, how?
- Do you incorporate any alternative methods in your fields/gardens such as organic, no-till, crop rotation, maintaining the genetic diversity of seeds, etc.?
- If so, have you come up against any barriers to implementation of these methods?
- If so, what were the driving influences of your decision to incorporate these methods?
- If not, why not? What are the barriers?
- Where do your main sources of information come from? (trial and error, knowledge acquired from college, friends/family/neighbors, workshops, ag magazines/journals, research articles, etc.)

Student Survey Questions

- What is your major/minor? (fill in the blank)
- What year are you? (multiple choice)
- What profession do you plan to go into/are interested in post-graduation? (fill in the blank)
- What is your background (if any) with agriculture & horticulture? (fill in the blank)
- In your ideal world, what does the future of US agriculture look like? (fill in the blank)
- What do you hope to get out of the ag science program? (fill in the blank)
- What are the most important topics you have learned relating to agriculture? (fill in the blank)
- Have any agricultural science courses changed or enhanced your perspective on any topics? If so, which ones? (fill in the blank)
- What are your thoughts on alternative agricultural practices idealized by the UN Sustainable Development Goals, such as small-scale farming, maintaining the genetic diversity of seeds, sustainable/resilient agriculture, etc.?
- Will practice or advocate for any of these alternative methods post-college?

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