Digging deep in the sociality of interaction:

Lessons from knowledge-making in potato science

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Land Acknowledgement

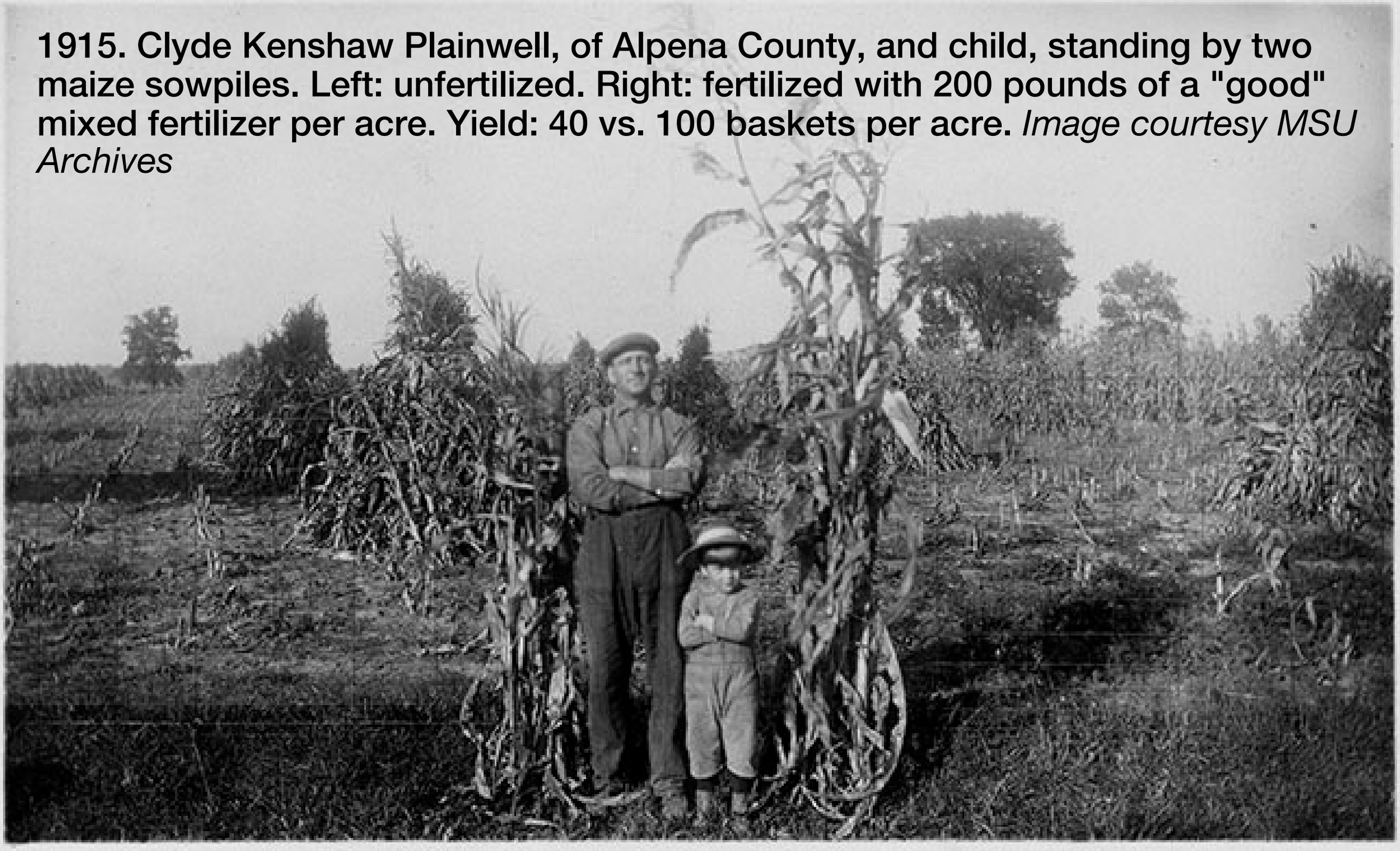
Michigan State University occupies the ancestral, traditional, and contemporary Lands of the Anishinaabeg – Three Fires Confederacy of Ojibwe, Odawa, and Potawatomi peoples. We recognize, support, and advocate for the sovereignty of Michigan's twelve federally-recognized Indian nations, for historic Indigenous communities in Michigan, for Indigenous individuals and communities who live here now, and for those who were forcibly removed from their Homelands.

The University of Kentucky rests on the dispossessed lands of the Cherokee, Chickasaw, Osage, and Shawnee people, and the land grants that established funding for the University dispossessed further unceded territories from tribal nations across the region. With recognition and respect, I live and work in these ancestral lands, as well as those of the Delaware, Mosopelea, Wyandot, and Yuchi people.

Scientizing Agriculture in the 19c

Produce, Producers, Production, and Yield

1915. Clyde Kenshaw Plainwell, of Alpena County, and child, standing by two maize sowpiles. Left: unfertilized. Right: fertilized with 200 pounds of a "good" mixed fertilizer per acre. Yield: 40 vs. 100 baskets per acre. *Image courtesy MSU Archives*



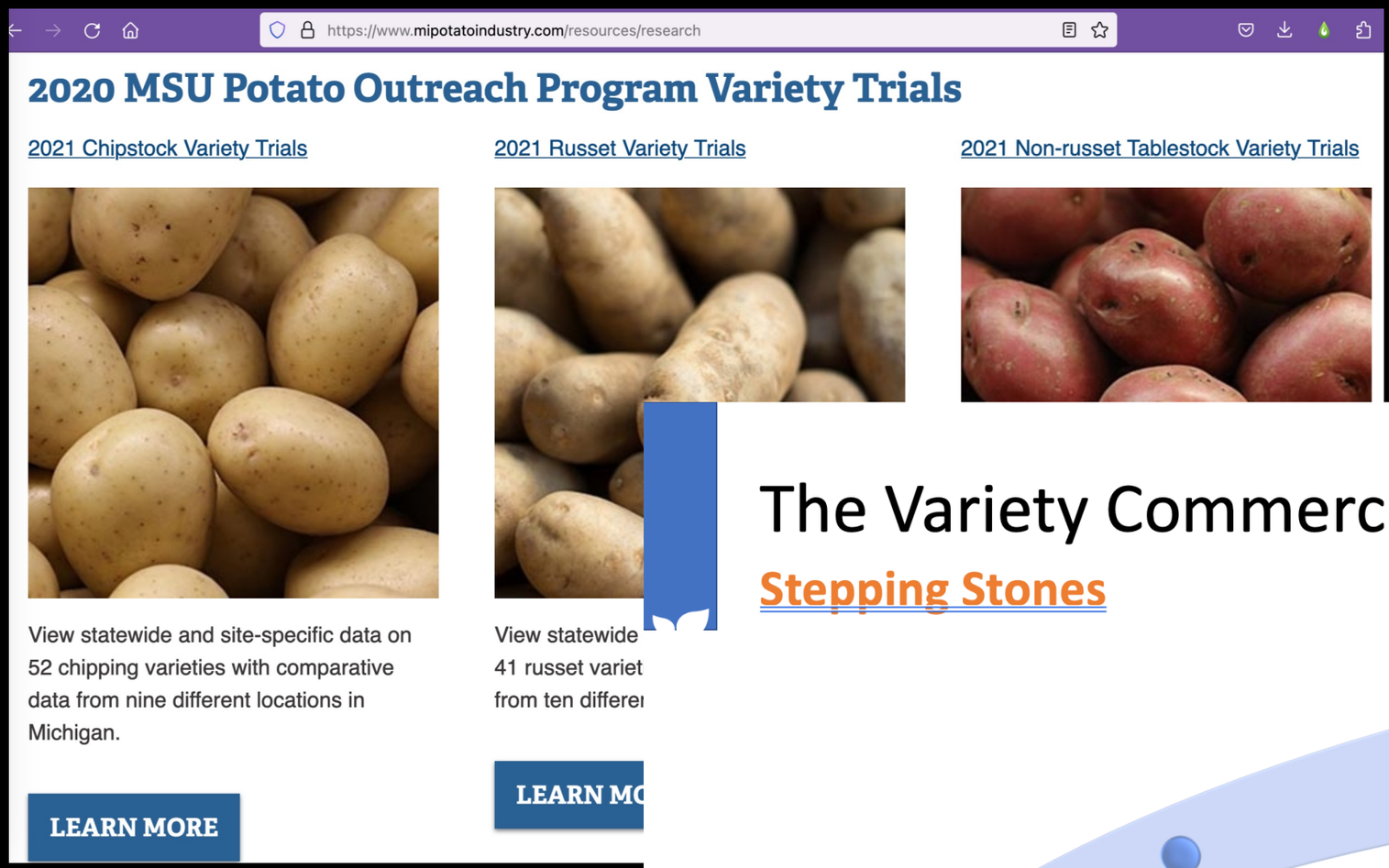
Agricultural Science: Basics

- Baconian record-keeping and comparative **experiments**
- Integration of biology, ecology, chemistry, mechanical engineering, fluid physics, and economics to improve **yield**
- **Application-driven** research programs with significant industrial funding, relationships with farms and agribusiness, and integration of commercial product testing into university-sponsored research

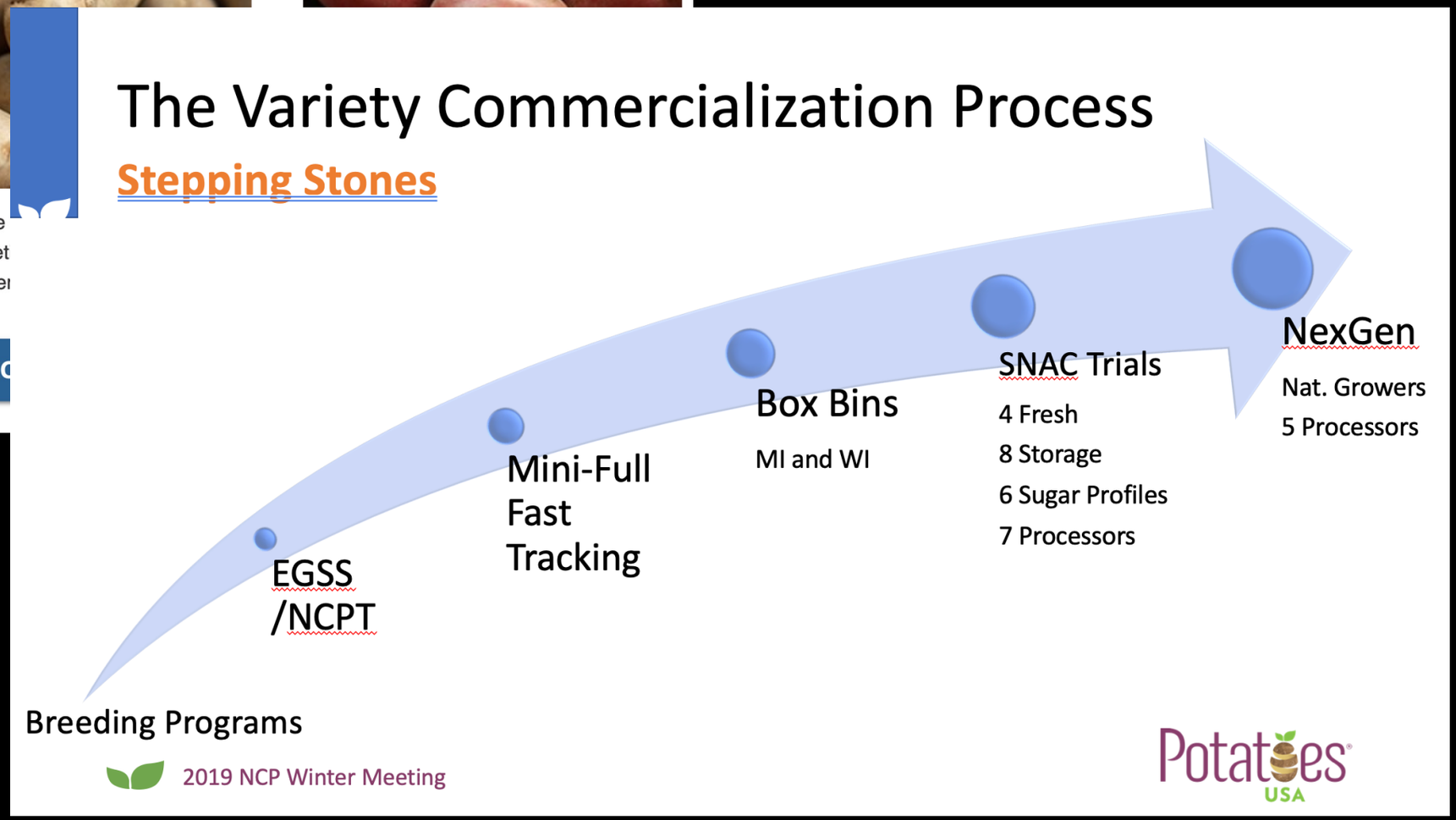
Potato Research Goals

- Understanding pest and disease pressures on potato crops and improving crop resilience
- Increasing efficiency in planting, growing, harvesting, and storing processes
- Tailoring the sugar, starch, and micronutrient content of potato tubers for specific purposes, such as optimal potato chip production or increased nutritive content
- Identifying and decreasing how much energy, especially non-renewable energy, goes into potato production
- Mapping and sequencing genetics of wild, landrace, and cultivated potato varieties

Variety trials and breeding commercialization



MPIC 2020 variety trials



MSU extension specialist potato variety commercialization model

Wild potato genetic diversity

Genome evolution and diversity of wild and cultivated potatoes

Dié Tang, Yuxin Jia, Jinzhe Zhang, Hongbo Li, Lin Cheng, Pei Wang, Zhigui Bao, Zhihong Liu, Shuangshuang Feng, Xijian Zhu, Dawei Li, Guangtao Zhu, Hongru Wang, Yao Zhou, Yongfeng Zhou, Glenn J. Bryan, C. Robin Buell, Chunzhi Zhang & Sanwen Huang

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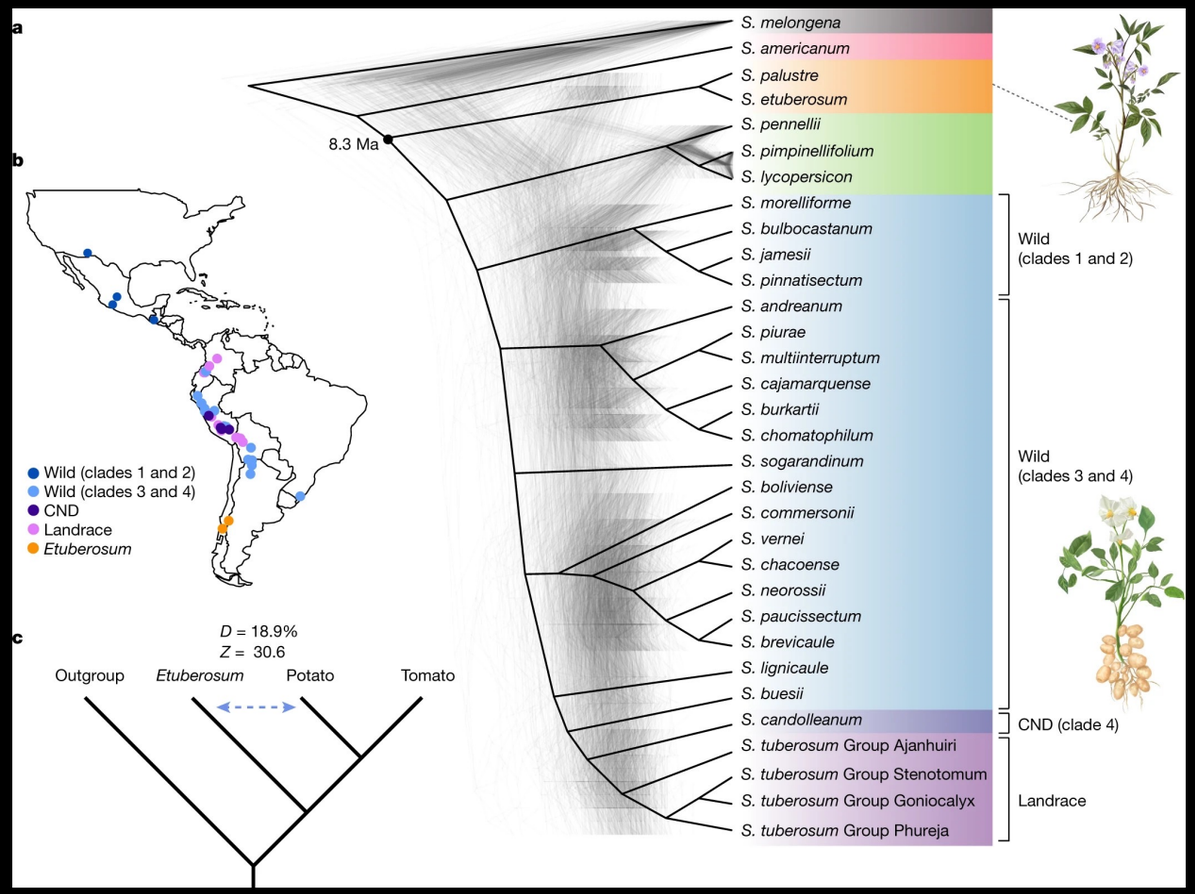
Abstract

Potato (*Solanum tuberosum* L.) is the world's most important non-cereal food crop, and the vast majority of commercially grown cultivars are highly heterozygous tetraploids. Advances in diploid hybrid breeding based on true seeds have the potential to revolutionize future potato breeding and production[1,2,3,4]. So far, relatively few studies have examined the genome evolution and diversity of wild and cultivated landrace potatoes, which limits the application of their diversity in potato breeding. Here we assemble 44 high-quality diploid



Wild potato genetics: Gene mapping from *Genome evolution and diversity of wild and cultivated potatoes*

Potato Storage Research Then & Now

From *Michigan State Extension Bulletin 104*

Extension Bulletin No. 104 May, 1930

PLAN OF POTATO STORAGE CELLAR

C. H. JEFFERSON, Agricultural Engineering
H. C. MOORE, Farm Crops

Michigan potato growers suffer heavy financial losses every year as a result of inadequate storage facilities. Approximately twenty million bushels of potatoes are stored in this state for a period of two months or longer each year.

Fig. 1.-A permanent storage cellar built in side hill.

Some of the most common storage losses occur from insufficient insulation o
storage walls and ceilings, permitting the potatoes to become chilled or frosted. Potat

From *16S rRNA gene-based microbiome analysis identifies candidate bacterial strains that increase the storage time of potato tubers*

		Storage				
Sampling time point	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**
Description	after harvesting	two weeks after harvesting	five weeks after harvesting	ten weeks after harvesting	dormancy break	Sprouting
BBCH stage	00	00	00	01	03	07
Soil type/ potato tuber	potting soil, Kettlasbrunn A, Kettlasbrunn B, Karnabrunn, Tulln					
Samples taken from:	**Tubers** of the varieties Agata, Fabiola, Hermes and Lady Claire cultivated in **five different soil types**	**Tubers** of the varieties Agata, Hermes and Lady Claire cultivated in **potting soil**	**Tubers** of the varieties Agata, Hermes and Lady Claire cultivated in **potting soil**	**Tubers** of the varieties Agata,Hermes and Lady Claire cultivated in **potting soil**	**Tubers** of the varieties Agata, Fabiola, Hermes and Lady Claire cultivated in **five different soil types**	**Tubers** of the varieties Agata, Fabiola, Hermes and Lady Claire cultivated in **five different soil types**

Overview of potato cultivars, sampling time points and corresponding BBCH stages investigated in this study. After harvesting four tuber varieties (Agata, Fabiola, Lady Claire and Hermes) from five different soil types (T2), tubers were stored at 8–10 °C in darkness. After 2 (T3), 5 (T4) and 10 weeks (T5), tubers were sampled. To consider the individual dormancy break (T6) of each variety, tubers were sampled according to the BBCH scale at stage 03. The same procedure was performed for samples that were taken at sprouting at stage 05 (T7). Additionally, at T7, sprout samples were taken. At each sampling time point, tuber/sprout samples were used for 16S rRNA gene amplicon sequencing. The red circles mark sites on the tubers that show visible signs of sprouting.

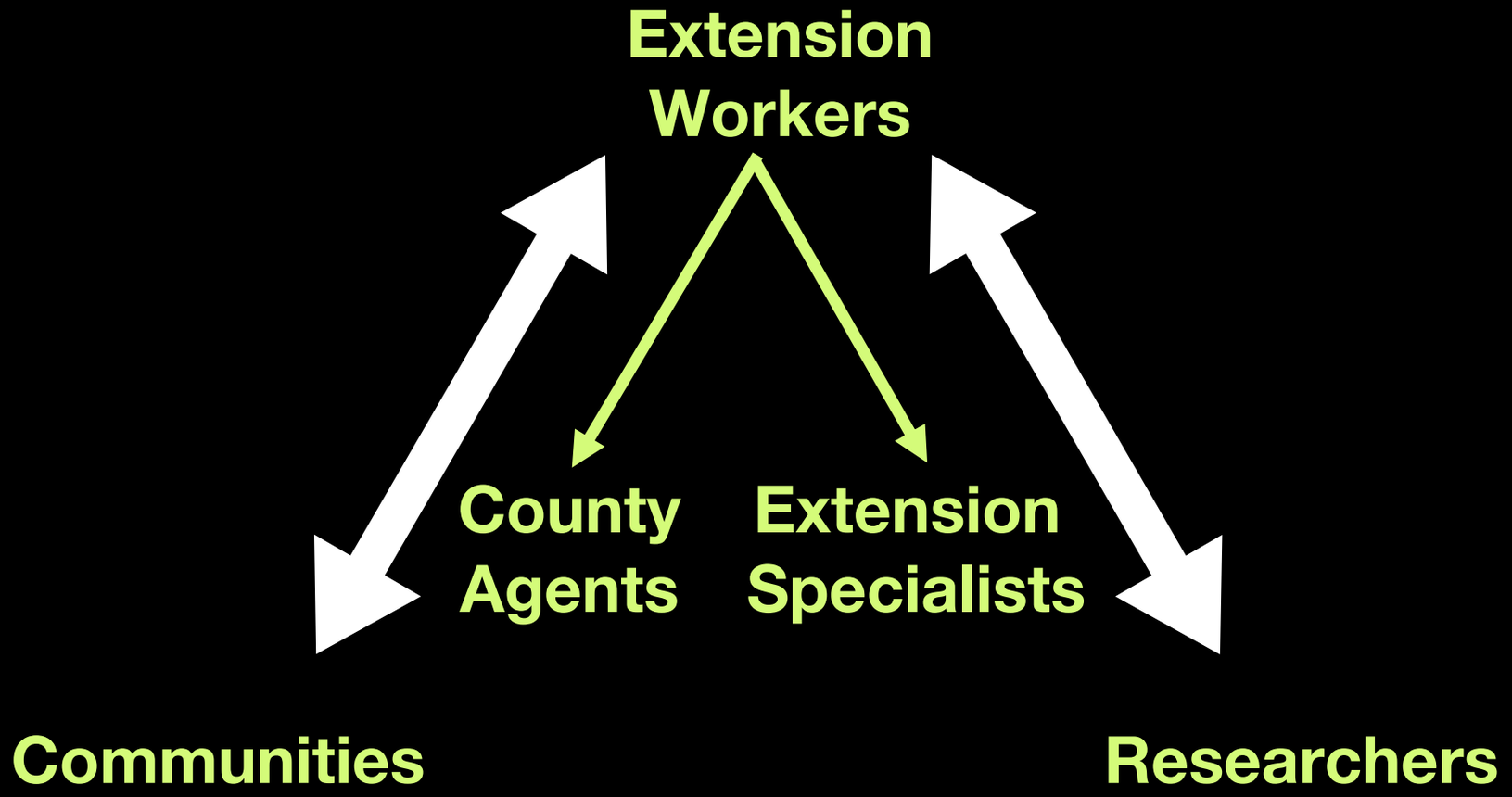
Potato farmer Dave Warsh siphons two truckloads' worth of potatoes out of a shed on his farm in Center, CO. Aug. 26, 2021 Image by Kevin J. Beaty/*Denverite*

Extension

Agronomy research<=>local communities

- 1887 Hatch Act: agricultural experiment station program
- 1914 Smith-Lever Act: associated extension work with Land Grant Institutions in the Cooperative Extension Service.
- *this made a formal union between agronomy research and extension work

… But What *is* Extension?

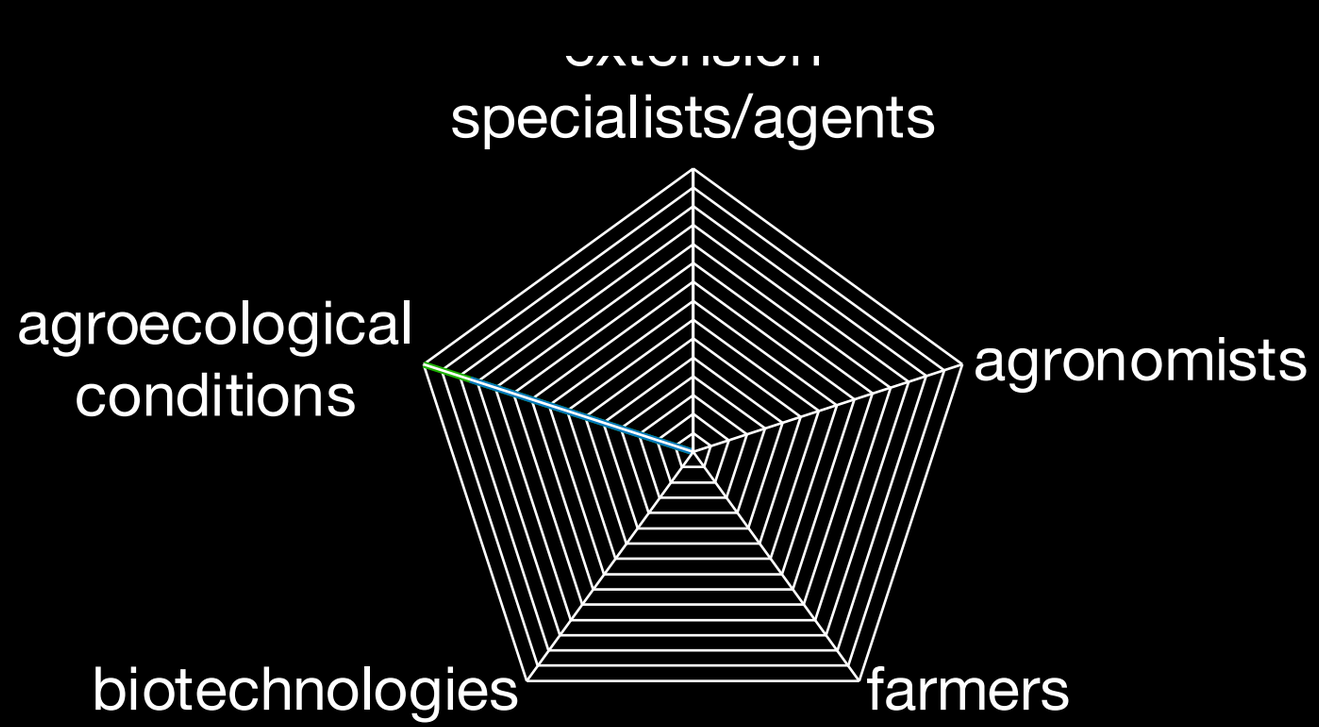


- Extension is a **knowledge co-producing** activity
- Knowledge produced through **interaction** between extension workers, researchers, and communities

Co-Produced knowledge

potato knowers and potato knowledges

- coproduced agricultural knowledge is a socially contingent epistemic product generated through the sharing, borrowing, inventing, and innovating by local farmers in collaboration with university extension specialists, agents, and agronomists.



The Sociality of Interaction

- Mere sociality: reactive experiences individuals have when among others especially when those others are conceived of as holders of information with shared attitudes.
- Strong sociality: interactivities in ways that are robustly and ineliminably participatory.
- In analyzing the sociality of interaction in the sciences, Longino argues that “concern with practices that are productive of knowledge, rather than with the content and subject of knowledge” should be the focus (Longino 2022: 173).
- This implies:
  - the analysis of practices and knowledge can come apart
  - the analysis of content knowledge in a domain shouldn't be the focus if what we want to understand is knowledge production

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WHAT'S SOCIAL ABOUT SOCIAL EPISTEMOLOGY?*

What do we mean when we talk about the social dimension of X? Both epistemology proper and philosophy of science have been loci of attention to the social dimensions of knowledge. In both one can find different understandings of what “social” means and different contrasts the word is used to signal. My contention in this paper is that most conceptions of sociality in this work are relatively thin. I will contrast the thinly social with more deeply social analyses of several phenomena addressed in the epistemology and philosophy of science literature, arguing that attention to scientific practice demands a deeper and more robust conception of the social than philosophers have yet to fully articulate.

“Social” has a variety of meanings in the majority of the mainstream social epistemology literature. The social dimension of X is often represented as the experiences of individuals with respect to X when among other individuals. In epistemology this has become the question: how do the individual cognitive agent's epistemological challenges and resources change when the agent's environment is expanded to include other individuals?[1] Other individuals are communicators of information as well as communicators of dissent. Thus, questions of the appropriate response to disagreement and to testimony have become salient issues in social epistemology. A second

* The paper has benefited enormously from the suggestions by the anonymous referees for this JOURNAL as well as from comments from Elisabeth Lloyd, Rasmus Winther, and especially Ken Waters. I am also grateful to members of the Philosophy Departments at MIT, the University of Colorado-Boulder, California State University-Fullerton, Tel-Hai College, the University of Georgia, and the University of Calgary, and to participants at the 2019 Women's Leadership Conference, Indiana University Department of History and Philosophy of Science and Medicine, and the 2019 meeting of the Canadian Society for History and Philosophy of Science for their comments on versions of these ideas.

[1] This set of questions is nicely captured in the title to Alvin Goldman's book, *Knowledge in a Social World* (Oxford: Oxford University Press, 1999).

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Our friendly amendment

An extra-strong sociality

- We argue that it is not possible to analyze practices without analyzing the content and subject of knowledge, and...
- Analysis of content-knowledge in a given scientific domain should be the focus of attention if the goal of a philosophical investigation is understanding of scientific knowledge production
- Extra-strong sociality: sociality is constitutive of knowledge in a way that without it, that which is being discussed ceases to be knowledge if it is not social

Sociality in Potato Research

1. **Variety trials and breeding program commercialization process model**: visualizes/identifies opportunities for **experimental intervention** at each step; emphasizes **synthetic** dimension of agricultural research; highlights role of **extension** groups

2. **Potato genetics mapping**: distinguishes **wild from cultivated potatoes** distinct from cultivation process distinctions (e.g. organic, non-GMO); correlates genetic information with **desirable phenotypes for agricultural purposes**

3. **Potato harvesting:** valuation and classification of desirable characteristics determined according to farmer practiced, institutionally defined, and agrotechnologically facilitated standards scaffolding potato-people interactions.

4. **Storage**: Research focus on an aspect of the potato life cycle that is necessarily created by **potatoes' relationship to humans**

Potatoes, People, Knowledge, Standards

Also, if the applicant requests the degree of skinning, apply the following skinning definitions:

§51.1549 Skinning. (a) The following definitions provide a basis for describing lots of potatoes as to the degree of skinning whenever description may be appropriate:

(1) "Practically no skinning" means that not more than 5 percent of the potatoes in the lot have more than one-tenth of the skin missing or "feathered;"

(2) "Slightly skinned" means that not more than 10 percent of the potatoes in the lot have more than one-fourth of the skin missing or "feathered;"

(3) "Moderately skinned" means that not more than 10 percent of the potatoes in the lot have more than one-half of the skin missing or "feathered;" and

(4) "Badly skinned" means that more than 10 percent of the potatoes in the lot have more than one-half of the skin missing or "feathered."

The degree of skinning on individual potatoes refers to the amount of skin missing or “feathered.” Usually the more immature the potatoes, the greater the degree of skinning.

The degree of skinning may be reported in general terms unless specifically requested to report actual percentages. The term "new potatoes" should not be used.

EXAMPLES:

Slightly to badly, most moderately skinned.
Generally moderately, few badly skinned.
Mostly slightly, some moderately skinned.

Such statements should be based upon a record of skinning for each sample on the notesheet as:

SLIGHTLY SKINNED	MODERATELY SKINNED	BADLY SKINNED
20%	70%	10%
00%	92%	08%
75%	25%	00%

Acknowledgements

- Thanks to our research team: Ryan McCoy, Gregory Rogel, Joshua Tonkel
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