Food for Thought: Could Swiss agriculture provide healthy and sustainable food for its population?

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1. Shifting our diet to reduce our environmental impact and the burden of diseases

Food production and consumption accounts for about a third of greenhouse gas emissions, and is a main cause of health problems (Crippa et al. 2021). To address this issue, a group of scientists developed the Planetary Health Diet (PHD), a reference diet for the entire population aimed at respecting the planetary boundaries for environmental resources while optimizing human's population health. The PHD is composed by a majority of plant-based food on the plate, completed with a small amount of animal-based proteins and fats. In addition, the emphasis is on the healthy composition of this diet, which includes for the most part foods that are unprocessed and rich in nutrients. Thus, beside its environmental sustainability, the PHD is aimed at decreasing the burden of mainly cancer and cardio-vascular diseases related to diet quality (Willet et al. 2019).
Nonetheless, it should not be used as strict diet reference, but as a guidance for political decisions (Willet et al. 2019). Local socio-cultural and economic contexts as well as agricultural practices need to be taken into account by the government to guide its population toward a healthy and sustainable diet (Biesbroek et al., 2023).

Swiss consumption of certain types of food is far from the PHD. In fact, Swiss population eats excessive amounts of meat, salted and sweet products, with insufficient intake of plant-based proteins such as pulses, nuts or cereals. This suggests that dietary habits should shift protein sources towards plant-based options, preferably non-transformed such as beans, lentils or soy. Regarding vegetables and fruits, Swiss consumption patterns align reasonably with the PHD while for cereals intakes are high for refined grains but low for whole grains.

In regard to the situation in Switzerland, shifting our diets towards the recommendations of the Swiss Society of Nutrition but with further replacement of animal-based by plant-based proteins (SSN and OSAV, 2011) would induce the highest reduction in environmental footprint compared to other diets. Applying these recommendations would lead to an average reduction of 36% in our daily greenhouse gas emission and phosphorus, nitrogen, land and water use (Chen et al., 2019).

This change can't be triggered without considering a transformation of our agricultural systems. The challenge of building a sustainable agriculture is particularly relevant in Switzerland, where the population is growing within limited space. Currently, one-third of Switzerland's land is dedicated to agriculture, covering about 1.5 million cultivated hectares, or roughly one hectare per five to six inhabitants (Federal office of the environment, FOEN). It is essential to distinguish within this area the two-thirds allocated to fields and the remaining third designated as alpine pasture, suitable mainly for animal grazing. In this context, we posed a simple question: Could Swiss agriculture theoretically produce the PHD?

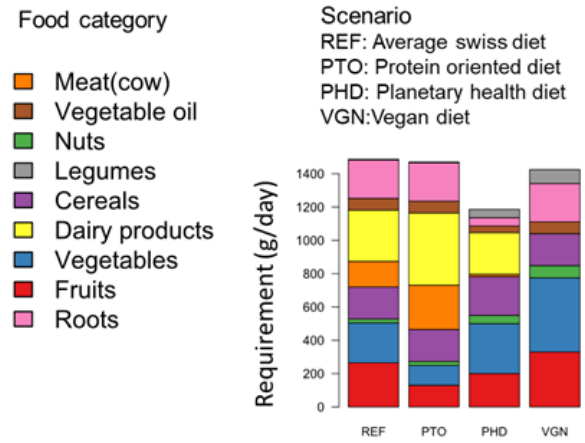
2. Planetary Health Diet within the Swiss land pattern

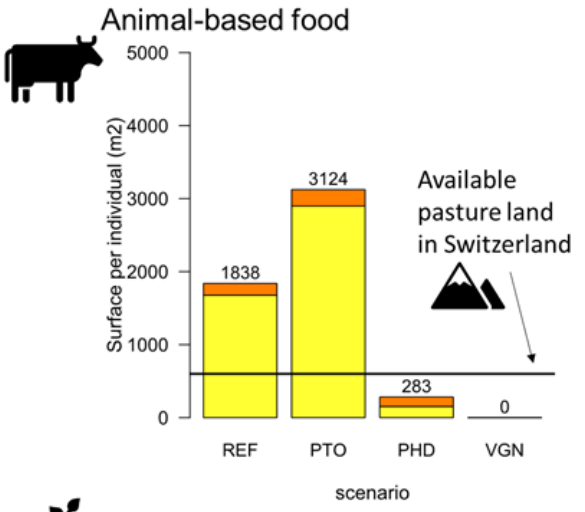
To address this question, we examined the dietary composition of various diets, simplifying them into nine food categories following Chen et al., 2019. We calculated the daily amount per capita within each food category (fig. 1). For each category, we took as reference Switzerland's average agricultural production as kg/ha in 2022 obtained from agricultural reports: i) Swiss total production for fruits (23 t/ha) ii) vegetables (28.6 t/ha) (OFAG, 2023). We selected one crop that make a major contribution to the daily meal composition of the Swiss population for the other categories: iii) potatoes (36 t/ha) (OFAG 2023) for roots, iv) wheat (4.3 t/ha) (OFAG 2023) for cereals, v) walnuts (3 t/ha) (AgriHebdo CH) for nuts, vi) colza (1.4 t/ha) (OFAG 2023) for colza-based oil, and vii) peas (3.0 t/ha) (Schweizer Bauernverband 2021) for legumes. Peas represent a main potential for plant-based protein as an alternative to meat (Boukid et al., 2021).
For animal-based products, we considered an alpine and sustainable production based on cows, with an average of one cow per hectare providing 7,000 liters of milk annually and 0.335 t meat[1].
From the yield/ha in the food categories (Table 1) and the individual daily requirements * 365 days = necessary intake per year and capita per food category (I) we calculated the necessary cultivated area per capita (A) and diet based on different diets as A = I * ha/ yield (tons). For a plant-based diet with daily meat amount following the PHD recommendations, Swiss agriculture could produce the recommended requirements in the food categories with approximately 800 square meters per individual, significantly less than the current 1100 square meters utilized by Swiss agriculture (FOEN).

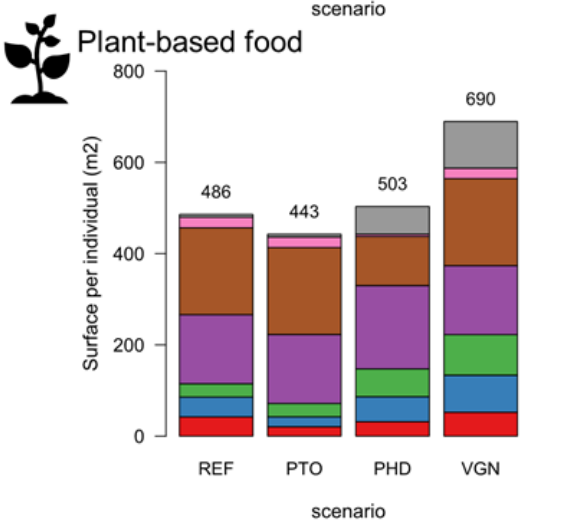
The model is a very limited approximation as it does not consider the full complexity of dietary habits, for example it did not consider the potential diversity in different crops in the categories of roots, cereals or legumes or biological sustainable production with sometimes considerable lower yields than our model crops. We did not consider food waste, which accounts for a third of food use in Switzerland (Beretta and Hellweg, 2019). Yet, we used our model as a tool to explore the potential of Swiss agriculture for sustainable and healthy diets.

In this model, within an area of approximately 500 - 700 square meters per capita most of plant-based foods could be grown with a substantial portion is dedicated to wheat, potatoes and vegetable oils (HGD, VGN). In contrast, the average Swiss diet (REF, Chen et al., 2019) or hyper-protein diets (PTO) demand ~ 1800 and 3100 square meters of additional pasture, more than the available land in alpine areas in Switzerland of 600 square meters (FOEN). In this model, alpine pastures could sustainably provide the reduced animal proteins for the population under the PHD recommendations. However, meat overconsumption redirects agriculture towards systems that use agricultural land mainly for the animal production and thus overconsume the land area or is dependent on feed import.

[1] as reported in https://www.fokus-fleisch.de/nebenprodukte-rind-schwein







3. Which approaches to change the population's dietary habits?

While a transformation of Switzerland's agricultural production area to the PHD recommendations is theoretically possible, such a scenario would only be feasible with the active participation of all stakeholders, consumers and policymakers. Although most consumers are expecting a strong reaction from policymakers, those have little leeway. In 2021, the Swiss government defined 4 main sustainability goals to be reached before 2030. The first, and the most relevant in the frame of this discussion is stating that +33% of the Swiss citizens should eat according to the Swiss Food Pyramid (OFAG, 2021) which is aiming in the same direction as PHD. To achieve this goal, regulators can count on different levers (Roberto & Gorski, 2015).

For instance, the economic incentives are widely implemented in the Swiss agricultural practices. Every year, around four billions of CHF, in the form of subsidies, are given to the agricultural sector (Anthamatten, 2020). Even though this money is only paid out against a proof of good agricultural practices, a recent Master Thesis showed that 71% (~three billions) are allocated to practices judged unsustainable (Perotti, 2020). Also, a recent study showed that many agricultural subsidies are hindering efforts to protect biodiversity (Gubler, 2020). Thus, we suggest that at least a part of those subsidies should be redirected to practices that are aligned with the goals set for 2030 to create opportunities for farmers and the different actors of the food supply chain to move towards a production system that is supporting plant-based diets.

Dietary changes also depend on consumer response. Government incentives may boost sustainable products, but this relies on an increased demand of consumers for plant-based food. A joint effort between policymakers and a shift in consumer habits is crucial. In addition to support from policies, the focus should be on education and support to reduce the constraints that prevent this transition. Namely, scarcity of time invested into food choices, access to food, and social dynamics influencing diet are barriers

for sustainable choices (Godin & Sahakian, 2018). Various systems, like eco-labeling with a sustainability grade could help consumers make informed choices quickly and thus reduce the barriers (Potter et al., 2023).

In summary, our report shows that Swiss agriculture has the potential to offer its population a sustainable and healthy diet. Nevertheless, this vision must deal with the practical challenges posed by trade-offs in land use, economic considerations, and, ultimately, consumer choices.

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Appendix

Table 1. Yield as ton/ha for fruits, vegetables, nuts, cereals, legumes, meat and dairy products. For vegetable oil the yield is l/ha. Yield was calculated from the reported area for growing each of the categories and the harvest in tons in 2022.

	Yield (Ton/Ha)	Reference
Fruits	23	1, 2
Vegetable	20	3, 2
Nuts, seeds	3	4
Cereals	4.6	5, 2
Meat	0.335	6
Dairy products	7	6
Vegetable_oil	1.36	7
Roots+tubers	36.3	8
Legumes	3	9

1 https://www.agrarbericht.ch/fr/marche/produits-vegetaux/fruits
2. https://www.agrarbericht.ch/de/produktion/pflanzliche-produktion/flaechennutzung?highlight:fruits
3 https://agrarbericht.ch/fr/marche/produits-vegetaux/legumes 4
4 https://www.agrihebdo.ch/dossiers/culture-de-noisettes#:~:text=Le%20rendement%20brut%20esp%C3%A9r%C3%A9%20pour,'environ%203%20t%2Fha.
5 https://www.agrarbericht.ch/fr/marche/produits-vegetaux/cereales; we calculated 3kg clza for 1l colza oil product. The yield is l/ha
6 https://www.agrarbericht.ch/fr/production/production-animale/production-laitiere#:~:text=La%20performance%20laiti%C3%A8re%20des%20vaches,vache%20laiti%C3%A8re%20et%20par%20an. For alpine areas, we considered 1 cow per ha and 0.335t edible meat per cow as reported in https://www.fokus-fleisch.de/nebenprodukte-rind-schwein
7 https://www.agrarbericht.ch/de/markt/pflanzliche-produktion/oelsaaten
8 https://www.agrarbericht.ch/fr/marche/produits-vegetaux/pommes-de-terre
9 https://www.sbv-usp.ch/fileadmin/sbvuspch/04_Medien/Medienmitteilungen/PM_2021/Bericht_Potential_Schweizer_Ackerkulturen_DE_def.pdf