

## Loss free food production – a dream or soon reality

Nadina Müller, 2024



# What are the environmental impacts of food and agriculture?

*Four main global impacts*

**26%**

of global greenhouse gases

**50%**

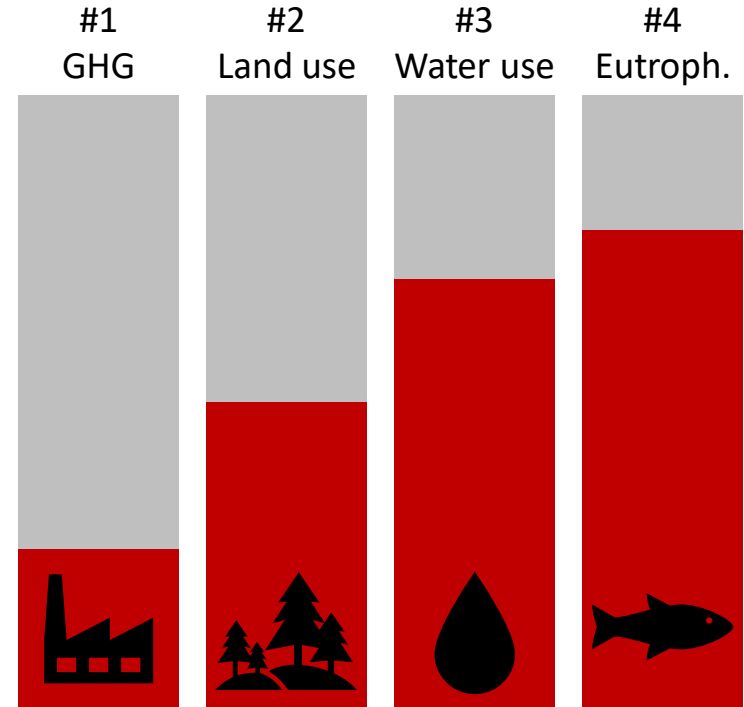
of global habitable land

**70%**

of global freshwater withdrawals

**78%**

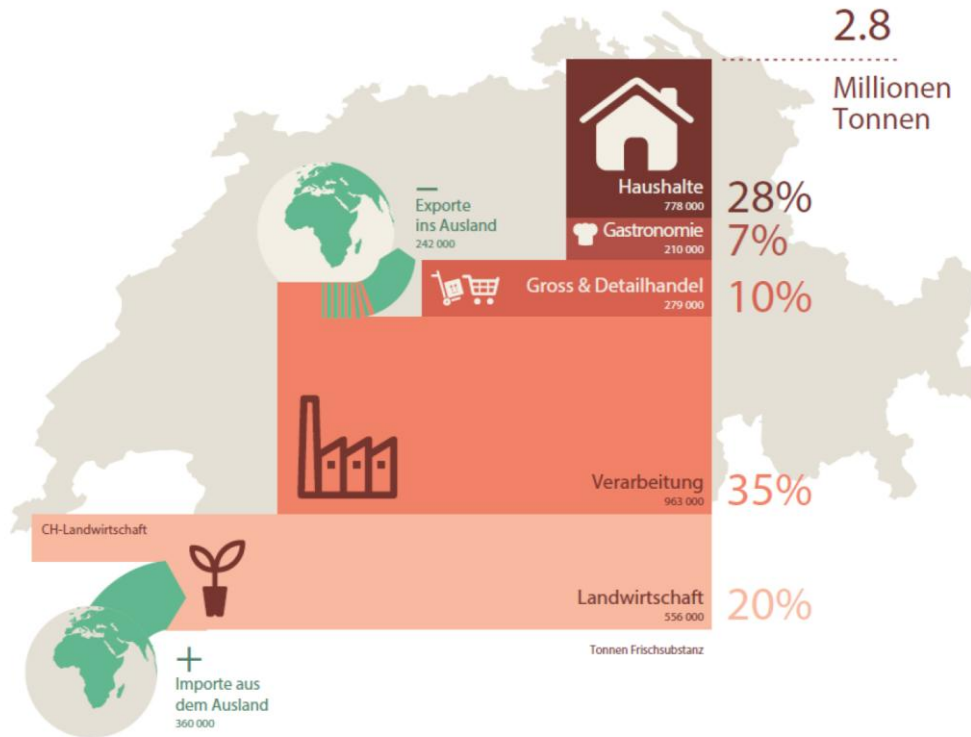
of global ocean & freshwater pollution



# 1.3 bio t



# Food loss & waste in Switzerland

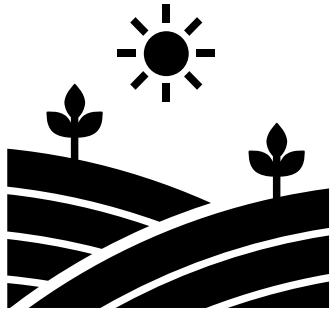


- 2.8 Mio. t per year
- A large part of food loss occurs in food processing
- This is often uniform material occurring in large quantities

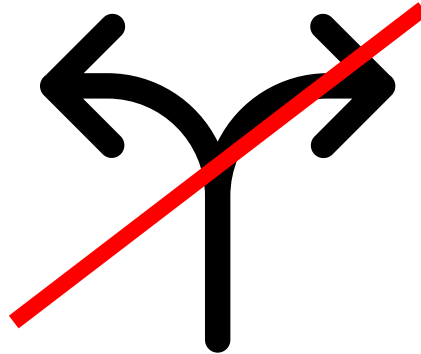
# Future-oriented food processing options

## *Three main possibilities*

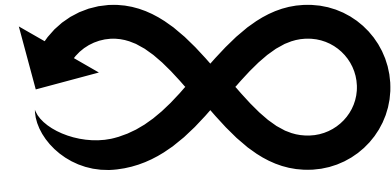
1. Processing of new raw materials  
from highly efficient production



2. Avoid losses and side streams



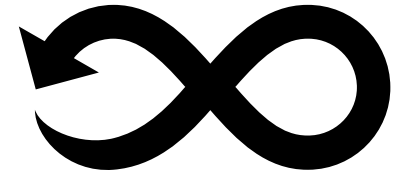
3. Upcycle side streams



# Future-oriented food processing options

*Three main possibilities*

## 3. Upcycle side streams



# What are side streams?

= materials produced besides the target product.



# Co-products and side streams from food processing

## *Valuable but challenging*



**Nutritionally and  
ecologically valuable**



**May contain chemical and  
biological contaminants**

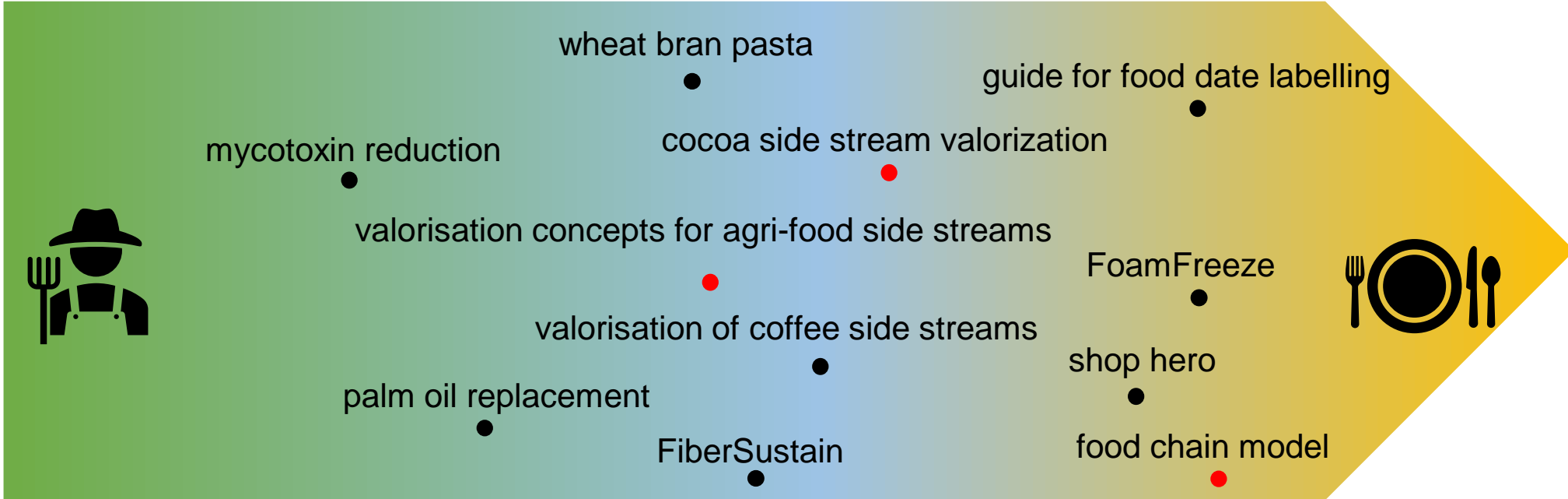


**Upcycling economically  
challenging but also offers  
economic potential**



# Technological approaches along the value chain

## *Project examples*



# Valorisation of Swiss Agri-Food side streams (VALISS)

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# VALISS / Food Waste – from data evaluation to solution

2023 – 2026, funded by Avina foundation

## Aim

- Analyze 15 key side streams from Swiss food industry
- determine promising processing and application pathways
- Develop concrete guideline how to upcycle side streams from food processing
- Develop 4 – 6 example products
- Publish report on side stream valorisation

## Team

- Research Group Food Packaging: Tobias Tschichold, Gabriel Mäder, Susanna Miescher, Prof. Dr. Selçuk Yildirim
- Research Team Food Technology: Ivana Salvatore, Dr. Claudio Beretta, Ramona Leue-Rüegg, Prof. Dr. Nadina Müller





# Cocoa husk valorisation

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# Cadmium removal from cocoa hulls

*Student theses Sylvana Meli, 2022 and Helena Asfour, 2022*

## Aim

- Test possibility to remove cadmium through biosorption

## Solution

- Soaking in citric acid solution w/wo biochar
- Reduction of cadmium from 0.171 mg/kg to 0.013 mg/kg achieved

## Open issues

- Integrated processing to avoid drying step
- Recuperation of citric acid solution

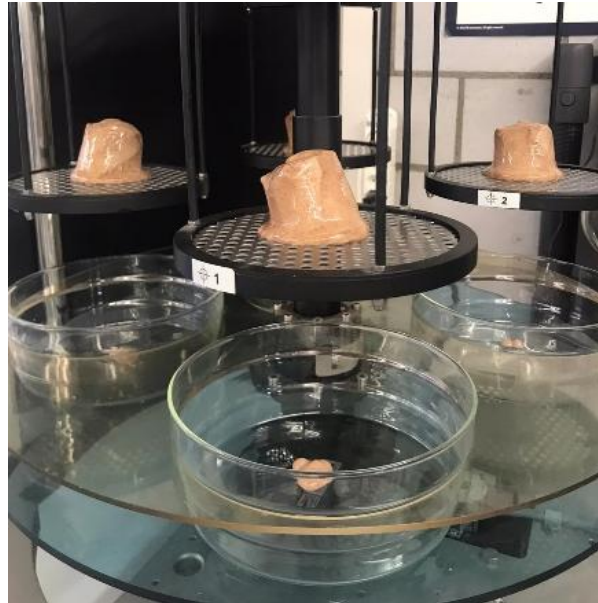



# Integration of cadmium removal into valorisation path

*Student thesis Helena Asfour, 2023*

## Results

- Chocolate ice cream with partial or full replacement of chocolate through addition of cocoa hull
- Partial replacement resulted in good texture and taste
- Full replacement leads to noticeable change in flavor profile and melting behaviour





Evaluation of the  
environmental  
impacts of valorizing  
cocoa pulp in food  
products

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# Food chain model applied to cocoa pulp

SATW funded project, 2022

## Aim

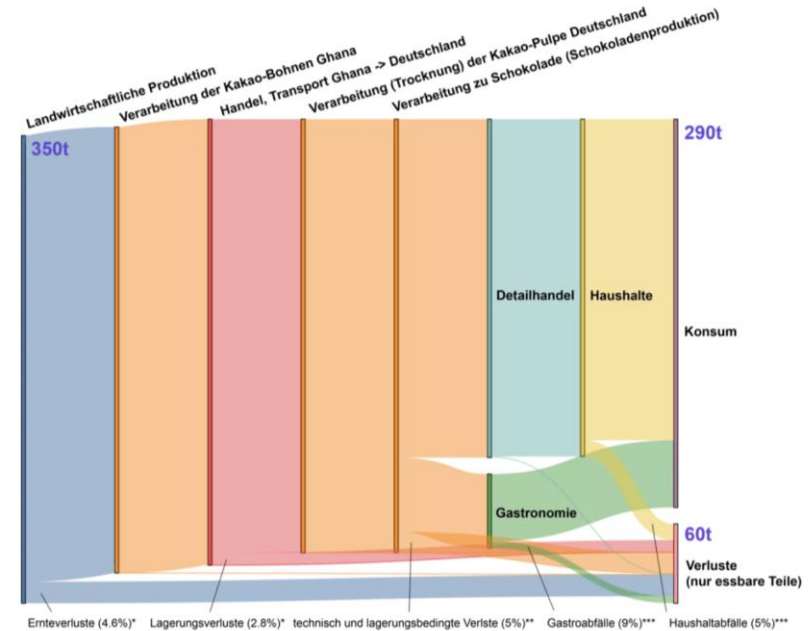
- Test robustness and applicability of food chain model in a concrete example

## Findings

- model **suitable to model** mass flows and environmental impacts of FLW in complex FVC
- **limitation** is quality of **available input data**
- outcome can vary depending on **specific case**
- for cocoa pulp: transport and drying need additional resources  
-> using **renewable energy for drying** will be **key** to ensure that the valorisation is beneficial

## Project team

- Dr. Claudio Beretta, Prof. Dr. Nadina Müller
- Davide Stallone, Erich Zbinden
- Partner: KOA



Prozentangaben beziehen sich auf Input in den entsprechenden Sektor

\* Schätzung der mittleren Ernte-, Nachernte- und Lagerungs-Verluste in Afrika (Gustavsson et al., 2011) und Annahme, dass bei Kakao aufgrund der Hochwertigkeit des Produktes die Hälfte des Durchschnittes aller Produkte anfällt

\*\* Schätzung von Lagerungs- und technisch bedingten Verlusten bei einem Schokolade-Verarbeiter (Mosberger et al., 2016)

\*\*\* Verluste im Haushalt aufgrund Schweizerischer Analysen zur Gesamtmenge an Lebensmittelverlusten im Keiricht und Grüngut und Aufschlüsselung nach Lebensmittelkategorien und Entsorgungswegen (Gartenkompost) aufgrund ausländischer Daten; Verluste in der Küche und beim Gast in der Gastronomie aus zahlreichen Primärerhebungen; Annahme, dass Aufschlüsselung nach Lebensmittelkategorien gleich ist wie in einem Luxushotel (Beretta & Hellweg, 2019)



# Loss free food production

*What does it take to make the dream come true?*



**New resource-efficient  
processing strategies  
& practical guidelines**

*Image: David Levêque, Unsplash*



**Contaminant  
mitigation concepts  
& clear legal basis**

*Image: Mika Baumeister, Unsplash*



**Delicious food**

*Image: Edgar Castrejon, Unsplash*



**Knowhow sharing /  
collaboration**

*Image: krakenimages, Unsplash*

# Weiterbildung ZHAW zu nachhaltiger LM-Verarbeitung

## 7. & 8.11.2024

Zürich University  
of Applied Sciences



Zukunftsfähige

Lebensmittelverarbeitung:

Grundlagen und

Lösungsansätze auf dem Weg

zu Kreislaufsystemen | ZHAW

Life Sciences und Facility

Management



THANK YOU FOR YOUR ATTENTION!



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