INDONESIAN NITROGEN FOOTPRINT ASSESSMENT OF FOOD SECTOR

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Introduction

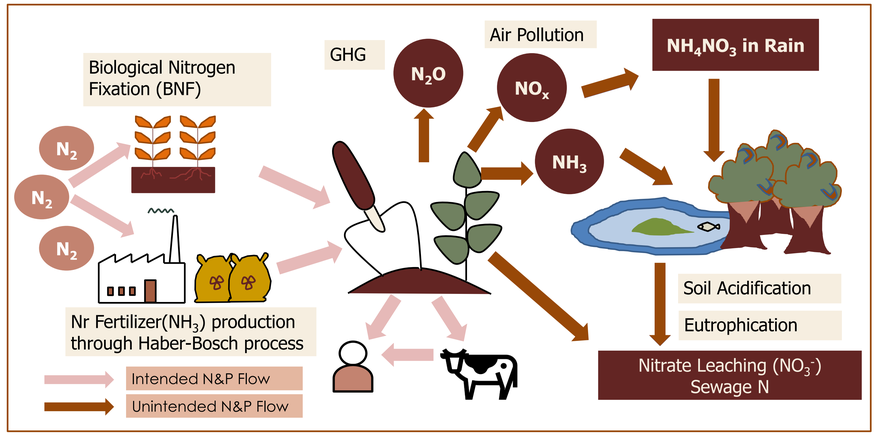

Fig 1. Map of Indonesia

- Indonesia is the 4th most populated country in the world, and it is predicted to be
- The demand of food in Indonesia is high because Indonesia is populated and agrarian country
- **86.4% of farmers** in Indonesia are using Synthetic fertilizer (Statistics, 2015)
- The primary food in Indonesia is cereals, particularly rice (FAO, 2019)
- Indonesian food consumption has been increasing continuously especially for seafood, meat, fruit, and vegetable (FAO, 2019)

Objective and Contributions

Investigate nitrogen footprint (NF) based on food diets in Indonesia

- Indonesian NF has a high impact on the world's nitrogen issues
- The NF results would be a scientific basis for policymakers to attain the reduction of NF

Methodology

Nitrogen Use Efficiency

$$NUE = \frac{Nutrient\ contained\ in\ products}{Nutrient\ Input}$$

Nutrient Input:
Fertilizer
Manure Fertilizer
BNF (Guo et.al., 2017)
Irrigation (Guo et.al., 2017)
Deposition (Guo et.al., 2017)

Nitrogen Footprint (NF)

$$NF_{Total} = \Sigma(NF_{production} + NF_{consumption})$$

$$NF_{production} = \Sigma NF_{consumption} \times Virtual\ N\ Factor\ (VNF)$$

$$NF_{consumption} = \Sigma(N_{supplied} \times (1 - R_{wasted}))$$

NOTE:
- $N_{supplied}$= N supplied in food item
- R_{wasted} = Food waste for each food
- Not include the transportation, energy
- The production includes the food processing

(Oita et.al., 2020; Guo et. al., 2017)

Results and Discussions

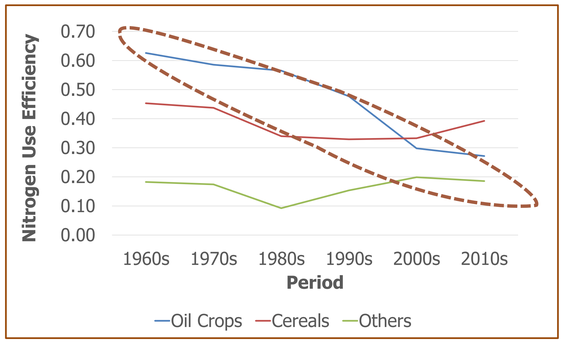

Fig 2. Nitrogen Use Efficiency

- Nitrogen use efficiency (NUE) shows the ratio of the nitrogen absorbed by the food commodities in the production phase
- In figure 2, NUE **of oil crops group** tended to decrease every year
- Low values for NUE potentially impact the higher values for NF

- Based on figure 3, the food NF in Indonesia has increased year by year
- Cereals as the major food in Indonesia is the highest contributor of food NF in Indonesia
- Food diet change to become **more animal-based product consumption** also influence the higher food NF
- **Oil crops group** is also noticed to become one of the reason for the high number of food NF in Indonesia

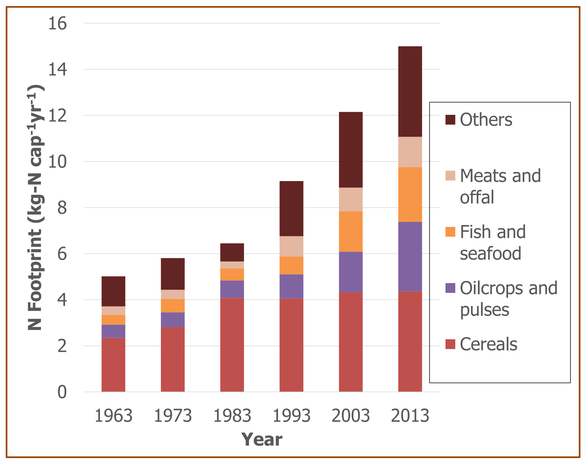

Fig 3. Nitrogen Footprint

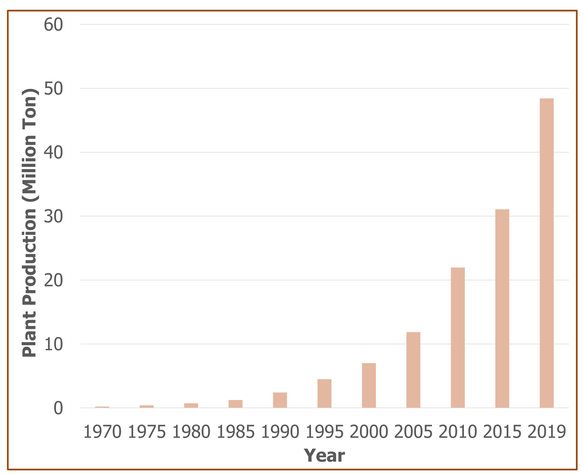

Fig 4. Palm Oil Production in Indonesia (FAO, 2019; Indonesian Statistics, 2019)

- Oil crops group highly contribute to the food nitrogen footprint in Indonesia
- **Indonesia is the largest producer of palm oil plantation**, which is categorized as an oil crops product
- As shown in figure 4, the production started to grow in 1980s
- Align with the higher production of palm oil, **fertilizer usage is also increased**
- Palm oil plantation only absorb **shallow N content** (Donough et. al., 2016)
- High N loss from palm oil is potentially high

Conclusions and Recommendations

- The total Indonesian food NF has increased over the years
- **Increased food consumption, a more animal-based diet, and a decrease in NUE of crop production for oil crops group** are vital factors of the rise of the NF
- **Maximize the organic fertilizer usage and try to apply a new method for food production** such as vertical garden are the options to reduce the NF
- **Education to the people and cooperation of all stakeholders** in Indonesia are necessary to lessen the impacts of Nr loss to the environment

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