

## Agriculture – The lifeline

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*“Agriculture is the most healthful, most useful and most noble employment of man.”*

– George Washington

*Agricultural development is a key driver in eliminating extreme poverty, promoting shared prosperity, and feeding an estimated 10 billion people by 2050. A range of pressures including rapid population growth, urbanisation, growing wealth and consequent changes in consumption patterns, are challenging global agri food systems’ ability to provide nutritious food. Whereas the major challenges before the Indian agriculture are climate change, changing consumption pattern, water scarcity, small land holding size, market prices and absence of value chain infrastructure.*

### 1. Economic Dimensions of Agriculture – Global V/S Indian Scenario

#### 1.1 Introduction

Agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity, and feed a projected 10 billion people by 2050. Conflicts, climate change, and high food prices are driving food and nutrition insecurity, pushing millions into extreme poverty, and reversing hard-won development gains. Around a quarter of a billion people now face acute food insecurity.<sup>1</sup>

#### 1.2 Some Facts on Indian v/s World Agriculture

- In 2021, the global agricultural land area was 4.79 billion hectares (ha).
- Global value added by agriculture, forestry and fishing reached to USD 3.7 trillion (2021).
- Agriculture remains the second largest source of employment worldwide after services sector.
- Four individual crops accounted for half the global production of primary crops- sugar cane (20%), maize (13%), wheat and rice (8% each)
- The value of global food exports was USD 1.66 trillion in 2021.
- The world average dietary energy supply (DES), measured as 2978 kcal per person per day in 2021.
- In 2021, the agriculture area under certified organic status or in conversion to organic was 77 million ha.
- In 2022, credit to agriculture reached USD 1099 billion. The global share of agriculture in total credit decreased from 2.77 percent in 2013 to 2.26 percent in 2022.<sup>2</sup>

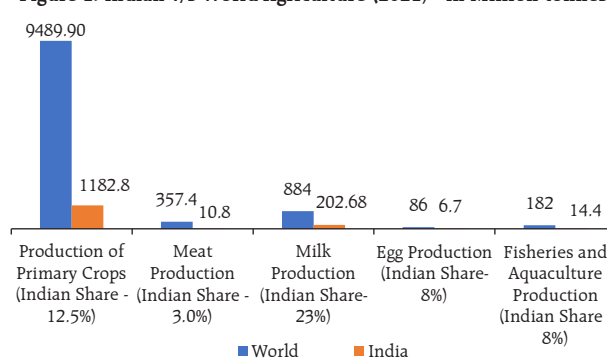
**Table 1: Comparison between world agriculture and Indian agriculture**

Sr. No.	Particulars	World	India
1.	Agricultural share in Global GDP (%)	4.3	16.3
2.	Share of total Work force in Agriculture (%)	27	44.0
3.	Women workforce in Agriculture (%)	37.8	30.9
4.	Crop land area per Capita (in ha)	0.2	0.12
5.	Area Equipped for Irrigation (mha)	352	75.5
6.	Pesticides usage (Kg/ha)	2.26	0.37
7.	Inorganic Fertiliser Usage (Kg/ha)	118.6	177.6
8.	Area under organic cultivation (in Million ha)	77	2.7

#### 1.3 OECD- FAO – Agricultural Outlook 2023-2032 – Key observations

- Food remains the primary use for basic agricultural crop commodities, currently accounting for 49% of quantities consumed at the global level. Over the decade to 2032, the evolving energy and nutrition requirements of a growing and increasingly affluent global population are expected to be the key drivers of demand for agricultural commodities.

**Figure 1: Indian v/s World Agriculture (2021) - in Million tonnes**



Source: Statistical Yearbook 2023, FAO.

- Another issue of increasing concern to the efficiency of the global food system are food losses along the value chain including food wasted in households and retail establishments. Across the globe, approximately 14% of the world's food, valued at USD 400 billion is lost on an annual basis between harvest and the retail market. At the same time, an estimated further 17% of food is wasted at the retail and consumer levels. Reducing food loss and waste is a significant level for broader improvements of food systems' outcomes, including improving food security and sustainability as well as increasing efficiency.
- Demand for feed is driven by two factors: the number of farm animals and the feed use per animal. Over the projection period, the expanding animal herds and the continuing intensification of the livestock sector will drive an increase in feed demand.
- Poultry meat will be the fastest growing segment of animal protein production (14%) and is projected to account for 48% of the increase in total meat production over the coming decade.
- Dairy will remain the fastest expanding livestock sector over the next decade, with global milk production projected to increase by 17%.

**Table 2: Average Yield of Major Crops ( Kg/ha)**

Crop	All-India Average	World Highest
Paddy	4229	7080
Maize	3387	10880
Sorghum (Jowar)	1092	5000
Pigeon Pea (Tur)	861	1698
Groundnut	1777	4505
Soybean	1069	3331
Sunflower	923	3021

Source: Statistical Yearbook 2023, FAO.

<sup>1</sup> World Bank

<sup>2</sup> FAO- Global & Regional Trends 2013-2022

- ❖ Global fish production is projected to grow by 12% over the coming decade, albeit at a slower rate compared to the previous decade. This slowdown in growth reflects the impact of policy changes in China toward more sustainable fisheries, the higher costs for fuel inputs, and the assumption that 2024, 2028 and 2032 will be El Nino years that will result in lower production, mainly in Latin America and the Caribbean.
- ❖ A recent FAO report on the status of women in agrifood systems<sup>3</sup> shows that inequalities related to land tenure, credit, training, and technology create a 24% gender gap in productivity between women and men farmers on farms of equal size.
- ❖ Global direct agricultural emissions are set to increase by 7.5% over the coming decade, while the projected increase in agricultural production is 13%. Livestock production will account for 80% of this increase.
- ❖ Real prices of agricultural commodities have been on a declining trend since the 1960s due to rising productivity, which lowers the marginal cost of production of food commodities. Prior to 1990, most output growth at the global level was driven by intensifying land use and increasing the area under cultivation, as well as extending irrigation. After 1990, growth in total factor productivity (TFP, i.e. output expressed relative to total inputs used in production) accounted for most of the growth in world output.
- ❖ About 93% of global milk production is consumed domestically in the form of fresh, unprocessed, or lightly processed (e.g. pasteurised or fermented) dairy products.
- ❖ It is projected that world cereal trade will increase by 11% by 2032. Wheat will contribute to 43% of this growth, while the rest is shared by maize (34%) and rice (20%) and other coarse grains (3%).
- ❖ Biofuels (bioethanol and biodiesel) are fuels produced from biomass. Currently, about 60% of ethanol is produced from maize, 23% from sugarcane, 7% from molasses, 3% from wheat, and the remainder from other grains, cassava, or sugar beets. About 70% of biodiesel is based on vegetable oils (14% rapeseed oil, 23% soybean oil, and 29% palm oil) and used cooking oils (25%).

#### Some Facts – Ancient Agriculture

- Rice was domesticated in China between 11,500 and 6,200 BC.
- Sheep were domesticated in Mesopotamia between 13,000 and 11,000 years ago.
- Cattle were domesticated in the areas of modern Turkey and Pakistan some 10,500 years ago.
- Potato was domesticated between 10,000 and 7,000 years ago.
- Sugarcane and root vegetables were domesticated in New Guinea around 9,000 years ago.
- Sorghum was domesticated in the Sahel region of Africa by 7,000 years ago.
- Cotton was domesticated in Peru by 5,600 years ago.
- Horse was domesticated in the Eurasian Steppes around 3500 BC.

#### 1.4 Challenges before World Agriculture

A range of pressures including rapid population growth, urbanisation, growing wealth and consequent changes in consumption patterns, are challenging our agri food systems' ability to provide nutritious food, and to contribute to enhanced livelihood opportunities in an environmentally sustainable way. The major challenges would be as under :

- ❖ **Food Insecurity:** 11.3% of the world population (900 million people) were exposed to severe food insecurity (2022).
- ❖ **Higher Food Prices:** Across the globe, approximately 14% of the world's food, valued at USD 400 billion is lost on an annual basis between harvest and the retail market and estimated further 17% of food is wasted at the retail and consumer levels. The global estimate of the cost of a healthy diet was 3.66 purchasing power parity (PPP) dollars per person per day (2021).

- ❖ **GHGs Emission:** Total emissions from agrifood systems in 2021 amounted to 16.2 billion tonnes of carbon dioxide equivalent (Gt CO<sub>2</sub>eq) of GHG released into the atmosphere, an increase of 10 percent, or 1.5 Gt CO<sub>2</sub>eq compared with 2000.

**Table 3: GHG Emissions Per Kg. of Food Produced**

Food items	(kg CO2 Equivalent)	Food items	(kg CO2 Equivalent)
Wheat & Rye	1.57	Pig Meat	12.31
Maize	1.70	Fish (farmed)	13.63
Oatmeal	2.48	Cheese	23.88
Milk	3.15	Coffee	28.53
Rice	4.45	Beef (dairy herd)	33.30
Eggs	4.67	Lamb & Mutton	39.72
Olive Oil	5.42	Dark Chocolate	46.65
Soybean Oil	6.32	Beef (beef herd)	99.48
Poultry Meat	9.87		

- ❖ **Increase in Natural Disasters:** Disasters are estimated to have caused production losses in crops and livestock valued at USD 3.8 trillion between 1991 and 2021, corresponding to an average loss of USD 123 billion per year, or 5 percent of annual global agricultural GDP.
- ❖ **Low level of Investment:** Globally, Agricultural support policies transfer around US\$ 800 billion per year to the farm sector worldwide. Most of the \$800 billion support is for market-distorting, incentivizing unsustainable practices and increase GHG emissions that contribute to climate change. Of which the individual producers received about USD 675 billion a year, or 15 percent of total agricultural production value. Under a continuation of current trends, this support could reach almost USD 1.8 trillion in 2030.

#### 1.5 Solutions suggested

A sustainable agrifood system is one that delivers food security and nutrition for all in such a way that the economic, social, and environmental bases to generate food security and nutrition for future generation is not compromised.

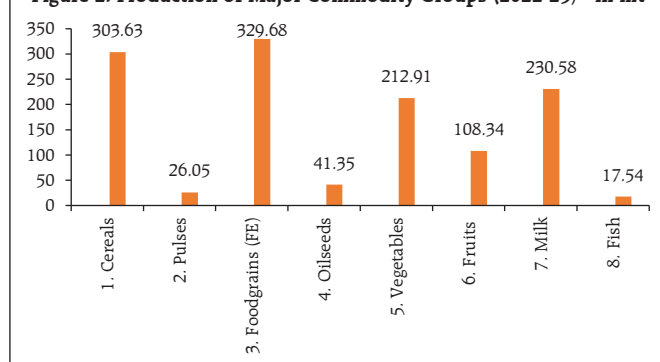
- ♣ Ensuring access to existing and new climate-smart technologies for poor farmers. These technologies can help reduce yield gaps and improve resilience.
- ♣ Closing the gender gap. Providing women farmers with proper resources and support will help raise yields and improve food security.
- ♣ Reducing GHG emissions through improved fertilizer use, alternate wet and dry irrigation of rice and improved livestock breeding and waste management.

#### 2. Indian Agriculture: Status and Way Forward

##### 2.1 Introduction

Indian agriculture has done well with an average annual growth rate of 4.6% in the past six years. It has been resilient with 4.1% and 4.62% during the pandemic years of 2020-21 and 2021-22, respectively and

**Figure 2: Production of Major Commodity Groups (2022-23) - in mt**



<sup>3</sup> The Status of Women in Agrifood Systems, FAO, 2023

**Table 4: Percentage share and growth rate of Different Activities in Agri GVA (at Current Prices)**

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Livestock GVA/ Agri GVA	24.4 (20.74)	26.1 (14.11)	26.7 (15.49)	27.8 (16.81)	29.1 (12.26)	29 (10.87)	30 (13.82)	30.2 (11.26)	30.2 (9.45)
Forestry GVA/ Agri GVA	8.3 (10.91)	8.3 (6.13)	8.2 (11.36)	7.7 (5.96)	8.4 (17.21)	8 (5.75) (11.06)	7.7 (5.46)	7.3 (4.53)	7.2 (9.26)
Fishing GVA/ Agri GVA	5.6 (18.72)	6 (13.86)	6.1 (16.52)	6.8 (24.98)	7 (9.73)	7 (11.06)	6.6 (3.99)	6.9 (15.71)	7.2 (14.67)
Crops	61.8 (3.58)	59.6 (2.98)	59 (12.19)	57.7 (10.1)	55.5 (2.91)	56 (12.3)	55.7 (9.68)	55.6 (10.59)	55.3 (8.8)

**Note:** Data in parentheses is year-on-year change  
**Source:** CMIE

the growth is estimated at 4.7% in 2022-23. However, in financial year (2023-24), the growth rate of agriculture and allied sector has gone below two percent and it is estimated to be at 1.44%. Agriculture and rural incomes are under stress for several reasons. The incomes of farmers from cultivation, in constant prices, have declined over time. Globally, fertiliser and food prices increased due to the Ukraine Russia war but have been rising even before the war due to high global liquidity. The rural areas have seen a decline in the purchasing power, along with a negative real rural wage growth due to high inflation (GoI 2023).

## 2.2 Agricultural Exports:

The vast production base offers India tremendous opportunities for export. During 2022-23, India exported fresh fruits and vegetables worth Rs. 14414.63 crore (\$1788.65 million) and the processed fruits and vegetables exported to be ₹11410.04 crore (\$1417.06 million). Grapes, Pomegranates, Mangoes, Bananas, and Oranges account for the larger portion of fruits exported from the country while Onions, Mixed Vegetables, Potatoes, Tomatoes, and Green Chilly contribute largely to the vegetable export basket (APEDA). India's dairy exports for 2023-24 slid by a fifth to \$468 million despite a 10 per cent rise in volumes on account of lower prices of skimmed milk powder and other products. India's dairy exports stood at a record \$588.93 million in 2022-23 (APEDA).

## 2.3 Major Challenges before Indian Agriculture

### a) Climate Change or Global Warming

Farming activities are carried out by the selection of crop, which is specific to suit climate, soil type, resource availability, etc. Therefore, farming, production and productivity are completely dependent on climatic conditions (Srinivasarao et al., 2016a; Bal and Minhas, 2017)<sup>4</sup>. Weather disruptions, like changes in temperature, precipitation, and solar radiation, affect the agriculture ecosystem including livestock, arable and hydrology sectors. As per the global report prediction, a loss of 10-40 per cent in crop productivity is estimated for 2100 AD.

- **Field Crops:** An average of 30 per cent decrease in crop yields is expected by mid-21 century in South Asian countries. For example, in India, an increase in temperature by 1.5° C and decrease in the precipitation of 2 mm, reduces the rice yield by 3 to 15 percent.
- **Vegetable crops** when exposed to extreme high temperatures are subject to very high transpiration losses, and it also limits fruit setting in citrus fruits. Most of the vegetable crops are severely affected by flooding, particularly tomato.
- **Livestock, Poultry and Fisheries sectors:** The climate change, whether it is global, regional or in a smaller scale, has a greater impact on biological production, or sum of those processes acts directly on individual organisms or species.

Higher temperatures abruptly change the animal's body physiology (Pereira et al., 2008) such as rise in respiration rates (> 70- 80/minute), blood flow and body temperature (>102.5° F). Erratic changes in weather conditions directly impact the production level of animal by 58 per cent and reproduction by 63.3 per cent). Dairy breeds are more vulnerable to heat stress than the meat breeds.<sup>5</sup>

- Changing consumption pattern:** The growing population, inflating disposable incomes, and elevating standards of living are resulting in an increased demand for food and agricultural products. According to a data, the total foodgrains demand will grow to the level of 311 million tons by the year 2030. The share of milk, fruits & vegetables in consumption basket increased from 22.6% in 1970-71 to 32% in 1995-96 to 43.7% in 2020-21.<sup>6</sup>
- Small Land Holdings and Livelihoods:** In India average size of land holding is 1.08 ha. India's large number of small land holdings (85% of total arable land) limits farmers' ability to earn dignified livelihoods.
- Low Market Prices makes Farming unsustainable:** Higher price spread in agricultural commodities adversely affects the income of farmers as well as of consumers.
- Depleting Aquifers and Water Scarcity:** The insatiable demand for water in agriculture is depleting aquifers. Extracting water for irrigation may become economically unfeasible in critical food-producing regions.
- Weakening Cooperative System in Rural areas:** Large no of PACS, Dairy Cooperative Societies and marketing Societies are loss making and some of them have become defunct.

## 3. Projections of food demand and supply (2047-48)

As per the NITI Aayog, projections are as under:

Table 5: Projections of food demand			
Sr. No.	Particulars	Demands in BAU (2.44%) & High Growth Scenario (3.07%)	Remarks
1	Foodgrains	402 -437 mt	Growth in demand for maize, pulses and nutri-cereals will be higher as compared to rice and wheat.
2	Pulses	49-57 mt	
3	Vegetables	365-417 mt	
4	Fruits	233 -283 mt	Between 2019-20 and 2047-48, gross cropped area is expected to expand at annual growth of 0.45%.
5	Sugar	44-45 mt	
6	Edible Oils	31-33 mt	The additional production to meet the domestic demand must come from yield improvements.
7	Milk	480- 606 mt	
8	Egg	16 -21 mt	
9	Meat	21 -29 mt	
10	Fish	37 -48 mt	

**Source:** Working Group report, Niti Aayog - 2024

## 4. Projections of Input Demand (2047-48):

Similarly, input demand are as under:

Table 6: Projections of Input Demand (2047-48)			
Sr. No.	Particulars		Remarks
1	Fertilisers	432- 640 lakh mt	Fertiliser consumption will increase from 193 kg/ha by 2030-31 to 300 kg/ ha in 2047-48. The per hectare pesticide consumption is estimated at 0.39 kg in 2030-31 and 0.55 kg in 2047-48. Cotton is the largest consumer of pesticides.
2	Pesticides	83,209 tonnes - 1,18,405 tonnes	
3	Seeds	49,701 thousand quintals	The demand for long-term credit will increase faster, consolidating its share in the total credit from 64% in 2030-31 to 81% in 2047-48 from its current share of 45%.
4	Credit	Rs 1,31,51,319 crore	

**Source:** Working Group report, Niti Aayog – 2024

<sup>4</sup> Srinivasarao, Ch., Gopinath, K.A., Prasad, J.V.N.S., Prasanna, K. and Singh, A.K. 2016a. Climate resilient villages for sustainable food security in tropical India: Concept, process, technologies, institutions, and impacts. *Advances in Agronomy*. 140(3): 101-214

Bal, S.K. and Minhas, P.S. 2017. Atmospheric Stressors: Challenges and Coping Strategies, In: P.S. Minhas et al.(eds) *Abiotic Stress Management for Resilient Agriculture*, Springer Nature Singapore Pte. Ltd., pp.9-50.

<sup>5</sup> ICAR Policy paper Climate Change and Indian Agriculture: Impacts, Coping Strategies, Programmes and Policy -2019

<sup>6</sup> From Green Revolution to Amrit Kaal Lessons and Way Forward for Indian Agriculture – Working Paper, Niti Aayog (page No. 6)

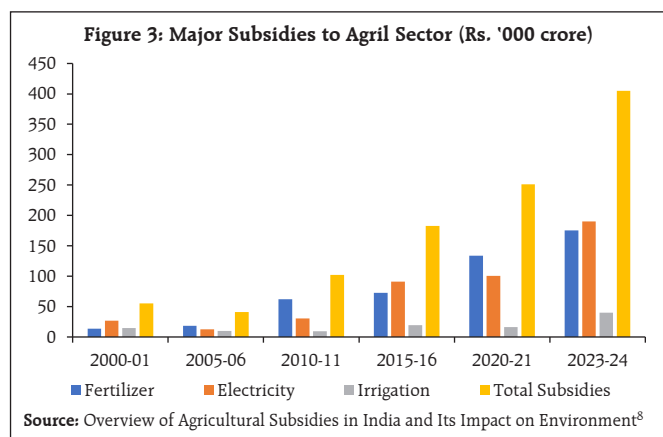


## 5. Recommendations of Working Group for agril sector<sup>7</sup>

- ❖ **Land use planning.** It is important to evolve economically feasible cropping patterns suited to the resource endowments of different agro-ecological zones.
- ❖ **Revisit price policy:** The open-ended procurement to be revisited. For the additional marketed surplus, farmers can be compensated through price deficiency scheme.
- ❖ Invest in infrastructure and value chains for perishable commodities.
- ❖ Promote millet consumption and production.
- ❖ Reduce consumption of edible oils & Enhance pulses production.
- ❖ Establish seed hubs in their niche production regions of different pulse crops.
- ❖ Rejuvenation of soil health.
- ❖ Promote climate-resilient technologies and practices.
- ❖ Improve credit flow for capital investment.
- ❖ Invest in agricultural research: It remains much less—0.5% of the agricultural gross domestic product—than in several developed countries (2-3%).
- ❖ Expand the extension system.
- ❖ Improve compliance towards food safety standards for exports.
- ❖ Robust & reliable data systems and Upscale digital innovations.

## 6. Repurposing of Agril Support – Needed relook

Providing healthy and nutritious food for a growing global population while protecting the natural systems that sustain life is one of the critical challenges in the coming decades. The global food and agriculture sector receives more than US\$700 billion in public support each year, but much of this is not currently geared toward addressing this challenge. Presently, it has become increasingly clear that the subsidies and policies that shape what and how food is produced are not addressing mounting challenges linked to climate change and environmental degradation (e.g., water availability, soil quality, biodiversity). In some cases, public agricultural support is exacerbating these challenges, which may intensify food insecurity, malnutrition, and/or obesity. However, 75% of this support goes towards supporting the incomes of individual producers, rather than supporting sustainability objectives.



There is a huge opportunity to invest more in public goods and services. Despite the US\$700 billion governments provide to their agriculture sectors every year, only 12% in OECD countries and 16% in non-OECD countries is invested into public goods such as rural infrastructure, agricultural research and innovation, climate mitigation and adaptation, conservation, and biodiversity.

**Indian Scenario:** In India, subsidies were introduced in the 1970s and have expanded to around US\$ 24 billion to date. Then there is another food subsidy for consumers, especially for wheat and rice. India gives five kilogrammes of wheat and rice per person free of cost to more than 800 million people every month through the Prime Minister's Garib Kalyan Yojana. This is perhaps the largest food security programme in the world. In total, these two subsidies, i.e. fertiliser and food subsidies in India, amount to nearly US\$48-49 billion. However, output prices are controlled, and input prices are subsidised.

The bottom line is that the OECD has made an estimate of the so-called producer subsidies. According to this, India has a negative estimate of producer subsidies. Most developed countries and all OECD countries, have a subsidy of 14% to 15% on both the input and output side. But India subsidizes its inputs but also suppresses the output prices, which is called market price support, and that is negative, while the budget subsidy through inputs is positive. So, the bottom line is that Indian farmers are implicitly taxed and not subsidised. However, this does not mean that inputs are not subsidised. Fertilisers are very heavily subsidised, which has an impact on biodiversity<sup>9</sup>

## Need of Repurposing Agricultural Support<sup>10</sup>

- ♣ Presently, agricultural support is not providing desirable results for sustainability and human health.
- ♣ By repurposing support to agricultural producers, governments can promote food systems that are healthier, more sustainable, more equitable, and more efficient.
- ♣ Support policies based on subsidies and trade barriers are highly distortive to markets and are also regressive.
- ♣ On balance, the incentives support creates appear to increase greenhouse gas emissions that contribute to climate change.
- ♣ Better outcomes could be achieved if even a small portion of agricultural subsidies were repurposed into investments which led to productivity-enhancing and emissions-reducing technologies.
- ♣ Redirecting, or "repurposing," agricultural subsidies toward investments that support both increased production and greater sustainability — such as agricultural research and development (R&D) and rural infrastructure — has the potential for win-win-win gains for people, planet, and prosperity.
- ♣ Repurposing would create multiple wins — mitigating global climate change, reducing poverty, increasing food security, and improving nutrition.
- ♣ Estimates suggest that the global food demand will increase by 70% by 2050 and at least \$80 billion annual investments throughout the value chains will be required in response.
- ♣ The current adaptation finance gap is now estimated at USD 194-366 billion per year<sup>11</sup>.

<sup>7</sup> Working Group report on Crop Husbandry, Agriculture Inputs, Demand and Supply, NITI Aayog, 2024

<sup>8</sup> Overview of Agricultural Subsidies in India and Its Impact on Environment, Aarti Deveshwar and Saloni Panwar, Department of Management Studies, Deenbandhu Chhotu Ram University of Science and Technology

<sup>9</sup> Dr. Ashok Gulati, Repurposing agricultural subsidies for the benefit of farmers and nature, Biodiversity Finance Initiative (BIOFIN)

<sup>10</sup> Policy brief: The Case for Repurposing Public Support to Agriculture 2021

<sup>11</sup> Adaptation Gap report 2023

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