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Assessing the Utilization of Climate Change Adaptation Information among Maize Farmers in Akwa Ibom State, Nigeria for Enhanced Climate Resilience

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Abstract
Climate change is a serious threat to maize production in Nigeria, so it is of importance to highlight the need for effective adaptation strategies for farmers. However, the availability of climate change information does not always result in successful adaptation, as various obstacles hinder its efficient use. This study investigated the utilization of climate change adaptation information among maize farmers in Akwa Ibom State, Nigeria, and its implications for climate resilience. Using a mixed-methods approach, the study collected data from 150 maize farmers through surveys, interviews, and focus group discussions, employing a multi-stage sampling procedure and descriptive statistical analysis to realize its objectives. The study examined the different communication channels through which the respondents receive climate adaptation information and found that the majority of information is conveyed by fellow farmers (29%), followed by friends and neighbours (16.7%), and radio (14.0%). The most widely available adaptation information in the study area included planting multiple crops (91.3%), preparing for pest and disease outbreaks (86.7%), rotating maize with legumes (82.1%), and seed preservation (62.1%). A grand mean of 2.38 indicated that 72% of the adaptation information was utilized by farmers. The main barriers to access and utilization were inadequate information (mean = 2.52) and the high cost of improved maize varieties (mean = 2.46). The study concludes that current information dissemination efforts are ineffective and calls for targeted communication strategies, capacity building for extension agents, and the promotion of climate-resilient agricultural practices.
Key Words: Climate Change Adaptation Information, Utilization, Maize farmers

Introduction

Agriculture is the major source of livelihood in many developing African countries. The World Bank estimated that 2.5 out of 3 billion rural inhabitants in developing countries are involved in agriculture, with 1.5 billion in smallholder households (Musandiwa, 2024). In Nigeria, large proportion of the rural populace depend on agriculture as their major source of livelihoods. Approximately 90% of rural households are involved in farming activities, which is largely dependent on rainfall patterns. Therefore, any disruption in these patterns is likely to negatively impact rural livelihoods. Rural farmers have observed an unpredictable rainfall pattern which have led to not planting at all in some seasons because they would have to wait for the right rainfall frequency and until then, it is too late to plant. Also, consecutive drought years had now discouraged them from planting at all.

Climate change continues to be a pressing global issue, with significant impacts on agriculture, food security, and rural livelihoods. In Nigeria, climate change, exacerbated by frequent and severe flooding, drought, late rainfall, and other related conditions, continues to alter the pattern and intensity of rainfall, posing a significant threat to agricultural production and emerging as a major contributor to food insecurity. Maize (Zea mays L.) is one of the most widely cultivated crops in Nigeria, accounting for over 33 million tons annually (FAO, 2020) produced by smallholder farmers on over 6.5 million hectares of land across diverse agroecological zones of the country (Onumah et al., 2022). As a quick maturing crop, it has become the most consumed staple food (USDA, 2020) for rural families when food reserves are depleted before the root crops, sorghum, millet, and other native crops are harvested. It is by far the largest cereal crops in terms of area and production volume (Onumah et al., 2022). In Sub-Saharan Africa, maize is a vital crop, providing livelihoods for millions of farmers and ensuring food security for most nations as well (Van Ittersum et al., 2016). In Nigeria, maize contributes to food security, provides job opportunities and promotes Nigeria economic development, as is valued at around $6 billion, providing employment and income for millions of people (FAO, 2017; Adeogbo, Ojo & Adetoro, 2021). Apart from human consumption, maize is also used in animal feed, pharmaceutical industries, food manufacturers, breweries, flour mills and other industries. Nearly 80 percent of the maize grain is used for human consumption and animal feed with the remaining 20 percent utilized for industrial processing of diverse products (Onumah et al., 2022). With a per capita consumption of about 35 kg per person per year, maize accounts for an estimated 10% of the daily calorie intakes in the country. The crop is also an important source of cash income for farmers and contributes significantly to agro-industrial development particularly in the livestock feed industry (Wossen et al., 2017).

Maize has become an invaluable crop fitting into the existing diverse farming systems because of its broad adaptation to varying growing conditions, ease of processing and resistance to pre-harvest bird damage that plagued sorghum millet and rice (Fakorede et al., 2022). However, maize production is highly vulnerable to climate change, with rising temperatures, changing precipitation patterns, increased frequency of extreme weather events and pests and diseases (Sato et al., 2020). Climate change poses significant challenges to maize production in Nigeria, particularly in Akwa Ibom State. The most threatening issue of climate change is that experienced farmers cannot predict when to plant their maize due to irregular seasons and this has caused a general decline in the yield of maize thereby resulting in hunger. However, effective information dissemination and utilization of climate change information by the farmers can play a crucial role in enhancing climate resilience in maize production (Arimi, 2021). In recent years, great emphasis has been placed on the need to make information **on climate resilience** both valuable and beneficial to decision-makers (Vincent et al., 2020). Despite increasing availability of climate data (Arimi & Adebayo, 2024; Hewitson, 2017), effective adaptation among maize farmers in Akwa Ibom State remains limited due to barriers in communication and utilization of this information (Vincent et al., 2020; Nkeme et al., 2023). As a result, many farmers continue to be vulnerable to climate variability and its impact on yield and food security (Imam & Babuga, 2021). This study addresses the gap in effective utilization of climate change adaptation information among maize farmers in Akwa Ibom State.

Objectives of the Study

The broad objective of the study is to assess the climate change adaptation information utilization among maize famers in Akwa Ibom State, Nigeria: Implications for climate resilience.

The specific objectives of the study are to;

i. describe the socio-economic characteristic of maize farmers in the study area;
ii. examine the climate adaptation information available in the study area;
iii. identify the most effective channels for disseminating climate adaptation information to maize farmers in the study area;
iv. determine the extent of utilization of climate adaptation information in the study area;
v. identify the constraints to utilization of climate change adaptation information in the study area;

Hypothesis of the study:

H0: There is no significant relationship between the socio-economic characteristic of the respondents and the utilization of climate change adaptation

Methodology

The study was carried out in Akwa Ibom State. The state is in the south-south region of Nigeria with an elevation of 42.58 m (139.7 feet) above sea level and having a tropical monsoon climate. A multi-stage sampling technique was employed in selecting 150 respondents for the study. In the first stage, three Agricultural Zones, Abak, Ikot Ekpene and Uyo, out of the 6 Agricultural Zone in the State were randomly selected. Secondly, five farming communities were randomly selected in the selected zones. Finally, 10 maize farmers were randomly selected from the list of maize farmers in each of the chosen communities giving a total of 150 maize farmers which constituted the study sample population. The data were collected with the aid of a structured questionnaire using interview schedule and was analyzed using descriptive statistical tools and tested using regression analysis.

Results and Discussion

Distribution of Respondents Based on Socio-Economics Characteristics

The results in Table 1 show a mean age of 43 years. This implies that the farmers were young, vibrant and in their productive ages which will enable them to easily adopt and adapt to new and better strategies for climate change effects. This aligns with the findings of Mohammad et al (2020) who found out that the farmers in Northern Guinea Savannah of Kaduna State, who involved in maize production were young and in their productive ages. Also, the table show that approximately more than half (59%) of the maize farmers were female while 41% were approximately male. However, the marital status of the respondents showed that approximately 89% of the respondents were married with a mean household size of approximately 7 people. The implication is that having a great number of married farmers with large family sizes will reduce the cost of labour in maize productivity. Educational status reveals that 11% of the respondents had no formal education, about (16%) attended tertiary education while 29% and 44% attended primary and secondary schools, respectively. This indicates that the respondents attained different forms of education, especially formal education. Also, findings show a mean farming experience of 21 years cultivating on an average of 1.7 hectares with an average annual income of N43, 126.67. This implies that maize farmers in the study area are experienced with increased knowledge that could influence adoption of improved technologies in farm practices but are financially incapacitated to successfully cope with the scourging effects of climate change. The major source of land acquisition was inheritance (49%) followed by purchase (32%) and rent (19%). More than half (58%) of the farmers had no contact with extension services.

Table 1: Distribution based on their socio-economic characteristics of the respondents

Variables	Frequency	Percentage	Mean
Age (Years)			
≤ 30	16	10.7	
31	- 38	25.3	
40	57	38.0	**43**
41- 50	39	26.0	
≥51			
Sex			
Male	62	41.3	
Female	88	58.7	
Marital Status			
Single	12	8.0	
Married	134	89.3	
Widowed	3	2.0	
Separated	1	0.7	

Household Size			
0-4	21	14.0	**7**
5-10	126	84.0	
>10	3	2.0	
Educational Status			
No Formal Education	16	10.7	
Primary Education	44	29.3	
Secondary Education	66	44.0	
Tertiary Education	24	16.0	
Farming Experience			
1-10	27	18.0	
11- 20	44	29.3	
21-30	52	34.7	**21**
31-40	19	12.7	
>40	8	5.3	
Annual Income (₦)			
≤ 30,000	52	34.7	
31-60,000	74	49.3	
61,000-90,000	11	11.3	
91,000-120,000	9	6.0	43,126.67
≥ 121, 000	4	2.7	
Method of Land Acquisition			
Inheritance	73	48.7	
Purchase	48	32.0.	
Rent	29	19.3	
Farm size (hectare)			
<1	92	61.3	
1-5	51	34.0	1.7
≥ 6	7	4.7	
Freq. of extension visit			
Often	15	10.0	
Not Often	48	32.0	
Never	87	58.0	

Source: Field survey, 2024

Table 2 shows climate adaptation information available for farmers in the study area. All the information presented were available in the study area but 6 out of the 11 were identified “mostly available” for the famers as reflected in the grand mean of 72.8. These statements included planting multiple crops to spread risk and optimize yields (91%), Information on mulching to retain soil moisture/reduce erosion (87%), information on preparation for pest and disease outbreaks (88%), rotating maize with legumes to maintain soil fertility (82%), information on expected rainfall amount and distribution (76%) and planting maize resistance varieties to withstand drought conditions (75%). The implication is that farmers are much more familiar with this information since they have been practicing these activities over the years.

Table 2: Distribution of Climate Adaptation Information Available in the study area (N >150)

Climate Adaptation Information	Available (%)	Not Available (%)
Accurate/timely forecasts on rainfall onset, duration, and intensity	65	35
Information on expected rainfall amount and distribution	76	24
Knowledge of potential dry spells and droughts	53	47
Information on preparation for pest and disease outbreaks	88	12
Rotating maize with legumes to maintain soil fertility	82	18
Information on trees planting to prevent wind outbreaks	65	35
Information on early harvesting	57	43
Information on preservation of seeds for planting	63	37
Information on mulching to retain soil moisture/reduce erosion.	87	13
Planting multiple crops to spread risk and optimize yields.	9	9
Planting maize resistance varieties to withstand drought conditions.	75	25
Grand Mean	**72.8**	**26.1**

Source: Field survey, 2024

Communication channels for receiving climate adaptation information

Table 3 shows various communication channels for receiving climate adaptation information by maize farmers in the study area. This finding shows that most of the information is always conveyed by fellow farmers (29.3%), followed by friends/neighbours/family (16.7%), radio (14%), and Television (10%). This implies that extension workers are inactive in the study area. Also, frequent power failure, poor communication networks, poorly funded research and high poverty rate may explain low responses to social media (6%), Extension workers (6%), research (4.7%). and input dealers (4%). However, this result agrees with the findings of Muhammad et al. (2020) who found fellow farmers to be the main source through which farmers elicit farm information.

Table 3: Distribution of the various communication channels on climate adaptation information available to maize farmers in the study area. (n= >150)

	Frequency	Percentage	Rank
Friends/family/Neighbours	25	16.7	2^{nd}
Fellow farmers	44	29.3	1^{st}
Farmers association	13	8.6	5^{th}
Television	16	10.7	4^{th}
Extension officers	9	6.0	6^{th}
Social media	9	6.0	6^{th}
Radio	21	14.0	3^{rd}
Researchers	7	4.7	7^{th}
Input dealers	6	4.0	8^{th}

Source: Field survey, 2024

Utilization of climate adaptation information in the study area

Table 4 shows the extent of utilization of climate adaptation information in the study area. Findings revealed a grand mean of 2.38, indicating that 64% of the information on climate adaptation were utilized by farmers in the study area. They were: included information on preservation of seeds for planting ($\bar{x}$= 2.64), information on preparation for pest and disease outbreaks ($\bar{x}$= 2.56), rotating maize with legumes to maintain soil fertility and reduce pest and disease pressure ($\bar{x}$= 2.53), information on trees planting to prevent wind outbreaks ($\bar{x}$= 2.52) and planting multiple crops to spread risk and optimize yields ($\bar{x}$= 2.52), information on early harvesting ($\bar{x}$= 2.50), and information on mulching to retain soil moisture/reduce erosion ($\bar{x}$= 2.47). The high extent of utilization must have been evidence that farmers have been using most of this information for over a decade even before the concept of climate change became a topical issue in development policy discourse.

Table4: Distribution of extent of utilization of Climate Adaptation Information in the study area (N =150)

Climate Adaptation Information	Total Score	Mean Score	Decision
Accurate/timely forecasts on rainfall onset, duration, and intensity	251	1.67	Not Significant
Information on expected rainfall amount and distribution	284	1.89	Not Significant
Knowledge of potential dry spells and droughts	278	1.85	Not Significant
Information on preparation for pest and disease outbreaks	384	2.56*	Significant
Rotating maize with legumes to maintain soil fertility	380	2.53*	Significant
Information on trees planting to prevent wind outbreaks	378	2.52*	Significant
Information on early harvesting	375	2.50*	Significant
Information on preservation of seeds for planting	397	2.64*	Significant
Information on mulching to retain soil moisture/reduce erosion.	371	2.47*	Significant
Planting multiple crops to spread risk and optimize yields.	378	2.52*	Significant
Planting maize resistance varieties to withstand drought conditions.	353	2.35	Significant
Grand Mean		**2.38**	

Source: Field survey, 2024 Decision rule: X ≥ 2. indicates significant (utilized) while x< 2 indicates 'Not significant' (Not utilized) * (Mostly utilized)

Constraints to Utilization of Climate Change Adaptation Information

Table 5 shows constraints to utilization of climate change adaptation information in the study area. The result revealed that all the statements representing constraints to use climate adaptation information were identified as severe constraint with a mean score of $\bar{x}$=2.0. However, a grand mean of 2.33 indicated that 55% of the statements reflected very severe constraints militating against utilization of climate change adaptation information in the study area.

Table 5: Mean Score Distribution of Constraints to Utilization of Climate Change Adaptation Information (N >150)

Constraints	Total Score	Mean Score	Decision
Inadequate information on climate change adaptation	378	2.52*	Severe
Financial difficulties in coping with climate change	345	2.30	Severe
Insufficient funds to purchase/use some of the adaptation measures	365	2.43*	Severe
High cost of manure/ fertilizer	368	2.45*	Severe
Limited knowledge of adaptation measures	314	2.09	Severe
High cost of improved maize resistance varieties	369	2.46*	Severe
Poor government attention to climate problems	366	2.44*	Severe
Lack of Knowledge on weather information and forecasts	356	2.37*	Severe
Inability to access extension services	309	2.06	Severe
Lack of basic training on how to interpret climate information	333	2.22	Severe

Lack of access to timely weather information and forecasts	347	2.31	Severe
Difficulty in understanding climate information	339	2.26	Severe
Grand mean		**2.33**	

Source: Field survey, 2024 Decision rule: X ≥ 2 indicates severe constraints while x< 2 indicates Not severe. * (Very severe)

Relationship between socioeconomic characteristics and use of climate change adaptation information

The lead equation for the regression result was the exponential function as it met the criteria, having a high R2 value and the highest number of significant values at 5% level. The model (independent variables) used to account for below 23% of the variability of the dependent variable. From the table, educational level and farming experience were significant at 1%, however, farming experience is negative. This implies that as educational level of the respondents increases, their use of climate adaptation information is likely to increase. On the other hand, as the farming experience of the respondents increases, their use of climate change adaptation information decreases. Thus, farmers with more farm experience are less likely to use climate change adaptation information. The age and sex of the respondents were significant at 5%, the age of the respondents was negative, while the sex was positive. Thus, the use of climate change adaptation information by the respondents decreases as the farmers get older. In addition, with regards to sex, this implies that male maize farmers are likely to use climate change adaptation information compared to their female counterparts. Thus, maize female farmers should be encouraged to use climate change adaptation information to mitigate the effect of climate on their maize production.

Table 6: Relationship between socioeconomic characteristics and use of climate change adaptation information

Variables	Exponential	Double log	Semi-log	Linear
Constant	1.708 (38.802)	1.577 (12.802)	38.134 (2.453)	53.516 (9.652)
Sex	0.026 (2.220) **	0.078 (1.912)***	10.806 (2.094)**	3.476 (2.388)**
Age	-0.014 (2.266)**	-0.053 (-1.139)	- 6.308 (- 1.066)	-1.660(2.135)**
Farming experience	-0.007 (-1.942)*	-0.055 (1.791)***	-5.710 (-1.476)	-0.680 (-1.567)
Educational level	0.024 (4.001)*	0.182 (4.831)*	20.331 (4.282)*	2.743 (3.579)*
Marital status	-0.011(-1.287)	-0.033 (-0.653)	- 5.030 (-0.789)	-1.358 (-1.254)
Household size	0.001 (0.160)	-0.045 (-1.052)	-5.855 (-1.095)	-0.084 (-0.072)
Farm size	0.007 (0.861)	0.043 (1.207)	2.995 (0.670)	0.391 (0.387)
Income	2.243E 8(1.312)	0.028 (1.462)	3.281 (1.152)	2.497E-6 (1.160)
R2	0.22	0.23	0.20	0.19
f-ratio	7.729	8.300	6.869	6.455

Figures in parenthesis are t-ratio; ** P≤0.05 *P≤0.01

Conclusion

To enhance farmers' resilience, boost crop yields, and facilitate adaptation to erratic climate conditions, the Akwa Ibom Agricultural Development Programme (AKADEP) has introduced climate-smart agriculture (CSA) practices through the dissemination of agriculture-related information, that could help them manage the harmful effects of climate change. Farmers, on the other hand, did not rely solely on the information provided by extension professionals; instead, they strategically sought information that could increase adaptation skills from a variety of sources. The information sought improved their adaptation skills on their farming business, resulting in a sustainable yield due to some resilience; however, most of the maize farmers could not use the information due to challenges faced, such as inadequate information on climate change adaptation and high cost of improved maize resistance varieties.

Recommendations

1. As a result of threat posed by climate change to humanity in food scarcity, there is urgent need for adequate and timely provision of information on climate change to the public, as this will allow people to build capacity for adaptation or mitigation of the effects of the phenomenon
2. Also, extension personnel should be equipped with the necessary resources to help increase their day-to-day interactions with farmers and disseminate information to farmers.
3. Farmers should be encouraged to join various farmer-based organizations (FBOs) in their communities since these organizations also serve as good platforms for disseminating agricultural information, which is very important to use during production and others.
4. Agricultural Extension Agents should educate maize farmers on measures to control and manage pests and disease that affect maize crops.Farmers should also be updated on newly improved varieties that have been certified by research institute since most of the maize farmers needed information on pest and disease management and information on newly improved seed varieties. Relevant and actionable

References

Adeogbo, O. A., Ojo, T. O., & Adetoro, A. A. (2021). Understanding the determinant of climate change adaptation strategies among smallholder maize farmers in South-West Nigeria. *Heliyon, 7*, e06231.

Arimi, K., & Adebayo, O. C. (2024). Climate change adaptation information usability among maize farmers in Ido Local Government Area of Oyo State, Nigeria. *International Journal of Applied Agricultural Sciences, 10*(4), 165–175. https://doi.org/10.11648/j.ijaas.20241004.13Opens a new window

Arimi, S. K. (2021). Climate change adaptation and resilience among vegetable farmers. *International Journal of Vegetable Science, 27*(5), 496–504.

Ekpali, S. (2023, September 25). Cultivating resilience: Addressing food production in a climate crisis. *Fairplanet Newsletter*. http://www.fairplanet.comOpens a new window

Fakorede, M. A. B., Ajala, S. O., & Fajemisin, J. M. (2022). *Maize Association of Nigeria: History, achievements, future trends*. Phaloray Book Works.

FAOSTAT. (2022). Statistical databases and data-sets of the Food and Agriculture Organization of the United Nations. http://faostat.fao.org/default.aspxOpens a new window

Food and Agriculture Organization (FAO). (2020). Country brief: Nigeria. http://www.fao.org/giews/countrybrief/country.jsp?code=NGAOpens a new window

Food and Agriculture Organization (FAO). (2017). 3.02 billion people hungry [News release]. http://doi.org/10-1016/j.heliyon.2021.e06231Opens a new window

Hewitson, B., Waagsaether, K., Wohland, J., Kloppers, K., & Kara, T. (2017). Climate information websites: An evolving landscape. *Wiley Interdisciplinary Reviews: Climate Change, 8*(5), 1–22.

Imam, M., & Babuga, U. S. (2021). Utilization of climate change information sources among farmers in Nigeria. *Direct Research Journal of Agriculture and Food Science, 9*, 144–148. https://doi.org/10.26765/DRJAFS5893722617Opens a new window

Muhammad, M. B., Hudu, M. I., Garba, A., & Thomas, I. (2020). Analysis of maize farmers' perception of climate change and adaptation strategies adopted in Northern Guinea Savannah of Kaduna State, Nigeria. *Journal of Agriculture and Environment, 16*(1), 31–39.

Musandiwa, S. (2024). Impact of climate change on the agricultural sector: Maize production. *Climate Change Writers*. https://www.climatechangewriters.comOpens a new window

Nkeme, K. K., Umoh, I. U., Ekanem, J. T., & Udoro, U. S. (2023). Adaptation measures utilized by food crop farmers to mitigate climate change effect in Northwest District of Akwa Ibom State,

Nigeria. *Journal of Community & Communication Research, 8*(2), 219–230. https://jccr.sccdr.orgOpens a new window
Nwankpa, A. (2022). Brooking Africa Growth Initiative: Foresight Africa 2022. https://twitter.com/Opens a new window
Obot, A., & Obiekwe, N. (2022). Climate adaptive measures among smallholder farmers in Akwa Ibom State, Nigeria. *American Journal of Agricultural and Biological Sciences, 17*, 58–64. https://doi.org/10.3844/ajabssp.2022.58.64Opens a new window
Onumah, G., Dhamankar, M., Ponsioen, T., & Bello, B. (2021). Maize value chain analysis in Nigeria. Report for the European Union, INTPA/F3. Value Chain Analysis for Development Project 2021 (VCA4D CTR 2016/375-804), 155p + annexes.

PWC. (2021). Positioning Nigeria as Africa's leader in maize production for AfCFTA: Insights on global maize production and how Nigeria can position itself as Africa's leader in maize production.
Rathoure, A. K., & Patel, U. R. (2020). Climate conditions and biodiversity decline: Impact assessment. In *Current state and future impacts of climate change on biodiversity* (pp. 79–94). IGT Global.
Sato, G. J., Joshua, M. K., Ngongondo, C., Chipungu, F., Mahdadi, C., & Monjerezi, M. (2020). Evaluation of different tillage systems for improved agricultural production in drought-prone areas of Malawi. In *Climate variability and change in Africa* (pp. 157–167). Springer.
Van Ittersum, M. K., Van Bussel, L. G. J., Wolf, J., Grassini, P., Van Wart, J., Guilpart, N., Claessens, L., De Groot, H., Wiebe, K., Mason-D'Croz, D., Yang, H., Boogaard, H., Van Oort, P. J. A., Van Loon, M. P., Saito, K., Adimoh, O., Adjei Nsiah, S., Agali, A., Bala, A., Chikowo, R., Kaizzi, K.,
Kouressy, M., Makoi, J. H. J. R., Ouattara, K., Tesfaye, K., & Cassman, K. G. (2016). Can sub-Saharan Africa feed itself? *Proceedings of the National Academy of Sciences, 113*(52), 1–6.
Vincent, K., Conway, D., Dougill, A., Pardoe, J., Archer, E., Henriksson, R., Malinga, N., Mittal,
N., Mkwambisi, D., Rouhaud, E., & Tembo-Nhlema, D. (2020). Re-balancing climate services to inform climate-resilient planning: A conceptual framework and illustrations from sub-Saharan Africa. *Climate Risk Management, 29*, 100242.
Wossen, T., Menkir, A., Alene, A., Abdoulaye, T., Ajala, S., Badu-Apraku, B., Gedil, M., Mengesha, W., & Meseka, S. (2023). Drivers of transformation of the maize sector in Nigeria. *Global Food Security, 38*, 100713.
Zadawa, A. W., & Omran, A. (2020). Rural development in Africa: Challenges and opportunities. In *Sustaining our environment for a better future* (pp. 33–42). Springer.