AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
National

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

# Some Innovative Methods of Preparedness for Climate Change Impacts

Abhishek Sharma
Research Scholar, Department of Management
Mewar University, Chittorgarh (Rajasthan), India
Email: **abs.18f@gmail.com**

Dr RL Tamboli
Professor and Supervisor, Department of Management
Mewar University, Chittorgarh (Rajasthan), India

## Abstract

Climate Change is a cause of worry to the scientits and administrators and to the business which may be seriously affected. Climate Change Mitigation can be in four stages through preventive measures, adaptation,preparesness and response to the extreme weather situations. Changes in the water and food resources distribution will be a major issues. This paper describes some methods for water haevesting and reuse. These methods could prove helpful in mitigating the effects of climate change through reducing the impcts of droughts and floods.

Key Words: `Preparedness, Mitigation, Climate Change, Agricultural Water Harvesting, Water Reuse, Drought, Flood, Storm

## Introduction

Climate Change impacts will increase the temperature, intensify situations of floods, droughts, extreme weather events and subsequent consequences [3] in differnt sectors. The preparedness measures would require to deal with intensified hazards. Water conservation and protecting its quality are major neccecity. A link between Climate Change and flood frequency is already proved, and all flood protection measures qualify for Climate Change mitigation and also for drought prevention and water quality protection. The protection against storm is only limited to flood protction measures and safe shelters to be used if evacuation is needed.

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

Still, there are measures which address directly the Climate Change impact, for example, the Finnish measures aim at optimising the water regulation schemes according to the observed and projected changes in seasonal flow. Measures by Austria are to increase cleaning efficiency of sewage treatment plants to compensate for the lower dilution capacity in received water as a result of low flow, and setting norms for water withdrawals for snowmaking in ski resorts in redudeced skiing season by low snowfall, to reddres Climate Change impacts.

## Mitigating Climate Change

Climate Change is a very slow developing hazard that will take decades and it will increase the intensity of weather events. It will result in increase in temperature, sea leve rise, increase in frequency, intensity and extent of droghts and floods, and subsequent effect on all the sectors of production starting from agriculture and the economy. Mitigation of climate change may need:

- **Preventive Measures** by limiting the Green House Gases (GHGs) Emissions or absorbing the Carbon dioxide (CO2)
- **Adapting to the Climate Change** and get adjusted to the changed environment by building resilience to meet the challenge of food, water and nutrition security
- **Preparedness** for reducing the impacts of drought and floods by infrastructural, policy based or nature based methods.
- **Response to the Disasters** like drought, floods, food and water scarcity.

## Limiting the Emissions

Limiting the emissions and intensifying agriculture are mutually competitive. Producing food, for the increasing poplation, will need more intensive operations for agriculture. Paddy farming, composting, fertilizer, pests, agricultural wastes, use of bio-fuels, all generate GHGs. It is necessary to limit GHG emissions but agricultural activities cannot be reduced. Nature based methods for agriculture [14] may help to great extent.

We need to plant trees extensively. Cutting the trees and burning of agricultural wastes need be reduced. Trees absorb the CO2. There are efforts to develop artificial process which does the job of coverting CO2 to Oxygen (O2) like the trees do. Zhou et.al [15] could Photo-disassociate CO2 into O2 and Carbon Mono-oxide (CO). Kothandaraman et.al [8] demonstrated that the CO2 from air can be converted to methanol (CH3OH) using a catalytic system and yield is as high as 79%. If these technologies are scaled up, a very large amount of CO2 from the atmosphere can be captured.

Swiss project Climeworks, uses commercial plant to pull CO2 from the air. They developed scalable, low-energy, CO2-filtering machines [7]. In Iceland, the CarbFix project captures CO2 from a geothermal plant and pumps it deep to form of porous basalt [10], [11]. The CO2 binds with calcium, and becomes carbonate rock like limestone. CarbFix2 is using machines to extract CO2 from the atmosphere and fix it. Mineral Carbon International developed carbon removal technologies and storage with mineralization in Oman, Australia, Canada, USA, South Africa, and parts of Europe [6],[7]. The photo-disassociation is the only process which releases O2 like photosynthesis. The other processes capture the CO2 and the O2 does not add to the atmosphere.

The animal wastes management need be improved. Animals can be given food additives that can lower the Methane (CH4) release by ruminents [9]. This is to be done under careful supervision of specialists. Making compost in covered pits, quick composing, harvesting and using CH4 from the sewer lines and animal waste may reduce GHGs release into the atmosphere.

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

Saving energy and using non-conventstional energy can help in lowering the CO2 emissions. The hydro-power, solar energy, wind enegy, nuclear energy do not produce GHGs.

The climate change adaptation and mitigation strategies in UK [12] report practicing adaptation measures to address climate impact on ecosystems. As the ecosystem measures have a high profile in the REFRESH Project, the measures used are given include the following:

- Revitalization of minor watercourses and small water areas in municipalities
- Establishment and rehabilitation of riparian
- Improvement of the retention capacity landscape and reduction of flood occurrence in a nature-friendly manner
- Rehabilitation of fish ponds
- Maintenance of the integrity of rivers
- Maintenance of river beds to ensure the passage of the flood peak
- Prohibition on empting small dams for fishing purposes
- Higher storage capacity for winter in the regulated lakes in southern and central Finland for increasing winter runoff and more frequent winter floods
- Need for lower storage capacity in spring if snowmelt floods are reduced
- Filling the lakes in spring for longer and drier summers
- Restoration of river floodplains
- Restoration of wetlands
- To replace habitats lost through SLR or increased flooding
- Reduction of habitat fragmentation and protected areas for water dependent habitats and species
- Addressing changes to ground and surface water flow at high-status sites
- Addressing changes to erosion and sedimentation pressures at high-status sites and protected areas for water dependent habitats and species
- Addressing changes to diffuse and point source nutrient loadings at high-status sites and protected areas for water dependent habitats and species

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

- Addressing the decrease in assimilative capacity of water bodies receiving pollutant loads from point and non-point sources
- Maintain compensation flows at reduced available water in summer to contribute to fish migration within systems particularly around barriers
- Investigate the impact of dumping sand on the beach or forebanks during sand nourishments on beach ecosystems
- 'Modelling Natural Resource Responses to Climate Change' (MONARCH), the Marine Biological Association led project 'Marine Biodiversity and Climate Change' and the Environment Agency led project 'Preparing for climate change impacts on freshwater ecosystems' (PRINCE) for predicting the change in composition of plant and animal communities in the UK.
- Continued control on importation and releases of invasive non-native species
- Broadening the range of species restricted for importation
- Develop the 'landscape ecology approach' to identify and protect key habitats, open up new habitats and develop and maintain wildlife corridors
- Reduce habitat fragmentation and protect and restore floodplains and wetlands
- Map current and future climate spaces and the vulnerability and impacts for priority species and environments
- Enhance the re-colonization potential of species
- Improve the connectivity of river systems
- Reduce nutrient loads of lakes and rivers and shading of water
- Carry out targeted investigations on the effect of Climate Change on species.

If the warming continues as usual many parts of the world will face severe water, food and fodder shortages [2],[4],[5]. The mitigation can be attampted through:

(i) Reduced Burning
(ii) Tree plantation
(iii) Machines working as CO2 absorbers
(iv) Reduction in Ruminants' CH4 release
(v) Water management for paddy crops

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

(vi) Wastes management and Wastewater treatment

(vii) Reducing temperatures through geo-engineering

(viii) Drought Mitigation

(ix) Flood Control Mechanism

(x) Storm Combating and avoiding risk by shifting to safer place

Other aspects are protecting the essentialities like food, fodder, water, assets and the livelihood of the people. The items (i) –(vi) above will obviously help because of reduction in GHG emissions. These steps can contribute extensively in GHGs reduction. The item (vii) is based on concept of injecticting aerosols into the stratosphere to cut some incomming radiations from the Sun [13], its cost effectiveness and side effects yet to be found out. As observed the warming is continued, there is requirement of preparedness. The items (viii)-(x) are the mesures to reduce the harshness of the weather extemes. In this paper we propose innovative methods for reducing the impacts of droughts, floods and exteme weather which is likely to occure due to climate change.

**Retaintion of Water**

The water is essntial to maintain life. In the liquid state it has tendency to move from higher to lower elevation due to gravity. If gets accumalated in large quantities it has extemely high force stored in it. The water moves in the horizontal and the vertical directions. The horigintal component of its motion generates the runoff and accumulation at distance, if it gets place, and the vertical component of its motion stores the water locally, specially in the local depressions, aquafires and as groundwater. The upward movement of water is in the form of water vapour, which has tendancy to rise being lighter than the air. The rising water vapor helps in formation of clouds and subsequently in bringing rains.

Excess water can be used for groundwater recharge by diversion into land that can absorb excess water. This water store can reduce the impact of droughts, which may

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

occur later. This water is used at distant places as well because the groundwater flows from one place to another. If water moves into the ground it will reduce the runoff and reduce the chances of floods as accumulation on the surface will be reduced. Thus for mitigatting droughts and contrlling floods the vertical movement of water into the earth need be increased.

A methods to control the floods by directing the water into ground is as follows. Let us consider a 100x100 plain agricultural farm. The rain occurs on a few days in a month. Some times it continues for many days. The annual rainfall in India is in the range of 50–300 cms a year except some places where the rainfall exceeds 400 cms a year. The community adjusts to the usually occurring rainfall. In the area where the rainfall is say 200 cms the rain is distributed over the entire monsoon period and it may occurs say in 40 rainy days with average rainfall on a day about 5 cms with some variations from drizzle to about 20 cms in a day in a severe storm.

The quanitity of water which falls on a day on a 100x100 m farm with 5 cms rain is 5 lakh liters. We can assume that 1 cm rain will be used to saturate the soil or water may stagnate on the canopies or in between the stems of a crop. Thus about 4 lakh liters of water will try to move out of the farm. If the farmers follow a practice of making partitions about 3 cms water can easily stand in the land for some time and will percolate into the soil. Thus only 1 lakh liters of water may flow as runoff. Having a 1.5x1.5x100 m ditch can hold the 2.25 lakh liters of water. This water can percolate or evaporate locally. If the rain occurs after a break of a few days this lowered area can hold further water. Thus ground water recharge will continue smoothly. The accumulated water can be used for irrigation in the same farm in long dry days even in the monsoon season. It will save the soil nutrients and fertilizers from draining out of the farm.

These ditches may overflow on heavy rains. We do not want 100% water to be stopped from the runoff but we only want to reduce it. Some water may fill the local ponds or go further into the river in the catchment. Continuous rains for many days

AIRO JOURNALS
Free / Unpaid
Peer Reviewed
Multidisciplinary
National
ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

may lead to overflow. If the rains occur for three days, first days rain water is stored and next days overflow will go to other surface water body like ponds, rivers etc.

Thus having a ditches of width and depth of 1.5 x 1.5 m on the one length of 100 meters, on the side which attracts water due to slope, is a sufficiently good estimate for rainwater harvesting pit in the agricultural farms 100 x 100 meter. This will occupy about 1.5 % land. During off monsoon time farmers can use this land also for sowing something if it dries out. If they can make it deep say 2 meters then 1 meter width may also be sufficient for the agricultural rainwater harvesting.

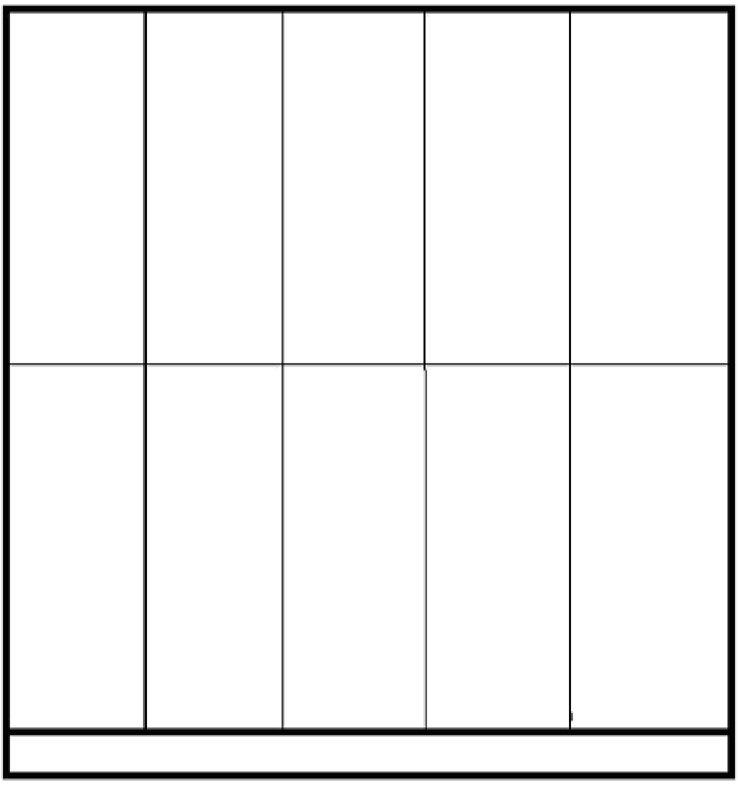


Figure 1 : Partioning Land to retard runoff and collect rain water

The practice need be followed in all farms and on the vacant land as well. The earthen partitioning and closing all the outlets is must as a practice to be followed. This has to be developed as a culture. The process is expected to eliminate floods, maintain water table and will protect against the drought to a great extent. It is required that:

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

- The farmers should make small partitions on their land
- The inlets and outlets are closed and not left open after irrigation
- They dig 1.5 x1.5 meters on every 100 meters of length on the down slope side. Smaller farm length can have proportionately smaller width of the ditch

Farmers can use this land for sowing some crop during off rain season. Even in rainy season they can use it for fisheries or crops like water nut, fox nut etc.

An alternative method can be to use mild slope towards any point on a piece of land. Two pits are dug close to each other. The one pits collects the rain water and the other pit is used to store filtered water. The soil in between the two pits can work as filter.

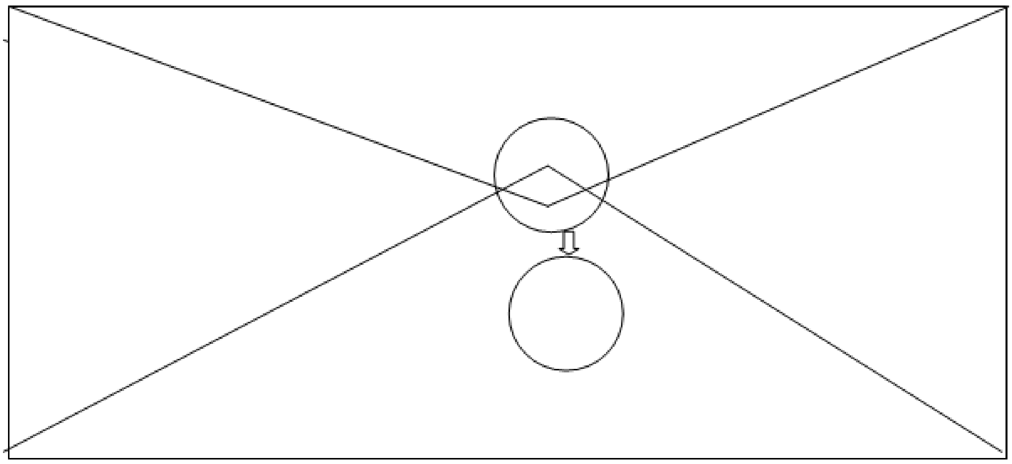


Figure 2: Rain water harvesting and filtering

In the Figure 2 is an illustration of a farm with agricultural rain water harvesting system.. There are two pits. The first pit does not allow infiltration and the second allows infiltration into the ground. A mild slope, may be given to direct the water to the first pit. The water from the both the pits can be used to irrigate. The water may contain washed off fertilizers and nutrients. These two pits need be carefully covered. The size of the pits can be worked out based on the size of the land and the rainfall of the place. It requires further research to find the optimal size and design of the pits.

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

If practiced in flood prone areas will reduce the runoff. Thses arrangements have to be on larger areas and it will be helpful in controlling floods caused by runoff. These system will also improve water table. Reuse of water will help in optimal use of fertilizers. The filtering arrangement will protect the ground water from chemicals and fertilizers. The method will be very useful in area where there is tendency of recurring droughts as groundwater will backup the crops' water needs.

**Water Reuse in Urban Areas**

Piped water supplies are used in most of the cities. The waste water is collected in a wastewater treatment plants, treated as appropriate, and discharged into the native water streme. Thus the incoming water volume is increased and chemically altered. If the external water source is used from another catchment, flow downstream of the urban area is increased. Urban runoff rates are usually higher than the rural runoff rates and heavily contaminated. If the water supply is from groundwater, problems of saline intrusion may prevail and might cause land subsidence. Thus urban development effects the hydrology.

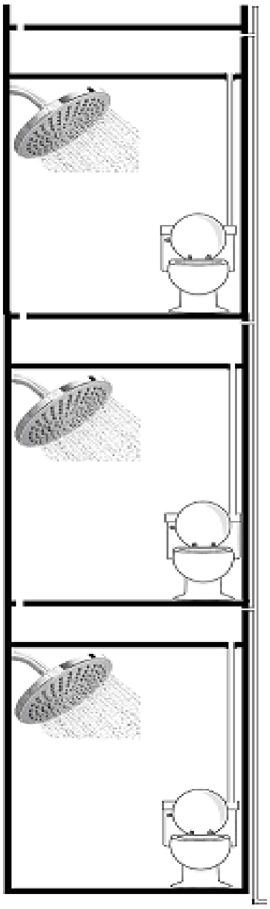
The cities collect water from the catchment area far off from the city, use it and throw it into the drain. The process consumes huge amounts of energy to pump the water into the individual houses and industries. Sometimes it is required to lift the waste water also from the drain to a water treatment plant. The energy consumed contributes to heat up the atmosphere. For improving the situation we need to:

- Harvest rainwater for future use
- Consume low quantities of water to save water
- Reuse the water as far as possible

A process to reduce $CH_4$ production from wastewater is to reduce water consumption and also reduce production of waste water. The toilets need to be improved to make them water efficient. In almost all cities, in developing counties, the piped water is

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

used for all domestic purposes. The same water is commonly used for drinking and also for flushing toilets, washing cars and for animal bath. The water consumption can be easily reduced. A suggested method is that the water used in taking bath can be used for cleaning toilets. In multistoried building this is easy as depicted in the following arrangements as shown in Figure 3A and Figure 3B.



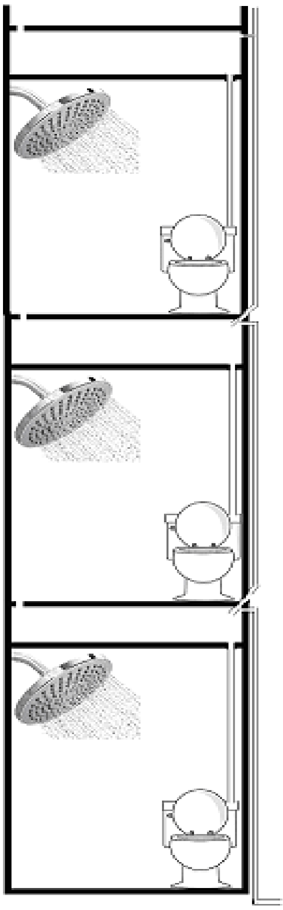


Figure 3A: Reuse of water(1 to 1)    Figure: 3B Reuse of water (1 to many)

These arrangements will require specialized skills for plumbing and some chemical treatment of the water in the storages in the bathrooms itself. There is space in the roof of a bathroom. Usual building height is 3 meters and the roof of bathroom is kept 2.4 meters. About 60 cms vacant space is filled with pumas stone. This space can be used to store the water to be used for flushing the toilets.

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

The arrangement shown in Figure 3B is more efficient as the overflow is minimised. In these processes we can reduce the water consumption approximately to half. A man normally consumes about 15 liters of water for taking a bath. If the toilet is used by one person twice a day and three times a day for urination the 15 liters of water is sufficient for one toilet use by one person. Water from kitchen and washing machine after filtering can also be reused similarly to flush the toilet.

Rest of the water except from the toilet which is drains out to the sewage can be used for irrigating lawn, kitchen garden, trees and shrubs nearby. Using wastewater from the toilets should be sent to the nearby water treatment plant. The semi-solid waste filtered out from the sewer, mixed with the perishable waste can be used to make compost and send to agricultural farms. The solid non-perishable material such as metal, plastic, glass etc. can be recycled.

**Mitigating Storms**

In the last two centuries, tropical cyclones killed about 2 million people worldwide. Strong winds, heavy rains, floods, lightning and surge cause collapse of houses, bridges, dams, and other infrastructure and so it causes large number of deaths and huge damages. The crops destroyed cause huge losses in all sectors of economy. Large areas of standing water due to sea water flooding lead to high salinity of soil, infections in living organism and mosquito-borne diseases. Heavily crowded evacuees in shelters increase the risk of disease propagation. Tropical cyclones destroy infrastructure, power supplies, and communication systems and thus hamper reconstruction and relief operations. Under the influence of climate change these effects will intensify as the storms are likely to get intensified. There have been following therotical developments for reducing the intensity of cyclones [1] :

- Project Stormfury for early precipitattion of the clouds in the eye,
- Covering the ocean with substance that inhibits evaporation,
- Soot – petroleum-burning and surrounding the storm to cut solar radiation,

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

- Dropping large quantities of ice into the storm eye to absorb latent heat,
- Blasting the cyclone with nuclear weapons,
- Upwelling machine for pumping out cold water and cooling the core of storm,
- Salter's sink to push warm water deep and bringing cold water up,
- TUBE – to push surface water deep and setting upwelling ahead of cyclones,
- Arrays of offshore wind turbines ahead the cities
- By Removing Electrical Charges of Clouds and reducing lightning

Some of these methods were patented but hardly experimented perhaps because the controvercies due to recurving of the hurricane under experimentation into another country in project Stormfurry. In a cyclone, very strong winds and gusts are main cause of destruction. Surge, which also developes due to stronger winds, causes extensive flooding and further destruction. It was found [1] that the electrical discharges by lightning in the storm accelerate winds and cause growth of the storm. If the electrical charges on the cloud base in the storm are removed, the winds will not be very strong. Removal of electrical charge from the clouds and hampering its sudden conversion to kinetic energy may keep the winds in limits.

**Conclusion**

The methods suggested are low cost but have to be practices enmass by the people. The emissions can be reduced to a great extent but the accumulation of population and expansion of cities is hampering the efforts towards emission reduction. Therefore the world has to remain prepared for the ill effects of climate change even if the emissions are controlled to limit the warming. The combatting storms, though very expansive, have very high business potential. The Governments can save extensively by safeguarding people and animal, and can reduce damages to crops and infrastructure. Insurance companies may save heavily on reduced compensation payments and they may jointly support such experiments. Many cyclone affected countries may come forward for hiring the services or collaborate on the processes.

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

**References**

1. Bhushan B, Sharma A, 2017, - Reducing Damaging Effects of Cyclone, Patent Application No. 201711028252, 2017, Patent Office at N. Delhi. Government of India.
2. Cheung, W.W.L., Lam, V.W.Y., Sarmiento, J.L., Kearney, K., Watson, R., Zeller, D. & Pauly, D. 2009. Large- scale redistribution of maximum fisheries catch potential in the global ocean under climate change. Journal of Global Change Biology, 16(1): 24–35.
3. Deschenes, O., and M. Greenstone. 2007. The economic impacts of climate change: Evidence from agricultural output and random fluctuations in weather. American Economic Review 97(1):354–85.
4. Eboli, F., R. Parrado, and R. Roson. 2010. Climate-change feedback on economic growth: explorations with a dynamic general equilibrium model. Environment and Development Economics 15(5):515–33.
5. FAO, 2008, Climate Change and Food Security: A Framework Document
6. Fountain, H. 2018, "How Oman's Rocks Could Help Save the Planet." The New York Times, April 26, 2018, sec. Climate. https:// www.nytimes.com/interactive/2018/04/26/climate/oman-rocks.html
7. Gertner, J., 2019, The Tiny Swiss Company that Thinks It Can Help Stop Climate Change. The New York Times, February 12, 2019. https://www.nytimes.com/2019/02/12/magazine/climeworks-business-climate-change.html
8. Kothandaraman J., Goeppert A,, Czaun M, Olah G A, and Surya Prakash G. K., 2016, Conversion of CO2 from Air into Methanol Using a Polyamine and a Homogeneous Ruthenium Catalyst,.J. Am. Chem. Soc. 2016, 138, 3, 778–781.
9. Mathison G. W. , Okine E. K. , McAllister T. A. , Dong Y. , Galbraith J., Dmytruk O.I.N., 1998, Reducing Methane Emissions from Ruminant Animals,

ISSN: 2321-3914
Volume:1 Issue: 3
March 2021
Impact Factor: 6.7
Subject Management

Journal of Applied Animal Research, 14:1, 1-28, DOI: 10.1080/09712119.1998.9706212

10. Matter, Juerg M., W. S. Broecker, M. Stute, S. R. Gislason, E. H. Oelkers, A. Stefansson, D. Wolff-Boenisch, E. Gunnlaugsson, G. Axelsson, and G. Björnsson. "Permanent Carbon Dioxide Storage into Basalt: The CarbFix Pilot Project, Iceland" Energy Procedia, 1(2009), pp. 3641-3646.
11. Matter, Juerg M., W. S. Broecker, S. R. Gislason, E. Gunnlaugsson, E. H. Oelkers, M. Stute, H. Sigurdardóttir, et al. 2011, "The CarbFix Pilot Project–Storing Carbon Dioxide in Basalt." Energy Procedia, 10th International Conference on Greenhouse Gas Control Technologies, 4: 5579–85. https://doi.org/10.1016/j.egypro.2011.02.546.
12. Nõges T, Nõges P, Cardoso Ana C, 2010, Climate change adaptation and mitigation strategies already in practice based on the 1st River Basin Management Plans of the EU Member States, EUR – Scientific and Technical Research series. ISSN 1018-5593, ISBN 978-92-79-18929-6, doi:10.2788/83841
13. Pidgeon N., Parkhill K, Corner A, and Vaughan N, 2013,Deliberating stratospheric aerosols for climate geoengineering and the SPICE project, Nature Climate Change, Vol 3, May 2013
14. WWAP (United Nations World Water Assessment Programme)/UN-Water. 2018. The United Nations World Water Development Report 2018: Nature-Based Solutions for Water. Paris, UNESCO.
15. Zhou Lu, Yih Chung Chang, Qing-Zhu Yin, C Y Ng, William M, Jackson. 2014, Evidence for Direct Molecular Oxygen Production in CO2 Photodissociation, PMID: 25278605 DOI: 10.1126/science.1257156