

Geoengineering: A Half-Century of Earth System Experimentation

CO₂ = carbon dioxide, **FeSO₄** = iron sulfate, **ha** = hectare, **M** = million (1,000,000), **m** = meter, **m²** = square meter, **mi²** = square miles, **MW** = megawatt, **N** = nitrogen, **NO₂** = nitrogen dioxide, **NO_x** = nitrogen oxide, **O₂** = oxygen, **PO₄** = phosphate, **R&D** = research & development, **SO₂** = sulfure dioxide, **t** = tonne (1,000 kg)

Geographic Information		Description		Participants			Sources
Continent	State	Scale	Year	Type	Sponsor	Further Information	
Africa	Algeria	1 Mt/a of CO ₂ has been captured since 2004. 1M t/year of CO ₂ are currently being captured and re-injected	2004 - ongoing (2012)	CCS	StatoilHydro and Sonatrach	BP (operator). Project name: In Salah. Located in Krechba. Onshore gas field with CO ₂ injection into saline formation below the reservoir. Project proponents seek to provide assurance that secure geological storage of CO ₂ can be verified as being cost effective. Short-term monitoring has been proposed as an option for providing long-term cost assurances and to demonstrate that industrial-scale geological storage of CO ₂ is a viable greenhouse gas-mitigating alternative. Precedents relating to the regulation and verification of the geological storage of CO ₂ (to allow the eligibility for greenhouse gas credits) are also being sought.	Global CCS Institute, http://www.globalccsinstitute.com/projects/12361
S-America	Antigua		1984	Increased Precipitation		Name: Antigua Cloud Seeding Project, carried out by Weather Modification Inc.; with Aircraft for Cloud Seeding.	http://www.nawcinc.com/Wxmod.pdf
S-America	Argentina	R&D to produce Biodiesel and other products from algae	Ongoing in 2012 (since ?)	Algae schemes		Private company "Oil Fox": Trials to extract oil from freshwater & brackish water algae to produce Biodiesel, Bioethanol, and proteins from animal and human consumption. Gas emitted from a thermal power station is used for algae cultures to improve productivity and to reduce emissions.	http://en.wikipedia.org/wiki/List_of_algal_fuel_producers ; http://www.oilfox.com.ar/ingles/index.htm
S-America	Argentina	2 projects in the Province of Mendoza, >5,000 km ²	1978 - 1993, 1998 - 2004	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO 1993 + 1994 + 2002 + 1984 and other sources, See Weather Modification Data for details, please.

Asia	Armenia	2 projects, Lake Sevan Area, Yerevan area, 15,000 km ²	1964 - 1993	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO 1993/94+92
Australia/Oceania	Australia	3 pilot plants in Eastern Australia, each with the potential to grow to a commercial plant of 80 ha	Since 2009	Algae schemes	In cooperation with Tarong Energy	Private company "MBD Energy": Binding agreement with Tarong Energy to deploy the company's first 1 ha plant at the Tarong Power Station (1,400 MW) in Queensland. Memorandum of understanding with both, the Loy Yang Power Station (2,200 MW) in Victoria and the Eraring Power Station (2,640 MW) in New South Wales. Company has also built a 5,000 m ² micro-algae R&D, and a pilot plant facility located at James Cook University in Townsville, Queensland.	http://www.powerplantccs.com/ccs/cap/fu/alg/alg_proj_mbd.html ; http://www.mbdenergy.com/our_projects.php
Australia/Oceania	Australia	1 photo-bioreactor to convert CO ₂ into biomass and O ₂ at Linc Energy's site in Chinchilla	Since Nov 2007	Algae schemes	Linc Carbon Solutions is a joint venture, 60% owned by Linc Energy, 40% remain with BioCleanCoal Ltd.	Linc Carbon Solutions: Algae-based CO ₂ sequestration with CO ₂ coming from industrial sources. R&D project to develop a bioreactor converting CO ₂ through a photosynthesis into O ₂ and solid biomass. "We expect to establish that our process of CO ₂ conversion is commercially scalable. »	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://www.lincenergy.com/data/info_sheets/e4-fact.pdf ; http://www.abnnewswire.net/press/en/59649/Linc_Energy_Ltds_(ASX:LNC)_Annual_General_Meeting_by_the_Chief_Executive_Officer_Mr_Peter_Bond.html ; http://www.lincenergy.com/data/investor_linc/investor-linc-issue-6.pdf
Australia/Oceania	Australia	Trial algae photo-bioreactor plant established at Hazelwood	Since ~2006 ?, trials have been closed few years later	Algae schemes	Energetix is a division of the Victor Smorgon Group.	Energetix: The plant's technology was developed at Massachusetts Institute of Technology and is licensed from Greenfuels. Experimental plant covered about 60m x 10m.	http://www.theage.com.au/articles/2006/11/12/1163266412354.html ; http://en.wikipedia.org/wiki/Hazelwood_Power_Station ; http://www.ecosmagazine.com/?act=view_file&file_id=EC133p34.pdf
Australia/Oceania	Australia	Pilot plant to culture algae on Torrens Island	Since 2009	Algae schemes	Supported by General Atomics, eventually as well by Exxon Mobil and Shell.	South Australian Research and Development Institute (SARDI) and Algal Fuels Consortium, a research consortium organized by CISRO (Commonwealth Scientific and Industrial Research) as the centre, jointly constructed a pilot plant to develop fuel from algae culturing.	http://www.asiabiomass.jp/english/topics/0911_07.html ; http://www.adelaidenow.com.au/business/sa-business-journal/algae-leads-way-to-sustainable-biofuel/story-e6fredel-1225778152739

Australia/ Oceania	Australia	A national initiative of biochar research with pyrolysis trials.	2009 - 2012	Biochar	DAFF, CSIRO, Univ WA, UNE, UNSW, NSW DII, Univ Sydney, Univ Adelaide, Pacific Pyrolysis, Anthrotterra	Project title: "From source to sink". Research objectives: Biochar-soil interactions, Biochar and GHG mitigation, Biochar/bioenergy production and life-cycle assessment. Project led by CSIRO Land and Water.	http://www.anzbiochar.org/projects.html ; http://www.anzbiochar.org/projects.html#twelve
Australia/ Oceania	Australia	Biochar producer (sales in kg and t)	Ongoing in 2012	Biochar		Private producer "BlackEarth Products Pty Ltd": Produces and sells biochar (made from Australian poultry manure mixes with sawdust). Producer supports biochar research in cooperation with the University of Queensland.	https://www.blackearthproducts.com.au/products-page/packaged-biochar/blackearth-biochar-4kg-2/
Australia/ Oceania	Australia	Mobile Biochar producer	Since 2009	Biochar		Private company "Black is Green Pty Ltd.": Produces and sells biochar to bulk users and collaborative researchers in Australia; "offers the equipment to generate BiGchar".	http://www.bigchar.com.au/bigchar.html ; http://www.bigchar.com.au/faq.htm#Can_I_buy_BiGchar_and_for_how_much
Australia/ Oceania	Australia	Pacific Pyrolysis Demonstration Facility	Ongoing in 2012	Biochar	NSW Department of Environment and Climate Change	Pacific Pyrolysis: Name of Biochar Project: Pacific Pyrolysis - Pyrolysis Demonstration Facility	http://www.anzbiochar.org/projects.html#seven
Australia/ Oceania	Australia	Trials in habitat 141 (SA-Vic border region from the coast to southern NSW); a biodiversity hotspot in Australia	Since 2010 (at least)	Biochar	Alcoa Foundation, cooperation with Victorian Department of Sustainability and Environment	Greening Australia (environmental organization): Carries out the project "Bio4". Until 2011: trials - investigating potential benefits and potential to sequester carbon.	http://www.greeningaustralia.org.au/index
Australia/ Oceania	Australia	Major agricultural regions of Australia (West, South, New South Wales, Queensland)	Since ~2007	Biochar	CSIRO - Australia's national science agency	2 national research projects, as well related to carbon sequestration; research partners: University of Western Australia, NSW Department of Industry and Investment, University of Sydney, University of New England, University of Adelaide	http://www.biochar-international.org/profiles/CSIRO ; http://www.csiro.au/science/Biochar-Overview ; http://www.csiro.au/files/files/pnzp.pdf

Australia/Oceania	Australia	Production of Biochar in NSW, Central Coast	Field trials since 2006	Biochar		Private company Pacific Pyrolysis (PacPyro): provides biochar to research institutions and projects; e.g. involved in projects studying biochar's influence on the flux of N ₂ O and CO ₂	http://www.biochar-international.org/profiles/pacificpyrolysis ; http://pacificpyrolysis.com/ ; http://pacificpyrolysis.com/agrichar.html
Australia	Australia	CO ₂ injection project	Construction underway in 2012	CCS		Global CCS Institute. Project name: Gorgon Carbon Dioxide Injection Project. This component of a larger gas production and LNG processing project will inject 3.4 to 4 M t of CO ₂ /year into a deep saline formation. Construction is under way after a final investment decision was made in September 2009.	http://www.globalccsinstitute.com/projects/map
Australia/Oceania	Australia	Biochar research, lab-scale, related to reduction of N ₂ O emissions	2007 - 2009	Major research project	NSW Department of Environment and Climate Change; Pacific Pyrolysis	Research Institution: NSW Department of Primary Industries. Project name: "NSW DPI - Reduction in N ₂ O Emissions" (from soils amended with Biochar).	http://www.anzbiochar.org/projects.html#seven
Australia/Oceania	Australia	Biochar research	Ongoing in 2012 (since ?)	Major research project		Research Institution: University of Queensland: research related to biochar & carbon sequestration.	http://www.qaafi.uq.edu.au/professor-roger-s-swift
Australia/Oceania	Australia	Research related to carbon sequestration & biochar	2010 - 2014	Major research project	ARC Future Fellowship FT0991007	Research Institutions: The Australian National University and CSIRO. Name of Biochar Project: "The CharXive Challenge".	http://www.anzbiochar.org/projects.html#three
Australia/Oceania	Australia	Research related to carbon sequestration & biochar	Ongoing in 2012 (since ?)	Major research project		Research Institutions: Collaborative project between the NSW Department of Primary Industries (NSW DPI) and the Department of Environment and Climate Change (DECC). Project name: Land management to increase soil carbon sequestration.	http://www.dpi.nsw.gov.au/research/topics/biochar
Australia/Oceania	Australia	Queensland, Tasmania, Western Australia, Snowy Mountains and other regions (see details WM data)	1955 - 1960, 1980, 1992, 1998 - 2009	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.

Australia/Oceania	Australia	Participated in SOIREE	1999	Ocean fertilization +	Australian BHP Billiton Group [Carbon Steel/Petrol./Alum./Energy/Coal/Diamonds], CSIRO (among others)	Australia funded and was involved in the SOIREE experiment in the Southern Ocean	http://www.etcgroup.org/en/node/4913 (page 14); http://lgmacweb.env.uea.ac.uk/soiree/
Asia	Azerbaijan	10,000 km ²	1967 - 1991, every year; e.g. in 1992: 105 seeding units (1 hour per unit)	Reduced Precipitation	Government		WMO 1992
S-America	Belize	1,200 farmers close to Toledo	2011 - 2012 (and probably longer)	Biochar	Kraft, Cadbury	Carbon Gold with Toledo Cacao Growers Association (TCGA): "The total available biomass of the area from the 1,200 farmer members of the cooperative is about 100,000 t, with an estimated yield of 30,000 t of carbon."	http://www.biochar-international.org/carbongold; http://www.biochar-international.org/9country
S-America	Brazil	Several experiments and research at several places	Since 2000 (at least)	Biochar		Embrapa (Brazilian agricultural research corporation) : Includes charring studies of different biomass sources and field experiments in different Brazilian biomes: the Amazon, the Atlantic forest, the Cerrado and the transition zones between Cerrado-Amazon and Cerrado-Pantanal (wet-lands).	http://www.google.com.mx/search?client=safari&rls=en&q=Advances+in+Biochar+Research+in+Brazil/+2011&ie=UTF-8&oe=UTF-8&redir_esc=&ei=2opWT-CBE6GQsALy5_jeCQ
S-America	Brazil	See Weather Modification Data for details.	1971 - 1980	Increased Precipitation	Government	See Weather Modification Data for details, please.	WMO 1980
Africa	Burkina Faso	Trials near Tiebele	Ongoing ? Reported in 2009	Biochar	Same sponsors as for Cote d'Ivoire project ?	Centre for Rural Innovations (France): Jatropa, Moringa and planned biochar trials, linked to Cote d'Ivoire project.	http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf
Africa	Burkina Faso	15,000 km ² target area	1998 - 1999, 2001 - 2011; e.g. 17 days in 1999 from Jun - Jul	Increased Precipitation	Government: Environmental Agency	Project Name: SAAGA; carried out by Weather Modification Inc.	http://www.weathermodification.com/projects.php?id=5 ; WMO report 1999; http://theblanketeffect.blogspot.com/search/label/African%20Programs

Asia	Cambodia	Field trials	Report completed in 2011	Biochar	ARTI, IRRI, SME Cambodia, University of Colorado; Asia Pacific Network for Global Change Research (APN).	UK Biochar Research Consortium: Report now available that includes information on the field trials with rice husk chars from small scale classifier systems in Cambodia. Study also included examination of potential for carbon financing.	https://spreadsheets.google.com/spreadsheet/pub?key=0AqK8nxi8zfEvdHdhQmpuZ1QtclNFZG9vdWVEaTFkOUE&single=true&gid=0&output=html ; https://docs.google.com/viewer?a=v&pid=explorer&chrome=true&srcid=0B3ZW1BCHOSzWNTk5YmY2NDgtOTRjNi00Nzk0LTg5ODItMmEyZm5NzBjMzk4&hl=en ; http://www.biochar.org.uk/project.php?id=13 ; http://www.biochar.org.uk/abstract.php?id=37
Asia	Cambodia	Pilot project	Since 2011	Biochar	\$4M grant from the Nordic Development Fund and \$600,000 from Vietnam, Laos and Cambodia governments	Carried out by Asian Development Bank: Pilot projects in biogas systems, biochar kilns and improved cooking stoves. "Promoting more efficient use of biomass can simultaneously address the goals of fighting climate change".	http://www.lankabusinessonline.com/indochina/fullstory.php?nid=1666004579 ; http://sea-biochar.blogspot.com/2011/07/adb-agrees-4-mln-grant-to-boost-biomass.html
Asia	Cambodia		1966 - 1972, 2005	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Africa	Cameroon	SW Cameroon, near Kumba, see involved villages here: http://www.biofuelwatch.org.uk/wp-content/uploads/Biochar-Cameroon-report1.pdf	Trials 2009 - 2010	Biochar		Biochar Fund (Belgium): The project's focus is on 1,200 subsistence farmers practicing shifting cultivation. The project started with small field trial with around 50 farmers, and plans to expand to tap into carbon markets. Project area is located near pristine rainforests that are under pressure from slash-and-burn farming and increasing populations. Future plans: creating "biochar buffers" that help protect the forest and its ecosystem services."	http://www.biofuelwatch.org.uk/wp-content/uploads/Biochar-Cameroon-report-Executive-Summary1.pdf ; http://www.biochar-international.org/9country ; http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf

N-America	Canada	Industrial pilot plant capturing at least 10,000 t/year: of CO ₂ in preparation	2011 - 2012	Air capture	The current \$6M, 3-year R&D phase, is funded by angel investors including Bill Gates and Murray Edwards	Canadian Private company "Carbon Engineering" (Alberta, Calgary) develops a fully integrated industrial plant that absorbs up to 1M t of CO ₂ /year. Current R&D initiatives include laboratory research, process modeling and simulation, and fabrication and operation of pilot-scale equipment.	http://www.carbonengineering.com/
N-America	Canada	Alberta: Installation of a photobio-reactor (made by Menova) to reduce CO ₂ emissions by algae growths	2007	Algae schemes		Trident Exploration Corp: grew algae in Menova's photobioreactors (based in Ottawa, Canada) to reduce the net carbon impact of petroleum processing by 50% or greater. No up-to-date information could be found on their website.	http://www.powerplantccs.com/ccs/cap/fut/alg/alg_proj_trident.html ; http://www.airwaterland.ca/article.asp?id=1852
N-America	Canada	Large scale facility, using CO ₂ derived from heavy industry to grow algae	Ongoing in 2012 (since ?)	Algae schemes		Private company "Pond Biofuels": Converts raw smokestack emissions from heavy industry into algal biomass, e.g. using the exhaust gas from CO ₂ emitters in the coal, steel, refining, cement, and other process industries (e.g. the St. Mary's cement kiln).	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://www.oilgae.com/algae/cult/cos/cem/cem.html ; http://www.pondbiofuels.com/
N-America	Canada	Carbon Basis company has 400,000 ha of land in Western Canada	Company was founded in 2011	Biochar	Biochar Solutions Canada Ltd is a partnership between Biochar Solutions and the company "Carbon Basis"	Private company "Biochar Solutions Canada Ltd": "will work to deploy carbon negative technologies to restore disturbed soils in the Canadian agriculture and mining sectors."	http://www.biocharsolutions.com/uploads/3/1/6/8/3168871/bsc_press_release_11.28.11.pdf

N-America	Canada	Tests in BC, Quebec & Alberta	2008 - 2012	Biochar	Federal government funding; Alterna Energy; Sustainable Development Technologies Canada; Nova Green; Alberta innovates; Technology Futures Battle River Agri Ventures Cooperative NGC Inc.	BlueLeaf Inc: Various Biochar tests. Involved in tar sands; looking for carbon credits.	http://www.sdtdc.ca/sdtdc_projects/index_en.htm ; http://alternabiocarbon.com/applications/biochar ; http://www.biochar-international.org/blueleaf
N-America	Canada	2 pyrolysis plants in West Lorne and Guelph (ON). Capacity: to process 130 - 200 t of dry biomass/day	Since 2007 involved in biochar	Biochar		Dynamotive BioOil: "is positioned in the market as a replacement for fuel oils used in stationary applications like boilers and kilns to produce building or process heat"; "Dynamotive expects that it can now "deliver advanced (second generation) fuels from biomass at a cost of less than \$2/ gallon of ethanol-equivalent fuel in facilities processing about 70,000 t of biomass/year."	http://www.biochar-international.org/dynamotive
N-America	Canada	Use of biochar in greenhouses in Odessa (ON)	Ongoing in 2012 (since ?)	Biochar		Burt's Greenhouse: heavy user of fossil fuels – usually in the form of natural gas or oil. By using biomass, these operations can come closer to being carbon neutral. By producing biochar in the process they could actually become carbon negative"	http://www.biochar-international.org/burtsgreenhouse

N-America	Canada	> 20M t of CO ₂ have been stored in 2 fields since Oct 2000. Covering more than 53,000 acres in South-eastern Saskatchewan	Since Oct 2000	CCS		Cenovus Energy (Weyburn Field) and Apache Canada (Midale Field). Project name: Great Plains Synfuel Plant and Weyburn-Midale Project. Associated with a long-standing research project, the "IEAGHG Weyburn-Midale CO ₂ Monitoring & Storage Project", directed by the Petroleum Technology Research Centre. Testing and evaluation of monitoring methods including surface seismic, shallow groundwater, soil gas, and passive seismic. Project includes enhanced oil recovery.	Global CSS Institute, http://www.globalccsinstitute.com/projects/12366
North America	Canada	CO ₂ Capture	Start date: 2014	CCS	The \$1,24 billion government-industry partnership between the Government of Canada, Government of Saskatchewan, SaskPower and private industry.	SaskPower. Project name: Boundary Dam Integrated Carbon Capture and Storage Demonstration Project.	http://www.saskpower.com/sustainable_g
N-America	Canada	>50,000 km ² ; e.g. Southern Alberta, British Columbia	1954 - 1960, 1974 - 1981, 1996 - 2003	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
N-America	Canada	Participated in SOIREE and SOFEX	1999, 2002	Ocean fertilization +	Canadian NSERC, CFCAS, PERD and NSERC C-SOLAS (among others)	Canada funded and was involved in the ocean fertilization experiment SOIREE and SOFEX	http://www.etcgroup.org/en/node/4913 (page 14); http://lqmacweb.env.uea.ac.uk/soiree/

S-America	Chile	Development of N-fertilizers based on Biochar	Ongoing in 2012 (since ?)	Biochar	Supported by the government of Chile (CONICYT-Chile, through FONDEF Project N°: D0711096) and the following commercial entities: Commercial Agrofusión S.A., Soquimich Commercial S.A., Sociedad Forestal Santa Elena Ltda. and Eugene Thiers	Scientific and Technological Bioresource Nucleus and the Department of Chemical Engineering of Universidad de La Frontera in Temuco, Chile, is looking to determine the best operational conditions for the development of controlled-release N fertilizers using biochar as a basis.	http://www.biochar-international.org/profile/chile
S-America	Chile	Biochar research project	2009 - 2013	Major research project	Ministry of Agriculture	Research Institution: Tarapaca University. Business partner is the Chilean company Asitec Ltda. Cost: 466,681 USD / 299,800.000 Chilean pesos.	http://latercera.com/contenido/657_120330_9.shtml
S-America	Chile	>30,000 km ² , e.g. Cachapoal River Basin, Andean Sector	1979 - 1980, 1990 - 1998 with interruptions, 2000 - 2002	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO 2000 + 2002 + 1980 + 1998
Asia	China	Bioreactor with 10.4 km length, facility on 500 ha of land in Guandong Province, 80t/day of algae	Since 2008 or 2009	Algae schemes		Biocentric Energy Algae LLC (US-American company): Algae-based CO ₂ sequestration, absorbing CO ₂ emitted from factories of the nearby region.	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://www.asiabiomass.jp/english/topics/0911_07.html ; http://biomassmagazine.com/articles/2091/biocentric-energy-to-produce-algae-oil-in-china
Asia	China	Pilot plant for algae culture	Since 2009, maybe longer	Algae schemes		ENN (Chinese innovation group): plans to build a demonstration production plant within 3 years on 100 ha of land (reported in 2009).	http://biomassmagazine.com/articles/2091/biocentric-energy-to-produce-algae-oil-in-china ; http://www.greenmuze.com/blogs/ecogeek/1260-chinese-algae-farming.html

Asia	China	>700,000 km ² , e.g. Hubei Province, Shaanxi Province, Jilin Province	1958 - 2003, 2007	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Central America	Costa Rica	Research & trials on Osa Peninsula	Ongoing ?	Biochar		Forest Trends, an NGO based in Washington DC with offices in Costa Rica: "several national and international partners designed to assess the socio- economic and technical feasibility of using biochar". Main activities (among others): implementing a mini-scale biochar production pilot facility, establishing research plots, analyzing the potential biochar-related revenues such as carbon credits.	http://www.biochar- international.org/9country#costa_rica

Africa	Cote d'Ivoire	2,500 ha of biomass production for Biochar in Niambroun, office in Grand Bassam.	Ongoing ? reported in 2009	Biochar	World Bank, AfDB, FAO, UNDP, UNEP, IFAD, UNIDO, West African Bank for Development, Ivorian National Bureau for technical Study and Development, National Agency for Rural development, Industrial Promotion Services West Africa, Union Bank of Africa, Pronatura international, Winrock, Mali Folkcenter, French Agency for environment and Energy, Kakute Tanzania, Burkina Centre of Forestry Seeds, Wageningen University from Holland, French Institute of research for Development, Brazilian EMBRAPA	Planet Action: "Biochar, a charcoal obtained from agricultural waste via pyrolysis, will offer carbon reduction when used as a combustible, and carbon sequestration when used to enhance soil productivity." Jatropha, moringa and biochar trials on 2,500 ha.	http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf ; http://www.planet-action.org/web/85-project-detail.php?projectID=1390
Africa	Cote d'Ivoire	South Coast, 9,000 km ²	1986 - 1987 from Dec - Apr (further years planned according to WMO report)	Increased Precipitation	University		WMO 1987
Europe	Croatia	>24,000 km ² , Northern Croatia	1970 - 2003	Reduced Precipitation	Government	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.

S-America	Cuba	Camagüey and adjacent provinces, Eastern Cuba	1982 - 1990, 2005 - 2011	Increased Precipitation	Government	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
S-America	DomRep	6,000 km ² target area	1984, May-Aug	Increased Precipitation	Government (Energy)	Project name: Increased stream flow to dams.	WMO 1980
Africa	DRC	Agricultural project in Pimu Region, Equator Province, in 10 villages	2010 - 2013; "ten year project"	Biochar	ADAPEL; Congo Basin Forest Fund	Biochar Fund: Agricultural project, aims at "access to carbon market".	http://www.treehugger.com/green-food/biochar-fund-project-gets-big-financial-boost-from-congo-basin-forest-fund.html ; http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf ; http://www.afdb.org/en/topics-and-sectors/sectors/climate-change/multimedia/biochar-forest-project-drc/
S-America	Ecuador	Canton Pujili, Cotopaxi	at least since 2009	Reduced Precipitation	Private company: Nintanga and Provefrut	Cloud bombing to diminish hail and rain, affecting local communities.	http://www.dailymotion.com/video/xeh7II_ecuador-danos-socio-ambientales-de_news , http://www.inredh.org/index.php?option=com_content&view=article&id=260%3Ademanda-a-brocolera&Itemid=151
Africa	Egypt	Ongoing trials, demonstration and small pyrolysis plant	Ongoing in 2012 (since ?)	Biochar	ProNatura (France)	ProNatura (France): Development of biochar with smallholder farmers in developing countries; pronatura is working to get carbon credits	http://www.pronatura.org/?page_id=521&lang=en ; http://www.new-ag.info/en/focus/focusItem.php?a=963
Africa	Eritrea		1994, 1995, 1997, 1998	Increased Precipitation	Eritrean Ministry of Agriculture	rain enhancement with cloud bombing	http://www.bibliotecapleyades.net/ciencia/ciencia_reich07.htm ; http://panacea-bocaf.org/droughtrelief.htm ; http://www.orgonelab.org/ResearchSummary2.htm
Europe	European Union (16 countries)	Biochar research project, to summarize & connect research in Europe	2012 - 2016	Major research project	European Union	Project name: Biochar as option for sustainable resource management. "This COST Action connects scattered European Biochar research."	http://www.cost.eu/domains_actions/fa/Actions/TD1107

Europe	European Union (53 scientists from 14 institutions and 3 companies from 7 European countries & South Africa)	Southern Ocean, Atlantic, patch of 150 km ²	2004, summer	Ocean fertilization +	European Union	Project name: EIFEX - European Iron Fertilization Experiment. Application of 2,820 kg of Fe (7 t FeSO ₄). Carried out by Alfred Wegner Institute (Germany), with national and international partners.	http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf , http://en.wikipedia.org/wiki/Fe_fertilization ; http://www.whoi.edu/oceanus/viewArticle.do?id=35609 ; http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://epic.awi.de/15162/1/Ass2006c.pdf , http://cis.whoi.edu/science/bcodmo/project.cfm?flag=viewr&id=22&sortby=project ; http://www.etcgroup.org/en/node/4913
N-America, Europe	European Union (Austria, Portugal) USA	R&D next generation biofuel	Ongoing in 2012 (since ?)	Algae schemes	Global Green Solutions, Oxford Catalysts Group PLC	SGC Energia: Transformation of biomass into Fischer-Tropsch products, transforming low value feedstock (algae) into advanced fuels.	ETC Group (2011): The New Biomasssters, page 63 http://www.biofuelsdigest.com/bdigest/tag/sgc-energia/
Europe	European Union (Denmark, Belgium, Germany, The Netherlands, Norway, United Kingdom, Sweden)	Biochar: small-scale research plots (13 partners from 7 countries around the North Sea)	2009 - 2013	Major research project	Supported by European Union INTERREG IVb North Sea Region Steering Group.	Project name: "BioChar: Climate saving soils" aims at raising the awareness and building confidence in biochar as a way of capturing carbon in a stabilized form and increasing soil quality and 'health', with attendant benefits to agriculture. 13 partners from 7 countries around the North Sea work together. Partners: Netherlands: Province Groningen (lead partner), Productschap Akkerbouw/Kiemkracht, Nutrient management Institute, WUR-Alterra Belgium: ILVO, University Gent Germany: HAWK-Applied University, Göttingen; 3N-Werlte Denmark: Risoe University Sweden: University Uppsala Norway: Bioforsk United Kingdom : Scottish Crop Research Institute, university Edinburgh, (UKBRC, United Kingdom Biochar Research centre)	http://www.risoecampus.dtu.dk/Research/sustainable_energy/energy_systems/projects/ECO_BioChar_Interreg.aspx?sc_lang=en

Europe, Asia	European Union (Germany), Malaysia	Agricultural research (& feasibility study ?)	2012 - 2015	Biochar	German Federal Ministry of Education and Research (BMBF)	Project name: "biochar in agriculture - perspectives for Germany and Malaysia": questions effects on the environment and the potential to reduce CO ₂ in the atmosphere. Partners: ATB, ZALF Müncheberg, Humboldt-University Berlin, Technical University Berlin, University Putra Malaysia (UPM)	http://www.idw-online.de/pages/de/news456776 ; http://www.diw.de/sixcms/detail.php?id=diw_01.c.392453.de
Europe	European Union (Hungary, Netherlands, Denmark, Italy, Germany, Spain, United Kingdom, Poland, Slovenia, Ireland)	European Research Project related to Biochar	2011 - 2015	Major research project	European Union	Project name: Reducing mineral fertilizers and chemicals use in agriculture by recycling treated organic waste as compost and bio-char products. (REFERTIL). Project Coordinator: Terra Humana Ltd. - Hungary	http://www.3ragrocarbon.com/3r-project-references ; http://ec.europa.eu/research/bioeconomy/agriculture/projects/refertil_en.htm
Europe	European Union, Austria	>2,000 km ² , e.g. Lower Austria	1981 - 1999, 2002	Increased Precipitation & Reduced Precipitation	Private sponsor (agricultural field)	See Weather Modification Data for details, please.	WMO 1999+2002+1992+2003+2004
Europe	European Union, Bulgaria	Pilot photobioreactor in Varna	Since 2009	Algae schemes		Private company "Greon LLC": provides a "green solution for industrial waste", including greenhouse and toxic gases, waste water and solid waste. Transformation of waste products into valuable products such as biomass, bioethanol, biodiesel, etc. Feeding flue gas (CO ₂ & NO _x) into a bioreactor. Production of microalgae-based oil as an alternative to fossil fuels.	http://www.greon.eu/
Europe	European Union, Bulgaria	> 18,000km ² ; e.g. northern Danube plain and upper Tracian lowland	1969 - 2003	Increased Precipitation & Reduced Precipitation	Government (Agricultural department, Research and Weather Services)	See Weather Modification Data for details, please.	WMO and other sources; See Weather Modification Data for details, please.

Europe	European Union, Czech Republic	Research project to decarbonize flue gas with a 55m ² culture area photobioreactor		Algae schemes	In cooperation with the Fuel Research Institute	Czech Research Academy of Science: Outdoor cultivation of microalgae <i>Chlorella spp.</i> , in a thin-layer photobioreactor. Technologies for microalgal cultivation have been studied in the context of greenhouse gas mitigation. Utilization of CO ₂ in flue gases from various sources by means of microalgae reduce the impact of green-house gas on the environment and makes production of algal biomass cheaper.	http://www.oilgae.com/algae/cult/cos/flu/fl u.html
Europe	European Union, France	Indian Sector of the Southern Ocean (Kerguelen Plateau)	2005, summer: Jan - Feb	Major research project	INSU-CNRS France	Project name: KEOPS 1 & 2 (Kerguelen Ocean and Plateau compared Study). Responsible institute: INSU-CNRS (France). Research related to natural Fe fertilization. Vessel with French, Belgian, Dutch and Australian researchers.	http://ecite.utas.edu.au/54193/ , http://www.insu.cnrs.fr/envFenement/keops2-kerguelen-ocean-and-compared-plateau-study ; http://www.obs-vlfr.fr/proof/vt/op/ec/keops/keo_obj.htm ; http://www.sciencedirect.com/science/article/pii/S096706450800009X ; http://www.techno-science.net/?onglet=news&news=5310 ; http://www.futura-sciences.com/fr/news/t/oceanographie-1/d/fertilisation-de-locean-contre-rechauffement-une-nouvelle-experience_17933/ ; http://www.futura-sciences.com/fr/news/t/vie-1/d/mission-keops-le-printemps-du-phytoplancton-en-pleine-tempete_5565/
Europe	European Union, France	>60,000 km ² , e.g., region of Lucerne, Basin Aquitaine, Vallée de la Loire	1952 - 2003	Reduced Precipitation	Government and private sector (agriculture, insurances)	Project name: Grossversuch IV.	WMO 1980+2003+2004+1992+2002

Europe	European Union, Germany	1,000 m ² photobioreactor and 2 pilot plants for research	2008 - 2011	Algae schemes		Participants: RWE, University of Bremen, Forschungszentrum Juelich GmbH, Phytolutions GmbH. RWE aims to expand the electricity and gas business while reducing its own CO ₂ emissions. Flue gases from the Niederaussem power station are fed into an algae production plant in the vicinity of the station to convert the CO ₂ into algae biomass.	http://www.powerplantccs.com/ccs/cap/fut/alg/alg_proj_rwe.html ; http://www.rwe.com/web/cms/mediablob/en/247480/data/235578/1/rwe-power-ag/media-center/lignite/blob.pdf
Europe	European Union, Germany	Pilot plant using marine algae as CO ₂ sink; research with local partners	Since 2000 (starting with research)	Algae schemes	In cooperation with City of Hamburg & Fraunhofer Institute	EON Hanse (energy producer): Algae production with flue gases of a 350-MW coal-fired power station in Bremen. Goal: to capture 1% of the total emissions of this power station in a closed reactor system within five years.	http://www.powerplantccs.com/ccs/cap/fut/alg/alg_proj_e_on_hanse.html ; http://www.eon.com/en/businessareas/35157.jsp ; http://www.eon-hanse.com/pages/eha_de/Engagement/Green_Capital/Mikroalgenprojekt_Hamburg/Pilotanlage_in_Hamburg-Reitbrook/index.htm
Europe	European Union, Germany	Biochar production capacity 1,250m ³ /year, a larger plant is planned	Since 2009	Biochar		Private company "Palaterra": production and sales of biochar. Product is also used for research but mainly for agriculture; website mentions that product can be used to improve soil while protecting the climate.	http://www.palaterra.eu
Europe	European Union, Germany	Biochar production "in industrial quantities "	Since 2009	Biochar	Schottorf Innovations is a subsidiary of Carbon Terra	Private company "Schottorf Innovations": Sales of biochar produced at their pyrolysis plant in Romania.	http://schottdorf.eu/ ; http://www.carbon-terra.eu/de/home
Europe	European Union, Germany	Biochar production and research	Since 2004	Biochar	Cooperation with the University of Applied Sciences Bingen (Germany) and other research institutions	Private company "Pyreg GmbH": involved in 3 different research projects with University of Applied Sciences Bingen (Germany) and other research institutions, e.g. related to sequestration of CO ₂ or use of biochar in sewage plants.	http://www.pyreg.com/Forschung.html

Europe	European Union, Germany	Sales of biochar production units (capacity up to 12,000 t/ year)	Since 2010	Biochar		Private company "Terra Nova Energy": Units use Hydrothermal Carbonization. Mass throughput of a TerraNova Energy system ranges from 1,200 t to 12,000 t of biomass/year. Since April 2010 sewage sludge is converted into a regenerative coal in the TerraNova Energy demonstration plant at the central sewage treatment plant in Kaiserslautern. Advertised as a medium to save around 2.5 t of CO ₂ emission certificates for each ton of biocoal.	http://www.terranoenergy.com/en/applications.php
Europe	European Union, Germany	Research, including field trials	2009 - 2014	Biochar	German Federal Ministry of Education and Research (BMBF)	Project name: APECS (Anaerobic Pathways to Renewable Energies and Carbon Sinks). Goal: develop a novel process that uses organic wastes to provide both – renewable energy and carbon sequestration. Carried out by ATB Potsdam-Bornim, together with University of Berlin, EU-AGRO-BIOGAS, Biogas Competence Network, Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e.V..	http://www.atb-potsdam.de/hauptseite-deutsch/Forschung/verbuende/apecs/apecs_start_eng.htm
Europe	European Union, Germany	>7,000 km ²	1975 - 2009	Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Europe	European Union, Greece	>5,000 km ² , different Greek provinces	1982 - 2003,	Increased Precipitation & Reduced Precipitation	Public	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Europe	European Union, Hungary	>14,000 km ² , e.g. in Southern Hungary	1976 - 1980, 1991 - 2003	Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO 2003 + 2004 + 2002 +1992 + 1980

Europe	European Union, Italy	Field trials with the goal to mitigate 15% of annual CO ₂ from a 500 MW power plant; "700 ha system"	2007	Algae schemes	EniTechnologie is the R&D arm of Eni (Italian oil & gas company)	EniTecnologie: CO ₂ uptake by <i>Tetraselmis suecica</i> supplied with CO ₂ from turbine flue gas in open and closed systems. Goal: to double biomass productivity. Eni plans to harvest and ferment the biomass (methane) to replace a fraction of fossil methane.	http://www.powerplantccs.com/ccs/cap/fut/alg/alg_proj_eni.html ; http://uregina.ca/ghgt7/PDF/papers/nonpeer/075.pdf
Europe	European Union, Italy	Eng Southern Italy	1975 - 1980, 1985 - 1995, 2001 - 2005	Increased Precipitation & Reduced Precipitation	Government	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Europe	European Union, Netherlands	Designs & manufactures algae growing equipment; cultivates algae at Yerseke.	Since 2007	Algae schemes	KLM (Project for jet fuel from algae), RIG investment	Company AlgaeLink N.V.: Among the products are the following biofuels from algae : Green energy, biodiesel, bioethanol, biogas, bio-oil, and jet fuel. "Ability to sequester CO ₂ & implement as profit making plant. "	ETC Group (2011): The New Biomasssters
Europe	European Union, Netherlands	Demonstration scale project in Rotterdam:	Started in 2010 ?	BECCS	Abengoa Bioenergia.	Rotterdam Climate Initiative: Researching variety of carbon capture options, some are currently in operation. BECCS project: CO ₂ captured from ethanol plant and then pumped through greenhouses.	CO2 Capture and storage in Rotterdam - a network approach 2011 http://www.rotterdamclimateinitiative.nl/en/english_2011_design/50_reduction/projecten/?portfolio_id=70
Europe	European Union, Portugal	Algae growing and production equipment	Since 2000	Algae schemes	INETI (Portugal's National Institute of Energy, Technology and Innovation); Algafuel is a spinout form Necton S.A.; European Union for research purposes	Company Algafuel: "Develops solutions for the industrial production of microalgae. Technology provides CO ₂ mitigation and other greenhouse gases with biomass production."	ETC Group (2011): The New Biomasssters
Europe	European Union, Portugal	District Evora, Castelo Branco, Coimbra	February 2004	Increased Precipitation			http://www.terradaily.com/2005/050223182149.f4orpp13.html
Europe	European Union, Slovenia	>9,000 km ² , e.g. Eastern Slovenia	1972 - 1998, with interruptions	Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.

Europe	European Union, Spain	Large-scale algae farming plant adjacent to a CO ₂ -spewing cement plant near Jerez, Spain	2001 - 2009	Algae schemes	Principal investors: Access Private Equity, Draper Fisher Jurvetson, Polaris Venture Partners. With the Spanish renewable energy firm Aurantia	GreenFuel Technologies Corp. (Cambridge, Massachusetts): In collaboration with the Massachusetts Institute of Technology (MIT), developed a bioreactor to remove NO _x and CO ₂ from emissions.	http://www.ecoworld.com/energy-fuels/factory-farmed-biofuel.html ; http://en.wikipedia.org/wiki/GreenFuel_Technologies_Corporation ; http://gigaom.com/cleantech/15-algae-startups-bringing-pond-scum-to-fuel-tanks/
Europe	European Union, Spain	>10,000 km ² ; e.g. Alava, La Rioja and Navarra Provinces	1970 - 1999 with interruptions	Increased Precipitation & Reduced Precipitation	Government	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Europe	European Union, Sweden	Production of Bone Char	Ongoing in 2012 (since ?)	Biochar		Private company "3R Agrocarbon": Pyrolysis with animal waste. Involved in a research project that aims to define improved compost and biochar standards in the EU27 (according to company website).	http://www.3ragrocarbon.com/bonechar ; http://www.3ragrocarbon.com/3r-project-references
Europe	European Union, Sweden	Field trials, Terra Pretra field (520 m ²), mobile pyrolysis plant, Uppsala	Since 2010	Biochar	Mistra; EU North Sea Inter-regional project "Biochar - Climate saving soils"	University of Uppsala carries out research on a Swedish Terra Pretra field. Further field trials. Uses a mobile pyrolysis plant.	http://www.geo.uu.se/biokol/default.aspx?pageid=37&lan=0 ; http://www.holon.se/folke/carbon/carbon.shtml
Europe	European Union, Sweden	Field trial on carbon rich soils	1996 - 2006	Biochar	Swedish University of Agricultural Science	Responsible person for the field trials: David Wardle of the Swedish University of Agricultural Science.	http://voices.yahoo.com/david-wardle-vs-carbonscape-battle-5301397.html
Europe	European Union, United Kingdom	Pilot scale bioreactor, algae based CO ₂ sequestration demonstration project; 20t of CO ₂ /year	Since 2009 (phase 2 started in 2009)	Algae schemes	"With the support of Shell, Edrington Group and the Scottish Environmental Technology Network we have built Britain's first pilot scale bioreactor"	Glentureet Whisky Distillery & Scottish Bioenergy Ventures: Algae-based CO ₂ sequestration Started as a demonstration project. Expanded in 2009, producing about 6,000 l of biofuel/year - capturing 20 t of CO ₂ . "Commercial-sized" algae reactor system if the expanded demonstration is successful.	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://www.scotlandwhisky.com/news-and-events/Famous-grouse-carbon-capture ; http://news.bbc.co.uk/2/hi/uk_news/scotland/tayside_and_central/8290266.stm

Europe	European Union, United Kingdom	"UK-wide initiative"; "200 people testing biochar"	2012	Biochar	Earthwatch, the Environmental Change Institute (Oxford University), and the UK Biochar Research Centre	Oxford Biochar Ltd: Project name: The Big Biochar Experiment; largest study on the use of biochar on British allotments to date.	http://www.biochar-international.org/profile/bigbiochar ; http://www.oxfordtimes.co.uk/business/profiles/9536533.ls_this_the_answer_to_climate_change_/ ; http://www.bigbiocharexperiment.co.uk/
Europe	European Union, United Kingdom	Research project, Pyrolysis plant under construction in 2012	Since 2009	Biochar	With core funding for five years, sponsored by the Engineering and Physical Sciences Research Council (EPSRC).	"UK Biochar Research Centre seeks to provide an evidence base to support the rational deployment of biochar for the primary purpose of climate change mitigation (particularly carbon abatement), while being driven by an understanding of how the most value can be added to it in terms of soil function."	http://www.biochar-international.org/ukbrc
Europe	European Union, United Kingdom	Pyrolysis plant & research	2010 - 2012 (18 months project)	Biochar	A £180,000 grant from the Welsh Assembly Government.	Aberystwyth University's Institute of Biological, Environmental and Rural Sciences (IBERS): "Innovative strategies for organic waste management, sustainable land management and climate change mitigation are key areas of consideration."	http://www.walesonline.co.uk/go-green/go-green-climate/2010/01/27/aberystwyth-to-build-biochar-facility-91466-25689352/
Europe	European Union, United Kingdom	Production & sales of biochar & biochar kilns	Since 2008, (maybe longer)	Biochar		Private company "Carbon Gold": "Has developed the first ever biochar methodology for calculating emissions reductions from the production of biochar."	http://www.carbongold.com/the-principles
Europe	European Union, United Kingdom	Production and sales of biochar, based in Devon	Ongoing in 2012 (since ?)	Biochar		Private company "Nutrichar": Lumpwood char from Devon trees, infused with certified organic seaweed fertilizer sourced from the UK.	http://www.nutrichar.co.uk/about.php

Europe	European Union, United Kingdom	Climate Model Development	2012-17	Major research project	European Commission: PESH, Seventh Framework program. Project is worth €2,137,014.	Research Institution: Oxford University. Project name: "Towards the Prototype Probabilistic Earth-System Model for Climate Prediction". The development of the prototype Probabilistic Earth-System Model will open a new era of international scientific collaboration on climate model development, and has the potential to influence climate policy, on mitigation, adaptation and on geoengineering, at the highest governmental and intergovernmental levels.	http://cordis.europa.eu/projects/102370_en.html
Europe	European Union, United Kingdom	Research related to Ocean acidification & climate change	Since 2008	Major research project	Shell Research	C-Quest rate : Their idea is to lime to oceans and to develop the technology in an open source way. The main person involved is Tim Kruger, also associated with the Oxford geoengineering institute.	http://www.cquestrate.com/about-us
Europe	European Union, United Kingdom	No testing	2010 - 2012	Major research project	Universities of Leeds, Bristol, Cardiff, Oxford, Lancaster, East Anglia, Met office, NERC, EPSRC	Project name: IAGP - Integrated assessment of Geoengineering Projects. Research carried out by: University of Leeds, Bristol, Cardiff, Oxford, Lancaster and East Anglia.	http://www.iagp.ac.uk/
Europe	European Union, United Kingdom	Look at governance of research, up to and including testing and deployment	Since 2010	Major research project	Royal Society with Environmental Defense Fund and Third World Academy of Science	Project name: SRMGI - Solar Radiation Management Governance Initiative	www.srmgi.org

Europe	European Union, United Kingdom	First test cancelled (Skuthorpe)	2011 - 2013	Major research project	The £1,6 M project, funded by the Engineering and Physical Sciences Research Council (EPSRC) and the Natural Environment Research Council (NERC), supported by the Science and Technology Facilities Council (STFC)	Project name: SPICE-Stratospheric Particle Injection for Climate Engineering. First test of "Trojan Hose" to shoot particles to stratosphere cancelled following activist campaign. Projects aims to evaluate particles, delivery mechanisms and impacts of stratospheric particle injection (SRM). University of Bristol in collaboration with the Universities of Oxford, Cambridge and Edinburgh, as well as military contractor Marshall Aerospace.	http://www.handsoffmotherearth.org/hose-experiment/spice-opposition-letter/ ; http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=EP/I01473X/1
Europe	European Union, United Kingdom	UK Parliamentary committee holds public hearings on the regulation of geoengineering	2010	Major research project	Government	UK committee advocated beginning an international discussion on the regulation of geoengineering, argued against the use of the precautionary principle and said that small scale SRM tests should be allowed!	http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/221/221.pdf
Europe	European Union, United Kingdom	Pilot plant in London (carbon negative cement)	Underway (beginning 2012)	Other	Laing O'Rourke, Rio Tinto Minerals, WSP Group, Imperial Innovations, the Royal Society Enterprise Fund and the London Technology Fund	Novacem: Developed a carbon negative cement.	http://novacem.com/wp-content/uploads/2010/12/Novacem-TSB-case-study_vF.pdf
Africa	European Union, United Kingdom	Crozet Islands, 2,222 km south-east of South Africa	2004 - 2005	Ocean fertilization +	NERC (Natural Environment Research Council, UK)	Project name: CROZEX (=CCROZet natural iron bloom and Export experiment). Application of iron. "At its peak the bloom covers a wide area (400 km x 400 km)."	http://en.wikipedia.org/wiki/Fe_fertilization , http://www.noc.soton.ac.uk/obe/PROJECTS/crozet/index.php

Europe	European Union, United Kingdom	Building model ship, status	Since 2006 (ongoing ?)	SRM	University of Edinburgh building hardware: ships	Cloud Whitening. Work has begun at Edinburgh University in Scotland on the design of practical seagoing hardware for an initial field demonstration. The proposal is to use a fleet of unmanned, wind driven spray vessels equipped with satellite navigation, positioned at suitable points around the oceans. They would sail back and forth across the local wind and drag oversize propellers through the water to act as turbines to generate the energy for spray. Periodically, they would be directed to new positions.	http://event.arc.nasa.gov/main/home/reports/SolarRadiationCP.pdf , page 8
Europe	European Union, United Kingdom	Skuthorpe Air field, Norfolk	2011 - 2012	SRM	The £1,6 million project is funded by the Engineering and Physical Sciences Research Council (EPSRC) and the Natural Environment Research Council (NERC), supported by the Science and Technology Facilities Council (STFC)	University of Bristol in collaboration with the Universities of Oxford, Cambridge and Edinburgh, and Marshall Aerospace. Project name: Stratospheric Particle Injection for Climate Engineering (SPICE). Engineering test hose to deliver particles to the stratosphere as an SRM technology. Test postponed due to civil society opposition.	Campaign website against the experiment: http://www.handsoffmotherearth.org/2011/09/press-release-no-spice-in-our-skies-say-environmental-justice-groups/ http://www.newscientist.com/article/mg21128294.000-geoengineering-trials-get-under-way.html
Europe	former Yugoslavia	>69,000 km ² , e.g. Serbia, Macedonia	1967 - 1994	Reduced Precipitation	Government	See Weather Modification Data for details, please.	WMO 1994 + 1980
Africa	Gambia	Western Region, Bwiam	Ongoing ?	Biochar	Supported by "Concern Universal"	"Small biochar projects", e.g. with jatropha and vetivier grass	http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf

Europe	Ghana	Research project with field trials in Northern Ghana (Gbilugu, Tamale); former field trials in Okwabena (Southern Ghana)	Since 2009	Biochar	Abokobi Society Switzerland; Rothamstead Research; Soil Research Institute of Kumasi; DeCo	Assessment of biochar's potential.	http://www.scribd.com/marylola/d/63513247-Ghana-Biochar-Production ; http://www.biochar-international.org/ghana ; http://www.biochar-international.org/node/923 ; http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf ; http://www.deco-farming.com , http://www.ghananewsagency.org/details/Science/Organic-fertilizer-is-suitable-for-soils-in-the-north/?ci=8&ai=33241 ; http://www.abokobi.ch/47/PROJEKTE/Biochar.html
Africa	Ghana	Research & training farmers to use biochar	Since 2007	Biochar	Council of Scientific and Industrial Research, Ghana; Arroz e Feijão (CNPAP); World Bank	Training local farmers in biochar production using available feedstock like rice husk, rice straw, sawdust, maize stover, and cocoa husk. Biochar workshop in 2011. Funding from World Bank for further research - project title: "Biochar for enhanced soil productivity".	http://www.biochar-international.org/ghana ; http://siteresources.worldbank.org/INTLAC/Resources/africabrazil_eligible_proposals-2010-11-02.pdf
S-America	Guatemala	Guatemala, C. A.: Chixoy River Drainage	1991, 1992, 1994: summer	Increased Precipitation	Sponsor: Empresa Electrica and Instituto Nacional de Electrificación	carried out by North American Weather Consultants, Inc; for hydroelectric power production	http://www.nawcinc.com/Wxmod.pdf ; http://www.nawcinc.com/NAWC%20Operational%20Programs.pdf
Africa	Guyana	Research	Since 2011 or 2012	Biochar	University of Guyana, Faculty of Natural Sciences Department of Chemistry & Faculty of Agriculture and Forestry Department of Chemistry	University of Guyana: Research focus: utilization of biochar for carbon sequestration and land restoration (agricultural and mining sectors)	http://www.biochar-international.org/Guyana

Australia/ Oceania	Hawaii	6 acre demonstration facility in Kona, Hawaii.	Since 2007	Algae schemes	Former joint venture between Shell and HRBP (HR BioPetroleum, Inc.). Since January 2011, HRBP is the sole owner of Cellana. Project stakeholders: University of Hawaii, Hawaiian Electric Company, Maui Electric Company, the National Alliance for Advanced Biofuels and Bioproducts consortium, the U.S. Department of Energy and others.	Cellana: Owns a demonstration facility to grow marine algae and produce vegetable oil for conversion into biofuel. Contract to establish commercial facility signed in 2008 with Hawaiian Electric and Maui Electric companies: CO ₂ from the Ma'alaea plant to an adjacent commercial algae facility.	http://www.oilgae.com/algae/cult/cos/cem/cem.html ; http://cellana.com/news/hr-biopetroleum-to-acquire-shells-shareholding-in-cellana-algae-joint-venture/ ; http://cellana.com/production-facilities/commercial-facility/
S-America	Honduras	Agricultural area, El Cajon Drainage Basins	1948, 1993, 1994, 1995, 1997: summer	Increased Precipitation & Reduced Precipitation	Empresa Nacional De Energia Electrica, United Fruit Company	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Europe	Iceland	Field scale injection of CO ₂ into basalts in Hellisheidi	January 2012	CCS	A combined industrial and academic research program.	Project name: CarbFix. Enhanced weathering (CO ₂). Led by power and utility firm Orkuveita Reykjavikur and the University of Iceland.	http://www.or.is/English/Projects/CarbFix/AbouttheProject/ ; http://www.or.is/English/Projects/CarbFix/Readstory/2290
Asia	India	R&D	Since 2002 ?	Algae schemes	Joint R&D with Renewed World Energies Co.	Company EBTI (Enhanced Biofuels & Technologies India Ltd.): discovered algae species with especially high productivity and oil content.	http://www.ebtiplc.com/ ; http://www.indiabizclub.com/qxzpmd/?q=1ox1susugi5o09qrt ; http://www.asiabiomass.jp/english/topics/0911_07.html

Asia	India	R&D, industrial size planned for the future	Ongoing in 2012 (since ?)	Algae schemes	ACC India is part of the Holcim Group.	ACC India (formerly known as Associated Cement Company) has initiated a project to sequester CO ₂ generated by cement kilns to produce high energy algal biomass, which will then be reused as fuel in its cement kilns. Goal is to harmonize the algal production rate with the CO ₂ emission rates, and ensure recycling of CO ₂ and providing continuous algal biomass fuel for the kiln & power plants.	http://www.oilgae.com/algae/cult/cos/cem/cem.html ; http://www.acclimited.com/newsite/sitemap.asp ; http://www.holcim.com/en/case-studies/acc-india-industrial-farming-of-co2-into-algal-biomass-fuel.html
Asia	India	20 different projects around the country	2009 - 2012	Biochar	Action carbonee, Good Planet; GEO (Geoecology Energy Organization); B*Capital (PNB Paribas); Econhoma; Sai Bhaskar Reddy; Biochar for Carbon Reduction, Sustainable Agriculture and Soil Management (BIOCHARM), UKBRC	There have been a variety of experiments, meetings and seminars and involvement of Indian non-profits with international biochar advocates but accurate information on the scope of activities is not easily accessible.	The summary of biochar projects in developing countries is supplied by the International Biochar Initiative, for a study that was supported by the World Bank, 11 May 2011. Summary available at http://www.biochar-international.org/sites/default/files/IBI_Survey_5-11-11_online.pdf ; http://www.biocharindia.com ; http://www.biocharsoc.org/ ; http://www.biochar-international.org/node/2044
Asia	India	E.g. 1,600 km ² in Maharashtra State	1967, 1973 - 1980, 2003, 2004	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Asia	Indonesia	South Kalimantan, West Java, Soroako area	1979 - 1980, 2005 - 2007	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Asia	Iran	Eng Central Iran	1974 - 1978, 1989 - 1996, 2004 - 2007	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Asia	Iraq	10,000 km ² target area; Mosul	1983	Increased Precipitation	Governmental research	Project name: Precipitation Enhancement in Mosul, Iraq	WMO 1980, http://www.wmo.int/pages/prog/arep/wmp/documents/Cloud%20seeding%20experiments%20in%20Arab%20countries.pdf

Asia	Israel	1,600 m ² pilot plant area within the campus of the Rutenberg power plant, close to Ashkelton	Since 2006	Algae schemes	Land leased from Israel Electric Corporation (IEC)	Private company "Seambiotic Ltd.": Algae cultivation in open ponds using flue gas from the power station. Further pilot plants and larger facilities planned.	http://www.powerplantccs.com/ccs/cap/fut/alg/alg_proj_seambiotic.html ; http://www.seambiotic.com/uploads/Seambiotic%20Ltd.%20-%20Algae%20Pilot%20Plant%20white%20paper.pdf
Asia	Israel	Develops/sells large-scale algae field technology	Ongoing (since ?)	Algae schemes		Private company "Cequesta Alga Ltd.": Company is engaged in large-scale algae field (LSAF) technology. The company's ambition is to design Large-Scale Algae Technology growing micro-algae at very low cost.	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://www.cequesta.com/component/content/article/42-general-info/48-cequesta-algae.html ; http://www.matimop.org.il/company.aspx?code=8635 ; http://www.aardvarkinvestments.com/investments.php
Asia	Israel	16,000 km ² at least, e.g. in Northern Israel	1960 - 2002	Increased Precipitation	Government (Agriculture, Hydrology)	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
S-America	Jamaica	> 11,500 km ² , e.g. Central Jamaica	1976, 1989 - 1991	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Asia	Japan	R&D for a Biofuel plant of 80 t oil/year capacity	Since 2006 (probably longer)	Algae schemes	Thailand's Institute of Scientific and Technological Research (TISTR), DENSO Corporation (global automotive supplier headquartered in Japan)	The institutions mentioned to the left formed a Joint Research Agreement on the "Research and Development of Biofuel Production from Microalgae in Thailand." Plans to use the microalgae <i>Pseudochorocystis ellipsoidea</i> to capture CO ₂ emissions from DENSO factories and to recover biodiesel from the resulting algal biomass.	http://www.asiabiomass.jp/english/topics/0911_07.html ; http://www.plantresearch-bath.org/algae-biotechnology/prof-rod-scott/ ; http://algae-energy.co.uk/algae-companies/japan/ ; http://www.denso.co.th/denso/en/news_article.jsp?lang=en&type=2&id=135
Asia	Japan	Research activities	2010	Biochar		Japan Biochar Association: Provides information, knowledge, technology and social science concerning biochar not only in agriculture, forestry and fishery but also in carbonizing technology, architecture and solution for environmental problems. "We also hope to contribute for the reduction of CO ₂ and pollutants in atmosphere with utilizing charcoal."	http://www.publish.csiro.au/?act=view_file&file_id=SR10006.pdf ; http://www.geocities.jp/yasizato/5subjects.htm

Asia	Japan	NW Pacific Ocean, patch of 80 km ² , NE of Japan	2001, summer	Ocean fertilization +	Japan's Global Environmental Research Fund with some Canadian support	Project name: SEEDS I (Subarctic pacific iron Experiment for Ecosystem Dynamics Study). Application of 350 kg of Fe.	http://en.wikipedia.org/wiki/Fe_fertilization , http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.pices.int/meetings/workshops/2005_workshops/SEEDS%20II/SEEDS_f.pdf ; http://www.etcgroup.org/en/node/4913
Asia	Japan	NW Pacific Ocean, patch of 64 km ² , NE of Japan	2004, summer	Ocean fertilization +	see SEEDS I ??	Project name: SEEDS II (Subarctic pacific iron Experiment for Ecosystem Dynamics Study). Application of 491 kg of iron.	http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf , http://en.wikipedia.org/wiki/Fe_fertilization ; http://www.pices.int/meetings/workshops/2005_workshops/SEEDS%20II/SEEDS_f.pdf ; http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf
Asia	Japan	>500 km ² , e.g. Nigata and Gunma prefectures	1993 - 2002	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO report 1999; 2002, 1996, 1993
Asia	Jordan	>30,000 km ² , e.g. North & West Jordan	1966 - 1999	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Asia	Kazakhstan	Around Astana	1998	Reduced Precipitation	Probably Russia (through ROSHYDROMET)	Carried out by ROSHYDROMET (Russian Agency of Atmospheric Technology): to improve weather conditions for the city.	http://www.wmo.int/pages/prog/arep/wmp/documents/Koloskov_Russia.pdf
Africa	Kenya	Research project in Western Kenya, Nandi district	Since 2005	Biochar		Cornell University: "application for the project to be recognized for carbon trading under CDM or other schemes including the voluntary market"	http://www.biochar-international.org/9country#kenya ; http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf
Africa	Kenya	Various projects in Bungoma District, Western Kenya	2004 - 2012	Biochar	African Christians Organization Network (ACON); Air Terra (Canadian, links to ConocoPhillips), National Geographic.	ACON: Field research. Goal: to train 1,000 farmers or more in biochar production and use.	http://www.biochar-international.org/profile/ACON/Kenya ; http://www.airterra.ca/about-us/team/http://stud.epsilon.slu.se/2572/1/alvum_toll_k_etal_110509.pdf
Asia	Korea, Republic of (South Korea)	> 2,000 km ² , e.g. Kyungnam Province, Gangneung	1995 - 1996, 2000 - 2002, 2006	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO 2002, 1996

Asia	Laos	Pilot project	Since 2011	Biochar	\$4M grant from the Nordic Development Fund and \$600,000 from Vietnam, Laos and Cambodia governments	Carried out by Asian Development Bank: Pilot projects in biogas systems, biochar kilns and improved cooking stoves. "Promoting more efficient use of biomass can simultaneously address the goals of fighting climate change "	http://www.lankabusinessonline.com/indochina/fullstory.php?nid=1666004579 ; http://sea-biochar.blogspot.com/2011/07/adb-agrees-4-mln-grant-to-boost-biomass.html
Africa	Libya	> 60,000 km ² , e.g. Northern Coastal areas	1972 - 2002 with interruptions	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Europe	Macedonia	8,000 km ² target area in 2003; in 1993+1994+1996+1999+2002: 25,000km ²	1971 - 2003 every year; e.g. 20 days in 2003 from May - Sept; 27 days in 1993 from Apr - Oct, 29 days in 1996: from Apr - Oct	Reduced Precipitation	Sponsor: Government	Project name: Hail Suppression Project, no evaluation.	WMO 2003-2004 projects; WMO 1999; WMO 2002, 1993+94, 1996
Africa	Madagascar	>10,000 km ² , e.g. Mahafaly and Androy regions	1980 - 1999 with interruptions	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO 1992, 1999, 1980
Asia	Malaysia	Pilot & research project	2008	Biochar		University of Putra Malaysia: Oil palm residues in the form of empty fruit bunches are successfully pyrolysed to produce biochar in a 20 t/day pilot scale "Carbonator".	https://spreadsheets.google.com/spreadsheets/pub?key=0AqK8nxi8zfEvdHdhQmpuZ1QtclNFZG9vdWVEaTFkOUE&single=true&gid=0&output=html
Asia	Malaysia	Research project	2010 - 2012	Biochar		Malaysian Palm Oil Board: Production and characterization of biochar.	https://spreadsheets.google.com/spreadsheets/pub?key=0AqK8nxi8zfEvdHdhQmpuZ1QtclNFZG9vdWVEaTFkOUE&single=true&gid=0&output=html

Asia	Malaysia	Research project	2012 - 2015	Biochar	German Federal Ministry of Education and Research (BMBF)	Carried out by Leibniz-Institute for Agricultural Engineering Potsdam-Bornim e.V. (ATB) in cooperation with other partners, e.g. University of Putra Malaysia. Project name: "Biochar in agriculture - perspectives for Germany and Malaysia": questions effects on the environment and the potential to reduce CO ₂ in the atmosphere.	http://www.biochar-international.org/node/2979
Asia	Malaysia	>5,000 km ² , e.g. North Perak	1977 - 1980, 1992, 1997 - 2005	Increased Precipitation	Government	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Africa	Mali	Ongoing trials & demonstrations, small pyrolysis plant	Since 2011 at least	Biochar	Altran Foundation	ProNatura (France): "green charcoal project"; "Biochar raises agricultural yields and reverses climate change"; ProNatura works to receive carbon credits for putting CO ₂ "back to ground".	http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf , http://www.pronatura.org/?page_id ; http://www.new-ag.info/en/focus/focusItem.php?a=963=521&lang=en
Africa	Mali	332 flights since 2007, e.g. near the town of Mopti, close to Burkina Faso	2006 - 2011	Increased Precipitation	Government (\$32,5 million from 2006 to 2010); NCAR (National Center for Atmospheric Research)	Carried out by "American consultants", probably Weather Modification Inc. for most/all flights.	http://www.journaldumali.com/article.php?aid=1601 , http://waterlawblog.blogspot.com/2010/06/cloud-seeding-in-mali-multi-million.html , http://www.rap.ucar.edu/projects/westafri ca/http://www.weathermodification.com/projects.php?id=18 ; http://desertification.wordpress.com/2009/10/15/bio-precipitation-or-cloud-seeding-for-faking-snow-in-the-desert-to-boost-rain-irin/ ; http://www.hutchnews.com/Localregional/pilotseeds
Africa	Mauritania	Cloud seeding, e.g. over Nouakchott, Trarza, Adrar and Nouadhibou	reported for 1998, 2009	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.

N-America	Mexico	Commercial scale production capacity planned for 2013 in Mexicali Valley	Since 2011 or 2012	Algae schemes	Aquaviridis is backed by private sector funding and cooperates with OriginOils (technology provider)	Aquaviridis (Minnesota): R&D with plans to scale up to 10 acres of pilot algae production in 2012. Commercial scale production capacity in 2013. Aquaviridis selected the Mexicali Valley as a strategic location due to favorable growing conditions, strong local and governmental support, and available sources of CO2.	http://www.businesswire.com/news/home/20120203005236/en/Algae-Producer-Aquaviridis-OriginOil-Announce-Joint-Commercial
Central America	Mexico	Eng Northern Mexico	1970 - 1984, 1996 - 1999, 2011	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Central America	Mexico	Participated in IronEX-II	1995	Ocean fertilization +	Mexican CICESE-Centro de Investigación Científica y Edu. Superior de Ensenada (among others)	Mexico funded and was involved in IronEx-II	http://www.usc.edu/uscnnews/stories/2203.html ; http://www.etcgroup.org/en/node/4913 (page 14)
Europe	Moldavia	21,250 km ² ; "60% of the national territory"	1964 - 2000, every year; e.g. 31 days in 1999 from May - Aug	Reduced Precipitation	Sponsor: Government (agriculture)	Project name: Prevention of Hail Damage.	WMO 1999 projects; 2000
Asia	Mongolia	Research project	Ongoing ?	Biochar	Partners include the NGOs People Centered Conservation in Mongolia (PCC); the Mongolian Women Farmers' Association (MWFA); and the Snow Leopard Conservation Fund (SLCF); Funding by Australian Embassy.	MoBI: Use of biochar producing stoves and examination of cooperative production of carbon credits from family units.	http://www.biochar-international.org/9country

Asia	Mongolia	> 800 km ²	1990 - 1996	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO 1996, 1993, 1994, 1992, 1996
Africa	Morocco	>16,000km ² , e.g. High Atlas mountains	1980 - 2003	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Australia/Oceania	New Zealand	Future plans to cultivate algae for CO ₂ capture	Since 2010	Algae schemes	In cooperation with UOP (Universal Oil Products).	Aquaflow: Announced project for industrial use of microalgae. Aquaflow has been harvesting wild algae from a municipal waste water site in Blenheim, New Zealand for over 5 years.	http://www.aquaflowgroup.com/projects/sequestering-industrial-waste-demonstration-project ; http://www.asiabiomass.jp/english/topics/0911_07.html
Australia/Oceania	New Zealand	Sales of biochar and pyrolysis plant	Since 2009	Biochar	Ernslaw One (Malaysia), EECA (NZ)	Alternative Energy Solutions Ltd: New Zealand's first demonstration wood pyrolysis plant located in Pukehe. Capacity: up to 100t/day.	http://www.bioenergy.org.nz/documents/publications/Liquid%20Biofuels/KeyPlayers%20in%20NZ%20LiqBio/AES.pdf ; http://www.biochar-international.org/images/April_2009_newletter.pdf
Australia/Oceania	New Zealand	Production of Biochar in Marlborough region	Since 2006	Biochar		Private company "CarbonScape": aims to address the problem of CO ₂ release".	http://www.carbonscape.com/
Australia/Oceania	New Zealand	Lab-research project	2011 (already earlier ?)	Biochar		Lakeland Steel: Pilot pyrolysis plant for sawmill residues at Rotura. Supplied biochar to at least one research project, by Landcare Research/University of Waikato.	http://www.biochar.co.nz/workshop.html ; http://www.lakelandsteel.co.nz/index.php?option=com_content&view=article&id=44&Itemid=73 ; http://www.plusgroup.co.nz/biochar-hydrological-properties.html

Australia/Oceania	New Zealand	Research project: GHG mitigation and carbon trading	2010 - 2013	Biochar	Government (\$1M annually for 3 years)	Participants: NZ Biochar Research Centre at Massey University, with co-chairs Professor Jim Jones and Associate Professor Marta Camps, 6 PhD students and cross-disciplinary collaboration between GNS Science, Landcare Research, Plant and Food Research, AgResearch and the NZ Agricultural Greenhouse Gas Research Centre.	http://biochar.co.nz/Files/2011_Biochar_Final_programme_low_res.pdf ; http://www.waikato.ac.nz/news-events/media/2010/06/Biochar%20benefits%20for%20farmers.shtml ; http://www.nzfarmersweekly.co.nz/cgi-bin/article.cgi?cmd=show&article_id=8622&view=view_printable&border=none
Australia	New Zealand	Hawkei Bay, 400km ²	1995 - 1996: Nov - Feb	Reduced Precipitation	Government	Project name: Small scale hail cannon.	WMO 1996
Africa	Niger	Ongoing trials & demonstrations, small pyrolysis plant close to Niamey	Ongoing in 2012 (since ?)	Biochar	ProNatura (France)	ProNatura wants carbon credits for putting CO ₂ "back to ground".	http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf , http://www.new-ag.info/en/focus/focusItem.php?a=963
Europe	Norway	Research project	2010 - 2013	Biochar	The project is financed by the Norwegian Research Council - Program for renewable energy and capture and storage of CO ₂ (FRIENERGI) in cooperation with UMB, NTNU, and the Universities of Firenze and Zurich.	Bioforsk, in cooperation with University for Life Sciences (UMB): Using miscanthus to test ability of biochar to enhance soil carbon sequestration.	http://www.bioforsk.no/ikbViewer/page/prosjekt/tema?p_dimension_id=23800&p_menu_id=23810&p_sub_id=23801&p_dim2=23806
Europe	Norway	~ 0,7M t/year of CO ₂ have been injected and stored in the Tubåen sandstone	Since April 2008	CCS	Statoil ASA, Petoro AS (Norwegian state direct interest), Total E&P Norge AS, GDF Suez E&P Norge AS, Norsk Hydro, Hess Norge	Global CCS Institute. Project name: Snohvit CO ₂ Injection. Location: Barents Sea, Norway. The project was among the first offshore hydrocarbon developments to entirely consist of sub-sea facilities. Liquefied natural gas is injected under seabed, some 2,600 m beneath the seabed, 45-75 meters thick.	Global CSS Institute, http://www.globalccsinstitute.com/projects/12406

Europe	Norway	~ 1M t/year of CO ₂ is injected into a deep saline formation 8M t injected to date.	Since 1996	CCS		Statoil ASA. Project name: "Sleipner CO ₂ Injection". The world's 1st fully operational offshore gas field with CO ₂ injection and first CO ₂ storage project in a geological layer 1,000 m below the sea floor. CO ₂ is separated from produced gas at the Sleipner T platform and re-injected into the saline formation. Planned maximum injection: 20M t.	Global CCS Institute, http://www.globalccsinstitute.com/projects/12401
Asia	Oman	Feasibility study & cloud seeding in the Dhahirah and Batinah regions	2004, summer	Increased Precipitation	Oman's Ministry of Regional Municipalities, Water Resources and Environment (but NO information available on their website: http://www.omagnet.com/english/commerce/econ11.asp?cat=comm)	"Oman's Ministry announced that his country is exploring rainmaking technology to solve its severe water shortage. Working with the American Institute for Rain Enhancement, Al Sulaimani's department plans to try seeding clouds with silver iodide particles this summer"	http://www.asr.ucar.edu/2004/RAP/precipitation-enhancement.htm ; http://www.source.irc.nl/page/12809 ; http://www.source.irc.nl/page/22957
Asia	Pakistan	Eng in Thar desert, Cholistan, Khuzdar and Baluchistan	1953 - 1956, Jun 2000 – Mar 2001	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
S-America	Panama	2 target areas: 3,620 km ² & 3,290 km ² ; Panama canal, Bayano river	1980 - 1983; e.g. 61 days in 1980 from Jun - Aug	Increased Precipitation	Government	Project name: Emergency project to increase rain in the Panama Canal & region of the Bayano river	WMO 1980
International	Peru	No testing; Expert meeting in Peru	2011, June	Major research project	IPCC, Working groups I, II, III	Joint IPCC Expert Meeting of WGI, WGII, and WGIII on Geoengineering: a platform for exchange and discussion among experts from the different disciplines	http://www.ipcc-wg3.de/meetings/expert-n
S-America	Peru	Upper and middle flow of Mantara River (1992), 9,000km ² (1993)	1992 - 1993: 120 days in 1992, Jan - Mar in 1993	Increased Precipitation	Government	Project name: Modification Artificial Del Tiempo	WMO 1992,WMO 1993

Latin America	Peru	70 ha on 3 mountain tops (surface albedo)	2010	SRM	World Bank	Eduardo Gold, and his company Glaciares Peru won a World Bank competition by claiming that melting glaciers could be replaced by environmentally friendly white paint, in order to maintain the Earth's albedo (reflectivity).	
Asia	Philippines	Eng Visayas, northern Luzon, southern island of Mindanao	1968 - 2005 (probably longer)	Increased Precipitation	Government	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Asia	Philippines	Sulu Sea, 1t of N (Urea)	2007 - 2008	Ocean fertilization +	Ocean nourishment Corporation (ONC)	A campaign by a coalition of civil society groups and Philippine government forced sponsors to cancel experiment but ONC is still open for business.	http://www.etcgroup.org/en/node/5081 ; http://en.wikipedia.org/wiki/Ocean_nourishment
S-America	Puerto Rico	Southern parts and watershed of the Carraizo Dam	1965, 1974	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Europe	Russia	Exact date and location not revealed	2009 Results published	SRM	Institute of Global Climate and Ecology, Roshydromet, Russian Academy of Science, Taifun Scientific Industrial Organization; Central Aerological Observatory	Stratospheric aerosols from ground and helicopters in attempt to measure sunlight scattering for SRM.	< http://www.etcgroup.org/en/node/5073#_ednref > See Chris Mooney, "Copenhagen: Geoengineering's Big Break?" http://motherjones.com/Environment/2009/12/copenhagen-geoengineerings-big-break . See also Yu A. Izrael et al., "Field Experiment on Studying Solar Radiation Passing Through Aerosol Layers", Russian Meteorology and Hydrology, 2009, vol 34, no. 5, pp. 265-273; Chris Mooney, "Copenhagen: Geoengineering's Big Break?" http://motherjones.com/Environment/2009/12/copenhagen-geoengineerings-big-break . See also Yu A. Izrael et al., "Field Experiment on Studying Solar Radiation Passing Through Aerosol Layers", Russian Meteorology and Hydrology, 2009, vol 34, no. 5, pp. 265-273

Asia	Russian Federation - in this case Former Soviet Union	>30,000 km ² , e.g. Georgia, Moldavia, Northern Caucasus	1960 - 2003	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO 1993, 1994, 1980
Asia	Saudi Arabia	>130,000 km ² , e.g. Abha area, Siydah area	1990 - 2011 (possibly with interruptions)	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Africa	Senegal	Field trials. Pyrolysis plant in Saint-Louis Region, Ross Bethio	Since June 2009	Biochar	Société Generale, Green Charcoal International	ProNatura: Ongoing field trials, demonstration and small pyrolysis plant. ProNatura is working to get carbon credits.	http://www.new-ag.info/en/focus/focusItem.php?a=963 ; http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf ; http://www.pronatura.org/wp-content/uploads/2011/12/Green-charcoal-Biochar-2010.pdf ; http://www.new-ag.info/en/focus/focusItem.php?a=963 ; http://www.biochar-international.org/VOA/Senegal ; http://www.biochar-international.org/Pronatura , http://www.steps-centre.org/PDFs/Biochar_web.pdf
Africa	Senegal		2005 - 2011 (possibly with interruptions)	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Europe	Serbia and Montenegro	Serbia, 77,134 km ² target area; 66,000km ² in 1993 & 1996	1967 - 2003 every year; e.g. 54 days in 2003 from Apr - Oct; 80 days in 1999 from Jul - Oct; 72 days in 2002; 39 days in 1993	Reduced Precipitation	Private agricultural sponsor in 2003, Government in 1999, 1993, 1996	Project name: Hail suppression system in Serbia. No Environmental Impact Assessment. Cost & benefit analysis available.	WMO 2003-2004 projects; WMO 1999: WMO 2002, WMO 1996, WMO 1993
Asia	Singapore	Eng in West Kalimantan Province	2006, 2011	Increased Precipitation	Government	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.

Africa	South Africa	Various experiments in Mpumalanga Province; Southern Cape	Ongoing in 2012 (since ?)	Biochar	University of Western Cape; Stellenbosch University; University of Northern British Columbia, SANERI	Alterna Energy ("biocarbon manufacturer"): The study will contribute to scientific knowledge that is important for soil fertility management and improving soil quality and Carbon sequestration in South Africa." Small pyrolysis plants, field trial, feasibility study.	http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf ; http://alternabiocarbon.com/applications/biochar ; http://academic.sun.ac.za/soil/research_projects_hard_hoff_ellis_harp.html
Africa	South Africa	>30,000 km ² , e.g. Nelspruit area	1972 - 1980's, 1991 - 1999	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Asia	Sri Lanka	Construction of a algae facility to sequester CO ₂ generated by cement kilns	Since 2011	Algae schemes	In cooperation with Holcim Lanka	AlgaeTec Ltd.: To sequester CO ₂ generated by cement kilns to produce high energy algal biomass, which will then be reused as fuel in its cement kilns. Using a high-yield enclosed algae growth and harvesting system provided by AlgaeTec. Facility will be built in conjunction with Holcim Lanka Ltd, a cement and building materials company.	http://www.oilgae.com/blog/2008/11/holcim-spanish-cement-plant-gets.html ; http://algaenews.com/2011/12/holcim-lanka-and-algae-tec-launch-first-biofuels-production-facility-in-asia/ ; www.algaetec.com.au
Europe	Switzerland	Eng Lugano Region	1986, around 2004 - 2005	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Asia	Syria	Countrywide, 125,000 - 170,000 km ² , depending on year	1991 - 2002 every year; e.g. In 50 days in 1999 from Jan - May & Nov - April or 18 days in 2002	Increased Precipitation	Government (agriculture)	Project name: Precipitation enhancement project; partly with support from Russia.	WMO 1999 projects; 2000; http://theblanketeffect.blogspot.com/search/label/Middle%20East%20Programs , WMO 1993-94
Asia	Taiwan	Central & Southern Taiwan, Tsengwen Dam Drainage	1992, 1994	Increased Precipitation	Sponsor: Taiwan Central Weather Bureau	Carried out by North American Weather Consultants, Inc: for irrigation water supplies.	http://www.nawcinc.com/Wxmod.pdf , http://www.nawcinc.com/NAWC%20Research.pdf ; http://www.nawcinc.com/NAWC%20Operational%20Programs.pdf , http://www.nawcinc.com/International.pdf

Asia	Tajikistan	Gissar and Vakhsh Valleys	1964 - 2000, every year: during agricultural growing period	Reduced Precipitation	sponsor: Government (Agriculture)	Project name: Hail in Tajikistan.	WMO 1999 projects; wMO 2000
Africa	Tanzania	Field trial (enhanced weathering)	Ongoing according to Negatonnes report in 2011	Other		Shuiling's 'Olivine concepts company: Field trial in Tanzania is utilizing waste olivine from gemstone mining. Addition of ground olivine (or other silicate minerals) to soils (or surface water) to accelerate the natural process of carbonation through dissolution in the soil and in runoff.	http://www.foe.co.uk/resource/reports/negatonnes.pdf ;
Africa	Tanzania		Since 1997 ?	Increased Precipitation		Tanzania imported rain-making technology from Thailand. Aircraft used for cloud seeding.	http://www.weathermodification.com/projects.php?id=10 ; http://theblanketeffect.blogspot.com/search/label/African%20Programs
Asia	Thailand	On national scale	1955 - 2007 with interruptions	Increased Precipitation	Government	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Europe	Turkey	Eng Istanbul watersheds	1990 - 2002, possibly with interruptions	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
Africa	Uganda		1999	Increased Precipitation	Government (Agriculture, Hydrology, Weather services)	Research project.	WMO 1999 projects
Europe	Ukraine	>14,000 km ² , e.g. Crimnea Peninsula, Odessa District	1968 - 2000, every year; e.g. 6 days in 2000 from May - Sep	Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	WMO 2000, 1992
Asia	United Arab Emirates	Abu Dhabi & various other places	1982, 1990 - 1993, 2000 - 2007, maybe longer	Increased Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.

N-America	USA	R&D to develop materials and prototypes for CO ₂ capture	Since 2010 (at least)	Air capture	Columbia University, Arch Venture Partners, Comer Science and Research Foundation	The private company "Kilimanjaro Energy" (New York, San Francisco) is aiming for \$50/t of captured CO ₂ to compete in the enhanced oil recovery market	Negatonnes report p. 15; http://www.foe.c
N-America	USA	Pilot plant erected at SRI International in Menlo Park, California	Since 2009	Air capture	Pilot plant was co-developed with Corning and BASF	Private company "Global Thermostat": Pilot plant captures 1,000 t/year of CO ₂ . Company is negotiating commercial plants with the largest users of CO ₂ for industrial gases and Enhanced Oil Recovery in the world. Plans to introduce its own brand of Renewable Gasoline in Northern America, Hawaii and China.	http://globalthermostat.com/news/sucking-carbon-from-air-carbon-negative-power-plants ; http://globalthermostat.com/news/sucking-carbon-from-air-carbon-negative-power-plants
N-America	USA	Pilot project in NE Oregon, Morrow County	Since 2008	Algae schemes	Cooperation with Oregon State University	Columbia Energy Partners & Portland General Electric: CO ₂ captured from Boardman coal plant. Open algae production system. Plans for a 2 nd trial with a closed system (in cooperation with Oregon State University)	http://www.powerplantccs.com/ccs/cap/fullalg/alg_proj_cep.html ; http://www.portlandgeneral.com/community_environment/initiatives/docs/algae_pilot_project.pdf ; http://www.oilgae.com/blog/2008/09/portland-general-electric-algae-turns.html
N-America	USA	NE Arizona, Cholla Generation Station: 1,000m ² closed system.	Since 2006 (starting with trials)	Algae schemes	Grant from the US Department of Energy for trials to feed algae with CO ₂ coming from its coal-fired electricity plants (in 2009).	Arizona Public Service Company (APS). Project name: Power Plant Emissions to Biofuels. Future plans for an 8 acres algae farm.	http://www.powerplantccs.com/ccs/cap/fullalg/alg_proj_arizona_public.html ; http://www.nrel.gov/biomass/pdfs/sun.pdf ; http://www.greentechmedia.com/articles/read/aps-gets-70.5m-to-feed-captured-carbon-to-algae/ ; http://www.aps.com/_files/renewable/FF010EmissionstoFuelProject.pdf ; http://www.aps.com/main/news/releases/release_415.html
N-America	USA	California: 326 acres "algae centre" in Imperial Valley	Since 2005	Algae schemes		Private company "Carbon Capture Corporation": Company processes algal-derived renewable diesel, butanol, biomethane and jet fuel propellant. Production capacity: 660 pounds/day of dried algae biomass with 7% moisture content, can be expanded to 2,200 pounds/day.	http://www.powerplantccs.com/ccs/cap/fullalg/alg_proj_car_cap_corp.html ; http://www.carbcc.com/

N-America	USA	Colorado: pilot scale photo-bioreactor	Since 2008 (at least)	Algae schemes		Private company "A2BE Carbon Capture LLC": Closed photo-bioreactor. "we expect to move from pilot scale to full scale bioreactor operation within 24 months with our first carbon capture projects within 48 months. "	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://www.algaeatwork.com/
N-America	USA	Louisiana (New Roads): field test at 1,489 MW coal-fueled power plant	Since 2007	Algae schemes		Private companies "NRG Energy, Inc" and "Green Fuel Technologies Corporation": Field testing GreenFuel's proprietary Emissions-to-Biofuels technology at NRG's Big Cajun II, a 1,489-net MW coal-fueled power plant in New Roads, Louisiana. Ultimate goal: construction of a commercial-scale facility, able to recycle enough CO ₂ to yield up to 8,000 gallons of biodiesel / acre annually.	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://www.renewableenergyworld.com/renewable/news/article/2007/04/nrg-energy-testing-greenfuel-technologies-algae-bioreactor-system-48172
N-America	USA	Colorado: Demonstration plant	Since 2007	Algae schemes		Private company "Solix Biofuels, Inc": Sells technology for industrial algae production. Outdoor Biosystem exceeded 3,000 gallons/acre & year in 2010.	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://www.solixbiofuels.com/content/products
N-America	USA	Developed and constructed an operational photo-bioreactor	Since 2009	Algae schemes		RWE - Renewed World Energies Co: Large Scale Photo-Bioreactor System, commercially viable, fully automated, closed system for microalgae production. Using industrial plant emissions (No _x and CO ₂) as a nutrient.	http://www.rwenergies.com/news-events/latest-news/76-a-new-age-in-algae-energy.html
N-America	USA	Lab-scale photobioreactors in Anoka, Minnesota	Since 2008 (at least)	Algae schemes		SarTec Corporation: trials for algae-based CO ₂ sequestration (using flue gas from carbon emitters).	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://www.sartec.com/co2capture.pdf ; http://www.sartec.com/about.html
N-America	USA	Pilot plant in Morrisville since 2009; 3 commercial scale plants since 2011 in Calhoun and Dalton area, GA	Since 2007	Algae schemes		BARD (Biofuel Advance R&D): In-door facilities to produce algae biomass at commercial scale, using flue gas from carbon emitters, as well waste water as nutrient source.	http://www.oilgae.com/club/users/MiaFranceska/blogs/109 ; http://www.bardholding.com/ ; http://www.bardholding.com/?page_id=117

N-America	USA	Commercial biorefinery in Fort Myers, Florida. Capacity : 100,000 gallons of Ethanol/year. 3,000 photo-bioreactors on 17 acres.	Since 2006	Algae schemes	\$25M from the US Department of Energy (2009) for a pilot-scale integrated biorefiner; \$10M economic development incentive grant from Lee County, Florida (2010). Additional \$90M from private funders (2011)	Algenol: patented its own DIRECT TO ETHANOL® technology. Company owns Cyano Biofuels GmbH (molecular biology laboratory) in Berlin, Germany since 2010. Algenol owns as well Algenol Biofuels Switzerland GmbH, located in Zug, Switzerland (research, development and finance). Completion in 2012 :Transforms its pilot-scale biorefinery into a commercial site with a capacity of 100,000 gallons of Ethanol/year.	http://www.algenolbiofuels.com/about-algenol/facilities-locations
N-America	USA	Research study (small-scale)	1978 - 1996	Algae schemes	U.S. Department of Energy's Office of Fuels Development funded a program to develop renewable transportation fuels from algae (Aquatic Species Program)	U.S. Department of Energy: Production of biodiesel from high lipid-content algae grown in ponds utilizing waste CO ₂ from coal fired power plants. The study demonstrated that more than 300 species of algae were well suited to the task. Project was abandoned because of the difficulty in harvesting algae and high cost of energy required to agitate the pond to ensure sufficient algal exposure to sunlight.	http://www.ecoworld.com/energy-fuels/factory-farmed-biofuel.html ; http://www1.eere.energy.gov/biomass/pdfs/biodiesel_from_algae.pdf

N-America	USA	Pilot plant in Alpharetta, GA	Ongoing in 2012 (since ?)	Algae schemes	Private company: Greenshift Corporation	GreenShift Corporation: acquired rights to Ohio University's patented <i>Cyanobacteria</i> based bioreactor process for reducing greenhouse gases emissions from fossil-fuel combustion processes. The algae also absorb NO ₂ and SO ₂ . Prototype is capable of handling 140 m ³ of flue gas per minute, an amount equal to the exhaust from 50 cars or a 3 MW power plant. Future research to determine the operational and economic feasibility of such systems for organic biomass production from the viewpoint of cement industry. This would lead to sequestration of CO ₂ produced from cement manufacturing and production of biofuel as an alternate fuel.	http://www.ecoworld.com/energy-fuels/factory-farmed-biofuel.html
N-America	USA	Algae to Biodiesel demonstration plant in New Port Richey, Florida	Since Nov 2011	Algae schemes	European Union Funded Research Facility.	Private company "Culturing Solutions, Inc": "Implementing Carbon Capture from Ethanol Production, Power Generation, Concrete Manufacturing, and other industrial flue gasses for use in the Phyta-Platform Photobioreactor for cultivation enhancement of algae."	http://www.culturingsolutions.com/index.html??
N-America	USA	Western USA: 5,000 acres for algae cultivation	Since 2008	Algae schemes		Private company "GEOVADA, LLC": 5,000 acres designated for growing algae for production of biodiesel. Local CO ₂ power plant emissions as a growth stimulant for the algae production together with geothermal heat.	http://www.geovada.com/page2/page2.html

N-America	USA	Algae-to-biofuel facility in Rio Hondo, Texas with 1,100 acres of ponds	Since 2008	Algae schemes		Energy company "PetroSun": "Farm consists of 1,100 acres of saltwater ponds, of which all but 20 acres will be dedicated to producing biofuel from algae. The other 20 acres will be used to develop an experimental jet fuel. The facility is expected to produce some 4.4M gallons of algal oil, plus 110M pounds of biomass/year." Plans to expand to several US states, as well as Mexico, Brazil and Australia.	http://www.treehugger.com/renewable-energy/first-commercial-algae-to-biofuels-facility-goes-online.html
N-America	USA	Developed an industrial process to produce different fuels from algae	Since 2008	Algae schemes		Private company "Algaeon Inc (former Stellarwind Bioenergy LLC)": Involved in algae-based CO ₂ sequestration; production of fuels from algae oil with own technology.	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://stellarwindbioenergy.com/?q=About%20Us ; http://www.algaeon-inc.com/?q=node/3
N-America	USA	160 acre development & production facility in Palm Springs, research lab in San Diego		Algae schemes	Cooperation with Clemson University	Private company "Kent BioEnergy Corporation": commercially viable microalgae-based technologies for water pollution remediation, CO ₂ capture, landfill management, and the production of livestock feed additives, fertilizer, and biomass derived energy. Exclusive rights to Clemson University's patented technologies for harvesting and converting microalgae biomass to biolipids.	http://www.oilgae.com/ref/report/co2_capture/co2_capture.html ; http://kentbioenergy.com/index.html
N-America	USA	Technology to produce fuel from Biomass (algae)	Since 2006	Algae schemes	Investors: biodiesel company Imperium Renewables, Cedar Grove Investments, Brighton Jones Wealth Management and undisclosed angel investors.	"Inventure Chemicals": "Algae produced from CO ₂ emissions"	http://gigaom.com/cleantech/15-algae-startups-bringing-pond-scum-to-fuel-tanks/ ; http://www.inventurechem.com/technology_and_services.html

N-America	USA	Algae production in open ponds	Since 2006	Algae schemes	Quercus trust (and others ?)	Private company "LifeFuels": Growing, harvesting and processing algal biomass into fuels and other valuable co-products.	http://gigaom.com/cleantech/15-algae-startups-bringing-pond-scum-to-fuel-tanks/ ; http://www.livefuels.com/pressreleases.htm
N-America	USA	Algae demonstration facilities in California, Florida, Mexico, and Australia	Since 2009	Algae schemes		Private company "Aurora": outdoor production of "highly productive algae" with "yield high concentrations of rich oil".	http://gigaom.com/cleantech/15-algae-startups-bringing-pond-scum-to-fuel-tanks/ ; http://www.aurorainc.com/technology/facilities/
N-America	USA	Algae-to-biofuel factory in Rio Honda, Texas. 1,100 acres ponds	Since 2008 (probably longer)	Algae schemes		Private company "Petro Sun": The algae farm with 1,100 acres ponds. Petro Sun thinks it will make 4.4M gallons of algal oil and 110M pounds of biomass/year.	http://gigaom.com/cleantech/15-algae-startups-bringing-pond-scum-to-fuel-tanks/ ; http://www.petrosuninc.com/
N-America	USA	In California and Maryland	Ongoing in 2012 (since ?)	Algae schemes	BP plc; Biotechnomy LLC; Draper Fisher Jurvetson; Plenus, S.A. de C.V.; ACGT Sdn Bhd; and Meteor Group. ExxonMobil, Genting Group, Life Technologies, Novartis, Biotechnomy, Asiatic Centre for Tenome Technology.	Synthetic Genomics Inc.: Production of biocrude, biogasoline and jetfuel from algae	ETC Group (2011): The New Biomasters
N-America	USA	Total of 7,700 t of CO2 injected to a depth of 870 m in Russel county, Kansas	2003 - 2005	BECCS	University of Kansas, National Energy Technology Laboratory (research institute of the USA Department of Energy).	Final report about the project available on the website of the Kansas Geologic Survey. Considered a failure because of weak Enhanced Oil Recovery results.	Global Status of BECCS Projects 2010, p. 27: http://cdn.globalccsinstitute.com/sites/default/files/publications/13516/gccsi-biorecro-global-status-beccs-110302-report.pdf

N-America	USA	105,000 t of CO ₂ /year in Texas	2009, ongoing in 2012	BECCS	Cooperation with Conestoga Energy Partners	Private project run by Chaparral Energy. The only project injecting CO ₂ from a biotic source. CO ₂ from ethanol plant owned by Conestoga Energy Partners, injected into Texas oil field "Booker North Upper Morrow Field". Plans to expand Enhanced Oil Recovery with injection into more fields in the area.	Global Status of BECCS Projects 2010, p. 28 http://cdn.globalccsinstitute.com/sites/default/files/publications/13516/gccsi-biorecro-global-status-beccs-110302-report.pdf
N-America	USA	140 t of CO ₂ /year in Kansas	Since 2011	BECCS		Ethanol plant "Bonanza Energy". Owned by Conestoga Energy Partners. Operated by PetroSantander Inc.	Global Status of BECCS Projects 2010, p. 29 http://www.globalccsinstitute.com/publications/global-status-beccs-projects-2010/online/27066
N-America	USA	1,000 - 5,000 t of CO ₂ /year	2012	BECCS	See Biorecro website for their partners.	Biorecro & Energy and Environmental Research Centre (at University of North Dakota): Gasification capture, injection into saline formation. Biorecro a leading firm in development of BECCS technologies.	http://www.globalccsinstitute.com/publications/global-status-beccs-projects-2010/online/27066
N-America	USA	Ethanol storage in Illinois; 3,6M t in total, peak rate 1 M t/year, depth of 2,000 m	2011 - 2015	BECCS	Midwest Geologic Sequestration Consortium (MGSC); USDE (Regional Carbon Sequestration Partnership program) and "cost sharing portion by industry partners"	To test CO ₂ storage from Ethanol production. Large scale CO ₂ injection into Mount Simon sandstone formation. Involving 40 academic, industry and NGO partners. The project will not involve Enhanced Oil Recovery.	Global Status of BECCS Projects 2010, p. 30 http://www.globalccsinstitute.com/publications/global-status-beccs-projects-2010/online/27066

N-America	USA	Various producers of biochar or biochar-making technology	2012	Biochar		Private companies: Agri-Tech Producers, Ambient Energy, LLC , Arizona Public Service Company, Avello Bioenergy, Biochar products, Biochar Solutions, Biz solutions, Brooks Pierce, Burdekin Bowen Integrated Floodplain Management Advisory Committee Inc. (BBIFMAC), Carbon Brokers International, Carbon Char.com, Carbon Resources, CoolPlanetBioFuels, Encendia™ Biochar , Eprida, GEK (BEK) Gasifier - All Power Labs, Genesis Industries, HM3, ICM, New Earth Renewable Energy, New England Biochar, Pyrolyzer LLC, Soil Reef , Three Dimensional Timberlands (3DT), Waste to Energy Solutions.	http://www.biochar-international.org/IBI-business-members ; http://terrapreta.bioenergylists.org/company
N-America	USA	1st pilot plant on the forested coast of southwest Oregon	Plant should be running end of 2012	Biochar		Private company "Three Dimensional Timberlands (3DT)": they will construct a three-ton-per-hour fast pyrolysis unit using forest waste.	http://www.biochar-international.org/three_dimensional_timberlands
N-America	USA	Several experimental sites	2011	Biochar	USDA Research priority: Quantify impact of biochar amendments on C sequestration and GHG emissions at larger scale and evaluate interaction with environmental conditions.	Cornell, University of Iowa: "Currently we conduct experiments in the U.S. and Kenya, and through collaborators in China and Paraguay. We have largely completed our work in Colombia, Brazil, and Zambia."	http://www.usda.gov/oce/climate_change/techguide/Denef_et_al_2011_Review_of_reviews_v1.0.pdf ; See http://www.usda.gov/oce/climate_change/techguide/Denef_et_al_2011_Review_of_reviews_v1.0.pdf p. 43; http://www.css.cornell.edu/faculty/lehman/research/index.html
N-America	USA	Production of Biochar	Since 2010	Biochar	In cooperation with Oregon State Uni	Private company "Mr. Miedema" Biochar production: 100 pounds/h --> source for USDA and Oregon State University to carry out experiments. Mr. Miedema plans a 1t/h biochar plant.	http://www.biochar-international.org/profiles/Thompson_Timber

N-America	USA	16 acres on 2 farms in southeastern North Carolina.	Since fall 2009	Biochar	USDA grant, 2009 national Conservation Innovation Grant (CIG)	North Carolina Farm Center for Innovation and Sustainability: "Richard Perritt, the Farm Center's director, believes that acceptance of biochar as a mainstream agronomic practice will be most encouraged by showing improvement in soils and persuading farmers to engage in efforts to combat climate change by sequestering carbon."	http://www.biochar-international.org/profiles/northcarolinafarmcenter
N-America	USA	Biochar by one large-scale poultry producer	Since 2007/08	Biochar	Grants and low-interest loans from several West Virginia state agencies such as the West Virginia Department of Agriculture	Private agricultural holding " Westside Energies": Burning chicken litter (800.000 chicken), producing about 30t of biochar and saving about 4,000 gallons of propane.	http://www.biochar-international.org/Frye/Poultry
N-America	USA	Research projects: field -, lab- and greenhouse experiments	Ongoing in 2012 (since ?)	Biochar		University of Georgia: Research includes "Nutrient and carbon cycling aspects of biochar use".	http://www.biorefinery.uga.edu/carbon%20cycl%20apps%20main.html ; http://www.biorefinery.uga.edu/docs/Steiner%20FPPC2009%2009_10_09.pdf
N-America	USA	Research initiative with 33 members	Since 2011 or 2012	Biochar	3-year, \$500,000 grant from the College of Engineering	"A national panel led by Iowa State University engineers is launching an effort to research and develop technologies that capture, use and sequester carbon while enhancing food production, ecosystems, economic development and national security." Participants represented universities, companies, federal agencies and non-governmental agencies, including the Massachusetts Institute of Technology, ConocoPhillips, the National Renewable Energy Laboratory and the International Biochar Initiative.	http://www.biorenew.iastate.edu/research/icne/ ; http://www.news.iastate.edu/news/2011/nov/carbonnegativepanel , http://www.cset.iastate.edu/research/current-research/biochar/

N-America	USA	Research project including field trials	2011 - 2016	Biochar		"Dr. East (Washington & Jefferson College) is leading a collaborative research effort between Washington & Jefferson College and the Rodale Institute to quantify the effects of biochar on soil biology/fertility and crop yields on the Rodale Institute's Kutztown farm. The first crop harvest is expected to occur in October and we'll be reporting our initial observations this fall/winter."	http://www.rodaleinstitute.org/20090605/biochar , http://www.rodaleinstitute.org/20110802_whats-the-big-deal-with-biochar
N-America	USA	Research projects in the Intermountain West	Since 2008	Biochar	Colorado Department of Agriculture's Advancing Colorado's Renewable Energy - ACRE: in the framework of a program to develop biochar application techniques suitable for pastureland.	Flux farm. Project goal: "Developing biochar best management practices for the Intermountain West", relevant to renewable energy and carbon sequestration development. In collaboration with project partner: Colorado Department of Agriculture, Colorado State University, BEST Energies, Dynamotive Energy Corporation, Aspen Valley Land Trust, Flying Dog Ranch, and The Community Office of Resource Efficiency.	http://www.fluxfarm.com/current-research.html
N-America	USA	680,000 t/year of CO ₂ are captured at Koch N's Enid fertilizer plant	Since 2010	CCS		Koch N Company. Project name: Enid Fertilizer. Location: Northern Oklahoma. CO ₂ is produced and captured at the plant during the fertilizer manufacturing process and then transported for use in Enhanced Oil Recovery. Supply of CO ₂ to the oil fields is being undertaken by Chaparral Energy and other off-take parties.	Global CCS Institute, http://www.globalccsinstitute.com/projects/12561

N-America	USA	Around 7 M t/year of CO ₂ are recovered in Shute Creek gas processing facility. A total of ~23-25 M t of CO ₂ has been injected at the Rangely Oil Field for enhanced oil recovery since 1986.	Since 1986.	CCS	ExxonMobil, ChevronTexaco, Anadarko Petroleum Corporation	Global CCS Institute. Project name: Shute Creek Gas Processing Facility. One of the largest Enhanced Oil Recovery projects in the USA. CO ₂ is recovered from ExxonMobil's Shute Creek gas processing facility and transported by pipeline to several oil fields in Wyoming for enhanced oil recovery. The larger volumes of CO ₂ from the plant are delivered to ChevronTexaco's Rangely Weber oil field (1Mtpa) and Anadarko's Salt Creek oil field (2.4Mtpa). Facility in Shute Creek opened in 2004, expanded in 2010; in 2012 5/18 phases are completed; completion due in 2023.	Global CCS Institute, http://www.globalccsinstitute.com/projects/16606
N-America	USA	~ 5M t/year of CO ₂ are captured from the 1st train of the plant. A total of ~8,5M t/year will be captured when the 2nd train becomes operational.	Since Fall 2010	CCS	In cooperation with Sandridge Energy (gas supplier)	Occidental Petroleum (operator). Name: Century Plant. A total CO ₂ capture capacity of 8.5M t/year expected in 2012. Project includes enhanced oil recovery. 2nd train expected to be in operation in 2012.	Global CCS Institute, http://www.globalccsinstitute.com/projects/16626
N-America	USA	Biochar research	March 2012	Major research project	USDA	32 research projects related to Biochar found, e.g. related to impacts on soil and GHG mitigation	http://www.ars.usda.gov/research/projects.htm (keyword "biochar")

N-America	USA	Cloud Whitening Simulation (Computer Model)	2010	Major research project	Pacific Northwest National Laboratory and National Oceanic and Atmospheric Administration	The PNNL-NOAA research team ran model simulations of aerosol injection using a high-resolution version of the Weather Research and Forecasting (WRF) model to investigate how the injected particles are transported through the marine boundary layer and how they affect the microphysical processes inside clouds. Interactions of aerosols, clouds and rain were studied across several sets of experiments. Each set combined different meteorological and aerosol background conditions observed off the coast of California. The injection of seawater particles was simulated in the model using moving point sources, closely mimicking the behavior of the conceptual seawater spraying vessels.	http://www.physorg.com/news/2011-08-brightening-clouds-atmospheric-scientists-technique.html ; Wang H, PJ Rasch, and G Feingold. 2011. "Manipulating marine stratocumulus cloud amount and albedo: a process-modeling study of aerosol-cloud-precipitation interactions in response to injection of cloud condensation nuclei." Atmospheric Chemistry and Physics 11(9):4237-4249. doi: 10.5194/acp-11-4237-2011
N-America	USA	No testing	2008 - 2013	Major research project	National Science Foundation grant to Rutgers University for \$622275 (Robock)	Evaluation of Suggestions to Geoengineer the Climate System Using Stratospheric Aerosols and Sun Shading, using Godard Space Model.	http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0730452
N-America	USA	R&D	Since 2006	Major research project	NASA, Carnegie-Stanford Institute	Unclear what R&D exactly is going on; observation of stratospheric aerosols. Expert workshop on SRM in California in 2006.	http://event.arc.nasa.gov/main/home/reports/SolarRadiationCP.pdf ; http://www.kiss.caltech.edu/workshops/geoengineering2011/presentations/vernier.pdf
N-America	USA	No testing	Since 2007	Major research project	Bill Gates Fund for Innovative Climate and Energy Research administered by David Keith and Ken Caldeira	A variety of projects, totally US \$4,600,000 in the following areas: climate related technology and policy analysis; modeling the climate system; developing technologies for removing CO2 from the atmosphere; researching approaches to reduce planetary absorption of solar radiation; and holding international workshops to discuss governance for climate intervention technology.	http://keith.seas.harvard.edu/FICER.html

N-America	USA	No known testing	2009 - 2010	Major research project	US Global Change Research Program, which includes 13 US federal government departments (e.g. DOE, DOD, USAID, NASA, EPA, NSF, SI, USDA, DOI).	According to the GAO, \$1,866,000 was directly allocated to geoengineering research (2009 - July 2010), whereas an additional \$200 M was invested in research that was relevant to geoengineering.	http://www.gao.gov/assets/320/310105.pdf , pp 19-21
N-America	USA	Research related to Space Mirrors in Arizona (no known testing)	Ongoing in 2012 (since ?)	Major research project	University of Arizona, with MIT and NASA	The plan would be to launch a constellation of trillions of small free-flying spacecraft a million miles above Earth. The spacecraft would form a long, cylindrical cloud with a diameter about half that of Earth, and about 10 times longer. About 10 % of the sunlight passing through the 60,000-mile length of the cloud, would be diverted away from our planet.	http://uanews.org/node/12812 ;
N-America	USA	No known testing, California	2011 - 2012	Major research project	KISS: Keck Institute for Space Studies	While some papers are available online the KISS won't tell workshop proceedings are confidential - but all participants need to agree to their release! Relates to US Global Change Research Program. Invitation only workshop to assess geoengineering research needs in order to advance technical development.	Very interesting presentation which reviews pertinence of several ongoing research programs see; http://www.kiss.caltech.edu/workshops/geoengineering2011/presentations/workshop_goals.pdf
N-America	USA	Public hearings in Washington	2010	Major research project	US Congressional Committee on Science and Technology	The US committee advocated more research and international coordination of geoengineering research as well as ongoing collaboration with the UK committee on such matters.	http://science.house.gov/hearing/subcommittee-energy-and-envFement-hearing-geoengineering ; http://science.house.gov/hearing/full-committee-hearing-geoengineering ; http://www.gpo.gov/fdsys/pkg/CHRG-111hrg62619/pdf/CHRG-111hrg62619.pdf

N-America	USA	Marine manipulation experiments on open ocean with barrels and pipes	2008 - 2010	Other	Atmocean	Atmocean was working on ocean upwelling and downwelling as a geoengineering strategy (increasing plankton growth from mixing water layers rich in nutrients with layers poor in nutrients) until 2010 but seems to have converted its business into generating electricity from waves, using a similar technology.	http://www.youtube.com/watch?v=nidh8WcHs3s&context=C39dfc20ADOEgsToPDskIDvab5hr_Nmv8KyX60NDZB
North America	USA	Southern Ocean, New Zealand, South of AFP, patch of 225 km ²	2002, summer	Ocean fertilization +	National Science Foundation, the Department of Energy, and the US Coast Guard	Project name: SOFEX-S (Southern Ocean)	http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf , http://en.wikipedia.org/wiki/Fe_fertilization ; http://www.whoi.edu/oceanus/viewArticle.do?id=35609 , http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.mbari.org/expeditions/SOFEX2002/history&purpose.htm
North America	USA	Southern Ocean, New Zealand, North of AFP, patch of 225 km ²	2002, summer	Ocean fertilization +	National Science Foundation, the Department of Energy, and the US Coast Guard	Project name: SOFEX-N (Southern Ocean)	http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf , http://en.wikipedia.org/wiki/Fe_fertilization ; http://www.whoi.edu/oceanus/viewArticle.do?id=35609 , http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.mbari.org/expeditions/SOFEX2002/history&purpose.htm
N-America	USA	Between SOFEX in the Southern Ocean and SERIES in the Gulf of Alaska	2002	Ocean fertilization +		Private company: Planktos Foundation: Dumped Fe containing paint pigments into the North Central Pacific along a 50 km transect East of Hawaii (Non - HNLC waters).	http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf

N-America	USA	Alaska, Arizona, California, Colorado, Dakota, Georgia, Idaho, Illinois, Iowa, Kansas, Michigan, Montana, New Mexico, New South Wales, Nevada, Oklahoma, Oregon, Texas, Utah, Washington, Wyoming	1911 - 1914, 1950 - 2012	Increased Precipitation & Reduced Precipitation	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
N-America	USA	Developing hardware (nozzle)	2010	SRM	Armand Neukermann, Bill Gates	The Silver Lining Project. Status of project is following a wave of unwelcome publicity.	http://www.guardian.co.uk/env/Fement/2010/may/14/bill-gates-cloud-whitening-dangerous; http://www.handsoffmotherearth.org/2010/05/bill-gates-funds-field-trial-global-coalition-urges-immediate-halt-to-geoengineering/
N-America	USA	California, off coast of Monterrey	2011: July	SRM		E-PEACE Eastern Pacific Emitted Aerosol Cloud Experiment. Lead Institution: University of California San Diego (UCSD), CoPIs and Collaborating Institutions: John H. Seinfeld, California Institute of Technology (CIT), Bruce Albrecht, University of Miami (UM), Armin Sorooshian, University of Arizona (UA), Center for Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS). Twin Otter aircraft with a full payload of instruments to measure particle and cloud number, mass and composition distributions.	http://aerosols.ucsd.edu/E_PEACE.html

N-America	USA	Biochar production in Golden, Colorado	Since 2009	Biochar		Private company "Biochar Engineering Corp": Development of smaller scale modular units to produce Biochar. "BEC's core mission is to accelerate the creation of the biochar industry. Fournier believes that it will take several years of field-scale agricultural trials before the biochar market will really take off and reach its full potential of gigaton-scale carbon sequestration."	http://www.biochar-international.org/BEC ; http://www.biocharengineering.com/
N-America	USA	1,3M t of CO ₂ is re-used. Enhanced oil recovery.	Since 1972	CCS		Val Verde Natural Gas Plants (formerly Sharon Ridge). Location: Texas. CO ₂ is captured from 5 gas processing facilities. Once captured, dehydrated and compressed, the CO ₂ is transported via the Val Verde and CRC pipelines to the Sharon Ridge oil field for enhanced oil recovery. Secondary sinks for the CO ₂ are the SACROC, Cogdell and Reinecke floods.	Global CCS Institute, http://www.globalccsinstitute.com/projects/16616
N-America	USA (15 international research institutions involved, including 9 US & 2 British)	64 km ² patch of near the Galapagos Islands (equatorial Pacific HNLC waters - 972 km west of Ecuador)	1993, fall	Ocean fertilization +	US Office of Naval Research and the US National Science Foundation	Project name: IRONEX I; first open ocean fertilization experiment; 1 application of 450 kg of Fe.	http://chemoce.mlml.calstate.edu/past.htm#Feex1 ; http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf (e.g. pages 24+53); http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf ; http://www.etcgroup.org/en/node/4913
N-America	USA, Chile, Suriname	Bioreactor demonstration facility in Florida, Chile and Suriname.	Since 2006	Algae schemes	Asesorias e Inversiones Quilicura (Chile), EcoFrontier (Korea), Foster Wheeler (USA)	Parabel (former PetroAlgae): Biocrude from algae for Diesel, Jet Fuel, Gasoline, Bunker Oil.	http://www.parabel.com/ , ETC Group (201
N-America, S-America	USA, Ecuador	100 t of Fe; Pacific Ocean, near Galapagos Islands	2007	Ocean fertilization +		Private company: Planktos plan to dump Fe and then sell carbon offsets was scuttled by activists from Ecuador.	http://www.etcgroup.org/en/node/637 ; http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf

N-America, Asia	USA, Israel	Main research centre in Ashdod.	Since 2008	Algae schemes	Raanan, Endicott Biofuels, Israeli Electric Company	TransAlgae Ltd.: Oil from algae. Company is based in Texas. Most of the activities related to Algae in Asdod (Israel). Production of "enhanced algae".	ETC Group (2011): The New Biomasssters
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Europe	USA, Peru, Chile, United Kingdom	Experiment involving 5 aircrafts, 2 ships, 2 surface sites in Chile	2008	SRM	<p>Department of Atmospheric Sciences, University of Washington, Seattle, USA; UCLA, Los Angeles, USA; Woods Hole Oceanographic Institution, USA; University of Hawaii, Honolulu, USA; Rosenstiel School of Marine and Atmospheric Science, University of Miami, USA; School of Earth, Atmospheric and Environmental Sciences, University of Manchester, UK; Brookhaven National Laboratory, Upton, USA; NOAA Earth System Research Laboratory, Boulder, USA; Departamento de Geofisica, Universidad de Chile, Chile; Instituto del Mar del Peru, Peru; NOAA Pacific Marine Environmental Laboratory, Seattle, USA; Dept. of Applied Environmental Science (ITM), Stockholm University, Sweden; Scripps Institution of Oceanography, University of California, San Diego, USA; Oregon State University, Corvallis, USA; North Carolina State University, Raleigh, USA; Department of Meteorology, University of Reading, UK; L'Institut de Recherche pour le</p>	<p>Major experiment to understand aerosols and clouds that is directly relevant to geoengineering . The VAMOS Ocean-Cloud-Atmosphere-Land-Study-Regional-Experiment (VOCALS-REx VOCALS-REx) involved 5 research aircraft, 2 ships and 2 surface sites in northern Chile. VOCALS-REx took place during October and November 2008, engaging over 150 scientists from 40 institutions in 8 nations.</p>	<p>http://aerosols.ucsd.edu/papers/Wood2011.pdf</p>
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N-America	USA, South Africa	Biodiesel plant in Odessa. 500 acre Algae farm under construction. Biodiesel reactors in South Africa	Since 1990`s	Algae schemes	De Beer Fuels Ltd.	Green Star Products, Inc: Biodiesel from algae. Plans to establish a 500 acre algae farm (announced in 2008). 9 months of algae farming (trials) in 2007. Signed agreement with De Beers Fuel Ltd to build 90 biodiesel reactors in South Africa.	http://www.greenstarusa.com/ ; ETC Group
Europe; N-America	USA, United Kingdom	Laboratory ?	Since 2010	SRM	Funded by Bill Gates	Cloud whitening: Armand Neukermans, an inventor and investor, is funded to develop a nozzle in order to spray sea water into clouds.	http://giving.stanford.edu/get/file/g2sdoc/highlights/W111_Neukermans_P4.pdf ; http://www.guardian.co.uk/ENVFement/2010/may/14/bill-gates-cloud-whitening-dangerous
Asia	Uzbekistan	>5,000 km ² , e.g. Kashkadarya River, Namangan District, Fergana Valley	1969 - 2003	Reduced Precipitation	Sponsor: Government (Agricultural department)	See Weather Modification Data for details, please.	See Weather Modification Data for details, please.
S-America	Venezuela	Venezuela's southeastern territories: Huri basin, Rio Uribante basin, Andes, Rio Tui basin	2009 - 2011	Increased Precipitation	Government	Project name: La siembra de nubes. Operator: Hidromet Chile.	http://www.globalpost.com/dispatch/venezuela/100202/rain-cloud-bombing , http://www.rnv.gov.ve/noticias/index.php?act=ST&f=14&t=117011 ;; http://www.minamb.gob.ve/index.php?option=com_content&task=view&id=2195&Itemid=43 , http://www.hidromet.cl/experiencia.html , http://www.hidromet.cl/clientes.html
Asia	Vietnam	Pilot project	Since 2011	Biochar	\$4M grant from the Nordic Development Fund and \$600,000 from Vietnam, Laos and Cambodia governments.	Carried out by Asian Development Bank: Pilot projects in biogas systems, biochar kilns and improved cooking stoves. "Promoting more efficient use of biomass can simultaneously address the goals of fighting climate change."	http://www.lankabusinessonline.com/indochina/fullstory.php?nid=1666004579 ; http://sea-biochar.blogspot.com/2011/07/adb-agrees-4-mln-grant-to-boost-biomass.html
Asia	Vietnam		1967 - 1972	Increased Precipitation	US Department of State and Department of Defense	"Operation Popeye" used cloud seeding as a means of warfare during Vietnam war, to drown out transport and crops.	http://en.wikipedia.org/wiki/Operation_Popeye

Africa	Zambia	Eastern Zambia, 300 farmers involved	Since 2006	Biochar	Cornell; WCS, COMACO	Scientific trials related to Biochar.	http://www.biofuelwatch.org.uk/docs/biochar_africa_briefing.pdf
Africa	Zimbabwe	390,757 km ² target area, Harare in 2003; in 1999 countrywide	1968 - 2003 with interruptions; e.g. 70 days from Dec 03 - March 04	Increased Precipitation	Sponsor: Government (meteorological services)	Project name: NASCO - National Cloud Seeding Operation); "evaluation carried out before project implementation".	WMO 2003-2004 projects; WMO 1999
		Sub-tropical NE Atlantic ocean, 2 patches of 25 km ²	2004, spring	Ocean fertilization +		Project name: FeeP; 1,840 kg of Fe (5 t of FeSO ₄), 20 t of PO ₄ .	http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf
		Eastern Mediterranean, patch of 16 km ²	2002, spring	Ocean fertilization +		Project name: CYCLOPS. Application of PO ₄ .	http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf
International	USA, France, China, Netherlands	Research consortium with the intention to carry out ocean fertilization experiments in future	Since 2011	Major research project	ISIS Consortium. Full list of universities participating: http://isisconsortium.org/fileserver.do?id=75364&pt=2&p=79886	It is a research consortium to do in-situ ocean fertilization experiments.	http://groups.google.com/group/climateintervention/msg/448ee85ffb2670b0 ; http://www.who.edu/ocb-fert/page.do?pid=38315
International	USA	No testing	2010 - 2013?	Major research project	Rutgers; Stanford; Max Plank; Met Office; Lawrence Livermore; King Abdullah University; Exeter; LSCE: http://climate.envsci.rutgers.edu/GeoMIP/leaders.html	GeoMIP - Geoengineering Model Intercomparison Project: GeoMIP serves to organize geoengineering simulations by prescribing the experiments which all participating climate models will perform.	http://climate.envsci.rutgers.edu/GeoMIP/publications.html ; http://climate.envsci.rutgers.edu/GeoMIP/about.html

International	West Africa, Australia, India, USA (Florida), and other countries	Implementation phase	Ongoing in 2012 (since ?)	Other		The global cooling project: Cooling the plant by increasing size of clouds, "most promising region is West Africa". Supported by Peter Cox, Exeter University. In cooperation with University of Wales, Centre for Ecology and Hydrology, People and Water (NGO)	http://www.theglobalcoolingproject.com/project/project.shtml
International	European Union (Germany); India (with 50 scientists from Germany, India, Italy, Spain, Chile, France and Britain)	Scotia Sea; patch of 300 km ² of the SW Atlantic Ocean (between Argentina & Antarctic Peninsula)	2009: 39 days, spring	Ocean fertilization +	Alfred Wegner Institute (Germany). Further sponsors?	Project name: LOHAFEX. Application of 10 t of FeSO ₄ .	http://www.etcgroup.org/upload/publication/pdf_file/etcspecialreport_rsgeoeng28aug09.pdf ; http://en.wikipedia.org/wiki/Fe_fertilization ; http://www.nature.com/news/2009/090109/full/news.2009.13.html , http://ksjtracker.mit.edu/2009/01/28/telegraph-deutsche-welle-times-of-india-off-antarctica-a-team-gets-a-green-light-to-grow-algae-to-sop-up-co2-other-geoengineering-news/ ; http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf
International	13 institutions	East Equatorial Pacific: 72 km ² patch	1995, summer	Ocean fertilization +	Britain, Mexico and the USA with the majority of resources provided by the US government – the National Science Foundation (NSF) and the US Office of Naval Research	Project name: IRONEX II, total of 450 kg of Fe; fertilized serially 3 times during 1 week.	http://en.wikipedia.org/wiki/Fe_fertilization , http://chemoce.miml.calstate.edu/past.htm#Feex1 ; http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.usc.edu/usnews/stories/2203.html ; http://www.etcgroup.org/en/node/4913

International	Researchers from ~ 20 organization	Sub-Antarctic ocean, 250 km from New Zealand, 50 (100?) km ² test area	2004, fall	Ocean fertilization +	Diverse international sponsors, e.g. "The New Zealand component of this work is sponsored by the Foundation for Research, Science and Technology".	Project name: SAGE (SOLAS Air-sea Gas Experiment). Addition of 2.100 kg of Fe (5,4 t FeSO ₄).	http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf , http://www.pices.int/meetings/workshops/2005_workshops/SEEDS%20II/SEEDS_f.pdf ; http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.niwa.co.nz/oceans/research-projects/sage ; http://www.niwa.co.nz/our-science/oceans/research-projects/all/sage/sage
International	Australia, Canada, European Union (United Kingdom), New Zealand, USA	Southern Ocean, Australian Sector, patch of 50 km ²	1999: Jan - Mar (summer)	Ocean fertilization +	European Union's CARUSO (Uptake Southern Ocean) project and 2 CO ₂ private companies (UK & Australia)	Project name: Southern Ocean Iron Release Experiment – SOIREE. Application of 1,740 kg Fe. Original patch of 50 km ² expanded to 150 km ² .	http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf , http://en.wikipedia.org/wiki/Fe_fertilization ; http://tracer.env.uea.ac.uk/soiree/ ; http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.etcgroup.org/en/node/4913
International	Scientists from 15 different countries	Southern Ocean, Atlantic Sector, close to Cape Town (South Africa), patch of 38,5 km ²	2000, spring	Ocean fertilization +	German Ministry of Research and Technology (BMBF), along with the European Union, the Netherlands and the UK	Project name: EisenEX; application of 2,350 kg Fe (4 t of FeSO ₄).	http://en.wikipedia.org/wiki/Fe_fertilization ; http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.etcgroup.org/en/node/4913
International	Among the countries involved: Canada (4 universities), New Zealand, China and Japan.	NE Pacific Ocean (Gulf of Alaska), patch of 77 km ²	2002, summer	Ocean fertilization +		Project name: SERIES (Subarctic Ecosystem Response to Fe Enrichment Study); 490 kg of Fe.	http://en.wikipedia.org/wiki/Fe_fertilization ; Boyd et al., 2004; http://www.cbd.int/doc/publications/cbd-ts-45-en.pdf ; http://www.etcgroup.org/en/node/4913 ; http://www.tos.org/oceanography/issues/issue_archive/issue_pdfs/22_3/22-3_strong.pdf