INNOVATE

Reaching Aichi Targets by stakeholder-based land-use adaptation

The transformation of the São Francisco River into the Itaparica Reservoir in Pernambuco state, Brazil, led to pronounced changes in land-use patterns in the area with increased grazing pressure on existing Caatinga dry forests, the spread of irrigation farming schemes and unsustainable aquaculture. The INNOVATE project aimed at promoting the conservation and the sustainable management of Caatinga dry forests in the area

Northeastern Brazil represents one of the most densely populated dry regions of the world and is particularly affected by land use and climate change. At the same time it harbours a unique biodiversity known as Caatinga (white forest). Plant diversity and related carbon sequestration are expected to mitigate the consequences of land use and climate change (Millenium Ecosystem Assessment 2005). The INNOVATE project aimed to develop novel approaches for sustainable use of water and soil in semi-arid regions within the model area of Itaparica Reservoir, in the Submedium Region of the São Francisco River. Based on the results, land-use options were adapted and implemented in the study region. The project collaborated with a diverse network of stakeholder organizations from the local to the global level. Due to this integrated and transdisciplinary approach, the project may exemplify a novel type of scientific projects that explicitly addresses the varying demands of civil society in cooperation with major stakeholder groups.

Not all five Strategic Goals are covered due to the following reasons:

We focus here on the main aspects of the INNOVATE project. In addition, the strategic goals A and E are addressed by the project within the implementation strategy which includes mainstreaming biodiversity across governments and society and enhancing implementation of acitivities.

B

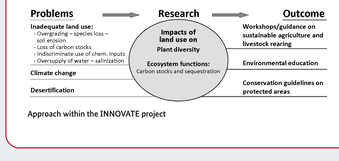
Stakeholder involvement and implementation strategy

The collaboration with stakeholders was a fundamental pillar during all project phases. As a starting point, a stakeholder analysis, combined with a constellation analysis, served for understanding the local situation of natural resource management. The group developed an implementation strategy which comprised the presentation of project results at national and global scale, including the three following work fields at local scale:
(1) Workshops/guidance on sustainable agriculture and livestock rearing: The current situation and possible options for more sustainable agricultural practices were discussed with representatives of farmer associations, experts from rural extension services and education systems, and secretaries of the municipalities.
(2) Environmental education: To raise awareness about environmental issues, INNOVATE organized different events on environmental education for stakeholders including pupils and teachers. During each event, the project was introduced and an overview on important environmental issues and possible solutions was offered in an interactive way.
(3) Conservation guideline for protected areas: The negative impact of heavy grazing on Caatinga diversity and carbon storage highlights that protected areas, i.e., sites where nature can develop without major anthropogenic disturbance, are of pivotal importance for the conservation of biodiversity and ecosystem functioning in the region. Project results support the establishment of new and improved management of existing protected areas in the study region. The project provided assistance for organization of the workshops and a conservation guideline to the respective local and national governmental bodies, the rural extension service offices, and a local NGO.

To ensure biodiversity conservation, the INNOVATE project aimed at promoting the sustainable management of Caatinga dry forests, agricultural areas and water bodies in NE Brazil

The project supported sustainable agriculture, environmental education (addressing Strategic Goal A1) and the establishment of protected areas in collaboration with the relevant stakeholders of the region. Local assessments and regional modeling were combined using a decision support approach.

To decrease the rate of loss of natural habitats such as forests, the project assessed the population structure of the most important trees in the area. These tree species showed sufficient regeneration irrespective of grazing and caatinga dry forests were overall increasing during the last decade (Schulz et al. 2016). However, species number in forests with historic human impact remains low and endangered tree species such as umbuzeiro require specific conservation activities.



Approach within the INNOVATE project

C

Genetic diversity of umbuzeiro

We analysed genetic diversity of the cultural key stone species umbuzeiro (Spondias tuberosa Arr. Câm.) in the study area and related it to land use and geographic distance. Umbuzeiro showed a clear decline in genetic diversity when comparing the current seedling generation and the adult generation. Highest diversity was found in preserved Caatinga; lowest diversity was related to long-term historic land use. The current land use pronouncedly influenced gene flow among populations with new river arms forming genetic barriers. The genetic patterns may explain the low natural regeneration of the species in the study area. Overall, mantaining gentic diversity which is pivotal for the survival of the species is a relevant conservation goal and was therefore included in the conservation strategy for the study area.

To counteract the loss of genetic diversity of cultivated plants, we analyzed the population genetics of the semidomesticated fruit tree umbuzeiro. The tree species show extremely scarce natural regeneration. Current land use clearly reduced genetic diversity in the species. To minimize genetic erosion, enrichment planting schemes for the species are necessary. Areas with particularly high genetic diversity are part of the system of protected areas proposed by the INNOVATE project.

Unbiased genetic diversity values of adult (green) and seedling (orange) generation

D

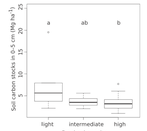
Heavy grazing deteriorates the soil carbon stocks of Caatinga forest ecosystems in Brazil

Grazing by domestic ungulates can have substantial impacts on forests in arid and semi-arid regions, possibly including severe loss of carbon from the soil. Predicting net livestock impacts on soil organic carbon stocks remains challenging, however. We aimed at better understanding grazing effects on soil organic carbon in seasonal tropical dry forests of northeastern Brazil (Caatinga). Therefore, we analyzed soil organic carbon on 45 study plots located in the vicinity of the Itaparica Reservoir. Livestock (mainly goats and cattle) are unevenly distributed in the studied ecosystem, thus grazing intensity was accounted for based on the weight of livestock droppings per square metre and classified as no or light, intermediate, or heavy grazing. The mean soil organic carbon in the area was 18.45 ± 1.37 Mg/ha C with approximately one-quarter found in the upper 5 cm of the soil profile (4.57 ± 0.46 Mg/ha C) and the remainder (13.72 ± 1.04 Mg/ha C) in greater soil depths (> 5 cm) . Heavy grazing led to significantly lower soil organic carbon stocks in the upper 5 cm, whereas no effect on soil organic carbon of the soil overall or in greater soil depths was detectable. Our findings show that grazing causes substantial release of carbon from Brazilian dry forest soils, which was addressed by INNOVATE by recommending improved grazing management (e.g. via a legally compulsory rotation system).

To safeguard ecosystem services, INNOVATE transferred knowledge on ecosystem functions and services to relevant stakeholders. In particular, ecosystem functions such as carbon sequestration and pest control by herbivore predators were assessed.

Amphibians and reptiles are relevant predators of pest insects in agricultural areas and Caatinga dry forests. The current grazing regime with harvest of ground vegetation and intense grazing at ponds decreases species number of predators (amphibians and reptiles).

Heavy grazing significantly deteriorated soil carbon stocks of the upper 5 cm in the study area. INNOVATE proposed adaptations of the existing grazing regime and a reduction of animal loads to intermediate levels to counteract carbon losses and desertification.



Soil organic carbon stock in the upper 5 cm of Caatinga soils at different grazing intensities. Different lowercase letters indicate significant differences (Tukey's HSD test)

IMPRINT

Friedl MA, Sulla-Menashe D, Tan B, Schneider A, Ramankutty N, Sibley A, Huang X (2010) MODIS Collection 5 global land cover: Algorithm refinements and characterization of new datasets, 2001-2012, Collection 5.1 IGBP Land Cover. Boston University, Boston.

Hijmans RJ, Cameron SE, Parra JL, Jones PG, Jarvis A (2005) Very high resolution interpolated climate surfaces for global land areas. Int J Climatol 25:1965–1978.

IBGE (2015) Geoscientific catalog of the Instituto Brasileiro de Geografia e Estatística. http://www.ibge.gov.br/english/geociencias/default_prod.shtm#REC_NAT, Accessed 24 June 2015

Millenium Ecosystem Assessment (2005) Ecosystemsand Human Well being: Biodiversity Synthesis. – World Resources Institute, Washington D.C.

Schulz C, Koch R, Cierjacks A, Kleinschmit B (2017) Land change and loss of landscape diversity at the Caatinga phytogeographical domain – Analysis of pattern-process relationships with MODIS land cover products (2001–2012). J Arid Environ 136:54–74.

Schulz K, Voigt K, Beusch C, Almeida-Cortez JS, Kowarik I, Walz A, Cierjacks A (2016) Grazing deteriorates the soil carbon stocks of Caatinga forest ecosystems in Brazil. Forest Ecol Manage 367:62–70.

The poster template was provided by GIZ on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). The above mentioned organizations do not take any responsibility for any content of the poster.

Layout by GeoMedia/MediaCompany.

For further reading, please use the QR-code provided hereunder.

November 2016

Bundesministerium für Bildung und Forschung

DLR Project Management Agency

AICHI BIODIVERSITY TARGETS
STRATEGIC GOALS

A Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

B Reduce the direct pressures on biodiversity and promote sustainable use

Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

C To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 11: By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

D Enhance the benefits to all from biodiversity and ecosystem services

Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

E Enhance implementation through participatory planning, knowledge management and capacity building

Target 17: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011–2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.