Food and Agriculture Organization of the United Nations

FAO elearning ACADEMY

Preventing and mitigating land degradation: Nutrient turnover and terrestrial carbon sequestration

28 October 2020

Recording Link: https://youtu.be/ONlhdFq_mD4

Questions and Answers

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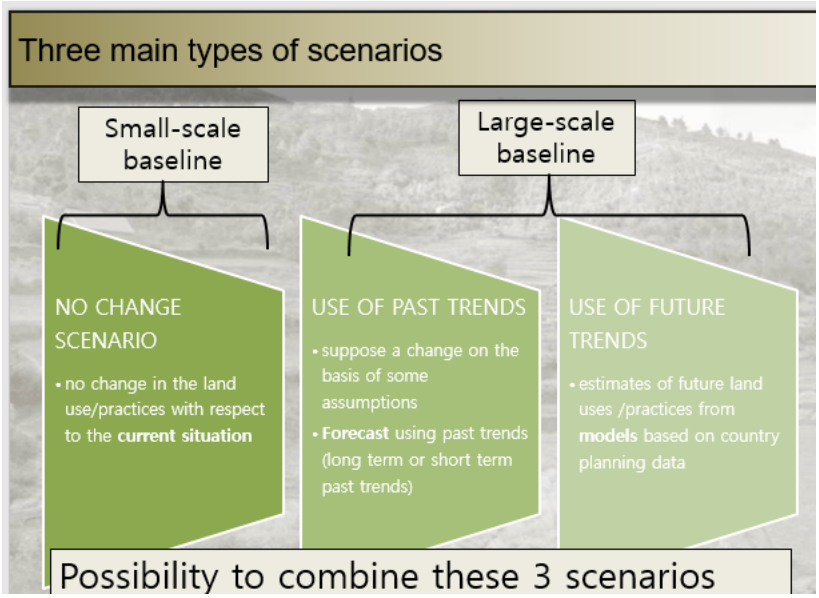
1) **How do you determine what activities will happen without the project presented?**

The scenario without project, also named baseline scenario, should be the most plausible baseline scenario including the most credible options of land use, possible land use changes and main management practices that could have occurred on the land within the project boundary, without the implementation of the project. There is no consensual accurate methodology to build the baseline scenario; it could be driven by many factors (future economic development, population growth, international prices, technological development…); it should consider specificities of different contexts/countries; any projection have more or less uncertainty.

There are three main types of baseline scenarios



Using a no-change baseline scenario for small-scale project is the easiest and quickest approach, requiring little data and work. However, it gives quite a shortcut view of the situation "without project"; this is why when time and resources are available, it is preferable to use past trends or future trends to build the baseline scenario.

Most plausible large-scale baseline: The past trend and future trend approaches will be used according to the availability of data linked to future trends. The use of predictive models should be preferred when available. By default, if no projections have been conducted, the easiest would be to forecast the future by using the past trends.

2) **Can EX-ACT tool be used to measure the progress towards countries' NDCs? If so, how to you determine the 'without project' scenario?**

EX-ACT is currently widely used to design, compute and compare NDC options, by NDC national teams. A series of training workshops organized with Regional Offices, sub regional Offices and FAORs with support of HQ OCB division did allow to support numerous NDC teams with EX-ACT. The monitoring of NDC to measure the progress is

still to strengthen. As explained above the without project scenario of NDC could consider the continuation of past trends (annual rate of deforestation- number of Ha deforested, yearly areas afforested on last 3-10 years, growth of livestock population based on last years figure, rate of pasture areas burnt per year…) which could apply in without project scenario) but it could also consider foreseen changes as economic growth increase (increase of input and energy use).

3) Can you tell us about methods of measuring carbon sequestration (organic and inorganic carbon) in soil?

EX-ACT enables users to utilize default values for carbon pools and emission factors, deriving a carbon-balance by specifying activity and land use change data. For the specified default values, and in accounting structure and logic, EX-ACT has been developed using IPCC 2006 currently updated, Guidelines for National Greenhouse Gas Inventories (IPCC 2006) and Chapter 8 of the Fourth Assessment Report from working group III of the IPCC (Smith, et al.,2007) for specific mitigation options not covered by the Guidelines.

For the soil carbon estimates, the default values are based on references for soil organic carbon stocks for mineral soils down to a depth of 30 cm. When soil organic carbon changes occur over time (land use change or management change), a default time period of 20 years is assumed for transitions between equilibria. These values are found in both IPCC 1997 and 2006 Guidelines, compiled from a wide range of observations and data from long-term monitoring. Some modules use carbon change rates instead of the soil carbon stock

difference and therefore do not require information on absolute soil carbon stocks. In both approaches it is hypothesized that soil organic carbon stock changes during the transition to a new equilibrium occur with a linear pattern. Although soil carbon changes in response to management changes may often be best described by a non-linear function, the linear assumption greatly simplifies the methodology and provides a good approximation over a multi-year period (EX-ACT users Manual)
http://www.fao.org/fileadmin/templates/ex_act/pdf/Technical_guidelines/EX-ACT_technicaldescription_EN_v7.pdf

Four (4) parameters are required to measure soil carbon stock (Qi) for soil layer i : soil carbon content (Ci) (in g/kg for instance), bulk density (Di) (in g/cm3), tickness of the soil layer (Ei) (in cm) and coarse fraction (Gi, fraction > 2 mm)

$$Q_i = C_i D_i E_i (1 - G_i)$$

It is recommended to measure in laboratory Ci by dry combustion to assess the total carbon (organic + inorganic) (see NF ISO 10694). Inorganic carbon is measured by addition of acid: see NF ISO 10 693. Organic carbon is then calculated by difference : total carbon – inorganic carbon.

4) **Can we have access to the presentations?**

The webinar video recording, presentations and Q&A will be available in the FAO elearning Academy dedicated webpage:
https://elearning.fao.org/course/view.php?id=620

5) **Could you please tell us a bit about the current ongoing activity at FAO to develop a module on agroforestry for the Ex-Act tool? What type of agroforestry systems, both biomass and soil coefficients, etc? When will it be available?**

Agroforestry systems have the capacity to sequester large quantities of carbon (C) in both soil and biomass. However, these systems were not fully considered in the approach to C accounting developed by the Intergovernmental Panel on Climate Change, largely due to the high diversity of agroforestry systems and scarcity of relevant data. EX-ACT team got support from CIRAD to rebuild an effective agroforestry database and redesign the EX-ACT agroforestry module. We have recently completely reviewed the Agroforestry module. Cardinael (CIRAD) developed an article "*Revisiting IPCC Tier 1 coefficients for soil organic and biomass carbon storage in agroforestry systems*" which was used by IPCC to enrich IPCC Data base. It allows to distinguish eight main agroforestry systems identified, including alley cropping, fallows,hedgerows, multistrata, parklands, shaded perennial-crop, silvoarable and silvopastoral systems, disaggregated by climate and region:
https://www.researchgate.net/publication/328525872_Revisiting_IPCC_Tier_1_coefficients_for_soil_organic_and_biomass_carbon_storage_in_agroforestry_syste

6) **Carbon sequestration in the biomass: used to make charcoal, what is then the real effect on CO2 emissions? Avoided deforestation?**

According to IPCC guidelines, the real effect on CO2 emissions depends if the source of biomass to produce charcoal is renewable or not. If the source of biomass is renewable (eg: replanting or natural regeneration after harvesting), then the balance is considered to be equal to zero (carbon sequestration in the trees than release of carbon due to the combustion of charcoal). If the source of biomass is not renewable (e.g.: from deforested areas), then production and combustion of charcoal is a source of GHG emissions.

7) **For the soil, you presented increased SOC concentrations, but what about bulk densities? We need both to estimate stocks and storage at equivalent soil mass. Any change in bulk density following plantation of Acacia?**

Four (4) parameters are required to measure soil carbon stock (Qi) for soil layer i : soil carbon content (Ci) (in g/kg for instance), bulk density (Di) (in g/cm3), thickness of the soil layer (Ei) (in cm) and coarse fraction (Gi, fraction > 2 mm)

$$Q_i = C_i D_i E_i (1 - G_i)$$

In the example of Mampu agroforestry system, bulk density is not documented so the effect on soil carbon stock can not be assessed. However, global meta-analysis highlighted the increase of soil carbon stocks when croplands or grasslands are converted into agroforestry systems, which is the case at Mampu.

8) How do you reflect your project findings in environmental conventions such as UNFCCC and UNCCD?

Projects similar to Mampu are implemented on the Batéké Plateau in DR Congo and are registered as Clean Development Mechanism project (UNFCCC) (see Ibi Batéké carbon sink project in particular). Besides, Soil Organic Carbon is one of three sub-indicators that make up SDG indicator 15.3.1 "Proportion of land that is degraded over total land area" and at the same time is an indicator for the global framework of LDN, which was endorsed by the 197 Parties to the United Nations Convention to Combat Desertification (UNCCD) in 2017.

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