Chapter 9. Tradeoffs and scenarios

Objectives

1. Discuss tradeoff and synergies associated with REDD+ policy
2. Present methods to conduct scenario analyses to address uncertain future policy and economic contexts.

Contents

ASB Partnership for the Tropical Forest Margins · CGIAR · Forest Carbon Partnership Facility · World Bank Institute · Carbon Finance Assist

Tradeoffs

1. A tradeoff is a situation involving a loss of one thing with a gain in another. Win-lose situations are tradeoffs. They are often depicted with two dimensional graphs, by an inverse relationship (or downward slope of points) displaying the tradeoff. The axes of the graph are in typically in physical units of the good or service.

2. The relationship between profits from and carbon within different land uses is an example of a tradeoff (Figure 9.1). The horizontal axis represents carbon content of a land use (t/ha); the vertical axis corresponds to profits of a land use ($/ha). Natural forests, in the lower right-hand section, have high carbon stocks but low profitability. Agricultural crops, in contrast, have low carbon and high profitability. Some land uses, such as extensive cropping and cattle raising in this example, do not represent a tradeoff since they have both low carbon and profitability. More importantly, there are no apparent "win-win" high-carbon with high-profit land uses, as evidenced by no examples in the upper-right portion of the graph.

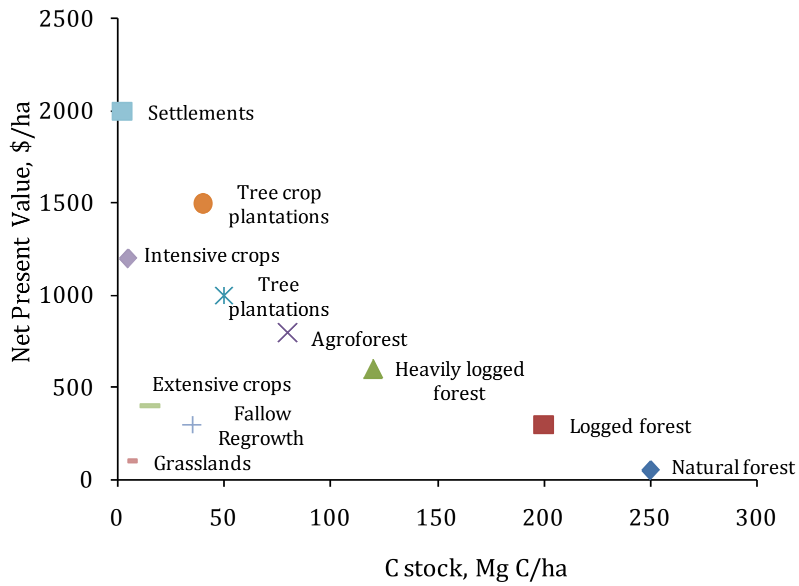

Figure 9.1. Example tradeoff of land uses: NPV profit vs. carbon stock

3. Many other REDD-related tradeoffs exist, for example, between profits and biodiversity co-benefits and profits and water co-benefits. Table 9.1 summarizes likely relationships, tradeoffs (-) or complementarities (+), between profits, employment, carbon, biodiversity and water. Instead of being tradeoffs, relationships between carbon, water and biodiversity are likely to be positive, also between profit and employment. A larger amount of one of these goods and services is likely to be linked with larger amounts of the other.

Generally, the human goods/services of profits are inversely related to the natural goods/services of carbon, biodiversity and water.

Table 9.1. Likely tradeoffs and complementarities of goods & services from land uses

	Employment	Carbon	Biodiversity	Water
Profit	+	-	-	-
Employment		-	-	-
Carbon			+	+
Biodiversity				+

4. A well-known tradeoff exists between profitability and biodiversity conservation. Farmer efforts to increase crop productivity often decreases biodiversity. Consequently, farmers may be unwilling to tolerate plant diversity and will remove trees and weeds in order to improve profit margins. Such productivity gains often occur in both agricultural monocrops and mixed land use systems. In rubber agroforests of Indonesia, for example, the number of rubber trees per unit area increased rubber production. Meanwhile, the number of other tree species decreased correspondingly (Lawrence, 1996). Extreme, yet common, cases are where economically-important agricultural crop or tree species are grown as monocultures.

5. At a landscape level, conservation and development objectives can become less clear. The spatial arrangement of land uses types can raise the question of how to achieve optimal levels of biodiversity within a landscape. Let's illustrate this point with an example. An entire landscape of monoculture oil palm has less biodiversity than a landscape containing a mixture of different-aged forests of native species within a mosaic of smallholder farms.

6. A 'segregated' option is to keep agriculture and forest completely separate: the forest untouched (with high biodiversity), and intensive agricultural production using monocultures e.g., oil palm, rubber, foodcrops with high intensity use of inputs (very low biodiversity). In contrast, an 'integrated' option incorporates/conserves as much biodiversity as possible in the farms within the landscape e.g., in fallows, complex cocoa agroforests, or multistrata agroforestry systems (including Brazil nut, mahogany, peach palm etc.).

7. The consequences for biodiversity of the segregate-integrate choices are of a mixed nature (Table 9.2). On the agricultural side of a 'segregated' landscape, the main benefits of agrobiodiversity may focus on the prevention or control of outbreaks of pests and diseases along with pollination. Yet, at the same time, forest animals can damage crop harvests.

Table 9.2. Biodiversity benefits: segregated versus integrated landscapes

Segregated - Agriculture	Segregated - Natural forest	Segregated landscape with Ag + Forest	Integrated - Agroforestry mosaic
Agrobiodiversity mainly relevant for pest and weed control	Large reserves desirable to maintain viable populations	Sharp (fenced) boundaries reduce conflict but create isolated and potentially unviable populations	Agrodiversity provides benefits or has relatively little negative impacts on human activities

Adapted from: Williams, et al. 2001.

8. Although economic – environmental tradeoffs may exist, the magnitude of the losses versus the gains can reveal opportunities for beneficial, and perhaps optimal, compromises. In some instance, it is possible to achieve a substantial gain with a small loss. Such insights into relationships help reveal the consequences of different policy options.

Spreadsheet analysis exercise

9. Let's examine a number of tradeoffs and complementarities. The worksheet entitled **Tradeoffs** (in the **SpreadsheetExercisesREDDplusOppCosts.xlsm** file, or see **Appendix F** for a view) is a simplified version containing four land uses and compares three attributes of the land uses: profits, carbon and employment. The study context is the Peruvian Amazon. Data inputs are per ha estimates for carbon, profit and workday per land use. Outputs are three tradeoff graphs: profitability vs. carbon, profitability vs. employment and employment vs. carbon. Adjustments to the data within the land use legend will affect the associated graphs.

10. While profitability and employment reveal a complementary relationship, both comparisons of profitability vs. carbon and employment vs. carbon are tradeoffs. Agriculture and agroforestry land uses generate more profits and have less carbon than logged and natural forests. In this example, agroforestry generates both greater profits and has higher carbon content than agricultural land uses. Therefore, given these criteria agroforestry would be a preferable policy option. Nevertheless, such broad conclusions are based on two specific criteria. Many other criteria exist that make agriculture a valuable land use, such as the importance of staple food produced and ability to generate earnings without a lag time. (See Chapter 6 for further explanation.)

Scenarios

11. In simple terms, scenarios are logically-consistent and realistic stories about the future. Scenarios can account for a variety of possible futures and their associated uncertainties. Scenarios encourage us to open our minds in order to consider the range of changes or surprises that could occur in the future and think about their impacts. They go far beyond a "business as usual" approach, where we anticipate the future by looking at the past. Thus, scenarios can help to improve the understanding of decision-makers about the potential consequences of decisions taken today.

12. While sensitivity analysis (in Chapter 7) considers the effects of marginal changes in specific parameters of land uses both biophysical (e.g. carbon content) and economic (e.g., prices of outputs, efficiency of production, costs of inputs and net present value), scenario analysis can considers changes in groups of parameters due to overall economic changes, the introduction or prohibition of specific land uses, or alternative rules regarding the eligibility of land uses and land use changes for mitigation payments. Possible scenarios include:

- **Large shifts in relative prices due to changes in the world commodity markets.** An example contrasts is a high price scenario (2008), and a low price scenario (2006). Such scenarios need to be translated into sets of adjusted price parameters.
- **Shifts in relative prices due to domestic or international policies.** For example, biofuel policies have potential to shift prices for oil palm or sugar cane.
- **Changes in property rights.** Uncertainty in property rights can be captured in NPV analysis through explicit adjustments to NPV estimate, where expectations explicitly recognize the probability of a land user being able to invest and capture increased future revenues. In the Sumberjaya area of Indonesia, for example, farmers are less than certain that they will be able to benefit from land investments.
- **Policy-induced changes in returns to alternative land uses.** Policies can foster technology change and thereby affect production efficiency. Examples include improved access to fertilizers in Africa, export taxes (cocoa in Ghana) and subsidies (e.g., Malawi's agricultural input subsidy programs)
- **Carbon market scenarios.** A possibility exists for farmers to be compensated for the carbon value of all or some land use types (e.g. AFOLU).
- **Different national land and forest use policies.** Avoided deforestation policies may decree and enforce the protection of certain land types (e.g.,

primary forests) that can be reflected in changes in the land use transition matrix.

- o **Different carbon estimates.** Increased accuracy or removal of systematic bias in carbon measurements (e.g., LIDAR, improved allometric equations or wood density estimates).
- o **Different carbon prices.** risk of permanence may affect carbon price, and market prices may fluctuate

13. Scenarios introduce creative thinking about driving forces of land use change and their potential impact. Scenarios can create awareness about current and future land use, as well as serving as a synthesis tool, where different types of knowledge are combined in different formats, using both quantitative and qualitative information/methods. For example, local knowledge on the driving forces of deforestation is key for scenarios to be credible and plausible. Scenarios can also help identify potential threats, uncertainties, conflicts, as well as opportunities that a community could be facing in the future. Key steps in scenario analysis include:

1. Identification of actors involved (stakeholders) and selection of participants to the participatory scenarios exercise,
2. Start the participatory scenarios process: Identification of focal questions including the goal / objectives of the analysis,
3. Identification of context and driving forces of change,
4. Develop the scenarios (storylines),
5. Description of the scenario, possible causes and implications for parameter values (changes in C, P, or elements of the land use transition matrix)
6. Analysis across scenarios:
    - Derivation of the opportunity cost estimate based on different scenarios
    - Comparison of results with the base scenario
7. Map the results of the scenario and compare the map results for the base case.
8. Interpretation of results and implications.

14. A combination of tools and methods, quantitative and qualitative can be used at any of the stages in scenario development above. The process could be based on expert knowledge or be developed as a participatory process in which all actors are involved. While expert knowledge of parameters is likely to be easier, cheaper and faster at Tier 1 level, expensive and comprehensive scenario modeling may be more appropriate at a Tier 3 level. In some cases, it can be argued that the best way for determining priority parameters and their likely range is via a participatory process. The choice of methods depends on each country given the skills, capacity and the resources available.

Exercise: the effects of different REDD+ eligibility rules

15. The spreadsheet **Eligibility filter** presents a quick analysis of how REDD rules will affect eligibility of different land use changes (in **SpreadsheetExercisesREDDplusOppCosts.xlsm**). Changes to the yellow highlighted cells reveals REDD+ policy effects on 11 categories of land use.

16. Given that no clear rules exist for REDD+, examining their potential effect is useful for national policy planning. Although discussions point toward agreement on conservation, sustainable management of forests and enhancement of forest carbon stocks as being eligible within REDD+, clarification on the eligibility of specific land uses is still needed.

17. Other issues include whether or not REDD+ will be part of National Appropriate Mitigation Actions (NAMA). If REDD+ becomes part of NAMA, then REDD+ policy would be equivalent to REDD++, AFOLU – Agriculture Forestry and Other Land Use or REALU – Reduced Emission from All Land Use, as described in the literature.

18. Thus, four types of approaches, RED, REDD, REDD+ and REALU are possible outcomes of a UNFCCC policy agreement. The implication of eligibility conditions under these four versions can be illustrated by identifying appropriate parts of a land cover change matrix (Figure 9.2).

- RED = Reducing emissions from (gross) deforestation: only changes from 'forest' to 'non-forest' land cover types are included; details depend on the operational definition of 'forest'
- REDD = RED + (forest) degradation, or the shifts to lower C-stock densities *within* the forest; details depend on the operational definition of 'forest'
- REDD+ = REDD, + restocking within and towards 'forest' ; in some versions RED+ will also include peatlands, regardless of their forest status; details still depend on the operational definition of 'forest'
- REDD++ = REALU = AFOLU, all transitions in land cover that affect C storage, whether peatland or mineral soil, trees-outside-forest, agroforest, plantations or natural forest. No dependence on operational definition of 'forest'

19. The approach to estimate opportunity costs within this manual could be selectively applied to any of the four versions. The eligibility filter works in conjuntion with the land cover change matrix that is used in the opportunity cost estimation.

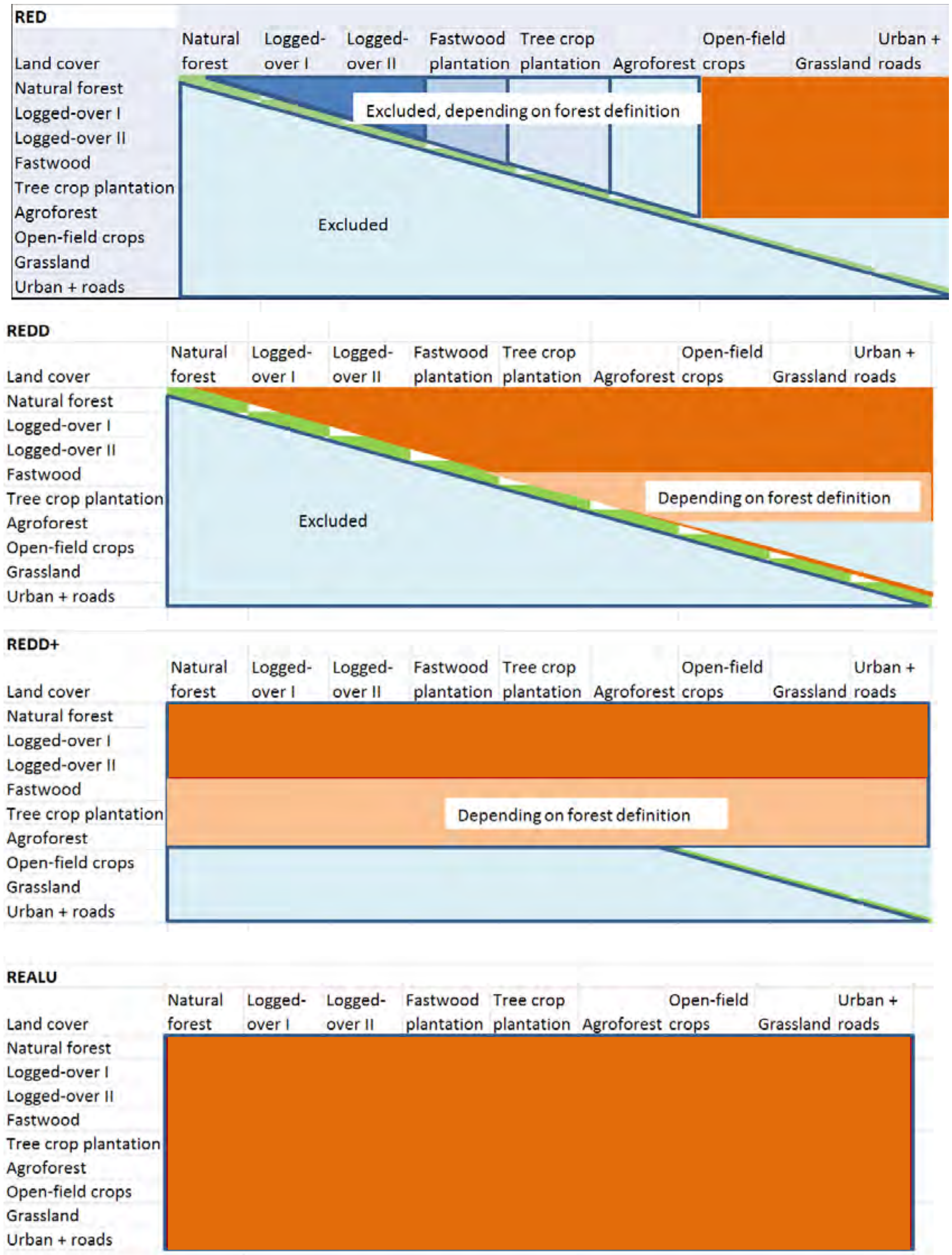

Figure 9.2. Comparisons of eligible land use changes per RED to REALU rules

Note: Land use change is from the initial state in the first column to a land use in one of the other columns. Eligibility of changes is indicated with colors (orange = permitted, blue = excluded)